

**LEGEND:**

■ Water Sample Location

- JLS-W1: Jaunita Satterfield (Well)
- USGS-BC1: Battlement Creek (Surface)
- CW-W2: Carey Weldon (Well)
- HC-S2: Hayward Creek (Surface)
- LJS-W3: Lynn Shore (Well)
- GVS-SP1: Grand Valley (Springs)
- RS-W4: Roy Savage (Well)
- EG-SP2: Ethel Gardner (Spring)
- WK-SP3: Wesley Kent (Spring)
- LH96-SP4: Hayward 96 Ranch (Spring)
- CK-W5: Christy Koeneke (Well)
- TJ-W6: Tim and Karla Jacobs (Well)
- PW-W7: Pat and Randy Warren (Well)
- MC-S3: Monument Creek (Surface)

In addition to the 14 samples listed above, one partial duplicate sample (JHD-SP5) and one complete duplicate (RW-W8) were also collected and submitted for laboratory analysis.

3-D TopoQuads Copyright © 1999 DeLorme Yarmouth, ME 04096 | 4500 ft Scale: 1 : 150,000 Detail: 10-4 Datum: NAD27

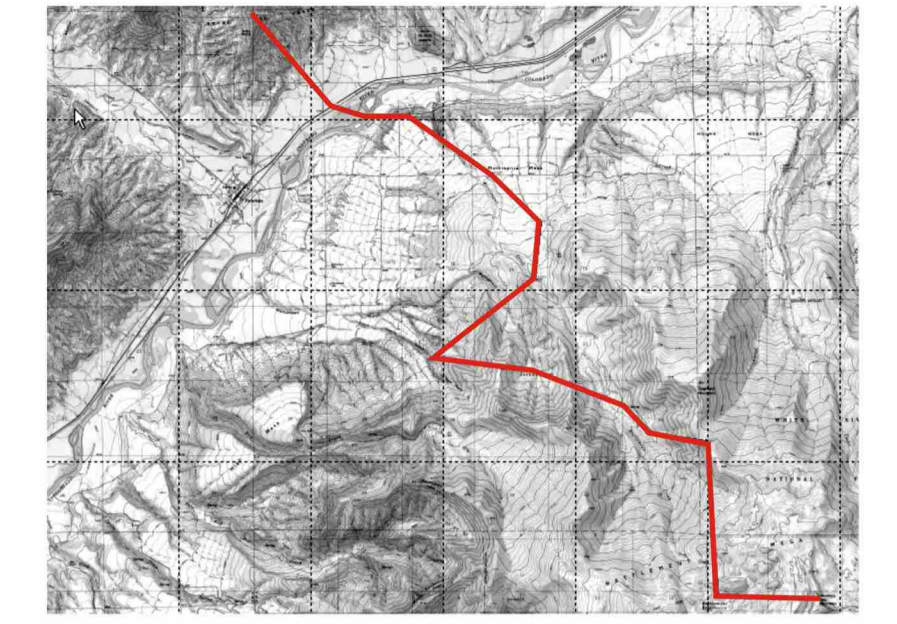
Figure 1  
 General Site Location Map  
 PRESCO Inc.  
 Baseline Water Sampling Locations  
 November – December 2004  
 Battlement Mesa, Garfield County, Colorado

Revision Date:	
Revision Number:	
Revised by:	
Approved by:	
Project Number:	
Scale:	

