GILLETTE MADISON WELLFIELD PROJECT
STATUS SUMMARY
FEBRUARY 20, 2018

The study area encompasses the majority of private domestic and stock wells and one springs that WDEQ identified for sampling and is shown on the **"**Study Area" figure **(Click here to view)**.

The WDEQ mobilized water sampling crews to the study area on October 25, 2017. A total of 55 locations were sampled and analyzed for the analytes identified in the Gillette Madison Well Field Private Water Well Sampling List (**Click here to view**). Of the 55 locations, 32 were domestic wells, 12 were identified as domestic/stock wells, 10 were stock wells and one location was a spring. One stock well was only sampled and analyzed for iron reducing bacteria because of fouling that occurred at the well.

The DEQ Water Quality Lab is also conducting fingerprinting to type the acid detected in the low pH wells.

There are two main categories of EPA drinking water standards –

National Primary Drinking Water Regulations (NPDWR or primary standards), which:

- Are legally-enforceable standards that apply to public water systems
- Protect drinking water quality by limiting the levels of specific contaminants that can adversely affect public health and are known or anticipated to occur in water from public water systems.
- Take the form of maximum contaminant level (MCL) or treatment technique rules

National Secondary Drinking Water Regulations (NPDWR or secondary standards), which

- Are non-enforceable guidelines for contaminants that may cause:
  - cosmetic effects (such as skin or tooth discoloration)
  - aesthetic effects (such as taste, odor, or color) in drinking water
  - technical effects (such as damage to water equipment or reduced treatment effectiveness for other contaminants)

Results

The following constituents exceeded Wyoming Water Quality Rules and Regulations (WQRR), Chapter 8, Table 1 Suitability Standards for domestic or livestock use, EPA Primary Maximum Contaminant Levels (MCLs) which are also known as the EPA National Primary Drinking Water Regulation (NPDWR), EPA secondary Maximum Contaminant Levels (SMCLs) or compound Specific EPA Health Advisory guideline levels (HAs):

pH: WQRRs, Chapter 8 suitability standard is between 6.5 to 8.5 s.u. for domestic and livestock uses. Field testing identified 25 locations outside of this range; 11 were less than 6.5 s.u. (ranging from 3.75 to 6.39) and 14 were greater than 8.5 s.u. (ranging from 8.58 to 9.69). A total of four (4) wells have been identified as having pH less than 4 s.u. pH of the water samples were also measured in the laboratory that identified 12 locations below the suitability range and 10 locations above the range (most were the same locations that were measured in the field and found to be outside pH standards). Please note that the laboratory results are reported outside of recommended holding time. In addition, pH standards are based upon aesthetic or technical effects such as taste, corrosion (low pH), or scaling potential (high pH). Areas in Wyoming may have elevated or low pH levels due to localized geologic conditions.

Total Dissolved Solids (TDS): WQRR, Chapter 8 suitability standard is 500 milligrams per liter (mg/L) for domestic use and 5,000 mg/L for livestock use. Laboratory analytical results identified 44

domestic-domestic/stock wells that exceeded TDS WQRR, Chapter 8 suitability standard for domestic wells with concentrations ranging from 643 to 2,860 mg/L. TDS from nine (9) stock wells was measured in the laboratory and none exceeded the Chapter 8 suitability standard for livestock. Based on a 1984 state-wide groundwater study published by the United States Geological Survey (Report 84-4034), *"water exceeding the recommended maximum TDS concentration (500 mg/L) is commonly used*". Groundwater samples from Crook County ranged in dissolved solids concentrations from about 100 mg/L to about 3,200 mg/L. Only thirty (30) % of groundwater wells sampled in Crook County had dissolved solids concentrations less than 500 mg/L. The results obtained from the DEQ Gillette Madison Wellfield sampling in 2017 are within the range of values reported in the 1984 state-wide groundwater well sampling conducted by the USGS.

Total Coliform was present in 13 sampling locations: seven (7) domestic wells, three (3) stock wells, two (2) domestic/stock wells, and one (1) was a spring. Total coliform bacteria are naturally present in the environment and used as indicators that other, potentially harmful, bacteria may be present. Total coliform bacterial may indicate contamination due to human or animal waste, that the wellhead and/or casing are not secure or are subject to surface water interference (for example, the well casing or wellhead is cracked or leaking), that well equipment is not functioning properly or is improperly installed (for example, lacking backflow prevention), or can be present in a sample due to improper sampling techniques.

