# USGS Activities, Reports, and Data Pavillion, Wyoming

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

By

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October 2, 2012

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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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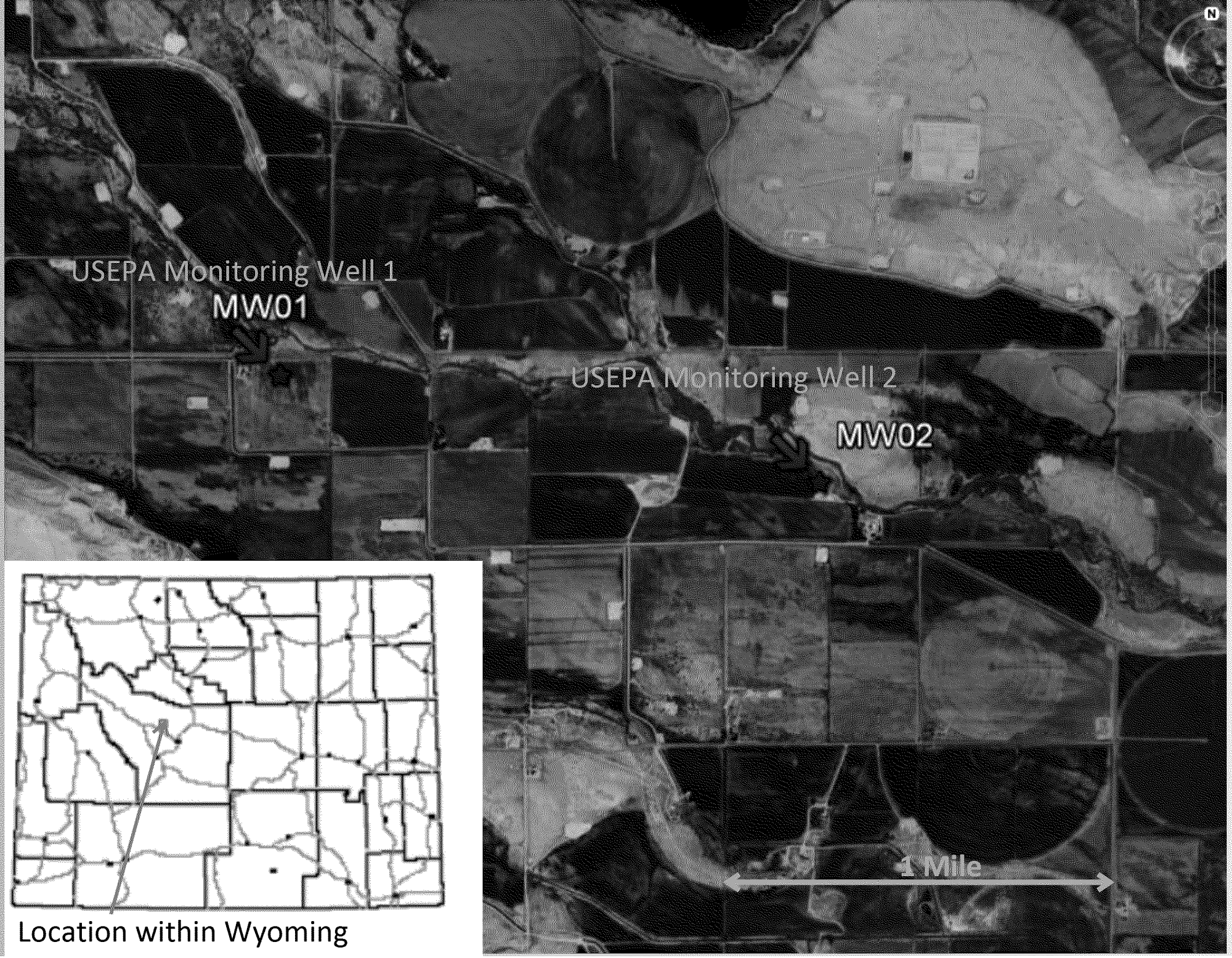
# USGS Groundwater Sampling Effort at Pavillion, WY

