The Water Policy Interim Committee

The Exemption

To change or not to change?

A study of water wells allowed without a permit

A **DRAFT** Report to the 63rd Legislature

June 2012

Published By
Montana Legislative Services Division
P.O. Box 201706
Helena, MT 59620-1706
www.leg.state.mt.gov
(406) 444-3064 FAX: (406) 444-3036

Legislative Services Division

WPIC
September 10, 2012
Exhibit 13

Water Policy Interim Committee Members

Before the close of each legislative session, the House and Senate leadership appoint lawmakers to interim committees.*

MONTANA SENATE

Sen. Bradley Maxon Hamlett, Presiding Officer
P.O. Box 49
Cascade, MT 59421-0049
799-5885
wranglergallery@hotmail.com

Sen. Debby Barrett
18580 MT Highway 324
Dillon, MT 59725
681-3177
grt3177@smtel.com

Sen. Sharon Stewart-Peregoy
P.O. Box 211
Crow Agency, MT 59022-0211
Ph: 639-2198 or 638-3133
apsaalookewomen@yahoo.com

Sen. Chas Vincent
34 Paul Bunyan Lane
Libby, MT 59923-7990
293-1575
cvvincent@hotmail.com

MONTANA HOUSE OF REPRESENTATIVES

Rep. Walt McNutt, Vice Presiding Officer
110 12th Ave. SW
Sidney, MT 59270-3614
Ph: 488-4966 or 489-4966
walt@midrivers.com

Rep. Pat Connell
567 Tiffany Lane
Hamilton, MT 59840-9241
370-8682
connell4hd87@yahoo.com

Rep. Betsy Hands
216 S. Ave. West
Missoula, MT 59801
Ph: 721-3881
betsyhands@gmail.com

Rep. Bill McChesney
316 Missouri Ave.
Miles City, MT 59301-4140
853-2826
macwilly66@msn.com

Legislative Environmental Policy Office Staff

Joe Kolman, Legislative Environmental Policy Analyst; Helen Thigpen, Attorney; Jason Mohr, Resource Policy Analyst; Sonja Nowakowski, Resource Policy Analyst; Hope Stockwell, Resource Policy Analyst; Maureen Theisen, Research and Publications; Kevin McCue, Legislative Secretary.

* This information complies with Senate Bill No. 120 (Chapter 236, Laws of 2011).

Notes on the Draft Report

This report is a summary of the work of the Water Policy Interim Committee pursuant to House Bill No. 602 as passed by the 2011 Legislature. Members received additional information and public testimony during meetings. This report is an effort to highlight key information. To review additional information, including written minutes, exhibits, and audio minutes, visit the WPIC website:
www.leg.mt.gov/water

Findings and Recommendations

* These are conclusions reached by the WPIC and suggestions, if any. This could include legislation, directives to agencies, or a desire for more study. None have yet been identified.
* Staff produced this initial draft report. The final version must be approved by the WPIC.
* In July, the full WPIC will discuss the draft report.
* Public comment on the draft report will be accepted through August.
* In September, the WPIC will review public comment and make any changes prior to adopting the final report.

Legislation

Bill drafts implement recommendations, if necessary. Same schedule as above.

Table of Contents

Executive Summary	Page: 1
Exempt from What? A Permitting Overview	Page: 3
Exempt Wells: How Many? How Much Water?	Page: 7
Enforcing the Exemption - Making A Call	Page: 11
Exempt Wells: What are the Options?	Page: 18
Public Comment (None at this time)	Page: 21
Findings and Recommendations (None at this time)	Page: 22

Appendix A	House Bill No. 602	Page: 1
Appendix B	Exempt Wells by County and Basin	Page:
Appendix C	Closed Basin Map	Page:
Appendix D	Exempt Well water Use Table	Page:
Appendix E	Hydrogeology Related to Exempt Wells	Page:

Executive Summary

(Final version will include summary of any recommended action).

This is the fourth consecutive interim that legislators made the topic of water wells that are exempt from permitting part of their work between sessions. However, the 2011 Legislature and the 2011-12 Water Policy Interim Committee (WPIC) devoted more time and resources to the issue than ever before.

The evolution of the exempt well in Montana and the study of it by the WPIC is well documented.[1]

To summarize, since Montana started requiring permits for most types of water use in 1973, there has been an exemption for some ground water wells. The amount of water allowed and the rules used to implement the law have changed, but the current law and accompanying rules have been around almost two decades.

The law states that a permit is not required for a well or developed spring that diverts water at 35 gallons a minute or less and does not exceed a volume of 10 acre-feet a year. It adds, however, that a combined appropriation from the same source from two or more wells or developed springs exceeding this limitation requires a permit.

The term "combined appropriation" is not defined in law. That is left to administrative rules, which explain the term as "an appropriation of water from the same source aquifer by two or more ground water developments, that are *physically manifold into the same system.*"[2] (emphasis added).

In recent years, legislative attempts have been made to change the exemption, including codifying the administrative definition of combined appropriation. The rules also have been challenged. None of the attempts succeeded.

What makes exempt wells controversial?

Most debate in recent years centers on the use of exempt wells in residential housing developments. About two-thirds of the subdivision lots created between July 2004 and June 2011 received water from exempt wells.[3]

---

[1] Boiling it Down, Water: Montana's Treasure; Water Policy in Montana. http://leg.mt.gov/content/Publications/Environmental/2010-water-policy.pdf
Water-Montana's Treasure http://leg.mt.gov/content/Publications/Environmental/2008montanastreasure.pdf

[2] 36.12.101 ARM.

[3] Department of Environmental Quality Subdivision Review Program

Even if each well only uses a small amount of water, there are those who argue that the cumulative effect is not analyzed for harm to existing water right holders to the same extent that another use that uses the same amount of water would be, such as an irrigation system. Others note that in some areas, if the effects of an exempt well are even measurable, they are so small in the larger scheme of water use as to be harmless.

Given the rural nature of Montana, some argue that an outright ban on exempt wells unrealistic. The permitting system could be overloaded evaluating new applications. Furthermore, allowing relatively small amounts of water for domestic or stock use is could be seen as an unalienable right.

But after that, options for addressing concerns about providing water for new uses, including housing, while protecting existing water right holders become more controversial.

In 2011, the Legislature passed House Bill No. 602 requiring a study of exempt wells. Among other things, the Legislature found that exempt wells may be adversely affecting existing water rights and that existing water law does not give the Department of Natural Resources and Conservation adequate direction on how to administer exempt wells. (Appendix A).

The legislation requires the Water Policy Interim Committee to examine a wide variety of topics related to exempt wells, including the amount of water used, the effects on other water rights, the enforcement of water rights, the relationship of exempt wells and land use, how other states deal with exempt wells, and the adequacy of existing programs.

With that direction, the WPIC pledged most of its time and efforts to evaluating the issue and gathering as much public comment as possible, including three meetings around western Montana, where most of the exempt wells used in subdivisions have been drilled in the last two decades.

Exempt from What? A Permitting Overview

For someone unfamiliar with western water law, the idea that a bureaucratic permit system must be negotiated prior to using water may seem needless. If you can see water in a creek or someone assures you that cool, clean liquid is bountiful below the surface, what more does one need to know?

Quite a bit. The actual presence of water at the time one wants to use it and in the quantity one needs are just a couple of the criteria that must be proven before most would-be water users can appropriate the precious but reusable resource.

The use of water is a property right. Montana and other western states allocate that right based on when the water was put to use or the right was permitted. This is known as the Prior Appropriation Doctrine. For example, a water right dating to 1889 is entitled to be exercised before any right occurring after that date.

More than a century ago, western lawmakers started seeing the need for a regulated system of water rights. The use and re-use of water by many parties, the complexity of a water right, was a recipe for confusion and disagreement without a centralized system.

In Montana, the 1972 Constitution required that, "The legislature shall provide for the administration, control, and regulation of water rights and shall establish a system of centralized records, in addition to the present system of local records." A permit system administered by the Department of Natural Resources and Conservation (DNRC) was created within the Water Use Act of 1973.

Revisions in 1997 to the declaration and purpose section of the Water Use Act reiterate the role of permitting and how it relates to the adjudication of rights that existed prior to the Water Use Act. Subsection (5) of 85-2-101, MCA reads in part:

> It is the intent of the legislature that the statutory determinations for issuing new water use permits and authorizing changes do not require the adjudication of all water rights in the source of supply. The legislature recognizes the unique character and nature of water resources of the state. Because water is a resource that is subject to use and reuse, such as through return flows, and because at most times all water rights on a source will not be exercised to their full extent simultaneously, it is recognized that an adjudication is not a water availability study. Consequently, the legislature has provided an administrative forum for the factual investigation into whether water is available for new uses and changes both before and after the completion of an adjudication in the source of supply.

The permitting requirements of law apply to both surface water and ground water. To understand more about exempt ground water wells, it may be helpful to examine the process from which these appropriations are exempt.

The criteria for a permit in Montana is contained in 85-2-311, MCA. An applicant must prove that:

* the proposed use of water is a beneficial use;
* water is physically available at the proposed point of diversion in the amount and during the period that the applicant seeks to appropriate;
* the amount of water requested can reasonably be considered legally available during the period in which the applicant seeks to appropriate. Legal availability includes an analysis of the physical availability and the existing legal demands on the source;
* the water rights of a prior appropriator will not be adversely affected;
* the proposed means of diversion, construction, and operation of the appropriation works are adequate; and
* the applicant has a possessory interest, or the written consent of the person with the possessory interest, in the property where the water is to be put to beneficial use.

The determination of physical availability for a ground water well entails an aquifer test supervised by a hydrogeologst or other professional, a minimum duration of pumping, an observation well, and a report that includes ground water and surface water monitoring data.

The examination of legal demands and possible adverse effects includes:

* Identification of prior appropriators
* A comparison of physical water supply within area of impact at point of diversion during the period of diversion requested with existing legal demands.
* Describing the effect on existing wells and hydraulically connected surface water; and
* Demonstrating that the proposed diversion can be regulated during periods of water shortage to satisfy rights of prior appropriators.

At this point in the process, if the above criteria are satisfied, the DNRC issues a preliminary determination that the permit will be granted. That triggers the public notice and objection portions of the law. General notice is provided by publication in a newspaper and specific notice is provided to senior water right holders and others who may be affected by the new appropriation. The notice may result in someone objecting to the application and being granted a hearing. An objector may be anyone whose property, water rights, or interests would be adversely affected.

Objections may be withdrawn or denied, or the approval may be conditioned to mitigate objections. The permit might be granted for less water than applied for, or the water use may require the retirement of another water right to offset the new use. Monitoring and reporting of the water use also may be required.

In September of 2011, the WPIC heard about two projects for which water right permits were granted and another that used exempt wells.

The town of Stevensville obtained a permit for a ground water well to serve the 117-lot Twin Creeks Subdivision, which sits on 40 acres. The appropriation is for municipal use with 33.6

acre-feet per year for in-home domestic uses and 62.7 acre-feet per year for lawn and garden uses. The total consumptive use is about 50 acre-feet per year.[4]

Because the appropriation is in a closed basin, the applicant also was required to obtain an aquifer recharge plan. The plan shows how water historically used for irrigation will be diverted to a pond and gravel pit to recharge the aquifer, thereby offsetting the new use.

Another project reviewed by the WPIC was a preliminarily-approved application in Lewis and Clark County for a three well system serving the Elk Creek Colony. The water will be used in 28 homes for up to 150 people, stock use, and industrial which will include a concrete batch plant and shop use. Again, this application is in a closed basin. The mitigation plan is to retire two water rights on 65 acres for a mitigation amount of about 50 acre-feet per year.[5]

Both the Stevensville and the Lewis and Clark County appropriations will be required to meter the wells and monitor ground water levels.

The third project, Timberworks Estates in the Helena Valley, chose to use exempt wells on 108 lots. While this project is also located in a closed basin, the use of the exemption means that no analysis for legal availability or adverse effect was required.

To use the exemption, one drills the well and puts the water to use. To obtain a certificate of water right, which includes a priority date, the water user pays the DNRC $125 and provides the location, the flow rate, and the beneficial use of the well.

All western states except Utah and California provide a ground water exemption. Most exemptions were created decades ago, with the idea that evaluating small uses of water for homes or stock would consume more time and money than it was worth.[6]

However, Montana and other states also share common challenges associated with exempt wells, including concern about the cumulative effect of withdrawls not subject to analysis of their effect on ground water or hydrologically connected surface waters. Exempt wells are often shallow, making them susceptible to contaminants. They are also often used in conjunction with septic

---

4 http://leg.mt.gov/content/Committees/Interim/2011-2012/Water-Policy/Meeting-Documents/September-2011/stevensville-permit.pdf

5 http://leg.mt.gov/content/Committees/Interim/2011-2012/Water-Policy/Meeting-Documents/September-2011/elk-creek-permit.pdf

6 Report: Exempt Well Issues in the West, Nathan Bracken, Western States Water Council, http://leg.mt.gov/content/Committees/Interim/2011-2012/Water-Policy/Meeting-Documents/September-2011/exempt-well-issues-west.pdf

systems to treat sewage and can become contaminated depending on location.[7]

[7] Ibid. At the request of the WPIC, the 2011 Legislature passed House Bill No. 28, which revised requirements for septic mixing zones. http://data.opi.mt.gov/bills/2011/sesslaws/ch0083.pdf

Exempt Wells: How Many? How Much Water?

There are more than 113,000 wells around Montana for which a permit was not necessary.[8]

About 56,000 of those wells were drilled after 1991, when the current law took effect. Of those, about 26,000 were drilled in closed basins. (Appendix B)

Closed basins are areas of the state where it is determined that there are no unappropiratied waters within the source of supply or that further appropriations would adversely affect prior appropriators. In these areas, requests for new surface water appropriations are mostly banned and permit applications for ground water undergo extra scrutiny for possible effects to surface water. Ground water permits that are approved may be required to mitigate those effects. The closed basin restrictions do not apply to exempt wells.[9] (Appendix C)

Most closed basins are in western Montana, which is also where much of the state's population growth occurred over the last two decades. Between 1990 and 2010, the population of Gallatin County and Broadwater County, both located in the closed Upper Missouri Basin, increased by about 70 percent each. In Gallatin County, that was an increase of almost 40,000 people.

Ravalli County, located in the closed Bitterroot Basin, increased in population by about 15,000 people during those two decades for a 61 percent increase.

To house new residents in those and other areas, subdivisions were created. Many lots within those developments are served by exempt wells. Of the more than 28,000 lots created between July 2004 and June 2011, about two-thirds were slated to get water from exempt wells. [10]

The DNRC estimates that the number of exempt wells in existing closed basins could double to 53,000 by the year 2030.[11]

While the effect of water use by exempt wells is not analyzed by the permitting process, the committee examined several scenarios based on well location, assumptions of actual use, and area-specific availability and allocation of ground water.

---

[8] DNRC database of water rights as of March 2012.

[9] Basins can be closed by the Legislature, the DNRC, a court, or a negotiated compact. See 85-2-319, 85-2-321, 85-2-330, 85-2-336, 85-2-341, 85-2-343, and 85-2-344, MCA.

[10] Department of Environmental Quality Subdivision Review Program

[11] DNRC presentation to WPIC. June 1, 2011. Number does not include stock wells. http://leg.mt.gov/content/Committees/Interim/2011-2012/Water-Policy/Meeting-Documents/June-2011/exempt-well-statistics-dnrc.pdf

The exemption allows for a flow rate of 35 gallons a minute, not to exceed a volume of 10 acre feet a year.[12]

That amount is equal to a football field under 10 feet of water. To put that much water on the gridiron, one would have to fill a one gallon milk jug every 10 seconds, around the clock, for an entire year.

The amount of water allowed under the exemption is sufficient for a variety of uses. Ten acre feet could quench the thirst of 500 cows for a year, keep five acres of grass green in Bozeman; sprinkle up to seven acres of pasture, serve a 150-room hotel, run a gravel operation, or supply a 10-lot subdivision in Billings.[13] (See Appendix C)

In terms of the water used in a housing development, it is estimated that a household of 2.5 people would divert about one-third of a single acre foot per year for in-house uses, including drinking, cleaning, and toilet operation. In Bozeman, an acre of lawn and garden could be irrigated with 2 acre-feet a year. [14]

The language in the exemption refers to the amount of water pumped out of the ground. But while the use of water is a property right that can be owned by an individual, the same water will be used by many water right holders as it cycles through each use. When it comes to debating the effect the exemption may have on existing users, the other component is the amount of water consumed.

Water is deemed consumed if it does not return to the system, meaning it cannot be used by other water right owners. The largest consumptive uses are evaporation from soil and surface water bodies and transpiration, which is water used by plants.[15]

How much water is consumed depends on the use. A household that diverts one-third of an acre foot for 2.5 people would consume just .03 acre-feet because most of the water is returned through the wastewater system. Nine out of every 10 gallons of water pumped out of the ground returns to the system. In contrast, a growing lawn consumes about 80 percent of water put on it. [16]

---

[12] This reflects the 1991 change in law from 100 gallons per minute with no limit on volume.

[13] DNRC presentation to WPIC. Sept. 13, 2011 http://leg.mt.gov/content/Committees/Interim/2011-2012/Water-Policy/Meeting-Documents/September-2011/water-use-table.pdf

[14] Ibid.

[15] John Metesh, Hydrogeology Related to Exempt Wells in Montana, Montana Bureau of Mines and Geology.

[16] DNRC presentation to WPIC. Sept. 13, 2011 http://leg.mt.gov/content/Committees/Interim/2011-2012/Water-Policy/Meeting-Documents/September-2011/water-use-table.pdf.

On a statewide scale, using assumptions more conservative than those above, the amount of water diverted by exempt wells in closed basins in 2010 was more than 30,000 acre feet with the consumed volume of almost 18,000 acre feet.[17]

As previously noted, any use of ground water in excess of 10 acre feet requires an analysis of how the use would affect existing water right owners. Any single request to appropriate 3,000 acre-feet or more of ground water requires not only that analysis, but also approval by the Legislature.[18]

But caution should be used when looking at the cumulative use of water on a statewide basis and comparing those cumulative amounts to single, larger, applications to appropriate. A water budget, much like a financial budget, can be analyzed by scale. When looking at the withdrawal of water across the state, less than 3 percent is ground water. And only 8 percent of that is withdrawn by exempt domestic wells. And even less than that is actually consumed. On that scale, the effect of exempt wells could be negligible. [19]

But the Ground Water Investigation Program at the Montana Bureau of Mines and Geology examined consumptive use on a much smaller scale. The analysis compared domestic lawn watering from exempt wells to three different types of agricultural irrigation.

As seen on page 27 of Appendix E, the percentage of consumptive use varied widely. In the lower Beaverhead River study area, exempt wells consumed just 2 percent of the water budget while in the Eightmile Creek area of Ravalli County, lawn watering accounted for more than half of water consumed.

In small study areas, there also can be marked differences in consumptive use based on an annual budget and a smaller, seasonal time-frame. As seen on page 29 of Appendix E, the domestic use in April and May in the Eightmile study area isn't much different in early spring than overall. However, in the Four Corners study area, the consumptive use of lawns in early spring is a much greater percentage of the water budget than when it is measured annually.

In subbasin study areas in regions where the growth of exempt wells has raised concerns, including Florence, Helena, Belgrade, and Bozeman, the study found that lawn watering from exempt wells consumed 15 percent of all water not returned to the system, or just less than 5,000 acre feet annually.

---

[17] DNRC presentation to WPIC. June 1, 2011. Number does not include stock wells. http://leg.mt.gov/content/Committees/Interim/2011-2012/Water-Policy/Meeting-Documents/June-2011/exempt-well-statistics-dnrc.pdf. Assumes .21 AF diverted for in-house use and .95 diverted for half acre lawn.

[18] 85-2-317, MCA.

[19] John Metesh, Hydrogeology Related to Exempt Wells in Montana, Montana Bureau of Mines and Geology.

