STATE OF COLORADO
OIL & GAS
CONSERVATION COMMISSION

September 25, 2008

Certified Mail Return Receipt Requested # 7007 1490 0001 8186 0965

Mrs. Linda Hampton
14600 County Road 30.1
Weston, CO 81091-9701

RE: Complaint 200194006
Baseline Water Well Analysis
SWNE 5 33S, 66W Las Animas County, Colorado

Dear Mrs. Hampton:

In response to your concerns regarding possible impacts to water quality from coal bed methane (CBM) operations in the area near your home, the Colorado Oil and Gas Conservation Commission (COGCC) conducted a field visit to your property on August 20, 2008. Water samples were collected for general organic and inorganic water quality testing as well as for analysis of dissolved methane. A summary of the results of the chemical analyses is presented below. The analytical results are also compared to published water quality standards and to results of prior testing of water from your well.

FIELD TESTING

I visited your property on August 20, 2008 and you and I drove to your domestic water well so that I could determine if methane was venting from your water well. I determined that there was no methane venting from the casing of your water well before or during the sampling. We started water flowing from the pump at approximately 5 gallons per minute at 8:27. We collected samples from your well at faucet near your pump house after pumping from the pressure tank for 2 minutes. The samples for general chemical analyses were shipped to Paragon Analytics in Fort Collins, CO and received on August 21, 2008.

COMPARISON OF INORGANIC ANALYTICAL RESULTS TO CDPHE INORGANIC STANDARDS

The Water Quality Control Commission (WQCC) of the Colorado Department of Public Health and Environment (CDPHE) has established "Domestic Use-Quality" human health standards and drinking water standards. Analytical data for the samples from your water well was compared to these standards. This information is summarized in Table 1 which is located in Attachment 1 and discussed in narrative form below. Please keep in mind that these "Domestic Use-Quality Standards" were established for **municipal public** drinking water supplies and often people use and consume ground water from private wells that exceed these standards. The analytical reports from Paragon Analytics are included as Attachment 2.

- **Antimony (Sb):** The CDPHE human health standard for antimony is 0.006mg/l. Antimony is a contaminate metal.

  Antimony was not detected in the sample collected from your water well.

- **Arsenic (As):** The CDPHE human health standard for arsenic is 0.05 mg/l. Arsenic is a highly poisonous metal.

  Arsenic was not detected in the sample collected from your water well.

- **Barium (Ba):** The CDPHE human health standard for barium is 2.0 mg/l. Barium is a contaminate metal.

  Barium was not detected in the sample collected from your water well.

- **Beryllium (Be):** The CDPHE human health standard for beryllium is 0.004mg/l. Beryllium is a contaminate metal.

  Beryllium was not detected in the sample collected from your water well.

- **Cadmium (Cd):** The CDPHE human health standard for cadmium is 0.005 mg/l. Cadmium is a contaminate metal.

  Cadmium was not detected in the sample collected from your water well.

- **Chromium (Cr):** The CDPHE human health standard for chromium is 0.1 mg/l. Chromium is a contaminate metal.

  Chromium was not detected in the sample collected from your water well.

- **Lead (Pb):** The CDPHE human health standard for lead is 0.05 mg/l. Prolonged exposure to this metal can result in serious health effects.

  Lead was not detected in the sample collected from your water well.

- **Nickel (Ni):** The CDPHE human health standard for nickel is 0.1mg/l. Nickel is a contaminate metal.

  Nickel was not detected in the sample collected from your water well.

- **Selenium (Se):** The CDPHE human health standard for selenium is 0.05 mg/l. Selenium is a contaminate metal.

  Selenium was not detected in the sample collected from your water well.

- **Silver (Ag):** The CDPHE human health standard for silver is 0.05 mg/l. Excess amounts of silver may cause a permanent gray discoloration of the skin.

  Silver was not detected in the sample collected from your water well.

- **Thallium (Tl):** The CDPHE human health standard for thallium is 0.002 mg/l. Thallium is a contaminate metal.

  Thallium was not detected in the sample collected from your water well.

- **Uranium (U):** The CDPHE human health standard for thallium is 0.03 mg/l. Uranium can be present due to erosion of natural deposits of this element.

  Uranium was not detected in the sample collected from your water well.

- **Fluoride (F)**: The CDPHE human health standard for fluoride is 4.0 mg/l. Where fluoride concentrations are in the range of 0.7 mg/l to 1.2 mg/l health benefits such as reduced dental decay have been observed. Consumption of fluoride at concentrations of greater than 2.0 mg/l can result in mottling of teeth. Consumption of fluoride at concentrations greater than 4.0 mg/l can increase the risk of skeletal fluorosis or other adverse health effects. Fluoride occurs naturally in the ground water in many areas in Colorado at concentrations that exceed the drinking water standard.

