

# WWDC Platte River Basin Plan, Groundwater Study (Level I) WSGS – USGS – WRDS

Scott Quillinan

Geologist

Wyoming State Geological Survey (WSGS) Laramie, Wyoming



# Groundwater Study Team

# **WWDO** Project Manager – Jodi Pavlica

- □ WSGS Laramie Scott Quillinan
- □ **USGS** Cheyenne *Tim Bartos*
- □ **WRDS** University of Wyoming *Steve Gray*
- **Energy Compliance** Paul Taucher
- □ **Hinckley Consulting** *Bern Hinkley*



# Platte river Groundwater Study

- Identify & inventory the "major" aquifers present within the drainage basin area
- Determine 3-dimensional configuration of the aquifers (outcrop areas, geologic structures, & depths)
- Estimate aquifer recharge rates, storage quantities, & discharge rates
- Identify areas with interaction between groundwater & surface water
- Assess the quantity & quality of groundwater available in the aquifers
- Investigate the usage of groundwater in the basin







 PlatteRegions
 Area
 Image: Central Wyoming Basins South
 Image: Central Wyoming Basins North
 Image: Central Wyoming Basin



# Identify and evaluate existing groundwater studies...

| BRA      | System a   | and Series                     | Stratigraphic units of Love et al. (1993) in Bighorn Basin and<br>Owl Creek and Bighorn Mountains |                                   | Hydrogeologic<br>divisions of<br>Lowry et al.<br>(1976) | Hydrogeologic unit of<br>Libra et al. (1981) | Hydrogeologic unit of<br>Western Water Consultants, Inc.<br>(1982a,b) and Doremus (1982) | Hydrogeologic unit of Western<br>Water Consultants, Inc. (1983b) | Hydrogeologic unit of Cooley<br>(1984, 1986) | Hydrogeologic unit of Jarvis<br>(1986) and<br>Spencer (1986) | Hydrogeologic unit of Wyoming<br>Statewide Framework Plan (WWC<br>Engineering et al., 2007, fig. 4–9) |                         | Hydrogeologic unit used in this report         |  |   |  |
|----------|------------|--------------------------------|---|-----------------------------------|---|--|--|--|--|--|---|-------------------------|--|--|---|--|
|          | mary       | Holocene<br>and<br>Pleistocene | Quaternary allutium and terrace deposits Pliocene rocks not present                               |                                   |   |  | Major aquifer  | Principal aquifers   | Secondary aquifer                            |  |   | Major aquifer           |  | Quaternary<br>unconsolidated deposit<br>aquifers |   |  |
|          | Quato      | Pliocene                       |   |                                   |   | 1  |  |  |  |  |   |                         |  |  |   |  |
|          |            | Miocene                        | Lower Miocene and Oligocene rocks <sup>1</sup>  |                                   |   |  |  |  |  |  |   |                         |  |  |   |  |
|          |            | Oligocene                      |   | White Ri                          | ver Formation   |  |  |  |  |  |   | Margins                 | l aquifer                                      | White Riv  | er aquifer  |  |
| CENOZOIC | tiary      | Eocene                         | Wapiti<br>Formation <sup>1</sup>  | Aycross<br>Formation <sup>1</sup> | Wagon Bed<br>Formation                                  | 2  | -  | Units not present and (or)<br>discussed in study                 |  |  |   |                         | Wagon Bed<br>Formation–<br>Marginal<br>aquifer |  | Wagon Bed<br>aquifer  |  |
|          | Ter        |                                |   | Tatmar                            | a Formation <sup>1</sup>                                |  |  |  |  |  |   |                         |  |  |   |  |
|          |            |                                | Willwood Formation  |                                   |   |  | Aquifer/discontinuous<br>aquifers and confining<br>units                                 |  | Secondary aquifer                            |  |   | Minor aquifer           |  | Willwood aquifer                                 |   |  |
|          |            | Paleocene                      |   | Fort Uni                          | on Formation  |  | Aquifer/discontinuous<br>aquifers and confining<br>units                                 | unac la  | Secondary aquifer                            |  |   | Major aquifi            | er–Sandstone                                   | Fort Union :                                     | iquifer<br>II<br>II<br>II<br>II<br>II<br>II<br>II<br>II<br>II<br>II<br>II<br>II<br>II |  |
|          |            | Upper<br>Cretaceous            | Lance Formation Mestetuse Formation Lewis Shale   |                                   |   | 3  | Aquifer/discontinuous<br>aquifers and confining<br>units                                 | is minimum<br>minimum<br>sectors<br>sectors<br>Drivering aggifar | Secondary aquifer                            |  |   | Major aquifer           |  | Lance aqu  | Lance aquifer   |  |
| 0        |            |                                |   |                                   |   |  | Aquifer/discontinuous<br>aquifers and confining<br>units                                 |  | Secondary aquifer                            |  |   | Major aquitard          |  | Meeteetse aqu<br>confining                       | Meeteetse aquifer and<br>confining unit   |  |
|          |            |                                |   | Mesaver                           | Tespot Sandstone<br>Member                              | -  | Aquifer/discontinuous<br>aquifers and confining<br>units                                 | (Lance-Meeteetve-Mesaverde<br>aquifer)                           | Secondary aquifer                            | Not discussed  | Not discussed   | Major aquifer-Sandstone |  | Mesaverde a                                      | quifer  |  |
|          | Cretaceous |                                | Cody Shale  |                                   |   |  | Regional aquitard  | Major regional confining unit                                    | Lesky confining unit                         |  |   | Major aquitard          |  | Cody Shale<br>confining unit                     |   |  |
|          |            |                                | Frontier Formation  |                                   | 4   | Minor aquifer                                | Principal aquifer<br>(Frontier aquifer)  | Alternating leaky confining<br>units and secondary aquifers      | -  |  | Minor aquifer   |                         | Frontier aquifer                               |  |   |  |
| MESOZ(   |            |                                |   | Mor                               | wry Shale   |  | Aquitard   | Leaky confining unit   | Leaky confining unit                         |  |   | Major                   | aquitard                                       | Thermopolis-                                     | Mowry .   |  |
|          |            | Lower<br>Cretaceous            |   | Muddy Sandstone                   |   |  | 0 united   | Minor aquifer  | Secondary aquifer                            | 1  |   | ? Muddy Sandstone ?     |  | Muddy Ss aquifer                                 |   |  |
|          |            |                                | Thermopolis Shale   |                                   |   | Aquata                                       | Leaky confining unit   | Leaky confining unit   | -  |  | Major   | squitard                | confining                                      | umit 50  |   |  |
|          |            |                                |   | Clover                            | ly Formation  |  | Minor aquifer  | Principal aquifer<br>(Cloverly aquifer)                          | Secondary aquifer                            |  |   | Major aquifi            | er—Sandstone                                   | Cloverly ac                                      | k Mesezoic aquifers a   |  |





