

# Common Complaints by Water Well Owners Related to Unconventional Development Programs\*

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\*Adapted from oral presentation entitled, “Preparing for and Handling Common Complaints by Private Water Well Owners Related to Coal Bed Methane, Shale Gas and Other Unconventional Development Programs,” at AAPG Rocky Mountain Section meeting, Cheyenne, Wyoming, USA, June 25-29, 2011; an adaptation of an update and minor revision, presented at AAPG International Conference and Exhibition, Singapore, DEG & EMD Luncheon, September 18, 2012, is entitled “Addressing Water Well ‘Problems’ and Complaints in Areas of Unconventional Resource Development: Appearances are Deceiving and Solutions Are Many,” [Search and Discovery Article #70137 \(2013\)](#).

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## Abstract

A major public concern with unconventional oil and gas development occurring today is the potential impact to ground water or private well owners. When development occurs in a populated rural area, it is not long before the operators and regulators are hit with complaints from private water well owners suspecting that their water well is impacted from nearby development activities. While a few complaints can be linked to real issues, such as poor cement jobs, leaky pits, and other accidents related to development, the vast majority turn out to be due to poor quality water well design, construction, and lack of maintenance that can mimic issues caused by oil and gas releases. While the actual releases and spills must be acknowledged along with their true impacts to ground water, public education is required to demonstrate that these are rare and many of the issues with private water wells are related to naturally occurring conditions or other historical activities, such as mining exploration, early oil and gas exploration, agricultural impacts or other industrial impacts. Water wells can also become non-productive and the quality of water degraded due to regional draw-down from over-use of the aquifer, drought, or just the limited life span of wells. Methane in a water well occurs naturally from bacteria present in, or introduced into, the well, natural gas seeps, or the result of adsorbed methane in the coals or shales present in some aquifers. Even though methane occurs naturally in many ground water aquifers, it is not toxic and therefore not routinely included in water quality tests in private wells, until gas development occurs in the area, when it then becomes “discovered” as a problem. If conducted prior to development, a proactive baseline testing program can head-off these problems with landowners. Some states have or are currently proposing new regulations to conduct baseline studies before drilling occurs and routinely thereafter. Baseline testing procedures and results are presented that help protect operators from complaints and potential law suits. The authors recently assisted in creating a brochure, website, and presentation for Raton Basin water well owners to educate the well owners on:

- the most common water-well problems, including methane,
- how to distinguish these issues from gas development releases or other forms of natural or anthropogenic contamination,
- how to resolve the issues with routine testing and maintenance.

## ABSTRACT

A major public concern with unconventional oil and gas development occurring today is the potential impact to ground water or private well owners. When development occurs in a populated rural area, it's not long before the operators and regulators are hit with complaints from private water well owners suspecting that their water well is impacted from nearby development activities. While a few complaints can be linked to real issues such as poor cement jobs, leaky pits and other accidents related to development, the vast majority turn out to be due to poor quality water well design, construction and lack of maintenance that can mimic issues cause by oil and gas releases. While the actual releases and spills must be acknowledged along with their true impacts to ground water, public education is required to demonstrate that these are rare and many of the issues with private water wells are related to naturally occurring conditions or other historical activities such as mining exploration, early oil and gas exploration, agricultural impacts or other industrial impacts. Water wells can also become non-productive and the quality of water degraded due to regional draw-down from over use of the aquifer, drought, or just the limited life span wells. Methane in a water well occurs naturally from bacteria present in or introduced into the well, natural gas seeps, or the result of adsorbed methane in the coals or shales present in some aquifers. Even though methane occurs naturally in many ground water aquifers, it is not toxic and therefore not routinely checked for as part of water quality tests in private wells, until gas development occurs in the area when it then becomes "discovered" as a problem. Done prior to development, a proactive baseline testing program can head off these problems with landowners. Some states are have or are currently proposing new regulations to conduct baseline studies before drilling occurs and routinely after. Baseline testing procedures and results are presented that help protect operators from complaints and potential law suits. The authors recently assisted in creating a brochure, website and presentation for Raton Basin water well owners to educate the well owners on the most common water well problems, including methane, how to distinguish these issues from gas development releases or other forms of natural or anthropogenic contamination, and how to resolve the issues with routine testing and maintenance.

