# USGS Activities, Reports, and Data Pavillion, Wyoming

## Briefing for Deputy Secretary Anne Castle
## DOI Office of Water and Science

By

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# Overview of Discussion

Review Background of USGS effort

Development of Sampling and Analysis Plan through Interagency Technical Team

Description of Sampling Event and Results

- Field parameter behavior at MW01
- Results of redevelopment efforts at MW02
- Review why MW02 was not sampled

Summary

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# Key Points

<u>Goal</u>: Provide information for the stakeholders and inform the EPA's expert panel

<u>Objective</u>: Provide environmentally representative samples of groundwater and test for USEPA list of chemical compounds

- MW01 successfully sampled
- MW02 is a low-yield well. Was redeveloped with EPA (USGS funded), but no improvement in flow
- Why MW02 was not sampled by USGS:
  - Lack of time to develop, test, and implement potential low-flow sampling approach to make September, 2012 deadline
  - Beyond scope of original cooperative agreement
- MW02 sampled by EPA prior to redevelopment and sample was split with USGS and EPA lab. Data from USGS contract lab provided directly to EPA
- Two USGS reports publically released

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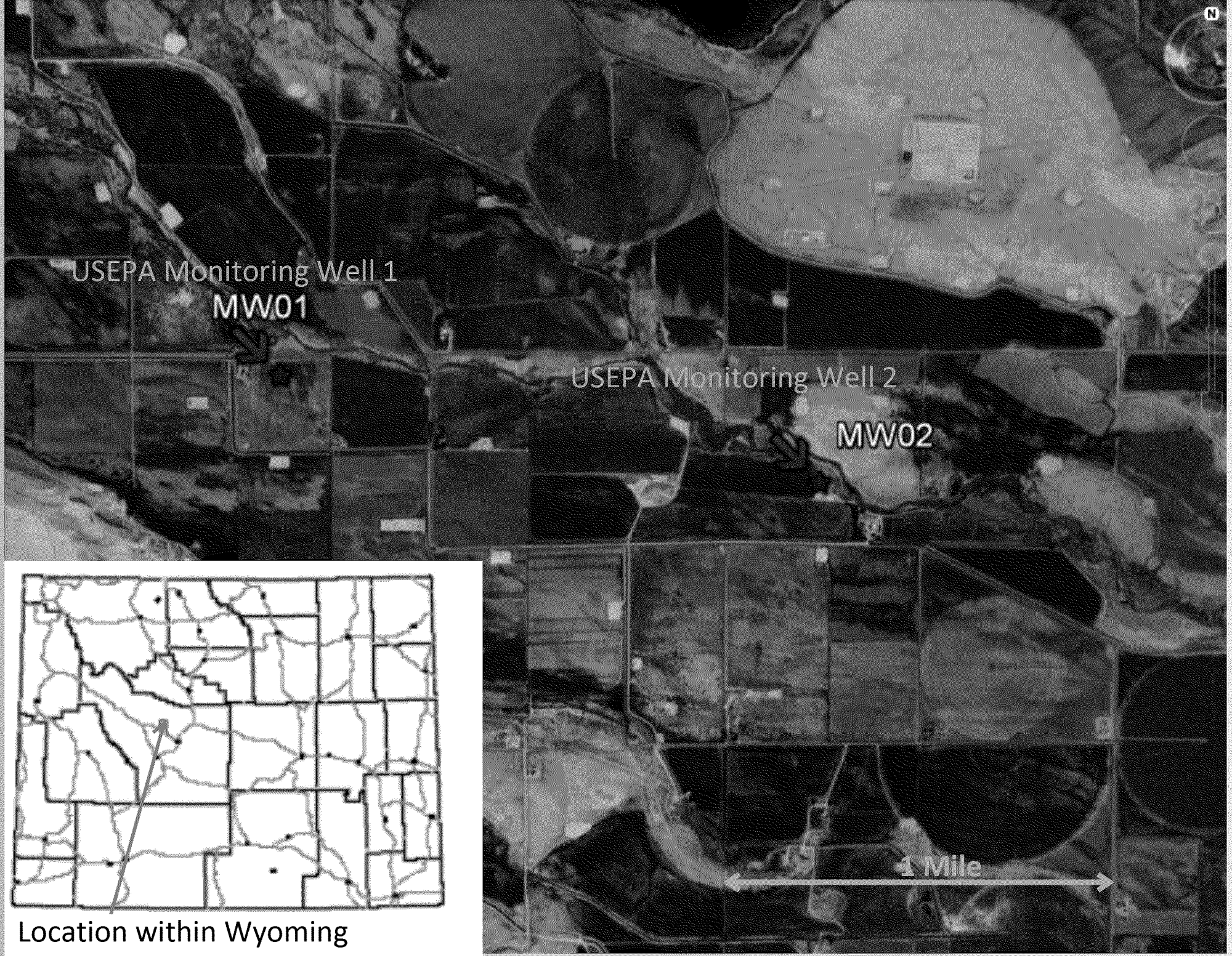
# USGS Groundwater Sampling Effort at Pavillion, WY