Define the 3-D extent of the aquifers...

Identify aquifer recharge areas...

1). Map depicting the outcrop areas of all aquifers and confining units

- 2). Series of cross-sections (small but multiple)
- 3). Isopach (thickness) maps are limited

4) Some 3-D modeling has been done for Laramie County

4). Geologic structures and basement elevation









# Identify the hydro-geologic, hydraulic, and hydrogeochemical....

- Compile and interpret water quality data
- Identify principal pollutants for each aquifer
- Compare water quality to state and federal regulatory standards





### 14 Appendix 2a

[--, not applicable; µS/cm, microsiemens per centimeter. Values in black are in milligrams per liter unless otherwise noted; values in blue are in micrograms per liter]

| Coologie unit | Constituent                                     | Min:      | 25th       | Madian | 75th       | Maximum | Sample size |  |
|---------------|---|-----------|------------|--------|------------|---------|-------------|--|
| Geologic unit | Constituent                                     | winninuni | percentile | weatan | percentile | Waximum |             |  |
| Madison       | Silica  | 7.5       | 8.6        | 10.3   | 20.0       | 24.0    | 12          |  |
| Formation—    | Sulfate   | 3.3       | 9.3        | 17.0   | 27.0       | 560     | 13          |  |
| Continued     | Dissolved solids                                | 181       | 209        | 216    | 245        | 920     | 13          |  |
|               | Ammonia (as N)                                  |           | 0.020      | 0.020  | 0.030      |         | 5           |  |
|               | Nitrate+nitrite (as N)                          |           | 0.080      | 0.20   | 0.92       |         | 11          |  |
|               | Phosphorus, unfiltered (as P)                   |           | 0.006      | 0.009  | 0.020      |         | 8           |  |
|               | Boron   |           | 14.4       | 20.0   | 27.8       |         | 7           |  |
|               | Iron  |           | 3.0        | 60.0   | 140        |         | 7           |  |
|               | Manganese                                       |           | 0.85       | 20.0   | 80.0       |         | 7           |  |
|               | Alpha radioactivity<br>(picocuries per liter)   |           | 1.2        | 2.7    | 6.8        |         | 6           |  |
|               | Gross beta radioactivity (picocuries per liter) |           | 2.0        | 4.0    | 6.3        |         | 5           |  |
|               | Radium-226 (picocuries per liter)               |           | 0.92       | 1.2    | 2.7        |         | 4           |  |
|               | Uranium, natural                                |           | 1.3        | 2.1    | 2.8        |         | 4           |  |