What effect, if any, the consumptive use of exempt wells may have existing surface right holders is not analyzed. However, the DNRC presented testimony on the legal availability of water in some of the areas studied by the Ground Water Investigation Program. Considering that an exempt well would be a year round use, the DNRC concluded that in the Threemile Creek Area, any depletion of surface flows by a new groundwater use would affect existing demands. While there is water legally available during certain times of the year in Eightmile Creek and the Bitterroot River, DNRC Water Division Administrator Tim Davis said that a year round use of groundwater that was subject to a legal availability analysis would likely need to also provide mitigation to offset effects on existing water rights.[20]

The committee also heard testimony from the Montana Association of Realtors referencing a study the association commissioned in 2008 on exempt wells. That study found that "it is difficult to conceive that there would be any practical circumstance in any closed basin in Montana where future growth in exempt wells would result in any discernable, detectable, or measurable adverse impact to any prior surface water appropriator."[21]

---

[20] Tim Davis testimony to WPIC. January 10, 2012.
http://leg.mt.gov/content/committees/interim/2011-2012/Water-Policy/minutes/January-10-2012/Exhibit03.pdf

[21] Jim Day testimony to WPIC, March 6, 2012. Nicklin Earth and Water Inc., submitted two reports to WPIC in 2008. The one quoted above is "Update on Evaluations Significance Of Exempt Wells Montana's Closed Basins."
http://leg.mt.gov/content/Committees/Interim/2007_2008/water_policy/staffmemos/evaluationssignificance.pdf
The other is "Water Rights in Closed Basins."
http://leg.mt.gov/content/Committees/Interim/2007_2008/water_policy/staffmemos/waterrightsnicklin.pdf The DNRC responded to the Nicklin studies, concluding in part that the analysis only examined annual water budgets on a basin wide scale to concluded that there are no cumulative impacts from exempt wells.
http://leg.mt.gov/content/Committees/Interim/2007_2008/water_policy/staffmemos/nicklinreportcomments.pdf

Enforcing the Exemption - Making A Call[22]

The Legislature asked the WPIC to evaluate the legal options for integrating exempt wells into the principle that first in time is first in right when senior water rights are not fulfilled. The study also directs the committee to examine enforcement options for exempt wells.

In Montana, as with other water uses, exempt wells are issued a priority date. The date is key to the prior appropriation doctrine. When the water is applied to a beneficial use determines the user's priority in the water, i.e. the first user to obtain the right is the first user who gets to use the water in times of shortages.

This notion of "first in time, first in right" is the bedrock of Western water law and has been recognized by courts throughout Montana's history. In 1911, for example, the Montana Supreme Court recognized the concept of "first in time, first in right" in a decision involving a change of use from power to agricultural.[23] In 1953, the Montana Supreme Court stated the rule as follows: "The rule is that he who first diverts the water to a beneficial use has the prior right thereto where the right is based upon the custom and practice of the early settlers as here . . ."[24] The concept of "first in time, first in right" has been integrated into the Montana Water Use Act. Section 85-2-401, MCA, specifically provides that "[a]s between appropriators, the first in time is the first in right."

To enforce a water right under the prior appropriation doctrine, a senior user can make a call on the source. When this occurs, water users with the most junior rights must cease using the water in reverse order of priority so that the more senior right is fulfilled first. In some cases each junior user upstream from the senior's point of diversion may be required to curtail their use.

Because the concept of a call is rooted in practice and judicial common law, the concept does not appear consistently throughout Montana's statutes. The concept is defined, in a section codifying a water compact, as "the right of the holder of a water right with a senior priority and an immediate need for a recognized use to require a holder of a water right with a junior priority to refrain from diverting water otherwise physically available."[25] Section 85-2-351, MCA, which addresses requirements for notices to provisional permit holders in the Clark Fork River basin, provides that "[i]n accordance with Montana law, you may be subject to a call by senior water right holders, in which case you may be required to discontinue your use of water for the period of the call."

In the context of surface water, a senior user will contact junior users upstream from the senior's point of diversion to notify them that a call is being made. The senior will call each user in the order of the most junior to the most senior until the right is satisfied. If the junior user does not

---

[22] Adapted from legal memorandum of Helen Thigpen, WPIC attorney, Aug. 30, 2011.

[23] Featherman v. Hennessy, 43 Mont. 310, 316, 115 P. 983, 986 (1911).

[24] Midkiff v. Kincheloe, 127 Mont. 324, 328, 263 P.2d 976, 978 (1953).

[25] Section 85-20-1501, MCA.

yield to the senior's request, the senior may seek a judicial remedy, usually an injunction. In addition to private enforcement by the senior user, the Department of Natural Resources and Conservation (DNRC) is authorized to petition a district court supervising the distribution of water among appropriators to order the person to cease using the water.[26] The DNRC may direct the attorney general or a county attorney to bring a suit to enjoin the unlawful use, or the attorney general or a county attorney may bring the action on their own initiative.[27] Either way, priority must be given to protecting the rights of prior appropriators.

In most cases a junior user cannot ignore a call by a senior user. However, this is not an absolute rule. The futile call doctrine may relieve a junior surface or ground water user from complying with the call. The futile call doctrine holds that a call may be denied if a junior user can prove that the water would not actually reach the senior to satisfy the call, i.e. if the call is futile. Courts have recognized the doctrine, but according to some, the doctrine can be difficult to establish, especially if some water will eventually reach the senior user.[28]

The case most often cited to illustrate the difficulty of establishing the futile call doctrine is State ex rel. Cary v. Cochran, 138 Neb. 163, 292 N.W. 239 (1940). In Cary, junior users alleged that a call by downstream seniors would be futile because of substantial losses from seepage and evaporation along the way to the seniors' point of diversion. The Nebraska Supreme Court refused to apply the doctrine even though the juniors would be required to let 700 cfs of water go by to satisfy senior users who needed only 162 cfs. Because some water would actually reach the seniors, the court reasoned that the call would not be futile even though the result created significant waste.

The futile call doctrine has been recognized by courts in Montana. In 1892, the Montana Supreme Court recognized the concept, stating that:

> Under the theory of the law of this State relating to water rights, the prior appropriator may insist that the water remain in the stream, from which he has the right of prior appropriation, so long as any useful quantity thereof would reach his point of diversion, if allowed to remain. He is entitled to insist that all of such water remain, in order to carry the flow down to his point of diversion, although a large portion of it would be lost by evaporation and percolation. He has the right to the prior use of the water of the creek, and while he may be entitled to a stated quantity only, it may require much more than that quantity in the creek to carry the amount he is entitled to down to his point of diversion. [9]2

In a later decision, the Montana Supreme Court again recognized the futile call concept.[30] In Irion v. Hyde, 105 P.2d 666, 674 (Mont. 1940), the Court reversed and remanded a district court

---

[26] Section 85-2-114, MCA.

[27] Section 85-2-114 (3) and (4), MCA.

[28] Dan Tarlock, *Law of Water Rights and Resources* 5:33 (Clark Boardman Callaghan 1988 & Supp. 1989-2009).

[29] Raymond v. Wimsette, 12 Mont. 551, 31 P. 537, 559 (1892).

[30] Irion v. Hyde, 110 Mont. 570, 105 P.2d 666, 674 (Mont. 1940).

finding that junior users were entitled to use any of the water flowing in the creek at their property that, if permitted to flow, would not reach the senior user's point of diversion in any useful quantity. The Supreme Court concluded that the district court erred because it seemed to "make the test the volume of the flow at defendant's dam." The Supreme Court held that the diversion is justified only if the juniors could prove that the seniors received their full appropriation or if no water would reach the seniors.

Not all Western states have recognized the futile call doctrine. For example, courts in Washington have consistently rejected the doctrine, choosing instead to rely on the language of decrees and priorities. Most recently, in 2006, the Washington Supreme Court reaffirmed its position that the futile call doctrine is best left to the Legislature, stating that "[w]ater management is a huge issue in this state."[31] The Washington court went on to say that "[t]here is clearly controversy as to the best way to manage this state's water resources. However, policy decisions are the province of the Legislature, not of this court."[32]

The State of Idaho has incorporated the futile call concept into the state's conjunctive management rules, which apply to areas that share a common ground water supply. In 1994, Idaho adopted a set of conjunctive management rules for the management of surface water and ground water. The rules "apply to all situations in the state where the diversion and use of water under junior-priority ground water rights either individually or collectively causes material injury to uses of water under senior-priority water rights."[33] Under the rules, a call may be denied if it is considered futile, but the Department of Water Resources may require mitigation or staged curtailment if the diversion causes material injury to a senior user. This may be true even though the hydrological connection is remote. With respect to exempt wells, the rules provide that a call is not effective against any ground water right used for domestic purposes or stock water right so long as the amount used is within the limits of Idaho's exemption statute.[34] The Idaho Supreme Court has upheld the constitutionality of the rules. For more information, see American Falls Reservoir Dist. No. 2 v. Idaho Dept. of Water Resources, 143 Idaho 862, 154 P.3d 433 (2007).

Ground water and surface water

Historically, Montana law distinguished ground water from surface water. Gradually, both the Legislature and the courts began to recognize the connection between ground water and surface water and treat them similarly for purposes of water appropriation and management. For example, in 1966, the Montana Supreme Court issued a decision that explicitly recognized the connection between ground water and surface water. In the decision, the Court stated that "[m]odern hydrologic innovations have permitted more accurate tracing of groundwater movement."[35] The Court also stated that "traditional legal distinctions between surface and

[31] Fort v. State Dept. of Ecology, 133 Wash. App. 90, 135 P.3d 515 (Div. 3 2006).

[32] Id.

[33] Idaho Admin. Code 37.03.11.020.01.

[34] Idaho Admin Code 37.03.11.020.11.

[35] Perkins v. Kramer, 148 Mont. 355, 363, 423 P.2d 587, 595 (1966).

groundwater should not be rigidly maintained when the reason for the distinction no longer exists."[36]

In 2006, the Montana Supreme Court issued a decision that squarely addressed the connection between surface water and ground water.[37] At issue in the case was the DNRC's interpretation of the state's closed basin law in the Upper Missouri River basin, which prohibited the DNRC from granting permits within the Upper Missouri River basin until the issuance of the final decrees.[38] The DNRC was not prohibited, however, from processing applications for the appropriation of ground water unless the ground water was "immediately or directly connected" to surface water.[39] In interpreting the meaning of "immediately or directly connected" to surface water, the DNRC determined that a well for ground water could not pull surface water directly from the source (i.e. induced infiltration). The DNRC's interpretation did not prohibit wells that captured ground water that would otherwise end up in the stream (i.e. prestream capture). The Supreme Court held that both pumping methods reduced surface flows and that DNRC's interpretation did not protect senior water right holders.[40]

Under current Montana law, ground water and surface water are managed under the same permitting system. This means that an applicant for a ground water permit must go through the same permitting process as a surface water applicant unless the appropriation is exempt from the permitting requirements. This is significant because, like a surface water applicant, a ground water applicant must demonstrate that "the water rights of a prior appropriator under an existing water right, a certificate, a permit, or a state water reservation will not be adversely affected."[41]

It also means that senior users have the opportunity to formally object to the application. As such, Montana law recognizes that a senior water right may be affected by both surface and ground water uses. In addition, Montana law does not prioritize any water use over any other, regardless of whether the use is for domestic, agricultural, or municipal purposes. The result is a strict adherence to the prior appropriation doctrine – first in time, first in right – applied to both ground water and surface water, and without prioritization of use.

Challenges to making a call

While senior users may legally make a call against more junior ground water users under the framework outlined above, there are significant practical and legal challenges associated with implementing and enforcing the call, especially if the call is made against a well that is exempt from the permitting process under the Montana Water Use Act.

---

[36] Id.

[37] Montana Trout Unlimited v. DNRC, 2006 MT 72, 331 Mont. 483, 133 P.3d 224.

[38] Section 85-2-343, MCA.

[39] Section 85-2-342, MCA. The definition of ground water was deleted from section 85-2-342, MCA, in 2007. Prior to 2007, section 85-2-342, MCA, defined ground water as "water that is beneath the land surface or beneath the bed of a stream, lake, reservoir, or other body of surface water and that is not immediately or directly connected to surface water."

[40] Montana Trout Unlimited v. DNRC, ¶ 43.

[41] Section 85-2-311(1)(b), MCA.

As noted above, Montana law does not distinguish between surface water and ground water for purposes of priority enforcement, which presents unique challenges for making a call to enforce a water right. Dan Tarlock, an expert in water law, has noted that "[i]n the western states that apply the prior appropriation system to ground water, priority has proved impossible to administer in practice for basins that are not directly hydrologically connected to surface systems."[42] The problem, according to Mr. Tarlock, "is that a causal connection between a victim senior well and a junior well is extremely difficult, if not impossible, to establish. All wells contribute to mining and it is difficult to insulate the causal connection between a well and the relevant cone of depression."[43]

Additionally, a senior user will only make a call on a source when a water shortage exists, and thus, timing is a significant issue in the context of using a call to enforce a water right. With surface flows, it is relatively easy to predict when a senior will receive water pursuant to a call. In the context of ground water, timing can be a significant challenge because it could take several days or weeks for water to reach the surface source depending on the connection. The Montana Bureau of Mines and Geology has illustrated this problem in a report issued to WPIC in 2008. In the report the Bureau stated that:

> There may be a considerable time lag between the start of pumping and any reduction in stream flow depending upon the location of the pumping well (distance and depth) relative to the stream, the hydraulic characteristics of the aquifer, and the pumping rate. Furthermore, the effect of ground-water pumping on stream flow may persist long after pumping has stopped. This is a simplified scenario; in the real world there will be other hydrogeologic factors such as ET, recharge variability, the presence of disconnected streams or reaches, low-permeability streambeds, and deep confined ground-water systems that complicate the stream–aquifer interactions.[44]

Because a call may be made in an area where the connection between surface and ground water is not immediately known and because water may not be received immediately, a call against a ground water development may not be a practical or timely means of enforcing a senior surface right.

It is also unclear what a senior would have to demonstrate upon making a call against a ground water user. As discussed above, upon making a call in Idaho senior users must allege that they have been materially injured by the ground water pumping. Under the Idaho rules "material injury" is defined as "[h]indrance to or impact upon the exercise of a water right caused by the use of water by another person as determined in accordance with Idaho Law . . ."[45] The Idaho Department of Water Resources looks at several factors in determining whether material injury

---

[42] Dan Tarlock, *Prior Appropriation: Rule, Principle, or Rhetoric*, 76 N. Dak. L. Rev. 881, 102, (2000).

[43] *Id.* at 102-103.

[44] See Final Case Study Report to the 60th Legislature Water Policy Committee at: http://www.mbmg.mtech.edu/gwip/gwip_pdf/hb831book_appendix.pdf

[45] Idaho Admin. Code 37.03.11.10.14.

exists, including "[w]hether the exercise of junior-priority ground water rights individually or collectively affects the quantity and timing of when water is available to, and the cost of exercising, a senior-priority surface or ground water right."[46]

Unlike other Western states, Montana law does not prioritize certain water uses over others. This strict enforcement of the prior appropriation doctrine means that a call could be made against a junior permitted well used for agricultural purposes or a junior exempt well used for domestic purposes. From a practical standpoint, however, a senior surface user will likely run into several challenges in attempting to enforce the call, including the futile call doctrine. For example, if a call is made in an area where the hydrological connection between surface water and ground water is unclear, a ground water user could invoke the futile call doctrine and argue that the senior would not receive any water to fulfill the senior's right despite curtailment of the use. Even if the hydrological connection between the surface and ground water source was relatively clear, a junior user could argue that the senior would not receive the water in time to prevent the call from being futile or that seepage or evaporation would prevent the senior from receiving a usable quantity. However, in attempting to invoke the futile call doctrine, a junior ground user would have to overcome the general rule that a call is futile only if the senior will not receive any water pursuant to the call.

Calling exempt wells

Each of the challenges outlined above would also apply to calls made against exempt wells. However, these challenges may be even more pronounced in the context of exempt wells.[47]

The most significant challenge with making a call against an exempt well is likely attempting to assess how the well is affecting the senior user and determining which well or wells caused the depletion.

The common concern with exempt wells is not necessarily the use by a few individual users but rather the cumulative effect of numerous exempt wells in a particular area or development. The question in the context of call, then, is how a senior user would actually make a call to ensure water availability. If the surface depletion is a result of numerous exempt wells in an area, a senior user would theoretically need to make a call on the wells in the entire area to enforce the senior's right. This could include making a call against a subdivision that relies exclusively on exempt wells for domestic water supply. In this context, would the senior make the call against the subdivision as a whole (i.e. against the homeowner's association if one exists) or against each

[46] Idaho Admin. Code 37.03.11.42.01.

[47] The WPIC asked for a list of water right calls made in Montana over the last several years. Unfortunately, it does not seem that such a list exists. This lack of information may be due in large part to the nature of a water right call. In a time of water shortage, a senior water user may make a call on junior water users in order to fulfill the senior's water right. This is an action between private parties and could be something as informal as a phone call, an email, or a chat at the post office, though that chat may be less than friendly. In these circumstances, a call is not an action performed and recorded within a government-based system. If the junior refuses to comply, the senior may ask a court for an injunction. But it does not appear these records are not centrally recorded.

individual user? What if a subdivision has 200 wells?

In addition, there could be serious health and safety problems with making a call on an exempt well. Because of the nature of the exemption itself, many exempt wells are used primarily for domestic purposes, including for drinking water. It is not practical for a senior user to attempt to enforce a call against these wells when shutting off the wells may result in a lack of drinking water for individuals and families. Courts are likely to take a dim view of such attempts. Idaho has prioritized the use of water for domestic purposes over other uses. Therefore, a call from a surface irrigator against a well used primarily for domestic purposes is not effective in Idaho.

Beyond practical problems associated with attempting to curtail the use of an exempt well, there may be constitutional provisions that would limit the ability of a senior user to enforce a water right through a call. The Montana Constitution broadly recognizes that "All persons are born free and have certain inalienable rights", which includes the right to pursue life's basic necessities and seek safety, health, and happiness.[48]

Water is one of life's most essential basic necessities, and it does not take much to see that a user that relies solely on a well for water would likely invoke Montana's constitutional protections for relief from compliance with a call.

Finally, it is worth noting that the permitting process itself may alleviate the need for a senior to make a call. To receive a surface or ground water permit from the DNRC, an applicant must demonstrate that an existing right will not be adversely affected. Oftentimes this requires applicants to mitigate effects on senior users. Whether an adverse effect exists is "based on a consideration of an applicant's plan for the exercise of the permit that demonstrates that the applicant's use of the water will be controlled so the water right of a prior appropriator will be satisfied".[49]

Because permitted ground water users are required to first demonstrate that senior users will not be harmed by the development, many of the issues that would have otherwise resulted in a senior attempting to enforce a water right through a call may be addressed through the permitting process. Nevertheless, because the individual exemption is relatively small, a larger permitted ground water well may have a greater effect on the source than a certain number of exempt wells.

---

[48] Mont. Const. Article II, section 3.
[49] Section 85-2-311, MCA.

Exempt Wells: What are the Options?

As legislators and others debated the exemption over the last few years, suggestions ranged from maintaining the status quo to major overhauls in the way water is dispensed. Attempts included proposed rule changes and legislation. To date, none have succeeded in changing the way exempt wells are administered.[50]

There are "hammer" approaches and "scalpel" approaches for addressing exempt wells, Nathan Bracken an attorney for the Western States Water Council, told the WPIC in January 2012. Bracken, who wrote a report exempt wells, said hammer approaches include repealing the exemption, a statewide reduction for existing wells, or requiring meters on every well. The scalpel approaches, he said, may include refining the exemption or targeting specific watersheds. [51]

In his report, Bracken wrote that overloading the permitting system with small applications, reducing an existing property right, or trying to administer a statewide reporting system rendered most of the hammer solutions infeasible.[52]

Feasible solutions may include limiting the type of exempt development, large subdivisions, for example, or require local governments to condition subdivision approval based on a water right determination. Other feasible approaches Bracken discussed included reducing flow rates and volumes for new wells or reducing the exemption in areas where water availability is of concern. He also discussed revising the exemption to focus on the amount of water consumed instead of the quantity withdrawn.[53]

The WPIC heard two examples of how exempt wells may be managed in specific areas of the state.

