

Regional Groundwater Monitoring in the Powder River Basin Wyoming

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BLM – Buffalo Field Office





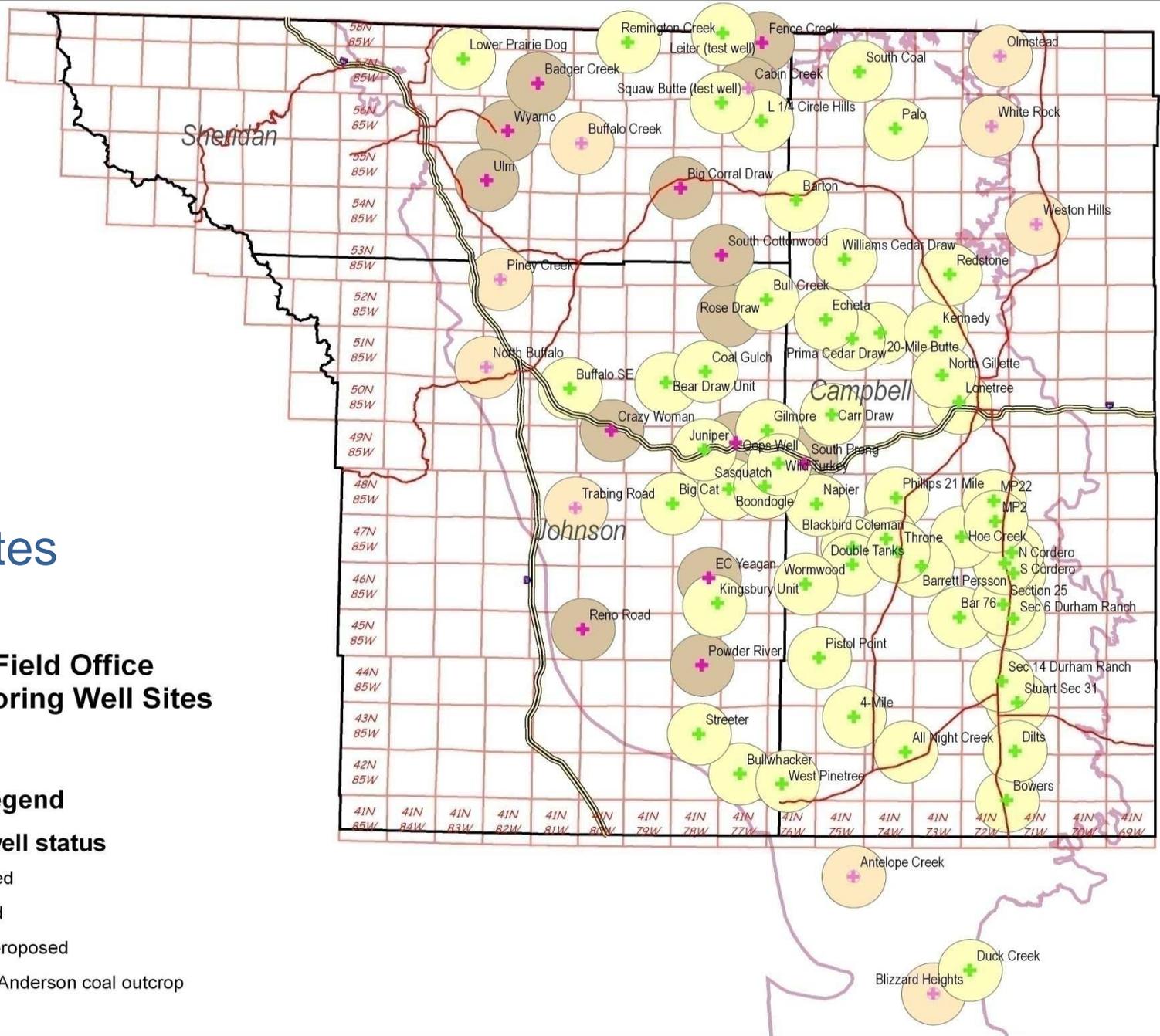
111
wells
at
78 sites

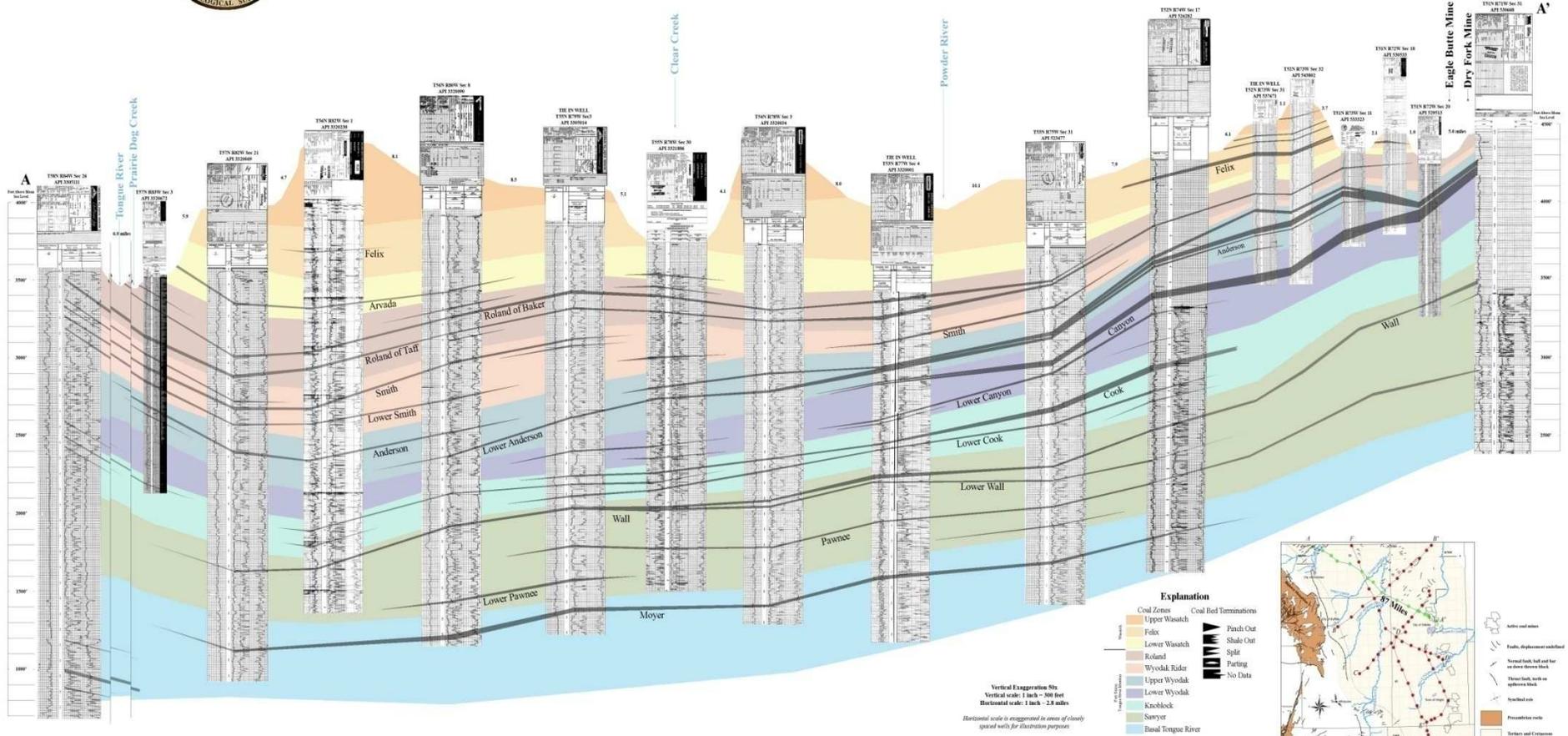
Buffalo Field Office Deep Monitoring Well Sites