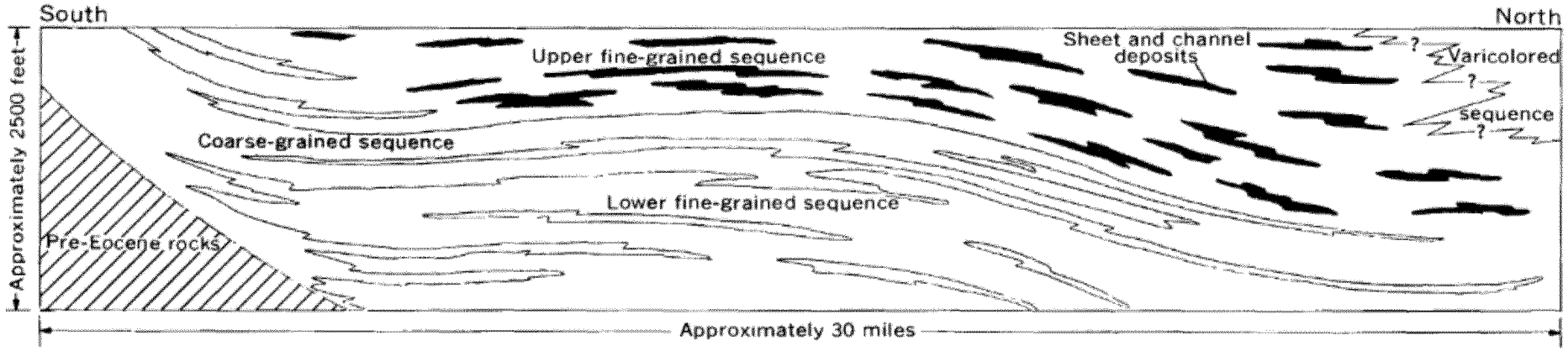
**<u>Background</u> Pavillion is complicated:**

- ✓ **Variable and complex hydrogeology**
- ✓ **Wind River Formation is both "gas reservoir" and drinking water "aquifer"**
- ✓ **No confining layer between "aquifer" and "gas reservoir"**
- ✓ **No pre-development data for aquifer**
- ✓ **Hydrocarbon presence could be expected**
- ✓ **Groundwater flow directions not characterized**
- ✓ **Fracking recipe unknown**

- **Conventional oil and gas development back to 1960's**
- **Hydraulic fracking occurred from ~1995 to 2005??**

Encana gas well, tribal minerals


USEPA Monitoring Well 1
MW01
USEPA Monitoring Well 2
MW02
1 Mile
Location within Wyoming



