



Washington State Department of Ecology

Principal Aquifer Water Level Monitoring Network: Final Report November 30, 2024

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Introduction

The National Groundwater Monitoring Network (NGWMN) is a United States Geological Survey (USGS) program established to provide national long-term groundwater quantity and quality data for principal aquifers by using existing federal, state, and local groundwater monitoring programs (ACWI, 2013). Ecology routinely collects groundwater level measurements from a network of wells that support water use permitting activities and planning related to changing groundwater level status and trends.

In September 2022, Ecology entered into a fourth two-year cooperative agreement with the USGS under the NGWMN program. During the previous agreements,

- G16AC00365, Ecology became a new data provider to the NGWMN.
- G18AC00067, Ecology maintained the web service, added wells, performed GPS surveys, performed well connectivity test, and installed 11 new wells.
- G20AC00191, Ecology maintained the web service, added wells, and filled information data gaps.

Specific tasks under agreement G22AC00131 include,

- (2A) maintain web services and keep the well registry up to date
- (2B) provide data and evaluate additional well sites to include in the NGWMN portal, and
- (5) identify and drill 3 new groundwater monitoring wells to provide expanded coverage within the current groundwater monitoring network.

Ecology Groundwater Monitoring Program

Ecology collects groundwater level information from a state-level network of domestic, irrigation, and purpose-built monitoring wells to support water use permitting activities. Ecology uses these data for long-term planning related to groundwater depletion, drought, and the evaluation of ambient groundwater level status and trends. Ecology also conducts groundwater quality monitoring throughout the state for a wide range of projects.

Washington States' annual groundwater water-level monitoring network is operated and maintained by Ecology's Water Resources Program (WRP). All data generated during annual monitoring of a select group of wells are entered and retained in Ecology's Environmental Information Management (EIM) database. Through the Ecology database, water-level and water quality data are then available for transfer from EIM to the NGWMN data portal.

Wells submitted to the NGWMN are a subset of 2,424 wells that have been historically measured. Wells selected for the NGWMN are drawn from those monitoring wells with recent water-level measurements that are submitted to the EIM WRP groundwater

monitoring database. In 2024, water-levels were measured in 215 groundwater wells throughout the state.

In addition to the WRP wells, the Ecology Environmental Assessment Program (EAP) also submits water level data for 14 dedicated groundwater monitoring wells. All 14 wells were drilled and installed with funding from the NGWMN grant program.

During annual monitoring activities for the 2024 calendar year, submissions to the NGWMN included 118 WRP wells and the 14 EAP wells for a total of 132 wells. Well locations from which data is submitted to the NGWMN web-services are shown in Figure 1. These wells consist of irrigation, water supply, and monitoring wells. The maps in this report are partitioned into four zones (NWRO, SWRO, ERO, CRO) that represent Ecology administrative regions.