Legend

Monitoring well status

-  Completed
-  Proposed
-  Orphan proposed
-  Wyodak-Anderson coal outcrop





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Acknowledgments:
 The Wyoming State Geological Survey thanks the Wyoming Water Development Commission for funding of the Powder River Basin projects, the U.S. Geological Survey for continued funding and support through the National Coal Resource Assessment program, the Wyoming Oil and Gas Conservation Commission for supplying scanned images of geophysical well logs, and the Wyoming Department of Environmental Quality - Water Quality Division for its contributions to the Powder River drainage coal assessment for their Assimilative Capacity Project.

Coal correlations and coal zones in the Powder River Basin, Wyoming

Cross Section A-A'
 by
 Nick R. Jones and James R. Rodgers
 2007

The authors acknowledge the work of the following previous investigators for their contributions and interpretations: Baber and others (1979), Callerton (1975), Dennis and others (1978, 1991), Grazis (1977), Haddeck and others (1976), Hardie and Van Gosen (1986), Kent and others (1976, 1977, 1978, 1979, 1981), Law (1978), Mapel (1954, 1976), Molina (1988), and Weaver and Flores (1985).

Complete citations for these references are included in the text for this report.

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Well Network History

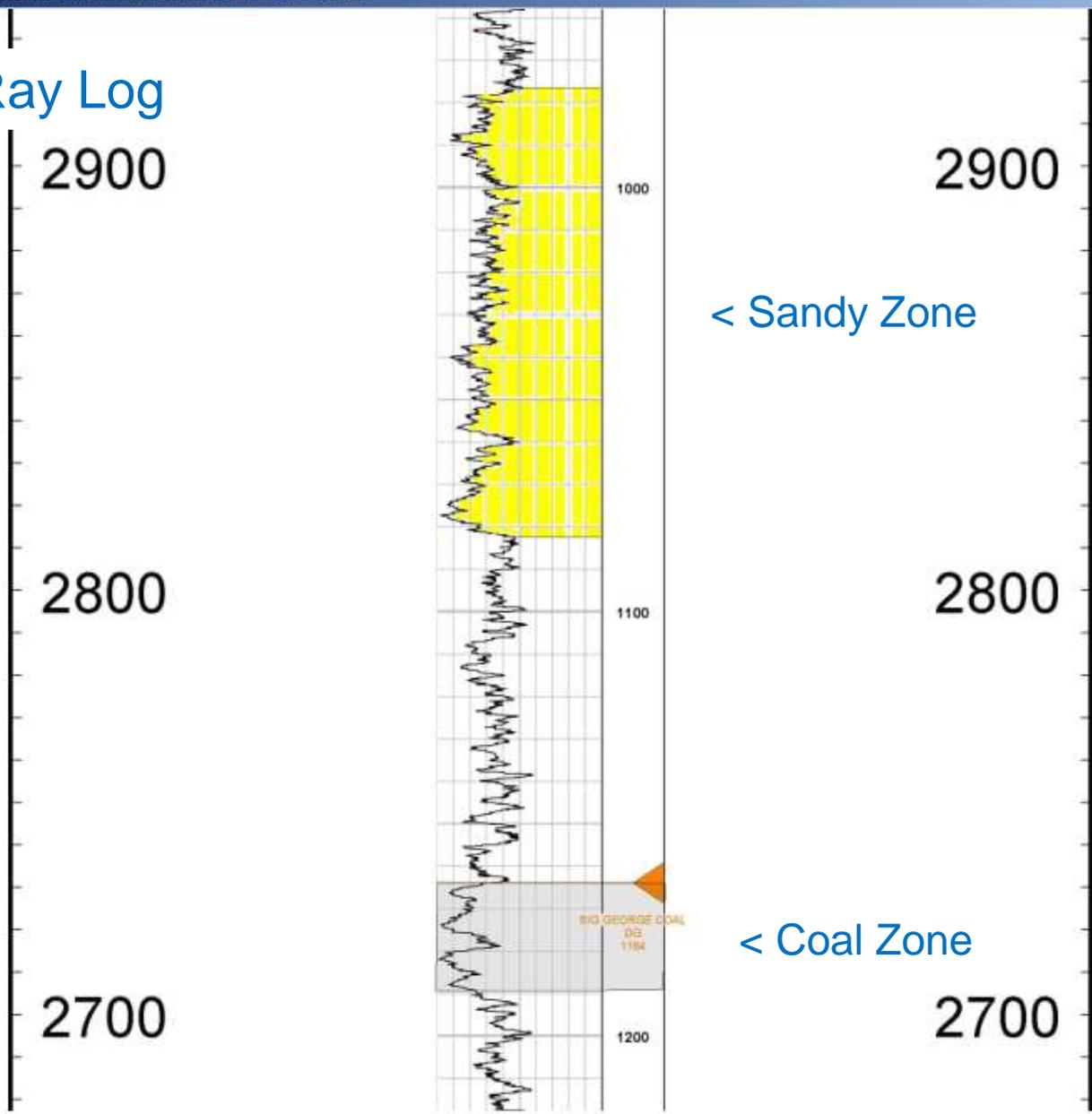
- Early wells were test/exploration holes
- Next series stopped with approval of new CBNG projects (e.g. Marquiss, Redstone, Lighthouse)
- Wyodak EIS ROD stipulated 2 well sets per township in development area
- PRB EIS reduced spacing to 1 well set per 4 townships, but called for more complex well sets



