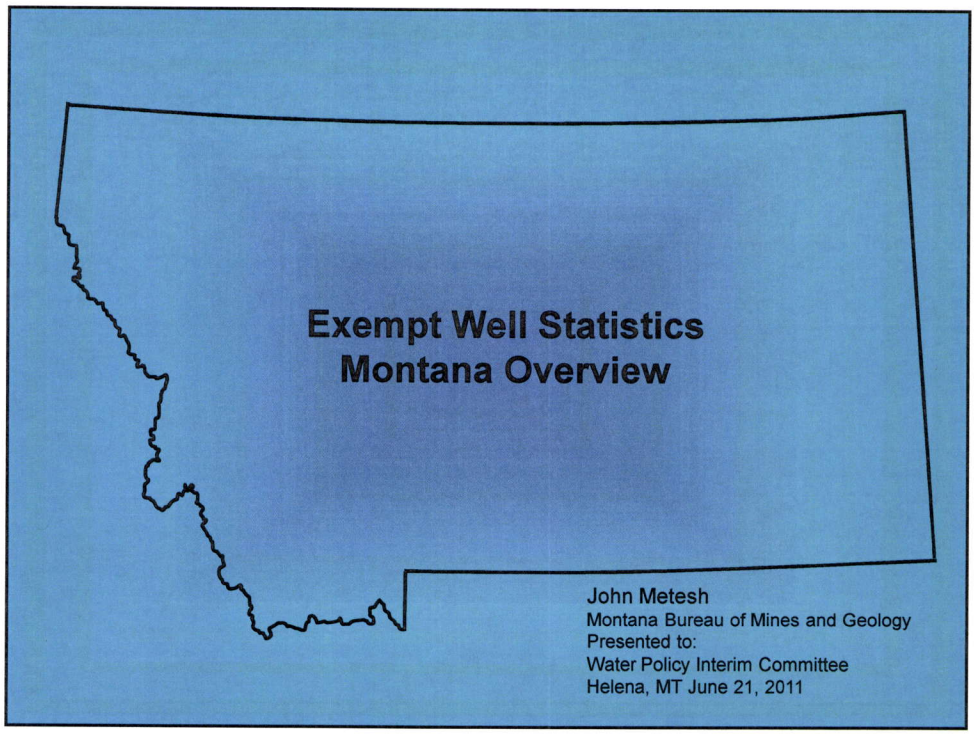
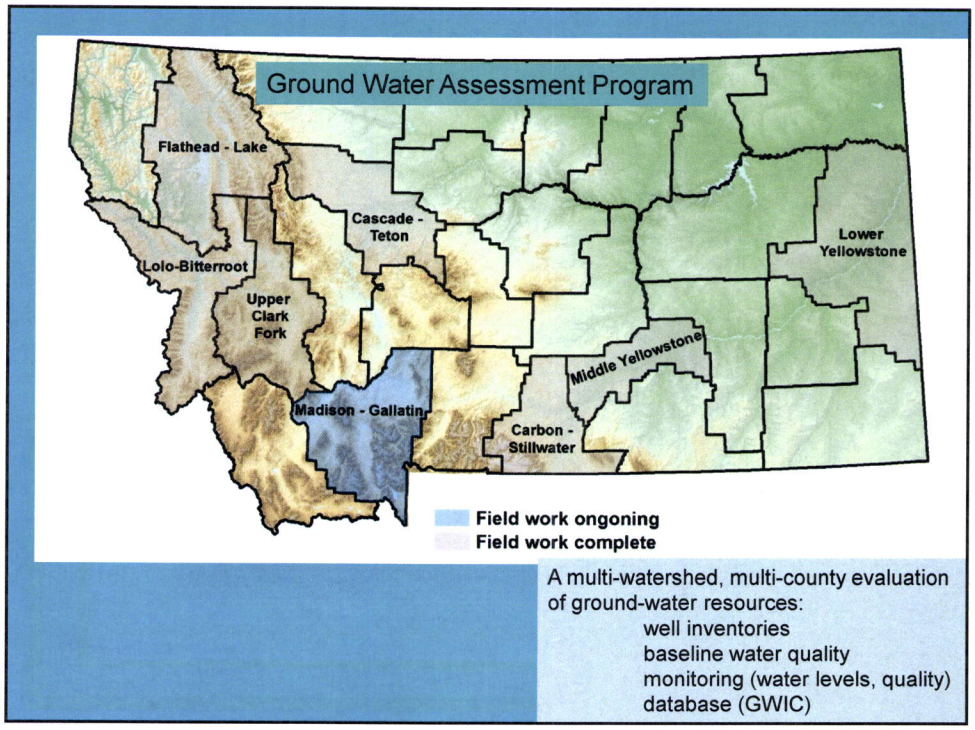
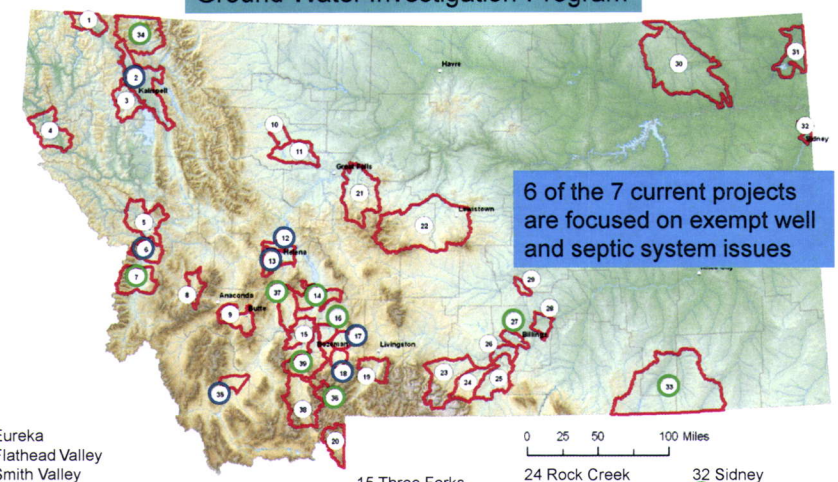