  Fluoride was detected in the sample collected from your water well at a concentration of 0.27mg/l which is below the CDPHE human health standard.

- **Nitrate (NO_3):** The CDPHE human health standard for nitrate is 10.0 mg/l. Nitrate can cause cyanosis in infants; a household water supply should not contain nitrate concentration in excess of 10 mg/l.

  Nitrate was not detected in the sample collected from your water well.

- **Nitrite (NO_2):** The CDPHE human health standard for nitrite is 1.0 mg/l. Nitrite concentrations exceeding 1.0 mg/l should not be used for feeding infants.

  Nitrite was not detected in the sample collected from your water well.

- **Copper (Cu):** The CDPHE secondary drinking water standard for copper is 1 mg/l.

  Copper was not detected in the sample collected from your water well.

- **Chloride (Cl):** The CDPHE secondary drinking water standard for chloride is 250mg/l. Chloride concentrations in excess of 250 mg/l usually produce a noticeable taste in drinking water.

  Chloride was detected in the sample collected from your water well at a concentration of 13mg/l which is below the CDPHE drinking water standard.

- **Iron (Fe):** The CDPHE secondary drinking water standard for iron is 0.3mg/l. Small amounts of iron are common in ground water. Iron produces a brownish-red color in laundered clothing, can leave reddish stains on fixtures, and impart a metallic taste to beverages and food made with it. After a period of time iron deposits can build up in pressure tanks, water heaters, and pipelines, reducing the effective flow rate and efficiency of the water supply.

  Iron was not detected in the sample collected from your water well.

- **Manganese (Mn):** The CDPHE secondary drinking water standard for manganese is 0.05mg/l. Manganese produces a brownish color in laundered clothing, may stain fixtures and affect the taste of coffee or tea.

  Manganese was detected in the sample collected from your water well at a concentration of 0.1mg/l which is above the CDPHE drinking water standard.

- **Sulfate (SO_4):** The CDPHE sulfate secondary standard for human drinking water is 250mg/l. Although CDPHE does not have an agricultural standard for sulfate, other agencies recommend a concentration below 1,500 mg/l for livestock watering. Waters containing high concentrations of sulfate, typically caused by the leaching of natural deposits of magnesium sulfate (Epsom salts) or sodium sulfate (Glauber's salt), may be undesirable because of their laxative effects.

  Sulfate was detected in the sample collected from your water well at a concentration of 90mg/l which is below the CDPHE drinking water standard.

- **pH:** pH is the measure of the hydrogen ion concentration in water. The pH of water in its natural state is generally from 5.5 to 9.0. The CDPHE standard for domestic and agricultural water is a range of 6.5 to 8.5. Seven (7) represents neutrality, while values less than 7 indicate increasing acidity and values greater than 7 indicate increasing alkalinity.

  pH was measured in the water sample from your well with a value of 8.08 which is within the CDPHE drinking water and agricultural standards.

- **Total Dissolved Solids (TDS):** CDPHE's TDS standard for human drinking water is 500 milligrams per liter (mg/l). Although CDPHE does not have an agricultural standard for TDS, other agencies recommend concentrations below 1500 mg/l for irrigation, and below 5,000 mg/l for most livestock watering. TDS occurs naturally in the ground water in many areas of Colorado at concentrations that exceed the drinking water standard.

  TDS was measured in the water sample collected from your well at a concentration of 380mg/l which is above the drinking water standard.

- **Zinc (Zn):** CDPHE's Zn standard for human drinking water is 5 milligrams per liter (mg/l) and the agricultural standard is 2mg/l.

  Zinc was detected in the sample collected from your water well at a concentration of 0.026mg/l which is below the CDPHE drinking water standard.

The following parameters were also measured as part of the laboratory analysis although there are no CDPHE standards.

- **Sodium (Na):** People on salt restricted diets should be aware of the sodium concentration in the water they drink. A concentration of less than 20 mg/l is recommended by some for people on salt restricted diets or for people suffering from hypertension or heart disease. Sodium occurs naturally in the ground water in many areas of Colorado at concentrations that exceed this health advisory level.

  Sodium was detected in the water sample from your well at a concentration of 96mg/l which is above the recommended level.

- **Boron (B):**

  Boron was not detected in the sample collected from your water well.

- **Calcium (Ca):**

  The calcium concentration in the sample collected from your well was 42mg/l.

- **Magnesium (Mg):**

  The magnesium concentration in the sample collected from your well was 1.7mg/l.

- **Potassium (K):**

  The potassium concentration in the sample collected from your well was 2.1mg/l.

- **Molybdenum (Mo):**

  Molybdenum was not detected in the sample collected from your water well.