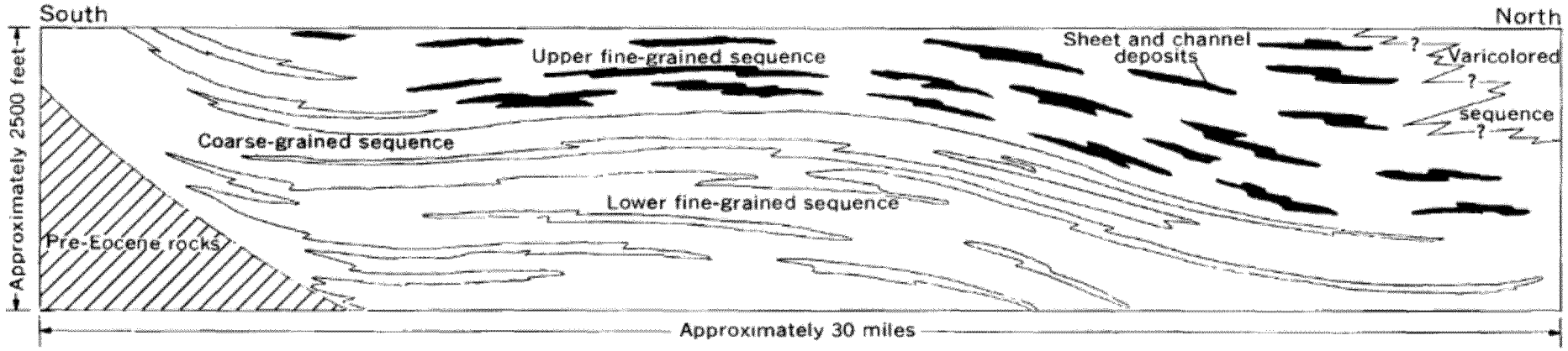
**<u>Background</u> Pavillion is complicated:**

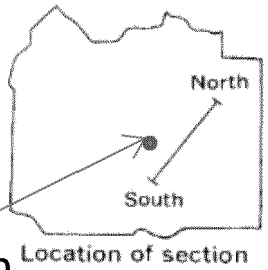
- ✓ **Variable and complex hydrogeology**
- ✓ **Wind River Formation is both "gas reservoir" and drinking water "aquifer"**
- ✓ **No confining layer between "aquifer" and "gas reservoir"**
- ✓ **No pre-development data for aquifer**
- ✓ **Hydrocarbon presence could be expected**
- ✓ **Groundwater flow 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




Pavillion

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.