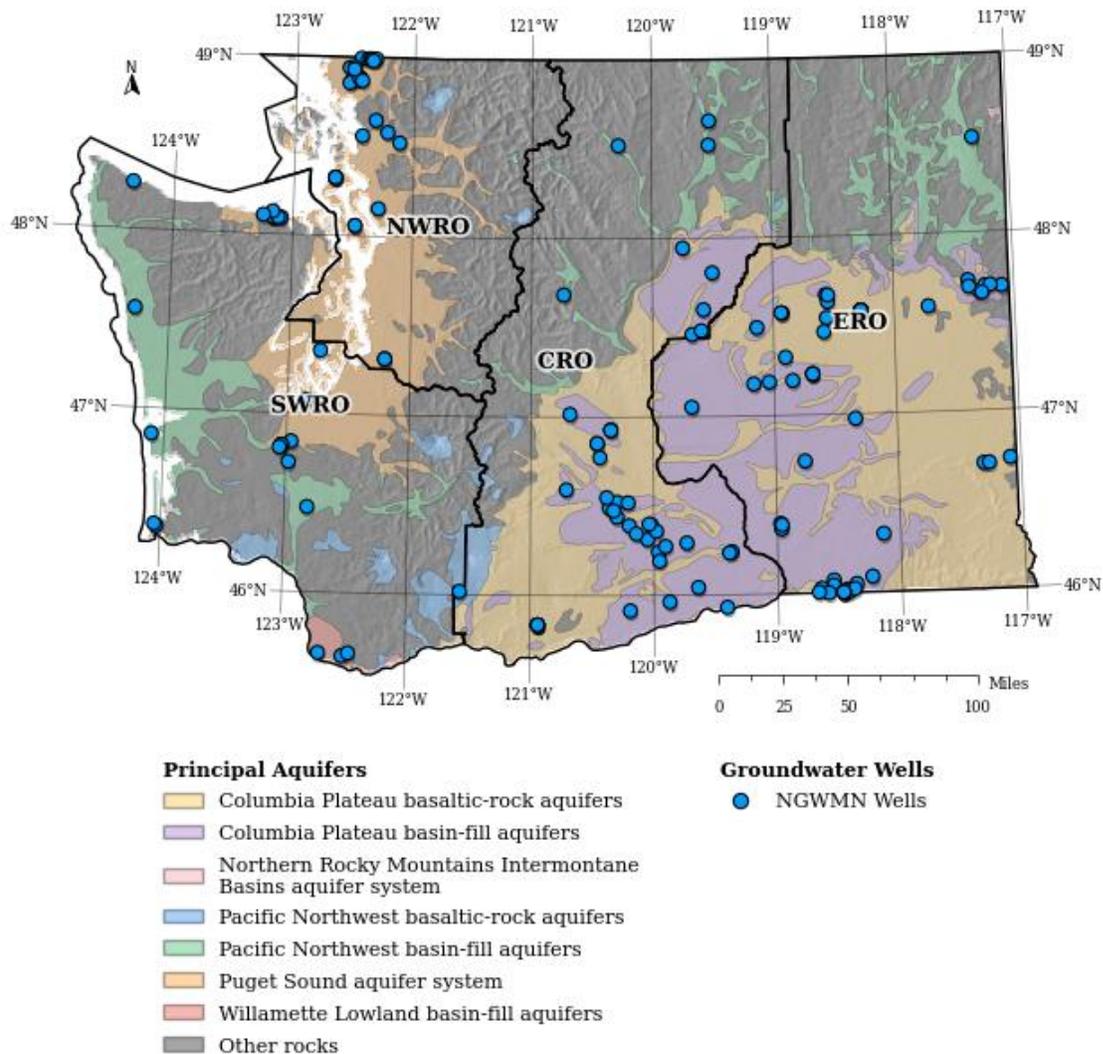


Figure 1. Location of groundwater wells Washington State submits to the NGWMN.

Table 1 shows the number of wells by NGWMN prescribed sub-networks and monitoring categories. Sub-networks and monitoring categories represent the same set of wells that are partitioned based on the subheading. Wells are then further differentiated based on parameters measured that include water-level (WL), water quality (WQ), and both WL and WQ.

Table 1. Wells in NGWMN by sub-network and monitoring category.

	Sub-network			TOTAL	Category	
	Background	Suspected	Documented		Trend	Surveillance
WQ & WL		10	6	16		16
WQ only		10		10		10
WL only	42	41	23	106	47	59
Total count	42	61	29	132	47	85

WQ = Water Quality

WL = Water Level

Table 2 lists the number of wells that are currently submitted to the NGWMN data portal within each of the principal aquifers of Washington State.

The procedure that describes how the WRP program will conduct groundwater monitoring and adhere to quality assurance requirements is provided in the *Integrated Statewide Groundwater Monitoring Strategy* (Culhane, 2017). Additionally, all water-level measurements follow prescribed Ecology Standard Operating Procedures (SOP's). Manual water levels follow EAP052 (Marti, 2023) and submersible pressure transducer deployment follow EAP074 (Sinclair and Pitz, 2019).

In the "Statewide Groundwater Assessment: 2017" (Ecology, 2018), groundwater monitoring schedules, important features that affect groundwater supply, and long-range trends in water-levels for the State are discussed. The information in that document highlights where groundwater supply issues exist and shows the distribution of monitoring wells throughout the State, with an emphasis on geographic regions.

Table 2. List of principal aquifers, locations, and all Washington State wells submitted through 2024.

