



April 22, 2013

Certified Mail Return Receipt Requested # 7011 3500 0000 1242 0736

Mr. and Mrs. Warren and Margaret Wilgus
19501 Ponderosa Drive
Weston, CO 81091

RE: Water Well Investigation
Permit 249629 Receipt 0509001, COGCC Water Well Facility 703908
SWNE 17 33S 66W, Las Animas County

Dear Mr. and Mrs. Wilgus:

In response to your safety concerns with respect to methane venting from your water well, staff of the Colorado Oil and Gas Conservation Commission (COGCC) conducted a field visit to your home on March 25, 2013 to collect a sample of the gas venting from your well after speaking with you and the local fire department and health department staff. On April 1, 2013, COGCC staff collected samples of gas produced from five coal bed methane (CBM) wells near you home. All of those samples were hand delivered to Dolan Integration Group's lab in Boulder Colorado on April 2, 2013.

On April 11, 2013 a group of concerned county and state workers and a representative of Pioneer Natural Resources met at the Mount San Rafael Hospital Board Room. Mary Garcia, the executive director of the bi-county health district wrote a letter summarizing the consensus of that group regarding the possible hazards at your home from the water well if you were to reside at your home under the current conditions and three steps the group thought should be done to attempt to partly mitigate the situation.

On April 17, 2013, staff of LTE performed a survey of the flux (volume of methane per unit of time) survey in the area near your water well and surrounding your home. The final report of this survey is not complete yet but I will discuss preliminary results below that I observed while the survey was underway.

On April 19, 2013, volunteers from the Stonewall Fire Protection District safely removed the well cap on your well as was suggested in the letter hand-delivered to you by Mary Garcia (executive director, LAHCDHD). This was done to lessen the back pressure of methane on your well which may have been causing migration of methane into soils around your well.

WATER WELL RECORDS

I retrieved the construction records for your water well from the Division of Water Resources web site. The construction record filed by Boday Well Drilling indicates the well was drilled to 612 feet in May 2003 (Attachment 1). The water well was drilled with air rotary methods. The well log indicates that no recoveries of cuttings were obtained from a depth of 186 to 612 feet in the 6.125 inch diameter hole. The volume of cuttings reportedly not returned to the surface was slightly more than 3.2 yards at a minimum. The loss of cuttings indicates to me that a cavernous section of the rocks was reached at or about the depth of 186 feet below surface. The cavernous section might be a coal mine working or with less likelihood could be

a natural cavern. There is one coal mine recorded in the vicinity of your property but at a distance of approximately one-half mile to the northeast of your home. The location and known workings of the closest coal mine known to us is shown on Attachment 2 and was known as the Monarch Mine. There may be other mines in the area for which we do not have records. Locations of gas seeps near the Monarch Mine are also shown on Attachment 2. Another seep was detected to the west of your home in the 2007 Raton Basin Phase 2 Baseline study and may correlate to a water well venting gas on your neighbor's property to the west of your home. Your neighbor did not grant access for a follow-up ground survey when requested in 2007. So we do not at present know the extent or nature of the gas seep to the west of your home indicated to be present from the 2007 driving survey of the Raton Basin. Construction records for the two wells that have been drilled on the lots to the west of you indicate the presence of several coal seams. Inspection of geologic maps of the area around your home indicates that your well and the neighbor's wells are drilled in and completed in the Raton Formation. The closest CBM wells to your home are completed in the deeper Vermejo Formation coals and not in the shallower Raton Formation coals.

You told me when I was at your home that the gas venting from your well caught on fire during the drilling of the well in 2003. And that lightning ignited a fire at the well several years ago. You accidentally ignited the gases venting from the well on March 25, 2013 while trying to thaw a valve near your cistern.