| ummaries of v<br>almin, gallens per | well yield and sprin<br>minute: (gel'min)/8, geller            | g discharge,<br>na per minute for | and hydraulic pro<br>t of dreadeau; ff <sup>2</sup> day, fi | perties, Wind and Bighorn F<br>at sparsed per day; WRB, Wind River | tiver Basins, Wyoming.<br>1 Basin; BHB, Bighers Kiver Basin; AY | ('V, Aye beven't a close)        |              |  |   |                                   |                                       |                                       |                        |                              |                               | St. add in  |
|-------------------------------------|--|-----------------------------------|---|--|---|----------------------------------|--------------|--|---|-----------------------------------|---------------------------------------|---------------------------------------|------------------------|------------------------------|-------------------------------|---|
| Region                              | U.S. Geological Survey National Water Informatio<br>Well yield |                                   | n System (NWIS)<br>Spring discharge<br>Flowing              | Rowing   | O<br>Well yield<br>Pumped or unknown                            | her sources<br>Oil well :        | data Flowing | All sources<br>Well yield or spring discharge<br>Fumped or flowing | Specific capacity   | Transmissivity                    |                                       | Porosity                              | Hydraulic conductivity | Storativity/storage coeffici |                               |   |
| Ce                                  | ust Range (mediar<br>(gal/min)                                 | 1) Count                          | Range (median)<br>(gal/min)                                 | Count Range (median)<br>(gal/min)                                  | Count Range (median)<br>(gat/min)                               | Count Range (media<br>(gal/min)  | n) Count Ray | nge (median)<br>(gal/min) Count Range (media<br>(gal/min)          | n) Count Range (modian)<br>(gal/min)<br>Conozoic                | Count [(gal/min)/ft]              | Count Bange (It?/day)                 | Count Range (R*/day)                  | Count Bange (percent   | Count Range (fl/day)         | Count Range units             |   |
| ARB                                 |  | 86                                | 0-200 (12)  | 1 10<br>1 1  |   | 90 4-1.010 (18)<br>53 4-600 (25) |              | 1 5  | Alluvium and colksvium<br>177 0–1.010 (15)<br>98 0.5–1.400 (20) | deposits 156 0.12–140 45 0.22–200 |                                       | 70 9.6-124,000<br>42 0.1-10,700       |                        | 11 6.2-2,500                 | 4 0.0001-0.01<br>14 0.003-0.2 | 1, 13, 20, 30, 33, 39, 41, 45<br>1, 7-9, 13, 25, 29, 42, 51-54  |
| ww                                  |  | 2                                 | 2; 128  |  |   | 6 25-108 (30)                    |              | 2 13.5; 44.9   | 10 2-128 (30)<br>Lacustrine depos                               | 6 3-39<br>its<br>4 0.22-1.7       |                                       | 2 469; 804                            |                        |                              | 5 0.0002-0.002                | 1, 11, 12, 25, 48   |
| VRB                                 |  | 1                                 | -   | 1 21   |   |                                  |              |  | Landslide depos   |                                   |                                       |                                       |                        |                              |                               | 1   |
| ATUB                                |  | 1                                 | -   | 1 27.5   |   |                                  |              |  | Dune sand (eolian) de   | aposits                           |                                       |                                       |                        |                              |                               | 2,48  |
| ATED                                |  | 11 60                             | 6-20 (8)<br>0.8-1,600 (12)                                  | 1 0.2  |   | 14 2-750 (19.5)<br>69 3-900 (20) |              | 1 30   | Terrace deposit<br>26 0.2-750 (16.5)<br>130 0.8-1,600 (16.8)    | 3<br>17 0.07-70<br>70 0.25-2,700  |                                       | 9 1.710-162,000<br>33 26.9-10,600     |                        | 3 190-230                    | 2 0.006, 0.02                 | 1. 13 20, 33, 37, 41, 43, 45<br>1, 7, 0, 25, 34, 36, 40, 42, 51, 52, 54   |
| VRB                                 |  | 4                                 | 4-7 (5)   |  |   | 4 15-20 (15)                     |              |  | Glacial deposit<br>4 15-20 (15)<br>5 4-11 (5)                   | 4 0.75-20<br>3 0.07-0.44          |                                       | 2 2.010; 4.020                        |                        | 1                            | n an                          | 133,42  |
