Statewide Groundwater Assessment: 2017

More information

Visit the [water supply information page](http://www.ecology.wa.gov/Water-Shorelines/Water-supply)
http://www.ecology.wa.gov/Water-Shorelines/Water-supply

Special accommodations

To request ADA accommodation including materials in a format for the visually impaired, call Ecology at 360-407-6872 or visit https://ecology.wa.gov/accessibility. People with impaired hearing may call Washington Relay Service at 711. People with speech disability may call TTY at 877-833-6341.

Introduction

Groundwater is one of Washington's most critical natural resources. It supplies about 65 percent of all drinking water and 36 percent of all freshwater uses in the state. Baseflow, the groundwater contribution of water in streams, sustains stream flows all year but is critically important in late summer and fall when reservoirs are low and there is little or no rainfall. Groundwater also sustains fish habitat by providing cool and clean water that maintains a healthy environment for fish and other aquatic life.

Groundwater is water below the ground surface found in water-bearing fractured rock or unconsolidated gravel, sand, or silt, referred to as aquifers. Groundwater is recharged by rain or snow melt draining into aquifers, then flows in a downward sloping direction, often resurfacing in lakes, streams, and rivers. Water levels observed in wells can increase due to high rainfall, excess irrigation water return flows, or surface water exchange. Water level may decrease in response to low rainfall or groundwater pumping.

Measuring water levels at groundwater wells is necessary to assess current conditions, identify emerging problems with water supply, and assist water managers when making decisions about water supply needs and resource protection.

This document evaluates the status of groundwater levels in 250 groundwater wells within six geographic areas of the State. Long-term data provides insights into the past, present, and future changes to groundwater trends and provides the information needed to effectively manage this critical resource.

Groundwater levels are manually measured in a number of wells by the Department of Ecology Water Resources Program once or twice per year. Water level measurements are collected at wells used for irrigation, public water supply, individual homes, or specifically for groundwater monitoring. The first groundwater monitoring event is usually done in March or April, when groundwater is usually at its highest level. The second event typically occurs during September or October, when water levels are likely to be at the lowest point for the year.

Geographic Areas

Six Geographic Areas were evaluated: (1) Northwest, (2) Thurston, (3) Dungeness, (4) Okanogan, (5) Columbia Plateau North (ColPlat-N), (6) Columbia Plateau South (ColPlat-S). These areas were selected based on: (1) how close wells are to each other, (2) which wells are located in similar geologic material, (3) similar climate, and (4) similar primary water use (typically for irrigation or public water supply). These areas are not representative of overall statewide conditions, since when selecting locations to monitor the Water Resources Program has often focused on measuring water levels in areas with known groundwater declines.

The 250 wells that were manually measured within the six areas plus 45 other wells outside these areas are shown on the maps below. Only wells with at least 6 measurements, data spanning 20 years (1997 – 2017), and at least one measurement as recently as 2015, 2016, or 2017, are included in this evaluation. The top map shows well locations that have long-term stable (relatively unchanged) or upward trending (rising) water levels, and the bottom map shows those wells with downward trending (dropping) water levels.