ISOTOPIC COMPOSITION OF GAS SAMPLES IN TOWNSHIP 33S RANGE 66W

Five gas samples were collected from nearby CBM wells on April 1, 2013. The two closest CBM wells producing from the Raton Formation were sampled (Michael John 21-20 and Speedster 14-17 Tr). Both wells are south of your home and the locations can be seen on the aerial photo plot of the area around your home. Three CBM wells producing from the Vermejo Formation were also sampled in April 2013 (Newcastle 22-17, Brewski 113-17 and the Tuborg 21-17). Three other CBM wells nearby are not producing gas at this time and were not sampled (Shiloh 31-17, Fools Gold 34-17 and the Last Chance 31-17). The attached plot (Attachment 4) is plot of carbon versus hydrogen (deuterium) isotopes. I have shown gas composition of the two samples collected from your well (2004 and 2013). Also shown on the graph is the isotopic composition of methane collected from a soil gas seep in 2007 near the Monarch Mine location. The soil gas sample to the northeast of your home and the two samples from your water well plot near one another on Attachment 4 as might be anticipated if the three samples share a common source or origin. The isotopic composition of methane from the two nearby Raton Formation CBM wells plot away from the three Raton Formation samples from soil and your water well. Samples from the three nearby Vermejo Formation CBM wells collected in April 2013 are of distinctly different isotopic composition than the samples from your water well and the nearby soil gas seep. Results of samples from other CBM wells in the same township and range your home is located in are also shown on Attachment 4. The Caesar 22-18 and the Habitant 43-18 produce from the Raton/Vermejo Formations and the Vermejo Formation respectively and are located less than a mile west of your water well. Isotopic composition of the methane from those wells is not similar to the isotopic composition of methane from your well or the nearby soil gas seep. The isotopic composition of all of the samples (locations shown on Attachment 2) is considered to be of thermogenic origin. Thermogenic origin means the gas is formed from organic material in the coal as the coal was exposed to higher temperatures than at the surface along with many millions of years of time for the methane to form. None of the samples discussed are of biogenic origin. Biogenic methane is formed by bacterial processes and generally has distinct isotopic composition due to several factors and depending on which biologic process the gas was produced by.

GAS COMPOSITION OF GAS SAMPLES IN TOWNSHIP 33S RANGE 66W

Attachment 5 is a plot of the ratio of methane (CH₄) to ethane (C₂H₆) in samples from your water well and nearby CBM wells to the isotopic composition of carbon in the methane in the same samples. The samples from your water well and the soil gas seep to the northeast have very high methane to ethane ratios (>10,000) and plot as distinct different composition or source from any of the nearby CBM wells from the Raton

formation, the Vermejo Formation or from CBM wells which produce from the Raton and Vermejo at the same time. This plot shows very clearly that the source of gas venting from your well is not any of the sampled CBM wells based on differences in gas composition and isotopic ratio of the methane in the samples. The flow of gas and the pressure of gas in your water well is most likely greater than any of the nearby CBM wells from my observations during sampling. Higher pressure would indicate migration out from your water well and not from the lower pressure CBM wells nearby.

DISCUSSION

Water well construction records indicate that more than 3 cubic yards of cuttings moved into spaces or cavities in the rock below your home. From my inspection of other water well records in Las Animas and Huerfano counties over the last six years, I would state that I have seen this extreme loss of cuttings in an air drilled well only in areas with records of coal mines. There has been methane venting from your well since it was drilled based on the occurrence of a fire at the time of drilling in 2003. Both your recollection and the recollection of the local fire chief are that the volume and pressure of methane venting from your well is greater now than in the 2003 to 2004 time frame. At this point of our investigation we do not know why an increase may have occurred.

Preliminary results of the soil gas flux survey indicated that methane was migrating along the trench excavated for the water pipe and power line between the well head and the cistern about 10 feet away. Flux measurements also indicated that lower amounts of gas were moving up the trench between the cistern and the southwest corner of your home. Several soil gas flux measurements around the other sides of your home did not detect methane, which indicates there is not a gas seep other than your water well close to your home.

The amount of gas venting from your water well does pose a fire hazard. The proximity of the cistern to the well is of concern as methane is seeping from the soil around the cistern. I would recommend moving the cistern further away from the water well to lessen the chances of igniting a fire from delivering water to the cistern by truck. As mentioned in the letter from the executive director of the bi-county health department the group of individuals who met on April 11, 2013 are concerned that living in close proximity to the well as it is now poses an unnecessary and unacceptable risk of injury or harm to you and your wife. A means of venting the well higher into the air may lessen the risk to you and your home but is not necessarily a good long-term solution. Venting the gas higher into the air can provide a better means of dispersal of the methane and lessen the risk of methane accumulating to explosive levels in the crawl space of your home compared to when the well was capped. Venting the methane through a pipe as high as your home can also lessen the risk of a fire at ground level of buildup of methane in your home or attic as methane is lighter than air and the methane will rise over the house if the vent pipe works as is typically seen. Plugging the water well bore properly could provide a better long-term means of lessening or removing the risk. Under any conditions I would not recommend occupying the house without installation of combustible gas detectors and alarms in the home.