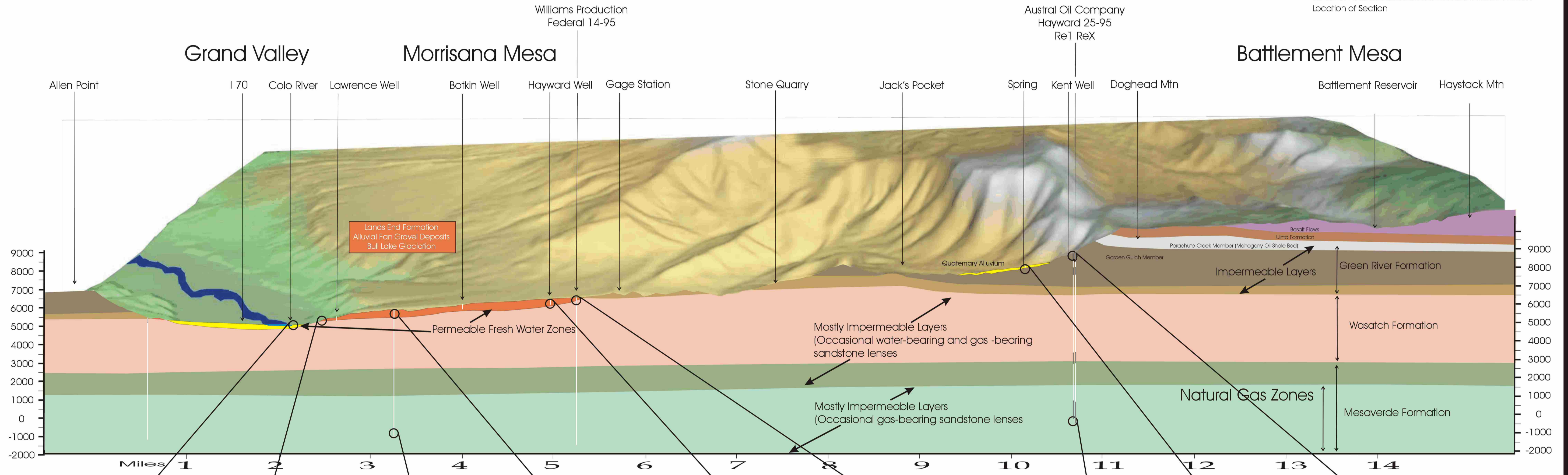




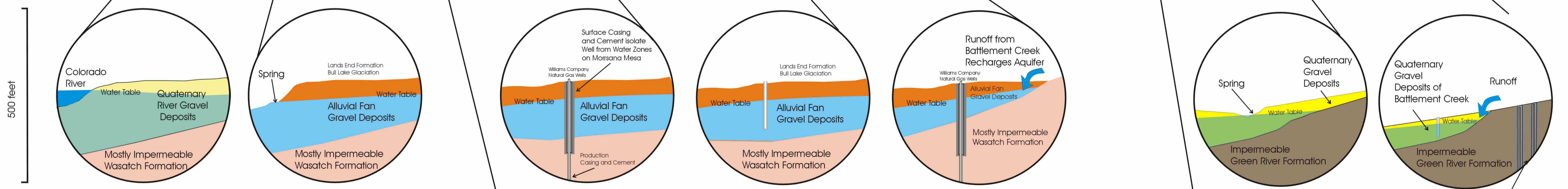
# Cross Section Showing Relationship Between Natural Gas and Fresh Water in Battlement Mesa Area



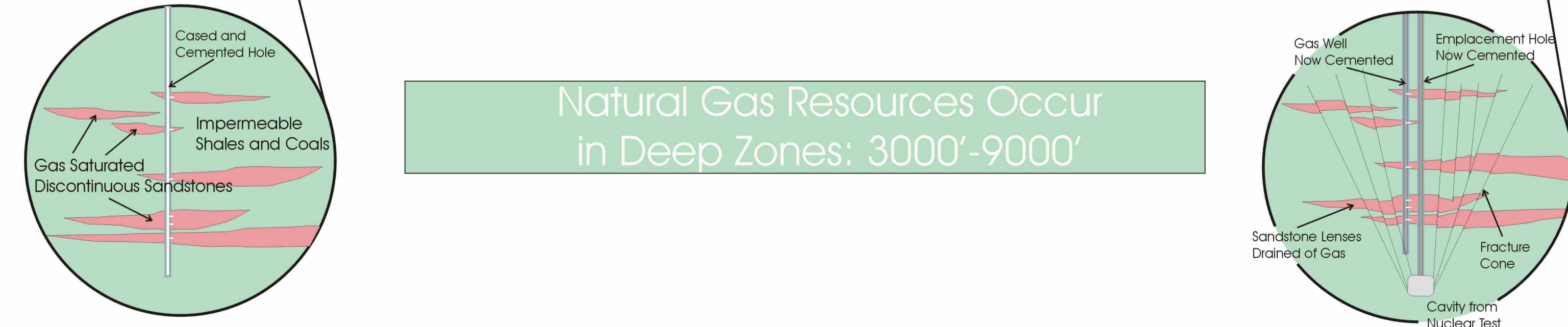
Location of Section



**Fresh Water Resources Occur in Shallow Zones: Surface - 400'**



**Natural Gas Resources Occur in Deep Zones: 3000'-9000'**



In 1969, a 43 kiloton fission-type nuclear device was detonated at a depth of 8,426 feet for the purpose of fracturing the low-permeability natural gas sandstones.