# Preparing for and Handling Common Complaints by Private Water Well Owners Related to Coal Bed Methane, Shale Gas and Other Unconventional Development

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# Outline

- Industry's Image
- Domestic Water Well Facts
- Leading up to the Complaint
- The Water Well Symptoms
- How to Prepare for the Complaints



# The Environmental Rules

- **Environmental Problems are Emotional**
- **Environmental Solutions are Technical**
- **Environmental Decisions are Political**

Author Unknown



# The Public Image of Oil and Gas Development







# Water Well Owner Facts

- About 95% of all rural Americans get their drinking water from a groundwater source
- 42 million depend on wells for their water
- Well Owner Associations Recommend Annual Maintenance and Testing
  - *Most Owners Don't Do Any!*
- Few Test for Methane





# How many water wells are there?

- **Raton Basin: Las Animas & Huerfano Counties**
  - **5,700 permitted water wells**  
(Colorado DWR)
  - **Compared to 3,100 Active Oil/Gas Wells**  
(COGCC)



## Domestic Well Problems are Common

- Lack of Routine Testing & Maintenance
- Poor Installation & Construction Practices
- Poor Aquifer Conditions



Photos Courtesy Anthony Gorody



## Private Wells Exceed EPA Standards

- *Private water wells are not required to meet EPA drinking water standards.*
- Many exceed primary or secondary standards.
- Most Domestic Water Wells Contain Measurable Dissolved Hydrocarbons (Mostly Methane)
  - Majority Contain Bacterial Gas
  - A Few Contain Gas From Historic Production





# The Complaint Sequence

- **CBM, Tight Sand, or Shale Play Develops**
  - No Previous Production History or...
  - Previous History Drilling – Possibly Old
  - Severed Mineral Rights
- **Leasing Acquisition**
- **Owners See Scary News Articles – Googles “Fracking”**
- **Operator Begins Drilling Program, then...**
- **A Landowner’s Well Has a Problem....**
- **The Land Owner Calls and Complains**



# The Complaint

- **After they drilled that gas well, my water well \_\_\_\_\_!!!! (Fill in the Blank)**
  - ... Stopped Working
  - ... Went Dry
  - ... Has Sediment, or Slimy Stuff
  - ... Has Gas Bubbles, or Methane
  - ... Tastes Awful, Salty
  - ... Smells
  - ... Blew Up!