Exempt Well Statistics
Montana Overview
John Metesh
Montana Bureau of Mines and Geology
Presented to:
Water Policy Interim Committee
Helena, MT June 21, 2011


Ground Water Assessment Program
Flathead - Lake
Cascade - Teton
Lolo-Bitterroot
Upper Clark Fork
Madison - Gallatin
Carbon - Stillwater
Middle Yellowstone
Lower Yellowstone
Field work ongoing
Field work complete
A multi-watershed, multi-county evaluation of ground-water resources:
well inventories
baseline water quality
monitoring (water levels, quality)
database (GWIC)

Ground Water Investigation Program



6 of the 7 current projects are focused on exempt well and septic system issues

1 Eureka
2 Flathead Valley
3 Smith Valley
4 Noxon
5 Missoula Valley
6 Florence
7 Hamilton

8 Georgetown Lake
9 Summit Valley
10 Priest Butte Lake
11 Greenfield Bench
12 North Hills
13 Scratchgravel Hills
14 Townsend, Toston

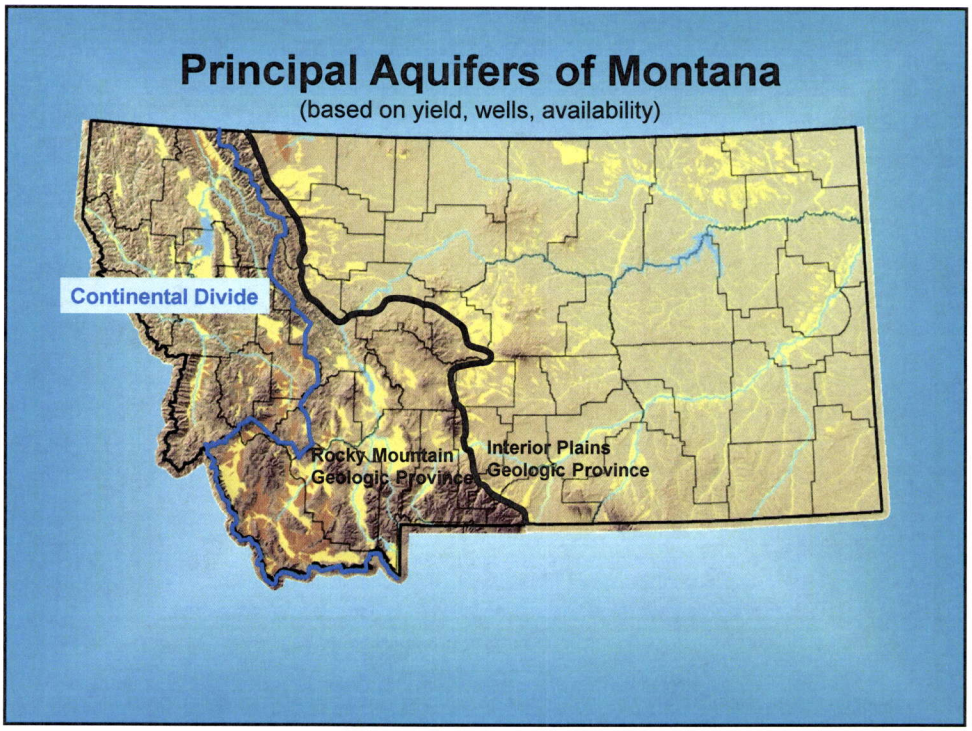
15 Three Forks
16 Manhattan
17 Belgrade
18 Four Corners
19 Pine Creek
20 W.Yellowstone
21 Belt, Monarch
22 Little Belt Mtns
23 Stillwater Valley

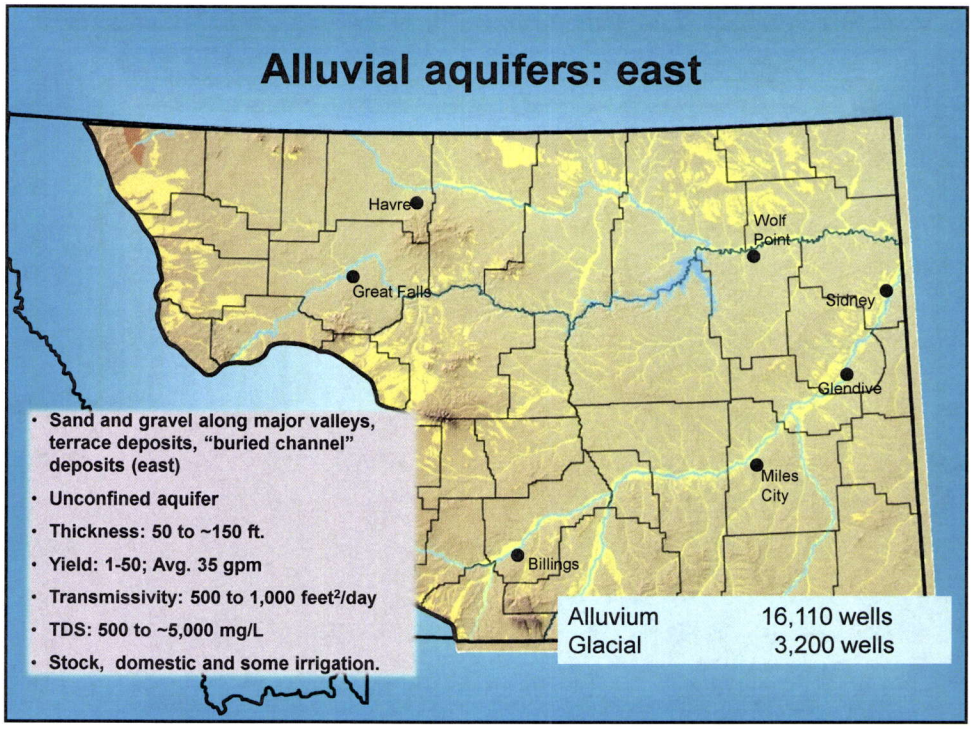
24 Rock Creek
25 Prior Mtns
26 Park City
27 West Billings
28 East Billings
29 Roundup
30 Flaxville gravels (several sub basins)
31 Clear Lake