Principal Aquifer Name	Aquifer Code	Description	Location	Number of Wells
Columbia Plateau basaltic-rock aquifer	N600CMBPLV	Basaltic volcanic rocks	Eastern Washington	50
Columbia Plateau basin-fill aquifer	N100CMBPLB	Unconsolidated to semi-consolidated sand and gravel	Eastern Washington	20
Northern Rocky Mountains Intermontane aquifer system	S100NRMTIB	Unconsolidated to semi-consolidated sand and gravel	Eastern Washington	
Pacific Northwest basin-fill aquifer	N100PCFNWB	Unconsolidated to semi-consolidated sand and gravel	Statewide	22
Pacific Northwest volcanic-rock aquifer	N100PCFNWV	Basaltic volcanic rocks	Western Washington	
Puget Sound aquifer system	S100PGTSND	Unconsolidated to semi-consolidated sand and gravel	Western Washington	40
Willamette Lowlands aquifer system	N100WLMLWD	Unconsolidated to semi-consolidated sand and gravel	Southwest Washington	
Other rocks	N9999OTHER	Sedimentary, volcanic, metamorphic	Statewide	

Grant Activities

Cooperative Agreement G22AC00131 provided funds for the following tasks: (2A) maintain web services and keep the well registry up to date, (2B) provide data and evaluate additional well sites to include in the NGWMN portal, and (5) identify and drill 3 new groundwater monitoring wells to provide expanded coverage within the current groundwater monitoring network.

Task 2A: Maintain web services and keep well registry updated

Ecology continues to check and maintain the EIM-NGWMN web service and data submitted to the NGWMN. The connection between the Ecology EIM database and NGWMN web service is currently functional and serving data.

The web service continues to provide both discrete (manual) measurements, and daily average groundwater levels (time-series) for results that originate from transducers. All water level results are normalized to a consistent datum (NGVD88) and reported as depths to groundwater, in feet below land surface. Data submitted to the NGWMN for actively monitored wells continue to meet quality assurance standards.

The NGWMN internet of water team rolled out a dashboard to monitor data submissions, including the Ecology EIM server to the NGWMN data portal. By using that tool, we were

able to identify a few well sites where data was not being updated at the data portal. We are in the process of resolving these issues.

Examination of select well site submission output to the portal map also resulted in identification of missing data. This discrepancy was not picked up by the NGWMN dashboard and may be an issue on the Ecology side. In response to this problem, Ecology's IT group has developed a dashboard application to screen data submission for omissions before transmission of data to the NGWMN data portal. This effort is in the early stage of development and therefore still needs further review and testing.

Task 2B: Evaluate new well sites for addition to the NGWMN portal

Ecology continues to evaluate wells using the NGWMN criteria for potential inclusion in the water-level and water quality well networks. No new wells were submitted during the first half of this grant (G22AC00131). Three new groundwater monitoring wells were installed as part of the second-year grant activities and were added to the NGWMN as new well submissions.

Figure 2 separates groundwater monitoring organizations by well symbols that will be discussed in this section, they include (1) Ecology Water Resources Program (WRP), Ecology Environmental Assessment Program (EAP), and the United States Geological Survey (USGS).

Activities during this grant involved data collection and discussions of network growth options with Ecology's regional hydrogeologists. Activities focused on building out the network east of the Cascade Mountain range, in the Ecology's eastern (ERO) and central (CRO) regions using existing wells located in the vertically stratified Columbia Plateau Basalt-Rock Aquifer (N600CMBPLV).

Ecology's regional hydrogeologists were asked to consider the current NGWMN well selections and to recommend additional wells that would enhance the network. Criteria for candidate wells are:

- Five or more years of water-level measurements
- Current and continued measurements planned
- Regionally distributed locations
- Vertically distributed monitoring intervals

A multilevel piezometer network (Figure 2) that was jointly funded by Ecology and the USGS during the 1970's is being evaluated to identify wells that can be recovered for potential addition to the NGWMN. A subset of the nested piezometers is still being monitored. However, it is likely that many of the wells that were removed from the network have either deteriorated well conditions, or the water-levels had dropped below the range of Ecology's instrumentation (500 ft e-tape).

Regional Ecology staff recently acquired longer e-tapes (1,000 ft) and plan on revisiting nested piezometers with water levels greater than 500 ft below ground surface that had been removed from active monitoring. Ideally, if piezometers are added back into the

monitoring network the extent of groundwater declines can be assessed over the parts of the Columbia Plateau basalts where the wells are located. This is particularly important since the aquifer is a major source of municipal water supply and provides water supply for heavily irrigated cropland.