In 1970, a standard gas well was drilled into the fracture chimney within 300 feet of the emplacement well. The well produced 455 million cubic feet of gas. The produced gas and surface conditions were monitored and it was determined that the detonation did not significantly or permanently affect conditions in the area. The site was restored.

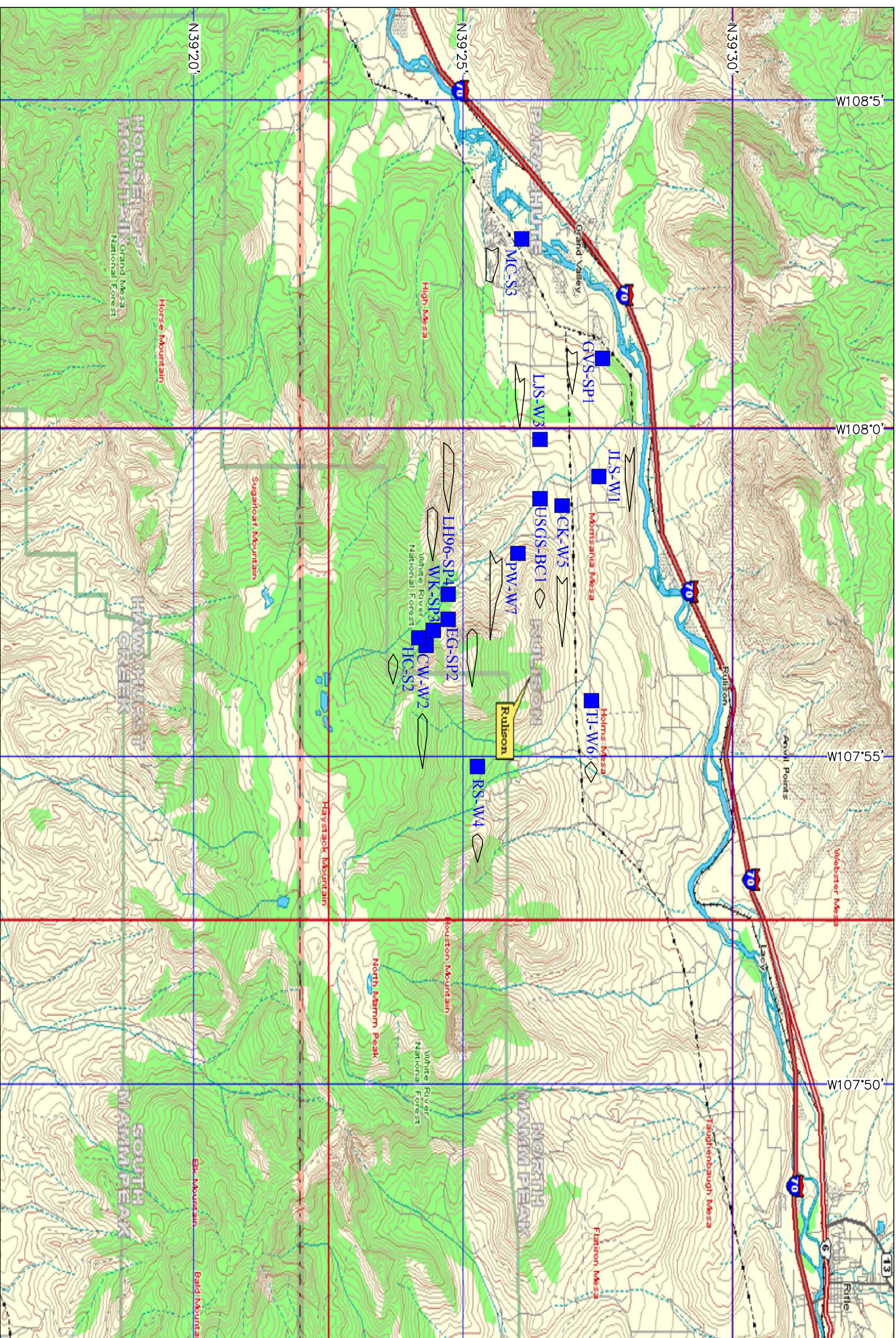
-Colorado Department of Public Health

Cross Section Showing Relationship Between Natural Gas and Fresh Water in Battlement Mesa Area