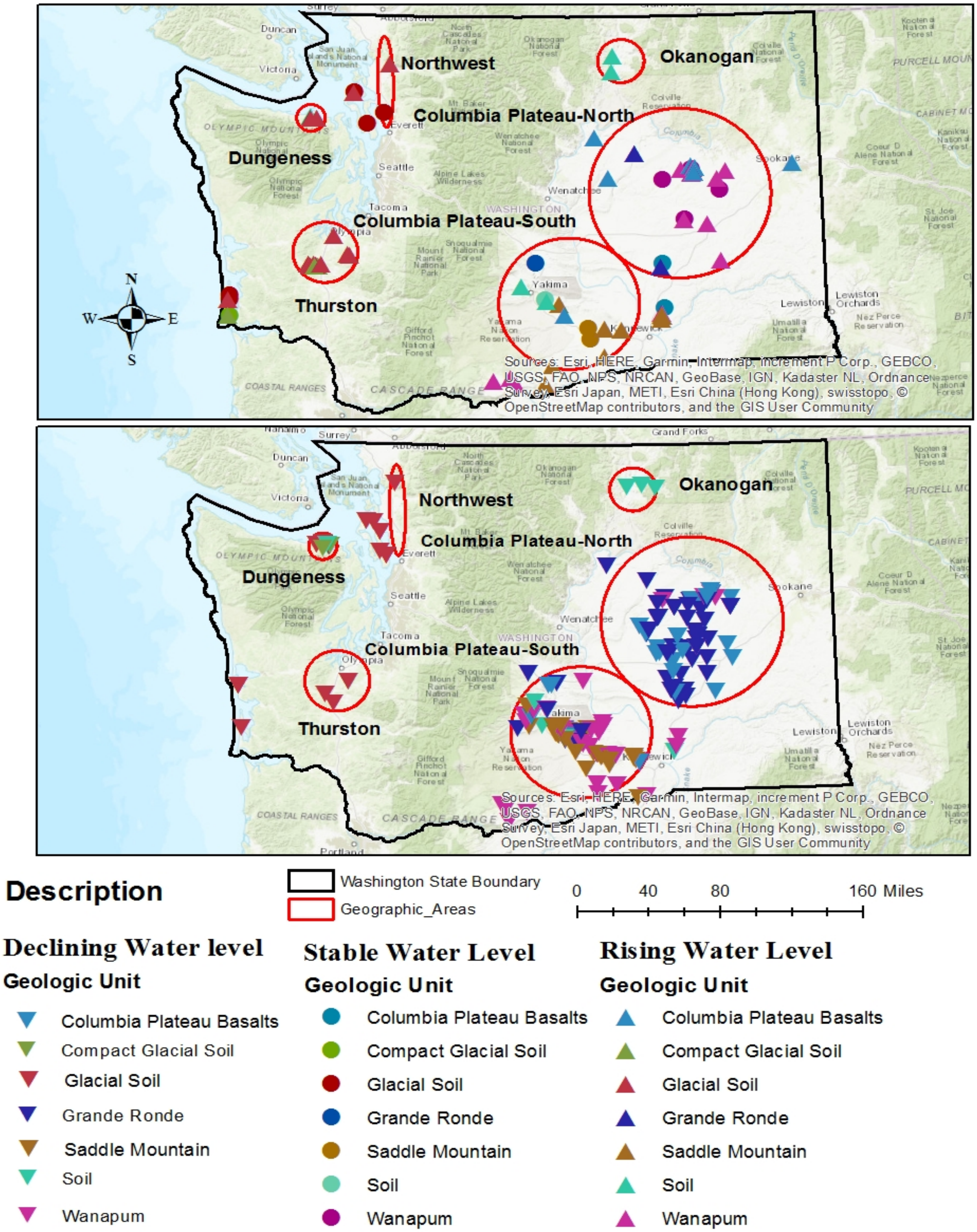
Geologic Units

The wells evaluated tap into water from seven geologic units: (1) Soil, (2) Glacial Soil (GS), (3) Compact Glacial Soil (CGS), (4) Columbia Plateau Basalts (CPB), (5) Saddle Mountain Basalt (SDLM), (6) Wanapum Basalt (WAN), and (7) Grande Ronde Basalt (GDRD). The CPB geologic unit spans two or more of the specific basalt units (SDLM, WAN, GDRD). All of the western Washington wells are completed in unconsolidated glacial deposits (gravel, sand, silt, and clay). Monitored wells in eastern Washington are mainly completed in Columbia Plateau volcanic basalts. Wells completed in soil units are found in both regions. The geologic unit intercepted by each well is represented on the map below by the symbol color.

Climate

Precipitation is the main source of groundwater recharge, and percolation of Columbia River irrigation water is significant in some areas as well. Climate contributes to water loss. The climate on the east side of Washington is much drier and hotter than the climate on the west side of the State. This is primarily because of the East-West separation by the Cascade Mountains, which causes a "Rain Shadow." Less rain or snow in Eastern Washington means there is less water that enters the soil and drains to the aquifers.

Groundwater Well Locations and Trends



Water Levels and Trends

The initial Ecology database query produced 340 groundwater wells monitored by the Water Resources Program with water levels reported one or more years between 2015 and 2017. Of these, 45 wells (13 percent) were removed from the analysis because (1) there were less than 6 water level measurements collected for the well, or (2) the measurements showed anomalous, erratic shifts in the water level data. Forty five wells additional wells were removed from the analysis because they are located outside of the defined geographic areas.

Water level measurements that span at least 20 years (1997-2017) were compiled. The water-level rate of change (feet per year) was then calculated from the slope of a straight "best fit" line through the historical water level data for each well. The table below shows the relative rates of water level change for each of the geographic areas. The minimum is the highest observed rate of decline, the maximum is the highest observe rate of rise, and the median is the rate of water level change where half the values are higher and half the values are lower.

On a long-term basis (20-year record) water levels increased slightly in Thurston; were unchanged in Northwest; and decreased in Okanogan, Dungeness, Columbia Plateau-North, and Columbia Plateau-South. The greatest overall declines occurred in wells located in the ColPlat-N and ColPlat-S Geographic Areas. Other features common to these two areas are: (1) highest number of irrigation wells sampled, (2) geologic units are predominantly deep basalts, and (3) climates tend to be dry and hot. The Thurston area shows a slight overall rise, and the Northwest area is effectively stable. These areas have (1) mostly water supply and monitoring wells, (2) geologic units that are predominantly shallow glacial, and (3) climates that are wet and cool.

Limitations of the Analyses

When selecting where to monitor in Washington, the Water Resources Program often has focused on areas with groundwater declines, so the overall data set is biased toward areas with declining groundwater.