# Common Well Problems

## 1. Poor Water Production (Quantity)

- Well Goes Dry or has Low Yield Rates

## 2. General Water Quality

- Odors, Taste, Color, Staining, etc.
- Sediment
- Bacteria - Slime

## 3. Gases in the Water





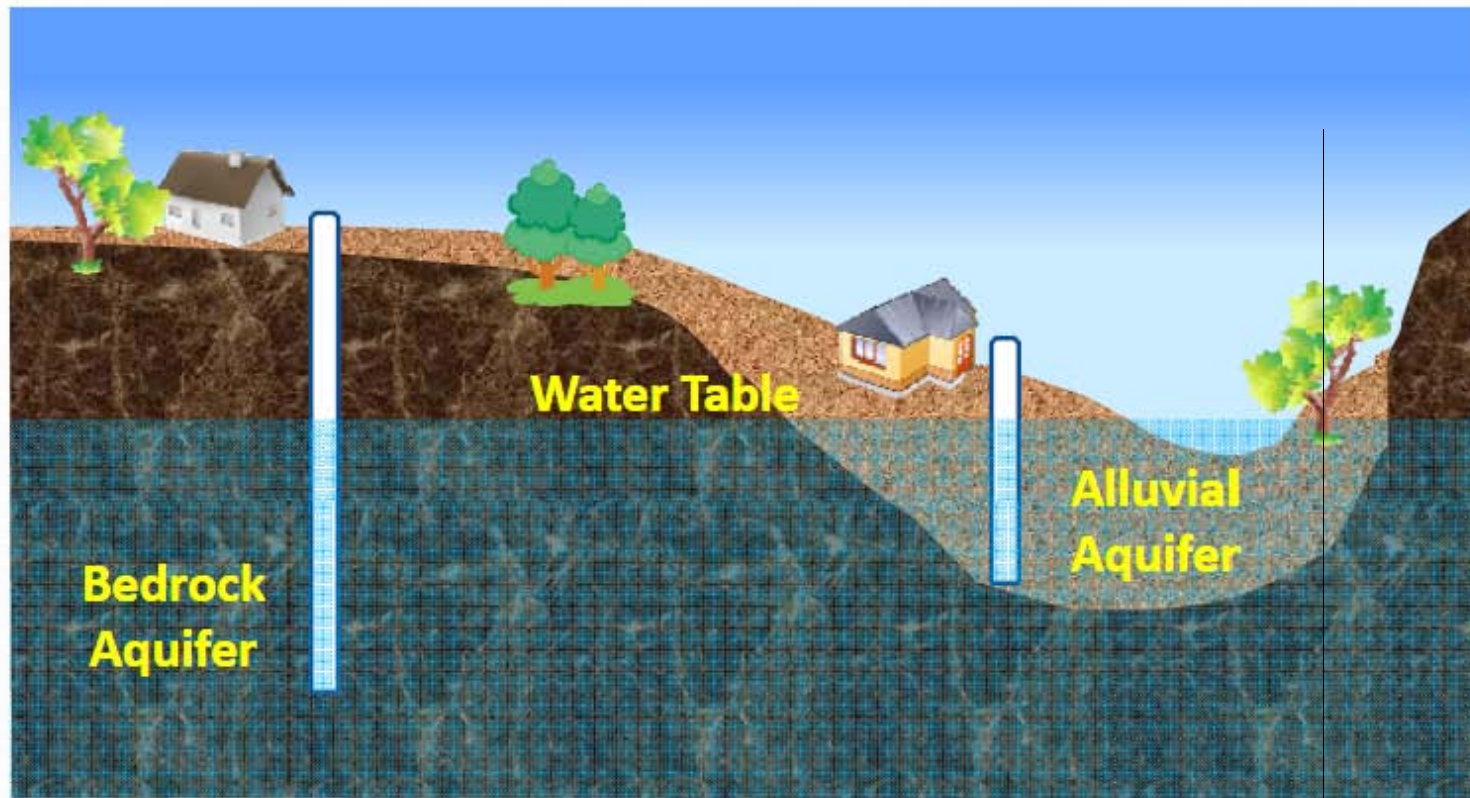
# Reasons for Low Yield

***“My well now goes dry!”***

- Day 1 will be your best yield ever!
- Potential Causes:
  - Tight or Low-Flowing Aquifer
  - Dry Season – Low Water Table
  - Drawdown (over-pumping)
  - Fouling of the Well Screen or Pump - Sediment
  - Pump Damage, Small Size, Bad Installation
  - Poor Well Design or Construction
  - Lifespan: Yield Declines with Age of Water Well



