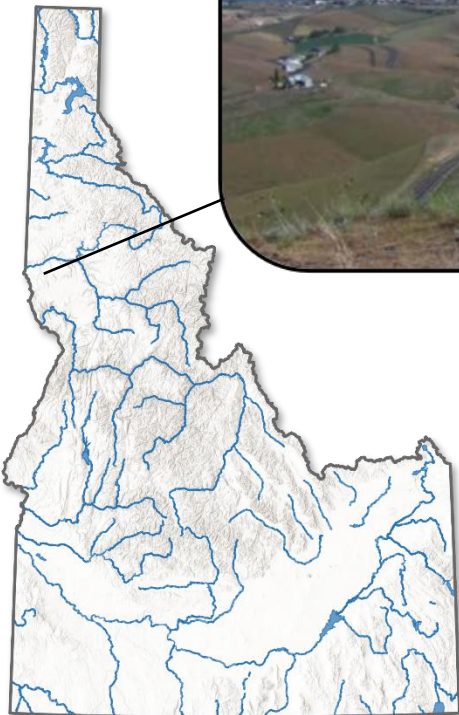


Update on the Groundwater Level Monitoring and Trends for the Lewiston Plateau Ground Water Management Area



Daniel Sturgis
August 10, 2026



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1. Introduction

In 2013, Idaho Department of Water Resources (IDWR) established the Lewiston Plateau Ground Water Management Area (GWMA) in response to observed water level declines in the shallow aquifers. Shallow aquifers include the Saddle Mountains Aquifer and the Wanapum Aquifer. The Lewiston Plateau GWMA replaced the Lindsay Creek GWMA previously established in 1992.

The Lewiston Plateau GWMA makes up a portion of the U.S. Environmental Protection Agency's (EPA) Lewiston Basin Sole Source Aquifer Area. The boundaries of the Lewiston Basin Sole Source Aquifer represent the extent of the Lewiston Basin and are based primarily on geological structures such as faults (EPA, 1988). Figure 1-1 shows the administrative boundaries for the Lewiston Plateau.

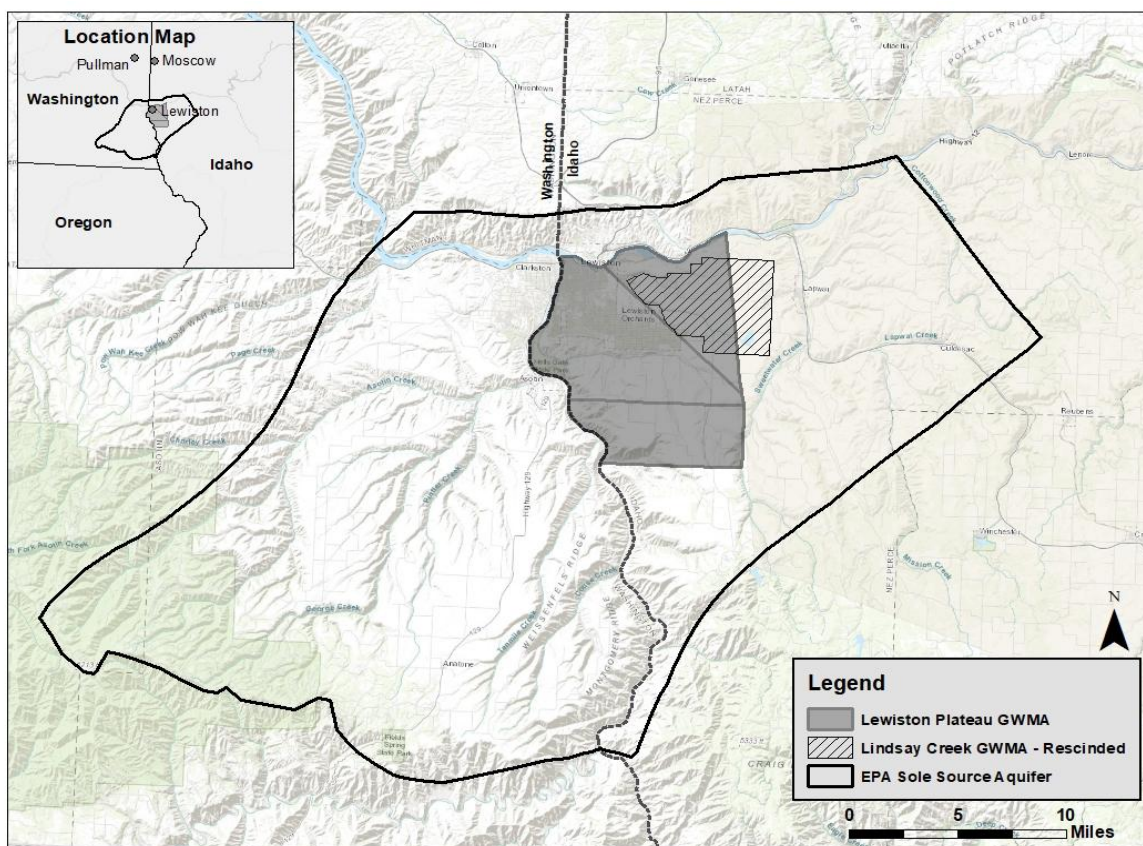


Figure 1-1. State and federal groundwater management for the Lewiston Plateau.

IDWR adopted a groundwater management plan for the Lewiston Plateau GWMA in 2015 (IDWR, 2015). The management plan divides the Lewiston Plateau GWMA into three subareas (Figure 1-2). Management policies for Subarea A and Subarea A-1 are similar and do not allow for new diversions from the Saddle Mountains or Wanapum Aquifers. New wells and water rights in Subareas A and A-1 are required to seek water from the Grande Ronde Regional Aquifer. Management policies for Subarea B allow for new wells to be drilled into the Saddle Mountains or Wanapum Aquifers. The management plan, however, requires any new shallow aquifer well in Subarea B to be 1,000 ft from an existing shallow aquifer well. Detailed descriptions of the aquifers are discussed in section 4 of this report. At the time the Lewiston Plateau GWMA was designated, IDWR monitored groundwater levels at 15 wells in the GWMA. The monitoring network included three wells in the Saddle Mountains Aquifer,

seven wells in the Wanapum Aquifer, and five wells in the Grande Ronde Regional Aquifer. As of 2024, IDWR monitors 68 wells in the Lewiston Plateau GWMA. The monitoring network now includes 13 wells in the Saddle Mountains Aquifer, 18 wells in the Wanapum Aquifer, 36 wells in the Grande Ronde Regional Aquifer, and one well in the unconsolidated sediments adjacent to the Snake River (Figure 1-2).

In addition to increased groundwater level monitoring, IDWR collects and compiles geological data to aid in developing an improved conceptual hydrogeologic model of the Lewiston Plateau. This report provides an update to previous monitoring and assessment efforts (Neely, 2012, 2018; Ralston, 2017) and summarizes recent water level observations from the Lewiston Plateau GWMA monitoring network.

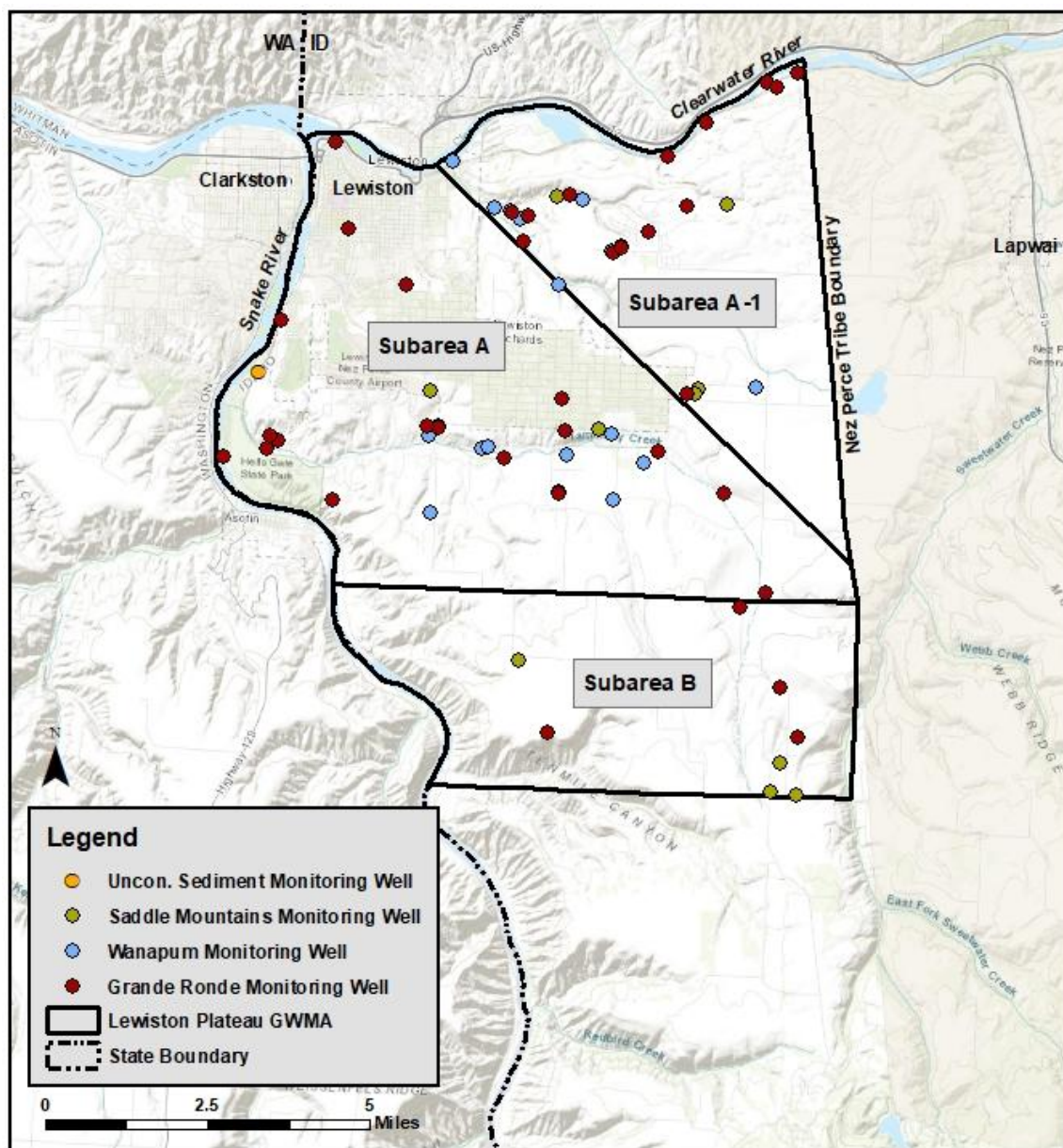


Figure 1-2. Map of the Lewiston Plateau GWMA and groundwater level monitoring network.