Presco, Inc.  
Prepared by Brian E. Richter  
2-15-2005

Sources of Information:  
Geologic Map of the Rulison Quadrangle, Garfield County, Colorado, USGS, 1988  
Quaternary Geology of the Grand and Battlement Mesas area, Colorado USGS PP 617





**LEGEND**

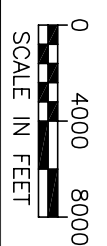
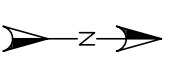
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In addition to the 14 samples listed above, one partial duplicate sample (JHD-SP3) and one complete duplicate (RW-W8) were also collected and submitted for laboratory analysis.



IONIC COMPOSITION



**FIGURE 3**  
Stiff Diagrams of Water Quality  
PRESCO Inc.  
Baseline Water Sampling Locations  
November–December 2004  
Battlement Mesa, Garfield County, Co

REVISION DATE:	4/5/06
REVISION NUMBER:	00#
DRAWN BY:	RAV
APPROVED BY:	JH
PROJECT #	E04243
SCALE:	AS SHOWN





**Table 1  
PRESCO, INC  
2004 Baseline and 2005 Annual Water Quality Report**

**Water Well Completion Data and Water Source Hydrogeology**

Sample Location	Sample ID	Sample Type	TWP	RNG	SEC	QTR/QTR	P.M.	CSEO- WRD Permit Number	Screened Interval (feet)	Reported Yield (gpm)	Static Water Level (feet)	Well Depth (feet)	Comments
Juanita Satterfield Well	JLS-W1	Well	7S	95W	10	NE NW	6	56086F	104-125	15		150	Guy Botkin Well: alluvial fan deposits, alluvial terrace deposits
USGS Gauging Station on Battlement Creek	USGS-BC1	Surface	7S	95W	15	NE SE	6	N/A	N/A	N/A	N/A	N/A	Battlement Creek Surface Water: modern alluvium
Cary Weldon Well	CW-W2	Well	7S	95W	25	NE SW	6	201786	60 - 90	15	43	98	NP 6/25/02 C. Weldon Well: 0-60 ft clays/silt and clays; 60 - 90 ft gravels, 90 - 98 ft Wasatch Fm
Hayward Creek Sample	HC-S2	Surface	7S	95W	25	NE SW	6	N/A	N/A	N/A	N/A	N/A	Hayward Creek Surface Water: modern alluvium
Lynn Shore Well	LJS-W3	Well	7S	95W	16	SW NE	6	175435	160-220	7	160	220	Lynn Shore Well: 0-220 ft volcanic rock, clays (colluvium/alluvium) mudflow and fan-gravel deposits
Grand Valley Springs	GVS-SP1	Springs	7S	94W	5	SW SE	6	N/A	N/A	N/A	N/A	N/A	Grand Valley Springs: alluvial fan deposits
Joan Savage Well	RS-W4	Well	7S	94W	20	NE SW	6	230057	120-150	15	93	150	Joan Savage Well: 0-53 ft clays, cobbles; 53 - 151 ft clays cobbles, volcanics (colluvium/alluvium)
Ethel Gardner Spring	EG-SP2	Spring	7S	95W	25	SE NW	6	N/A	N/A	N/A	N/A	N/A	Ethel Gardner Spring: colluvium/alluvium mudflow and fan-gravel deposits
Wesley Kent Spring	WK-SP3	Spring	7S	95W	25	NE SW	6	N/A	N/A	N/A	N/A	N/A	Wesley Kent Spring: colluvium/alluvium mudflow and fan-gravel deposits
Lee Hayward Spring	LH96-SP4 JHD-SP5	Spring	7S	95W	25	SW NW	6	N/A	N/A	N/A	N/A	N/A	L. Hayward Spring: colluvium/alluvium mudflow and fan-gravel deposits
Christy Koeneke	CK-W5	Well	7S	95W	10	SE NW	6	924		10	90	115	Lee & Anna (March 1958): 0-16 ft general formation, 16 -91 ft brown clay, 91-115 ft blue sand w/ a lava rock now and then
Tim and Karla Jacobs	TJ-W6	Well	7S	94W	7	NE NW	6	60324	90-142	15	71	142	Tim Jacobs well: 0-142 ft volcanic rocks, clays, gravels (colluvium/alluvium)
Pat and Randy Warren	PW-W7	Well	7S	95W	15	NE SE	6	238033	215 - 240	11	173	250	Pat & Randy Warren Well: 0-160 ft volcanic rocks, dirt; 160-215 ft clays, dirt; 215-240 ft volcanic cobbles, 240 -250 ft Wasatch Fm
Monument Creek	MC-S3	Surface	7S	95W	18	NW SW	6	N/A	N/A	N/A	N/A	N/A	Monument Creek Surface Water: modern alluvium