# Common Aquifer Types



# Seasonal Fluctuation or Drought

**Spring/Summer**

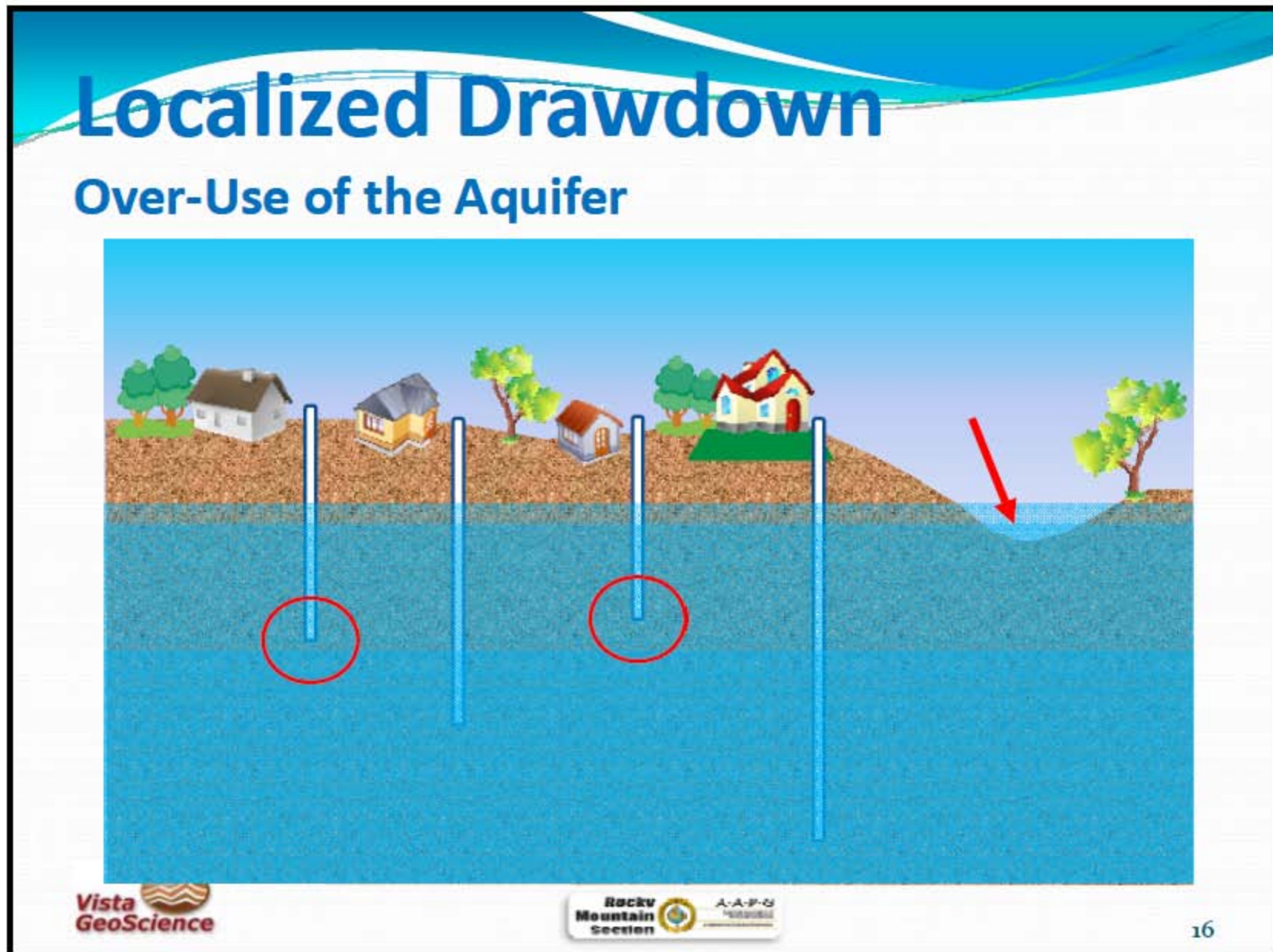
**High water level**

**Fall/Winter**

**Low water level**







# Fouling (blockage) of the Well Screen or Pump

- Silts and Clays
- Encrustation
  - Hard Water
  - Iron
- Corrosion
- Bio-Fouling
  - Bacteria Growth





# Poor Well Design or Construction



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- **Minimum Construction Requirements & Rules**

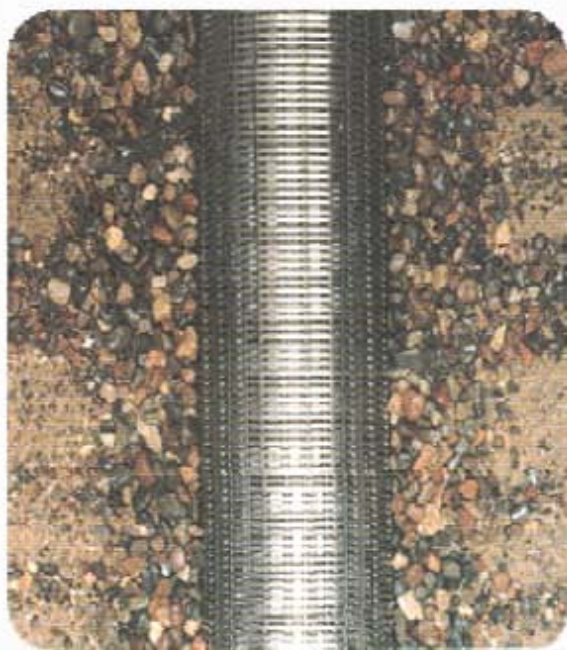
– Good Enough?

- Maybe Not.....
  - Sand/Gravel Filter or Open Bore?
  - Post-drilling well cleaning?
  - Adequate Bore-Hole Diameter & Depth?
  - Is the casing too small or too big?
  - Well Casing Size & Screen Type?
  - Pump Size & Location?

Rocky  
Mountain  
Section



# Lifespan of a Water Well



**Years to decades based on:**

- The Geology/Environment
- Well Design/Construction
- Maintenance
- Normal Corrosion/Wear & Tear
- Water Chemistry
- Amount of Use



# Water Quality Complaints:

- **Odor**



- **Taste**



- **Color & Sediment**



# Causes of Poor Quality

- Dissolved Minerals & Salts
- Excessive Bacteria Activity
- Sediment



Photos Courtesy Anthony Gorody



# Gas Bubbles

*My water fizzes like soda!*

- **Causes**

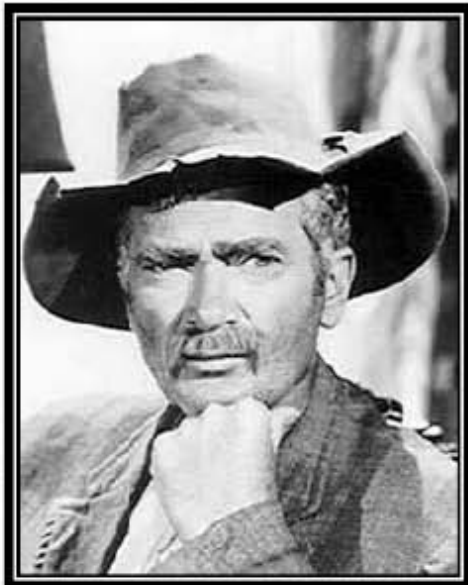
- Dissolved Air or Natural Gas - Methane and/or Carbon Dioxide

- **Sources**

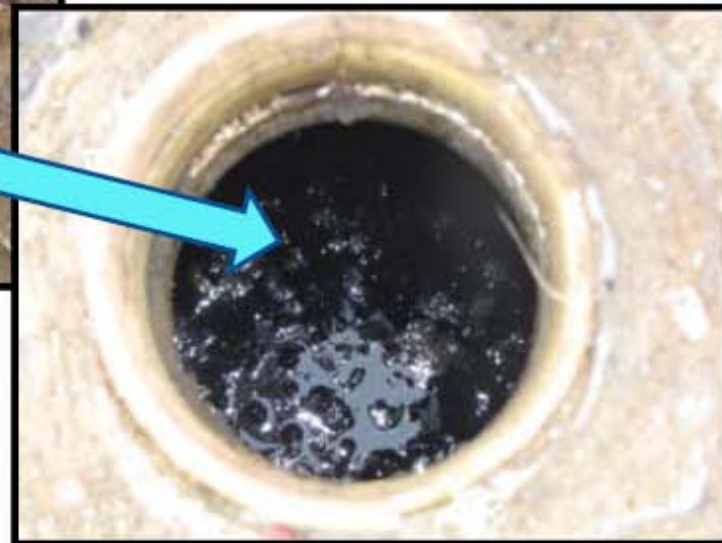
- Natural Bacteria Gas
- Natural Gas - Coal Bed Methane
- Radon – Uranium is potential