2. Climate

2.1 Average Precipitation and Air Temperature

Climate data from the Lewiston Airport (Figure 2-1) shows the Lewiston Plateau experiences warm, dry conditions during the months of July, August, and September. Precipitation typically increases in October and continues through June, with May being the wettest month. On average, the Lewiston Airport receives about 13 inches of precipitation each year with an average annual temperature of about 53 °F. Climate data at the Lewiston Airport, however, does not fully represent the climate of the Lewiston Plateau.

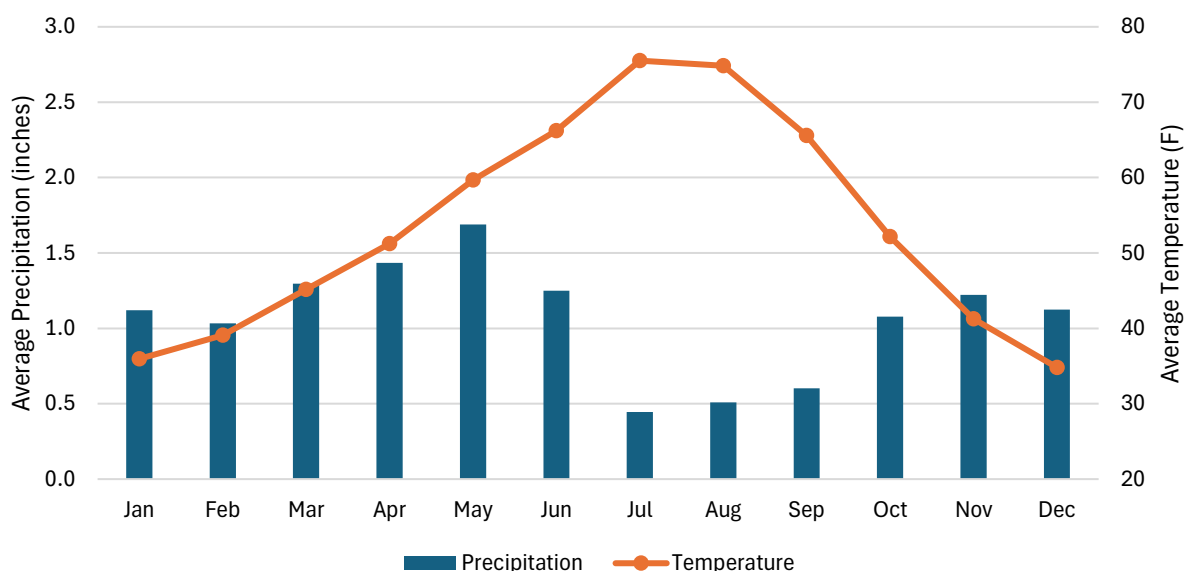


Figure 2-1. Average monthly precipitation and air temperature (1991-2020) for the Lewiston Airport (DRI, 2023).

Average annual air temperatures for the Lewiston Plateau range from approximately 56 °F at lower elevations to 46 °F at higher elevations south of the GWMA (Figure 2-2a). Average annual precipitation can range from approximately 12 inches per year near the confluence of the Snake and Clearwater Rivers, to over 20 inches per year near the southern boundary of the GWMA (Figure 2-2b). Higher elevations located south of the GWMA and near the base of the Craig Mountains can receive over 26 inches per year on average.

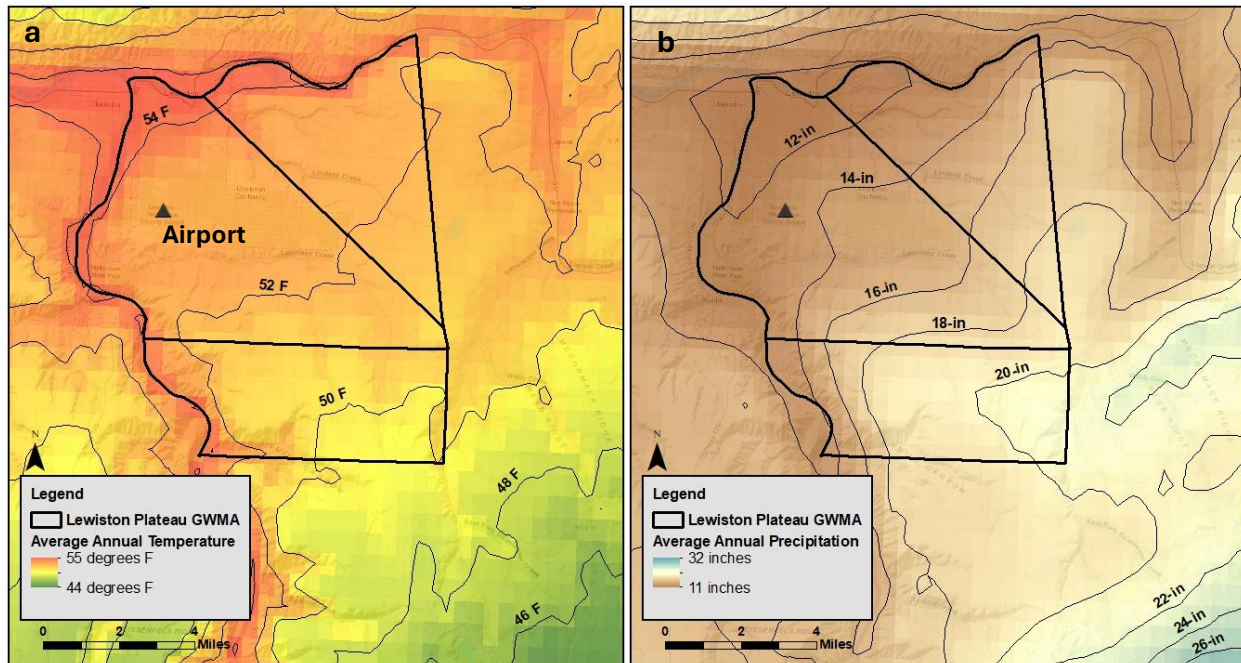


Figure 2-2. (a) Average annual air temperature and (b) average annual precipitation for the Lewiston Plateau (PRISM, 2014).

2.2 Annual Snowfall

Total monthly and annual snowfall is recorded at the Lewiston Airport. The total annual snowfall from 1950 through 2023 is shown in Figure 2-3. The Lewiston Plateau recently experienced high snowfall in 2017 and 2019, with almost 40 inches in 2017 and 34 inches in 2019. Snowfall depths as large as these have not been recorded at the Lewiston Airport since the 1960s.

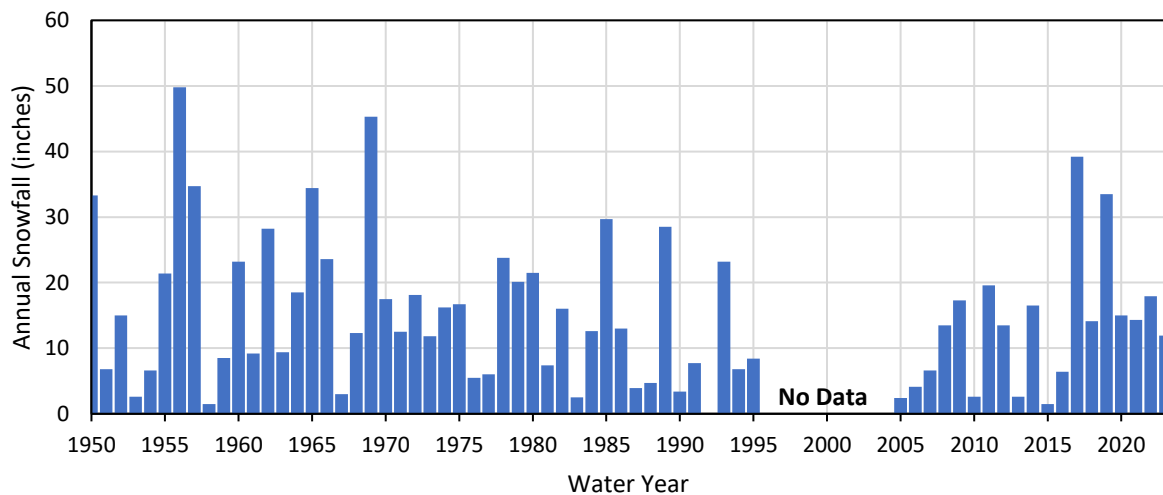


Figure 2-3. Annual cumulative snowfall for the Lewiston Airport from 1950 to 2023 (DRI, 2023).

2.3 Drought Periods

Multiple drought periods have occurred in the Lewiston Plateau since meteorological data have been recorded at the Lewiston Airport. Drought periods can be identified using both the Palmer Drought Severity Index (PDSI) for the Lewiston Plateau region and observed annual precipitation at the Lewiston Airport.

The PDSI method considers precipitation, evapotranspiration, soil moisture, and runoff for a specific region when calculating the PDSI value (Rhee and Carbone, 2007). Figure 2-4(a) shows the monthly PDSI value for the North Central Canyons PDSI Region, which includes all of the Lewiston Plateau. Positive PDSI values indicate wet conditions with excess water availability and negative values indicate dry conditions with deficient water availability (Dai, 2023). The more positive or negative a value, the more extreme the conditions are. PDSI values between -2.0 and +2.0 are considered near normal, whereas values less than or equal to -4.0 and greater than or equal to 4.0 are considered extreme (Dai, 2023).

Another method to identify wet and drought conditions is using annual precipitation to calculate the cumulative departure from the mean (CDM) precipitation (Long and Konrad, 2020). Positive trends in the CDM indicate wet periods, negative trends indicate dry periods, and stable trends indicate average or near average periods. The CDM can be used to correlate changes in groundwater levels to changes in climatic conditions (Long and Konrad, 2020; Smail et. al, 2019). The CDM from precipitation data at the Lewiston Airport is shown in Figure 2-4(b).