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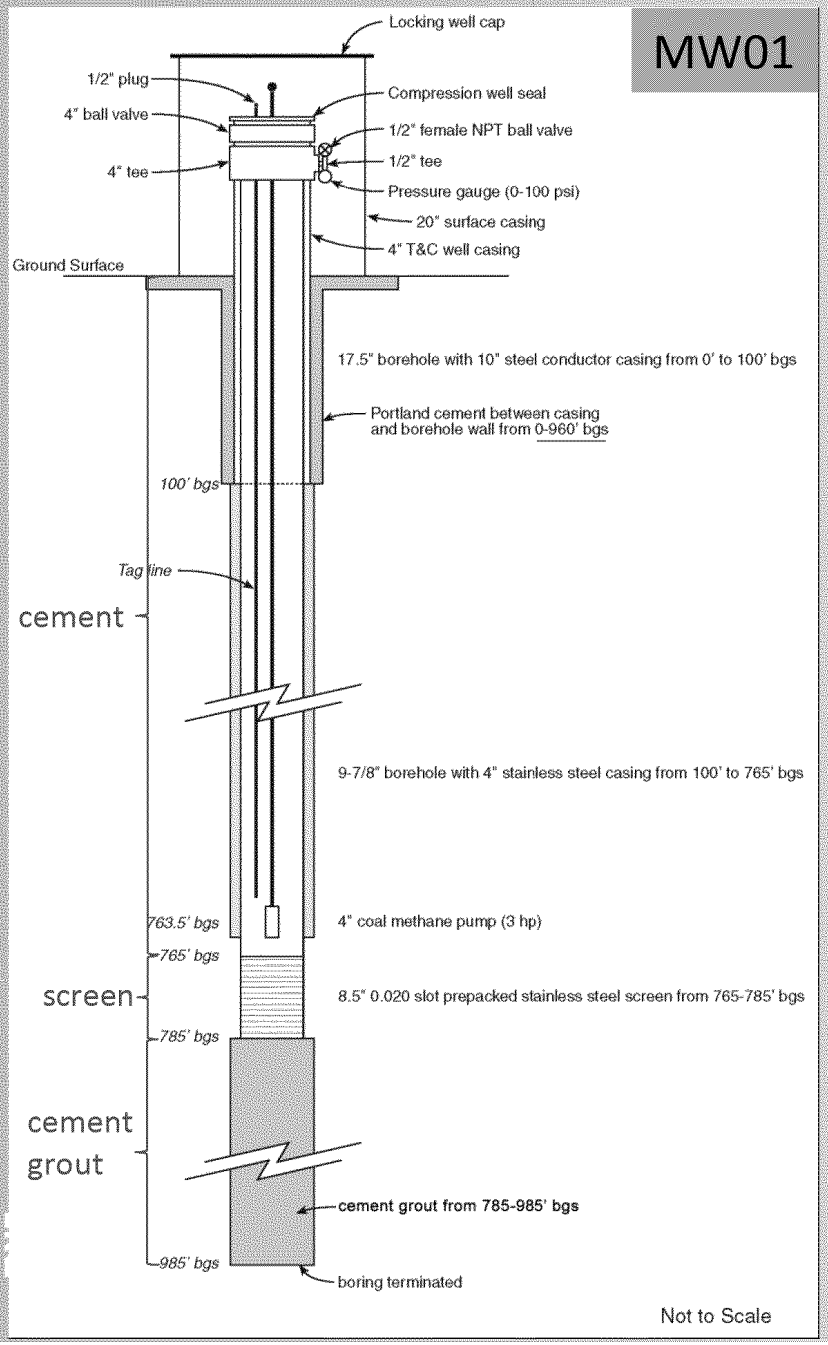
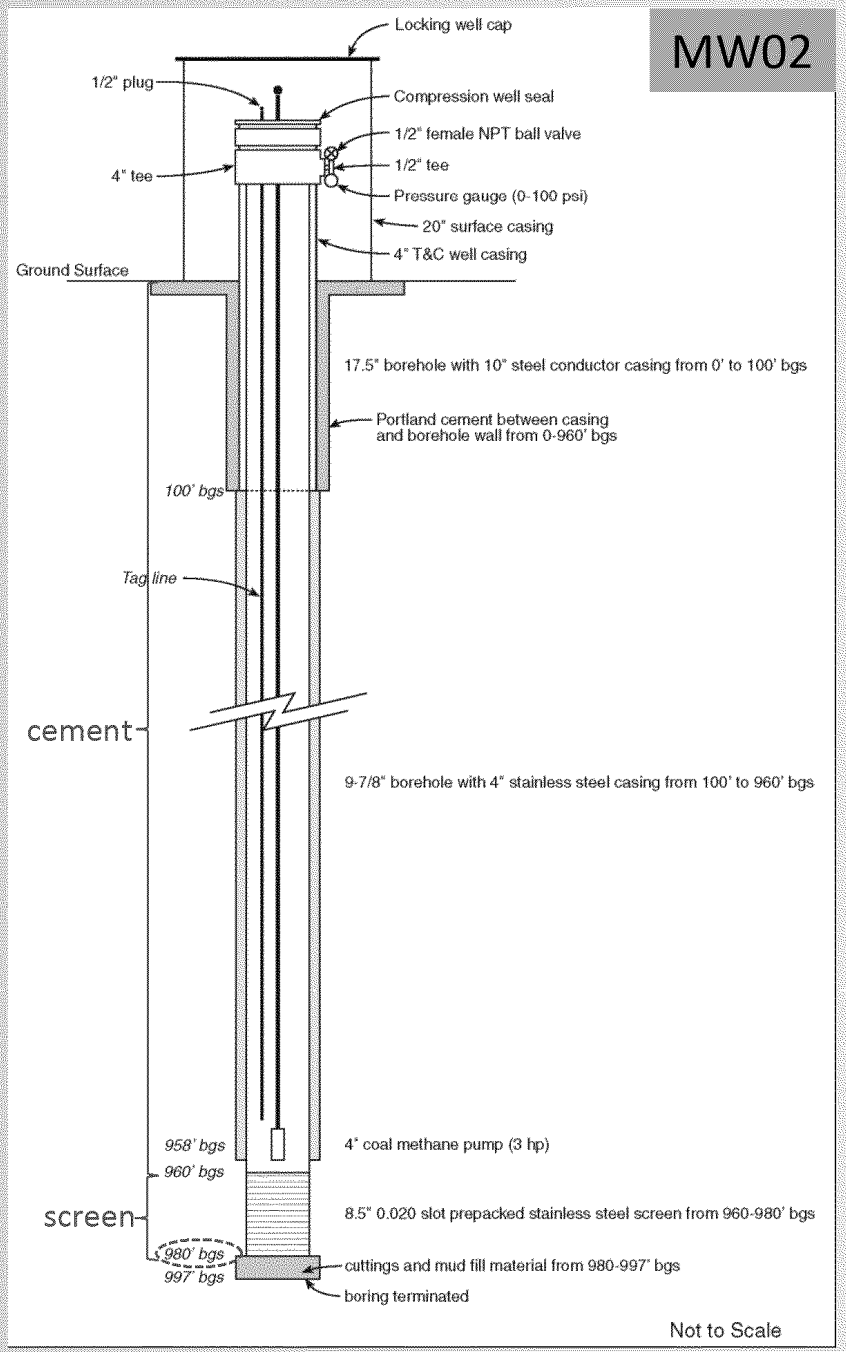
# Background for discussion: Completion logs MW01 & MW02