Notes:  
gpm - gallons per minute  
N/A - not applicable  
TWP - township                      Sec - Section (typically 1 square mile: 640 acres)                      P.M. - Principal Meridian  
RNG - range                              Qtr/Qtr - quarter/quarter (160 acres; 40 acres)

CSEO - Colorado State Engineer's Office Division of Water Resources      Water Well Permits and drilling log descriptions  
Comments contain descriptions from the Geologic Map of the Rulison Quadrangle, Garfield County, Colorado by Warren E. Yeend, John R. Donnell, and Marjorie C. Smith, 1988 (Map MF:2060) 1:24,000

**TABLE 2**

**Laboratory Analytes Reference Table  
Presco Inc., Battlement Mesa Development  
2004 Baseline/2005 Annual Water Sampling**

Analytes	Laboratory Method	Sample Container	Preservatives Storage	Holding Times
BTEX, MTBE	8260/8021B	(2) 40 ml glass vials	HCl, Ice (4°C)	14 days
Methane	8015 GC/FID	(3) 40 ml glass vials	HCL, Ice (4°C)	14 days
Major Anions (CO <sub>3</sub> , HCO <sub>3</sub> , PO <sub>4</sub> , SO <sub>4</sub> , NO <sub>2</sub> /NO <sub>3</sub> ) (Br, Cl, F, HCO <sub>3</sub> , PO <sub>4</sub> , SO <sub>4</sub> , NO <sub>2</sub> /NO <sub>3</sub> )	300.0 SO <sub>4</sub> - M375.3 PO <sub>4</sub> - M365.1/M365.3 NO <sub>x</sub> - M353.2	(1) 250-ml polyethylene	Unpreserved Ice (4°C)	28/2 (NO <sub>2</sub> , NO <sub>3</sub> , PO <sub>4</sub> ) days
Sulfate Reducing, Iron Related and Slime Forming Bacteria	Plate Count EPA 375.4 HACH 8051	(1) 120-ml sterilized specimen cup	Unpreserved Ice (4°C)	24 Hours Grand Junction Laboratories
Alkalinity	SM 2320B/ SM2340B M 310.1	(1) 250-ml polyethylene bottle	Unpreserved Ice (4°C)	14 days
Hydrogen Sulfide (H <sub>2</sub> S)	SW 846 7.3	500-ml polyethylene bottle	Preserved with zinc acetate Ice (4°C)	28 days
Total Dissolved Solids	SM2540 C	500-ml polyethylene bottle	Unpreserved Ice (4°C)	7 days
Ammonia (NH <sub>3</sub> )	M 350.1 M 350.3	500-ml polyethylene bottle	Preserved with sulfuric acid (H <sub>2</sub> SO <sub>4</sub> ) Ice (4°C)	28 days
Total Metals (Major Cations: Ca, Fe, K, Na, Mg, Mn, Se)	M 200.7 ICP	250-ml polyethylene bottle	Preserved with nitric acid (HNO <sub>3</sub> ) Ice (4°C)	180/28 (Hg)
Tritium	Convention Distillation SM 7500 - 3HB M 906.0	(2) 40 ml glass vials	Unpreserved Ice (4°C)	Hazen Research 2004
Gamma Spectrometry	HpGe detector EPA 901.1	3.5L cubitainer	Unpreserved Ice (4°C)	

