STATE OF COLORADO
OIL & GAS
CONSERVATION COMMISSION

November 26, 2013

Certified Mail Return Receipt Requested # 7012 2920 0000 8652 6848

Ms. Dorota Szwaja
14435 Pine Drive
Weston, CO 81091-8734

RE: Complaint 200387998
Baseline Groundwater Analysis
Well Permit 275902 Receipt 3623055
SESE 6 33S 66W Las Animas County, Colorado

Dear Ms. Szwaja:

In response to your concerns regarding possible impacts to water quality from nearby coal bed methane (CBM) operations, I conducted a field visit to your water well on September 11, 2013 to collect water quality samples on behalf of the COGCC. Water samples were collected for general inorganic water quality testing as well as for analysis of dissolved methane, volatile organic compounds and semi-volatile organic compounds. A sample was also collected for analysis of gas composition and isotopic ratio determination. A summary of the results of the September 11, 2013 sampling event and the chemical analyses is presented below. The analytical results are also compared to published water quality standards.

FIELD TESTING

I visited your home in the Rancho La Garita subdivision in western Las Animas county on September 11, 2013 to collect water samples from the domestic well at your home. You assisted me in obtaining samples of water from a hydrant in line with your pump and following your pressure tank. There was no treatment system prior to the sample collection point. You told me that the well is regularly pumped for household use. We started pumping from your well at 08:58 at an approximate rate of 8 to 9 gallons per minute. We collected samples of the water at 09:20 after the temperature of the water had been stable for 10 minutes at 58ºF and after approximately 170 gallons of water had been purged from your 260 foot deep well. The samples from your well for general inorganic, organic analyses and dissolved methane analyses were shipped to ALS Laboratory Group in Fort Collins, CO and received on September 12, 2013. The samples from your well for analysis of volatile organic compounds were shipped to ESC Lab Sciences in Mount Juliet, TN and received on September 11, 2013. The sample for gas composition and isotopic analysis was received by Isotech Laboratories, Inc. in Champaign, IL on September 12, 2013. These samples were stored and shipped on ice with custody seals and by overnight service.

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 Water Supply - Human Health standards" (Table 1) and Domestic Water Supply - Drinking Water standards" (Table 2) within their Regulation 41 "The Basic Standards for Groundwater" (5CCR 1002-41). The COGCC is an implementing agency of the groundwater standards for impacts associated with oil and gas exploration and production activities. Analytical data for the recently collected samples from your 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" are analogous to but not the same as standards established for **municipal or public** drinking water supplies and oftentimes people use and consume ground water from private wells that exceed these standards. The groundwater standards are different in concept than the rules and standards adopted for public supply systems but many of the threshold concentrations are identical. A paper copy of the reports from ALS Laboratory Group is included as Attachment 2. A paper copy of the report from ESC Sciences Lab is included as Attachment 3. A paper copy of the report from Isotech Laboratories, Inc. is included as Attachment 4.

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

  Antimony was detected in the sample from your well at a concentration of 0.0012mg/l, which is below the CDPHE human health standard (2013).

- **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 samples from your well (2013).

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

  Barium was detected in the sample from your well at a concentration of 0.33mg/l, which is below the CDPHE human health standard (2013).

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

  Beryllium was detected in the sample from your well at a concentration of 0.0003mg/l, which is below the CDPHE human health standard (2013).

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

  Cadmium was not detected in the samples collected from your well (2013).

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

  Chromium was not detected in the samples collected from your well (2013).

- **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 samples from your well (2013).

- **Molybdenum (Mo):** The CDPHE human health standard for molybdenum is 0.21 mg/l. Molybdenum occurs naturally in the earth's crust and is usually found in very low concentrations in groundwater.

  Molybdenum was not detected in the sample from your well (2013).

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

  Nickel was not detected in the samples collected from your well (2013).

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

  Selenium was not detected in the sample from your well (2013).

- **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 samples collected from your well (2013).

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

  Thallium was detected in the sample from your well at a concentration of 0.00007mg/l, which is below the CDPHE human health standard (2013).

- **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 from your well (2013).

- **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 from your well at a concentration of 0.72mg/l, which is below the CDPHE human health standard (2013).

- **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 from your well (2013).

- **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 samples collected from your well (2013).

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

  Copper was not detected in the samples from your well (2013).

- **Chloride (Cl):** The CDPHE domestic supply 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 from your well at a concentration of 13mg/l, which is below the CDPHE domestic supply drinking water standard (2013).

- **Iron (Fe):** The CDPHE domestic supply 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 samples collected from your well (2013).

- **Manganese (Mn):** The CDPHE domestic supply 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 from your well at a concentration of 0.012mg/l, which is below the CDPHE domestic supply drinking water standard (2013).

- **Sulfate (SO_4):** The CDPHE sulfate domestic supply drinking water 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 from your well at a concentration of 4.7mg/l, which is below the CDPHE domestic supply drinking water standard (2013).

- **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 samples from your well at 8.32 which is within the CDPHE drinking water and agricultural standards (2013).

- **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 concentration measured in samples from your water well was 280mg/l which is below the CDPHE drinking water standard (2013).

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

  Zinc was detected in the sample from your well at a concentration of 0.0086mg/l, which is below the CDPHE domestic supply drinking water standard (2013).

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 110mg/l (2013). The sodium concentration is above the recommended level.

- **Boron (B):**

  Boron was not detected in the samples collected from your well (2013).