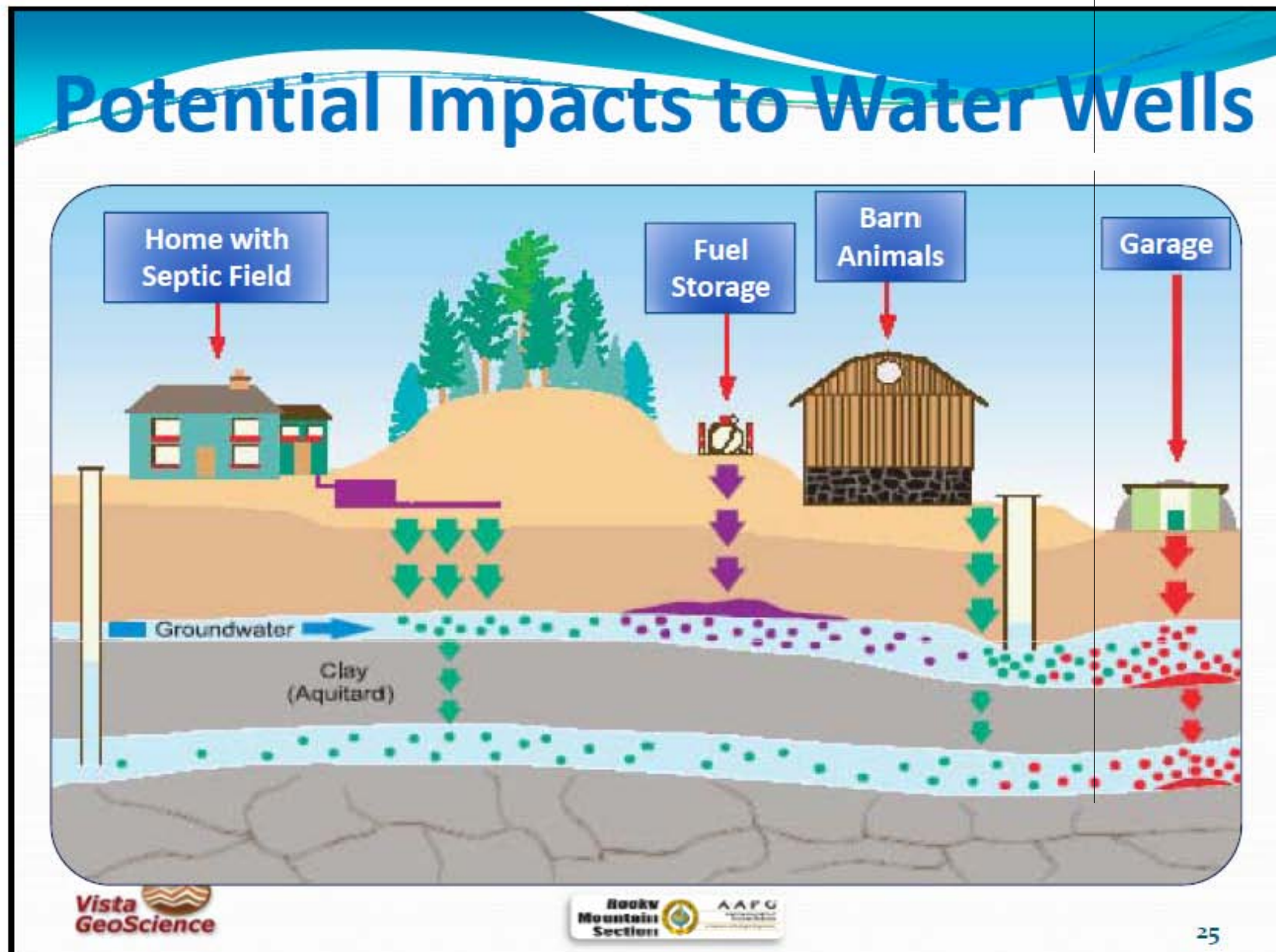
# Natural Seeps Do Exist – Ask Jed!