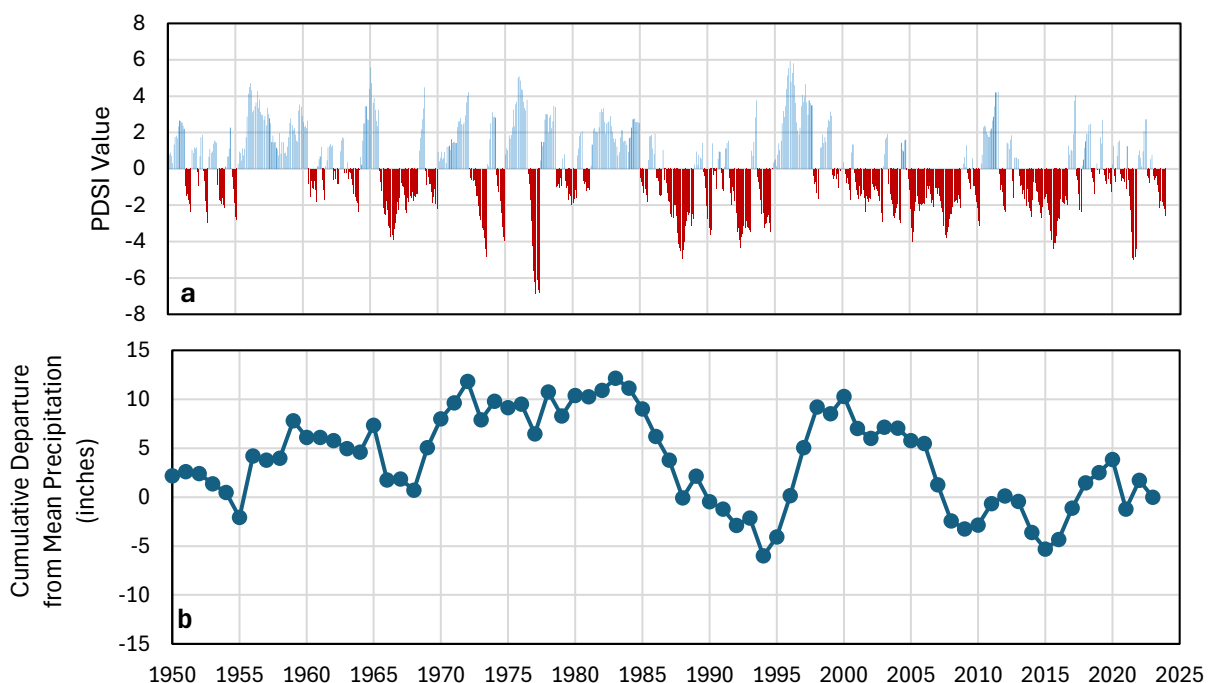


Figure 2-4. (a) PDSI values for the Lewiston Plateau Area. **(b)** Precipitation trends for the Lewiston Plateau.

As observed in Figure 2-4, a long-term drought began in Lewiston in 1985 and lasted through 1994, with brief breaks occurring in 1989 and 1993. IDWR established the Lindsay Creek GWMA in 1992, near the end of this drought period. Two additional drought periods occurred between 2001 to 2015. IDWR established the Lewiston Plateau GWMA in 2013.

3. Local Hydrography

The Lewiston Plateau GWMA is bounded by the Snake River to the west and the Clearwater River to the north. Portions of these rivers in Idaho are within the Lower Granite Dam pool (Figure 3-1). The Lower Granite Dam is located approximately 31 miles downstream of the confluence of the Snake and Clearwater Rivers. The Lower Granite Dam typically maintains a pool elevation of about 740 feet (NAVD88) in the fall and winter months and an elevation of about 736 feet (NAVD88) during the spring and summer months.

Other surface water features of interest adjacent to and east of the GWMA include Lapwai Creek, Sweetwater Creek, Sweetwater Canal, and Mann Lake which is also commonly referred to as Reservoir A (Figure 3-1). Lewiston Orchards Irrigation District diverts surface water from Sweetwater Creek into Sweetwater Canal to fill and store irrigation water in Mann Lake. On average, Lewiston Orchards Irrigation District diverts about 5,400 acre-feet annually into Sweetwater Canal with a loss of about 1,000 to 1,400 acre-feet per year to seepage and evaporation (Bureau of Reclamation, 2024).

The Lewiston Plateau has two primary watersheds within the GWMA boundary. Lindsay Creek watershed in the northern region with Lindsay Creek tributary to the Clearwater River, and Tammany Creek watershed in the southern region with Tammany Creek tributary to the Snake River (Figure 3-1).

The Lindsay Creek watershed is about 14,200 acres in area (IDEQ, 2019) and spans an elevation of 750 feet near the Clearwater River to about 2,020 feet at the upper extent of the watershed. Flows in Lindsay Creek, just above the Clearwater River, range from less than 0.1 cubic feet per second (cfs) during the summer and fall months, to about 2.5 cfs in January (Hortness and Berenbrock, 2001). IDEQ (2019) measured discharge near the mouth of Lindsay Creek in 2018, measuring low flows of about 4 cfs in July and high flows of about 6 cfs to 6.8 cfs during the spring months.

The Tammany Creek watershed has an area of about 24,500 acres (IDEQ, 2010). The elevation of the watershed near the southern border of the GWMA is approximately 2,750 feet with the confluence of Tammany Creek at the Snake River at an elevation of 740 feet. Flows in Tammany Creek near the mouth can range from approximately 0.1 cfs during the summer months to about 4.7 cfs in January (Hortness and Berenbrock, 2001). In 2008, IDEQ measured the flow in Tammany Creek near the mouth to assess total maximum daily loads for various water quality parameters. IDEQ (2010) measured a high flow of 1.33 cfs in February 2008 and low flows of 0.1 cfs to 0.2 cfs in the late summer and fall months of 2008.

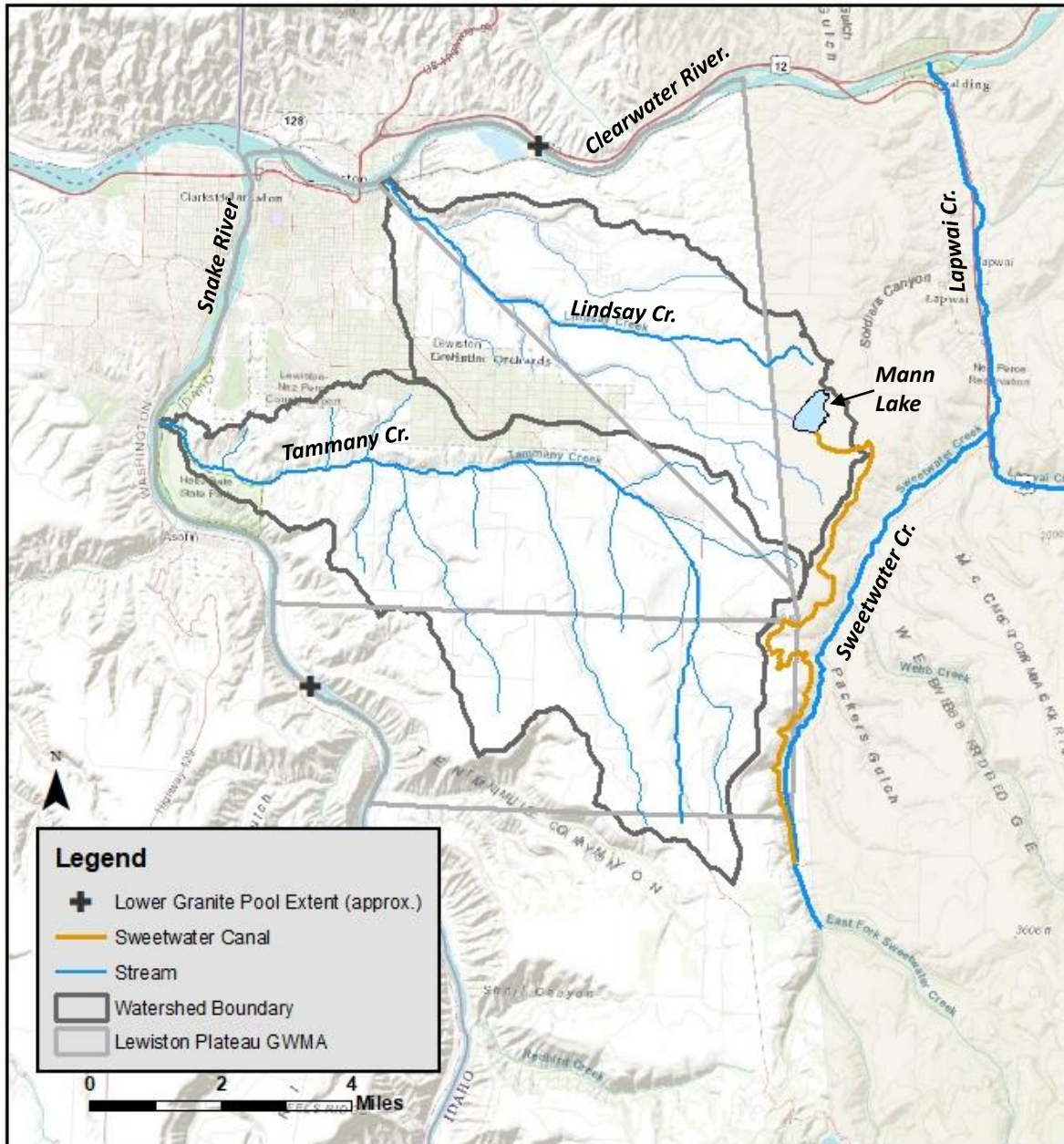


Figure 3-1. Surface water features within and adjacent to the Lewiston Plateau GWMA.

4. Hydrogeological Setting

4.1 General Geology

The general hydrogeological setting for the Lewiston Plateau is described in several previous reports including Cohen (1980), Wyatt et. al (1994), and the EPA Resource Document for the Lewiston Plateau Sole Source Aquifer (1988). Previous descriptions of the hydrogeological setting focus on the three basalt formations in the area – Saddle Mountains Formation, Wanapum Formation, and the Grande Ronde Formation. IDWR has built on these general descriptions to separate the Columbia River Basalts from the formation level to the member level (Table 4-1). This allows for a more detailed hydrogeological assessment of the Lewiston Plateau. Details include identifying the location a specific basalt formation and member intersects surface water, identifying the groundwater producing formation and member at a well, and interpreting the lithology described on well logs. Identification of the Columbia River Basalts at the member level has also allowed for the development of more detailed geological cross-sections used for illustrating the subsurface in the Lewiston Plateau. Detailed geological cross-sections developed by Garwood Geoservices (2019) are provided in Appendix D and E.