In 2011, the DNRC established the Horse Creek Controlled Groundwater Area, a 12-square mile area southwest of Absarokee. According to the agency, data showed that springs in the Horse Creek drainage could dry up and the average annual flows in Horse Creek could be reduced by 25 percent during dry years if a platted subdivision is completed as intended. In that area, an exempt well of 35 gpm may be used if the volume does not exceed 1 acre foot per year. [54]

---

[50] In a November 2010 agreement to dismiss a lawsuit brought by the Clark Fork Coalition and others, the DNRC agreed to initiate rulemaking to define the term "combined appropriation" in a way that would be broader than the current definition of only wells physically connected. House Bill No. 602 prevented the DNRC from rulemaking until after Oct. 1, 2012.

[51] http://leg.mt.gov/content/committees/interim/2011-2012/Water-Policy/minutes/September-13-2011/Exhibit10.pdf

[52] Report: Exempt Well Issues in the West, Nathan Bracken, Western States Water Council, http://leg.mt.gov/content/Committees/Interim/2011-2012/Water-Policy/Meeting-Documents/September-2011/exempt-well-issues-west.pdf

[53] Ibid.

[54] http://leg.mt.gov/content/Committees/Interim/2011-2012/Water-Policy/Meeting-Documents/January-2012/horse-creek-gwa.pdf

The other example was a proposal that is part of the Confederated Salish and Kootenai Tribe's (CSKT) water right compact being negotiated in northwestern Montana. As proposed, a well for a single home or business with a rate of up to 35 gpm could divert up to 2.4 acre-feet annually. Irrigation would be limited to .7 acres. Up to three homes or businesses could share 2.4 acre-feet annually with .75 acres of irrigation allowed. Neither of these options would require metering.[55]

Multiple homes and businesses could share up to 10 acre-feet annually, with a quarter acre of irrigation allowed for each. However, metering and reporting would be required.[56]

In an effort to involve those who would be affected by any changes to exempt well policy, the WPIC asked for suggestions from stakeholders. That resulted in five bills being drafted for discussion purposes at public meetings.

As proposed by Trout Unlimited, LC8000 would prohibit multiple exempt wells in new subdivisions anywhere in the state. And in Gallatin, Lewis and Clark, Missoula, and Ravalli counties, a mitigation exchange would be established to offset the effects of new water uses.[57]

The Montana Building Industry Association proposed in LC8001 that larger, denser subdivisions (30 or more lots, with an average lot size of 3 acres or less) install public water systems, which would most likely also require a water use permit.[58] The association also proposed LC8002, which would reduce the volume allowed under the exemption to 10 gpm and 1 acre-foot consumed. The amount of water consumed is that amount used by plants or lost to evaporation.[59]

The Montana Well Drillers Association suggested in LC8003 to lower the exemption volume to 5 acre-feet for wells drilled in unconfined aquifers within closed basins, for the reason that those wells are more likely to be connected to surface water used by senior water right holders.[60]

The Senior Water Rights Coalition proposed in LC8004 to limit new subdivisions to an exemption of 35 gallons a minute and 10 acre-feet a year using one or more wells. Appropriations of more water would be subject to permitting.[61]

---

[55] http://leg.mt.gov/content/committees/interim/2011-2012/Water-Policy/minutes/January-10-2012/Exhibit16.pdf

[56] Ibid.

[57] LC8000 http://leg.mt.gov/content/Committees/Interim/2011-2012/Water-Policy/Legislation/lc8000-02.pdf

[58] LC8001 http://leg.mt.gov/content/Committees/Interim/2011-2012/Water-Policy/Legislation/lc8001-02.pdf

[59] LC8002 http://leg.mt.gov/content/Committees/Interim/2011-2012/Water-Policy/Legislation/lc8002-02.pdf

[60] LC8003 http://leg.mt.gov/content/Committees/Interim/2011-2012/Water-Policy/Legislation/lc8003-02.pdf

[61] LC8004 http://leg.mt.gov/content/Committees/Interim/2011-2012/Water-Policy/Legislation/lc8004-02.pdf

Public Comment

The WPIC may wish to include written public comment received once the report, any findings and recommendations, and legislation is released in August 2012.

Findings and Recommendations

Through research and presentations on the topics the WPIC chose to study, committee members formulated findings and recommendations. There are none to report as of this draft.

Appendix A

AN ACT ESTABLISHING A PROCESS FOR THE LEGISLATURE TO PROVIDE DIRECTION FOR THE IMPLEMENTATION OF EXEMPT WELL LAWS; REQUIRING AN INTERIM STUDY OF ISSUES RELATED TO GROUND WATER WELLS EXEMPT FROM PERMITTING; TEMPORARILY PROHIBITING RULEMAKING FOR WELLS EXEMPT FROM PERMITTING; PROVIDING AN APPROPRIATION; AND PROVIDING EFFECTIVE DATES AND A TERMINATION DATE.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF MONTANA:

Section 1. Legislative findings. The legislature finds that:

(1) the state of Montana has managed the allocation of water under the prior appropriation doctrine for more than 100 years;

(2) Article IX, section 3, of the Montana constitution recognizes and confirms all existing water rights;

(3) the right to the use of water through a water right is a recognized property right;

(4) the development of ground water wells that are exempt from permitting may have an adverse effect on other water rights;

(5) the Water Use Act requires the department of natural resources and conservation to coordinate the development and use of the water resources of the state so as to effect full utilization, conservation, and protection of its water resources; and

(6) the Water Use Act does not provide the department of natural resources and conservation with clear direction on the administration of ground water wells exempt from permitting.

Section 2. Interim study. (1) The water policy interim committee, provided for in 5-5-231, shall conduct a study of:

(a) wells that are exempt from permitting pursuant to 85-2-306, including:

(i) determining the number of existing exempt wells and estimating the number of ground water wells that may be exempted from permitting over the next decade under current laws and regulations;

Appendix A

(ii) summarizing the types of beneficial uses to which water from exempt wells is applied;

(iii) analyzing the amount of water reasonably necessary for the various beneficial uses served by exempt wells compared to the current statutory limits for flow rate and volume;

(iv) exploring options to provide accurate measurement of water appropriated via exempt wells;

(v) examining enforcement options for exempt wells to ensure that they do not exceed statutory limits or disrupt the priority system for water right administration governed by the Water Use Act and the Montana constitution;

(vi) examining applicable research and analysis conducted by the ground water investigation program at the Montana bureau of mines and geology provided for in 85-2-525;

(vii) examining the historical treatment of exempt wells and the evolution of laws and rules governing exempt wells;

(viii) analyzing how the water appropriated by exempt wells may affect surface water appropriations, including existing claims, permits, certificates, and reservations; and

(ix) examining the legal options for integrating exempt wells into the principle that first in time is first in right when senior water rights are not fulfilled;

(b) the statutes, rules, programs, and policies employed by other prior appropriation states for exempt wells, including legal challenges;

(c) the adequacy of existing programs and tools for managing and mitigating the development of wells that would otherwise be exempt from permitting, including but not limited to controlled ground water areas created pursuant to Title 85, chapter 2, part 5, water mitigation banks, community water system incentives, and in-lieu-of-fee programs;

(d) the relationship between exempt wells and land use decisions, including the relationship between exempt wells and individual septic systems, the cost comparison of installing public water systems or extending existing water infrastructure, and the role of local governments in requiring alternatives to exempt wells; and

(e) the rulemaking authority of the department of natural resources and conservation in relation to the statutory policy and purpose provided for in 85-2-101.

(2) The committee shall prepare a report to submit to the 63rd legislature that provides clear policy direction and necessary legislation to guide Montana's policy regarding wells that may be exempt from the permitting process.

Appendix A

Section 3. Limit on rulemaking authority. (1) Except as provided in subsection (2), the department of natural resources and conservation may not adopt rules to implement the provisions of 85-2-306(3) for ground water wells that are exempt from permitting until October 1, 2012.

(2) The department may adopt rules to implement amendments to 85-2-306(3) that were passed and approved by the 62nd legislature for:

(a) appropriations by a local governmental fire agency organized under Title 7, chapter 33, provided that the appropriation is used only for emergency fire protection; or

(b) nonconsumptive appropriations for geothermal heating or cooling exchange applications.

Section 4. Appropriation. (1) There is appropriated $15,000 from the general fund for the biennium beginning July 1, 2011, to the water policy interim committee for the purpose of completing the study required pursuant to [section 2].

Section 5. Effective dates. (1) Except as provided in subsection (2), [this act] is effective on passage and approval.

(2) [Section 4] is effective July 1, 2011.

Section 6. Termination. [This act] terminates June 30, 2013.

- END -

Appendix A

HB0602

I hereby certify that the within bill,

HB 0602, originated in the House.

_____

Chief Clerk of the House

_____

Speaker of the House

Signed this _____ day

of _____, 2011.

_____

President of the Senate

Signed this _____ day

of _____, 2011.

Appendix A

HOUSE BILL NO. 602

INTRODUCED BY W. MCNUTT

AN ACT ESTABLISHING A PROCESS FOR THE LEGISLATURE TO PROVIDE DIRECTION FOR THE IMPLEMENTATION OF EXEMPT WELL LAWS; REQUIRING AN INTERIM STUDY OF ISSUES RELATED TO GROUND WATER WELLS EXEMPT FROM PERMITTING; TEMPORARILY PROHIBITING RULEMAKING FOR WELLS EXEMPT FROM PERMITTING; PROVIDING AN APPROPRIATION; AND PROVIDING EFFECTIVE DATES AND A TERMINATION DATE.

Appendix B

Exempt Well Certificates of Water Right by County and Year 1/1/1991 to 12/31/2010

COUNTY	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Grand Total
RAVALLI	238	331	529	336	308	375	341	298	294	293	235	273	387	383	356	617	304	208	241	162	6509
FLATHEAD	276	223	340	311	238	119	422	215	216	206	181	210	262	614	414	623	230	399	224	139	5862
GALLATIN	193	268	324	308	352	155	298	229	243	287	219	299	153	594	296	296	520	193	187	25	5439
LEWIS AND CLARK	197	158	188	217	258	146	185	202	235	253	170	134	310	389	263	361	273	145	174	187	4445
MISSOULA	164	230	365	273	242	260	218	176	185	207	152	151	208	189	227	419	162	189	176	116	4309
YELLOWSTONE	86	130	128	106	137	157	133	172	172	190	157	177	165	212	145	300	158	136	132	15	3008
LINCOLN	80	46	86	122	73	56	162	61	90	83	60	61	94	206	111	257	99	172	91	60	2070
MADISON	50	71	70	62	107	52	90	56	75	71	36	82	51	177	131	122	177	106	62	12	1660
CARBON	41	52	70	88	70	113	77	70	107	67	65	94	64	110	80	126	88	102	76	10	1570
PARK	41	50	119	68	136	36	88	60	64	84	58	89	42	128	93	75	148	55	62	7	1503
CASCADE	52	48	91	51	76	44	71	64	72	83	74	89	51	55	56	93	91	63	60	46	1330
JEFFERSON	85	47	50	69	59	50	61	68	74	78	43	22	83	107	88	116	66	37	50	32	1285
STILLWATER	41	40	67	62	49	56	74	49	72	112	52	73	61	90	55	79	76	82	67	7	1264
LAKE	87	73	118	132	94	55	176	73	59	32	18	20	31	53	35	81	22	42	20	7	1228
SANDERS	38	35	62	89	68	50	108	47	51	45	32	33	31	78	62	118	68	95	71	30	1211
BEAVERHEAD	55	36	39	50	50	44	59	28	57	48	33	21	75	109	77	97	87	45	70	38	1118
SILVER BOW	111	98	50	47	46	38	46	46	39	58	18	8	27	70	28	36	45	14	45	26	896
BROADWATER	20	13	16	28	29	22	32	31	32	35	25	7	37	84	78	107	70	37	58	33	794
FERGUS	26	28	43	20	24	33	26	23	49	34	78	82	49	27	50	78	46	35	29	13	793
MUSSELSHELL	25	45	40	26	33	24	22	34	28	30	34	34	24	38	40	50	27	25	28	9	616
GRANITE	12	22	31	17	27	35	28	17	24	20	24	21	29	42	38	56	40	28	28	15	554
RICHLAND	24	26	26	35	41	27	36	20	20	33	14	20	12	33	24	45	29	39	29	19	552
MINERAL	15	22	24	15	26	23	30	29	38	37	10	14	25	31	33	65	24	25	15	14	515
SWEET GRASS	17	19	28	23	16	20	24	17	23	36	45	34	30	23	31	40	19	26	36	3	510
POWELL	30	16	17	29	38	21	18	23	27	33	15	4	22	45	30	41	26	24	26	22	507
DEER LODGE	28	9	17	17	33	17	28	22	33	24	13	10	28	40	23	27	18	7	22	16	432
CUSTER	10	17	18	32	22	32	21	15	10	14	15	18	20	43	24	38	21	18	20	13	421
POWDER RIVER	18	34	22	29	12	4	6	14	11	17	21	29	14	27	23	25	29	15	16	5	371
DAWSON	13	16	27	11	25	20	11	9	22	26	7	30	13	20	13	46	19	14	17	7	366
BIG HORN	13	16	8	9	23	14	11	15	12	17	8	18	66	18	14	19	12	17	14	12	336
SHERIDAN	11	3	20	14	27	25	12	16	30	27	10	22	14	4	10	21	19	12	21	12	330
JUDITH BASIN	5	6	17	3	4	6	9	7	20	31	42	43	15	9	18	25	22	19	18	8	327
ROSEBUD	9	12	16	18	12	6	15	19	13	12	19	19	7	29	17	25	11	15	20	7	301
TETON	8	8	9	7	7	6	7	2	5	20	19	14	19	13	7	72	26	24	18	9	300
GARFIELD	13	10	13	10	18	10	16	15	11	22	8	11	14	5	12	16	23	23	16	23	289
HILL	25	27	13	14	19	8	14	17	16	8	21	15	8	12	15	16	3	9	10	8	278
MCCONE	13	21	13	23	15	8	11	9	7	11	10	17	8	5	9	30	22	9	23	5	269
MEAGHER	15	14	7	5	22	5	8	8	8	13	26	20	7	21	10	19	32	10	9	4	263
VALLEY	9	8	8	16	20	8	7	10	16	7	3	13	10	8	11	14	12	10	8	14	212
CARTER	12	19	23	12	9	4	6	2	6	12	7	21	13	6	11	19	5	2	2	3	194
ROOSEVELT	7	2	14	15	17	9	14	18	13	13	13	12	5	1	5	15	5	9	2	1	190
PHILLIPS	5	9	18	6	11	6	2	2	3	5	6	18	6	2	5	28	13	11	11	15	182
BLAINE	21	23	14	5	6	1	2	1	6	2	20	17	11	3	3	13	5	3	9	2	167
PRAIRIE	3	13	6	6	8	4	8	7	4	17	6	5	13	11	3	12	13	2	9	17	167
FALLON	6	8	8	7	4	8	3	6	6	10	4	5	8	15	12	13	10	10	16	5	164
GOLDEN VALLEY	7	5	1	2	6	3	7	4	6	5	12	7	7	17	8	24	8	10	2	2	143
WHEATLAND	9	4	13	7	6	6	2	3	9	2	13	8	5	3	7	4	6	11	6	1	125
WIBAUX	15	8	6	14	5	1	4	2	6	6	4	6	3	8	2	7	2	4	14	6	123
CHOUTEAU	11	8	9	6	3	1	1	5	9	7	6	7	1	3	4	8	4	3	3	2	101
TREASURE	8	4	3	8	4	4	1		2	2	5	4	3	7	5	9	2	18	5		94
DANIELS	1	1	7	11	13	7	5	5	7	6		2	3		1	9	3	4	1	6	92
PONDERA	1	2	4	2			5		2	5	12	5	4	3	2	17	8	2	12	6	92
GLACIER	2	3	2	1		3	4	3	10	6	6	9	2	1	1	9	2	7	2	1	74
PETROLEUM	2	6	7	2	5	2	2	2	4	5	4	4	6	2	3	4	2	3	2	2	69
TOOLE	3	2	2		2	1	1	2		5	4	4	2		1	5	1	3	3		41
LIBERTY	1	1	3			1	1	1		2	6	3					1		2		22
Grand Total	**2308**	**2446**	**3269**	**2896**	**2955**	**2241**	**3069**	**2349**	**2653**	**2814**	**2198**	**2468**	**2658**	**4223**	**3120**	**4887**	**3254**	**2626**	**2390**	**1259**	**56083**

Appendix B

CUMULATIVE NUMBERS OF EXEMPT WELLS
(excluding stock)

Year	Bitterroot	Jefferson / Madison	Teton	Upper Clark Fork	Upper Missouri	Total
1991	0	256	12	324	846	1,438
1992	455	391	18	559	1,361	2,784
1993	879	526	27	706	1,890	4,028
1994	1,274	698	30	889	2,451	5,342
1995	1,620	857	33	1,094	3,084	6,688
1996	2,027	1,008	35	1,264	3,534	7,868
1997	2,346	1,133	37	1,429	4,003	8,948
1998	2,697	1,272	39	1,598	4,551	10,157
1999	3,049	1,461	41	1,791	5,155	11,497
2000	3,355	1,605	57	2,006	5,856	12,879
2001	3,645	1,724	65	2,151	6,533	14,118
2002	3,957	1,882	71	2,267	7,142	15,319
2003	4,311	2,039	82	2,411	7,620	16,463
2004	4,682	2,226	90	2,578	8,222	17,798
2005	5,160	2,444	97	2,772	8,870	19,343
2006	5,797	2,785	145	3,056	9,847	21,630
2007	6,156	2,912	167	3,291	10,941	23,467
2008	6,435	3,013	188	3,468	11,775	24,879
2009	6,607	3,071	198	3,575	12,212	25,663
2010	6,813	3,151	202	3,699	12,508	26,373
2020	11,000	4,900	280	5,500	19,000	41,000
2030	14,000	6,500	380	7,300	25,000	53,000
2040	18,000	8,100	480	9,100	31,000	67,000

CUMULATIVE VOLUMES (AF) FOR EXEMPT WELLS
(assuming 1/2 acre lawn)

Year	Bitterroot	Jefferson / Madison	Teton	Upper Clark Fork	Upper Missouri	Total Diverted Volume	Total Consumed Volume
1991	0	298	14	377	984	1,672	974
1992	529	455	21	650	1,582	3,237	1,885
1993	1,022	612	31	821	2,197	4,683	2,728
1994	1,481	811	35	1,034	2,849	6,210	3,617
1995	1,883	996	38	1,272	3,585	7,775	4,529
1996	2,357	1,172	41	1,469	4,109	9,147	5,328
1997	2,727	1,317	43	1,661	4,654	10,403	6,059
1998	3,135	1,479	45	1,858	5,291	11,808	6,878
1999	3,545	1,699	48	2,082	5,993	13,366	7,785
2000	3,900	1,866	66	2,332	6,808	14,973	8,721
2001	4,238	2,004	76	2,501	7,595	16,413	9,560
2002	4,600	2,188	83	2,636	8,303	17,809	10,374
2003	5,012	2,370	95	2,803	8,859	19,139	11,148
2004	5,443	2,588	105	2,997	9,559	20,691	12,052
2005	5,999	2,841	113	3,223	10,312	22,488	13,099
2006	6,739	3,238	169	3,553	11,448	25,146	14,647
2007	7,157	3,385	194	3,826	12,720	27,282	15,891
2008	7,481	3,503	219	4,032	13,689	28,923	16,847
2009	7,681	3,570	230	4,156	14,197	29,835	17,378
2010	7,921	3,663	235	4,300	14,541	30,660	17,859
2020	13,000	5,700	330	6,400	22,000	48,000	28,000
2030	16,000	7,600	440	8,500	29,000	62,000	36,000
2040	21,000	9,400	560	10,600	36,000	78,000	45,000

