USGS Activities, Reports, and Data Pavillion, Wyoming

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

By

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USGS

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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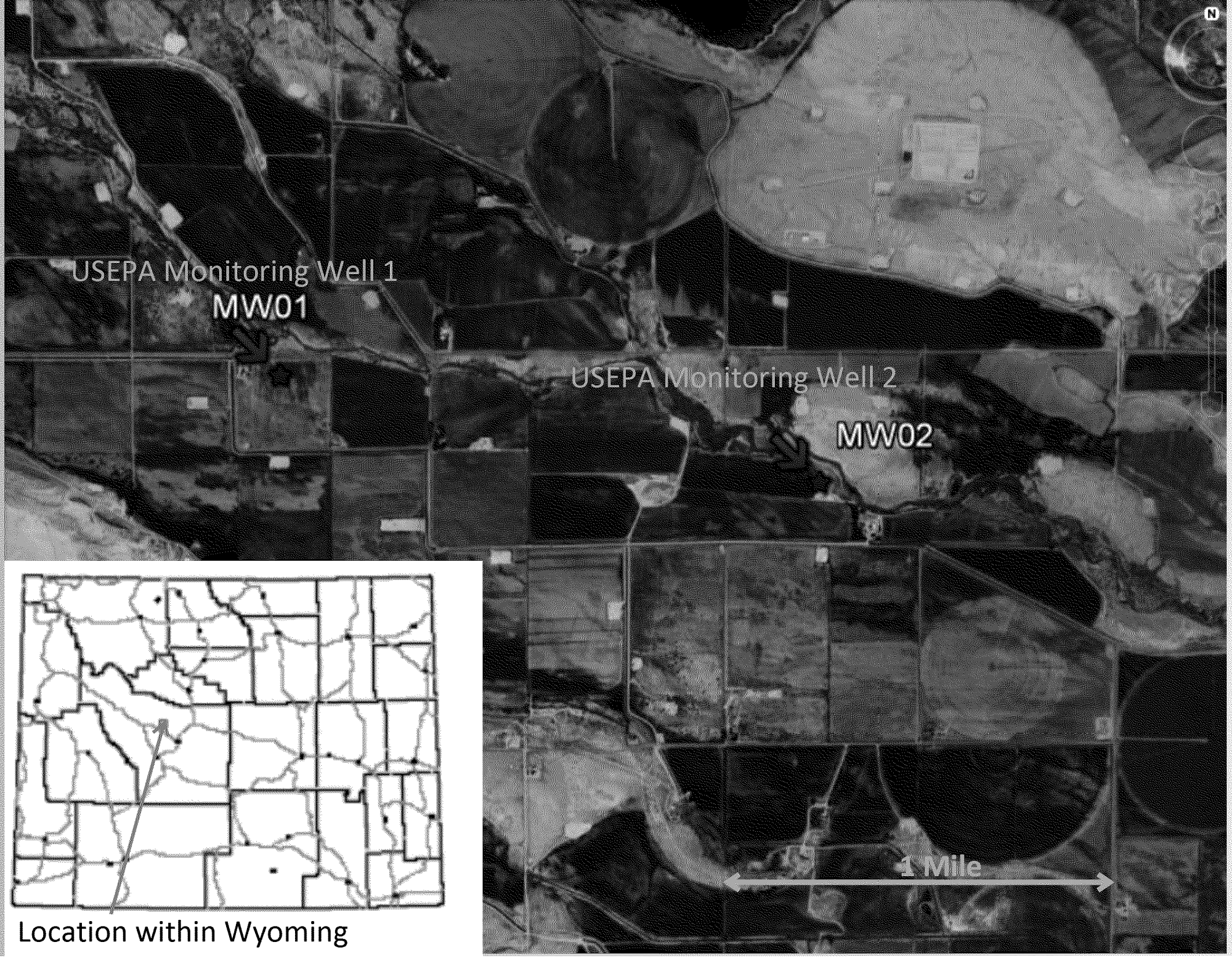
USGS Groundwater Sampling Effort at Pavillion, WY