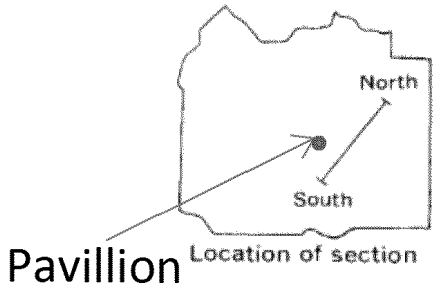



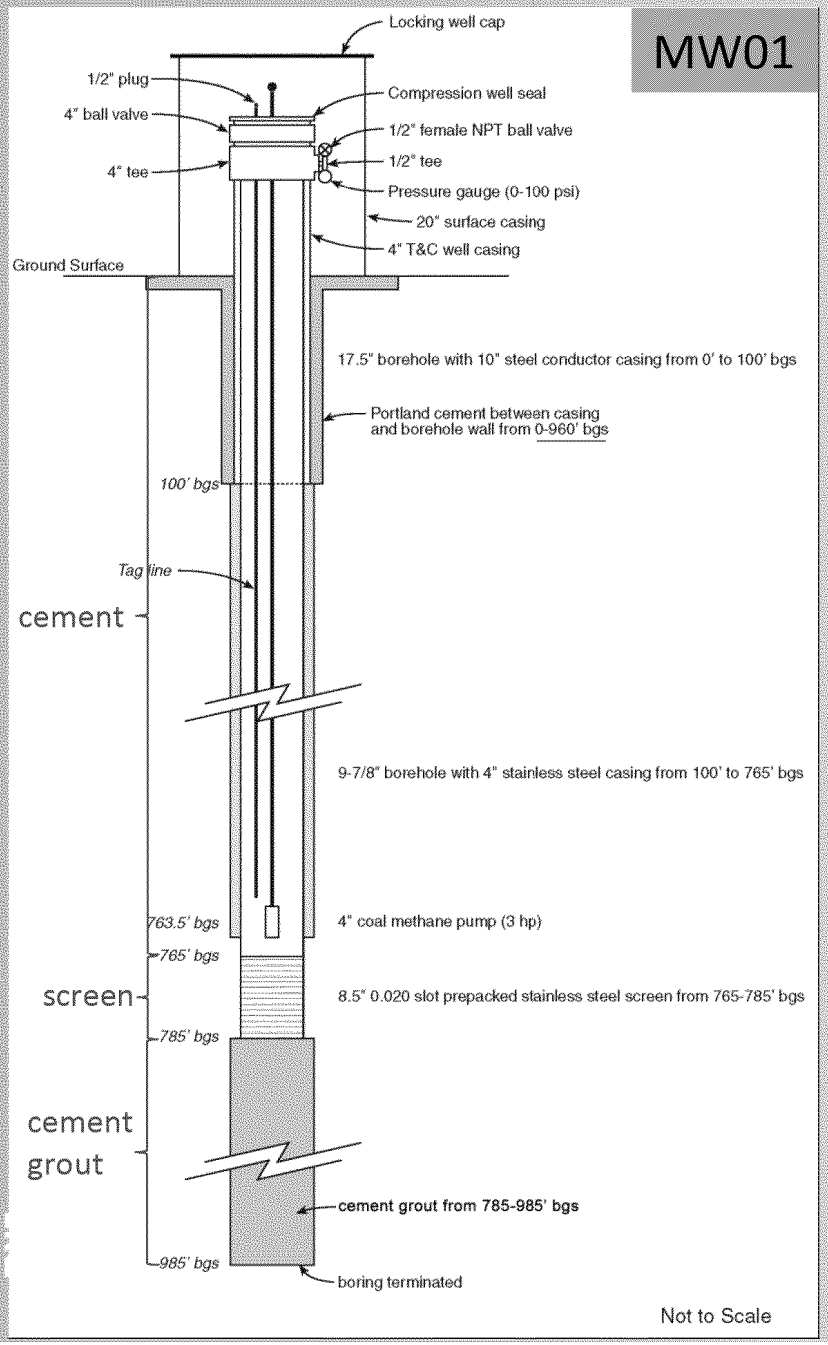

FIGURE 13.—Diagrammatic section showing approximate relations of major facies of part of the Wind River Formation.