Ecology in cooperation with the Washington Department of Natural Resources (DNR) has begun to evaluate DNR owned wells to find additional wells from which to fill gaps in the current statewide groundwater monitoring network. During this grant cycle, DNR conducted an inventory of groundwater wells located on DNR managed land. Figure 3 shows the distribution of DNR wells in relation to the wells that are currently submitted by Ecology to the NGWMN data portal. This figure shows there is a large set of additional wells that may be available to fill in gaps in the statewide network. The next steps are to determine the condition of the wells and the aquifers into which the wells are completed.

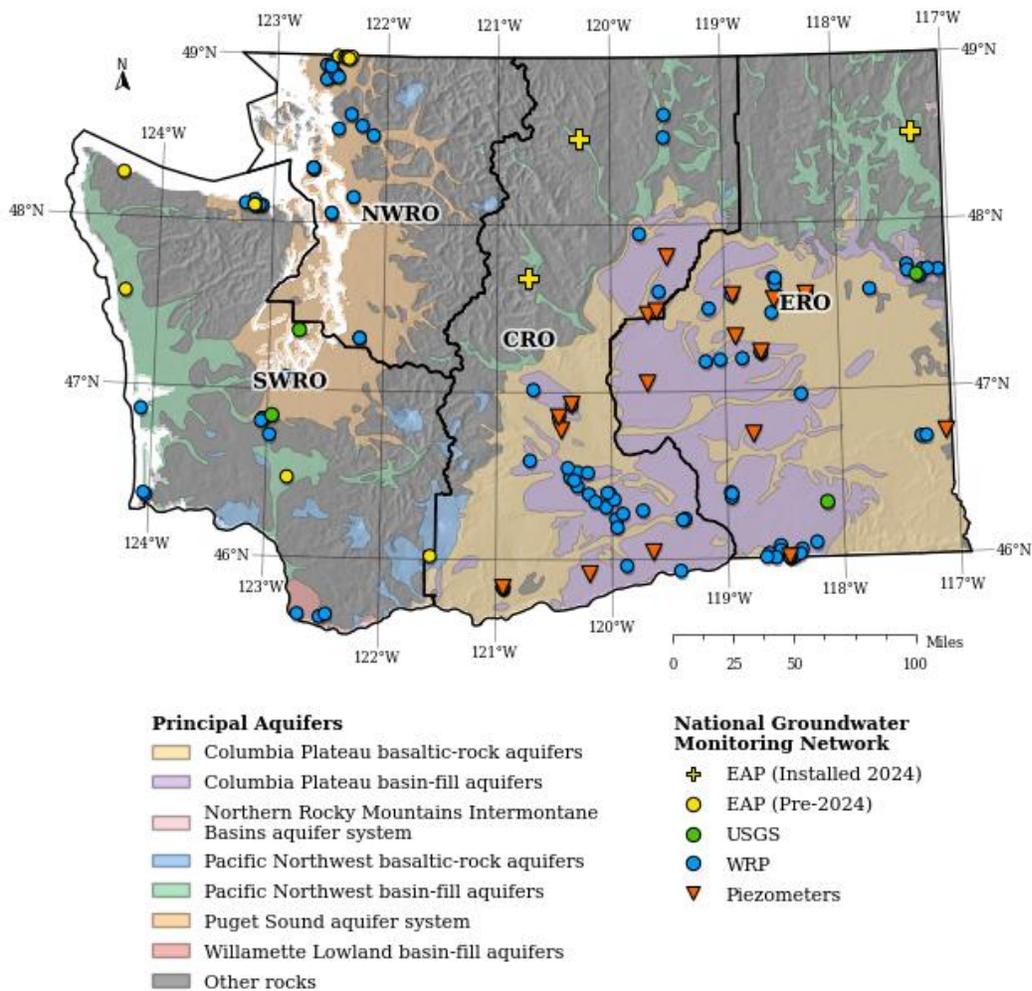


Figure 2. Location of all wells submitted to the NGWMN and the multi-level nested piezometers in the Columbia Plateau basalts.