Furthermore, in instances where there were fluctuations, such as two or more time periods with distinctly different trends (e.g. a consistent decline for 10 years, followed by a consistent rise) the analysis method simply fits a single trend line to represent cumulative change over the 20 year period. In cases such as these trend lines can miss more complex histories.

In addition, results presented are potentially subject to uncertainty because of (1) different lengths of record, (2) different numbers of measurements, (3) different times of year when water levels were collected, (4) geologic structure effects, (5) potential nearby withdrawals occurring during measurements, and (6) instrument malfunctions.

Summary

Of all 250 wells for which a water level trend was defined, 75 percent (187 wells) show a declining trend, 18 percent (45 wells) show a rising trend, and 7 percent (18 wells) show a stable trend.

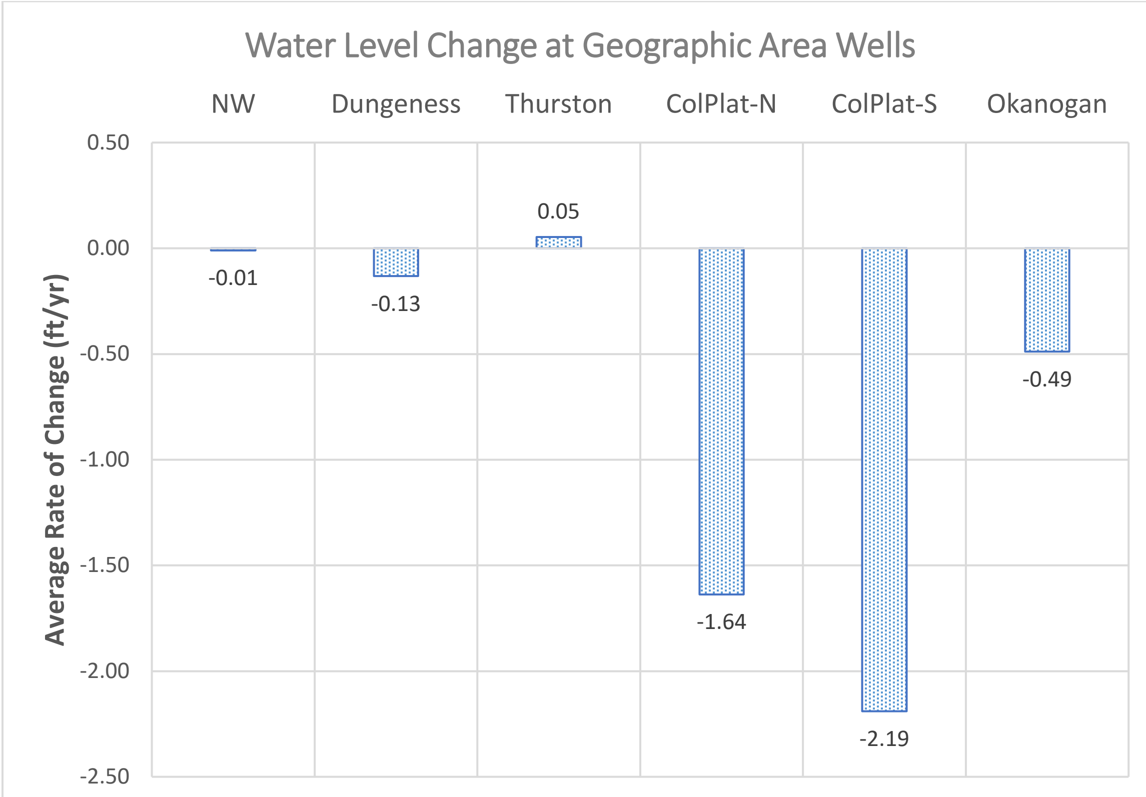


Figure 1 Average water level change

Geographic	NW	Dungeness	Thurston	ColPlat-N	ColPlat-S	Okanogan
Minimum	-0.13	-0.55	-0.80	-9.33	-11.00	-0.95
Maximum	0.10	0.58	1.30	6.67	2.00	-0.05
Average	-0.01	-0.13	0.05	-1.64	-2.19	-0.49
Median	0.00	-0.20	0.00	-0.64	-1.53	-0.35
Number of Wells	3	16	25	98	103	5

Table 1 Data for water level changes by geographic area

Contacts

Central | *Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, and Yakima counties:*
Trevor Hutton
trevor.hutton@ecy.wa.gov
509-454-4240

Eastern | *Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, and Whitman counties:*
Keith Stoffel
keith.stoffel@ecy.wa.gov
509-329-3464

Northwest | *Island, King, Kitsap, San Juan, Skagit and Snohomish, and Whatcom counties:*
Ria Berns
ria.berns@ecy.wa.gov
425-649-7270

Southwest | *Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, and Wahkiakum counties:*
Mike Gallagher
mike.gallagher@ecy.wa.gov
360-407-6058