- **Bicarbonate (HCO_3):**

  Bicarbonate alkalinity was measured in the sample collected from your well at a concentration of 230mg/l.

- **Bromide (Br):**

  Bromide was not detected in the sample collected from your water well.

METHANE GAS ANALYSIS

Methane was detected in the sample collected from your well at a concentration of 0.0056mg/l. The concentration of methane in the water produced from the well is below the threshold level of 1.1mg/l that could allow methane to accumulate in confined unventilated spaces and potentially be explosive.

CONCLUSIONS

The inorganic chemistry of water from your well is not similar to coal bed methane (CBM) produced water and does not appear to have been impacted by CBM operations in the vicinity of your home. CBM produced water is typically much higher in sodium content that your well water is. CBM produced water typically has much greater levels of total dissolved solids than water from your well. Table 2 in Attachment 3 compares analytical results from samples collected in the since 2005 from your domestic water well. The analytical results shown in Table 2 do not indicate any significant changes in water chemistry.

Table 3. Comparison of Major Ion Chemistry

Analyte	units	Hampton Water Well	Bakersfield 11-5 CBM Well	Homestead 14-5 CBM Well
TDS	mg/l	470	1610	2100
Na	mg/l	70	650	660
Ca	mg/l	76	2.8	5.6
Mg	mg/l	19	0.93	1.4
Cl	mg/l	7.2	165	410
HCO_3	mg/l	350	1440	1300
SO_4	mg/l	76	0.63	<5
SAR	ratio	1.9	85.7	64

NA = not analyzed

Table 3 above compares analytical results from your well to data from two coal bed methane (CBM) wells located in the vicinity of your home. The water from your well is predominantly of a calcium-sodium-

sulfate-bicarbonate character. Waters produced from CBM wells in the Raton Basin are generally of a sodium-bicarbonate character.

Table 1 shows a comparison of results from the sample collected from your well in 2008 to groundwater standards established by the Water Quality Control Commission. The concentration of manganese in your well water exceeds the groundwater standard. No analyte other than managanese exceeded the groundwater standards. Manganese also exceeded the groundwater standards in thw two previous samples collected as shown in Table 2. The presence of bacterial colonies in a well can oftentimes create conditions that cause manganese oxides present in an aquifer to dissolve. Shock chlorination of the well and water distributionsystem can help to reduce the activity of bacterial colonies and at the same time reduce the concentrations of manganese in your well water. The water quality data for the 2008 sampling and analysis does not show any impacts from nearby CBM drilling and production activities.

If you have any questions or would like to discuss these matters further, please contact me at 719-846-3091 or by email at peter.gintautas@state.co.us .

Sincerely,
Colorado Oil and Gas Conservation Commission

Peter Gintautas
Environmental Protection Specialist

Attachments:
Attachment 1 - Table 1 - Analytical Summary
Attachment 2 - Paragon Analytics Reports
Attachment 3 - Table 2 – Summary of Analytical Results
Attachment 4 - CDPHE water well pamphlets

cc: David Neslin, Acting COGCC Director w/o attachments
Debbie Baldwin, COGCC Environmental Protection Manager w/o attachments
Margaret Ash, COGCC Environmental Protection Supervisor w/o attachments

TABLE 1
ANALYTICAL SUMMARY
Complaint 200194006
Hampton Water Well

Parameter	Water Sample		CDPHE Standards		
	Sample Date				
	20-Aug-08				
	Result	Unit	Domestic	Agriculture	Units
Antimony	ND	mg/l	0.006	NS	mg/l
Arsenic	ND	mg/l	0.01	0.1	mg/l
Barium	ND	mg/l	2.0	NS	mg/l
Berylium	ND	mg/l	0.004	0.1	mg/l
Boron	ND	mg/l	NS	0.75	mg/l
Cadmium	ND	mg/l	0.005	0.01	mg/l
Calcium	42	mg/l	NS	NS	
Chromium	ND	mg/l	0.1	0.1	mg/l
Cobalt	ND	mg/l	NS	0.05	mg/l
Copper	ND	mg/l	1	0.2	mg/l
Iron	ND	mg/l	0.3	5	mg/l
Lead	ND	mg/l	0.05	0.1	mg/l
Lithium	0.025	mg/l	NS	NS	
Magnesium	1.7	mg/l	NS	NS	
Manganese	0.1	mg/l	0.05	0.2	mg/l
Molybdenum	ND	mg/l	0.035	NS	mg/l
Nickel	ND	mg/l	0.1	0.2	mg/l
Potassium	2.1	mg/l	NS	NS	
Selenium	ND	mg/l	0.05	0.02	mg/l
Silver	ND	mg/l	0.05	NS	mg/l
Sodium	96	mg/l	NS	NS	
Strontium	1.4	mg/l	NS	NS	
Thallium	ND	mg/l	0.002	NS	mg/l
Uranium	ND	mg/l	0.03	NS	mg/l
Zinc	0.026	mg/l	5	2	mg/l
Chloride	13	mg/l	250	NS	mg/l
Nitrite	ND	mg/l	1.0	10	mg/l
Nitrate	ND	mg/l	10.0	100	mg/l
Total Nitrite/Nitrate	ND	mg/l	10.0	100	mg/l
Fluoride	0.27	mg/l	4.0	NS	mg/l
Total Dissolved Solids	380	mg/l	400	*1500	mg/l
pH	8.08	No units	6.5 - 8.5	6.5 - 8.5	No units
Sulfate	90	mg/l	250	NS	mg/l
Bromide	ND	mg/l	NS	NS	
Total Alkalinity	230	mg/l	NS	NS	
Bicarbonate	230	mg/l	NS	NS	
Carbonate	ND	mg/l	NS	NS	
Conductivity	612	umhos/cm	NS	NS	
methane	0.0056	mg/l	NS	NS	
Total Organic Carbon	1.3	mg/l	NS	NS	