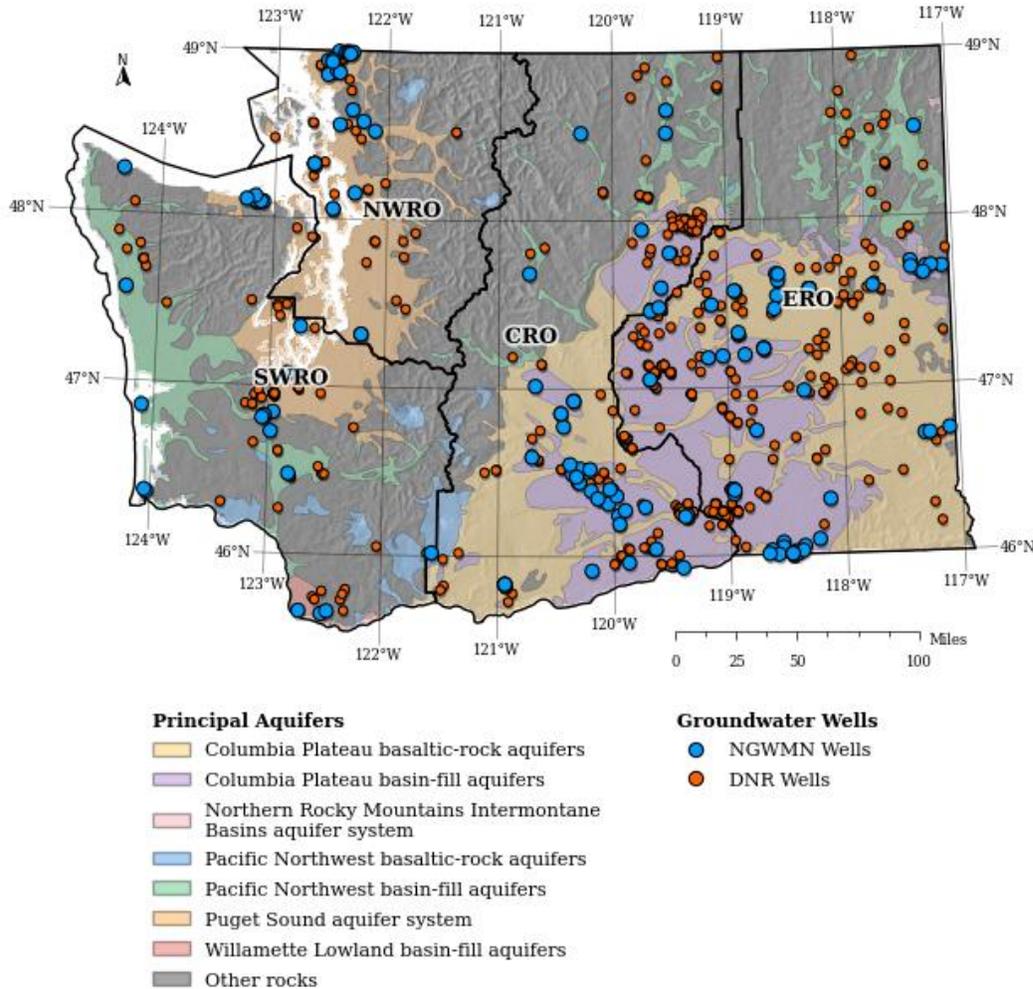


Figure 3. Location of all the Ecology wells submitted to the NGWMN and the statewide DNR well network.

Task 5: Install 3 new monitoring wells in eastern Washington

Ecology identified locations and scheduled drilling during 2024 of three wells in ERO and CRO within the Pacific Northwest Basin Fill (N100PCFNWB) as depicted in Figure 4. Activities during the first year of the grant focused on securing permission to install the three new wells at the selected locations, develop access agreements, confirm drilling contractor availability and costs to install the wells. Additionally, two of the three well sites required a cultural resource survey before drilling. The cultural resource survey required additional contracting and coordination.

Each of the candidate well sites were visited during the first year and well locations were staked. The cultural resource survey and drilling at all well sites were suspended in 2023 due to winter conditions that prevented some required tasks until the spring thaw.