2020-40 future year projections estimated by linear regression

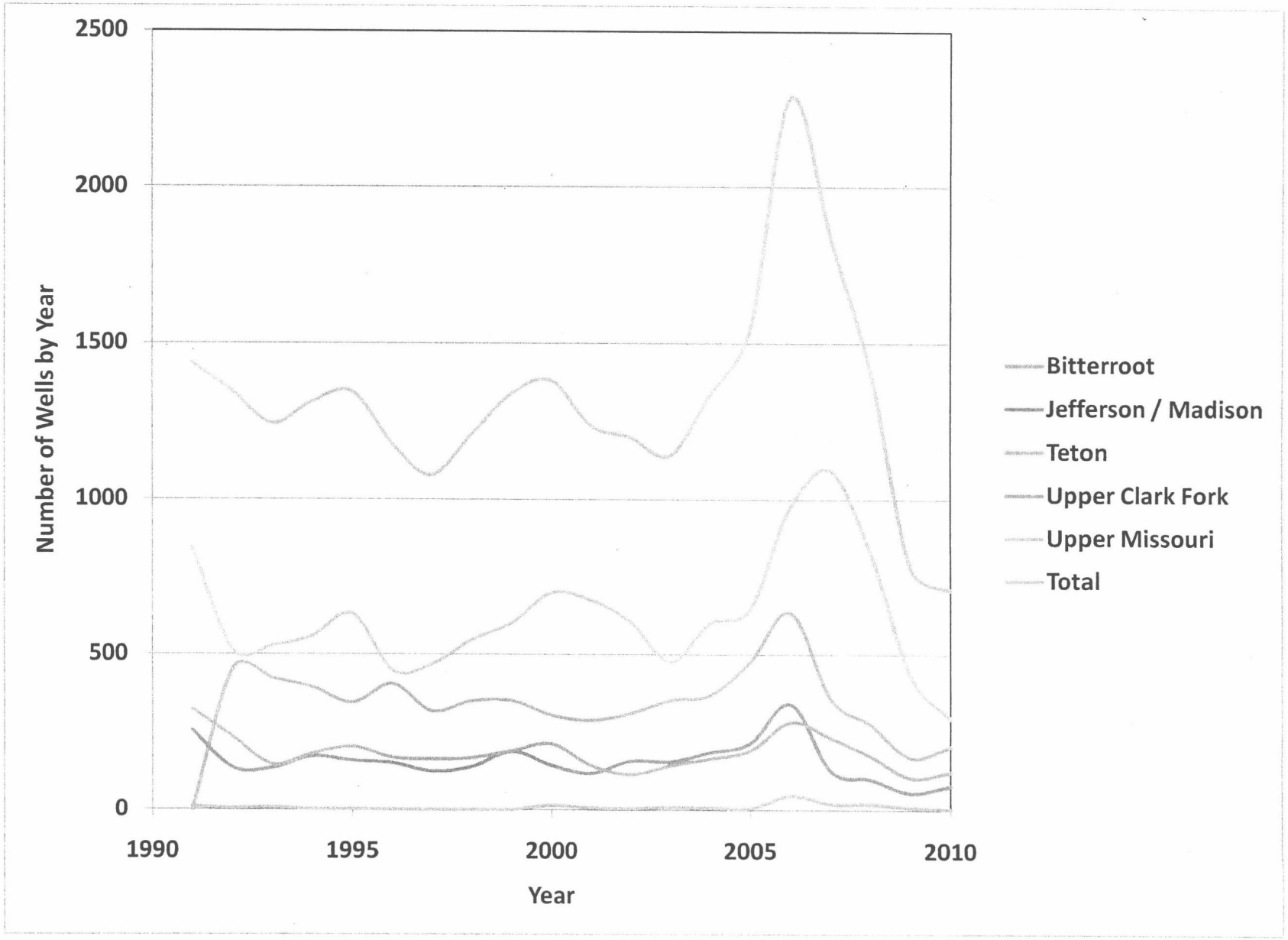
Standards Used for Volume

	Domestic In-House Use		Lawn irrigation
	GPD	AF	AF/acre
Diverted	187.5	0.21	1.9
Consumed	9.375	0.01	1.33

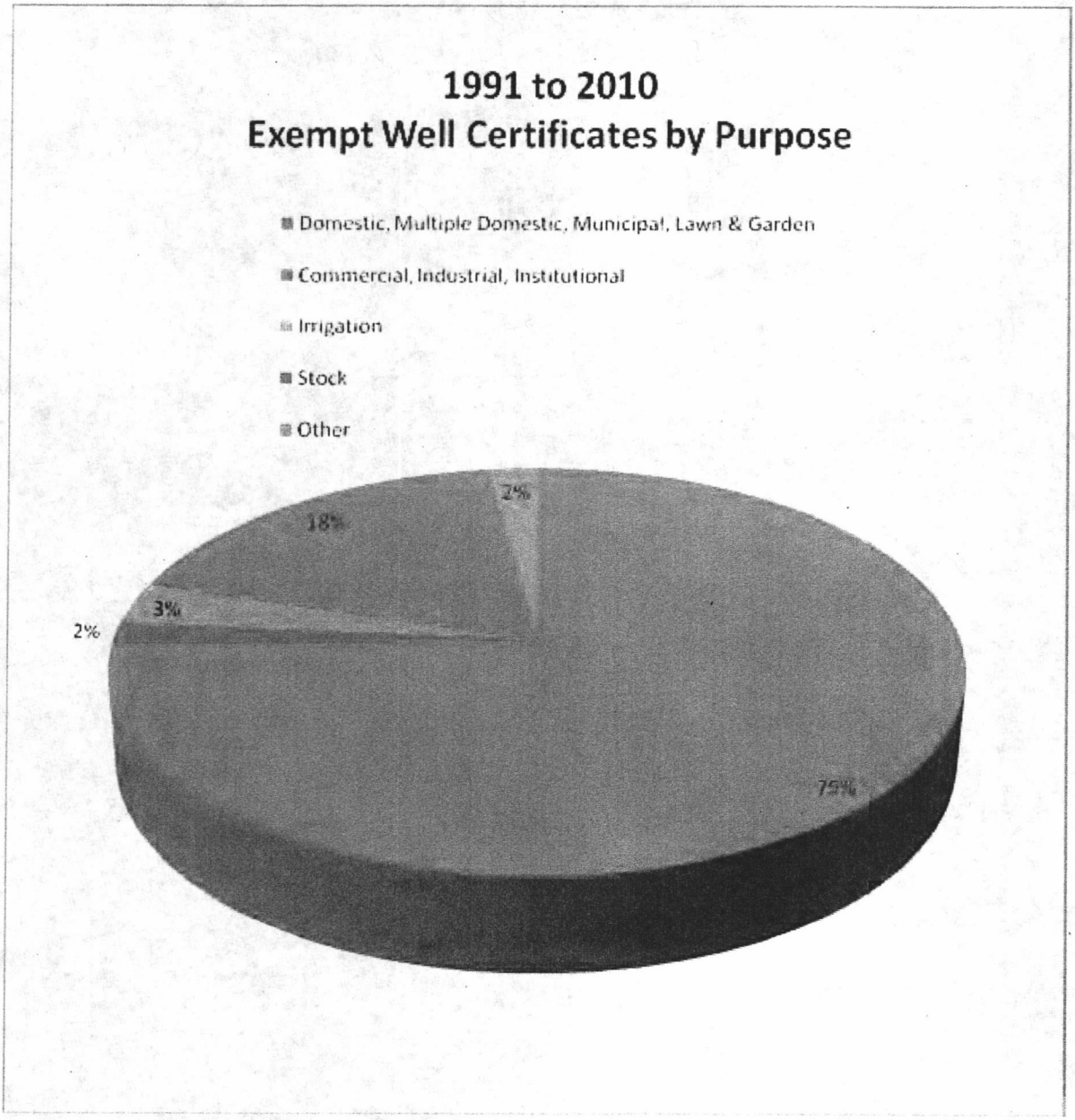
Appendix B

DNRC, Water Resources Division
June 1, 2011

EXEMPT WELLS BY YEAR
IN CLOSED BASINS



Appendix B

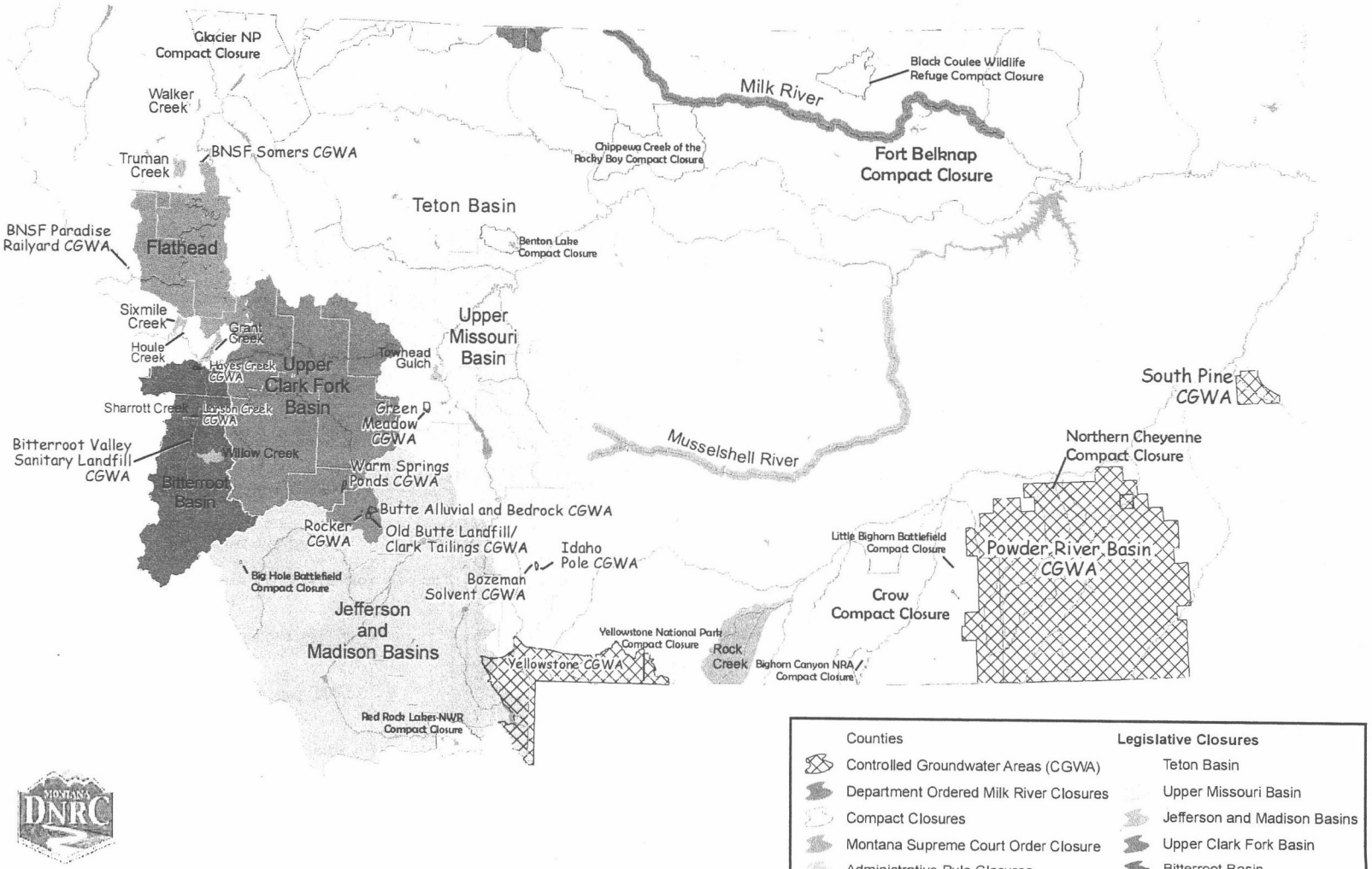


Compiled by DNRC for June 2011 WPIC

"Other Uses" include such purposes as: fishery, wildlife, wetlands, and recreation

Appendix C

Montana Basin Closures and Controlled Groundwater Areas September 2010



Map created by MT DNRC WRD on 09/13/10.

Appendix C

CONTROLLED GROUNDWATER AREAS

BNSF Paradise Railyard (76N) Effective 08/19/2002 (0.5 sq.mi).

BNSF Somers Site (76LJ) Effective 05/23/2003 (approx. 0.11 sq.mi).

Bozeman Solvent Site (41H) Effective 07/20/1998 (approx. 5.5 sq.mi.).

Bitterroot Valley Sanitary Landfill (76H) Effective 02/09/2004 (0.51 sq.mi.).

Butte Alluvial and Bedrock (76G) Effective 10/30/09 (approx. 9 sq mi.)

Green Meadow- Temporary (41I) Effective 4/11/2008, extended 4/05/2010 (approx. 9 sq mi)

Hayes Creek (76 HB) Permanent Closure 05/25/1995 (0.08 sq.mi.) Permanent Closure 12/01/1998 (3.9 sq.mi.).

Idaho Pole Site (41H) Effective 12/30/2001 (0.2 sq.mi.).

Larson Creek (76HF) Effective 11/14/1988 (approx. 0.5 sq.mi.).

Old Butte Landfill/Clark Tailings Site (76G) Effective 12/17/1999 (1.2 sq.mi).

Powder River Basin (42A, 42B, 42C, 42I, 42J, 42KJ, 43O, and 43P) Effective 12/15/1999 (7105 sq.mi.)

Rocker (76G) Effective 05/30/1997 (0.25 sq.mi.)

South Pine (42L and 42M) Effective 11/01/1967 (178 sq.mi.).

Sypes Canyon (41H) Effective 04/26/2002 (4.75 sq.mi.).

Warm Springs Ponds (76G) Effective 05/25/1995 (5 sq.mi.).

Yellowstone Controlled Groundwater Area USNPS - Montana Compact (41F, 41H, and 43B) Effective 01/31/1994 (1334 sq.mi.)

MONTANA SUPREME COURT ORDER

Flathead Indian Reservation Closure (2061 sq.mi.) Effective until the Confederated Salish and Kootenai tribes' water rights are quantified or otherewise resolved.

COMPACT CLOSURES

Chippewa Cree Tribe of the Rocky Boy's Reservation - Montana Compact Effective 12/09/1999 (932 sq.mi.) - Big Sandy Creek (Excluding Sage Creek and Lonesome Lake Coulee) and Beaver Creek (40H).

Crow Reservation - Montana Compact Effective 06/16/1999 (3.586 sq.mi.) - Bighorn River (43P); Little Bighorn River (43O); Pryor Creek (43E); Rosebud Creek within the Reservation (42A), and these drainages within the Reservation: Youngs Creek, Squirrel Creek, Tanner Creek, Dry Creek, Spring Creek (42B); Sarpy Creek (42KJ); Cottonwood Creek, Five Mile Creek, Bluewater Creek (43D); Sage Creek (43N); Fly Creek, Blue Creek, Dry Creek, and Bitter Creek (43Q).

Fort Belknap Reservation - Montana Compact Effective 04/06/2001 (15071 sq.mi.) - Milk River Basin, both above the Western Crossing and below the Eastern Crossing of boundary between USA and Canada (40GF, 40G, 40H, 40I, 40J, 40K, 40L, 40M, 40N, and 40O). Supercedes pre-existing closures.

National Park Service - Montana Compact Effective 01/31/1994 - Big Hole Battlefield (41D) - Glacier N.P. (76LJ, 76I, 40T, 41L, and 41M), (1580 sp.mi.) - Yellowstone N.P. (43B, 41F, and 42H) (1820 sq.mi., 251 sq.mi. within Montana) - Littler Bighorn Battlefield National Monument (3O) - Bighorn Canyon (43P).

Northern Cheyenne-Montana Compact Effective 05/17/1991 (1308 sq.mi.) - Rosebud Creek Basin Moratorium (42A).

United States Fish and Wildlife Service - Montana Compact Effective (05/17/1991) - Benton Lake (249 sq.mi.) and Black Coulee (136 sq.mi.) National Wildlife Refuges (41Q) Effective 04/19/1999 (239 sq.mi.) - Red Rock Lakes National Wildlife Refuge (41A).

DEPARTMENT ORDERED MILK RIVER CLOSURES

Milk River Basin Mainstem (40F, 40J, and 40O) Effective 01/01/1983 (283 sq.mi.).

Milk River Southern Tributaries (40F) Effective 09/01/1991 (152 sq.mi.).

ADMINISTRATIVE RULE CLOSURES

Grant Creek (76M) Effective 01/26/1990 (55 sq.mi.).

Houle Creek (76M) Effective 09/20/1996 (3.43 sq.mi.).

Musselshell River (40A and 40C) Effective 06/26/1992 (292 sq.mi.).

Rock Creek (43D) Effective 02/09/1990 (618 sq.mi.).

Sharrott Creek (76HF) Effective 07/16/1993 (8 sq.mi.).

Sixmile Creek (76M) Effective 12/08/1995 (23.2 sq.mi.).

Towhead Gulch (41I) Effective 01/17/1992 (7 sq.mi.).

Truman Creek (76LJ) Effective 02/10/1995 (7 sq.mi.).

Walker Creek (76LJ) Effective 09/28/1990 (40 sq.mi.).

Willow Creek (76HD) Effective 09/23/1994 (61.4 sq.mi.).

LEGISLATIVE CLOSURES

Bitterroot Basin Temporary Closure (76H) Effective 03/29/1999 (2862 sq.mi.).

Jefferson and Madison Basins (41A, 41B, 41C, 41D, 41E 41F, and 41G) Effective 04/01/1993 (11660 sq.mi.).

Teton Basin (41O) Effective 04/21/1993 (1917 sq.mi.).

Upper Clark Fork Basin (76E, 76F, 76G, and 76GJ) Effective 04/14/1995 (6017 sq.mi.).

Upper Missouri Basin (41H, 41I, 41J, 41K, 41QJ, and 41U) Effective 04/16/1993 (10620 sq.mi.).

Appendix D

WATER POLICY INTERIM COMMITTEE
September 13, 2011

GENERAL WATER USE REQUIREMENTS

This Table does not include flow rate but these uses are based on using 35 GPM or less.

PURPOSE	DIVERTED (acre-feet per yr)	CONSUMED (acre-feet per yr)	ASSUMPTIONS
DOMESTIC (in-house use)	.3 AF	.03 AF	- 2.5 persons / household - 100 gpd / household - 10% consumed w/standard drain field[1]
STOCK ➢ Per animal unit ➢ 100 animal units	.017 AF 1.7 AF	.017 AF 1.7 AF	- 100% consumed
LAWN & GARDEN ➢ ¼ acre ➢ ½ acre ➢ 1 acre	Billings / Bozeman 0.6 AF / 0.5 AF 1.2 AF / 1.0 AF 2.4 AF / 2.0AF	Billings / Bozeman 0.5 AF / 0.4 AF 1.0 AF / 0.8 AF 2.0 AF / 1.6 AF	- 80% efficiency - Billings – 24" net irrigation (IWR) - Bozeman – 19" net irrigation (IWR)
IRRIGATION ➢ 1 acre ➢ 4.34 acres ➢ 7 acres[2]	1.4 - 2.3 AF 10.0 AF 10.0 AF	.98 – 1.61 AF 7.0 AF 7.0 AF	- Pasture grass - Pertinent climatic area - 70% sprinkler efficiency
COMMERCIAL			- 10% consumed[3] - Does not include landscape water
➢ Restaurants (75 seats)	.67 AF	.067 AF	- 8 gpd / patron
➢ Motels (100 rms)	5.6 AF	.56 AF	- 50 gpd / 2-person
➢ Retail / Mini-Mall	.08 AF	.008 AF	- 5 retail shops w/ 2 sales persons each - 8 gpd / salesperson

[1] Consumption could vary dramatically with use of community wastewater systems.
[2] The flow rate necessary for 7 acres of irrigation will vary and may exceed 35 GPM depending on the type of sprinkler system.
[3] Consumption could vary dramatically with use of community wastewater systems.