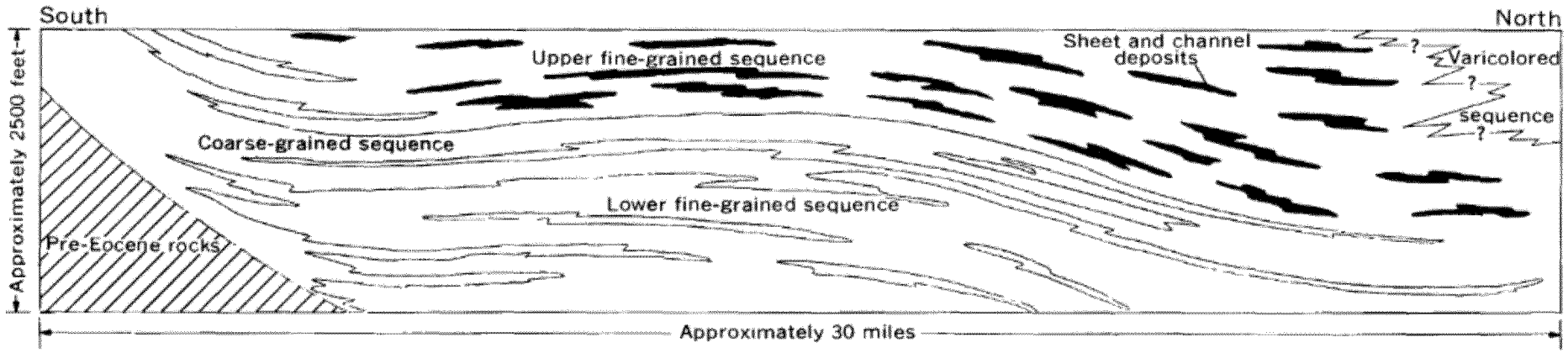
<u>Background</u> Pavillion is complicated:

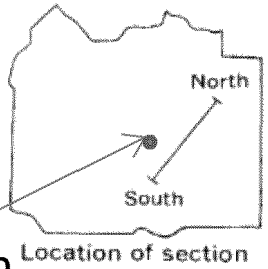
- ✓ **Variable and complex hydrogeology**
- ✓ **Wind River Formation is both "gas reservoir" and drinking water "aquifer"**
- ✓ **No confining layer between "aquifer" and "gas reservoir"**
- ✓ **No pre-development data for aquifer**
- ✓ **Hydrocarbon presence could be expected**
- ✓ **Groundwater flow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