Table 4-1. Geological formations and members of the Columbia River Basalts in Idaho (Garwood, 2019).

Formation	Symbol	Member	TiO ₂	MgO	Thickness Range (ft.)
Saddle Mountains	Tlm	Lower Monumental	3	5	0-100
	Tt	Tammany Creek	2.9-3.2	3.6-3.8	0-150
	Tem	Elephant Mountain	4.2	3.7	0-250
	Tpom	Pomona	1.6-2	4.5-7.5	0-400
	Twl	Weissenfels Ridge	2.1-3.1	5-8	0-50
	Taw	Asotin-Wilbur Creek	1.3-2.2	3-9	100-200
Latah	Tlis	Sweetwater Creek	Sediments		20-250
Wanapum	Tpr	Priest Rapids-Lolo	2.8-3.5	3.5-6	30-200
Latah	Tliv	Vantage	Sediments		0-50
Grande Ronde R2	Tgr2mr1	Meyer Ridge	1.7	5	50-100
	Tgr2gc1	Grouse Creek	2-2.2	4	50-75
	Tgr2wr1	Wapshilla Ridge	2.55-2.85	2.7-3.4	175-400
	Tgr2wr2		2.3-2.6	2.8-3.7	
	Tgr2mh1	Mt. Horrible	2.2	3.5	30-100
Grande Ronde N1	Tgn1cc1	China Creek	1.9	4.2	175-200
	Tgn1cc2		1.7	4.7	
	Tgn1fp1	Frye Point	2	4	30-120
	Tgn1dg1	Downey Gulch	2.3	3.4	400?
	Tgn1dg2		2	3.7	

The Lewiston Basin in Idaho and Washington is bounded by geological structures including Cottonwood Fault to the east, Limekiln and Waha Faults to the south, and Wilma and Vista Faults to the north (Garwood and Bush, 2005; Kauffman et. al, 2006). The basin extends into Washington and is bounded by various structural features to the west and southwest (Schuster, 1993). Geological structures in the Lewiston Basin are shown in Figures 4-1 to 4-3 along with the extent of the main Columbia River Basalt Formations that make up the aquifers of the region.

The Saddle Mountains Formation (Figure 4-1) in the Lewiston Plateau GWMA consists of several basalt flow members. Younger members include the Lower Monumental, Tammany Creek, Elephant Mountain, and Pomona which can be found in paleo-stream channels in the area (Kauffman et. al, 2006). The Weissenfels Ridge and Asotin-Wilbur Creek members are present as part of the continuous stratigraphic profile of the Columbia River Basalts in the area, however, the Asotin-Wilbur Creek member is the water-bearing member.

As shown in Figure 4-1, rivers and streams in the Lewiston Plateau have eroded through the Saddle Mountains Formation. In the Lewiston Plateau GWMA, the Saddle Mountains Formation is separated by Tammany Creek forming two separate aquifers. For the report, these are considered the Saddle Mountains South Aquifer and the Saddle Mountains North Aquifer (Figure 4-1). The Saddle Mountains South Aquifer has an area of approximately 22,000 acres. The Saddle Mountains North Aquifer has an area of approximately 29,000 acres.

The Wanapum Formation has also been eroded through by local rivers and streams forming discontinuous sections of the Wanapum Formation (Figure 4-2). In Idaho, the Wanapum Formation consists of the Priest Rapids-Lolo member and does not extend much beyond the GWMA. In the northern areas of the GWMA, the Wanapum Formation can be approximately 250 feet thick, and to the south, the Wanapum Formation is approximately 50 feet thick. Wells completed in Subarea B do not appear to find water in the Wanapum Basalt, possibly because the Wanapum Formation is not exposed at or near the surface in Subarea B and is relatively thin.

The Wanapum Formation outcrops along sections of the Clearwater and Snake Rivers in Idaho. It is also exposed at the surface along the lower reach of Tammany Creek and in select locations in the upper reach of Tammany Creek.

The Grande Ronde Formation is continuous across the Lewiston Basin and outcrops at higher elevations along the southern extent of the basin (Figure 4-3). The Grande Ronde Formation is also exposed along multiple rivers, streams, and drainages in Idaho and Washington. Several previous studies have identified multiple groundwater bearing zones in the Grande Ronde Formation. Cohen (1980) developed the term "Russell Aquifer" to refer to a group of aquifers in the Grande Ronde Formation that are part of a larger groundwater flow system. Ralston and Sprenke (1998) noted multiple aquifers in the Lapwai Valley near the Clearwater River.

Based on detailed geological assessment of the Lewiston Plateau GWMA conducted by IDWR since 2017, water-bearing members, and possibly multiple aquifers, are found in the Wapshilla Ridge, Mt. Horrible, China Creek, and Downey Gulch members. Several municipal wells that are completed to depths greater than 2,000 feet may have found water-bearing zones in the Grande Ronde-R1 formation. These water-bearing members make up the Grande Ronde Regional Aquifer.

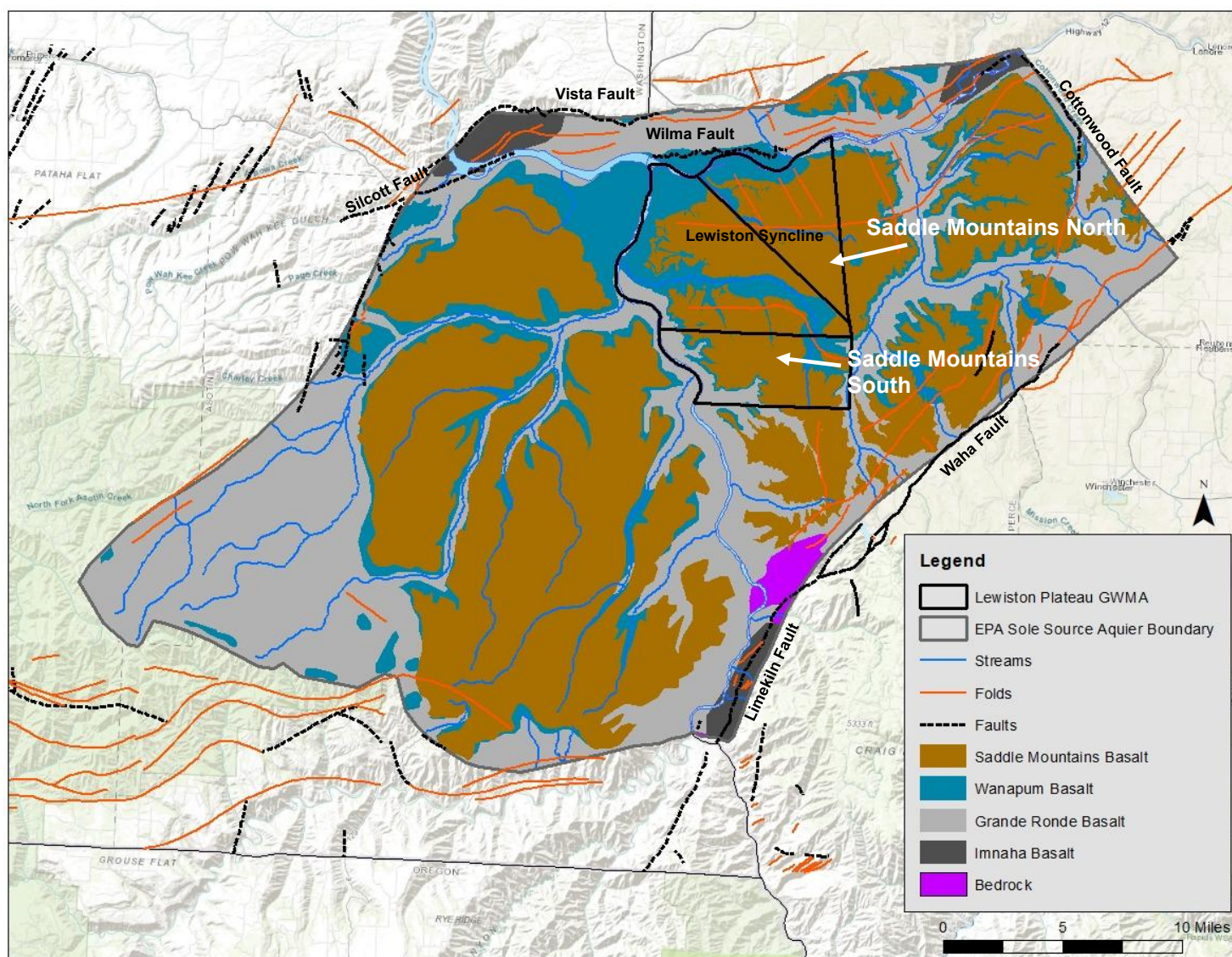


Figure 4-1. Map and extent of the Saddle Mountains Formation in the Lewiston Basin (Kaufman et. al, 2009; WA DNR, 2016).

