Executive Summary

Oregon statute's ORS 468B.155 stated objective is "to prevent contamination of Oregon's groundwater resource while striving to conserve and restore this resource and to maintain the high quality of Oregon's groundwater resource for present and future uses." To understand how Oregon is doing in meeting this goal, the Statewide Groundwater Monitoring Program received funding to begin collecting water quality data in 2015.[1] The goals of the program are to establish the status of ambient groundwater conditions, identify emerging groundwater quality problems and inform groundwater users of potential risks from contamination. Groundwater studies are conducted annually with the goal of monitoring Oregon's vulnerable aquifers over a 10-year period. Regional study areas are selected based on previously identified groundwater vulnerabilities, environmental justice concerns, nitrate data collected during real estate transactions as required by statute (ORS 448.271), time elapsed since water quality data were last collected, analysis of potential contamination sources and community interest. All studies include analysis of nitrate, arsenic, bacteria, pesticides and common ions in 60 to 100 wells. Additional analyses are added based on local risk factors and program capacity.

In 2018, the Statewide Groundwater Monitoring Program conducted a groundwater study in Harney County. Objectives of the study were:

1. To collect high-quality data on nitrate, arsenic, coliform bacteria, pesticides, pharmaceutical and personal care products, volatile organic compounds, and contaminants of local concern in groundwater throughout the study area;
2. To identify areas of groundwater contamination related to these parameters;
3. To inform well water users of the results of this study and provide information regarding potential risks to human health;
4. To identify areas needing additional investigation in order to describe the extent of contamination and focus efforts to prevent further contamination.
5. To help establish long-term trending data and describe changes over time.

Outside the scope of this study and report:

- Hydrogeologic characterization of the study area and contamination
- Investigation of the sources of contamination
- Health assessments that are based on an individual's personal risk and exposure.

Study Area Description:
This study is located in Harney County with the cities of Burns and Hines in the north and the small city of Fields in the south. This county is known for its sparse population, agricultural fields dominated by hay, grazing pastures and forested uplands. It has an arid climate and has been severely challenged with drought. A broad portion of the study area consists of the central Harney Basin Valley. This valley is considered a closed basin which means that surface water that enters the basin through snow melt and precipitation can only leave naturally by evaporation or transpiration by plants rather than flowing away toward an ocean. The hydrogeology and groundwater – surface water interactions have been poorly understood. Much of the marginal uplands to the north are a mix of marine sediments, volcanic deposits, and older basin fill, with predominantly volcanic deposits in the south uplands.

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[1] DEQ had a groundwater monitoring program in the 1990s, however funding for groundwater monitoring was decreased in the 2000's to only include the Groundwater Management Areas (GWMAs) and select special studies. The three GWMAs are the Southern Willamette Valley, the Lower Umatilla Basin and the Northern Malheur Basin. The current Statewide Groundwater Monitoring Program is a new planning effort that looks at groundwater quality outside of the GWMAs. The 2013-15 Oregon Legislative Session passed a Policy Option Package funding and directing the DEQ to "monitor groundwater for contaminants of concern, including nitrates and pesticides, in two geographic regions per year. Groundwater quality throughout the state would be characterized over a ten year period. The data and information developed will be used to determine: areas of the state that are especially vulnerable to groundwater contamination; long term trends in groundwater quality; status of ambient groundwater quality; emerging groundwater quality problems; and to inform groundwater users of potential risks from contamination".

There are 28 public water systems served by around 30 groundwater wells in the Harney Basin portion of the study area. These systems serve approximately 5,800 people, in addition to visitors at recreation sites. There are no public water systems that use surface water in this area.

Ninety-one wells were selected for this study. Sixty were sampled in the spring 2018. Twenty-one of those wells were resampled in the fall along with an additional 31 new wells. Resampled wells were used to compare seasonal changes in detections.

Key findings include:

- Of the 258 analytes sampled for, 42 chemicals or water chemistry parameters were detected and measured (Table 1).

- Of the 91 wells sampled in this study 58% had one or more contaminants posing a human health concern by exceeded a maximum contaminant level or other human health-based benchmark for drinking water. These wells tap into the same groundwater system with different hydraulically connected geologic units within Harney County, and are a mix of private drinking water wells, irrigation wells, stock watering wells, and static water level monitoring wells. All of these well owners were notified of their results by DEQ staff and referred to local and state public health resources and Oregon State University Extension Agricultural resources to discuss potential risks.

- Nitrate detections were widespread but not at levels concerning to human health. Fifty-seven out of 91 wells (62%) had detections of nitrate ranging from 0.0065 - 5.48 mg/L. Seven wells had detections elevated above natural background levels of 3 mg/L. There were no wells exceeding the EPA Maximum Contaminant Level (MCL) of 10 mg/L.