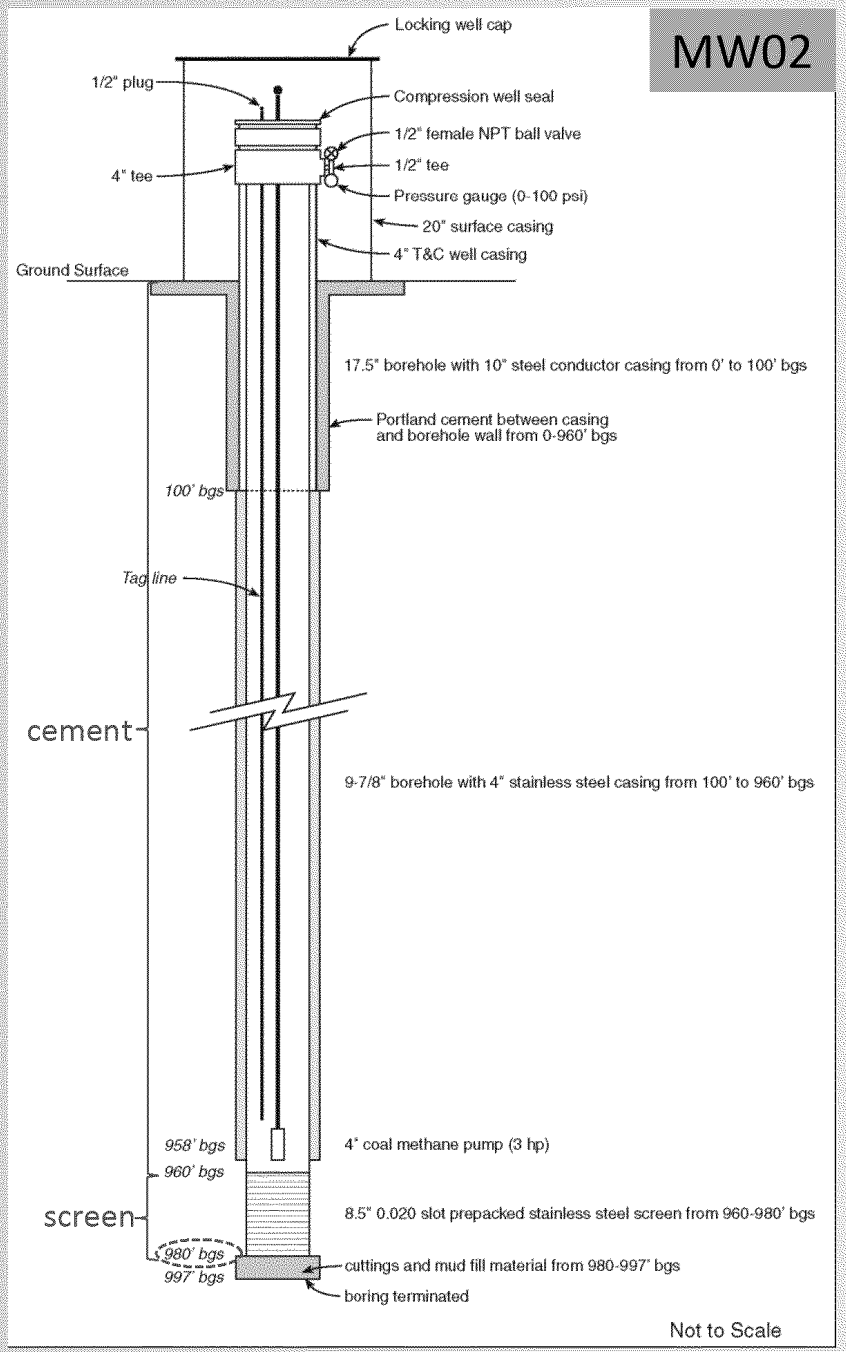


McGreevy, L.J., Hodson, W.G., and Rucker, S.J. IV, 1969, Ground-water resources of the Wind River Indian Reservation, Wyoming: U.S. Geological Survey Water-Supply Paper 1576-I, 45 p., 3 pl.

EPAPAV0111128

# Background for discussion: Completion logs MW01 & MW02



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**Background:** Definition of a Low-Yield Well:

- Produces substantially less than 1 gallon (3.75 liters) per minute
- Drawdown occurs such that the well is rapidly pumped dry or for which recovery to at least 90 percent of the pre-pumping water level takes many hours to several days or longer

Data collected after USGS redevelopment of MW02

- Yield = 0.007 – 0.011 gal per minute
- MW02 borehole volume ~ 510 gallons
- MW02 Estimate of 90 percent recovery would take ~32 days

Recall original goal: collect representative sample from aquifer

➢ **Important point:**

- Low-yield sampling possible, but beyond the scope of the project and funding
- Not able to design, buy correct pump, test system, and sample well in time for mid-September deadline