Monitoring Program Objectives

- Establish baseline conditions.
- Track drawdown in production zones.
- Measure groundwater leakage between producing coals and proximal sand aquifers.
- Measure wellhead gas pressure in production zones and gas concentrations in all zones.
- Check drawdown predictions of PRB FEIS and provide calibration data for future modeling work.
- Track groundwater recovery following cessation of CBNG production.

Gamma Ray Log



< Sandy Zone

< Coal Zone



Well Installation



- Operator drills and completes well or wells
- BLM personnel installs equipment
 - Site plumbing and wiring
 - Transducers for water level and gas pressure
 - Air lines for measurements when well is under high pressure
 - Data logger for continuous data collection
 - Well house

Well Site Setups

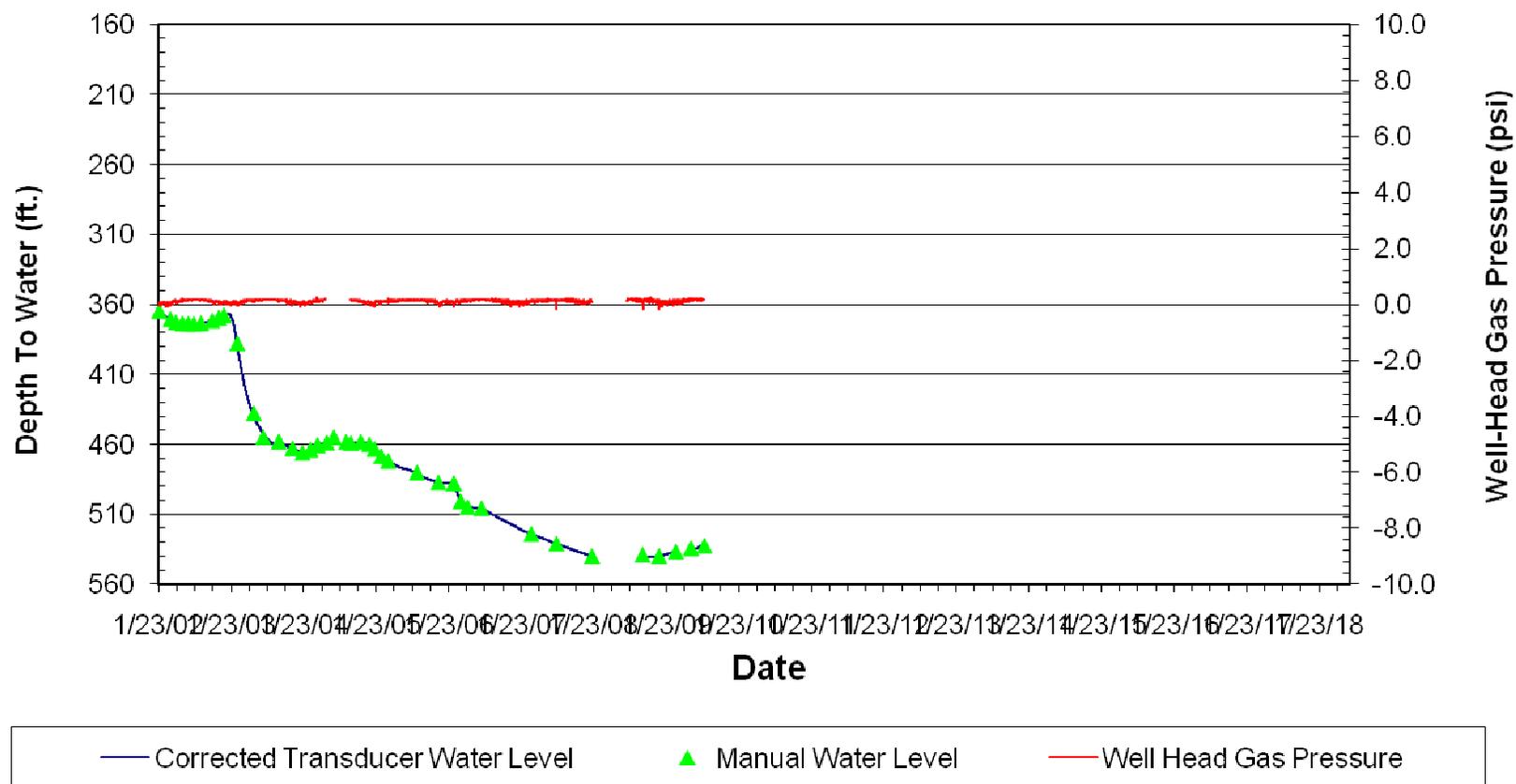


- Single Coal Well (test or exploration wells)
- Multiple Individual Wells (coal and sand units)
- Dual Completion Wells, (two zones separated by a packer in one bore hole)