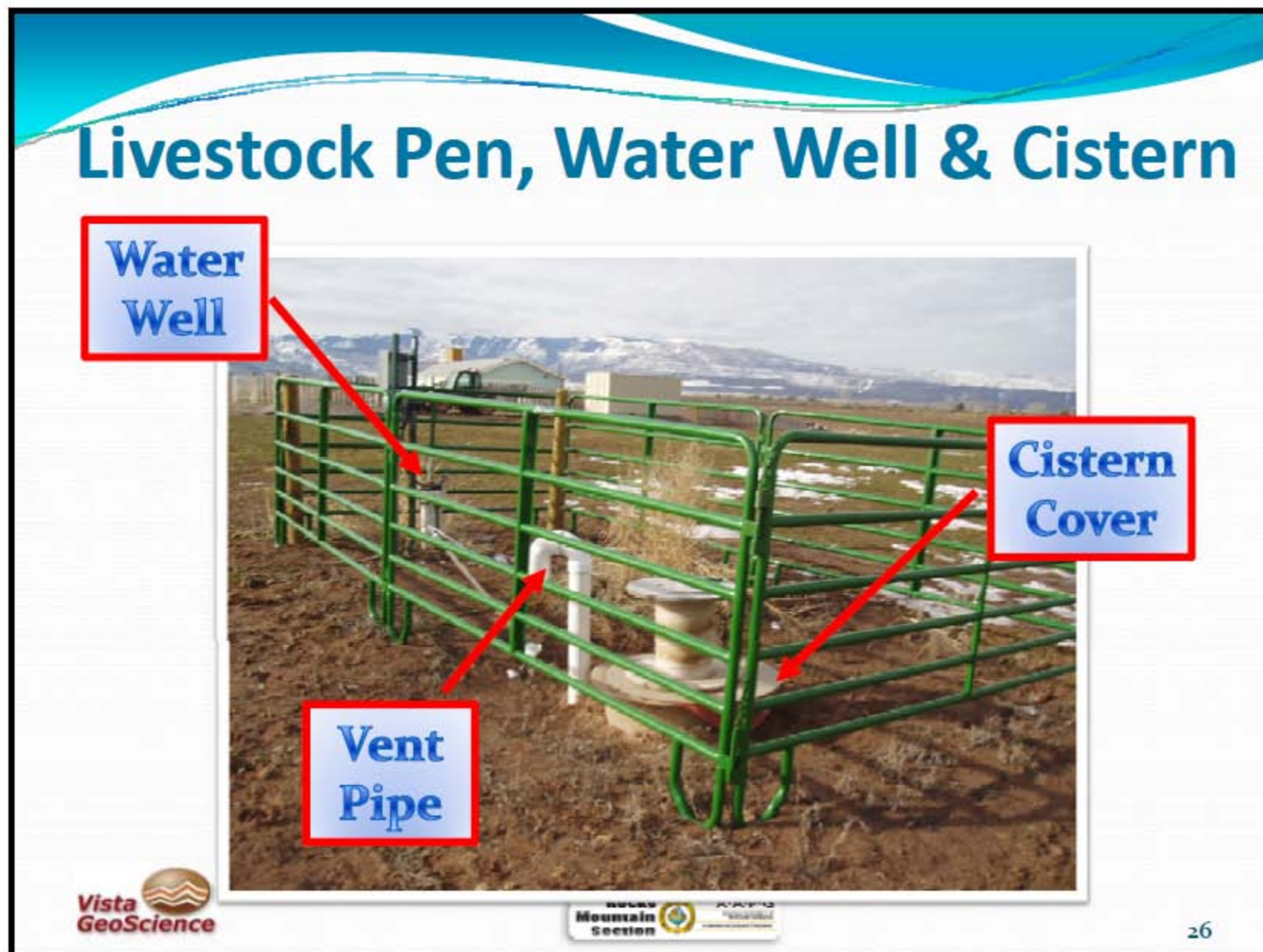


# Case History: Cistern or Septic Tank?











# Preparing for Complaints

- Educate Owners on Your Efforts, Water Well Testing & Maintenance



- Establish a Baseline – Conduct Sampling
- Opportunity for Stakeholder Engagement
- Promote it as a Valuable Community Service





# Establish Baseline Water Quality & Dissolved Gas Parameters

- Fingerprint of Water and Gas
- Major Anions and Cations - Balance
- pH, eH, Conductivity, Temp, DO
- Dissolved Hydrocarbons
  - Methane (*required in CO Rule 608*)
  - $C_1$ - $C_6$  (*also recommended*)
  - BTEX - TPH
- Stable Isotopes of Methane
  - $\delta^{13}C$  and  $\delta D$
  - $C_2+$ ,  $CO_2$  and Water Isotopes