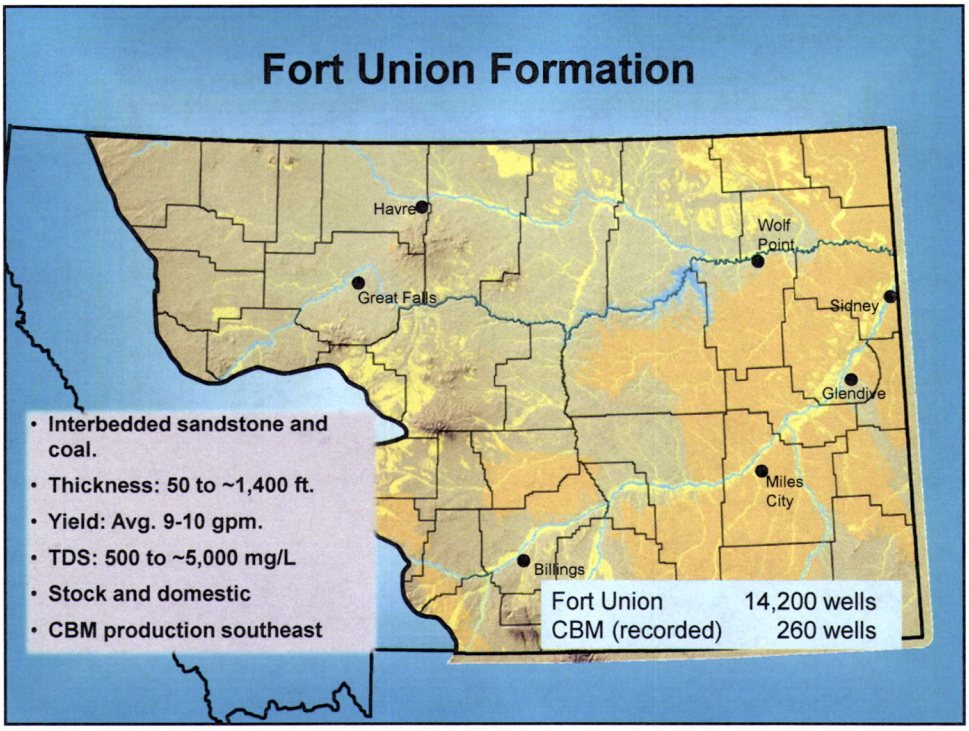
32 Sidney
33 Coalbed methane (several sub basins)
34 NF Flathead
35 Beaverhead – west
36 Big Sky
37 L Boulder
38 Ennis
39 L Madison

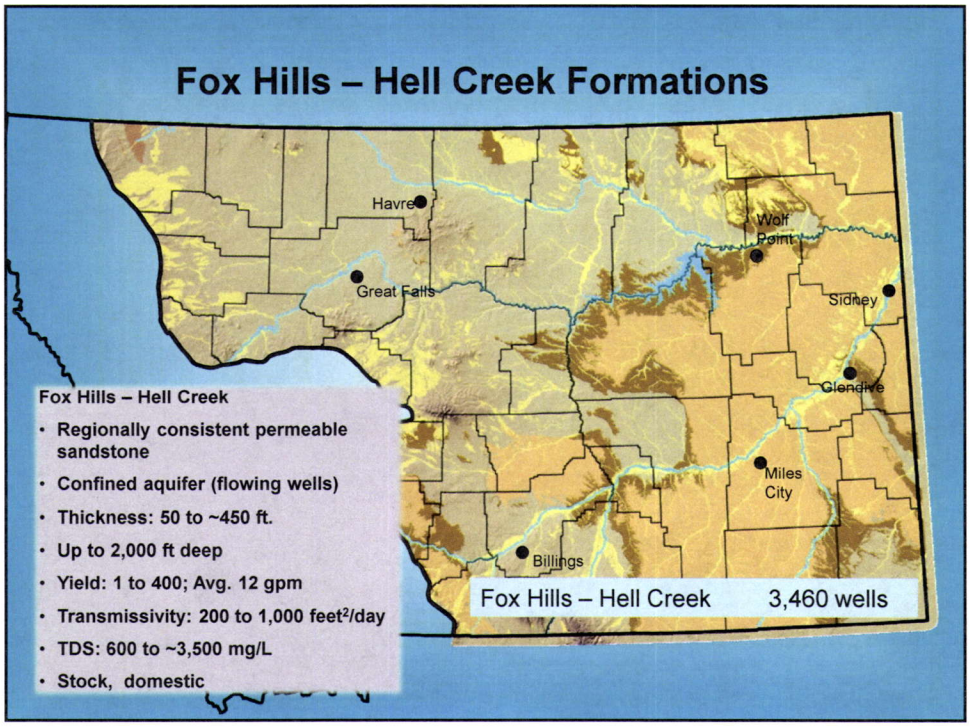
Exempt Wells in Montana (well log vs water right)