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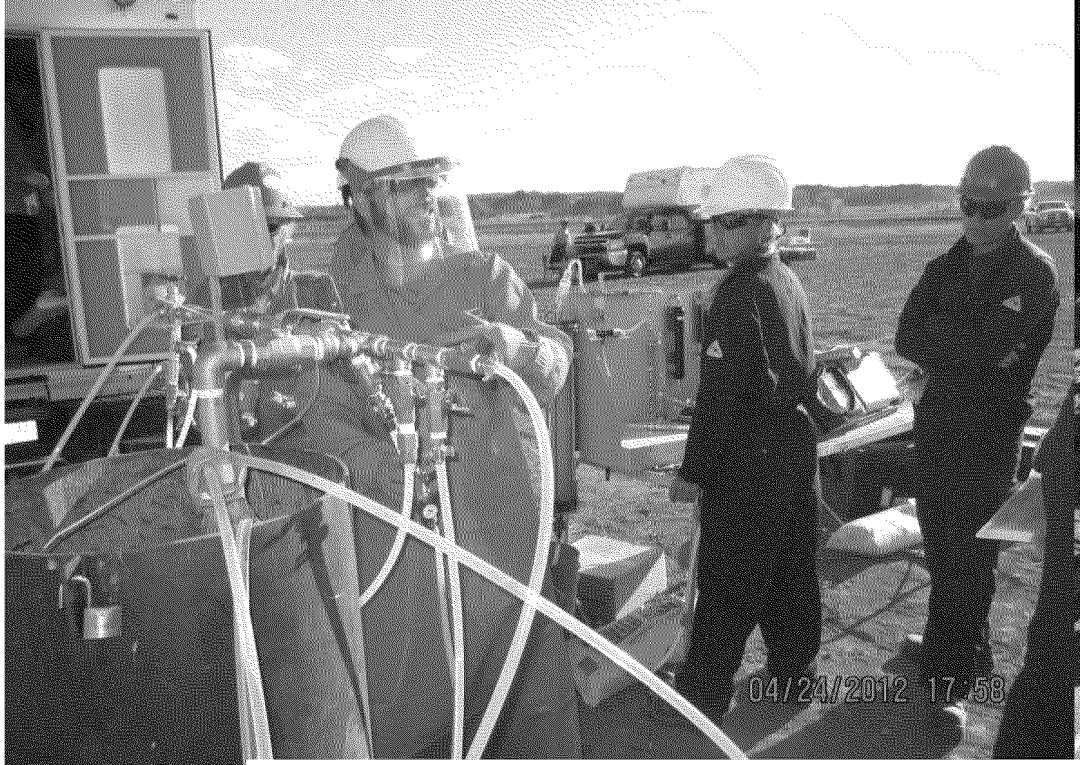