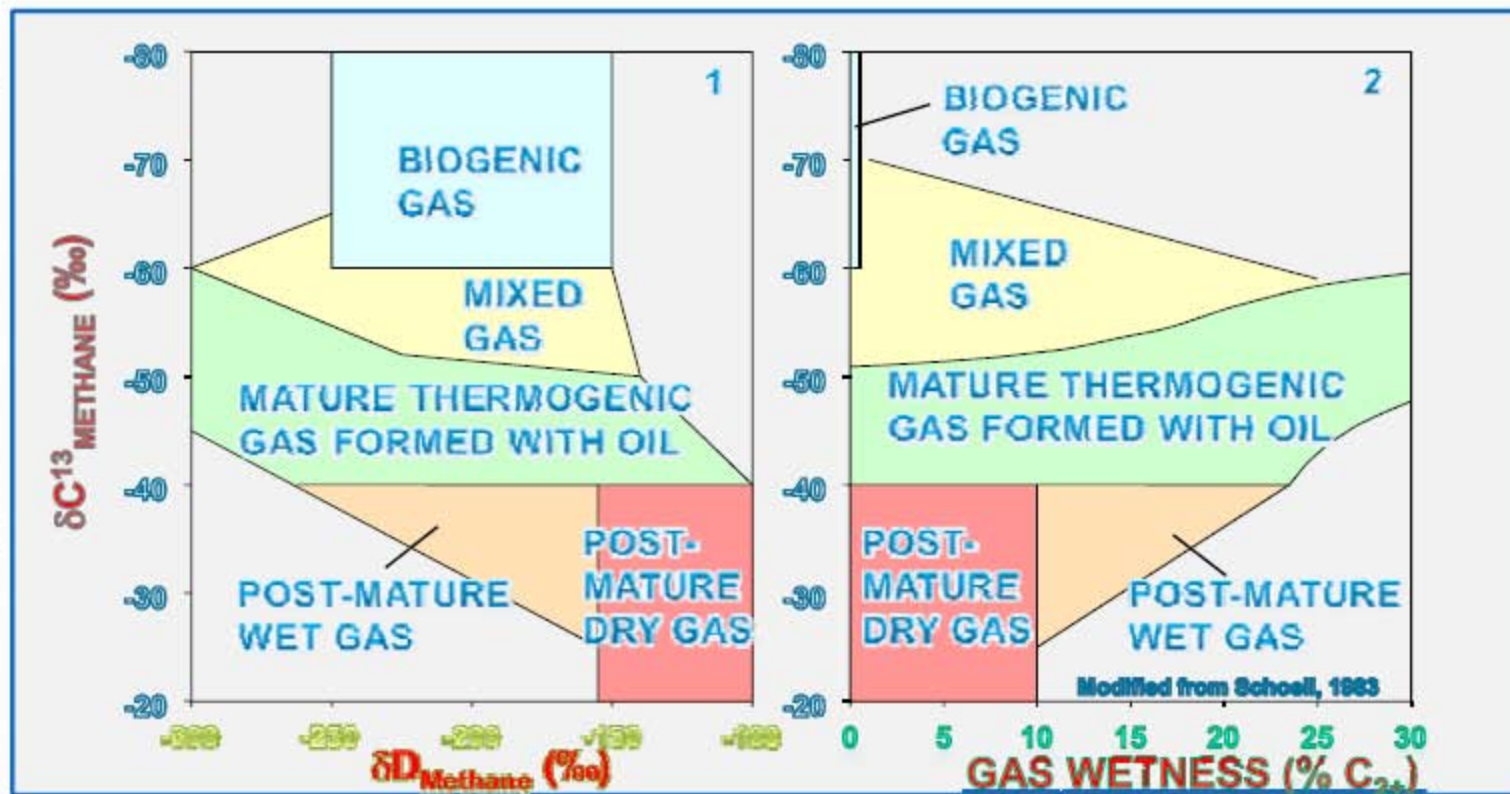


# Establish Baseline Water Quality

- **Bacteria Activity Reaction Test (BART)**
  - Iron Related (IRB)
  - Sulfate Related (SRB)
  - Slime Forming (SLYM)
- Coliform Bacteria
- Nitrates
- Trace Elements