Appendix D

WATER POLICY INTERIM COMMITTEE
September 13, 2011

PURPOSE	DIVERTED (acre-feet per yr)	CONSUMED (acre-feet per yr)	ASSUMPTIONS
INDUSTRIAL			- 100% consumed
➢ Dust control	3.31 AF	3.31 AF	- 2 (3500 gal) trucks = 7000 gpd for 154 days = 1,780,000 gals.
➢ Gravel Operation (crushing/pug mill)	8.4 AF	8.4 AF	- Crusher 360,000 gals. (10 hrs/day for 60 days) - Dust Control 1,300,000 gals. (200 days) - Pug Mill 1,080,000 gals. (10 hrs./day for 60 days)

DEVELOPMENT OPTIONS UNDER 10 AF USING EXEMPT WELLS

(Volumes of water are based on table above but do not include flow rates)

Example 1:

10 lot subdivision with 2.5 persons and ¼ acre lawn and garden per household

Billings

.3 AF/household x 10 homes = 3 AF (in-house use)

.6 AF/household x 10 homes = 6 AF lawn and garden

Total diverted volume = 9 AF

Bozeman

.3 AF/household x 10 = 3 AF (in-house use)

.5 AF/household x 10 = 5 AF lawn and garden

Total diverted volume = 8 AF

Example 2:

6 lot subdivision with 2.5 persons and ½ acre lawn and garden per household

Billings

.3 AF/household x 6 homes = 1.8 AF (in-house use)

1.2 AF/household x 6 homes = 7.2 AF lawn & garden

Total Diverted Volume = 9 AF

Bozeman

.3 AF/household x 6 homes = 1.8 AF (in-house use)

1 AF/household x 6 homes = 6 AF lawn and garden

Total Diverted Volume = 7.8 AF

Appendix D

WATER POLICY INTERIM COMMITTEE
September 13, 2011

Example 3:

20 lot subdivision with 2.5 persons and 3,500ft^2 (0.08 acres) lawn & garden per household

Billings

.3 AF/household x 20 homes = 6 AF (in-house use)

.19 AF/household x 20 homes = 3.8 AF

Total Diverted Volume = 9.8 AF

Bozeman

.3 AF/household x 20 homes = 6 AF (in-house use)

.16 AF/household x 20 homes = 3.2 AF lawn and garden

Total Diverted Volume = 9.2 AF

Example 4:

Commercial development with a mini-mall, 1 restaurant (75 seats), and ¼ acre lawn & garden

Billings

.08 AF = Mini-mall

.67 AF = Restaurant

.6 AF = lawn and garden

Total Diverted Volume = 1.35 AF

Bozeman

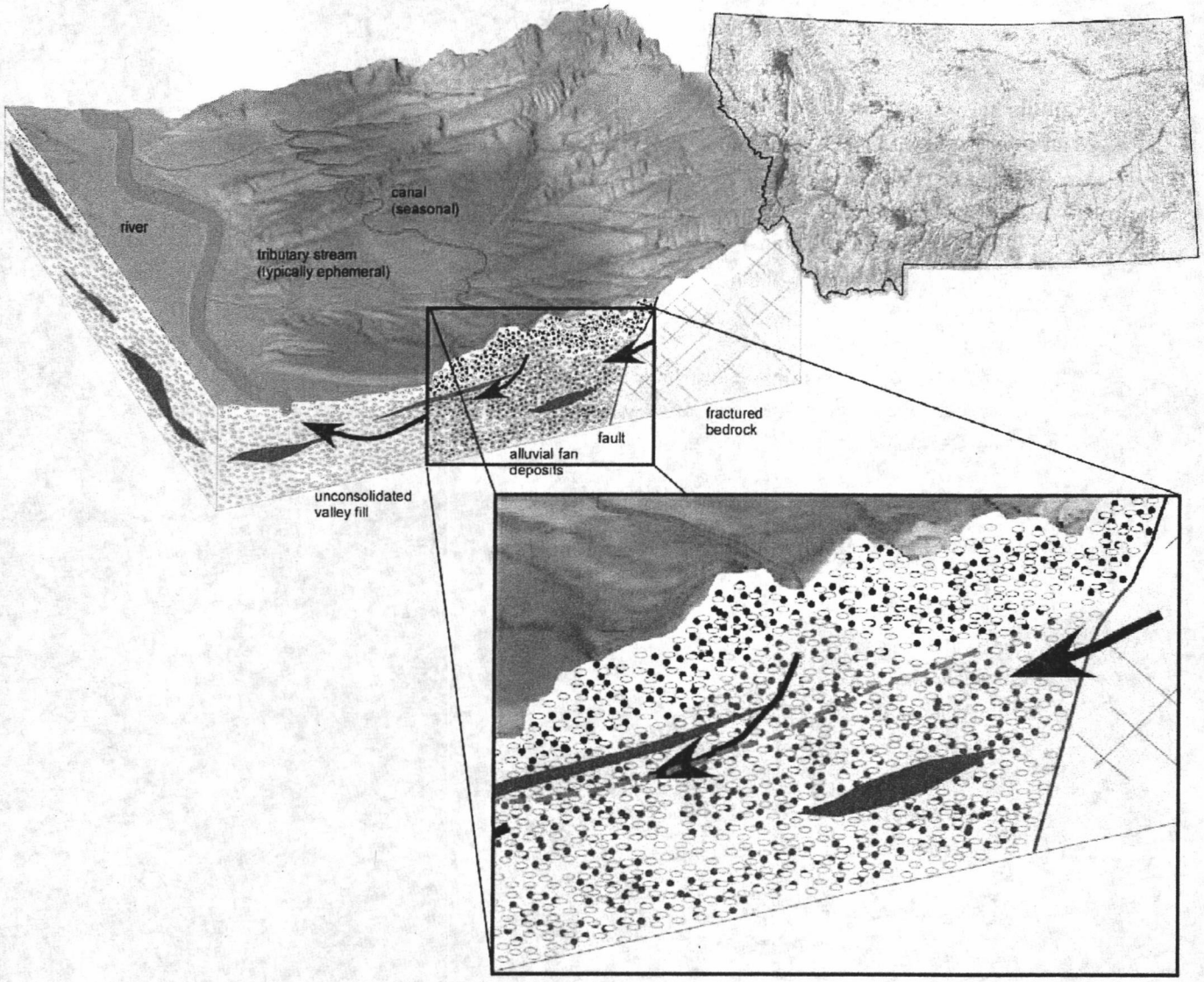
.08 AF = Mini-mall

.67 AF = Restaurant

.5 AF = lawn & garden

Total Diverted Volume = 1.25

Appendix E



Hydrogeology Related to Exempt Wells in Montana

A Report to the 2010–2012 Water Policy Interim Committee of the Montana Legislature

John Metesh
Montana Bureau of Mines and Geology
Open-File Report 612

Appendix E

Contents

Introduction 1

Groundwater Sources 2

Western Montana 3

Eastern Montana 4

Growth Trends 4

Hydrologic Budgets—The Importance of Scale 6

Large Area Budgets 6

Groundwater Consumptive Use at the Basin Scale 7

Consumptive Use at the Sub-Basin Scale 7

The Importance of the Temporal Scale 10

Summary of Study Area Budgets 13

Altered Watersheds 13

Stream Depletion Zones 18

References 20

Figures

Figure 1. The Ground Water Information Center (GWIC) database contains more than 221,000 records for wells throughout Montana 1

Figure 2. Aquifers are often described as confined or unconfined 2

Figure 3. GWIC reports about 130,000 total wells in western Montana 3

Figure 4. Productive basin-fill aquifers are generally restricted to river valleys 4

Figure 5. Changes in reporting requirements affect short-term changes in growth trends, but the steady long-term growth in the number of wells is evident 5

Figure 6. Estimation that 2.5 percent of all water withdrawn in Montana is groundwater 6

Figure 7. Consumptive use of groundwater by domestic wells estimated from withdrawal rates and the relative percentage of consumption for each use. 8

Figure 8. Consumptive use of all water estimated for each of six sub-basins in southwest Montana 9

Figure 9. Consumptive use compared for two different time scales at two of the study areas 11

Figure 10. Consumptive use compiled for the study areas in which the growth of domestic wells is of concern 12

Figure 11. Water table mounding, downgradient water-level rise, and increased groundwater flow toward the stream result from increased recharge to groundwater from irrigation canals 14

Appendix E

Figure 12. The East Bench irrigation canal provides one of many examples of groundwater recharge by irrigation 15

Figure 13. The rate of stream depletion by pumping groundwater is largely affected by the distance between the well and the stream 17

Figure 14. Stream depletion zones can be established based on aquifer properties and groundwater flow modeling 19

Table

Table 1. Ditch loss reported by MBMG investigations throughout Montana 13

Appendix E

Introduction

Montana has over 200,000 wells on record with the Montana Bureau of Mines and Geology (MBMG) Ground Water Information Center database (GWIC; mbmggwic.mtech.edu) whose use has been identified as domestic. Some estimates show as much as 30 percent of the population relies on wells for water supply.

For the purposes of this discussion, it is important to note the difference between the terms domestic and exempt. When a well log is filed, the driller or well owner indicates the intended use of the well. Domestic use is one option; other options include, but are not limited to, stock, irrigation, public water supply, or monitoring. The term exempt refers to a groundwater development that, based on the maximum proposed annual volume pumped (currently 10 acre-feet per year) and the maximum pumping rate (currently 35 gallons per minute), is exempt from permitting; the exemption is established by a certificate issued by the Montana Department of Natural Resources and Conservation. The use of the exempt well, whether it be domestic, irrigation, or stock, does not affect the exemption. Due largely to changes in the regulatory requirements regarding well log and water-right filing, there are many wells that indicate domestic use on the well log for which a certificate does not exist. More than 90 percent of all the wells for which a use has been reported are used for domestic or stock.

Figure 1 shows the distribution of all the wells across Montana; each well is represented by a small red dot. Population centers and river valleys are easily distinguished by areas of high well density. Although a geologic source or aquifer is not reported for all wells in the GWIC database, shallow basin-fill aquifers along river and stream valleys are subject to the greatest development.

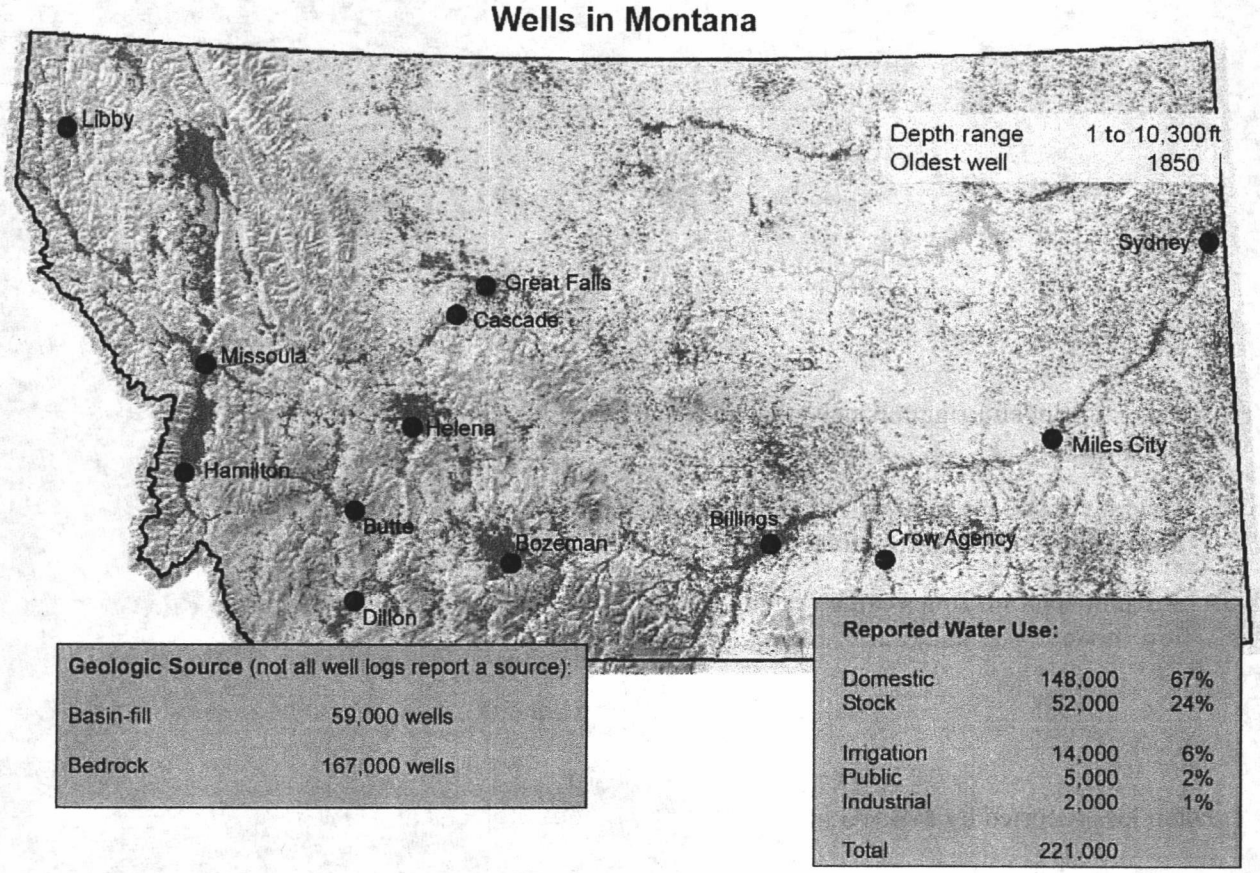


Figure 1. The Ground Water Information Center (GWIC) database contains more than 221,000 records for wells throughout Montana. Each well is represented by a small red dot on the map.

Appendix E

John Metesh

Groundwater Sources

Montana is often described in terms of its contrasting physiographic or geologic provinces—the mountainous western third and the plains of the eastern two-thirds. An aquifer is permeable geologic material capable of storing and transmitting groundwater. An unconfined or water-table aquifer (bottom of fig. 2) is recharged directly by infiltration of precipitation or surface water; the water table typically ranges from a few feet to tens of feet below the surface. Unconfined aquifers are sensitive to changes in precipitation and withdrawal and are particularly vulnerable to contamination by surface sources such as septic systems and applied chemicals.

Confined aquifers (top of fig. 2) are overlain by a low-permeability material that limits the vertical flow of water into or out of the aquifer. In central and eastern Montana, confined aquifers are typically consolidated, permeable sandstone or limestone formations overlain by low permeable shale. These aquifers extend for hundreds of miles, from the recharge areas in the mountains to the northern and eastern areas of the State. In the western Montana valleys, the deeper portions of the basin-fill aquifers may be confined or partially confined by layers of clay or silt.

It is important to note that confined aquifers must somewhere be unconfined or exposed to receive surface recharge; likewise, for groundwater to flow, the aquifer must discharge to the surface. The recharge areas for several of the important confined aquifers in eastern Montana are in the central mountains; the discharge areas are unknown, but certainly are north and east of the State. Recharge areas for the deep confined aquifers of the western Montana valleys are in the mountains that define the valley or unconfined aquifers in the upland valley margins.

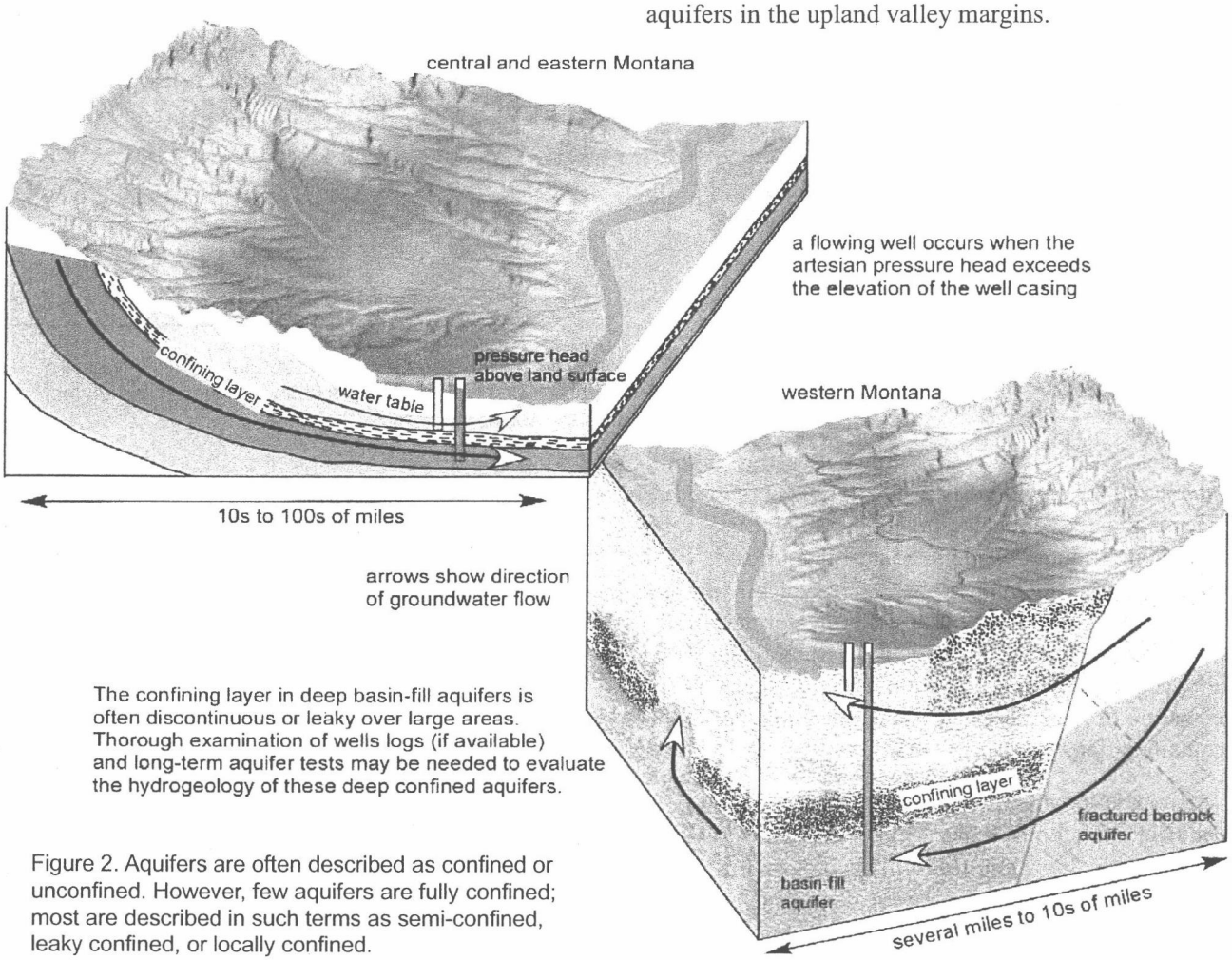
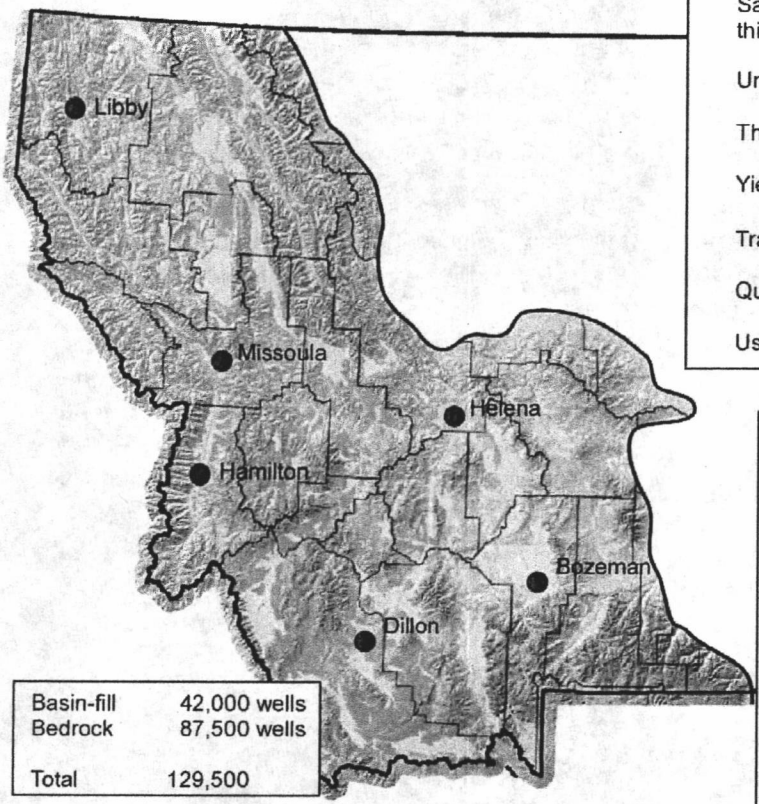


Figure 2. Aquifers are often described as confined or unconfined. However, few aquifers are fully confined; most are described in such terms as semi-confined, leaky confined, or locally confined.