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 .

Warren and Margaret Wilgus
Water Well Investigation
April 22, 2013

Sincerely,
Colorado Oil and Gas Conservation Commission

Peter Gintautas, Ph.D.
Environmental Protection Specialist

Attachments

- Attachment 1 - Water well construction record
- Attachment 2 - Location map with all sample locations discussed indicated
- Attachment 3 - 2011 aerial photo with sample near the Wilgus water well indicated
- Attachment 4 - Isotopic composition of methane
- Attachment 5 - Gas composition and carbon isotopic composition

cc: Matt Lepore, COGCC Director
Jim Milne, COGCC Environmental Protection Manager
Margaret Ash, COGCC Field Inspection Manager
Steve Lindblom, COGCC Environmental Protection Supervisor
Dave Holland, Pioneer Natural Resources
Mary Garcia, Las Animas-Huerfano Counties District Health Department
Jim Casias, Las Animas County Sheriff
Loyd Holliman, Stonewall Fire Protection District

WELL CONSTRUCTION AND TEST REPORT
STATE OF COLORADO, OFFICE OF THE STATE ENGINEER

For Office Use only
RECEIVED

MAY 16 2003

WATER RESOURCES
STATE ENGINEER
COLO.

0509001

1. WELL PERMIT NUMBER 249629

2. OWNER NAME(S) WARREN J. WILKUS
Mailing Address 32973 GENEVA LN
City, St. Zip EVERGREEN, CO 80439
Phone (303) 670-2537

3. WELL LOCATION AS DRILLED: SU 1/4 NE 1/4, Sec. 17 Twp. 33 S, Range 66 W
DISTANCES FROM SEC. LINES:
2361 ft. from north Sec. line. and 2549 ft. from east Sec. line. OR
(north or south) (east or west)
SUBDIVISION: Rancho La Boreita LOT 1002 BLOCK _____ FILING(UNIT) _____
STREET ADDRESS AT WELL LOCATION: _____

4. GROUND SURFACE ELEVATION _____ ft. DRILLING METHOD Air Rotary
DATE COMPLETED May 5 2003 TOTAL DEPTH 662 ft. DEPTH COMPLETED 608 ft.

5. GEOLOGIC LOG:

Depth	Description of Material (Type, Size, Color, Water Location)
0-6	overburden Loose
6-31	Brown sandstone tight
31-186	Gray sandstone / gray shale sands tight
186-612	Lost returns -

REMARKS: _____

6. HOLE DIAM. (in.) From (ft) To (ft)

From (ft)	To (ft)	Hole Diam. (in.)
0	39	8 3/4
39	612	6 3/8

7. PLAIN CASING

OD (in)	Kind	Wall Size	From (ft)	To (ft)
6 3/8	steel	188	0	39
4 1/2	plastic	200	-7	288
4 1/2	plastic	200	308	388
4 1/2	plastic	200	408	488
4 1/2	plastic	200	508	588
PERF. CASING: Screen Slot Size: <u>5/8 inch</u>				
4 1/2	plastic	200	288	308
4 1/2	plastic	200	388	408
4 1/2	plastic	200	488	508
4 1/2	plastic	200	588	608
31	intervals	30-20's	1-8'	