The site name, NGWMN identifier, and Ecology Region for each of the new wells are:

- Winthrop 100139270 CRO
- Chiwaukum 100139271 CRO
- LeClerc 100139272 ERO

The cultural resource survey was conducted in March 2024 at both the LeClerc and Winthrop well locations. The Chiwaukum site was exempted from a cultural resource survey because it was located in a previously developed area.

The Winthrop and Chiwaukum wells were drilled the week of June 16, 2024, using a sonic drill rig. This method was selected because the soils at the Chiwaukum location were known to contain boulder size material. The LeClerc well was drilled the week of July 1, 2024, using a hollow-stem auger rig. The NGWMN network information and well construction information for all three wells is provided in Tables 2 and 3.

All wells are constructed to comply with Washington state well construction and maintenance regulations (WAC 173-160). All wells are above ground completion (3-foot stickup). The well is in a protective steel casing surrounded by three steel bollards. All completed wells are 2-inch diameters schedule 40 PVC and have a 10-foot-long, 10 slot screen section. A clean sand was placed in the annular space around the screen to a height of 1 foot above the top of screen, then bentonite chips are added to a depth of two feet from ground surface. The remainder of the annular space is filled with neat cement to surface and elevated slightly above ground level to permit drainage away from the well.

After the well construction was completed, the well was developed using a submersible pump. Each well was pumped until the discharge water had cleared of silty material. The water-level in each well was then measured and recorded. An absolute transducer (Onset, U20 series transducer/data logger) was installed in the screen interval of each well.

The U20 series data loggers will be replaced by the MX-2001 (Onset), Bluetooth enabled transducers at the next site visit. The transducer was replaced in the LeClerc well in October 2024. The Winthrop and Chiwaukum well transducers will be replaced in the spring.