Hydrology Technicians visit wells quarterly at minimum

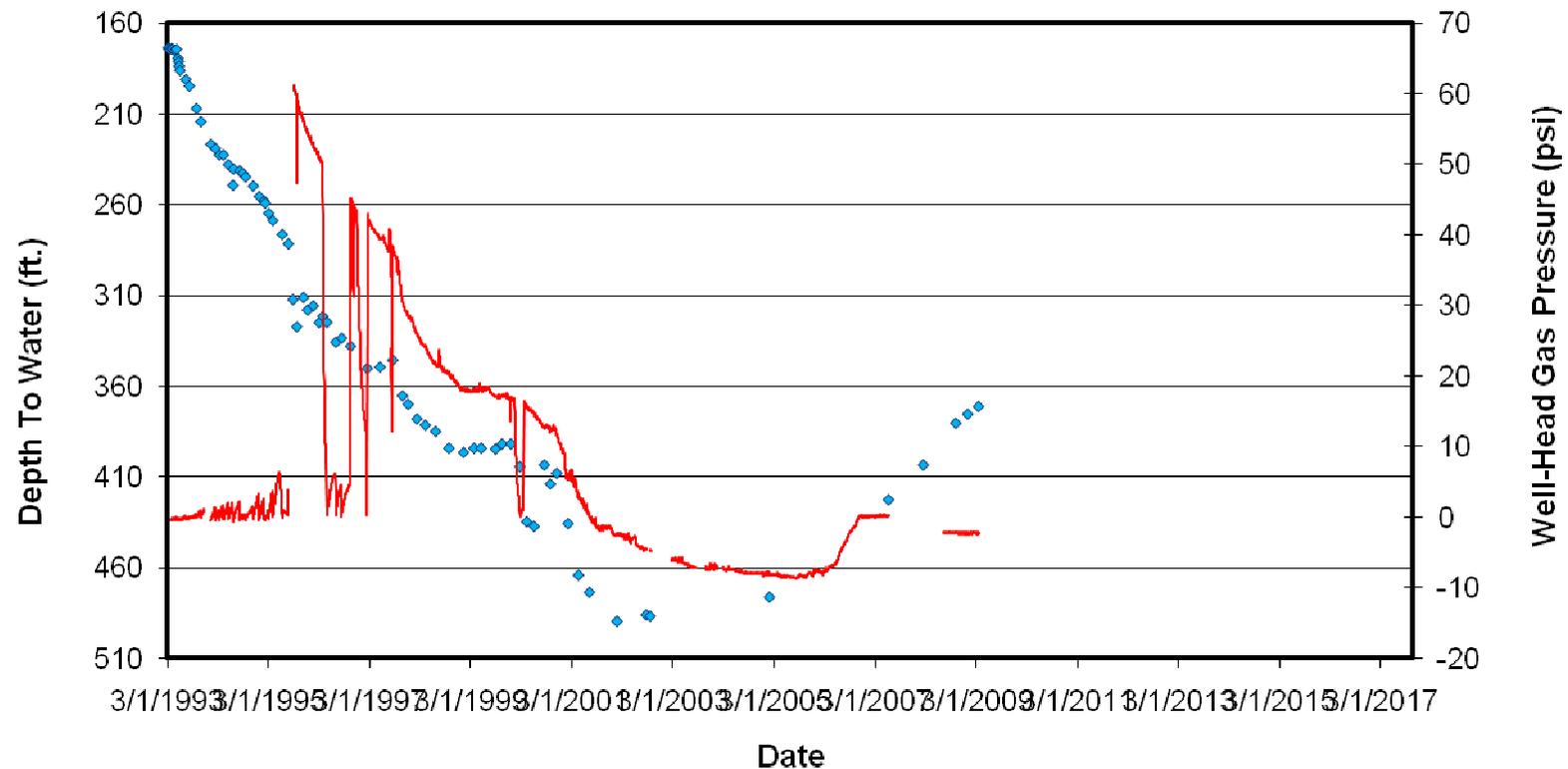
Barton Cook Coal

T54N R76W Sec.3, SWSE, Surface Elevation=3960Ft. @ GL



Example - Drawdown with CBNG production, no gas pressure build-up

Martens and Peck Sec. 22 - Wyodak Coal Well

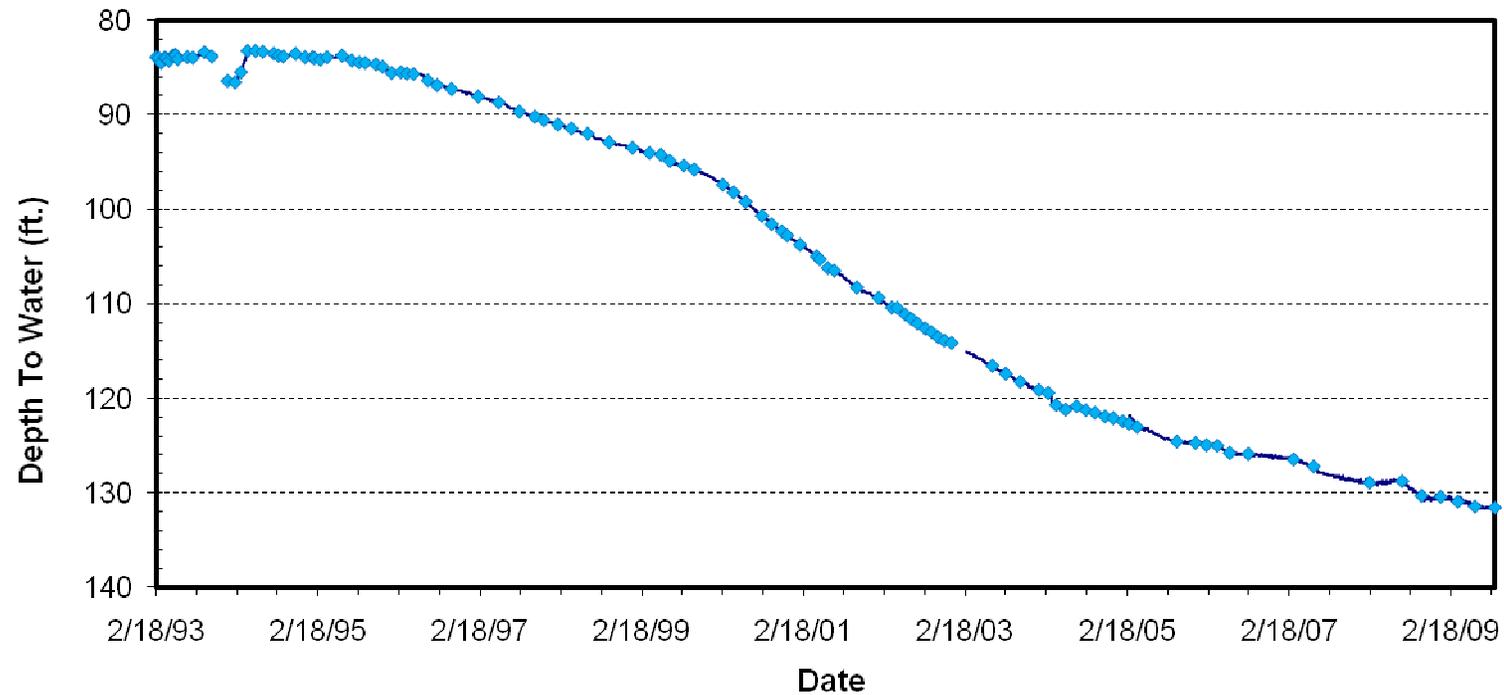


Example - Gas pressure build up with drawdown and beginning recovery in eastern PRB

MP- 22 Wasatch Sand

SEO Permit # P90659W

T48N R72W Sec.22 NESE, Surface Elevation=4557.0 Ft. @ GL



— Corrected Transducer Water Level ◆ Manual Water Level

Example - Sand Aquifer Drawdown

Initial Groundwater Report

- Wyoming State Geological Survey prepared first report version in corporation with BLM-BFO.

- **Open-File Report 2009-10**

1993 – 2006 Coalbed Natural Gas (CBNG)
Regional Groundwater Monitoring Report:
Powder River Basin, Wyoming.

(“Open-File” designation leaves the opportunity for continual editing and updating of report)