- **Calcium (Ca):**

  Calcium was detected in the water sample from your well (2013) at a concentration of 10mg/l.

- **Magnesium (Mg):**

  Magnesium was detected in the water sample from your well (2013) at a concentration of 0.6mg/l.

- **Potassium (K):**

  Potassium was detected in the water sample from your well (2013) at a concentration of 1.3mg/l.

- **Strontium (Sr):**

  Strontium was detected in the water sample from your well at a concentration of 0.38mg/l (2013). The U.S. EPA has not established drinking water standards for strontium. However this federal agency has issued a health advisory level of 4mg/l for lifetime consumption of water by an individual. The Sr concentration in your well water is less the advisory level if you were to consume this water for your entire life.

- **Bicarbonate (HCO_3):**

  Bicarbonate alkalinity was detected in the water sample from your well at a concentration of 230mg/l (2013).

- **Bromide (Br):**

  Bromide was detected in the water sample from your well at a concentration of 0.11mg/l (2013).

METHANE GAS ANALYSIS

Methane was detected in the samples collected from your well (2013) at a concentration of 0.11mg/l. The concentration of methane present in the samples from your well is below the concentration of 1.1mg/l than theoretically can lead to buildup of explosive quantities of gases in small enclosed areas.

VOLATILE ORGANIC COMPOUND ANALYSIS

A target list of sixty-four volatile organic compounds (VOC) was utilized during analysis of water from your well. None of the 64 target compounds was detected above the lab's established reporting limit in water samples from your well.

SEMI-VOLATILE ORGANIC COMPOUND ANALYSIS

A sample of water from your well was also extracted and analyzed for the presence of seventy-three semi-volatile organic compounds (SVOC). The lab did not detect the presence of any of the 73 SVOC compounds in the sample. This analysis is general scan for the presence of semi-volatile organic compounds that are may be present in groundwater.

CONCLUSIONS

The concentrations of all analytes tested in water samples from your well are within the groundwater standards established by the CPDHE Water Quality Control Commission. The overall water quality of groundwater pumped from your well in 2013 is of similar major ion composition to general water quality of groundwater from many wells in the Raton Basin. No impacts to water quality from nearby CBM operations were noted at this time. The pamphlet included as Attachment 5 may be useful in understanding how your well works and in understanding the results of the analyses described in this letter.

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

Digitally signed by Peter Gintautas
DN: cn=Peter Gintautas, o=COGCC, ou=Environmental Protection Specialist, email=peter.gintautas@state.co.us, c=US
Date: 2013.11.26 08:06:20 -07'00'

Peter Gintautas, Ph.D.
Environmental Protection Specialist

Attachments:
Attachment 1 - Table 1 - Analytical Summary
Attachment 2 - ALS Laboratory Group Analytical Reports
Attachment 3 - ESC LaB Sciences Report
Attachment 4 - Isotech Laboratories Report
Attachment 5 - How Well Do You Know Your Water Well Booklet

cc: Matt Lepore, COGCC Director w/o attachments
Jim Milne, COGCC Environmental Protection Manager w/o attachments
John Axelson, COGCC Environmental Protection Supervisor w/o attachments
Andrew Ross, CDPHE w/o attachments

TABLE 1. ANALYTICAL SUMMARY
Szwaja Water Well 2013 Sampling

Parameter	752831 Szwaja		CDPHE Groundwater Standards		
	Sample Date				
	11-Sep-13				
	Result	Unit	Domestic	Agriculture	Unit
Aluminum	ND	mg/l	NS	5	mg/l
Antimony	0.0012	mg/l	0.006	NS	mg/l
Arsenic	ND	mg/l	0.01	0.1	mg/l
Barium	0.33	mg/l	2.0	NS	mg/l
Berylium	0.0003	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	10	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	0.0066	mg/l	NS	NS	
Magnesium	0.6	mg/l	NS	NS	
Manganese	0.012	mg/l	0.05	0.2	mg/l
Molybdenum	ND	mg/l	0.21	NS	mg/l
Nickel	ND	mg/l	0.1	0.2	mg/l
Potassium	1.3	mg/l	NS	NS	
Selenium	ND	mg/l	0.05	0.02	mg/l
Silicon	4.1	mg/l	NS	NS	
Silver	ND	mg/l	0.05	NS	mg/l
Sodium	110	mg/l	NS	NS	
Strontium	0.38	mg/l	NS	NS	
Thallium	0.00007	mg/l	0.002	NS	mg/l
Thorium	ND	mg/l	NS	NS	
Uranium	ND	mg/l	0.03	NS	mg/l
Zinc	0.0086	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	0.72	mg/l	4.0	NS	mg/l
Total Dissolved Solids	280	mg/l	400	*1500	mg/l
pH	8.32	No units	6.5 - 8.5	6.5 - 8.5	No units
Sulfate	4.7	mg/l	250	NS	mg/l
Bromide	0.11 J	mg/l	NS	NS	
Total Alkalinity	230	mg/l	NS	NS	
Bicarbonate Alkalinity	230	mg/l	NS	NS	
Carbonate Alkalinity	ND	mg/l	NS	NS	
Conductivity	479	umhos/cm	NS	NS	
methane	0.11	mg/l	NS	NS	
total organic carbon	ND	mg/l	NS	NS	
SAR	8.4	No units	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 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.
	Domestic Water Supply - Human Health Standard (Table 1).
	Domestic Water Supply - Drinking Water Standard (Table 2).