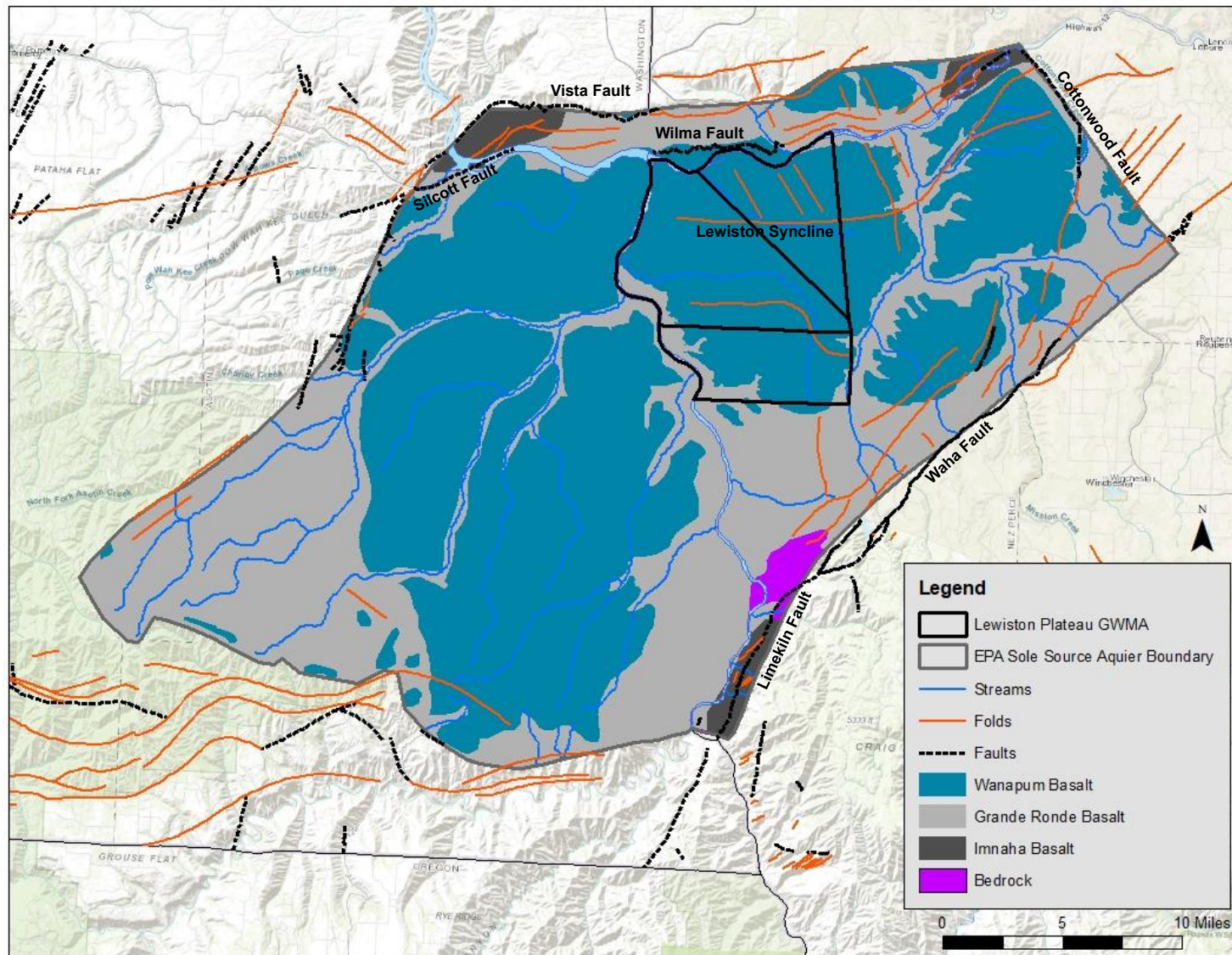


Figure 4-2. Map and extent of the Wanapum Formation in the Lewiston Basin (Kaufman et. al, 2009; WA DNR, 2016).

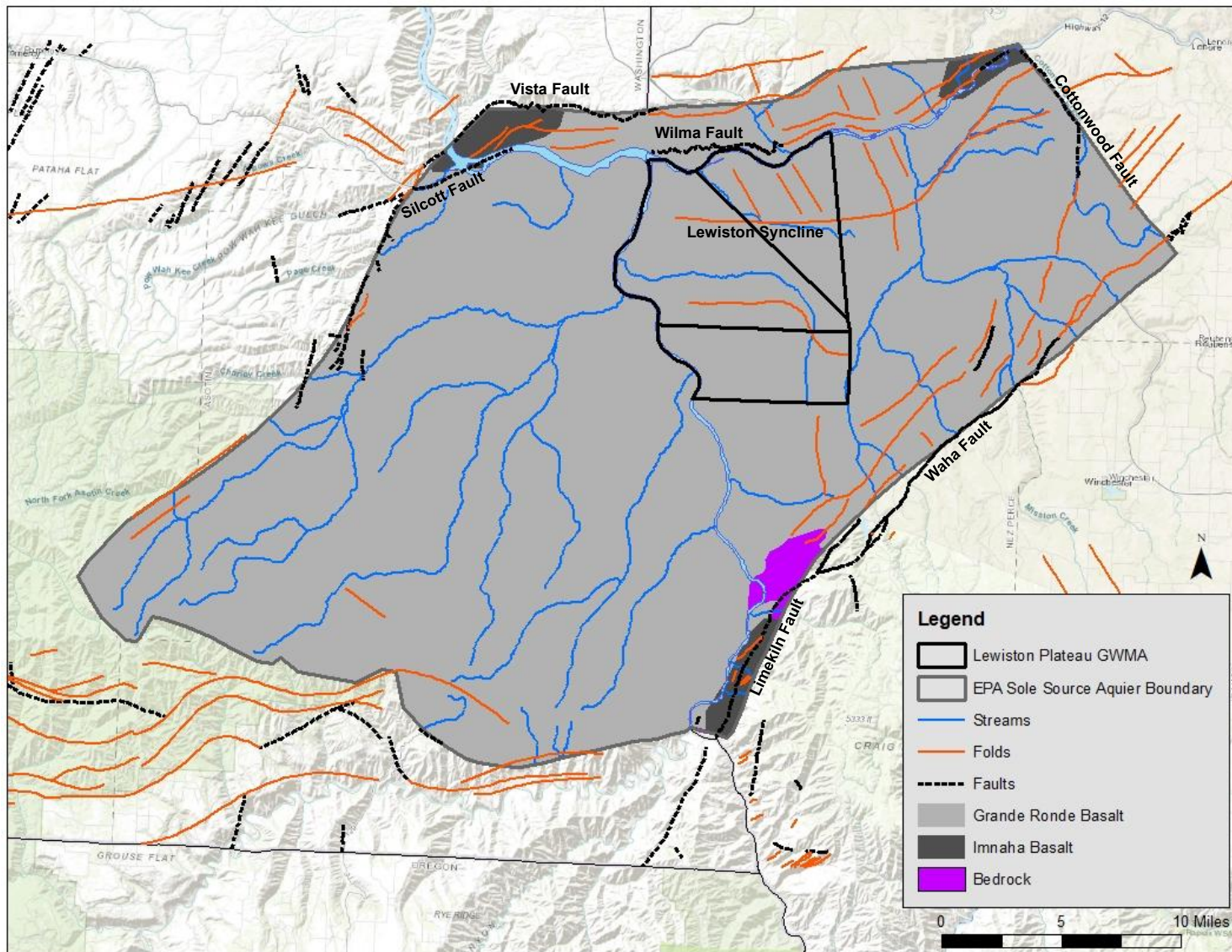


Figure 4-3. Map and extent of the Grande Ronde Formation in the Lewiston Basin (Kaufman et. al, 2009; WA DNR, 2016).

4.2 General Structural Features

The Lewiston Syncline has been mapped to run east to west across the northern portion of the Lewiston Plateau GWMA (Garwood and Bush, 2005). The mapped location of the Lewiston Syncline is shown in Figure 4-1. North of the syncline the Columbia River Basalts generally dip to the south along the Clearwater River. South of the syncline the Columbia River Basalts generally dip to the north-northwest (Garwood and Bush, 2005). However, based on interpolation of geological information from well logs, geological outcrops, and mapped geological contacts, the Lewiston Syncline extends from the eastern boundary of the basin to the west and along Lindsay Creek to the Clearwater River. Elevation contours of the Vantage Interbed and a more accurate location of the Lewiston Syncline is shown in Figure 4-4.

Additionally, the elevation contours for the Vantage Interbed show that a south to north syncline is present along the Snake River. This northerly syncline was first described by Russell (1901), though not mapped by more recent geological maps of the region. For this report, this fold is labeled “Snake River” Syncline. Both synclines appear to terminate at the lowest portion of the basin under the City of Lewiston where the Vantage Interbed is at 500-ft elevation.

Geological features, such as the Lewiston Syncline and the Snake River Syncline, could be affecting the flow of groundwater in the Lewiston Plateau GWMA and groundwater-surface water interactions along the Snake and Clearwater Rivers. Previous groundwater studies in the Columbia Plateau in regions of Washington identified folds as potential barriers to groundwater flow or as providing for preferential flow paths (Barns et. al, 2012). Continued geological assessment of the Lewiston Plateau and mapping of groundwater levels in the area will aid in identifying whether the folds and other geological features within the Lewiston Plateau form preferential flow paths or flow barriers.

