Groundwater Quality in Western Canyon County

Presented on behalf of Van Slyke Farms, Inc.
to the
Canyon County Board of Commissioners

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BACKGROUND

- Zoning approval is sought by Van Slyke Farms for a 14-lot residential subdivision.
- At the Canyon County Board of Commissioners hearing in May 2025, Shawna Kondo, a neighboring property owner, provided a water quality analysis from her domestic well showing a high concentration arsenic (ten times the drinking water standard).
- The hearing was continued until June 23 to allow applicant Van Slyke Farms to provide additional information regarding local groundwater quality for drinking water purposes.

This presentation will discuss Canyon County groundwater quality, first in general terms and then specifically for the Van Slyke Farms area. Recommendations are provided.

QUALIFICATIONS

I am registered in Idaho as a professional engineer and a professional geologist, and I have worked extensively on groundwater quality issues in Canyon County since 1986. This experience includes:

- Long-term groundwater quality monitoring programs
- Investigation, design, or testing of dozens of public drinking water system water wells in Canyon County that have sought to optimize water quality through careful design.

DISCLAIMER

I am not a geochemist, a toxicologist, or a water treatment expert, but I have worked with experts in these fields for many years.

GROUNDWATER QUALITY CONCERNS IN CANYON COUNTY

Health-based water quality concerns and standards

- Coliform bacteria and E. coli bacteria – zero CFU/ml
- Nitrate – MCL = 10 mg/L
- Arsenic – MCL = 10 µg/L (0.010 mg/L)
- Uranium – MCL = 30 µg/L (0.030 mg/L)
- Fluoride – MCL = 4 mg/L

These contaminants are present in groundwater everywhere in Canyon County in concentrations that vary with depth.

MCL is EPA maximum contaminant limit
mg/l = parts per million (ppm)
µg/L = parts per billion (ppb)

GROUNDWATER QUALITY CONCERNS IN CANYON COUNTY

Aesthetic water quality concerns and secondary (non-enforceable) standards

- Iron - SMCL = 0.300 mg/L (300 µg/L)
- Manganese – SMCL = 0.050 mg/L (50 µg/L)
- Total Dissolved Solids (TDS) - SMCL = 500 mg/L
- Fluoride – SMCL = 2 mg/L
- Odor (typically hydrogen sulfide) – SMCL = 3 TON
- Aluminum - SMCL = 0.20 mg/L
- Hardness – subjective; <100 mg/L is “soft”, >200 mg/L is “hard”
- Iron bacteria, sulfate-reducing bacteria

SMCL is EPA secondary maximum contaminant limit
TON = Threshold Odor Number

GROUNDWATER QUALITY VARIES WITH LOCATION AND DEPTH

- As of 2004, the counties with the highest percentage of Idaho Statewide Monitoring Program wells containing an arsenic concentration above 10 µg/L were Owyhee County (72%), Washington County (50%), Twin Falls County (49%), Payette County (46%), Canyon County (42%) and Gem County (35%)[1].
- Arsenic concentrations may show trends horizontally, whereas uranium concentrations are more spotty[2]. Arsenic and uranium concentrations have consistent trends vertically[3].
- Well owners can construct wells to appropriate depths to avoid specific contaminants

[1]Hagan, E.F. (2004)

[2]Womeldorph, Gus, and Shawn Benner (2018)

[3]Womeldorph, L.A. (2019)

GENERAL PATTERNS OF WATER QUALITY WITH DEPTH

Groundwater chemistry is influenced by oxygen content, recharge sources, soil chemistry, sediment chemistry, and human activities. Common trends in Canyon County are:

- Coliform bacteria and E. coli bacteria are found near or at ground surface – presence indicates a well construction or plumbing problem
- Nitrate – nearly always decreases with depth
- Arsenic and uranium – typically decrease with depth
- Fluoride - increases with depth
- TDS and hardness – typically decrease with depth
- Manganese and sulfide – typically increase with depth
- Iron - difficult to predict, typically shallower than manganese

SOURCES OF CONTAMINANTS

- coliform bacteria – naturally occurring in soils
- E. coli bacteria – mammals (livestock, septic)
- Nitrate – fertilizer, manure, septic
- Arsenic and uranium – natural, mobilized by irrigation[1, 2]
- Fluoride – natural from deep geothermal aquifers
- TDS and hardness – natural, often irrigation influenced
- Manganese, iron, aluminum, and sulfide – natural, may be influenced by irrigation or organic matter

[1]Busbee, M. W., Kocar, B. D., & Benner, S. G. (2009)
[2]Hansen, B. (2011)