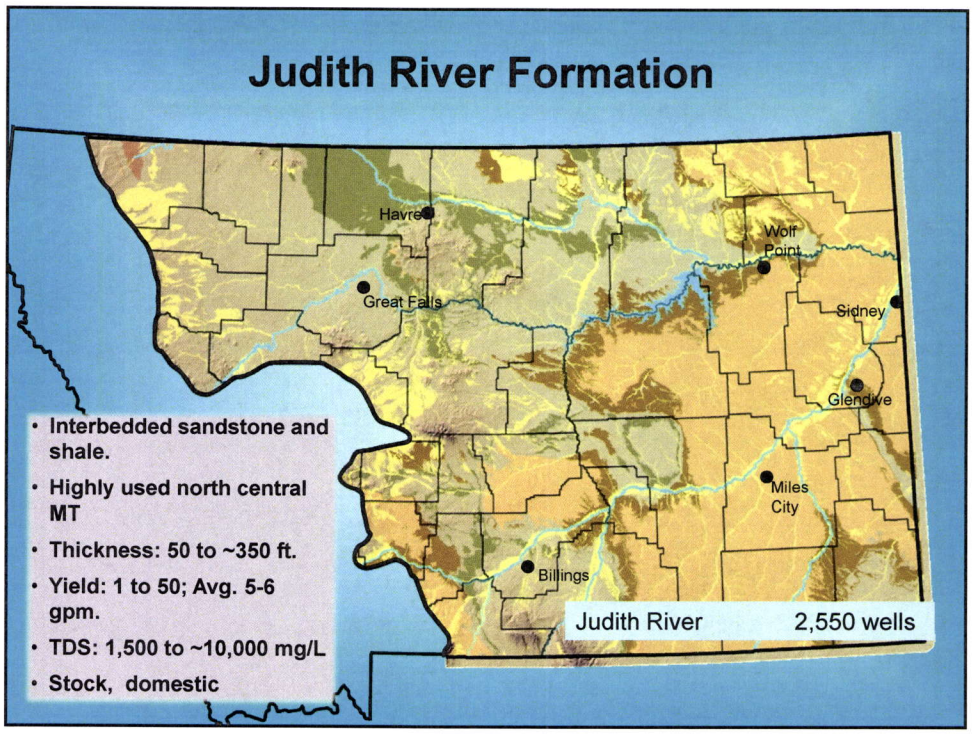
- changes in the law = changes in reporting
  (eg well use; filing logs prior to 1973)
- not all report forms are filled out completely
  (use, geologic source, yield, etc.)
- well log/record does not mean a water right
  (domestic well may not have a Notice of Completion or permit)
- exemption is based on <u>rate</u> and <u>volume</u> (35gpm/10acft/y)
  not <u>use</u> (domestic, irrigation, stock…)
- reported yield or capacity is rarely actual use (having a 35gpm right doesn't mean your well will produce it; having a 100gpm well doesn't mean you have a right to it)

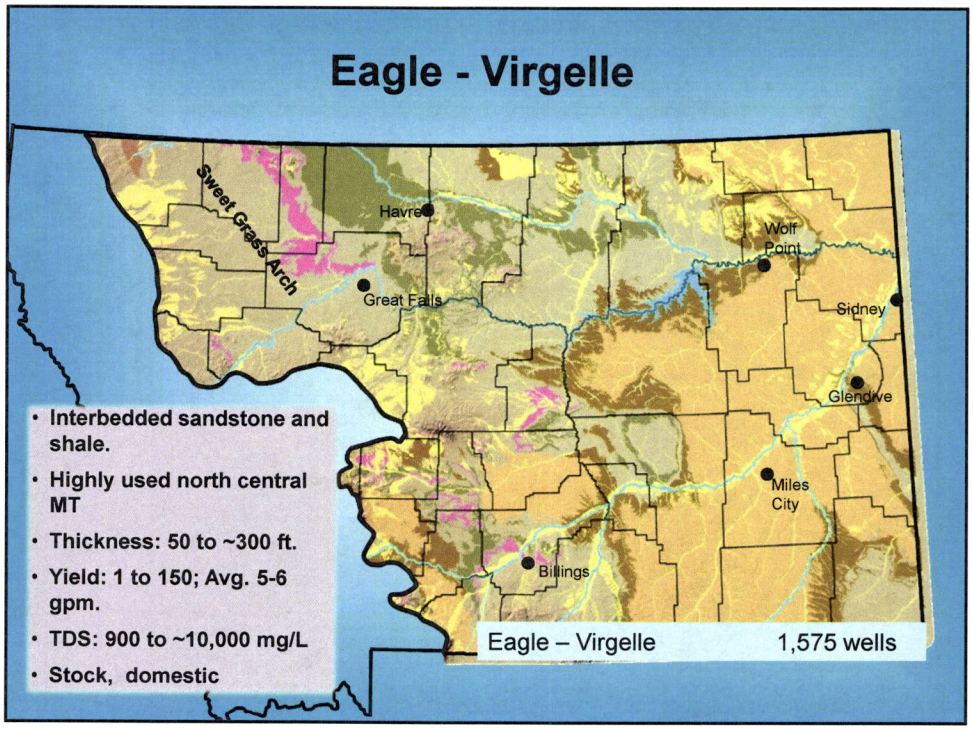

Principal Aquifers of Montana
(based on yield, wells, availability)
Continental Divide
Rocky Mountain Geologic Province
Interior Plains Geologic Province


Alluvial aquifers: east
Havre
Great Falls
Wolf Point
Sidney
Glendive
Miles City
Billings
• Sand and gravel along major valleys, terrace deposits, "buried channel" deposits (east)
• Unconfined aquifer
• Thickness: 50 to ~150 ft.
• Yield: 1-50; Avg. 35 gpm
• Transmissivity: 500 to 1,000 feet²/day
• TDS: 500 to ~5,000 mg/L
• Stock, domestic and some irrigation.
Alluvium 16,110 wells
Glacial 3,200 wells