8. FILTER PACK: Material NONE Size _____ Interval _____

9. PACKER PLACEMENT: Type NONE Depth _____

10. GROUTING RECORD:

Material	Amount	Density	Interval	Placement
cement	6 sacks	36 gals	3-39	powered

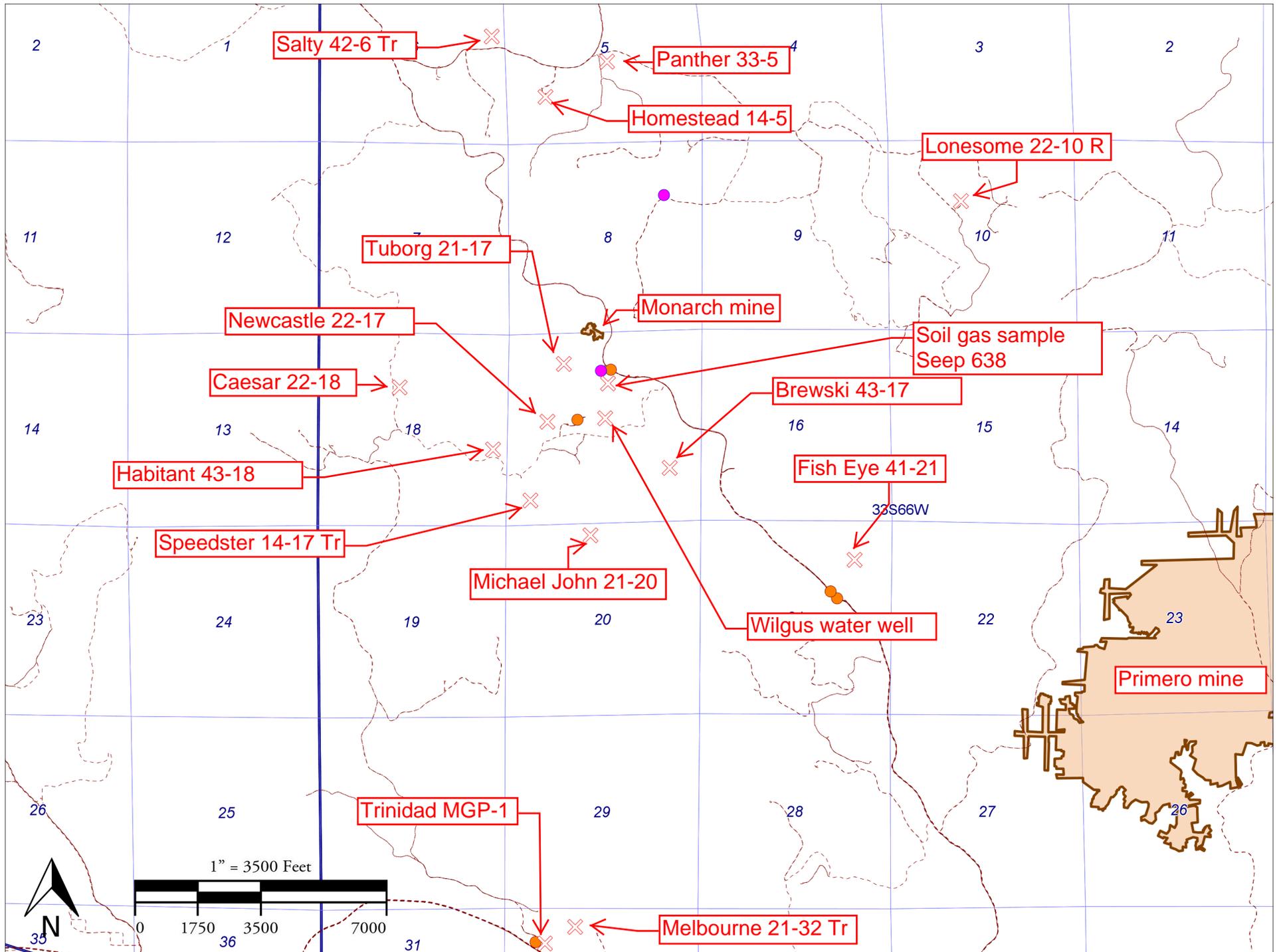
11. DISINFECTION: Type Chlorine Amt. Used 3 gallons Left in hole

12. WELL TEST DATA: Check box if Test Data is submitted on Form No. GWS 39 Supplemental Well Test.
TESTING METHOD Boiler
Static Level 300 ft. Date/Time measured 5/5/03 7:30, Production Rate 1 1/2 gpm.
Pumping level 608 ft. Date/Time measured 5/5/03 9:00-2:30, Test length (hrs.) 5 1/2
Remarks _____