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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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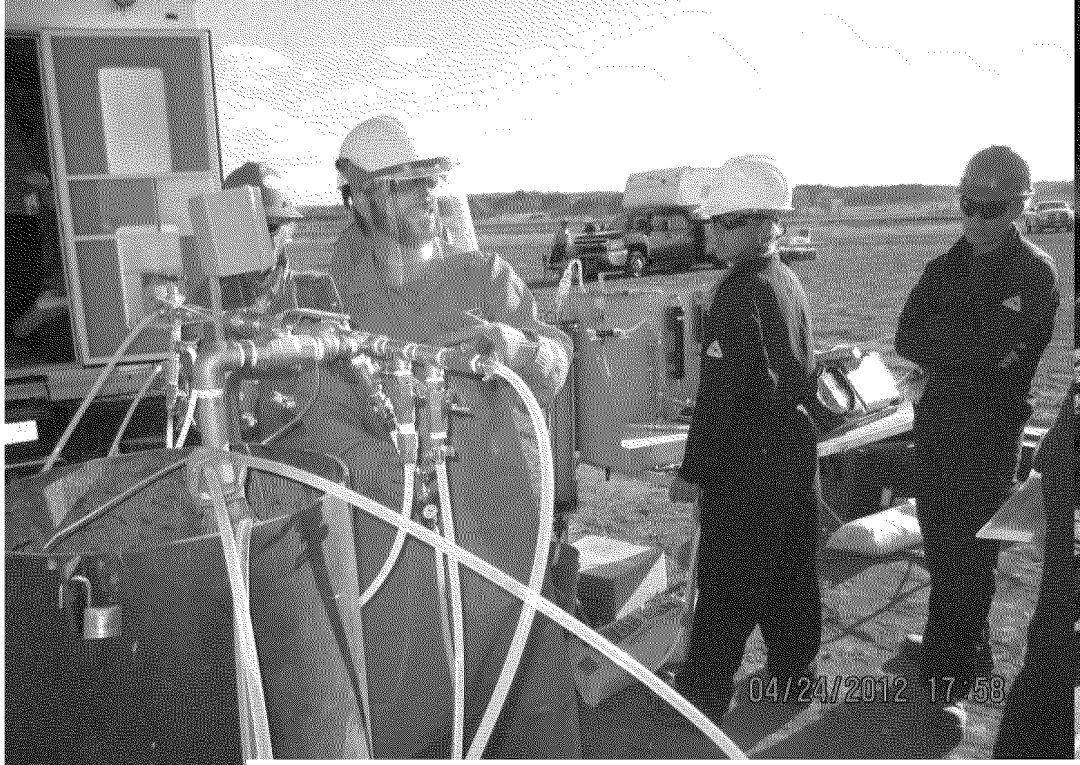
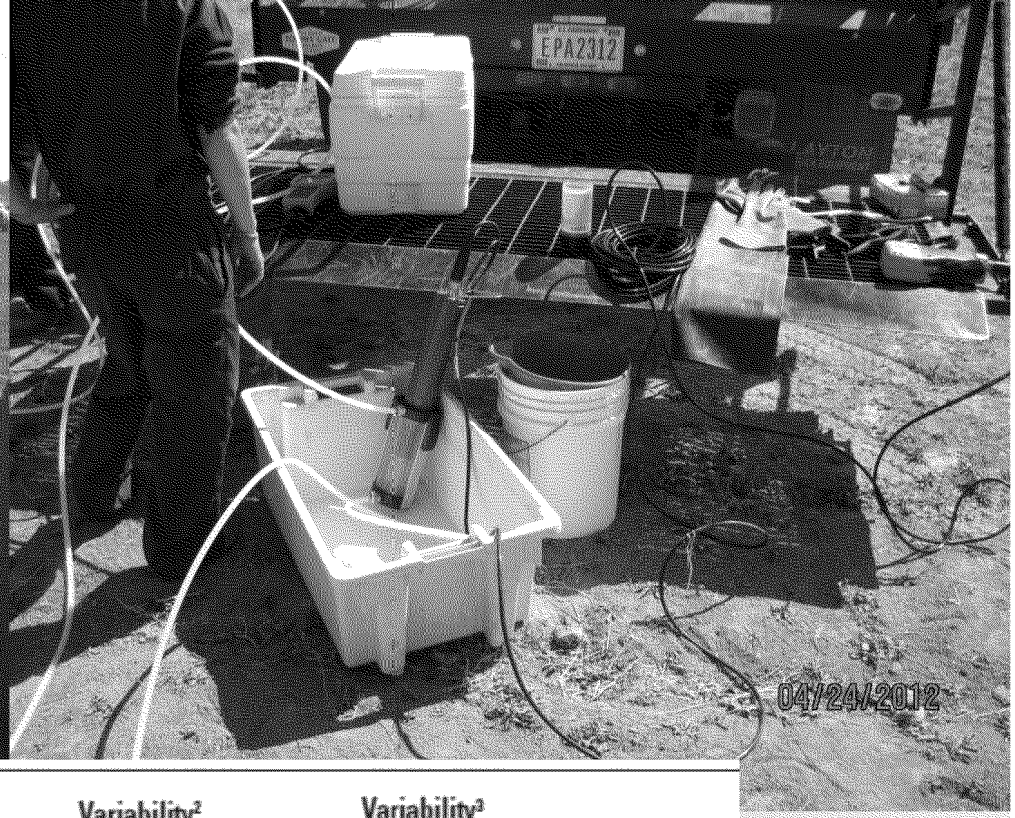
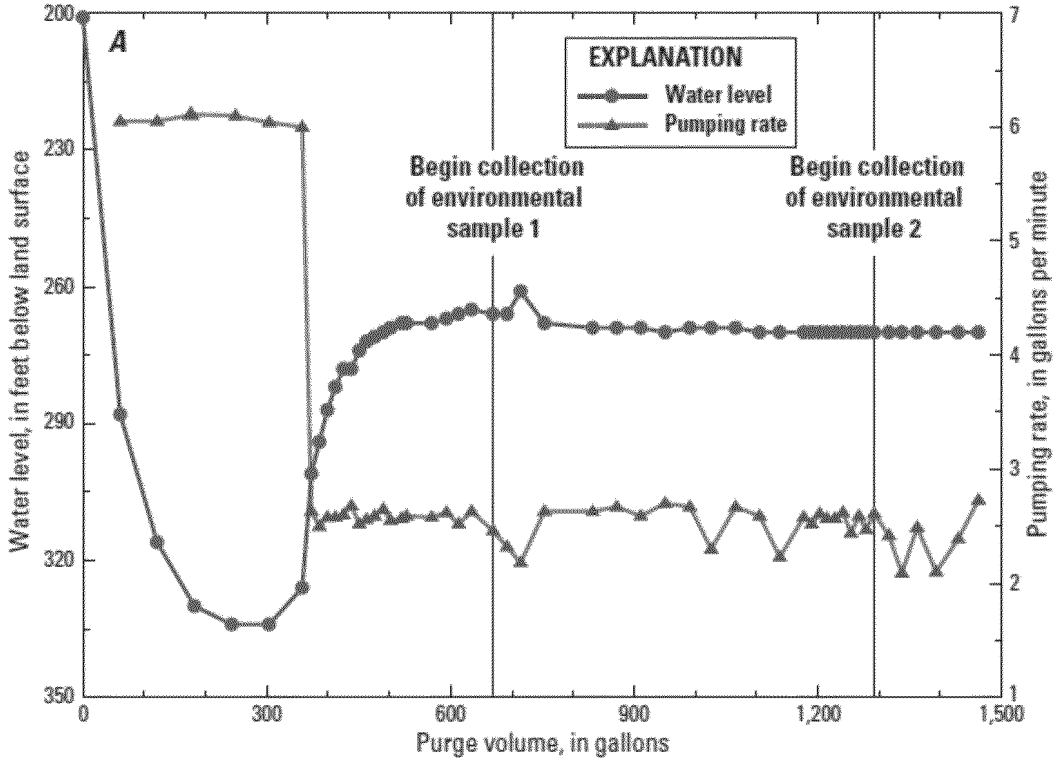
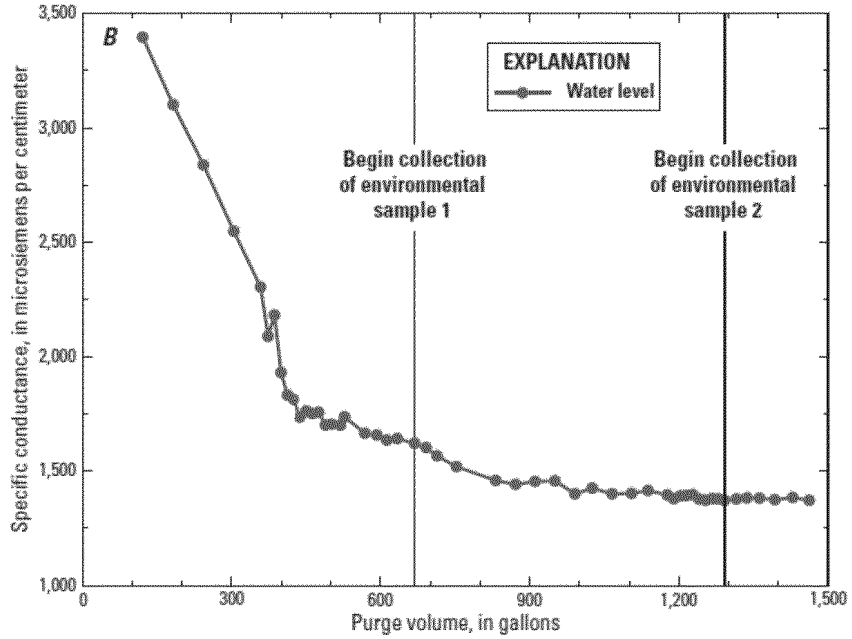