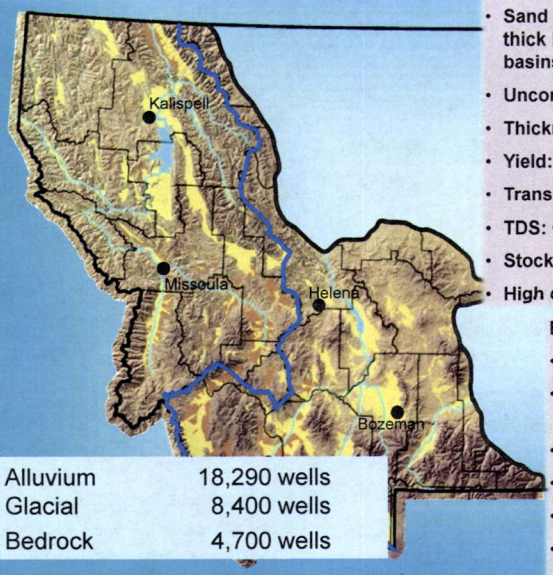

Fort Union Formation
Havre
Great Falls
Wolf Point
Sidney
Glendive
Miles City
Billings
• Interbedded sandstone and coal.
• Thickness: 50 to ~1,400 ft.
• Yield: Avg. 9-10 gpm.
• TDS: 500 to ~5,000 mg/L
• Stock and domestic
• CBM production southeast
Fort Union 14,200 wells
CBM (recorded) 260 wells


Fox Hills – Hell Creek Formations
Havre
Great Falls
Wolf Point
Sidney
Glendive
Miles City
Billings
Fox Hills – Hell Creek
• Regionally consistent permeable sandstone
• Confined aquifer (flowing wells)
• Thickness: 50 to ~450 ft.
• Up to 2,000 ft deep
• Yield: 1 to 400; Avg. 12 gpm
• Transmissivity: 200 to 1,000 feet²/day
• TDS: 600 to ~3,500 mg/L
• Stock, domestic
Fox Hills – Hell Creek 3,460 wells


Judith River Formation
Havre
Great Falls
Wolf Point
Sidney
Glendive
Miles City
Billings
Judith River 2,550 wells
• Interbedded sandstone and shale.
• Highly used north central MT
• Thickness: 50 to ~350 ft.
• Yield: 1 to 50; Avg. 5-6 gpm.
• TDS: 1,500 to ~10,000 mg/L
• Stock, domestic


Eagle - Virgelle
Sweet Grass Arch
Havre
Great Falls
Wolf Point
Sidney
Glendive
Miles City
Billings
Eagle – Virgelle 1,575 wells
• Interbedded sandstone and shale.
• Highly used north central MT
• Thickness: 50 to ~300 ft.
• Yield: 1 to 150; Avg. 5-6 gpm.
• TDS: 900 to ~10,000 mg/L
• Stock, domestic

All aquifers: west



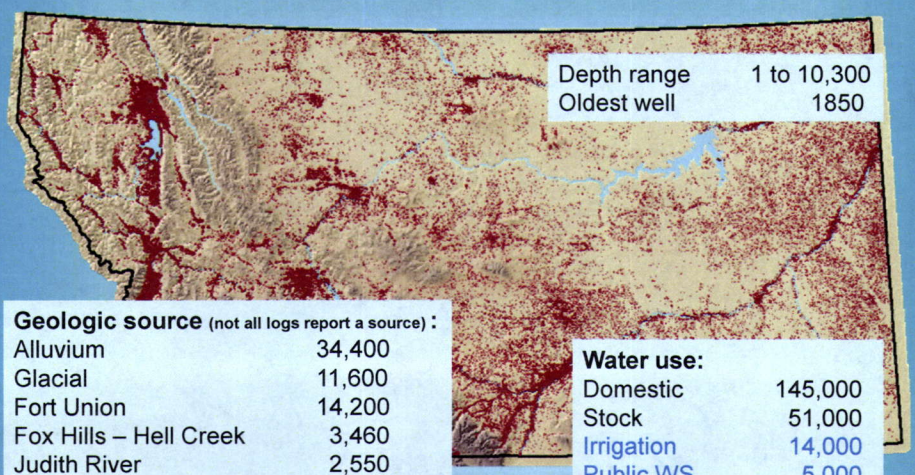
Alluvium:

- Sand and gravel along major valleys, thick basin-fill deposits in intermontane basins
- Unconfined aquifers
- Thickness: 30 to >1,000 ft
- Yield: 1 to 3500; Avg. 35 gpm
- Transmissivity: 500 to 200,000 feet^2/day
- TDS: < 500 mg/L
- Stock, domestic and some irrigation
- High demand in small areas

Bedrock: Belt, volcanics, intrusives, etc.

- Valley margin or deep wells in valley
- Unconfined on margins, deep confined aquifers
- Thickness: generally unlimited
- Yield: 1 to 5000 gpm typical range
- Transmissivity: 50 to 10,000 feet^2/day
- TDS: < 100 mg/L
- Stock, domestic and rare irrigation