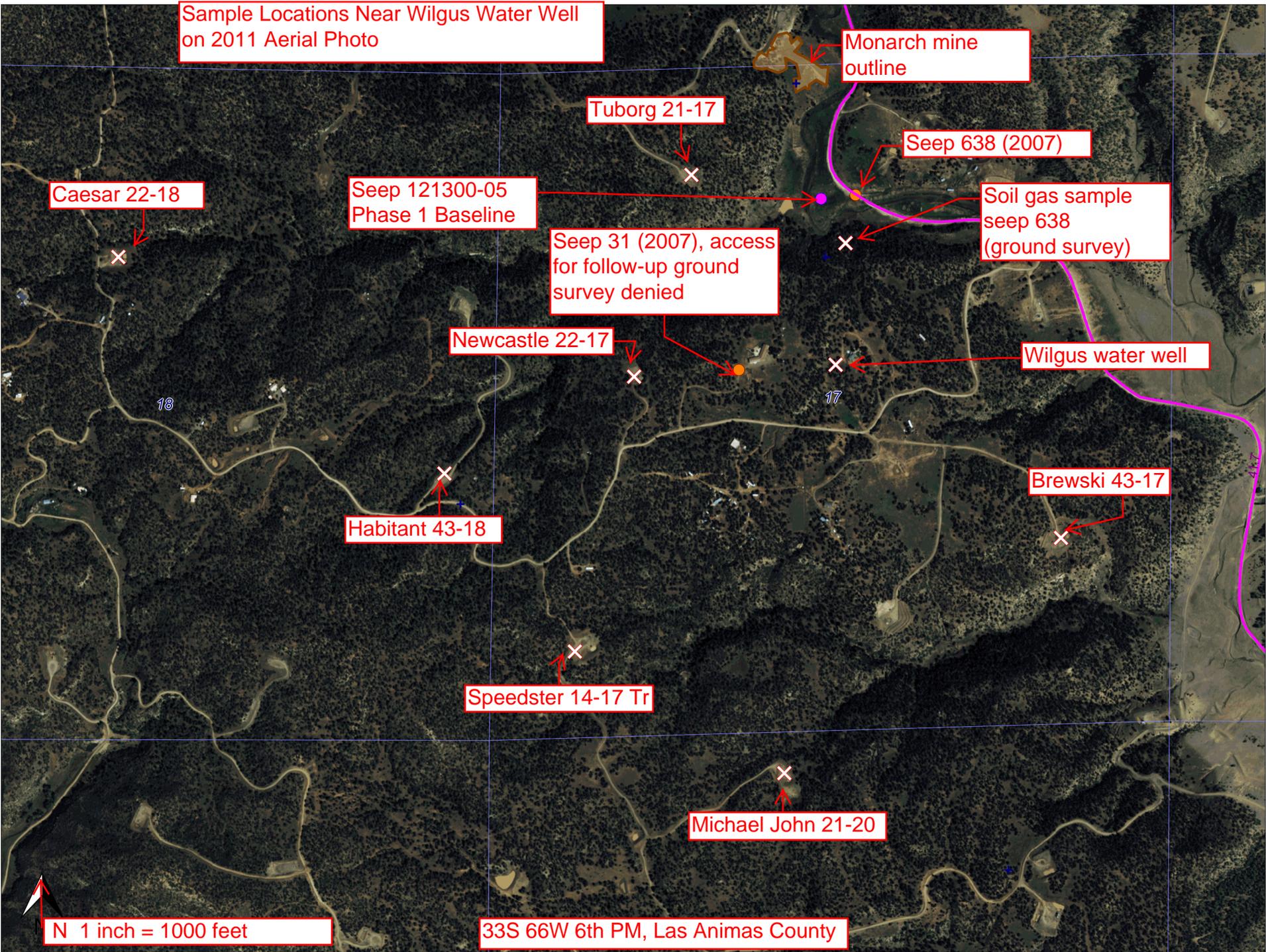
13. I have read the statements made herein and know the contents thereof, and that they are true to my knowledge. [Pursuant to Section 24-4-104 (13) (a) C.R.S., the making of false statements herein constitutes perjury in the second degree and is punishable as a class 1 misdemeanor.]

CONTRACTOR Booley Well Drilling Phone (719) 846-6412 Lic. No. 1321
Mailing Address P.O. Box 3295 Colorado, CO 81032

Name/Title (Please type or print) <u>Kathleen Booley / Booley Well Drilling</u>	Signature <u>Kathleen Booley</u>	Date <u>05-12-03</u>
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Sample Locations Near Wilgus Water Well on 2011 Aerial Photo



Monarch mine outline

Tuborg 21-17

Seep 638 (2007)

Caesar 22-18

Seep 121300-05 Phase 1 Baseline

Seep 31 (2007), access for follow-up ground survey denied

Soil gas sample seep 638 (ground survey)