Major Aquifers of Western Montana



Basin-fill	42,000 wells
Bedrock	87,500 wells
Total	129,500

Basin-fill:

Sand and gravel along major and tributary valleys, thick basin-fill deposits in intermontane basins

Unconfined aquifers

Thickness: 30 to >1,000 feet

Yield: 1 to 3,500 gpm; average is 35 gpm

Transmissivity: 500 to 200,000 feet^2/day

Quality: < 500 mg/L (total dissolved solids)

Use: domestic and stock, some irrigation

Bedrock:

metamorphic rocks, shale, limestone, granite, volcanic rocks, shallow on valley margins

Unconfined on valley margins

Thickness: generally unlimited, but yield decreases with depth

Yield: 1 to 5,000 gpm; average is 5 gpm

Transmissivity: 50 to 10,000 ft^2/day

Quality: < 100 mg/L (total dissolved solids)

Use: domestic and stock, rare irrigation

Figure 3. GWIC reports about 130,000 total wells in western Montana. The bedrock aquifers consist of igneous, metamorphic, and sedimentary rocks.

Western Montana

Domestic wells in western Montana are most often completed in the shallow basin-fill aquifers composed of unconsolidated sand and gravel in the major valleys or along tributary valleys. Basin-fill aquifers, shown as yellow and tan in figure 3, are typically thick (>1,000 ft); well yields are usually far greater than the demand of a typical domestic user. Natural water quality is generally very good, but the shallow unconfined nature of these aquifers makes them vulnerable to contamination.

As population growth continues and development expands into the foothills and valley margins, wells in the fractured-bedrock aquifers will become an important source of water for domestic use. Wells in the fractured-bedrock aquifers tend to have low or marginal yield for domestic use, which will limit growth in some areas.

Appendix E

John Metesh

Major Aquifers of Eastern Montana

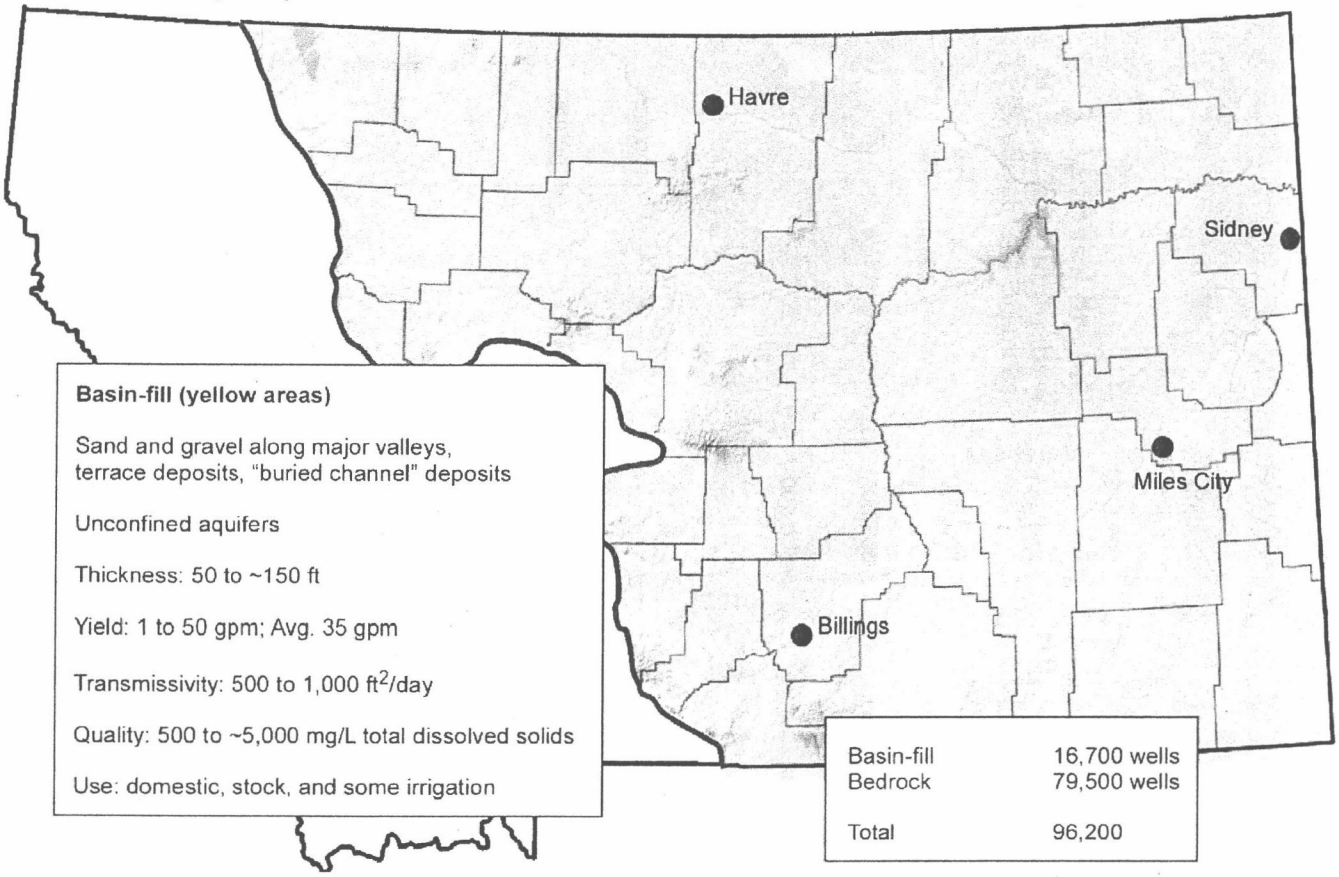


Figure 4. Productive basin-fill aquifers are generally restricted to river valleys. Most areas outside the major river valleys rely on bedrock aquifers for water supply.

Eastern Montana

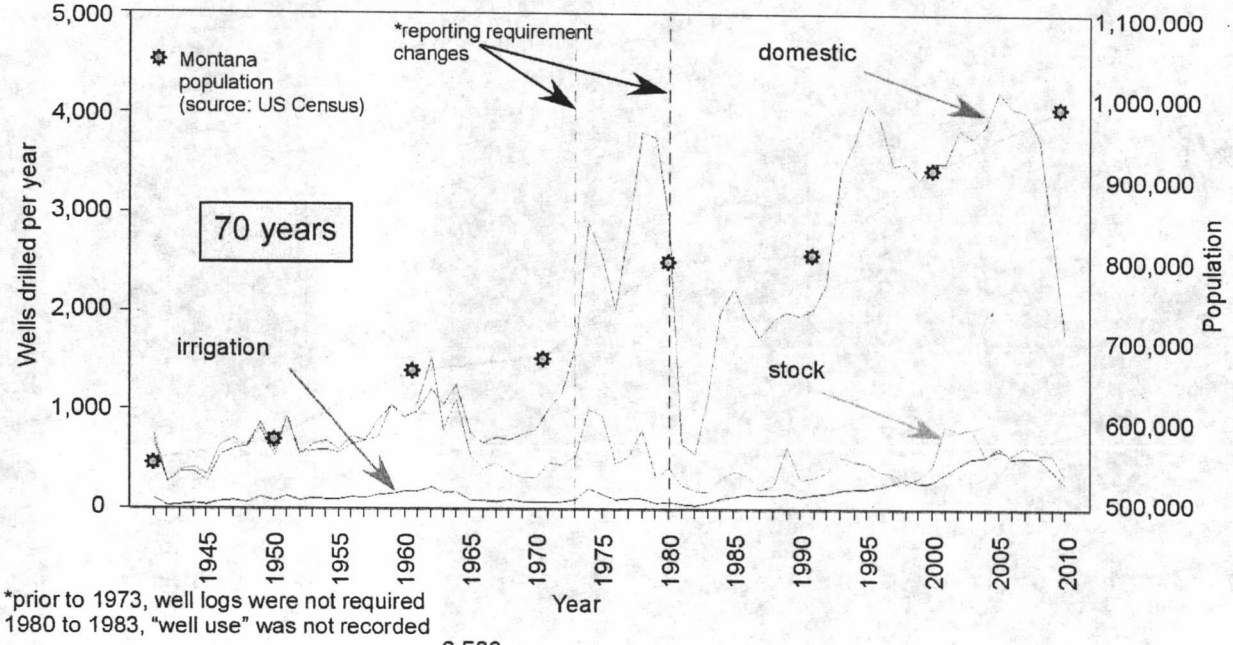
Population centers in central and eastern Montana have developed along the major river valleys; surface water is the typical source for cities and towns. Outside the population centers, domestic wells are the principal source of water. The unconsolidated basin-fill aquifers of eastern Montana, shown in yellow in figure 4, are notably thin compared to those of the western valleys and are vulnerable to overpumping and contamination by surface sources.

There are several important bedrock aquifers in eastern Montana (not shown); these include the sandstone and coal beds of the Fort Union (14,000 wells), the sandstone beds of the Fox Hills–Hell Creek (5,500 wells), the Judith River (2,700 wells), and the Eagle–Virgelle Formations (2,200 wells). As discussed in the previous section, the bedrock aquifers in the central and eastern part of the state are generally extensive and confined; aquifers in the eastern part of the state are confined and flowing wells are common. These aquifers are generally the sole source of water for domestic and stock use throughout eastern Montana.

Growth Trends

More than half of the 200,000 wells in Montana were drilled in the past 20 years, and more than 6,000 wells were drilled in 2004, a trend that appeared likely to continue, but was disrupted by the (temporary?) economic downturn of 2008 (fig. 5).

Although changes in reporting requirements over the past 70 years affect the accurate account of drilling activity, the trend of the number of domestic wells appears to mimic population growth. By far, the highest rate of growth has been for domestic wells, which accounts for 85 to 90 percent of all wells drilled in a given year; there has also been a notable increase in the number of wells for which irrigation is the reported use (top graph of fig. 5).



Growth trends of wells in Montana
(source: GWIC database)

*prior to 1973, well logs were not required
1980 to 1983, "well use" was not recorded

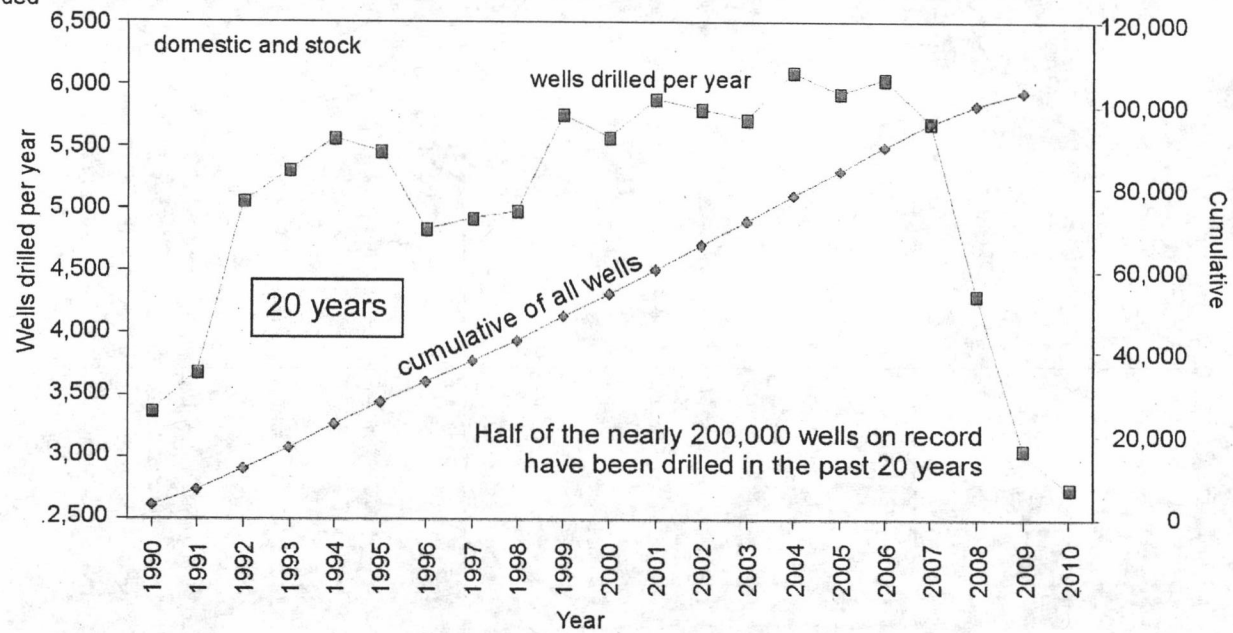


Figure 5. Changes in reporting requirements affect short-term changes in growth trends, but the steady long-term growth in the number of wells is evident.

Appendix E

John Metesh

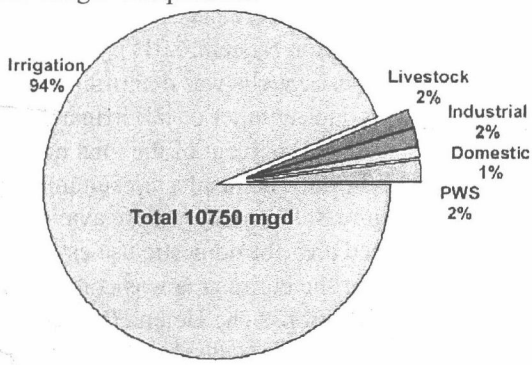
Hydrologic Budgets—The Importance of Scale

A budget, whether it be for finances or water, relates the income/inflow to expenses/outflow at a specific scale of time or space; it provides a means to evaluate the availability and allocation of the supplies and demands. A change in the scale of the budget can drastically change the emphasis. For example, compare the financial budget of Montana (about $4 billion) with that of the US (about $1.4 trillion). Montana's budget, at 3% of the national budget, is much smaller than that of many Federal agencies. However, a budget change of $1 billion would have a much greater impact in Montana than at the Federal level. Similarly, farmers and businessmen appreciate that the amount of money in the bank, or in the field, or in stock, differs widely on a daily, monthly, or annual scale. Just like comparing a small business budget to that of a large corporation, the monthly financial budget for a retail business can tell a much different story than that of the annual budget. The same analysis can be applied to hydrologic budgets. It is critical for the discussion of budgets to examine the scale, both temporal and spatial, of the budget and to appreciate the importance of individual budget components.

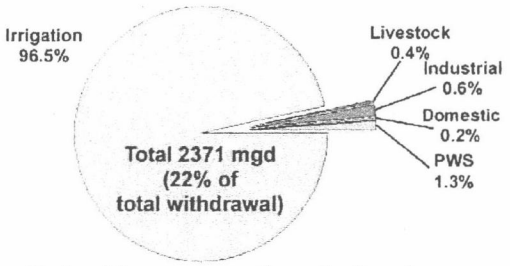
Large Area Budgets

The U.S. Geological Survey (USGS; Cannon and Johnson, 2004), estimated that 94 percent of all water withdrawn in Montana each was for irrigation and 1 percent was for domestic purposes (fig. 6). Consumption of that water followed a similar pattern; irrigation consumed almost 96 percent of the water withdrawn and domestic about 0.2 percent. Cannon and Johnson also point out that about 2.5 percent of all water withdrawn is groundwater; the rest is surface water. On the scale of the entire State, on an annual basis, groundwater withdrawal or consumptive use, for any purpose, is a minor component of the budget. However, if the scale of the budget is changed, the importance of groundwater can drastically change. Consider the global scale of water storage: only 2.5 percent of all the water on the planet is fresh; almost 69 percent of that fresh water is inaccessible as ice. Of the remaining, useable water, 99 percent is available as groundwater and only 1 percent is surface water (Gleick, 1996; inset box of fig. 6).

Figure 6. Cannon and Johnson (2004) estimate that 2.5 percent of all water withdrawn in Montana is groundwater. On a different scale, Gleick (1996) estimated that 99 percent of all usable water in the world is groundwater.



Statewide withdrawal of all water



Statewide consumption of all water

Exempt wells—the big picture

Montana total water withdrawal (million gallons per day)
Surface water = 10,480 (97.5%)
Groundwater = 272 (2.5%)

Groundwater uses (million gallons per day)

Irrigation	=	140	(52%)
Public water	=	65	(24%)
Industrial	=	32	(12%)
Exempt (domestic)	=	22	(8%)
Exempt (stock)	=	12	(4%)

Source:
Cannon and Johnson (2004)

Global water distribution:

2.5% of all water is fresh (non-saline)

Of that, 1.3% is surface water and 30% is groundwater (the rest is in glaciers and ice caps)

That means that 99% of the world's usable water is groundwater

Groundwater Consumptive Use at the Basin Scale

Consumptive use is water removed from the hydrologic system without replacement or return. Water consumed by plants, known as transpiration, and evaporation from the soil and surface water bodies are the largest consumptive uses. Plant transpiration and soil evaporation is termed evapotranspiration. Estimates of the evapotranspiration component of a water budget are typically taken as consumptive use.

As noted, Canon and Johnson (2004) estimated that 2.5 percent of all the water withdrawn in Montana annually is groundwater. Within that 2.5 percent, they estimate that about 21 percent of the water withdrawn for irrigation is consumed, about 21.5 percent of the water withdrawn for industrial use is consumed, and 37 percent of the water withdrawn for public water supply is consumed. Consumption of water for domestic and livestock use was assumed to be 100 percent of the water withdrawn. When these percentages are applied to reported withdrawals on the basin scale (fig. 7), the relative consumptive use rates change dramatically from those presented on a statewide scale.

Consumptive use by domestic wells in southwest Montana ranges from 15 to over 50 percent of the total groundwater consumed (fig. 7). Irrigation consumptive use has a similar range, but in different basins. Total consumptive use ranges from less than 1 million gallons per day (mgd) to about 15 mgd.

Consumptive Use at the Sub-Basin Scale

Domestic consumptive use is attributed largely to lawn and garden watering; in-house consumptive use is small. In this analysis, the in-house consumptive use was considered zero; that is, domestic consumptive use was attributed entirely to evapotranspiration by lawns. Agriculture consumptive use is attributed to water consumption by crops irrigated by one of three methods: (1) center pivot, (2) flood irrigation by canals and turnouts, or (3) sprinkler.

Consumptive use of both surface water and groundwater was estimated for the six MBMG Ground Water Investigation Program areas for each of the three agriculture irrigation categories and for domestic use. The monthly crop-water demand was multiplied by the estimated area irrigated by each of the three methods for agricultural land and for each lot served by a domestic well. Crop-water demand data for each area was obtained from the local AgriMet station (U.S. Bureau of Reclamation, 2011) for the 2010 water year; alfalfa was used to represent agricultural use and lawn was used to represent domestic use. The area of each agricultural application was determined from GIS coverages (Montana State Library's Natural Resource Information System, 2011). The lawn area assigned to domestic wells was determined from air photos showing late summer or fall irrigation for a randomly selected 10 percent of the total number of lots in the sub-basin. The results are summarized in the table in figure 8. Where data were available, the average irrigated area for domestic use estimated from the air photos for the entire area was compared to data from local subdivisions. The Helena (North Hills) project area included several subdivisions with public water supplies. In their evaluation of the water budget, Waren and others (2010) determined a consumptive use equivalent to 0.25 acres irrigated. This compares well to the 0.23 acres determined by the method used for this analysis. Similar comparisons showed good agreement in the lower Beaverhead and Belgrade study areas. The pie charts in figure 8 present the total annual consumptive use by each land use type. At this scale, with project sub-basins ranging from 7,000 to 78,000 acres, the impact of domestic wells used for lawn irrigation is markedly different from that presented at a statewide scale.