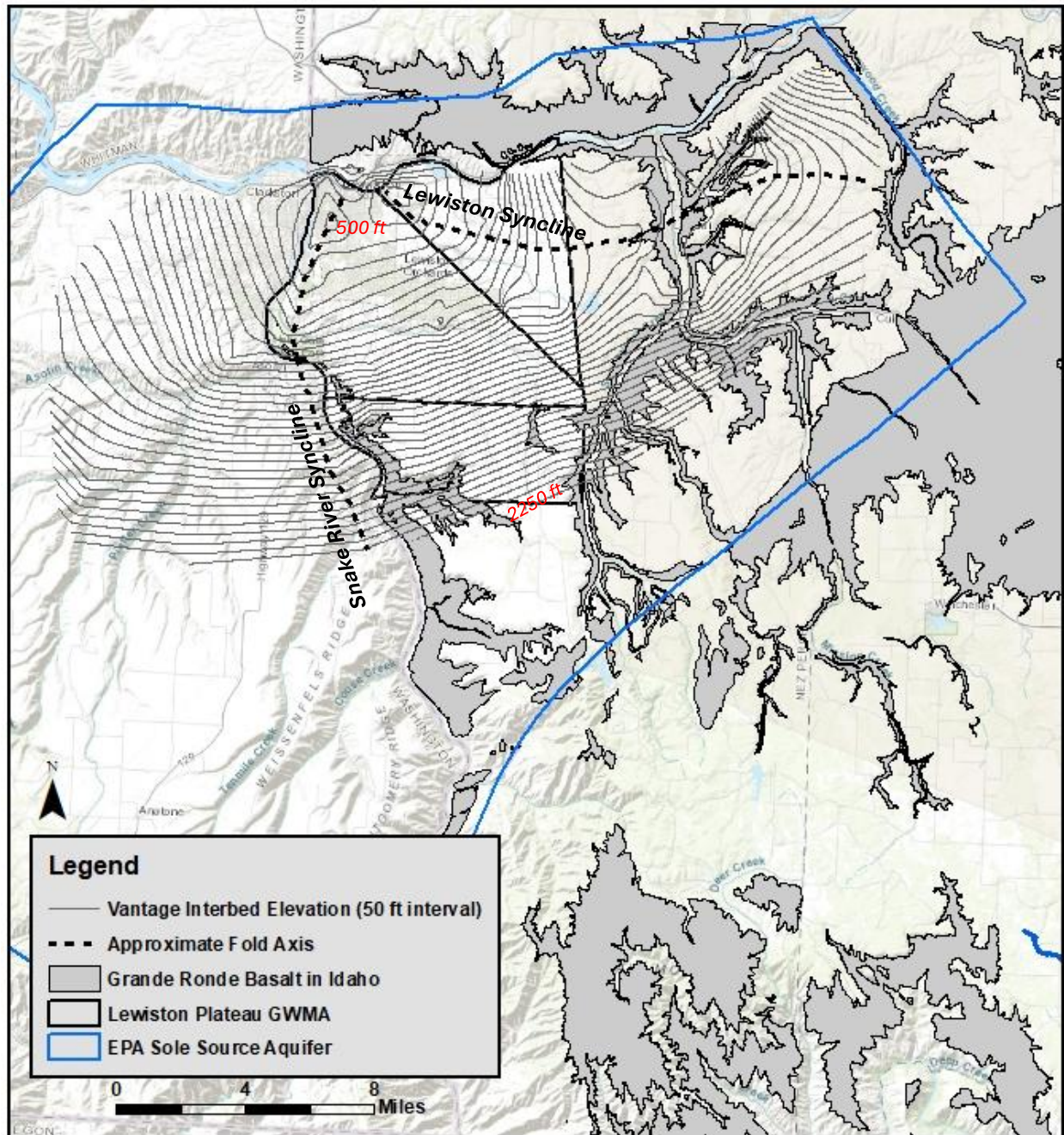


Figure 4-4. Structural contours of the Vantage Inter-bed in the Lewiston Plateau.

4.3 Groundwater Elevation and Flow

Saddle Mountains Aquifers

Observed groundwater elevations in the Saddle Mountains North Aquifer range from about 900 feet-above mean sea level (amsl), at the lower reach of Lindsay Creek, to about 1,700 ft-amsl near Mann Lake (Figure 4-5). Groundwater flow in the Saddle Mountains North Aquifer generally follows the dip of the basalts, flowing from the south-southeast to the northwest. There appears to be a groundwater flow divide present at the western extent of the Saddle Mountains North Aquifer, similar to the structure of the basalts in this location. The Saddle Mountains North Aquifer contributes to spring flows and flows in Lindsay Creek (DEQ, 2019).

Observed groundwater elevations in the Saddle Mountains South Aquifer range from about 1,400 feet-amsl at the northern extent of the aquifer to about 2,400 feet-amsl in the southern extent of the GWMA (Figure 4-5). Groundwater flow in the Saddle Mountains South Aquifer also follows the dip of the basalts, flowing from the south-southeast to the northwest. The Saddle Mountains South Aquifer appears to contribute to the flow of springs in the area.

Inflows to the Saddle Mountains South Aquifer includes excess precipitation, excess irrigation, and effluent from septic systems. Inflows to the Saddle Mountains North Aquifer also include seepage from Mann Lake and, possibly, seepage from the Sweetwater Canal delivering surface water to Mann Lake. Natural groundwater discharge locations for the Saddle Mountain South Aquifer include springs, seepage to units below the Saddle Mountains along Tammany Creek, and discharge to the upper reaches of Tammany Creek. Natural groundwater discharge locations for the Saddle Mountain South Aquifer include springs and discharge to streams in the Lindsay Creek area.

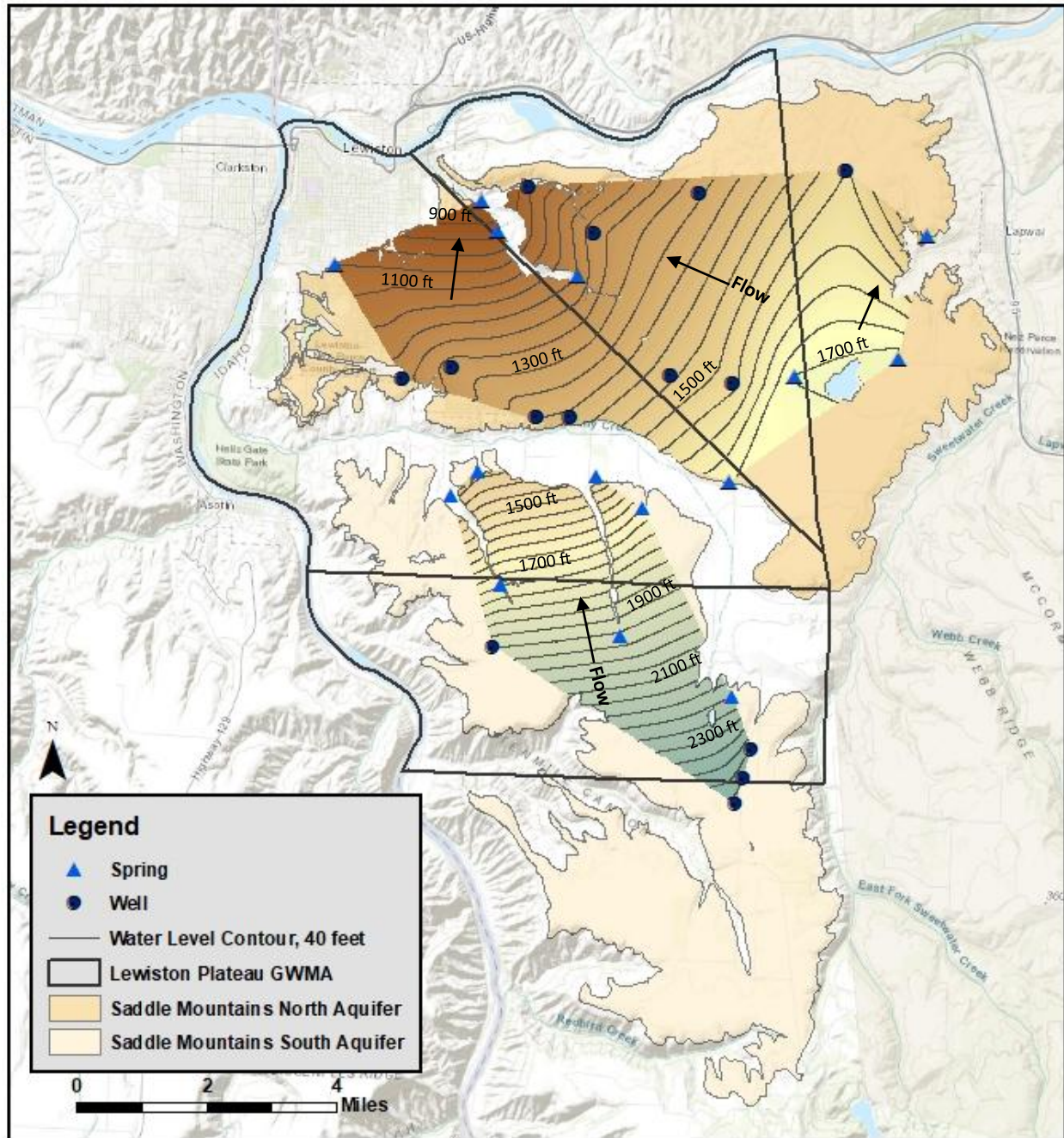


Figure 4-5. Map of groundwater level elevation and flow for the Saddle Mountains Aquifers.

Wanapum Aquifer

Observed groundwater elevations in the Wanapum Aquifer range from about 600 feet-amsl near the confluence of Lindsay Creek and the Clearwater River, to about 1,500 ft-amsl south of Tammany Creek (Figure 4-6). Groundwater flow in the Wanapum Aquifer generally follows the dip of the basalts, flowing from the south-southeast to the northwest. A cone of depression has formed at the lower reach of Lindsay Creek and along the Lewiston Syncline. In this area of groundwater depression, water levels are 140 feet below the Lower Granite Dam pool elevation on the Clearwater River. The groundwater depression appears to be caused by pumping of a City of Lewiston well near the Clearwater River.

Groundwater mounding is present south of Tammany Creek. Groundwater mounding is possibly caused by both natural recharge and by the presence of a low hydraulic conductivity barrier. The Wanapum Aquifer could extend to the southeast where the Wanapum Basalt is at or near ground surface in the upper reaches of Tammany Creek. The Wanapum Aquifer may be contributing surface water flows to Tammany Creek, the Snake River, and natural springs where the Wanapum Aquifer intersects the surface.

Inflows to the Wanapum Aquifer include the surface water from the Clearwater River and, possibly, the Snake River near the confluence with the Clearwater River. Inflows also include seepage from the Saddle Mountains South Aquifer, excess precipitation, excess irrigation, and effluent from septic systems along Tammany Creek.