318-228—69——4

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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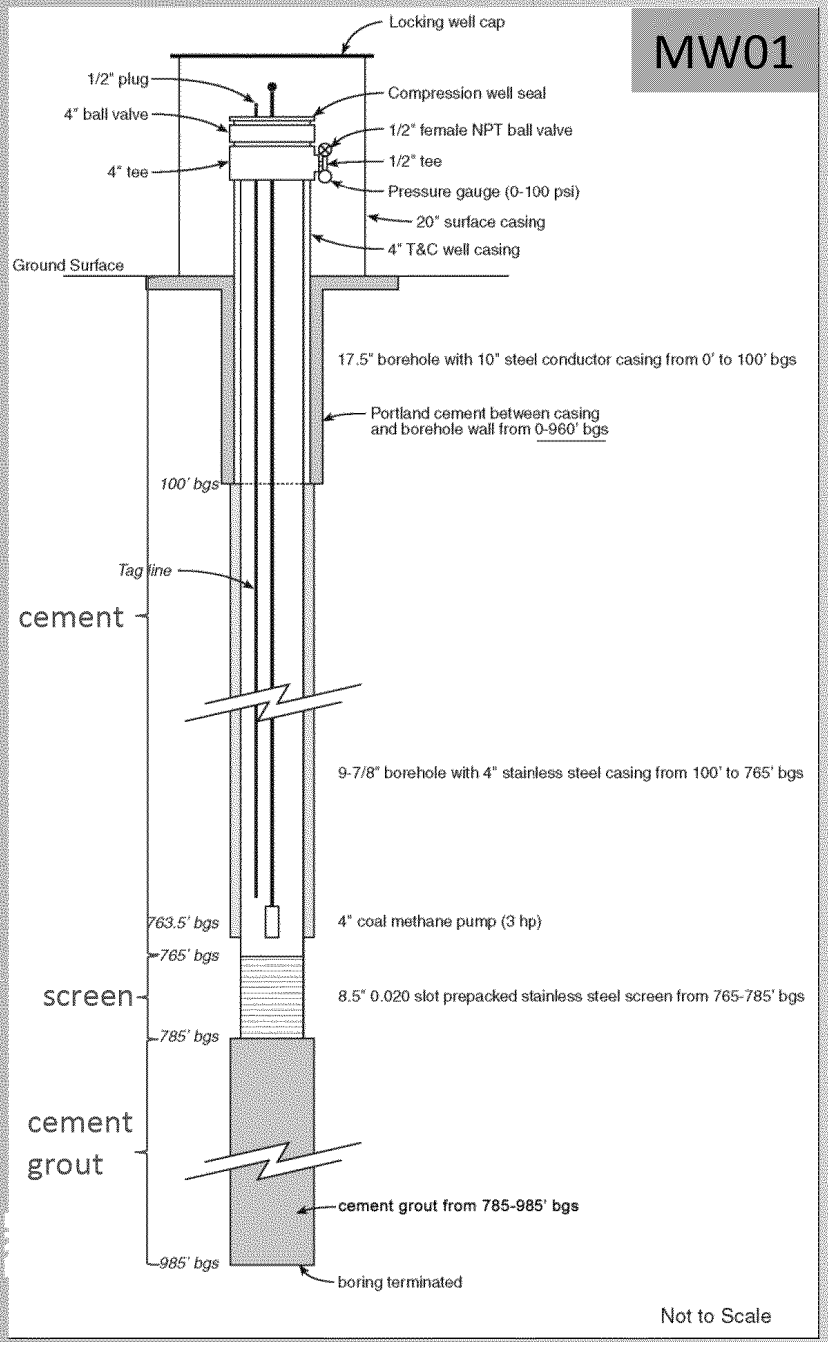
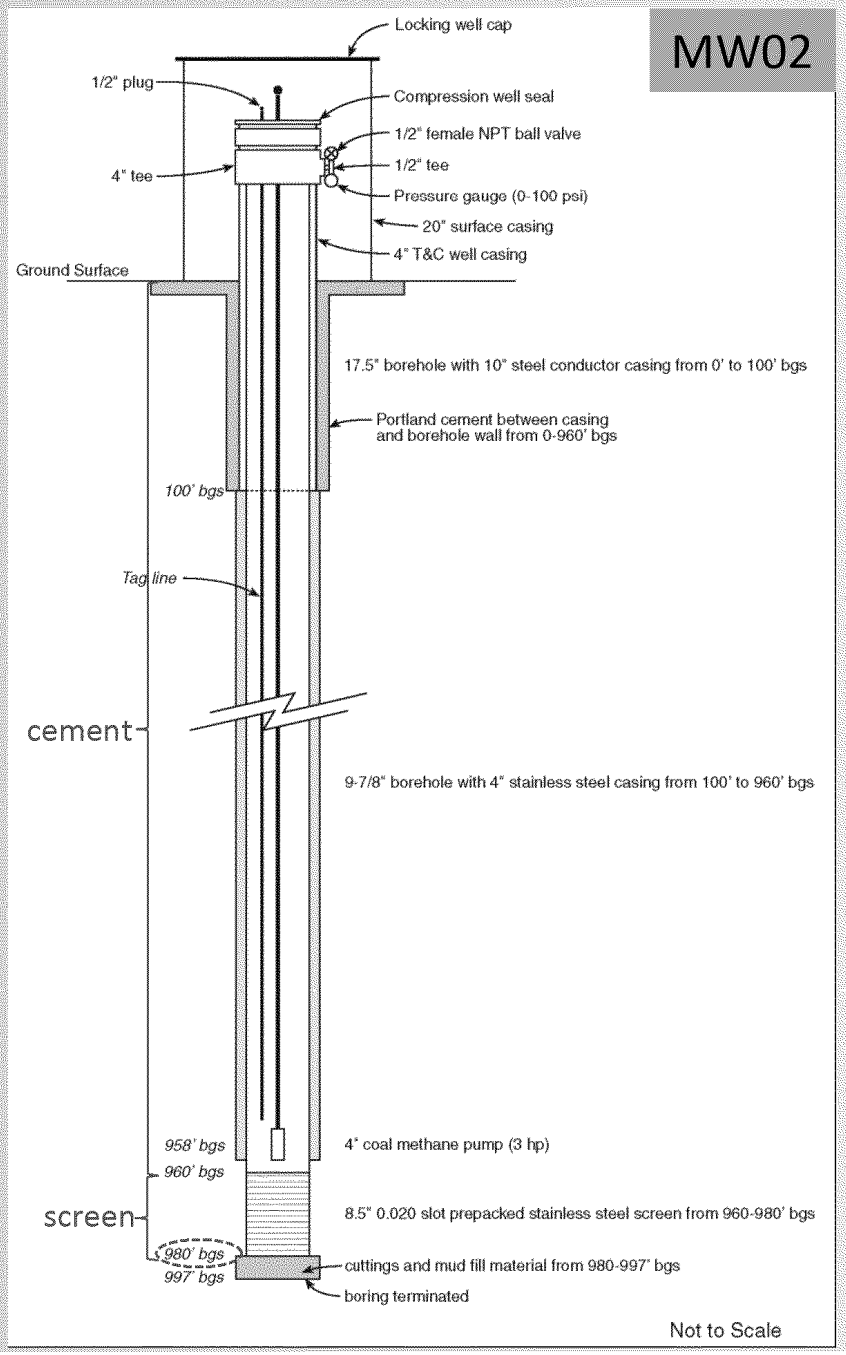
Background for discussion: Completion logs MW01 & MW02