- Arsenic was detected in 80% of wells tested, and in some cases at levels concerning to human health. Seventy-eight wells (80%) had detections of arsenic, widespread throughout the county. Detections ranged from 0.25 µg/L to 655 µg/L. Twenty-eight wells (31% of well sampled) exceeded the EPA Maximum Contaminant Level of 10 µg/L.

- Sixteen wells (18%) tested positive for total coliform, and three of those wells also contained *E. coli*. Detections of bacteria in groundwater wells suggest a vulnerability in the well infrastructure that may enable other sources of contamination.

- Relatively few pesticides were detected, and all detections were below applicable human health screening levels. Nine different pesticide related chemicals, derived from seven different parent pesticides, were detected in this study. A total of 137 pesticide related chemicals were analyzed in the collected samples. Eighteen wells (20%) had detections of at least one current use or legacy pesticide, and five wells had two or more pesticides detected. The most commonly detected pesticide was 2,4-D detected in nine wells, followed by atrazine compounds detected in five wells. Dieldrin was the only legacy pesticide detected. No detections of any pesticide related chemicals were close to their applicable health related screening levels[2]. 2,4-D accounted for ten out of the eleven highest pesticides detections measured.

- One pharmaceutical or personal care product, sulfamethoxazole which is a common antibiotic, was detected in one well at low levels that are not a concern for health.

- Out of 68 volatile organic compounds (VOCs) analyzed, five were detected in five different wells. One well sampled in the fall contained four trihalomethane VOCs which are by-products of chlorine

[2] Atrazine and 2,4-D have USEPA Maximum Contaminant Levels (MCL). Deisopropylatrazine, desethylatrazine, and metsulfuron-methyl have USEPA non-regulatory Human Health Benchmarks. Diuron, Prometon and Dieldrin have USGS Health Based Screening Levels. 3,5-Dichlorobenzioc acid (DBA) does not have an available health screening level, but it's parent pesticides 2,6 dichlorobenzamid (BAM) and dichlobenil have non-regulatory Human Health Benchmarks of 32 µg/L and 70 µg/L, respectively. Also see Table 1.

disinfection. Two of those chemicals, bromodichloromethane and bromoform, have non-enforceable EPA Maximum Contaminant Level Goals of zero. The combination of the four trihalomethane concentrations did not exceed the EPA Maximum Contaminant Level of 800 µg/L. Chlorinated tris (TDCP), a compound used as a flame retardant, found in four wells, was the most commonly detected, but did not exceed any applicable health screening levels.

- Boron was detected in 93% of wells, with twenty-three wells exceeding the Longer Term Health Advisory Level for children of 2000 µg/L. Six wells exceeded the Lifetime Health Advisory for adults of 6000 µg/L

- Vanadium was detected in 58% of wells with only one well (118 µg/L) exceeding the EPA Maximum Contaminant Level of 86 µg/L.

- Manganese was detected in 63% of wells sampled. Eight wells had detections above the EPA Lifetime Health Advisory of 300 µg/L.

- Aluminum was detected in 24% of wells sampled. Three wells exceed the Agency for Toxic Substances and Disease Registry (ATSDR) Health-based guidance for chronic exposure in children of 7000 µg/L.

- Selenium, a new analyte to this study, was detected in 4% of wells sampled, none exceeding the EPA Maximum Contaminant Level.

- There was no statistical difference in detected concentrations of nitrate or pesticides between wells sampled in the spring versus the fall, and when comparing shallow (<100ft) and deeper wells, there was no statistical difference between detected concentrations of bacteria, nitrate or pesticides.

The results of this study can be used to inform the people of Oregon about the current condition of the state's groundwater aquifers, which are an increasingly important public natural resource, used publicly and privately at large and small scales. These results can be used to focus outreach and educational activities that encourage private well owners to routinely test wells for nitrate, bacteria, and arsenic, and encourage well protection and maintenance best practices to protect the aquifer. Regular monitoring of wells throughout Harney County and particularly in the basin's central valleys (Harney Valley, Sage Hen Valley, Silver Creek Valley, Warm Springs Valley, Blitzen Valley, and Virginia Valley) should include arsenic, bacteria, nitrate, boron, manganese, aluminum, and vanadium. It is recommended that a network of wells be established and monitored to detect any changes over time. Long-term monitoring of current use pesticides, including atrazines and 2,4-D, as well as volatile organic compounds is encouraged. Continued monitoring could be established locally, or, with continued funding, the Statewide Groundwater Monitoring Program would be able to consider addition of wells within this basin to be included in the agency's long-term monitoring network.