ACZ Laboratory – Steamboat Springs, CO 2004  
Paragon Analytics – Fort Collins, CO 2005

**TABLE 3**

**Battlement Mesa Natural Gas  
Radionuclides of Interest Action Levels**

Radionuclide	Class/f1	Half Life (Years)	Radiation Type	Energy (MeV)	Inhalation					Ingestion
					ALI (MBq)	ALI (μCi)	ALI (pCi)	DAC (MBq/m <sup>3</sup> )	DAC (μCi/cm <sup>3</sup> )	ALI (MBq)
Hydrogen Tritium (H-3)	Water Vapor Elemental	12.35	Beta (b)	0.019	3,000	80,000	80,000,000	0.8	0.00002	3,000
				NE	NE	NE	NE	20,000	0.5	
Carbon-14 (C-14)	Compounds*	5,730	Beta (b)	0.16	90	2,000	2,000,000	0.04	0.000001	90
	CO				60,000	2,000,000	2.00E+09	30	0.0007	
	CO <sub>2</sub>				8,000	200,000	2.00E+08	3	0.00009	
Krypton-85 (Kr-85)	Sub	10.72	Beta (b) Gamma (g)	0.25 0.0022	NE	NE	NE	5	0.0001	NE

ALI - Annual Limits on Intake

DAC - Derived Air Concentrations

MBq - Mega Becquerel

μCi - microcuries

pCi - picocures

NE - none established

\* Labelled Organic Compounds

ALIs and DACs are not available for other tritiated compounds. Under normal conditions, hydrogen gas may rapidly convert to water vapor form.

Sub' denotes situations in which exposure is submersion-limited. Elements in 'vapor' form deposited in lung are assumed to be totally taken up by blood.

Since all three are beta emitters, the EPA drinking water standard is 4 mrem/year.

**Table 4**  
**2004 Baseline and 2005 Annual Water Sampling Field Parameters**  
**Presco Inc. - Battlement Mesa, Garfield County, Colorado**