Alluvium	18,290 wells
Glacial	8,400 wells
Bedrock	4,700 wells



Depth range	1 to 10,300
Oldest well	1850

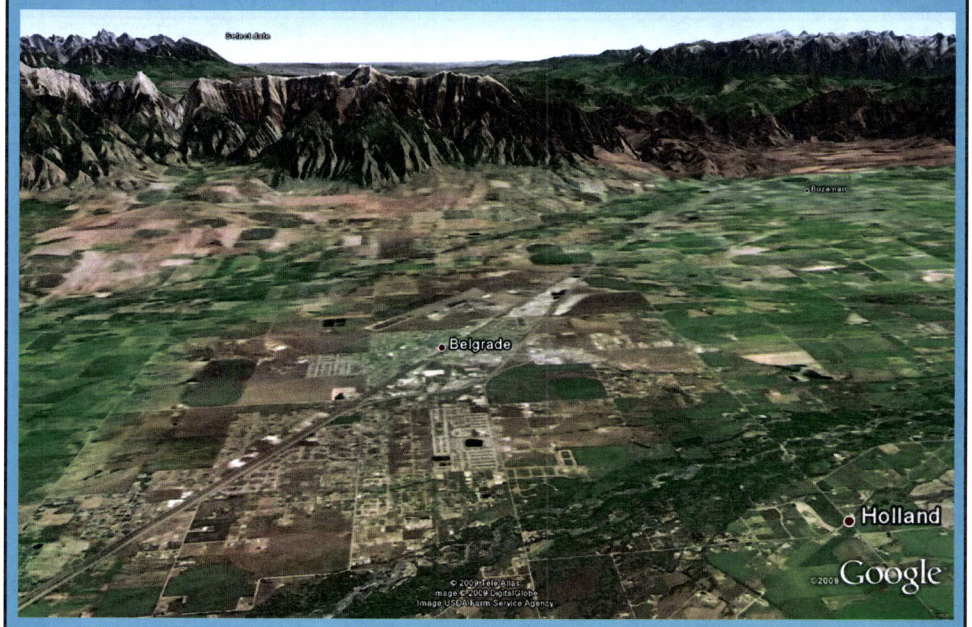
Geologic source (not all logs report a source):

Alluvium	34,400
Glacial	11,600
Fort Union	14,200
Fox Hills – Hell Creek	3,460
Judith River	2,550
Eagle – Virgelle	1,575
Kootenai – Madison	2,200
Bedrock (western MT)	4,700

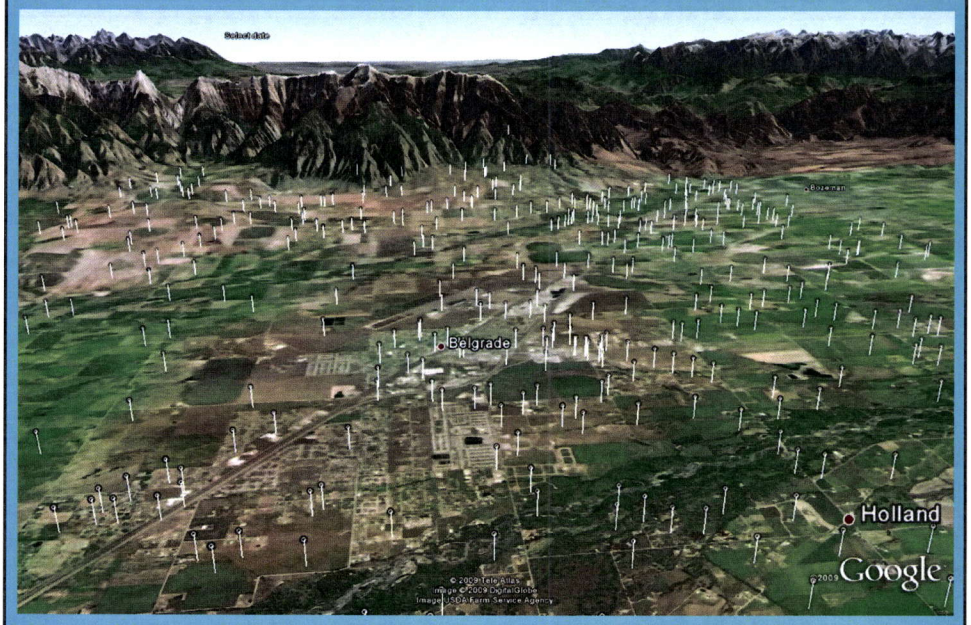
Water use:

Domestic	145,000
Stock	51,000
Irrigation	14,000
Public WS	5,000
Com/Ind	2,000

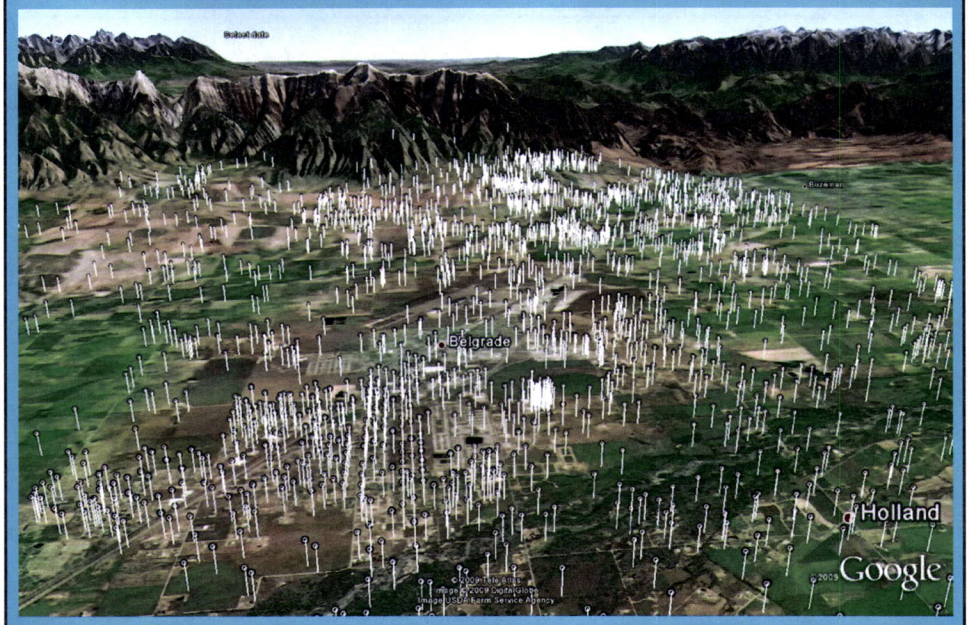
Belgrade



Belgrade 1975



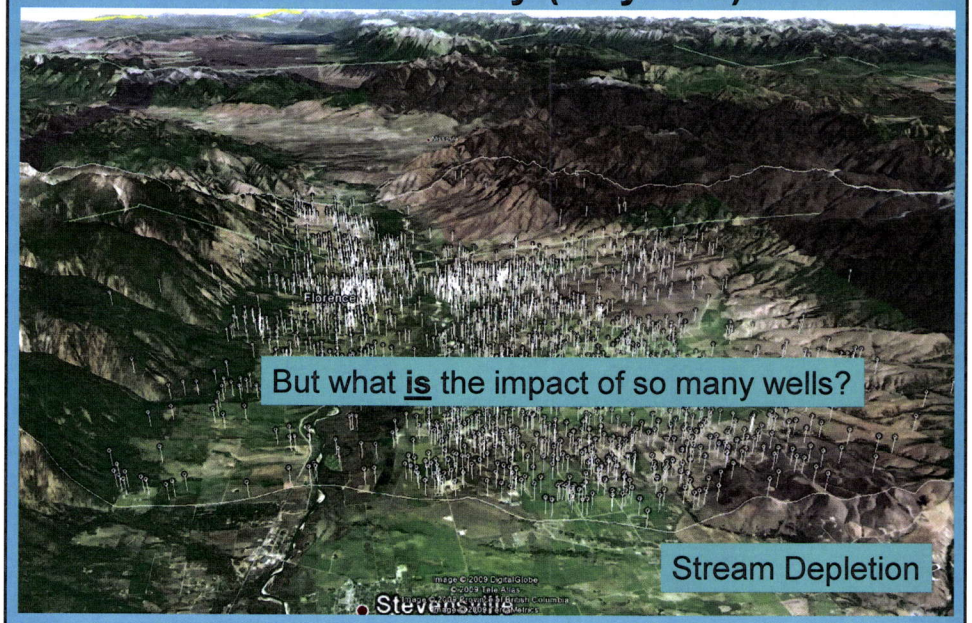
Belgrade today (35 years)



Florence

Florence 1975

Florence today (35 years)



Stream depletion simplified…

Stream Depletion is (ultimately) equal to

$$\frac{Q_{well(s)}}{\text{Periodicity}}$$

For example: the stream depletion for a well pumped at 400 gpm for 3 months of each year is 100 gpm

$$\frac{400\text{gpm}}{12\text{months}/3\text{months}} = 100\text{gpm}$$

…this excludes direct runoff or return flow through ground water (ie consumptive use)

Stream depletion simplified…

Stream Depletion is independent of stream discharge
same effect whether 1000 cfs or 10 cfs

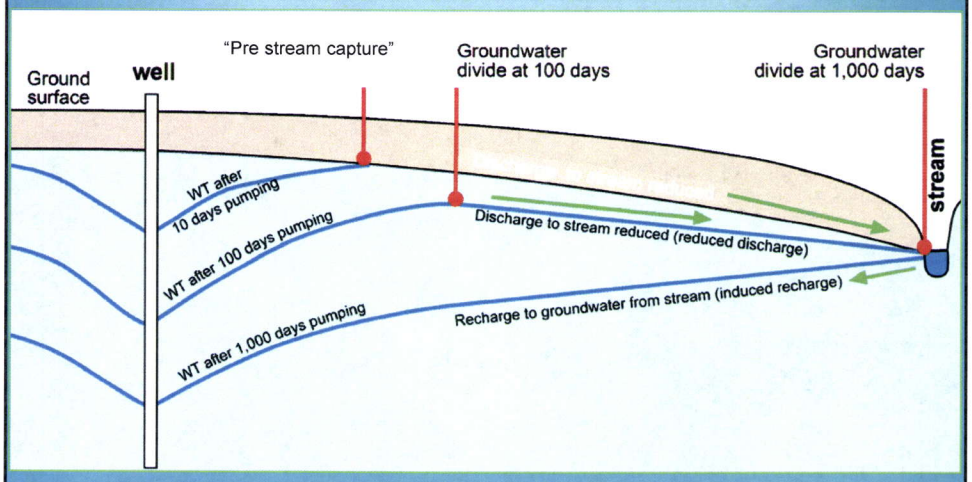
Unless, of course, you dry up the stream

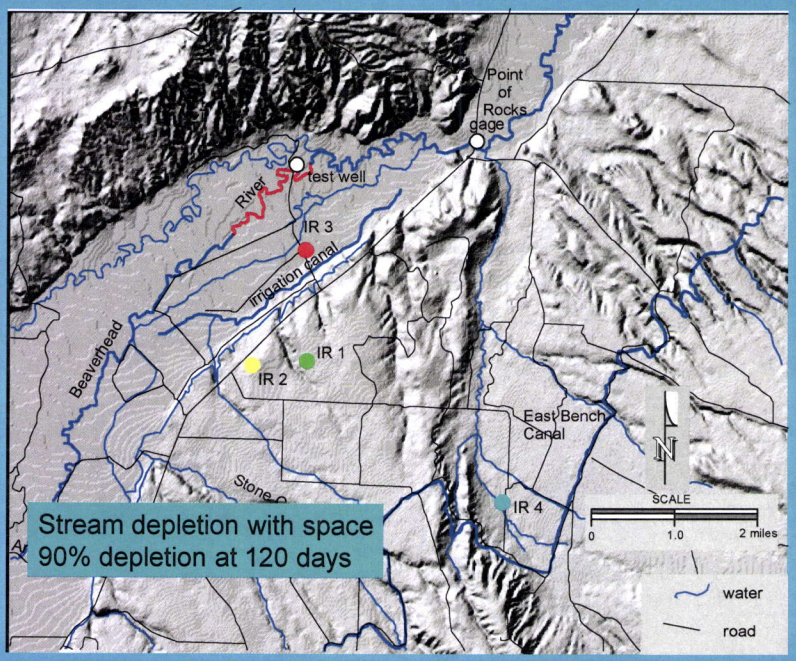
Stream Depletion is independent of well interference
it is both cumulative and additive
1 well pumping 500 gpm
has the same effect as
50 wells pumping 10 gpm