| av                                  | 1  | 1                                 | 50  | 1 16   |   | 5 5-20 (9)                       |              | 2 1.3; 36  | 8 1.3-50 (12.5)<br>Rhyolite                                     | 4 3.3-53                          |                                       |                                       |                        |                              | 101                           | 1.10-12-13  |
| IRB                                 | 1  | 1                                 | 1   | 2 1:2  |   |                                  |              |  | White River Forms   | tion                              |                                       |                                       | $\sim 0$               |                              |                               | 1   |
| RB                                  | 1  | 1                                 | 2   | 3 0.5-5 (1)  | 11  |                                  | 1            | 11   | Wagen Bed Ferma<br>4 0.5–5 (1.5) Undifferentiated Abserok       | a Volcenies                       |                                       | < A                                   | 11~                    | SN                           |                               | 1   |
| /V                                  | 8 0.1-50 (2)   | 367                               | 0-350 (12)  | 2 2  |   | 206 1-400 (20)                   | 3 1-7        | 0  | 7 0.5-37 (1.5)<br>Wind River Forma<br>586 0-400 (1.5)           | 5on<br>422 0.004-400              | 2. 205-3.1                            | 0                                     |                        |                              | 10 0.0001-0.002               | 1, 13   |
| HB                                  | 2 3  | 40                                | 2-1.100 (8)   |  |   | 68 1-60 (6.5)                    |              |  | Willwood Format   | an 84 0.004-8.5                   | / .I                                  | ARI                                   | itte                   |                              | 2 0.4                         | 1, 7, 25, 29, 40, 42, 54  |
| i'RB                                |  | 1 1                               | 1; 10   |  |   |                                  | 10 1-10      | • (3)  | Fort Union Format   | tion 1 0.1                        | - Ar                                  | <b>u</b> – ,                          | 4111                   |                              |                               | 1, 13, 41   |
| 10                                  |  | U 14                              | 1 +-30 (10)   | 11 1 2   | 1 0.25  | 12   3-40 (5.5)                  |              |  | 1] 28   0.2-40 (6.5)   <br>Meaozoic                             |                                   | na                                    |                                       |                        |                              |                               | III 1, 7, 40, 54  |
| нв                                  |  | 1 1                               | 10<br>6-84 (37.5)   |  |   | 2 10                             | 4 1-7        | (3)  | Lance Formatio  | 1.0                               | 1* 2.2<br>2 4.2-17.9                  | ar a                                  | 27 15-20               |                              | 1 0.0004                      | 1, 13, 41   |
| 108                                 | 1 3.5  | 1 5                               | 4-500 (10)  | 1 5  | II I  | 1 1                              |              | 11 1   | Meet dise Forma<br>7 35 000 (10)                                | -415                              |                                       |                                       |                        | 1                            | 11 1                          | 1.54  |
| R.B<br>EB                           | 1 1<br>1 25  | 3                                 | 7; 20<br>5–50 (13)  | 2 8:9.5  | -   | 2 10; 15<br>9 1-25 (10)          | 8 1-31       | 50 (5)   | 1 1-350 (7)<br>27 1-50 (10)                                     | 1 0 7 5                           | 102.                                  | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 1* 18                  | 1 1                          |                               | 1, 41   |
| RB<br>68                            | 2 4; 7.1   | 11                                | 4-20 (9)<br>12-25 (20)                                      |  |   | 13 1.5-20 (8)<br>4 1-20 (6)      | 14 1-20      | • • • •  | 38 1 1-20 Cod Shall   | 19 0.01-4<br>7 0.01-1.2           | 1110                                  | 2.7-1.070                             | 2* 15-18               | 1                            |                               | 1. 13. 41 1. 25. 54   |
| RB B                                | 1 4  | 9                                 | 1.5-40 (6)  | 4 2.5-38 (4)   | 2 2   | 19 0.5-120 (10)<br>27 1-200 (16) | 1 10         | 14103  | -r-3  | n<br>26 0.003-<br>15 0.01-        | 0.2-30.6                              | 14 0.8-6,700                          | 15* 10-25<br>125* 6-26 |                              |                               | 1, 13, 30, 41   |