GROUNDWATER QUALITY - VAN SLYKE FARMS VICINITY

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Kondo Domestic Well – 1/8 mile to the east

- 272-285 feet deep, 188-foot static water level
- Arsenic = 105 µg/L – ten times 10 µg/L MCL
- Uranium = 35 µg/L – slightly above 30 µg/L MCL
- Nitrate = 7.5 mg/L – nearing 10 mg/L MCL
- Hardness = 375 mg/L – very hard

GROUNDWATER QUALITY - VAN SLYKE FARMS VICINITY

TimberStone Public Drinking Water System Wells – 1/2 mile to the northeast

Initial Investigation 2006

- Poor water quality in data for seven nearby Statewide Program wells. Wells were 63 to 325 feet deep.
  - Arsenic 12 to 65 µg/L
  - TDS 375 to 747 mg/L
  - Iron and manganese low to very high
  - Fluoride moderate
- Two adjacent private wells were sampled (221 and 310 feet deep).
  - High arsenic (79 µg/L and 24 µg/L, respectively)
  - Nitrate and uranium elevated at 221 feet but not detectable at 310 feet

Conclusion from initial investigation – Avoid water-bearing zones above 300 feet due to high arsenic concentrations.

GROUNDWATER QUALITY - VAN SLYKE FARMS VICINITY

TimberStone Public Drinking Water System Wells – 1/2 mile to the northeast

Well drilling and testing - 2006

- Zone tests at 3 depth intervals
  - 310-355 feet
    - Arsenic 0.017 mg/L – not acceptable
    - High manganese
  - 380-425 feet
    - Arsenic <0.005 mg/L - acceptable
    - Sulfide odor, elevated manganese, low TDS
  - 670-715 feet
    - Arsenic 0.006 mg/L – acceptable
    - Sulfide odor, elevated manganese, lower TDS
    - Fluoride 2.28 mg/L (above SMCL but below MCL)

Conclusion – Construct permanent wells to depths below 350 feet.

GROUNDWATER QUALITY - VAN SLYKE FARMS VICINITY

TimberStone Public Drinking Water System Wells – 1/2 mile to the northeast

Well drilling and testing – 2006 (continued)

- Completed TimberStone wells were generally consistent with zone test results
    - Shallow well (385-460 feet) had acceptable arsenic (0.005 µg/L), no detectable uranium or nitrate, high manganese (0.25 mg/L) and moderate iron (0.13 mg/L), moderate hardness (165 mg/L), low fluoride (0.44 mg/L), and elevated aluminum (0.24 mg/L).
    - Deep well (632-705 feet) acceptable arsenic (0.009 µg/L), no detectable uranium or nitrate, no detectable iron or manganese, low hardness (33 mg/L), elevated fluoride (2.1 mg/L) and high aluminum (0.40 mg/L).

Overall Conclusion – The best water quality locally is found below 350 feet depth

WATER TREATMENT OPTIONS

- Depending on well depth, homeowners will find different water chemistries and will need to consider different water treatment or conditioning methods.
- Treatment can be whole-house (point-of-entry) or drinking water tap only (point-of-use), or both, depending on needs.
    - Point-of-entry treatment or conditioning is typical for water conditioning (hardness, iron, manganese, odor) and reduction of some contaminants (arsenic).
    - Point-of-use treatment typical for removal of contaminants (arsenic, nitrate, uranium, fluoride).

CONCLUSIONS

- High arsenic concentrations are common in many areas within Canyon County and Idaho.
- Arsenic in groundwater is from natural sources.
- Groundwater meeting health-based water quality standards (i.e., MCLs) is likely to be found below a depth of 350 feet in the Van Slyke Farms vicinity.
- Home water treatment systems can be used to improve the aesthetic quality of groundwater or to remove contaminants (including arsenic) if present. This is true throughout Canyon County.

RECOMMENDATIONS

- Well depths should consider water quality, with wells tapping zones above approximately 350 feet depth expected to have unhealthy concentrations of some contaminants. Lot buyers should be advised to drill deeper than 350 feet for optimum water quality.
- Wells should be constructed with full-length surface seals to prevent the comingling of aquifer zones.
- Wells should be properly disinfected following drilling and following pump installation/servicing to minimize the spread of bacteria.

RECOMMENDATIONS (continued)

- Following pump installation, well water samples should be collected and analyzed at a state-certified laboratory. At a minimum, analyze for coliform bacteria, nitrate, arsenic, uranium, fluoride, iron, manganese, aluminum, and hardness.
- Well owners should contact reputable water treatment vendors to discuss treatment and conditioning options specific to their well water quality.

QUESTIONS?

REFERENCES

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