Appendix E

John Metesh

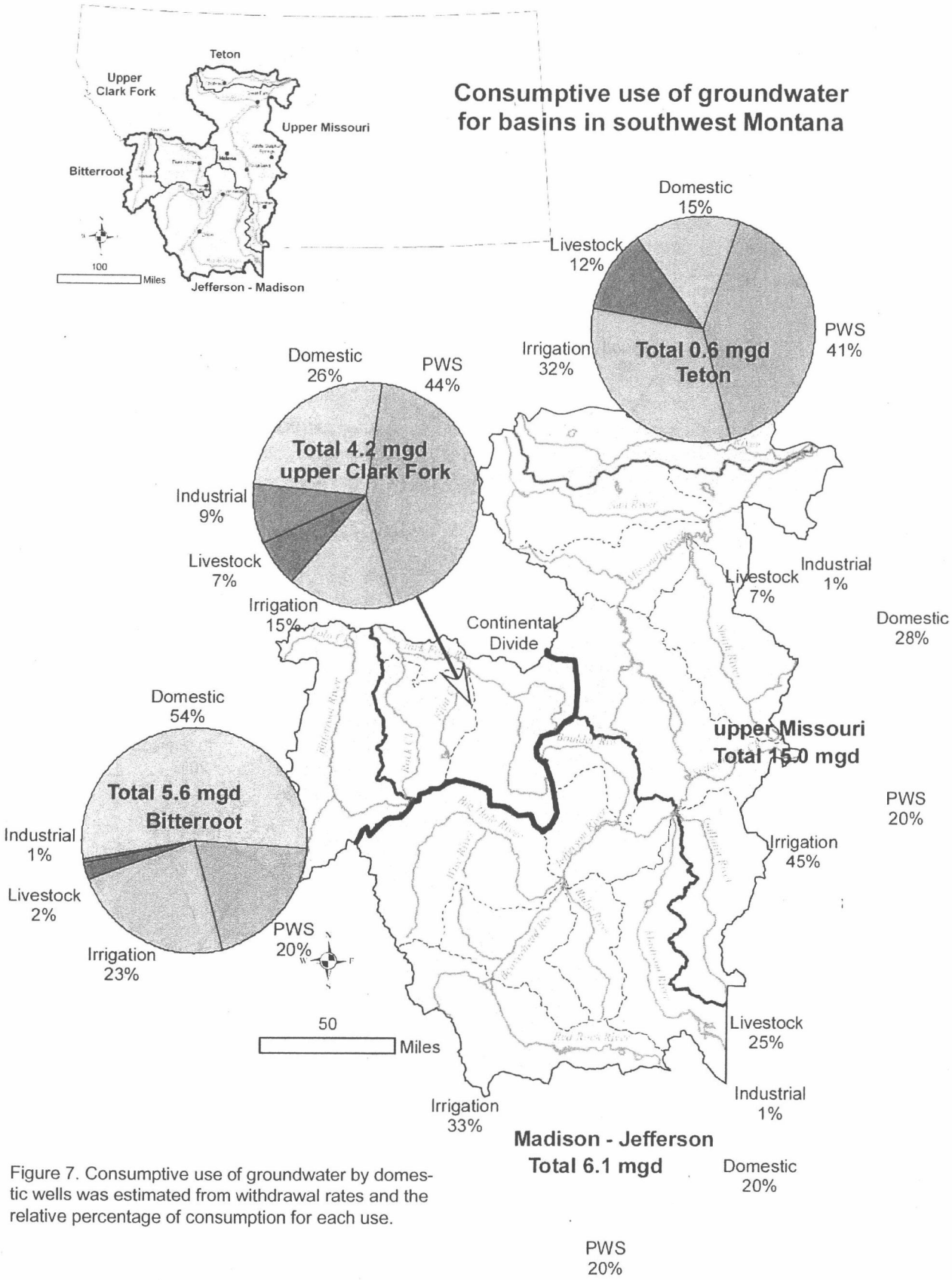


Figure 7. Consumptive use of groundwater by domestic wells was estimated from withdrawal rates and the relative percentage of consumption for each use.

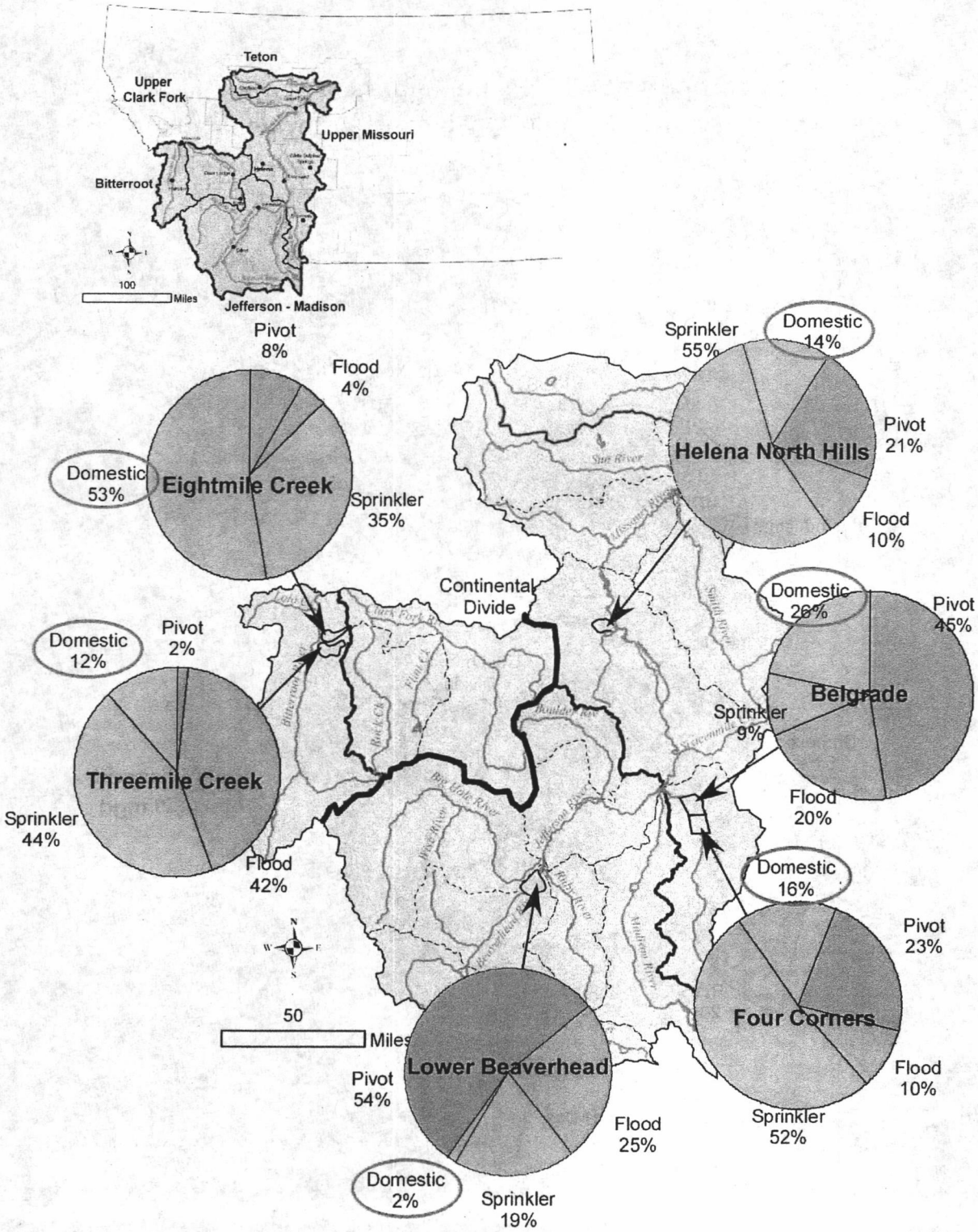


Figure 8. Consumptive use of all water was estimated for each of six sub-basins within southwest Montana.

The Importance of the Temporal Scale

Water budgets are most often presented on an annual basis; generally the changes in the hydrologic system respond to annual climate cycles. Consumptive use, particularly by human activities, varies significantly daily, monthly, or seasonally depending on local conditions and activity. Overall, consumptive use by lawns in the six study areas showed the greatest variance at a monthly temporal scale. With the exception of the lower Beaverhead, all the study areas were focused in areas of high domestic well density.

The pie charts in figure 9 compare the annual consumptive use to an early summer, monthly consumptive use. In Eightmile Creek, the peak consumptive use month did not vary much from the annual, but in the Four Corners area, there is considerable difference. Identifying where and when these seasonal differences are important may help manage water use during the months of high demand and low supply.

Another aspect of the temporal scale is the time between the diversion of the water and the consumption of the water. Reduction of stream flow from a surface-water diversion is immediate; reduction of stream flow from a pumping well can take days or decades depending on the aquifer properties and the distance between the stream and the well. Thus, the timing of consumptive use may be very different than the impact of that consumptive use on stream flow or groundwater levels. A more detailed discussion of the factors affecting the timing of groundwater pumping is presented later.

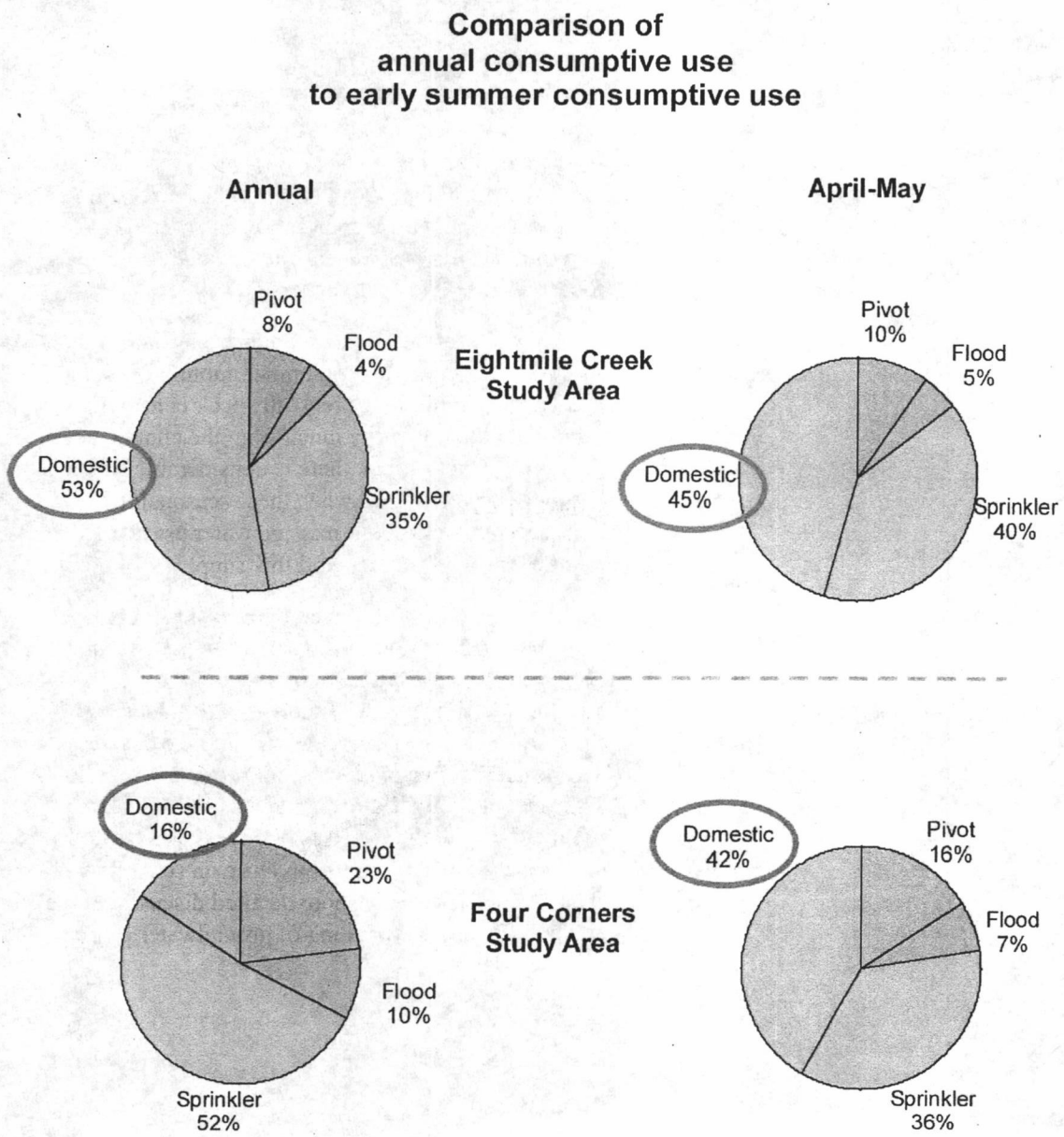
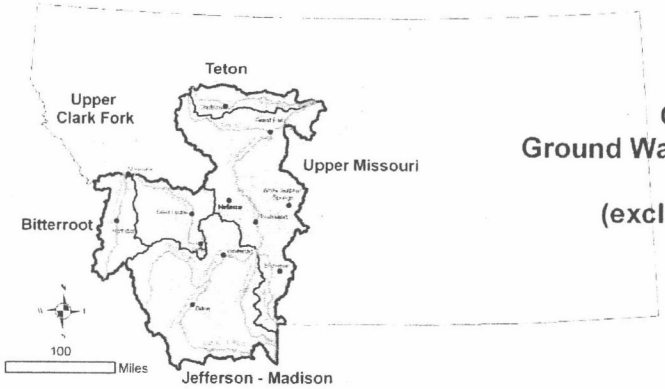


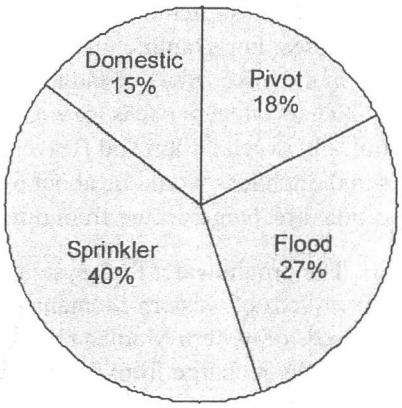
Figure 9. Consumptive use was compared for two different time scales at two of the study areas. In Eightmile Creek the high-use months did not differ from the annual total, whereas in the Four Corners area, the difference was markedly different.

Appendix E

John Metesh



Composite for 5 Ground Water Investigation Program Study Areas (excludes L Beaverhead)



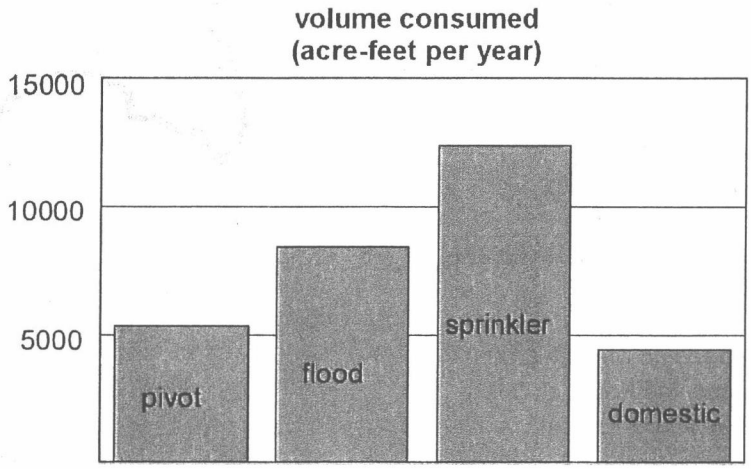


Figure 10. Consumptive use was compiled for the study areas in which the growth of domestic wells is of concern: Florence–Eightmile Creek, Florence–Threemile Creek, Helena–North Hills area, Bozeman–Four Corners area, and the Belgrade area.

Summary of Study Area Budgets

A composite of data for the five sub-basins shows that domestic lawn use accounts for 15 percent of the annual consumptive use of groundwater (fig. 10). This is notably higher than the 0.2 percent consumptive use based on a statewide average reported by Canon and Johnson (2004). That is not to say the data or analyses of the data are in conflict, or that there is no impact at the basin or statewide scale; it demonstrates the importance of the scale of observation. Data collected and analyzed for local conditions in a sub-basin will likely reveal potential issues sooner than those of the basin scale.

Altered Watersheds

Montana has more than 3,000 miles of irrigation canals that carry 11.6 million acre-feet to irrigate about 2.2 million acres of crop and pasture on an annual basis. Crop water demand ranges from 1 to 3 acre-feet per year (Bauder and others, 1983); the average consumptive use rate for all crops and pasture is about 1.2 acre-feet per year (Cannon and Johnson, 2004). Thus, almost 9 million acre-feet of the 11.6 million acre-feet, or 77 percent, of the water diverted for irrigation is available for return flow as run off or recharge to groundwater. Table 1 shows the ditch loss reported by MBMG investigations throughout the State.

The volume of groundwater recharge from irrigation ditch loss often overwhelms the natural recharge processes. For example, the East Bench Irrigation Canal in the lower Beaverhead River may lose as much as 398 acre-feet per season; with a length of about 17 miles between Dillon and Beaverhead Rock, the seasonal ditch loss would be about 6,800 acre-feet. Additional recharge occurs from direct flood irrigation.

The groundwater flow systems in nearly all of the watersheds of western Montana and the large watersheds of eastern Montana have been substantially altered by recharge from irrigation canals (fig. 11).

Table 1. Ditch loss reported by MBMG investigations throughout Montana.

Figure 11 Inset Map Reference: Source	Ditch Loss (cubic feet per second per mile)	Ditch Loss (acre-feet per year per mile)*
A: Osborn and others (1983)	0.45–4.7	81–850
B: Madison (2006)	0.6	114
C: Abdo and Metesh (2005) Abdo and Roberts (2008)	0.15–1.5	27–271
D: GWIP Beaverhead	2.2	398
E: GWIP Belgrade	0.40–4.3	72–778
F: Kuzara and others (2012)	1.1–1.8	199–326
G: Olson and Reiten (2002)	0.05–0.5	9–90

*Assumes the ditch is active 3 months per year.

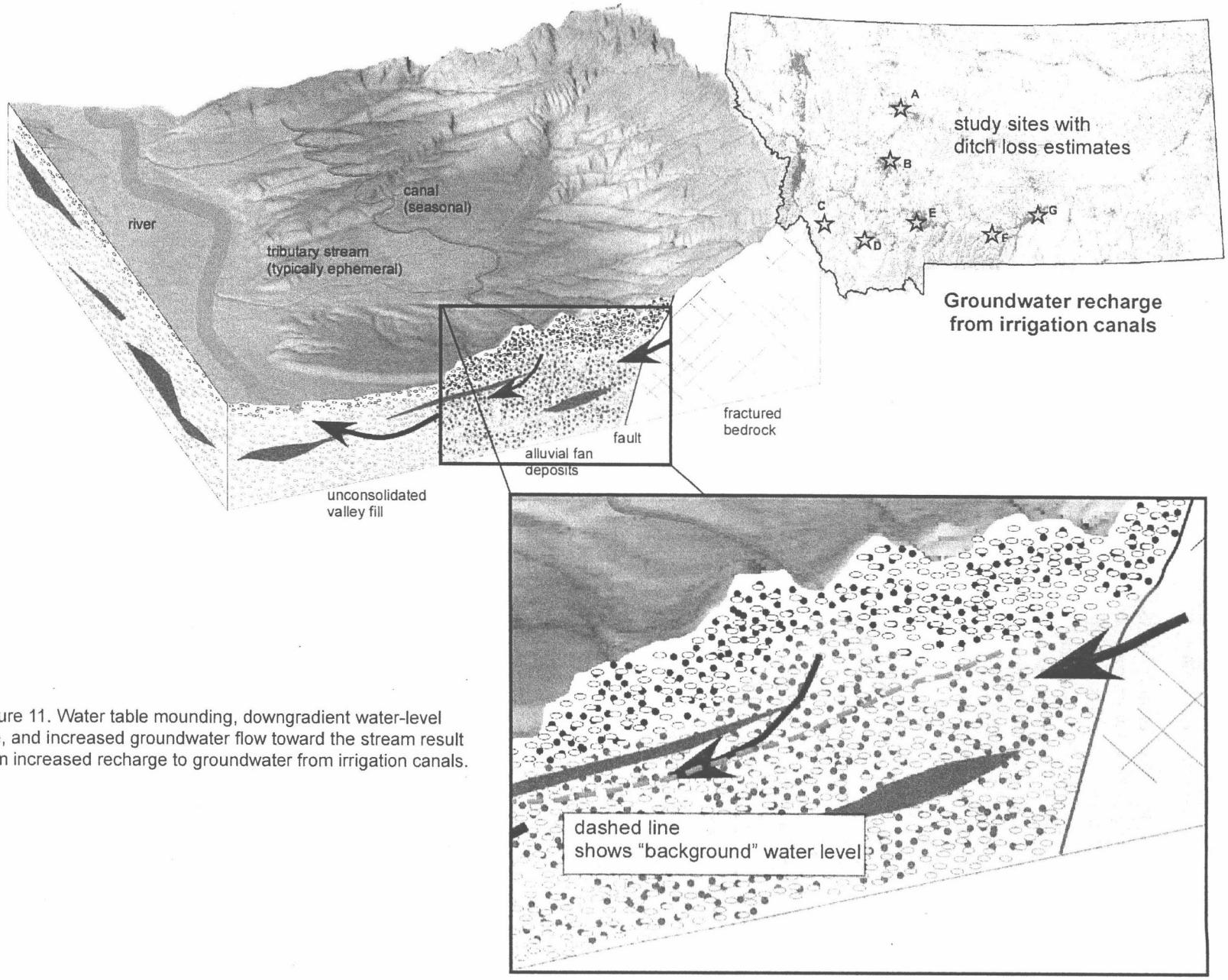


Figure 11. Water table mounding, downgradient water-level rise, and increased groundwater flow toward the stream result from increased recharge to groundwater from irrigation canals.