| rv I                                |  | 1 1                               | 18  |  |   |                                  |              |  | Mowry Shale   | au                                |                                       |                                       |                        |                              |                               | 1   |
| 103                                 | 1 5  |                                   |   | 1 2<br>4 0.01-100 (0.8)  |   |                                  |              |  | 5 0.01–100 (1.5)<br>uddy Sandstone Member of the                | ormopous Shalo                    |                                       |                                       |                        |                              |                               | 1   |
| RB<br>III                           |  | 3                                 | 1-20 (8)  |  |   | £ 1→3 (3.5)                      | 1+           |  |   |                                   | 6* 0.06-0.7<br>6 0.08-5.9             |                                       | 4* 7-18                |                              |                               | 41 1, 51, 52, 54  |
| RB<br>B                             |  | 1                                 | 10 10; 15   | 2 3:5  |   | 2 1:27                           |              | 10101  | 00  | 1 0.1 0.06                        | 1 4.0                                 |                                       |                        |                              |                               | 1 1,54  |
| 28<br>03                            | 1 8  | 9                                 | 10-230 (77)<br>4-60 (20.5)                                  | 2 4;16   |   | 6 5 0 (13.5)<br>4 12-26 (17)     | 11 3 1       |  | 1 12 12-00 (1)  | 13 0.13-4.3<br>4 0.02-1.5         | 10* 2.4-78.2<br>10* 0.1-7.3           |                                       | 7* 15-25<br>9* 7-15    |                              |                               | 1, 13, 41<br>1, 13, 25, 47, 51, 52, 54  |
| 8B<br>1B                            |  | 1                                 | 6<br>2  |  |   |                                  |              | 3.4 (1.5)  | 1 0.2-3.4 (1.8)   | 1 0.04                            | 4* 0.04-0.4<br>3 0.1-0.6              |                                       | 2* 10<br>1 15          |                              |                               | 1, 41 1, 25, 51, 52   |
| RB<br>1B                            |  | 1                                 | 15  | 1 6  |   | 1 AIK                            | 1 3 05       |  | 2 6; 15<br>5 0.8–35.1 (1.3)                                     | 1 3.8                             | 5 0.07-2.2                            |                                       |                        | 1 1                          |                               | 1, 13   |
| RB B                                |  | 1                                 | 20  | 3 5-28 (12)  |   | Y NY                             | 1 Li         | 0.5 /  | Gypsum Spring Form     3 5-28 (12)     5 4-59 (20)              | 1 20                              | 1 49                                  |                                       |                        |                              |                               | 1, 13   |
| RB                                  | 1  | 1 3                               | 10-90 (90)  | 1 5  | · . C   | 3 20-28 (28)                     | -N           |  | Nugget Sandstor   | 6 0.2-14                          | 4* 0.05-31.9                          | 1 1                                   | 3* 10-20               | 1 1                          | 1                             | 1, 13, 30, 41   |
| 4.B                                 | 1 6  | 2                                 | 2:9   | 5 5 5 (50)<br>5 1-150 (6)  | IN Y  | 3 15-20 (18)<br>3 8-25 (2        | 1 01         |  | 12 2-75 (16.5)<br>17 0.1-200 (8)                                | 4 0.56-4.5<br>4 0.7-17            | 6* 0.05-15.9<br>5* 0.7-5.9            |                                       | 4* 10-15<br>6* 15-22   |                              |                               | 1, 13, 41<br>1, 9, 13, 21, 25, 51, 52   |
| 2m                                  |  | 1                                 |   |  | 217   | 10h                              |              |  | Dirwoody Format<br>Goose Egg Format                             | ion                               | 2* 0.05-1.1                           | 1 1                                   | 1* 15                  | 11 1                         | 11 1                          | 41  |
| в                                   | 2 2; 5   |                                   |   | <b>1</b>   |   | nu                               | /            | 1 4,500  | 5 2-4,500 (40)  |                                   | I I                                   |                                       |                        |                              |                               | 1, 6, 21  |