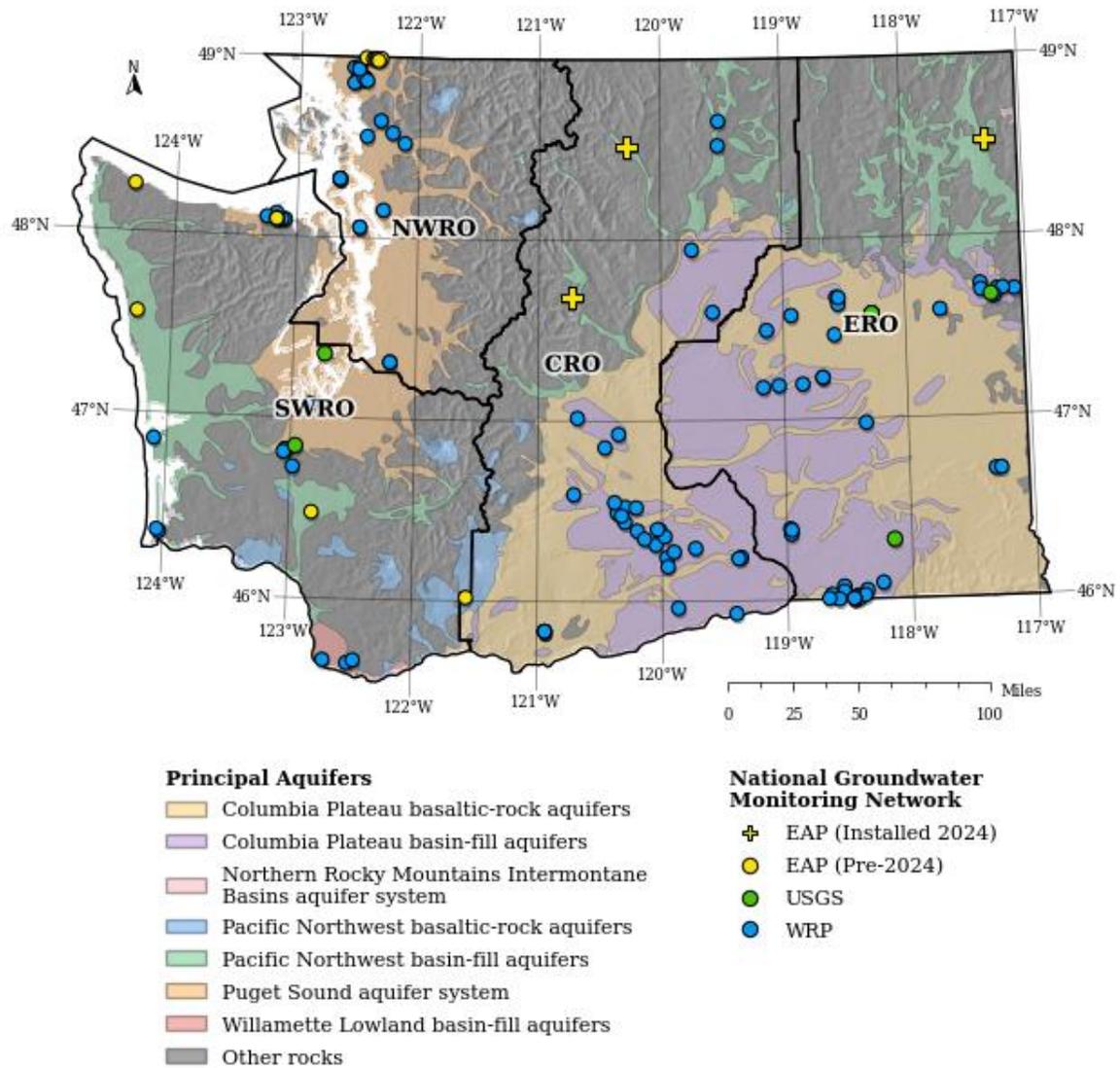


Figure 4. Location of all the Washington statewide groundwater wells submitted by WRP, EAP, and the USGS.

Table 2. Network information for wells added to Ecology NGWMN submissions.

NGWMN ID	Location ID	Latitude	Longitude	Subnetwork	Category	Principal Aquifer
100139270	BPL284	48.52165	-120.28006	Background	Trend	N100PCFNWB
100139271	BPL285	47.68544	-120.73506	Background	Trend	N100PCFNWB
100139272	AGT452	48.53019	-117.29918	Background	Trend	N100PCFNWB

Table 3. Well construction details for wells added to Ecology NGWMN submissions.

NGWMN ID	Date Drilled	Drilling Method	Screen Interval (ft bgs)	Casing Stickup (ft)	Water-level Below Top of Casing (ft)
100139270	6/18/2024	Sonic	20 to 30	+2.85	5.22
100139271	6/19/2024	Sonic	35 to 45	+2.40	32.83
100139272	7/02/2024	Auger	38 to 48	+2.69	27.97

bgs = below ground surface

Summary

The objective of the NGWMN is the implementation of a long-term national groundwater quantity and quality monitoring network (ACWI, 2013).

This is achieved by engaging other organizations who collect groundwater data and establishing cooperative agreements. These data are shared through a web service that transfers the organizations data to a common data portal. The cumulative data from all contributors is made available through a map-based interface.

Ecology entered into a cooperative two-year agreement to provide groundwater data to enhance the NGWMN starting in 2022 and ending in 2024.

Ecology completed the following tasks:

- Continued to maintain web services between the Environmental Information Management system and the NGWMN portal.
- Identified additional well sites to fill data gaps within the current NGWMN well submissions and add wells to the network as available.
- Drilled and installed 3 new purpose-built groundwater monitoring wells to fill gaps in the well network in eastern Washington.
- Completed and submitted the final status report.

Ecology is currently providing data for 132 groundwater wells throughout Washington State. Of the 132 wells, 106 wells provide water level data only, 16 wells provide both water level and water quality data, and 10 wells provide water quality data only.

Tasks that are ongoing to improve and refine the NGWMN submissions include:

- Identify and remove existing wells submitted to the NGWMN that are no longer supporting groundwater monitoring activities or have been found not to satisfy the NGWMN criteria.
- Identify and add new water-level and water quality wells to the network that meet the NGWMN criteria.
- Continue to identify and fill spatial gaps in the State-wide groundwater monitoring network that may be potentially part of the NGWMN.

References

ACWI, 2013, [A National Framework for Groundwater Monitoring in the United States](#). Advisory Committee on Water Information.

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Sinclair and Pitz, 2019, Standard Operating Procedures for the use of Submersible Pressure Transducers during Groundwater Studies. Washington State Department of Ecology, Environmental Assessment Program, EAP074.

WAC 173-160, [Minimum Standards for Construction and Maintenance of wells](#), Washington Administrative Code.