Newcastle 22-17

Wilgus water well

Brewski 43-17

Habitant 43-18

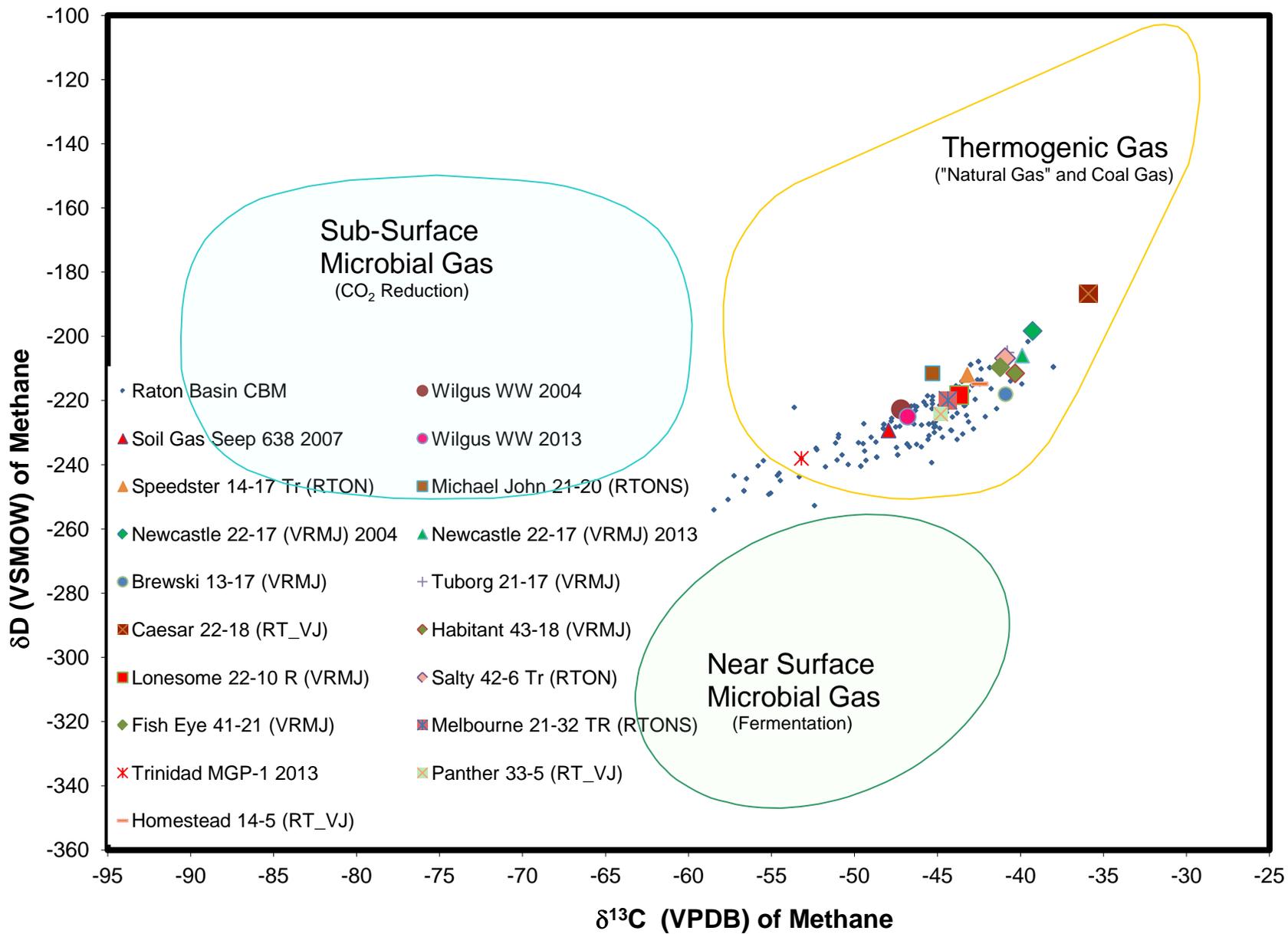
Speedster 14-17 Tr

Michael John 21-20

N 1 inch = 1000 feet

33S 66W 6th PM, Las Animas County

Isotopic Composition of Methane Raton Basin



Methane to Ethane Ratio and ^{13}C Isotopic Ratio of Methane