Gross Alpha minus Rn & U + Ra 226: WQRRs, Chapter 8 suitability standard is 15 picocurie per liter (pCi/L) for domestic or livestock uses. No domestic-domestic/stock wells exceeded the WQRRs, Chapter 8 suitability standard for Gross Alpha. One stock well exceeded the Gross Alpha suitability standard with a concentration of 29.8 pCi/L. Gross Alpha is a test that is performed to measure the overall radioactivity in drinking water attributable to the radioactive decay of alpha emitting elements. Naturally occurring radioactive elements that release alpha particles are present in a wide range or concentrations in all rocks/soil, air, and water.

Radium 226 and 228: WQRRs, Chapter 8 suitability standard is 5 pCi/L for domestic and livestock uses. Four (4) locations, two (2) domestic and two (2) stock wells, were identified to have Radium 226 + 228 above the WQRR Chapter 8 Radium 226+228 suitability standard with a range of 6.2 to 14.3 pCi/L. The level of Radium 226+228 in groundwater is heavily influenced by geology and the characteristics of the groundwater itself. Some rocks may contain higher levels of uranium, thorium or radium, especially in areas of uranium mining. Groundwater that is acidic (low pH), has a low dissolved oxygen content, high total dissolved solids, and/or moves through rock slowly can dissolve more radium from the parent rock.

Sulfate: WQRRs, Chapter 8 suitability standard for sulfate is 250 mg/L for domestic use and 3,000 for livestock use wells. All but one domestic-domestic/stock wells exceeded the WQRRs, Chapter 8 suitability standard for sulfate with a sulfate concentration range from 332 to 1,720mg/L. No stock wells (including the spring) exceeded WQRRs, Chapter 8 sulfate suitability standard for livestock. Sulfate is a naturally occurring common salt in groundwater, especially in Wyoming due to mineral dissolution. Sulfate levels can vary due to localized geologic conditions, such as the presence of gypsum or sulfide minerals.

Ammonia as Nitrogen: WQRRs, Chapter 8 domestic use suitability standard is 0.5 mg/L, there is no standard for livestock uses. Four (4) domestic-domestic/stock wells exceeded the suitability value. However, the EPA HA guidance value is 30 mg/L and is based on a taste threshold. No domestic-domestic/stock wells exceeded 30 mg/L. The WQRR, Chapter 8 concentration for ammonia was set based on potential effects of ammonia concentrations on chlorination efficiency, and for use as a potential indication of groundwater impacts. Please note that neither standard is a

health-based value. Ammonia may be present in groundwater naturally due to the degradation of naturally occurring organic matter, or it may be introduced due to anthropogenic activities.

Sodium (total): There are currently no suitability standards available for sodium for domestic or livestock uses. However, there is an EPA HA guidance value of 20 mg/L for people on a sodium restricted diet and 30 to 60 mg/L based on a taste threshold. The domestic-domestic/stock wells sampled had concentrations ranging from 41 to 705 mg/L. Sodium is a naturally occurring element in soils and rocks, and is easily dissolved from parent materials. Concentration of sodium in groundwater may vary based on localized geologic and hydrogeologic conditions (amount of sodium in geologic material, how fast water moves through the aquifer).

Aluminum (dissolved and total): Aluminum does not have a WQRR, Chapter 8 suitability standard for domestic use or an EPA PMCL. WQRRs Chapter 8 has a suitability standard of 5 mg/L for livestock use and the EPA set a SMCL of 0.05-0.2 for domestic use based on aesthetics (water color). Two (2) stock wells exceeded the WQRR, Chapter 8 suitability standard for livestock with a range from 30.8 to 94.9 mg/L (total and dissolved). Four (4) domestic/stock wells exceeded the SMCL and WQRRs Chapter 8 for livestock with concentrations of aluminum ranging from 0.091 to 50.9 mg/L. Eight (8) domestic wells exceeded the EPA SMCL with a range from 0.176 to 40.8 mg/L (total and dissolved). Aluminum is the most abundant metal and the third most abundant element in the earth's crust, it is especially prevalent in igneous rocks containing aluminosilicate minerals and sedimentary rocks derived from such sources.