Stream Depletion is independent of distance from the well(s) to the stream
BUT the **RATE** of depletion **IS** dependent on distance

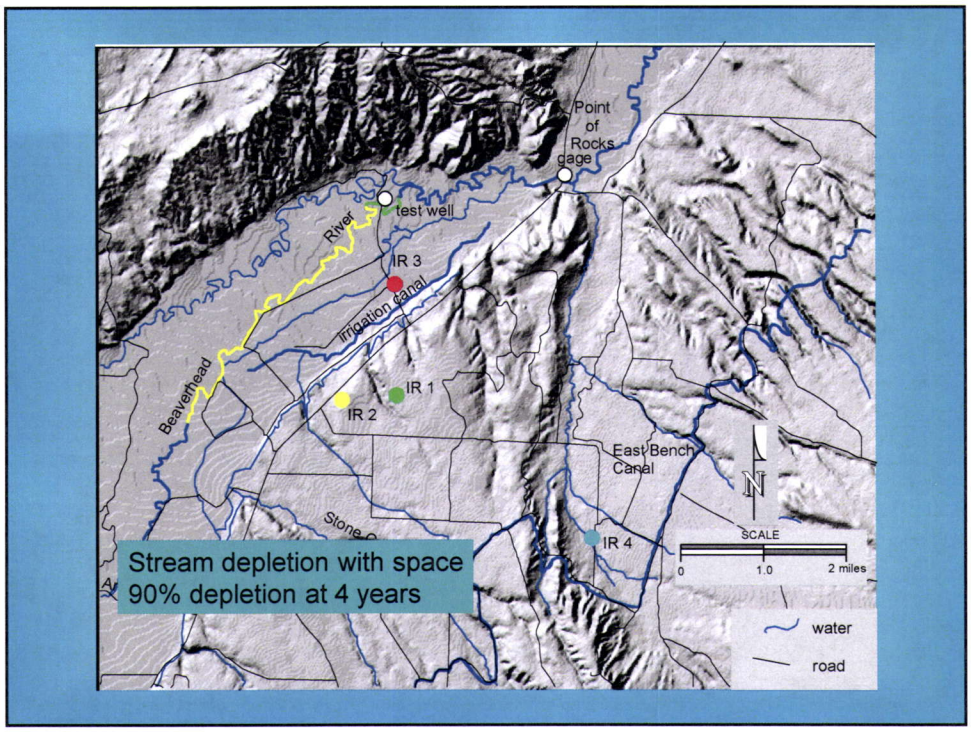
Stream depletion simplified…

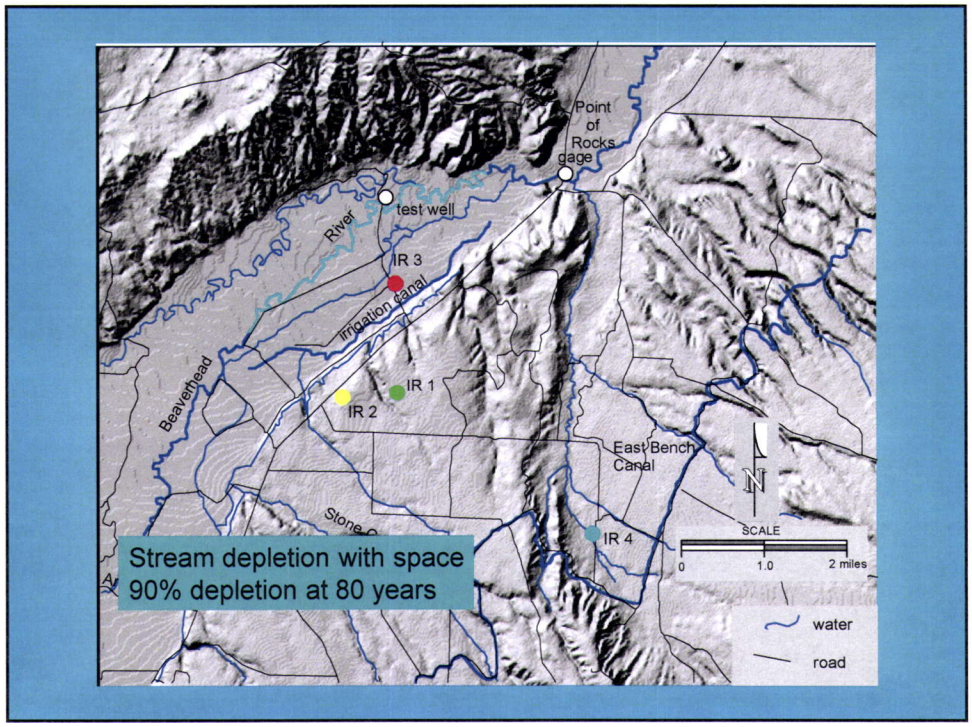
Stream Depletion occurs before the "cone of depression" reaches the stream
(some applications prior to HB831did not address this)





Stream depletion with space
90% depletion at 120 days


Point of Rocks gage
test well
River
IR 3
Irrigation canal
Beaverhead
IR 1
IR 2
East Bench Canal
Stone
IR 4
SCALE
0
1.0
2 miles
water
road
Stream depletion with space
90% depletion at 4 years


Point of Rocks gage
test well
River
IR 3
Irrigation canal
Beaverhead
IR 1
IR 2
East Bench Canal
Stone
IR 4
SCALE
0
1.0
2 miles
water
road
Stream depletion with space
90% depletion at 80 years