- Report found online at

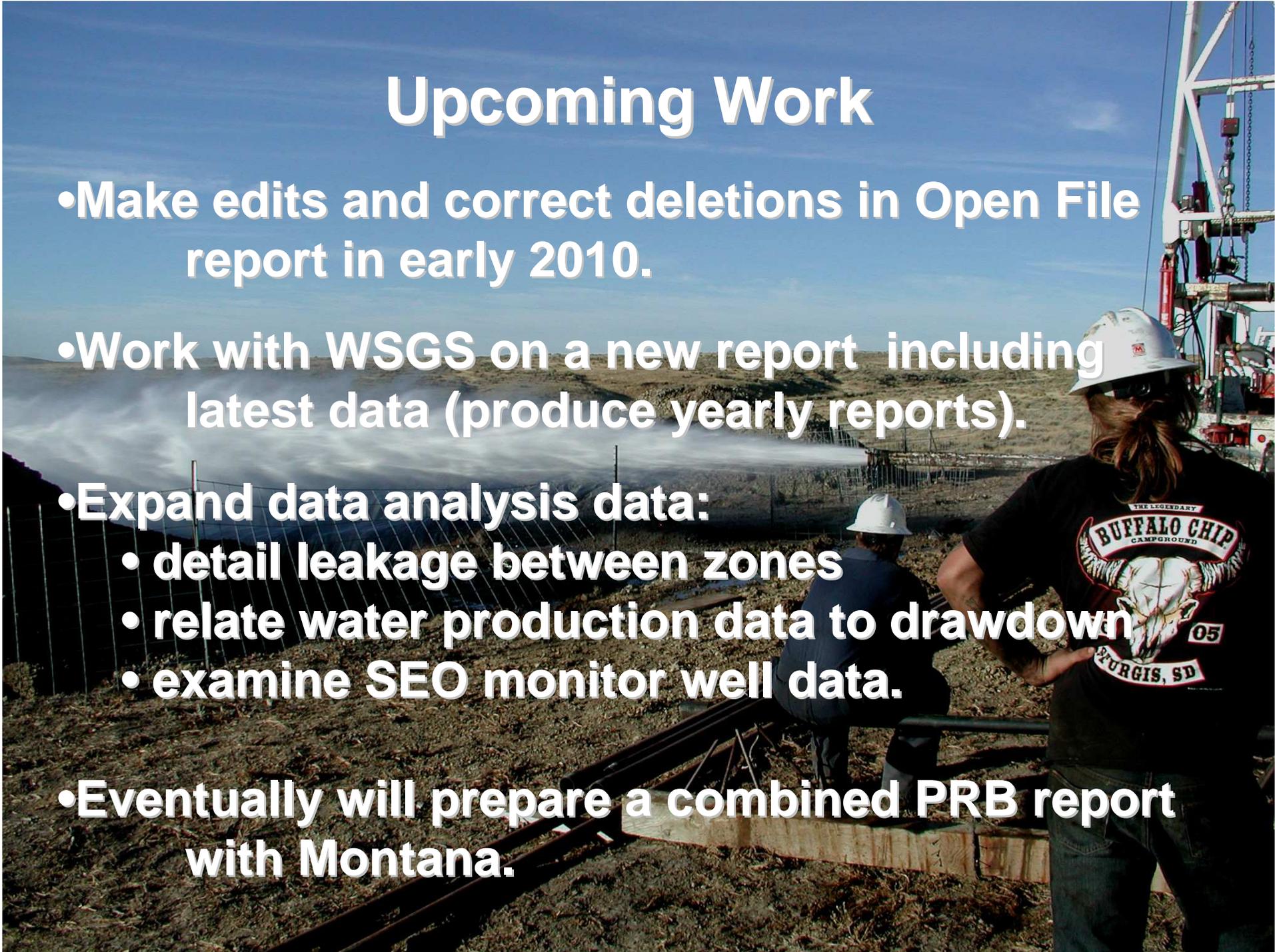
<http://www.wsgs.uwyo.edu/docs/OFR-PRB.pdf>

Groundwater Report Summary

- Initial organization and compilation of data through 2006.
- 2002 Groundwater Model (PRB FEIS) predicted drawdowns in the Ft. Union Coals ranging from 500 to over 750 feet by 2006.
- Most wells showed drawdowns less than 500 feet (4 greater with a max of 650 feet).
- 15 of 49 monitored sand units showed 10+ feet of drawdown with a maximum of 269 feet.

Upcoming Work

- Make edits and correct deletions in Open File report in early 2010.
- Work with WSGS on a new report including latest data (produce yearly reports).
- Expand data analysis data:
 - detail leakage between zones
 - relate water production data to drawdown
 - examine SEO monitor well data.
- Eventually will prepare a combined PRB report with Montana.





Open File Report found online at
<http://www.wsgs.uwyo.edu/docs/OFR-PRB.pdf>

BLM Monitoring Data posted at
<http://partners.wygeisc.uwyo.edu/wygeolibrary>