| R.B                                 | 1 1.2  |                                   | 3-900 (77.5)  | and line   | 1:0   | <b>N</b> .                       | 30 1-12      | 20 (5)   | Phosphoria Forma<br>43 1-900 (5)                                | tion<br>1 3.3                     | 26* 0.05-8.6                          | 1 1                                   | 19* 10-24              | 11 1                         | 1 1                           | 1, 13, 21, 41, 57   |
| RB                                  | 4 13.6-150 (70.6)  | 5                                 | 20-625 (34)   | 2 25, 332  |   | 6 67.5 (10)<br>10-215 (18)       | 25 0.1-      | -27.5 (1.2)  | 37 0.1–583 (2)<br>Tensleep Sandsto<br>46 2–625 (67.5)           | 1 5.5<br>me<br>12 0.43-310        | 44* 0.01-12.9<br>22* 0.05-84.8        | 8 305-26.800                          | 31* 2-24<br>14* 5-32   | 1 2                          | 1 0.0002                      | 1, 2, 18, 21, 25, 47, 49, 51, 52, 54  |
| 08 1<br>RB                          | 6 5-250 (20)   |                                   | 20  | 3 5-1.410 (353)  | U''   | 21 [2-50.5 (1))                  | 124 0.2-     | -44 (6.4) 4 449-1,000 (90  | 0) 190 0.2–1,410 (9.5)<br>Amsden Fermati                        | 9 0.4–15<br>on                    | 168* 0.01-176<br>2* 0.1-4.9           | 9 0.01-6.700                          | 35* 3.3-26             | 1 0.01                       |                               | 1, 2, 4, 6, 9, 17–19, 31, 22, 35, 27, 31, 51, 52, 54, 56<br>41  |
| 08                                  | 1 52   | 1                                 | 1 130: 700  | Aro  | 3 10-55 50)   | 1 14                             | 5 0.8-       | 3.6 (2.3) 1 3.060  | 11 0.8-3.060 (10)<br>Madison Limesto                            | 2 0.2                             | 4 0.1-0.7                             | 16 112 2-80 (***                      | 2* 7-10                |                              |                               | 1, 21, 25, 27, 31, 51, 52   |
|                                     | 11 15-1,100 (380)  | 4                                 | 5-1,650 (168)   |  | 21-6,000 (312)  | e 1,5-540 (108)<br>23 3-730 (56) | 38 0.6-      | 61.9 (14.6) 2 2,960; 9,470   | 98 0.6-9,470 (39.6)<br>2 4,490; 8,530                           | 21 0.02-20                        | 37* 0.8-429                           | 17 83.1-5,490                         | 8* 1.5-26              | 2 0.08; 2.7                  | 3 0.00002-0.00                | 1, 5, 57, 57, 71, 75, 57, 76, 91<br>1, 6, 14, 15, 19, 21, 22, 25–28, 31, 35, 38, 50–52, 54, 56, 59, 6<br>12, 48 |
| 108                                 |  |                                   | $\wedge \mathbf{n}$   |  | Ш І   | 1 23                             | 1 8.1        | 11 1   | 2 8.1: 23<br>Bighorn Dolomi                                     | to                                | 2 13.4; 590                           | II I                                  |                        | 11 1                         | 1 1                           | 19, 51, 52, 54  |
| RB<br>IB                            |  | 1                                 | 323   | 0 1-22 (3)<br>1-22 (3)   |   | 2 25<br>2 42; 94                 | 2 4; 11      | 1.3 1 3,050  | 5 0.2-628 (25)<br>12 1-3,050 (8.6)<br>Gallatin Formati          | 2 2.5; 4.2<br>1 1.1               | 4* 4.3-268                            | 2 670; 1,110                          | 3* 2-25                |                              |                               | 1, 13, 41<br>1, 19, 21, 32, 25, 51, 52, 54  |
| RB HB                               |  | 1                                 |   |  |   | 1 26<br>2 1;9                    | 1 11.8       | 8  | 2 8; 26<br>3 1-11.8 (9)   |                                   | 1 5.7                                 |                                       |                        |                              |                               | 1, 13, 57<br>51, 52, 54   |
| 105                                 |  | 1 1                               | 110   | 2 3  | П Г   | 1                                |              |  | Gros Ventre Forma<br>3 3–110 (3)<br>Flathead Sandsto            | ne                                | I I I I I I I I I I I I I I I I I I I | 1 1                                   |                        |                              | 11 1                          | 1   |
| RB<br>rB                            | 2 105; 531   |                                   |   | 2 31; 85<br>3 7.5–15 (15)  |   | 1 96                             |              |  | 2 31; 85<br>6 7.5–531 (55.5)<br>Undifferentiated Precam         | brian Units                       | 2 26.8; 30.8                          |                                       | 1* 25                  |                              |                               | 1, 13   |
| RB<br>1B                            |  |                                   | 1-20 (6)  | 2 1.1; S   |   |                                  |              |  | 2 1.1; 8  | 5 000.38                          |                                       |                                       |                        |                              |                               | 1, 13   |