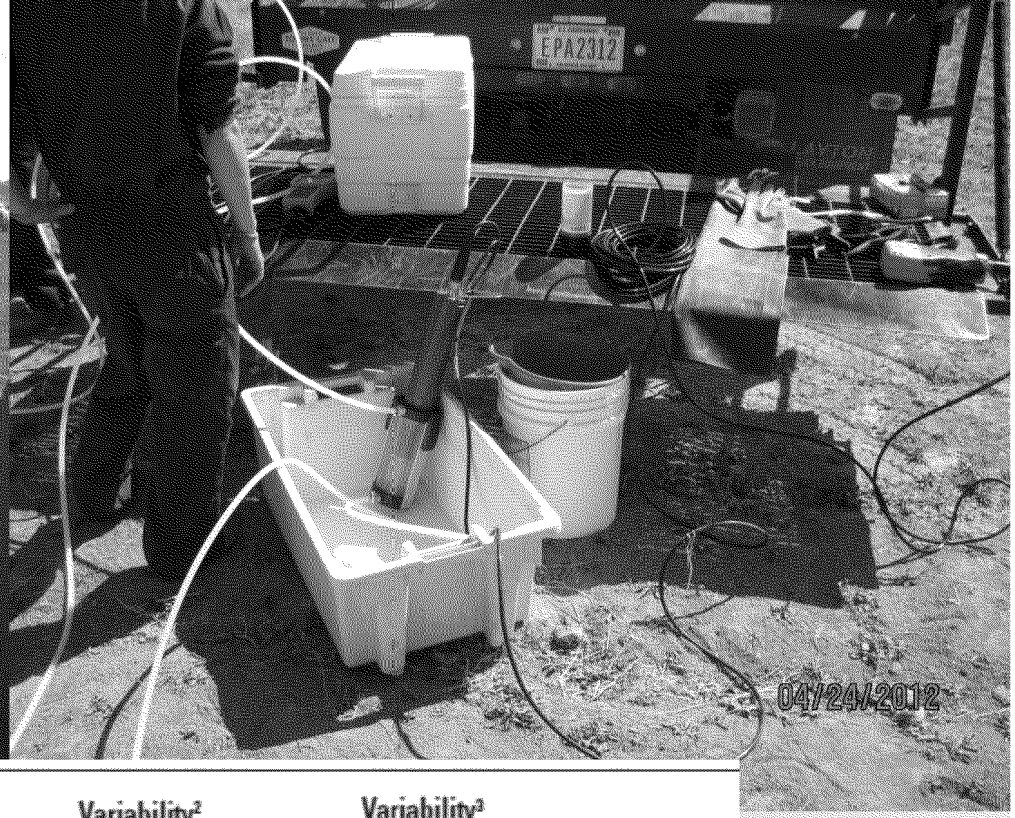
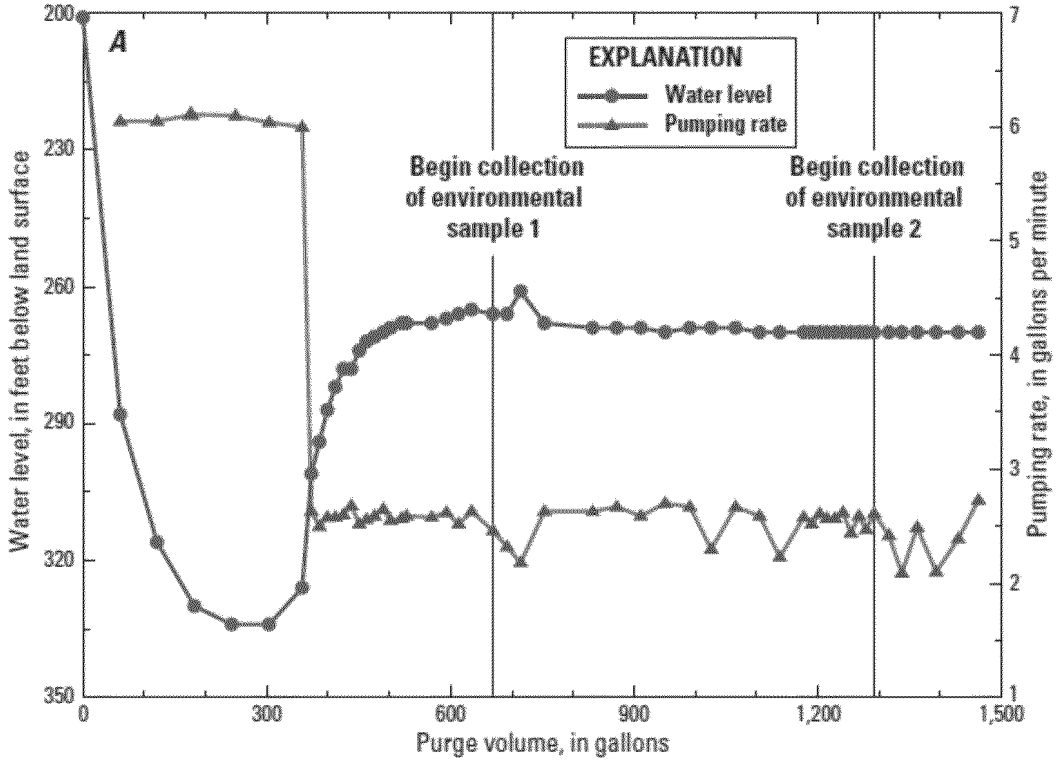
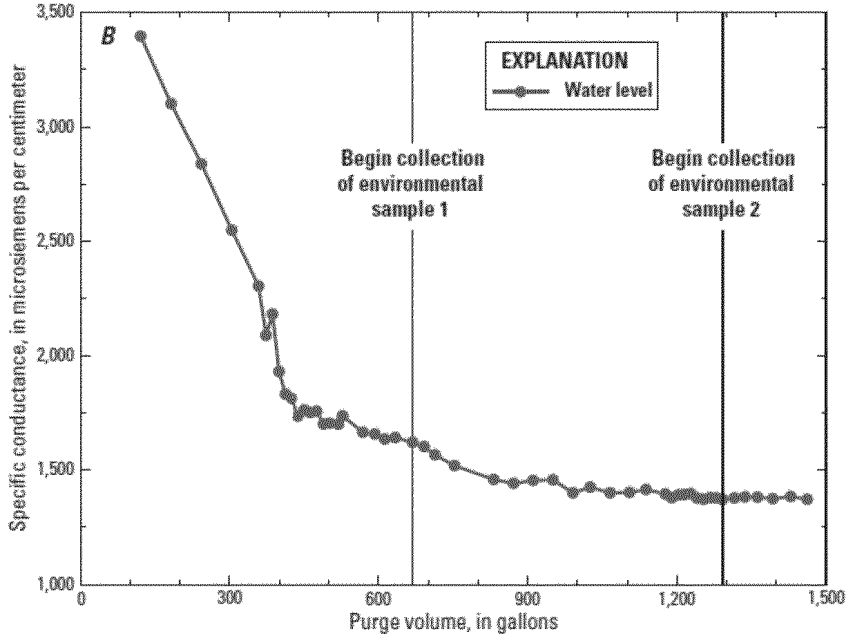