Beryllium (dissolved and total): The PMCL for Beryllium is 0.004 mg/L for domestic-domestic/stock use wells. There is no standard for livestock uses. Beryllium (total and dissolved) exceeded the PMCL at three (3) domestic-domestic/stock wells with concentrations of 0.005 to 0.006 mg/L. Beryllium is a naturally occurring element, present in various concentrations in rocks, oil, coal, soil and volcanic dust. Most beryllium in groundwater is due to the dissolution of beryllium from rocks and soils.

Boron (total): WQRRs, Chapter 8 suitability standard is 0.75 mg/L for domestic use and 5 mg/L for livestock. One domestic/stock well exceeded the WQRR suitability level with a concentration of 0.82 mg/L. Boron is a naturally-occurring element found in rocks, soil, and water, particularly in soils originating from marine sediments and in arid regions

Chromium (dissolved and total): WQRRS, Chapter 8 and the PMCL suitability standard is 0.1 mg/L for domestic use and WQRRs, Chapter 8 suitability standard for livestock use is 0.05 mg/L. No domestic-domestic/stock use wells exceeded standards for domestic use. One stock well exceeded the livestock standard for both total and dissolved chromium with concentrations of 0.077 and 0.067 mg/L, respectively. Chromium is a naturally occurring metallic element found in rocks, soils, plants and animals, and occurs mainly in two forms, trivalent chromium ,and hexavalent chromium, chromium is most commonly found in the trivalent form.

Iron (dissolved and total): WQRRS, Chapter 8 suitability standard and the EPA SMCL is 0.3 mg/L for domestic use. There are no standards for livestock use. Dissolved iron exceeded the suitability standards at 13 domestic-domestic/stock wells with concentrations ranging from 0.355 to 40.4 mg/L. Total iron exceeded the suitability standards at 19 domestic-domestic/stock wells (same wells that exceeded dissolved iron plus an additional 6 wells) with concentrations ranging from 0.31 to 30.074 mg/L. Please note that the suitability standards for iron are not health-based values, but related to taste, and aesthetic effects such as staining of fixtures and laundry. Iron is a naturally occurring metallic element in rocks and soils. The amount of iron in groundwater can vary based on localized geologic and hydrogeologic conditions, such as parent rock and water acidity. In addition, iron concentrations can vary seasonally due to water oxygen levels.

Manganese (dissolved and total): WQRRS, Chapter 8 suitability standard and the EPA SMCL is 0.05 mg/L for domestic use. There are no standards for livestock use. Dissolved manganese exceeded the suitability standard at 19 domestic-domestic/stock wells with concentrations ranging from 0.056 to 0.701 mg/L. Total manganese exceeded the suitability standard at 17 domestic-domestic/stock wells (same wells that exceeded dissolved manganese minus 2 wells) with concentrations ranging from 0.057 to 0.723 mg/L. Please note that the suitability standards for manganese are not health-based values, but related to taste and aesthetic effects such as staining of fixtures and laundry. The amount of manganese in groundwater can vary based on localized geologic and hydrogeologic conditions, such as parent rock and water acidity. In addition, manganese concentrations can vary seasonally due to water oxygen levels.

The following Fact Sheet (**click here**) provides information on possible warnings and/or suggestions regarding exceedances identified above. Questions regarding this document can be directed to Nicole Twing at **nicole.twing@wyo.gov** or 307-777-8275.

Next Steps

An advisory group consisting of an Executive Committee and three (3) working groups has been established to investigate the water quality and quantity concerns of private well owners in the study area. The Executive Committee consists of one (1) representative each from WDEQ, Water Development Office, State Engineers Office, Oil and Gas Conservation Commission, and the City of Gillette. The WDEQ representative is the chairperson of the executive committee. In addition, the advisory group has hired an independent consultant to assist with the data review and investigation.

The structure of the working groups, members of the Executive Committee and Working Groups and the task for the specified working group can be **downloaded here**.

The following are meeting agendas for each working group:

Working Group #1– December 21st, 2017
February 16, 2018

Working Group #2 – January 23, 2018

Working Group #3 – December 22nd, 2017

Working Group #4 – Not yet active

Interested 3rd parties may attend working group and executive committee meetings (including conference calls) and will be provided, during the meeting or conference call, an opportunity for comment prior to working group and executive committee votes on recommendations and, at the discretion of the working group or Executive Committee chairperson, prior to adjournment. Questions regarding this effort can be direct to Lily Barkau at **lily.barkau@wyo.gov** or 307-777-7072.