Notes

CDPHE	Colorado Department of Public Health and the Environment.
Domestic	Water Quality Control Commission 5 CCR 1002-41, Regulation No. 41 - The Basic Standards For Groundwater.
Agriculture	* Standards for agriculture complied from CDPHE and other of sources.
mg/l	milligrams per liter (ppm or parts per million).
µmhos/cm	micromhos per centimeter
NA	Not analyzed.
ND	Not detected.
NS	No Standard.
****	Health Advisory.
	Human health standard.
	Secondardy standard.

TABLE 2
Comparison of Results
Complaint 200194006
Hampton Water Well

Parameter	Water Sample				CDPHE Standards		
	Sample Date	Sample Date	Sample Date				
	13-Jul-05	20-Jun-06	20-Aug-08				
	Result	Result	Result	Unit	Domestic	Agriculture	Units
Arsenic	ND	ND	ND (<0.1)	mg/l	0.01	0.1	mg/l
Barium	ND	0.069	ND	mg/l	2.0	NS	mg/l
Boron	NA	ND	ND	mg/l	NS	0.75	mg/l
Cadmium	ND	ND	ND	mg/l	0.005	0.01	mg/l
Calcium	36	39	42	mg/l	NS	NS	
Chromium	ND	ND	ND	mg/l	0.1	0.1	mg/l
Copper	NA	ND	ND	mg/l	1	0.2	mg/l
Iron	ND	ND	ND	mg/l	0.3	5	mg/l
Lead	ND	ND	ND	mg/l	0.05	0.1	mg/l
Magnesium	1.5	1.6	1.7	mg/l	NS	NS	
Manganese	0.09	0.094	0.1	mg/l	0.05	0.2	mg/l
Potassium	ND (<3)	ND (<3)	2.1	mg/l	NS	NS	
Selenium	ND	ND	ND	mg/l	0.05	0.02	mg/l
Silver	ND	ND	ND	mg/l	0.05	NS	mg/l
Sodium	100	97	96	mg/l	NS	NS	
Chloride	9.8	10	13	mg/l	250	NS	mg/l
Nitrite	ND	ND	ND	mg/l	1.0	10	mg/l
Nitrate	ND	ND	ND	mg/l	10.0	100	mg/l
Total Nitrite/Nitrate	ND	ND	ND	mg/l	10.0	100	mg/l
Fluoride	ND (<0.5)	ND (<0.5)	0.27	mg/l	4.0	NS	mg/l
Total Dissolved Solids	NA	390	380	mg/l	400	*1500	mg/l
pH	7.9	8	8.08	No units	6.5 - 8.5	6.5 - 8.5	No units
Sulfate	74	84	90	mg/l	250	NS	mg/l
Bromide	ND	ND	ND	mg/l	NS	NS	
Total Alkalinity	220	210	230	mg/l	NS	NS	
Bicarbonate	220	210	230	mg/l	NS	NS	
Carbonate	ND	ND	ND	mg/l	NS	NS	
Conductivity	NA	590	612	umhos/cm	NS	NS	
methane	ND (<0.005)	ND (<0.005)	0.0056	mg/l	NS	NS	

Notes

CDPHE	Colorado Department of Public Health and the Environment.
Domestic	Water Quality Control Commission 5 CCR 1002-41, Regulation No. 41 - The Basic Standards For Groundwater.
Agriculture	* Standards for agriculture complied from CDPHE and other of sources.
mg/l	milligrams per liter (ppm or parts per million).
µmhos/cm	micromhos per centimeter
NA	Not analyzed.
ND	Not detected.
NS	No Standard.
****	Health Advisory.
	Human health standard.
	Secondardy standard.