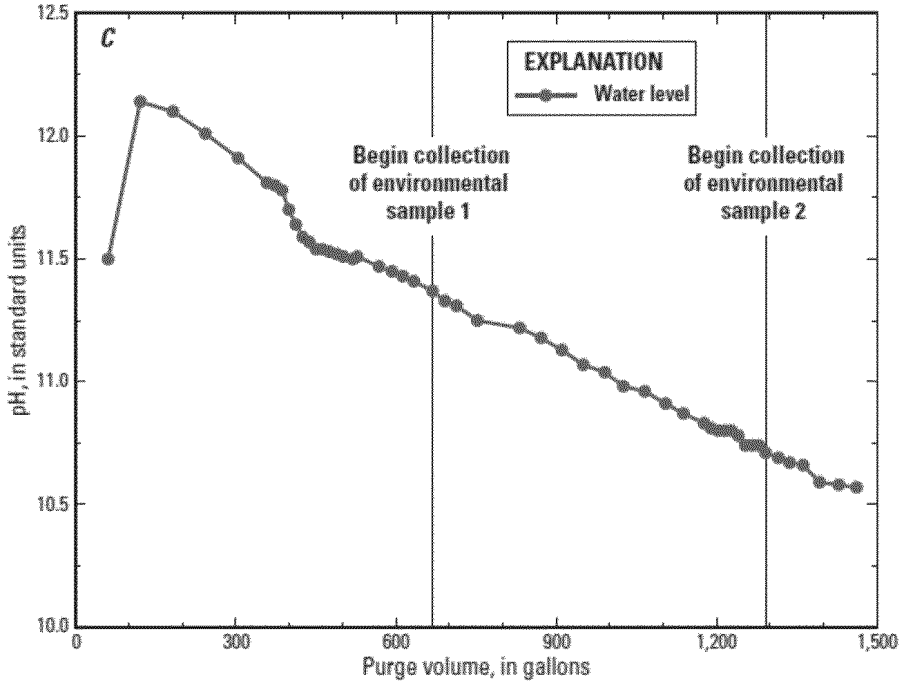




| Time | Water level (ft BMP) | Draw down (ft) | Pumping rate (gal/min) | Volume (gallons) | Borehole volumes | Water Temper-ature (°C) | Variability[2] of last 5 temperature measure-ments | SC (µS/cm) | Variability[3] of last 5 SC measure-ments (percent) | pH (standard units) | Vari-ability |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 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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