Effects of Irrigation Canals on Groundwater Levels

Nearly all of the intermontane valleys of western Montana are irrigated and sub-irrigated (recharged) by surface-water diversions. Recharge to groundwater from irrigation ditch loss is substantial; in many areas, the irrigation system is more than 100 years old and has established an artificial recharge system. There are several examples of wetlands and groundwater-dependent ecosystems that rely on recharge from these irrigation systems.

The hydrograph in figure 12 shows water levels in a well influenced by the East Bench Irrigation Canal in the lower Beaverhead River drainage. The water levels (red squares) show a 40 ft water-level rise in response to flow in the canal. The canal was shut off for about 2 years (2003 through mid-2005) for lack of water; water levels dropped nearly 30 ft due to the lack of precipitation in the area and the lack of recharge from the canal.

Similar water-level responses to irrigation canals have been observed in other areas of Montana. Waren and others (2012) observe a 15- to 20-ft response near the Helena Valley Irrigation District canal, and Kuzara and others (2012) observed an 18-ft response in the Stillwater River drainage. Smith (2006) discussed water-level response to irrigation in wells of the Bitterroot Valley.

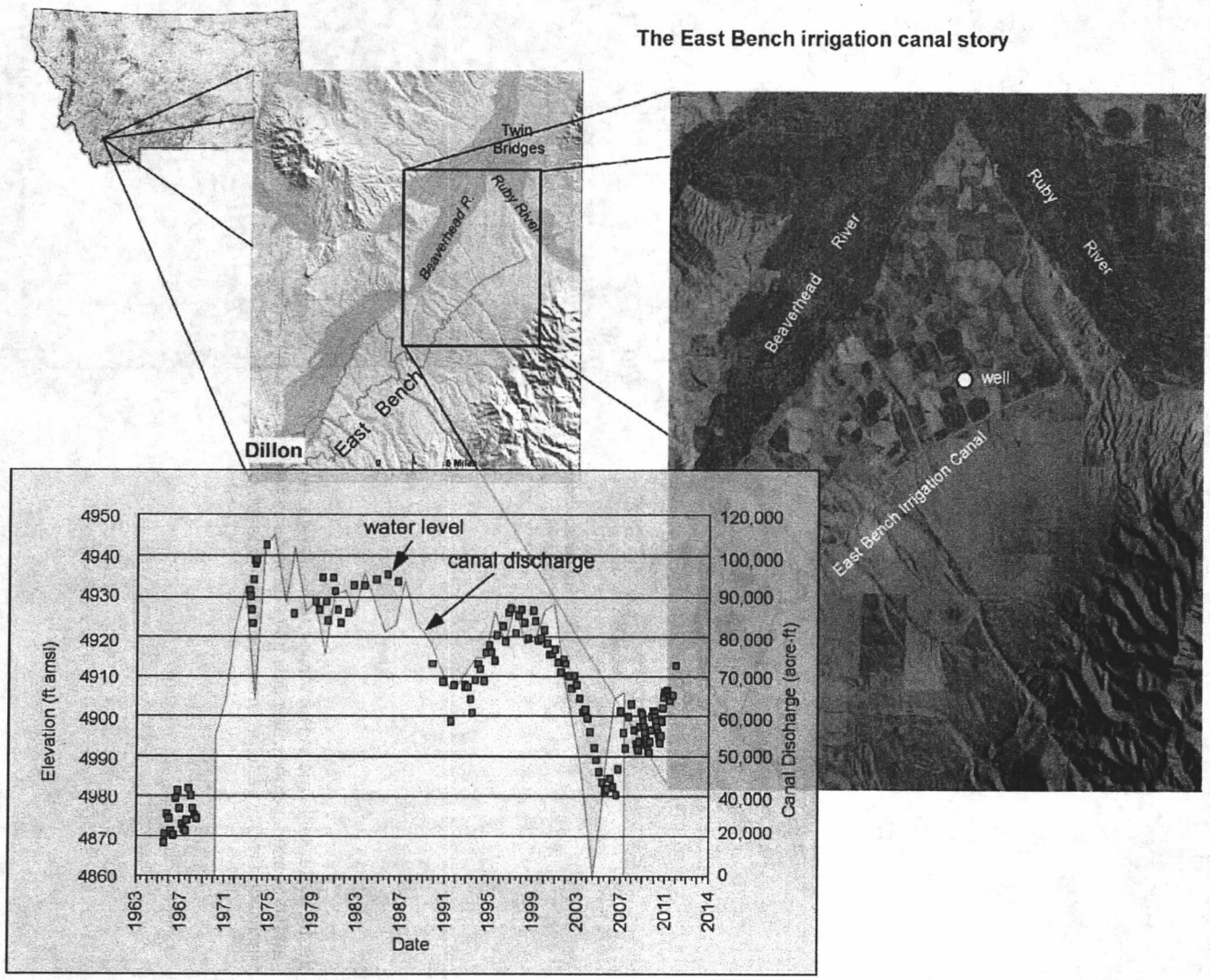


Figure 12. The East Bench irrigation canal provides one of many examples of groundwater recharge by irrigation. In addition to groundwater levels, the pattern of stream discharge has also been changed.

Appendix E

John Metesh

As land use changes from one type of irrigated agriculture to another or from irrigated agriculture to domestic use, recharge to the local groundwater flow system is likely to be affected. When irrigation canals are abandoned, the reduction to groundwater recharge may be substantial. Water levels in wells may decline, even to the point of wells going dry, groundwater flow to tributary streams and wetlands may be reduced, and the effects of stream depletion by existing pumping projects may be exacerbated.

Stream Depletion by One Well or Many

Stream depletion or stream-flow reduction from groundwater withdrawal presents a complex challenge to management of water. Stream depletion is ultimately equal to the discharge rate of the well as it relates to the periodicity of that discharge. For example, pumping 400 gpm for 3 of every 12 months will establish a depletion rate of 100 gpm. Stream depletion is independent of stream discharge; the 100 gpm depletion in the example will be the same whether the stream discharges 1000 cubic feet per second (cfs) or 10 cfs. The ultimate volume of depletion is independent of distance from the stream; however, the rate and timing of depletion is dependent on distance, aquifer properties (transmissivity and storage coefficient), as well as the pumping rate. There is no difference between pumping from one or many wells; one well pumping at 1,000 gallons per minute (gpm) is equivalent to 100 wells pumping at 10 gpm; however, the location of the well(s) can be very important.

Figure 13 presents the effect of well placement and other factors such as septic drain fields on stream depletion. The top figure shows the difference between two wells, pumping at the same rate of 600 gallons per day (gpd) for in-house use, at different distances from the stream. The second figure shows the same wells pumping 600 gpd for in-house use plus cyclical pumping for lawn irrigation for 90 days each year. Under the same hydrogeologic conditions, the difference between a well at 1,000 versus 2,620 feet from a stream changes the peak stream depletion by a full month. That is, instead of depleting the stream during critical low flows in August (red line), it could be delayed until September when stream flows are not as critical (blue line). The third figure shows stream depletion rates for a case where the well is 2,640 feet from the stream, but the septic drain field is 1,000 feet from the stream. In this example, installing the supply well away from the stream and using near-stream recharge from the drain field to offset consumption reduces stream depletion by 60 to 75% each year (green line). The latter example is not always practical for individual homes, but demonstrates a potentially useful strategy for managing a public water supply with properly installed individual septic systems in a multi-home subdivision.

Appendix E

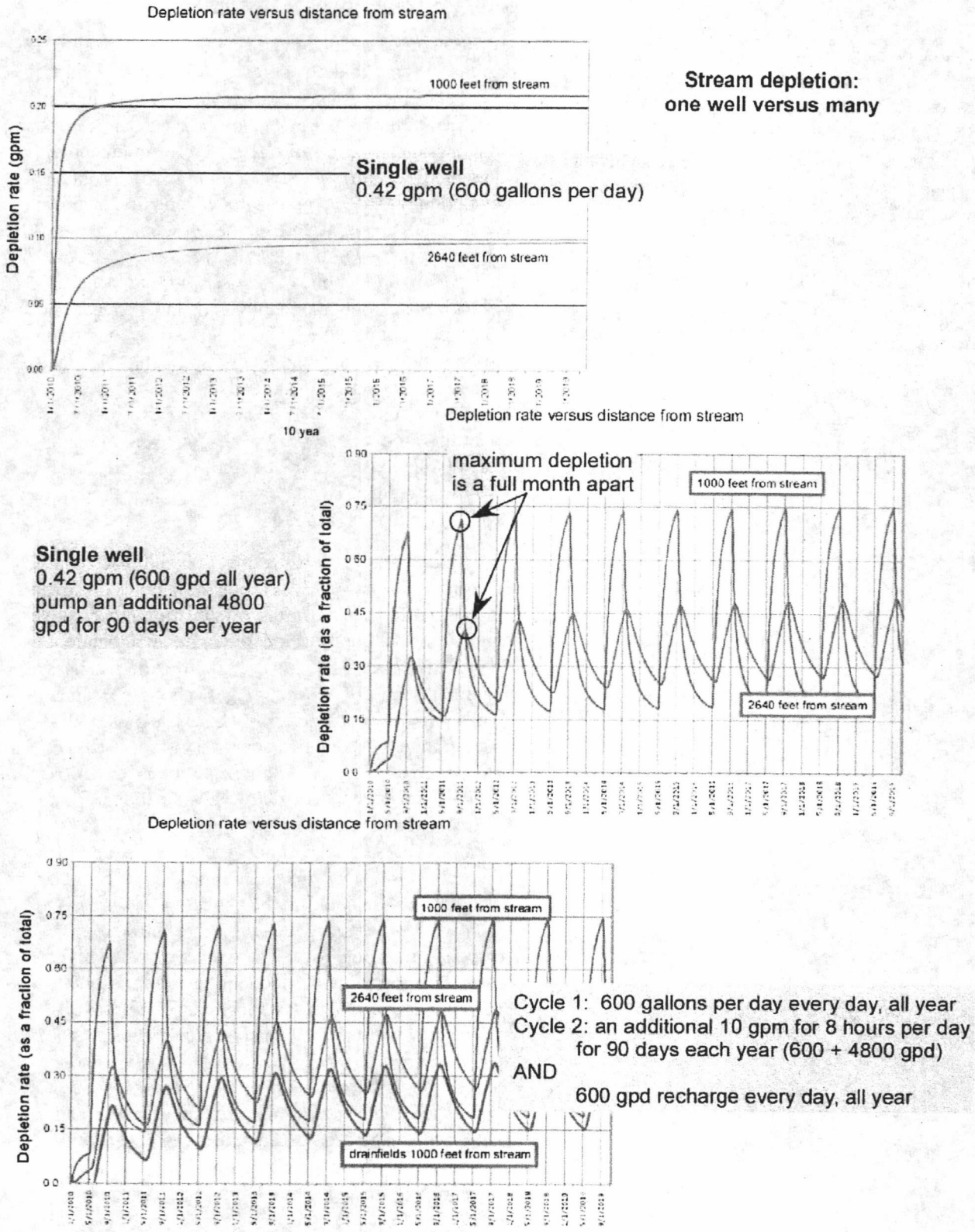


Figure 13. The rate of stream depletion by pumping groundwater is largely affected by the distance between the well and the stream.

Appendix E

Stream Depletion Zones

As discussed, stream depletion is affected by aquifer properties, the discharge of the well, and the distance between the well and the stream. Using predictive modeling to estimate stream depletion for each and every proposed well can be onerous and expensive. Alternatively, modeling data from hydrogeologic studies with representative or anticipated values for well discharge can be used to map zones that represent stream depletion rates and volumes.

Figure 14 shows an example of a map where stream depletion zones were established for various areas in the aquifer near the stream. The hydraulic conductivity and storage coefficient of the aquifer were used to map areas where stream 80% if the total depletion would occur within 1 month, between 1 and 2 months, and within 3 months at a specific pumping rate. In addition to those presented, zones of peak-month depletion or zones of average annual stream depletion can also be constructed. Where data are sufficient for more detailed modeling, groundwater recharge as affected by climate variation can also be evaluated.

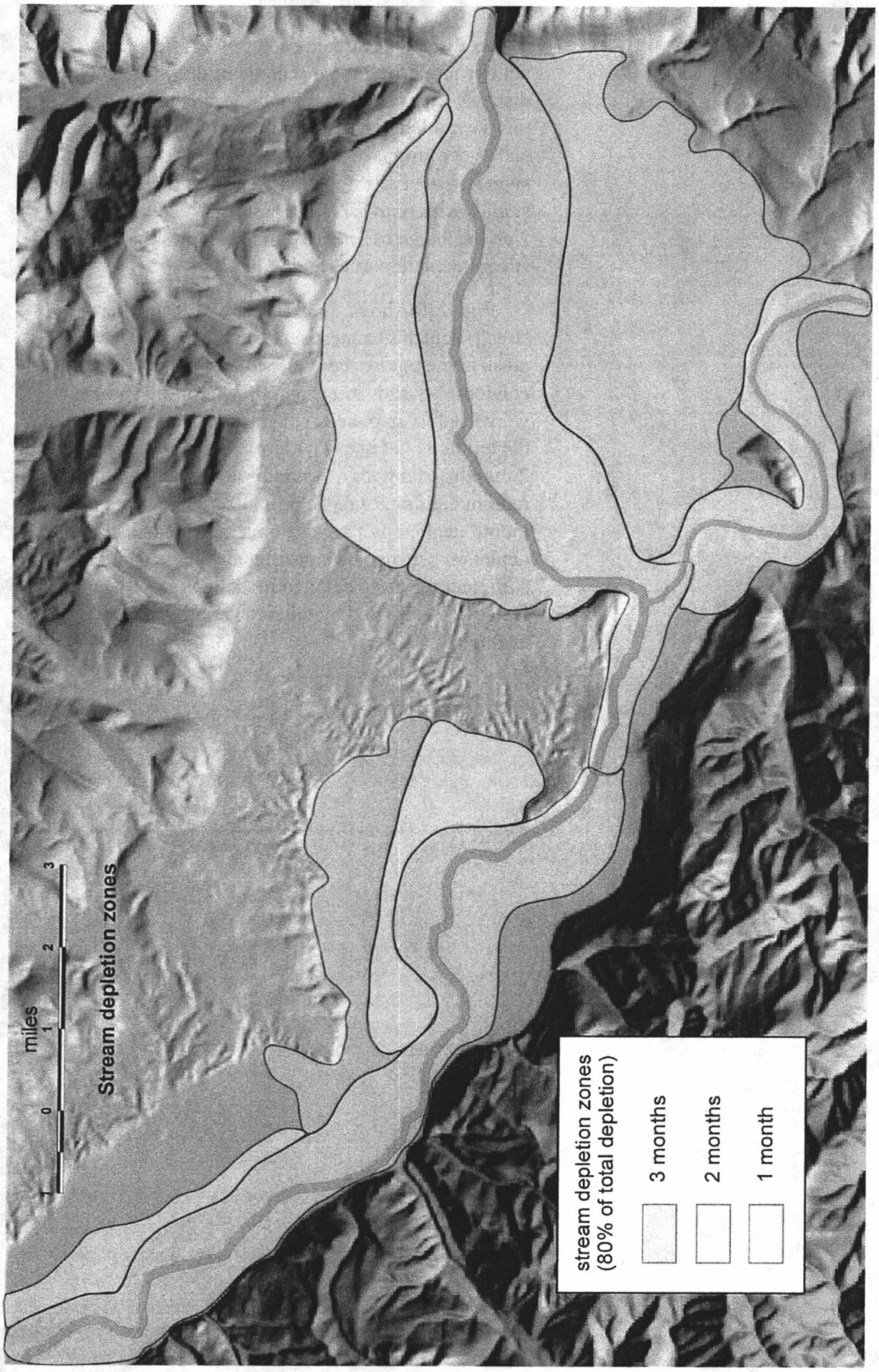


Figure 14. Stream depletion zones can be established based on aquifer properties and groundwater flow modeling.

Appendix E

John Metesh

References

Abdo, G. N., and Metesh, J., 2005, Big Hole Watershed Management Study, Report submitted to the Beaverhead County Conservation District, 51 p.

Abdo, G.A.., Roberts, M., 2008, Ground water and surface water in a study area within the upper Big Hole River basin, Montana Bureau of Mines and Geology: Open-File Report 572, 85 p.

Bauder, J.W., King, L.D., Westesen. G.L., 1983, Montguide: Using evaporation tubs to schedule irrigations. Montana State University Cooperative Extension Service Publication C-1 MT8343

Cannon and Johnson, 2004, Estimated water use in Montana in 2000, U.S. Geological Survey Scientific Investigations Report 2004-5223 49p.

Gleick, P. H., 1996, Water resources, In Encyclopedia of Climate and Weather, ed. by S. H. Schneider, Oxford University Press, New York, vol. 2, pp.817-823.

Kuzara, S., Meredith, E., Gunderson, P., 2012, Aquifers and Streams of the Stillwater–Rosebud Watersheds, Montana Bureau of Mines and Geology: Open-File Report 611, 130 p.

Madison. J.P., 2006, Hydrogeology of the North Hills, Helena, Montana, Montana Bureau of Mines and Geology: Open-File Report 544, 41 p., 3 sheet(s), 1:24,000.

Montana State Library's Natural Resource Information System (NRIS), 2001, MT Department of Revenue coverages of irrigation methods, http://nris.mt.gov/gis/ (accessed November 2011).

Olson, J.L., and Reiten, J.C., 2002, Hydrogeology of the West Billings area: impacts of land-use changes on water resources, Montana Bureau of Mines and Geology Report No. 206, 32 p.

Osborne, T.J., Noble, R.A., Zaluski, M.H., and Schmidt, F.A., 1983, Evaluation of the groundwater contribution to Muddy Creek from the Greenfields Irrigation District, Montana Bureau of Mines and Geology Open-File Report 113, 141 p. + appendices.

Smith, L.N., 2006, Patterns of water-level fluctuations, Lolo-Bitterroot area, Mineral, Missoula, and Ravalli counties, Montana (open-file version), Montana Bureau of Mines and Geology: Ground-Water Assessment Atlas 4B-10, 1 sheet(s), 1:350,000.

U.S. Bureau of Reclamation, 2011, The Great Plains Cooperative Agricultural Weather Network, http://www.usbr.gov/gp/agrimet (accessed November, 2011).

Waren,K.. Bobst, A., Swierc, J., Madison. J.D., 2012, Hydrogeologic Investigation of the North Hills Study Area, Lewis and Clark County, Montana, Interpretive Report, Montana Bureau of Mines and Geology: Open-File Report 610, 99 p.