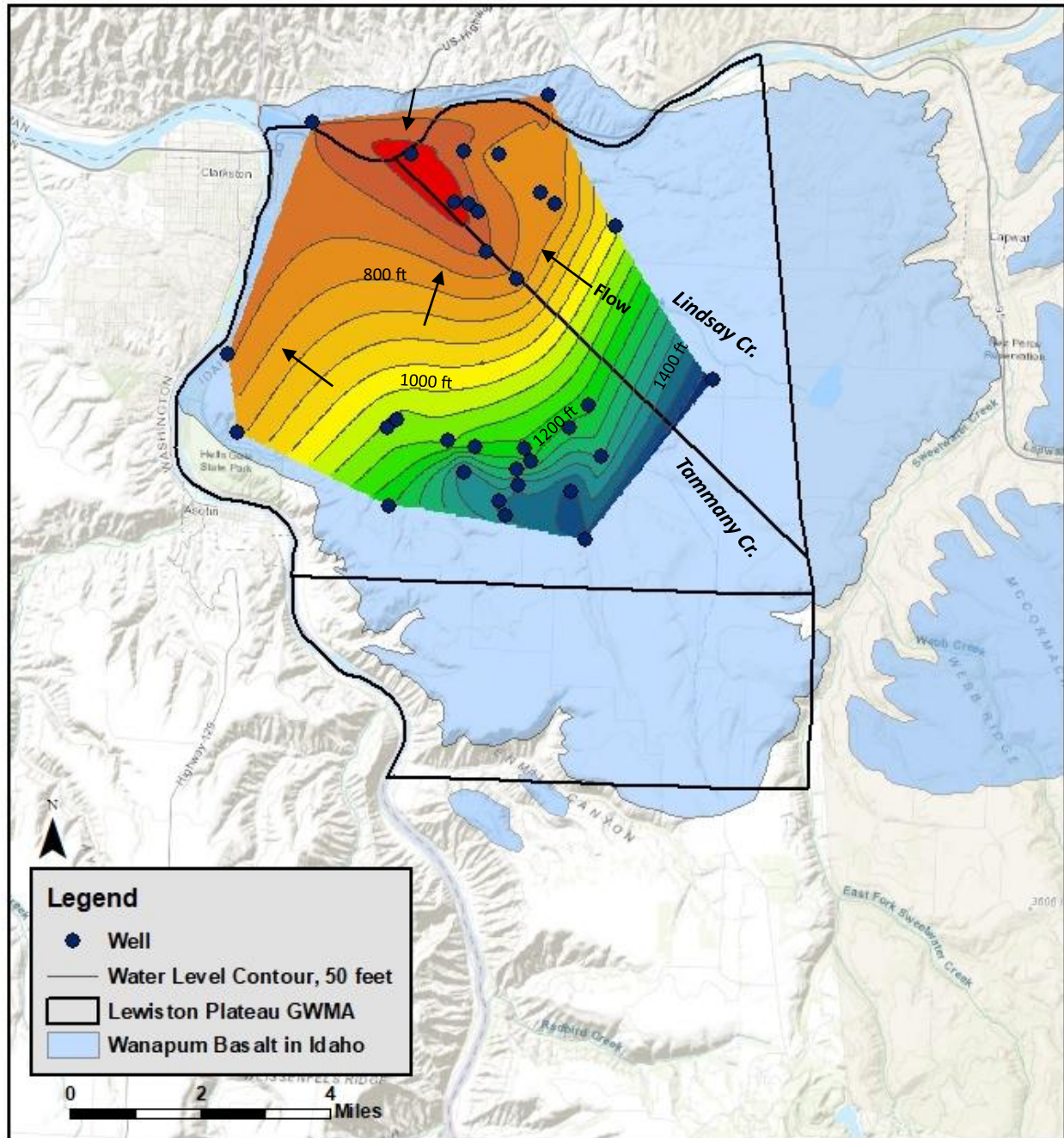


Figure 4-6. Map of groundwater level elevation and flow for the Wanapum Aquifer.

Grande Ronde Regional Aquifer

Observed groundwater elevations in the Grande Ronde Regional Aquifer range from about 700 feet-amsl along the lower reach of Tammany Creek to about 2,200 ft-amsl near the southeast extent of the GWMA. (Figure 4-7). Groundwater elevations continue to increase to the south of the GWMA to the extent of the Lewiston Plateau Basin.

General flow direction across the Lewiston Plateau is from the southeast to the northwest and the City of Lewiston. Groundwater levels in the Grande Ronde Regional Aquifer near the City of Lewiston and Lewiston Orchards area are approximately 10 feet to 40 feet below the Lower Granite Dam pool elevation. Major municipal wells are present in this area of depressed groundwater levels and pumping from these wells have caused water levels in the Grande Ronde Regional Aquifer to be lower than expected.

Natural recharge from precipitation occurs along the southern extent of the Lewiston Plateau Basin near the Craig Mountains (Wyatt et. al, 1994). Natural recharge from the Snake River below the confluence with the Clearwater River in Washinton has also been identified (Cohen, 1980; Wyatt et. al, 1994). Based on groundwater flow direction in the Grande Ronde Regional Aquifer, groundwater appears to be discharging to the Snake River near Subarea B of the GWMA. Groundwater also appears to be discharging to the Clearwater River near Subarea A1.

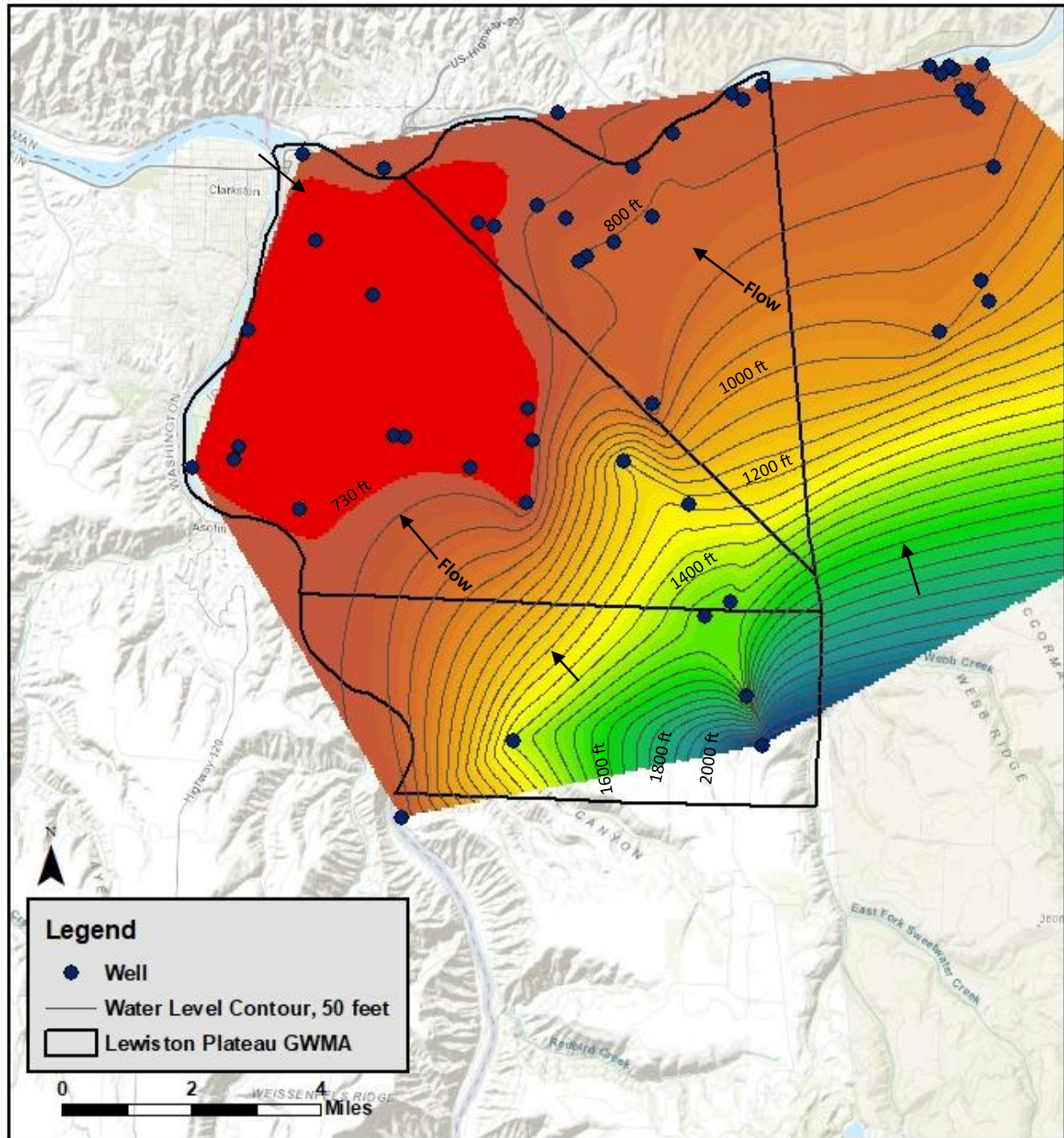


Figure 4-7. Map of groundwater level elevation and flow for the Grande Ronde Regional Aquifer within and near the Lewiston Plateau GWMA.

5. Wells and Groundwater Use

5.1 Saddle Mountains Aquifers

An estimated 60 wells have been completed in the Saddle Mountains North and South Aquifers (Figure 5-1). Based on production estimates recorded on available well logs, most wells in the Saddle Mountains Aquifers produce much less than 25 gallons per minute. Therefore, the majority of wells completed in the Saddle Mountains Aquifers are for domestic purposes. Approximately 180 acre-feet of groundwater has been allocated from the South Aquifer and approximately 600 acre-feet of groundwater from the North Aquifer. A summary of beneficial use and allocated groundwater from the Saddle Mountains North and South Aquifers is provided in Table 5-1.

Table 5-1. Summary of allocated groundwater resources diverting from the Saddle Mountains Aquifers.

Beneficial Use	Total Diversion Rate (cfs)	Allocated Annual Volume (acre-feet)
Domestic, Stock, and Irrigation (Saddle Mtns South)	0.51	176.1
Domestic, Stock, and Irrigation (Saddle Mtns North)	1.62	499.1
Irrigation Only (Saddle Mtns North)	0.28	104.3
Estimated Total	2.41	779.5