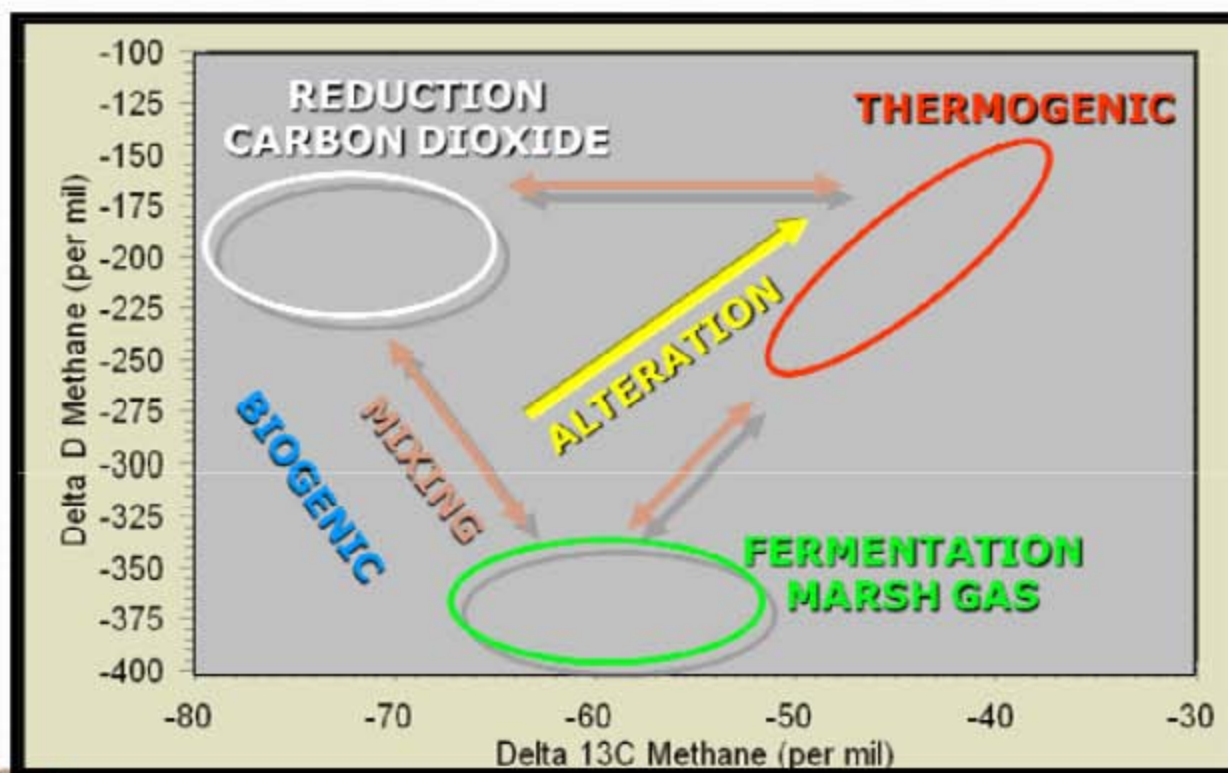


# Composition = Source

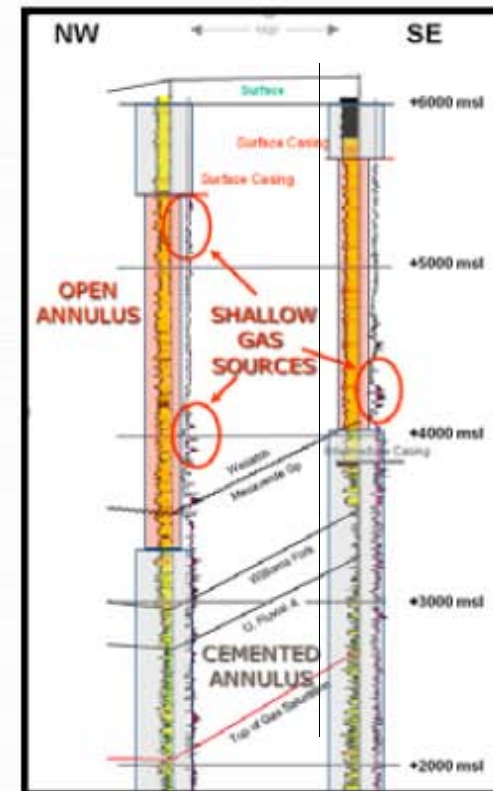




# Mixing & Alteration Create a Complex Picture



- **Old Wells or Open Annulus Can Create Cross-Communication with Aquifers**



# Odd Symptoms May Be Related

## Vibrations from Construction & Hydraulic Fracturing Activities

Distance to well	Depth of well	Maximum PPV (mm/sec)
4.5m	3-14m	0.79
13m	20-26m	0.37
25m	26-29m	0.2
50m	29-32m	0.09
100m	32-38m	0.08
150m	38-44m	0.07
300m	>44m	0.04

[http://www.planning.nsw.gov.au/assessingdev/pdf/171-7-2005\\_assessment\\_report.pdf](http://www.planning.nsw.gov.au/assessingdev/pdf/171-7-2005_assessment_report.pdf)

- Ground motion impacts on water wells:
  - Disturbed bottom sediment
  - Dislodging scale and bacterial slime
  - Temporary increase in suspended material
  - = *Immediate complaint*





# Summary

- **Complaints Happen**
- **Water Well Problems or Contaminants are a Result of:**
  - Lack of Maintenance & Testing (**most common**)
  - Poor Construction, Poor Aquifer or Lifespan of a Well
  - Historic Drilling or Mining Activities
  - Natural Migration or Seepage
  - New Releases, Casing Leaks, Spills (**least common**)
- **A Proper Baseline Sampling & Monitoring Program can:**
  - Educate Stakeholders
  - Establishes Pre-Drill Baseline Conditions
  - Be an Effective Approach to Risk Mitigation





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**Thanks**

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