### References

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Plate X. Summaries of well yield, spring discharge, and hydraulic properties, Wind and Bighorn River Basins, Wyoming.









### WDEQ Water Quality Division:

- □ Known contaminated sites under the Groundwater Pollution Control Program
- Class I, III, IV, V injection wells under the Underground Injection Control (UIC) Program
- Wyoming Pollutant Discharge Elimination System (WYPDES) and National Pollutant Discharge Elimination System (NPDES) discharge points
- Public Owned Treatment Works (POTWs) and septic systems (Water and Wastewater Program)
- Concentrated Animal Feeding Operations (CAFOs)
- Pesticides / herbicides (Nonpoint Source Program)

### WDEQ Solid and Hazardous Waste Division:

- □ Known contaminated sites under the Voluntary Remediation Program (VRP)
- Permitted disposal pits and other small Treatment Storage and Disposal (TSD) facilities
- Landfills
- Above and underground storage tanks

### • WDEQ Land Quality and Abandoned Mine Land Division:

- □ Active and inactive mines (LQD/AML)
- □ Gravel Pits, Quarries, etc.

### • Wyoming Oil & Gas Conservation Commission:

- □ Class II disposal wells
- Produced water pits



Figure x-x - Potential groundwater contaminant sources: oil and gas fields, pipelines, and Class II injection and disposal wells, Wyoming Platte River Basin.

# Investigate groundwater



Figure x-x. Municipal permitted wells, Platte River Basin.

### **Domestic groundwater permits**



## <u>Appendix A</u>

# HINCKLEY

CONSULTING

P.O. Box 452 Laramie, WY 82073 307-745-0066 bhinckley@aol.com

### MEMORANDUM

TO: Matt Hoobler

DATE: February 7, 2011

FROM: Bern Hinckley

PROJECT: North Platte Technical Support

SUBJECT: Hydrological Connection

This memo has been prepared at the request of the Wyoming State Engineer's Office (SEO) to provide background and screening criteria for assessment of "hydrological connection" of groundwater wells in the North Platte River Basin under the provisions of the Modified North Platte Decree and the Platte River Recovery Implementation Program (PRRIP), i.e. the "28:40" connection criteria. Following discussion of the origin and associated principles, a step-by-step approach to application is suggested. The final section provides references and calculation tools.

### BACKGROUND / HISTORY

MBSA, 1982. For a series of reports published in 1982, the Missouri Basin States Association developed an analysis of the impact of groundwater development on streamflow, i.e. "stream



# Summary

- We are identifying and characterizing each aquifer (Define recharge areas, areal extent, thickness, hydraulic properties, water quality)
- Calculating (recharge rates, quantity, safe yield, potential contaminate areas and future development opportunities)
- Modified North Platte Decree (Appendix complete)
- Inventory potential contaminant sources (complete)
- Inventory of SEO permitted wells is (complete)
- The WSGS-USGS-WRDS team is progressing with the groundwater study for the updated Platte study.



# Thank you, Questions?

Scott Quillinan (307) 766-2286, x233 scottyq@uwyo.edu