EPAPAV0111115

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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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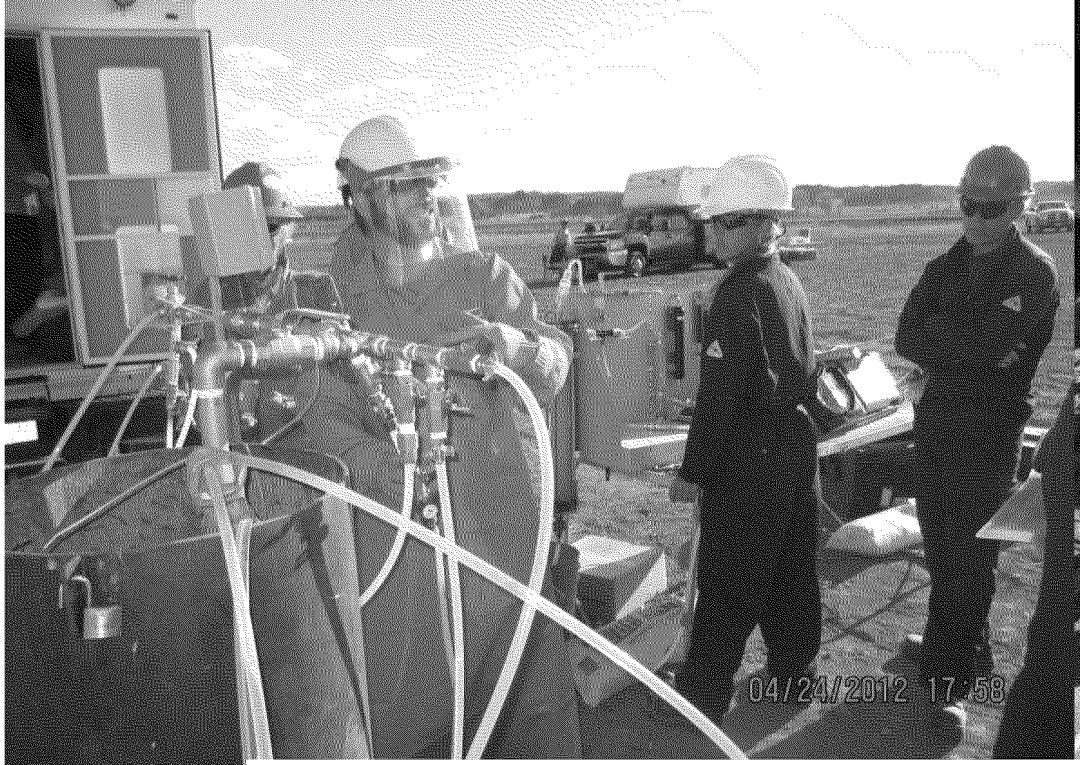
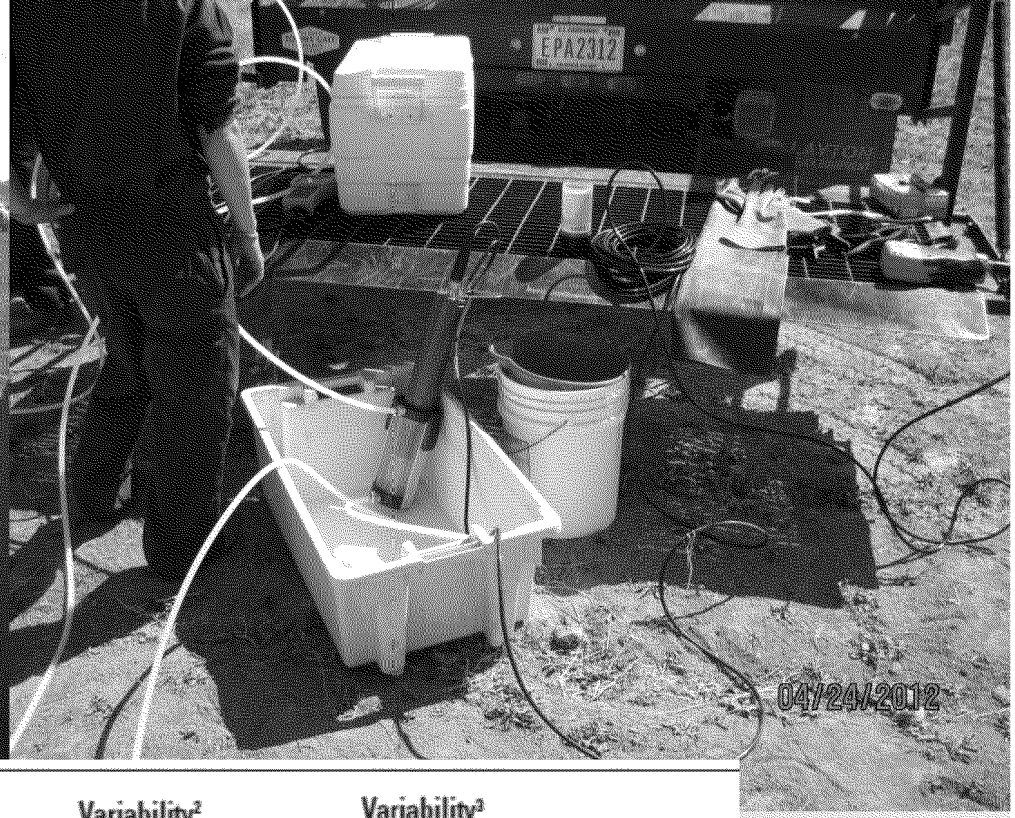
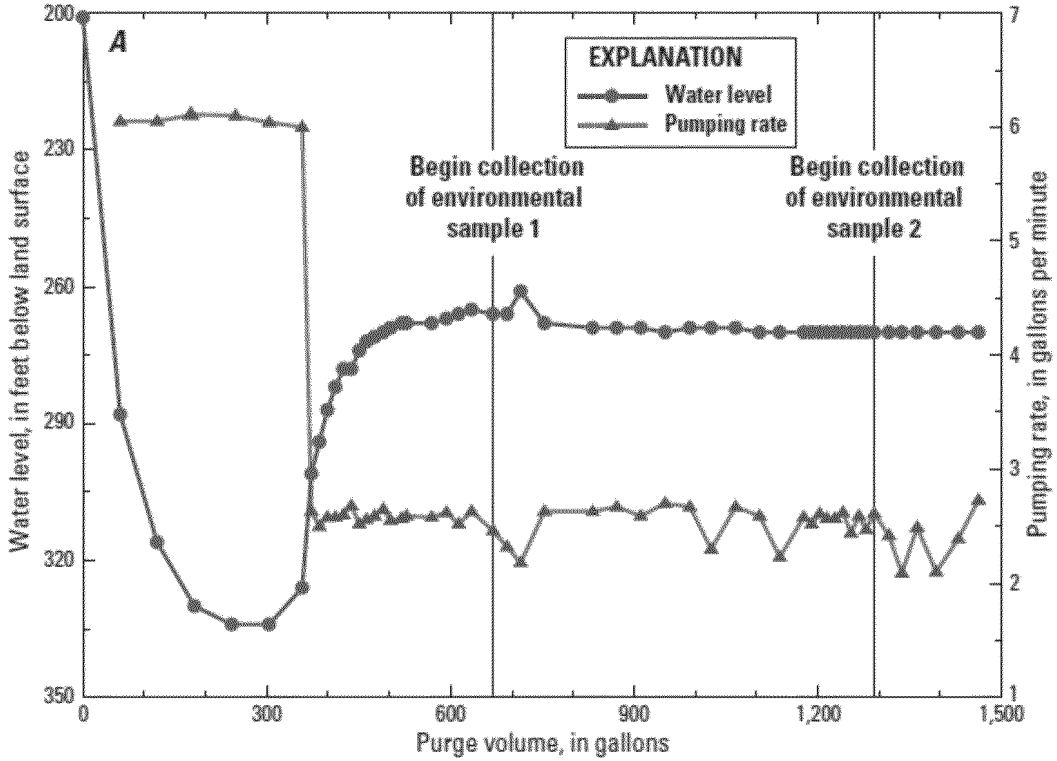
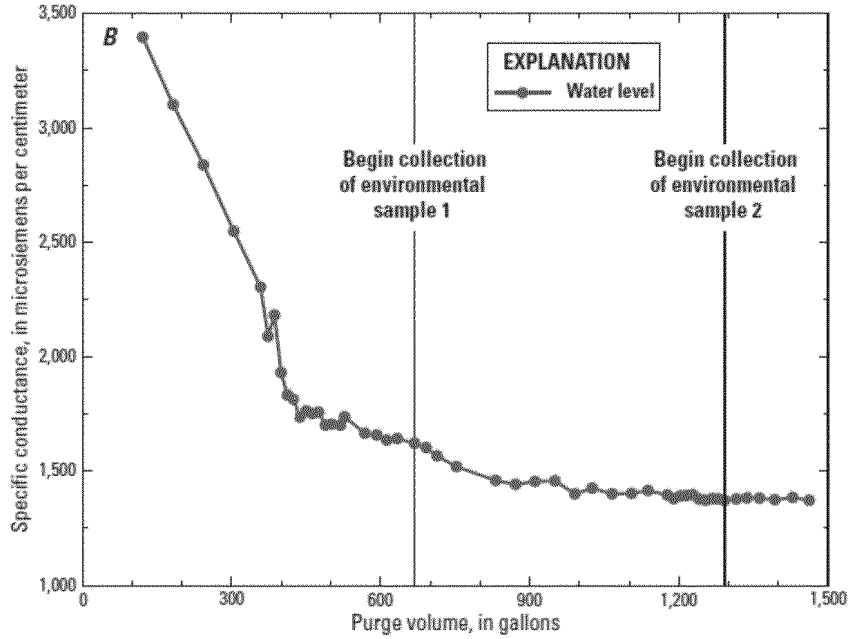