Sample Location	Sample ID	Date	Temperature (°C)	Specific Conductance (mS/cm)	Dissolved Oxygen (mg/L)	pH (pH units)	Total Dissolved Solids (TDS) (g/L)	Saturated Dissolved Oxygen (%)	Turbidity (NTU)	Purge Rate (gpm)	Ludlum Survey Meter 0.1x (CPM)	Comments	
Juanita Satterfield Well	JLS-W1	11/9/2004	11.09	0.688	3.20	8.10	0.4	35.5	5.9	10	< 150	Clear, dinking water, no odor, no sheen,	
		10/18/2005	11.05	0.711	2.09	7.55	0.5	22.7	7.6		50	Clear, slight effervesence, no odor, no sheen	
USGS Gauging Station on	USGS-BC1	11/9/2004	3.20	0.213	3.97	8.70	0.1	36.2	6.2	NA	< 150	Clear to slightly turbid, no odor, no sheen	
		10/17/2005	5.91	0.228	1.64	7.69	0.2	15.7	28.6	NA	60	Slightly turbid, opaque, no odor, no sheen, no effervesence	
Cary Weldon Well	CW-W2	11/9/2004	7.25	0.660	2.80	7.86	0.4	28.3	0.9	15	< 150	Clear, no odor, no sheen,	
		10/17/2005	9.39	0.691	1.50	7.41	0.4	15.8	7.0		60	Clear, no odor, no sheen, no effervesence	
Hayward Creek Sample	HC-S2	11/9/2004	3.15	0.309	3.86	8.62	0.2	35.0	7.4	NA	< 150	Clear, no odor, no sheen	
		10/17/2005	3.79	0.305	1.76	7.64	0.2	16.0	21.6	NA	50	Slightly turbid, fine sediment, no odor, no sheen, no efferv	
Lynn Shore Well	LJS-W3	11/9/2004	11.53	0.653	3.12	8.12	0.4	34.8	29.3	NM	< 150	Clear, no odor, no sheen, no effervesence	
		10/17/2005	16.12	0.678	0.87	7.58	0.4	10.6	57.4	NM	50	Clear, no odor, no sheen, no effervesence	
Grand Valley Springs	GVS-SP1	11/10/2004	13.30	0.534	3.79	8.00	0.3	43.2	10.6	NM	150	Clear, no sheen, no odor, no effervesence	
		10/18/2005	10.86	0.566	1.42	7.25	0.4	15.5	10.7	NM	60	Clear, humic material, no sheen, no odor, no effervesence	
Joan Savage Well	RS-W4	11/10/2004	5.46	0.302	2.97	8.83	0.2	28.3	2.3	NM	< 150	Clear, no effervesence, no odor, no sheen	
		11/18/2005	6.25	0.283	6	8.93	0.2	62.5	30.8	10	60	Clear, no effervesence, no odor, no sheen	
Ethel Gardner Spring	EG-SP2	11/10/2004	6.25	0.713	3.18	7.95	0.5	31.3	2.7	NM	< 150	Clear, no odor, no sheen, no effervesence	
		10/17/2005	6.62	0.755	1.56	7.44	0.5	15.4	7.2	NM	150	Clear, no odor, no sheen, no effervesence	
Wesley Kent Spring (Duplicate 10/17/05)	WK-SP3	11/10/2004	6.77	0.649	3.19	7.79	0.4	32.8	1.2	15	< 150		
		10/17/2005	10.24	0.704	1.24	7.41	0.5	13.4	7.3		120	Clear, no odor, no sheen, no effervesence	
Lee Hayward Spring	LH96-SP4 JHD	11/10/2004	6.40	0.875	3.45	7.87	0.6	33.5	1.9	NM	< 150	Clear, no odor, no sheen, no effervesence	
Judi Hayward Duplicate	JHD-SP5	11/10/2004	6.40	0.875	3.45	7.87	0.6	33.5	1.9	NM	< 150		
	LH96-SP4 JHD	10/17/2005	9.47	0.91	1.58	7.33	0.6	16.7	6	1.5	120	Clear, no odor, no sheen, no effervesence	
Christy Koeneke (Duplicate 10/18/05)	CK-W5	12/2/2004	9.27	0.731	3.82	7.82	0.5	46.8	30.3	7.5	NM	Clear, no odor, no sheen	
		10/18/2005	10.99	0.803	2.00	7.53	0.5	21.9	10.9		50	Clear, moderate effervesence, no odor, no sheen	
Tim and Karla Jacobs	TJ-W6	12/2/2004	7.78	0.348	5.83	7.83	0.2	65.2	9.6	10	NM		
		10/18/2005	7.72	0.404	2.27	7.64	0.3	22.8	10.5		50	Clear, slight effervesence, no odor, no sheen,	
Pat and Randy Warren (Duplicate Warrens)	PW-W7	12/15/2004	12.05	1.75	0.5	8.00	1.1	5.5	13.7	7.5	NM		
		RW-W8	12/15/2004	12.05	1.75	0.5	8.00	1.1	5.5	13.7	7.5	NM	
		10/17/2005	13.52	2.18	0.69	7.35	1.4	8.1	9	NM	120	Clear, reduced smell/salts, no sheen, no effervesence	
Monument Creek	MC-S3	12/15/2004	5.3	1.045	9.36	8.76	8.7	90	19.1	NA	NM		
		10/18/2005	11.28	1.033	1.88	7.93	0.7	20.8	19.5		50	Clear, organic materials, no odor, no sheen	
Spring Flow - Culvert	BM 36-23 Culv	10/21/2005	4.88	0.192	9.9	8.44	0.1	98	62.4	NA	NM	Slightly turbid, Water from Culvert down from BM 36-23 Pad	

Notes:

NM - Not Measured  
NA - Not Applicable

(°C) - degrees Celsius  
(mS/cm) - milliSiemens per centimeter

mg/L - milligrams per liter  
g/L - grams per liter

NTU - nephelometric turbidity units  
gpm - gallons per minute

CPM - counts per minute