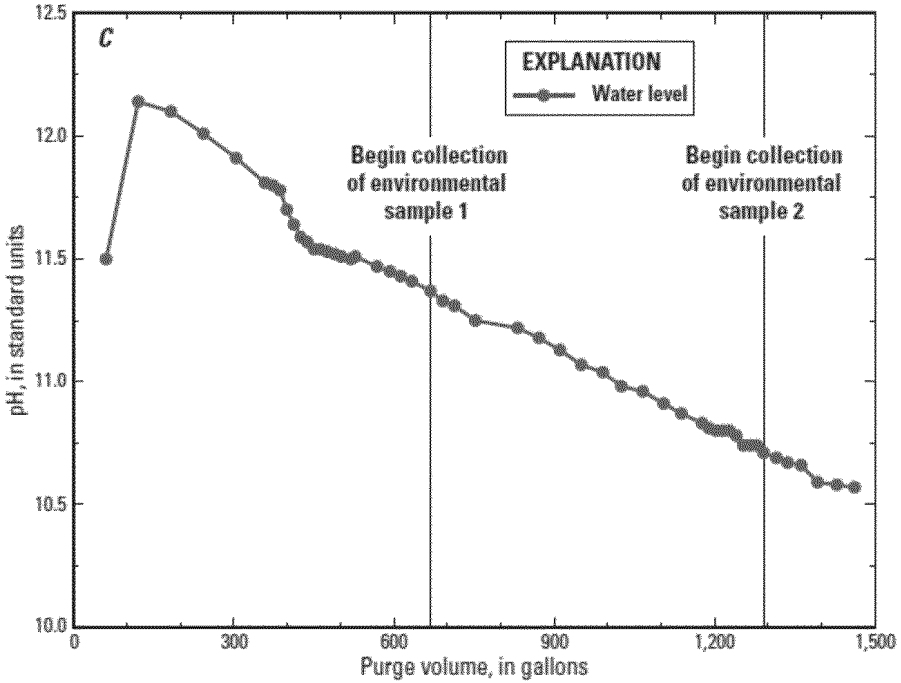




| Time | Water level (ft BMP) | Draw down (ft) | Pumping rate (gal/min) | Volume (gallons) | Borehole volumes | Water Temper-ature (°C) | Variability[2] of last 5 temperature measure-ments | SC (µS/cm) | Variability[3] of last 5 SC measure-ments (percent) | pH (standard units) | Vari-ability |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12:55 | 270.84 | 69.49 | 2.59 | 476 | 1.11 | 14.53 | 0.80 | 1,757 | 4.37 | 11.5 | 0.06 |
| 13:00 | 269.96 | 68.61 | 2.65 | 490 | 1.14 | 15.09 | 0.80 | 1,701 | 3.56 | 11.5 | 0.05 |
| 13:05 | 269.24 | 67.89 | 2.55 | 502 | 1.17 | 14.86 | 0.58 | 1,704 | 3.57 | 11.5 | 0.03 |
| 13:12 | 268.41 | 67.06 | 2.57 | 520 | 1.21 | 14.18 | 0.91 | 1,700 | 3.31 | 11.5 | 0.04 |
| 13:15 | 268.24 | 66.89 | 2.59 | 528 | 1.23 | 14.19 | 0.91 | 1,737 | 3.31 | 11.5 | 0.03 |
| 13:31 | 267.92 | 66.57 | 2.58 | 569 | 1.33 | 14.57 | 0.91 | 1,665 | 4.23 | 11.5 | 0.05 |
| 13:40 | 266.64 | 65.29 | 2.62 | 593 | 1.38 | 15.04 | 0.86 | 1,657 | 4.73 | 11.5 | 0.06 |
| 13:48 | 266.42 | 65.07 | 2.52 | 613 | 1.43 | 14.89 | 0.86 | 1,635 | 6.08 | 11.4 | 0.08 |
| 13:56 | 265.21 | 63.86 | 2.63 | 634 | 1.48 | 15.54 | 1.35 | 1,642 | 6.12 | 11.4 | 0.10 |
| 14:10 | 266.21 | 64.86 | 2.46 | 669 | 1.56 | 14.99 | 0.97 | 1,621 | 2.68 | 11.4 | 0.10 |
| 14:20 | 266.37 | 65.02 | 2.32 | 692 | 1.61 | 15.77 | 0.88 | 1,602 | 3.37 | 11.3 | 0.12 |
| 14:30 | 261.41 | 60.06 | 2.18 | 714 | 1.66 | 15.45 | 0.88 | 1,566 | 4.71 | 11.3 | 0.12 |
| 14:45 | 268.03 | 66.68 | 2.63 | 753 | 1.76 | 15.47 | 0.78 | 1,519 | 7.74 | 11.3 | 0.16 |
| 15:15 | 268.56 | 67.21 | 2.63 | 832 | 1.94 | 14.92 | 0.85 | 1,459 | 10.43 | 11.2 | 0.15 |
| 15:30 | 268.50 | 67.15 | 2.67 | 872 | 2.03 | 14.81 | 0.96 | 1,442 | 10.54 | 11.2 | 0.15 |
| 15:45 | 268.60 | 67.25 | 2.59 | 911 | 2.12 | 14.88 | 0.66 | 1,455 | 8.33 | 11.1 | 0.18 |
| 16:00 | 269.94 | 68.59 | 2.70 | 951 | 2.22 | 15.10 | 0.66 | 1,458 | 5.25 | 11.1 | 0.18 |

# Purge Record for MW01 (4/24/2012)

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# Concentrations for MW01 as a function of purge volume