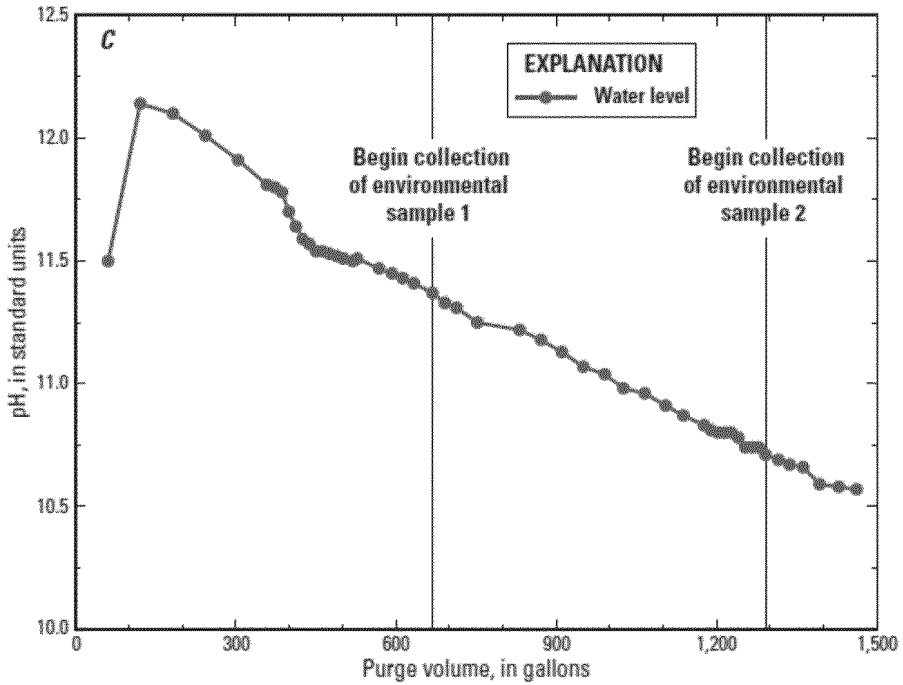


Time	Water level (ft BMP)	Draw down (ft)	Pumping rate (gal/min)	Volume (gallons)	Borehole volumes	Water Temper-ature (°C)	Variability[2] of last 5 temperature measure-ments	SC (µS/cm)	Variability[3] of last 5 SC measure-ments (percent)	pH (standard units)	Vari-ability
12:55	270.84	69.49	2.59	476	1.11	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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