| Constituent | Units | Sample 1 (1.6 borehole volumes) | Sample 2 (3.0 borehole volumes) | Relative % difference (sample1-sample2) | Relative % difference (sample-replicate) | |
|---|---|---|---|---|---|---|
| **Alkalinity** | **mg/L as CaCO3** | **215** | **174** | **-21 %** | **0.9 to 4.5 %** | * |
| **Sulfate, filtered** | **mg/L** | **380** | **410** | **- 8 %** | **0** | |
| **Chloride, filtered** | **mg/L** | **26** | **27** | **+ 4 %** | **0** | |
| **Potassium, filtered** | **mg/L** | **15** | **13** | **- 14 %** | **7 %** | * |
| **Methane (TAL, pres.)** | **mg/L** | **27.5** | **25.5** | **- 7.5 %** | **6 to 10 %** | |
| **Dissolved organic carbon** | **mg/L** | **4.3** | **3** | **- 36 %** | **2.3 %** | * |
| **Diesel range organics (pres.)** | **ug/L** | **E 180** | **E 85** | **Approx. - 72 %** | **2 to 5 %** | * |
| **Gasoline range organics (pres.)** | **ug/L** | **700** | **730** | **+ 4.2 %** | **3 to 8 %** | |
| **Benzoic acid** | **ug/L** | **340** | **190** | **- 57 %** | **5 to 6 %** | |
| **Phenol** | **ug/L** | **E 10** | **E 6.1** | **Approx. - 48 %** | **8 to 10%** | * |

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# Highlights – MW01 Sample 2

- Sodium/sulfate type water common in arid western aquifers
- No Volatile Organic Compounds (VOCs) detected
- 3 - Semi VOCs detected
- Diesel and Gasoline Range Organics detected
- Some non-detects, such as with glycols, could be a function of high reporting levels by contract lab (TAL)
- We reported Tentatively Identified Compounds (TICs)
- Very stringent QA/QC measures implemented and reported

➢ Couldn't exactly match EPA's analyte list and detection levels

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# Summary

- Cooperative agreement with WYDEQ completed, no current plans for additional work

- SAP developed through technical team and reviewed multiple times, both reports peer reviewed by EPA and WYDEQ

- Awaiting interpretation of EPA and USGS results by formal EPA peer review process

- State of Wyoming and others will also provide their independent interpretations. Our role was to provide the best possible samples and not to critique EPA or others

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