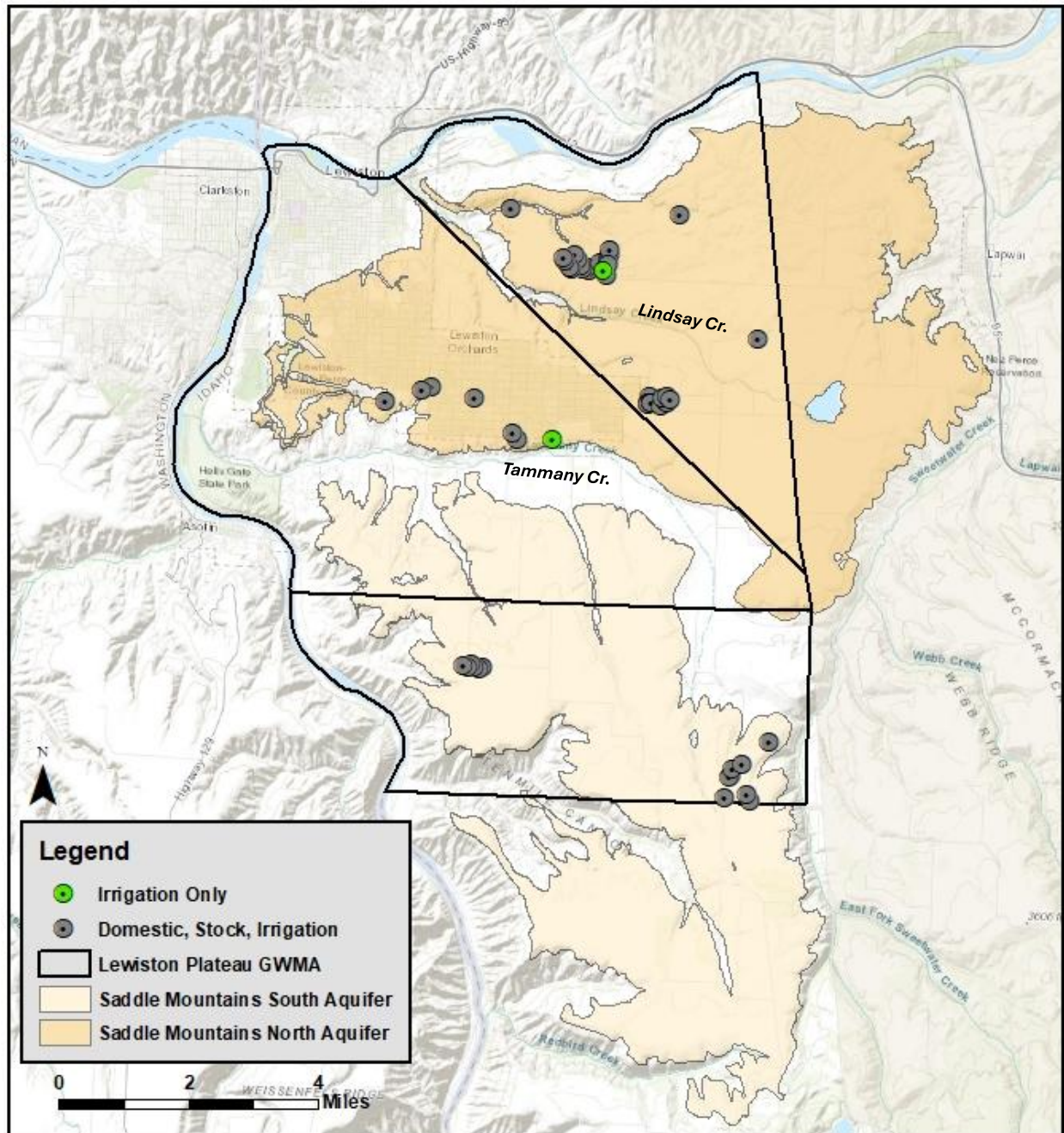


Figure 5-1. Location of wells completed in the Saddle Mountains Aquifers within the GWMA and beneficial use.

5.2 Wanapum Aquifer

There are an estimated 120 wells completed in the Wanapum Aquifer within the Lewiston Plateau GWMA (Figure 5-3). A majority of these wells are for domestic or domestic-mixed use purposes. However, two municipal providers divert from the Wanapum Aquifer. These include the City of Lewiston (Lewiston Well #4) and Cougar Ridge Water and Sewer District. Cougar Ridge Water and Sewer District's water right allows the district to divert up to 88.8 acre-feet per year. Since 2001, the City of Lewiston diverts up to about 400 acre-ft per year from Lewiston Well #4, averaging 160 acre-feet per year (Figure 5-2). Both municipal systems are in the Lindsay Creek area (Figure 5-3).

In the Tammany Creek area, several irrigation water rights exist allowing up to about 655 acre-feet per year to be diverted from the Wanapum Aquifer. In total, about 14.5 cfs and 2,900 acre-feet per year of groundwater is allocated from the Wanapum Aquifer in the Lewiston Plateau GWMA. A summary of beneficial uses and allocated groundwater from the Wanapum Aquifer is provided in Table 5-2.

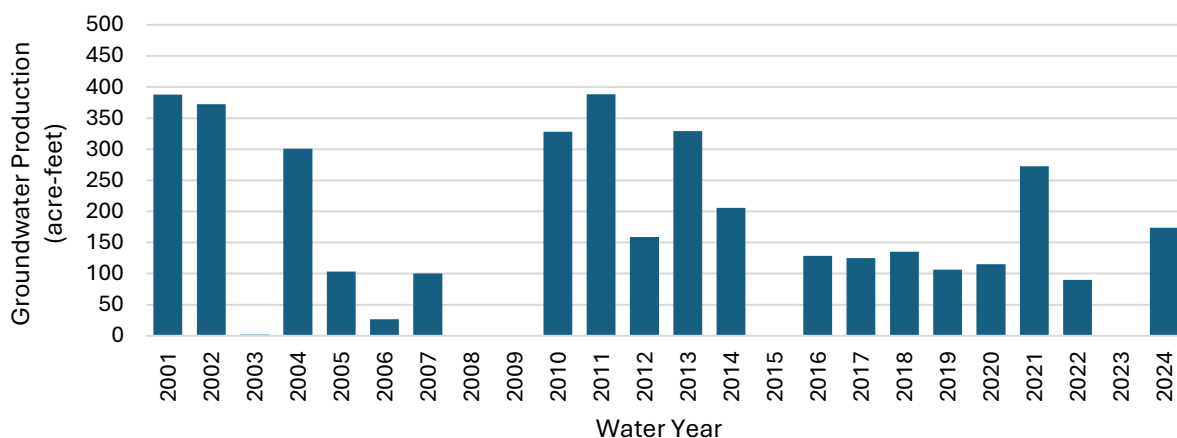


Figure 5-2. Total annual groundwater production at Lewiston Well #4.

Table 5-2. Summary of allocated groundwater resources diverting from the Wanapum Aquifer.

Beneficial Use	Total Diversion Rate (cfs)	Allocated Annual Volume (acre-feet)
Municipal - City of Lewiston	6.0	NA (100-400 estimated use ¹)
Municipal – Cougar Ridge Water and Sewer District	0.80	88.8
Irrigation Only	1.38	654.7
Domestic, Stock, and Irrigation	6.29	750-1,750
Estimated Total	14.5	1,600-2,900

1. Based on annual production data from the City of Lewiston.

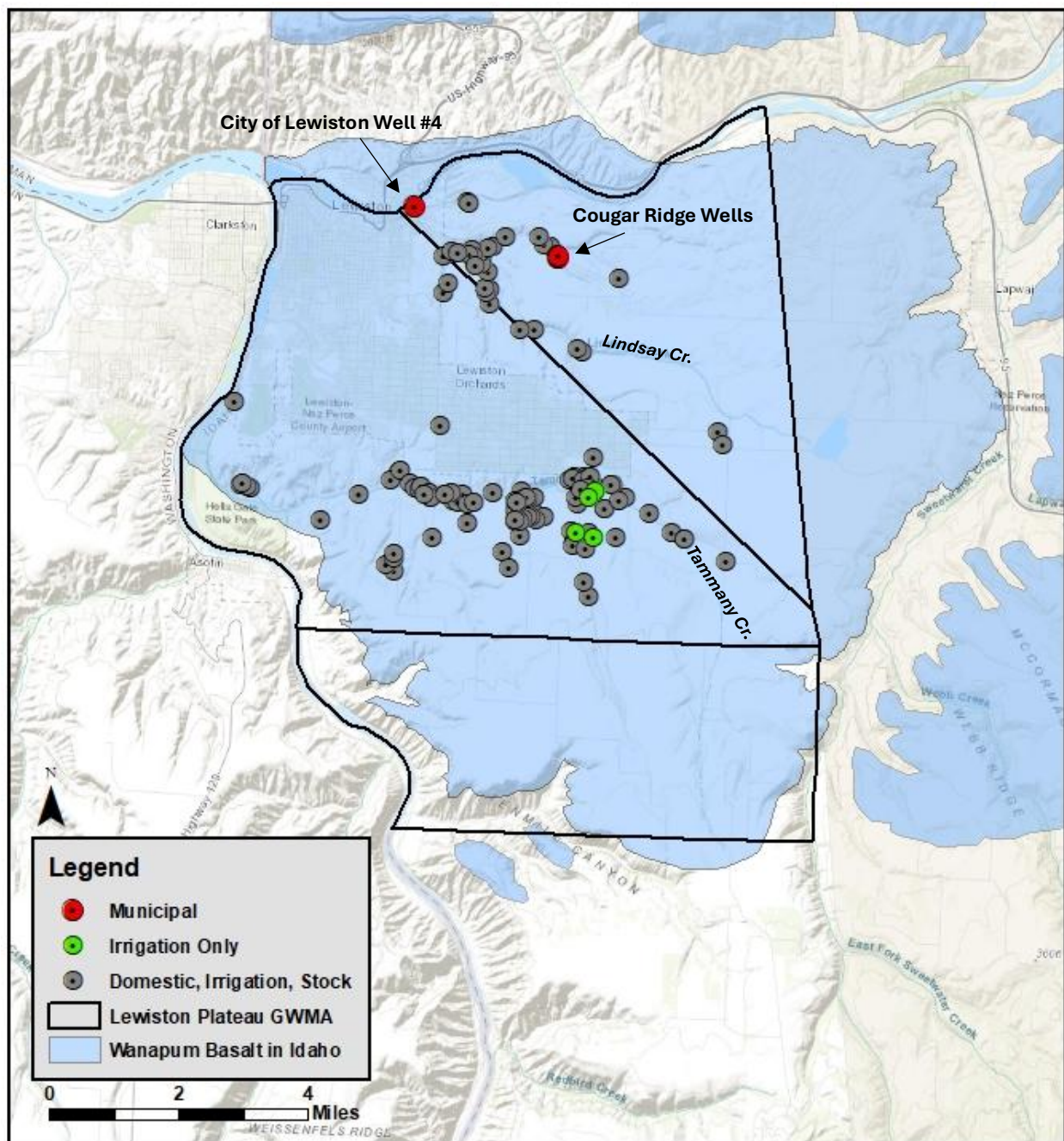


Figure 5-3. Location of wells completed in the Wanapum Aquifer within the GWMA and beneficial use.

5.3 Grande Ronde Regional Aquifer

As of 2023, there are approximately 158 wells completed in the Grande Ronde Regional Aquifer within the Lewiston Plateau GWMA (Figure 5-5). Major groundwater producers within the GWMA include the City of Lewiston and Lewiston Orchards Irrigation District. Combined, major municipalities produce up to 5,000 acre-feet per year, averaging about 3,600 acre-feet per year since 2016 (Figure 5-4). Smaller municipal systems include Red Pheasant Water Company, Eagles Pointe Development, and Tammany View LLC. A total of 763 acre-feet per year has been allocated for the smaller municipal systems.

Other beneficial uses of the Grande Ronde Regional Aquifer within the Lewiston Plateau GWMA include domestic use, irrigation use, and industrial or commercial use. Allocated groundwater for these uses total approximately 3800 acre-feet per year. A summary of beneficial uses and allocated groundwater from the Grande Ronde Regional Aquifer within the GWMA is provided in Table 5-3.

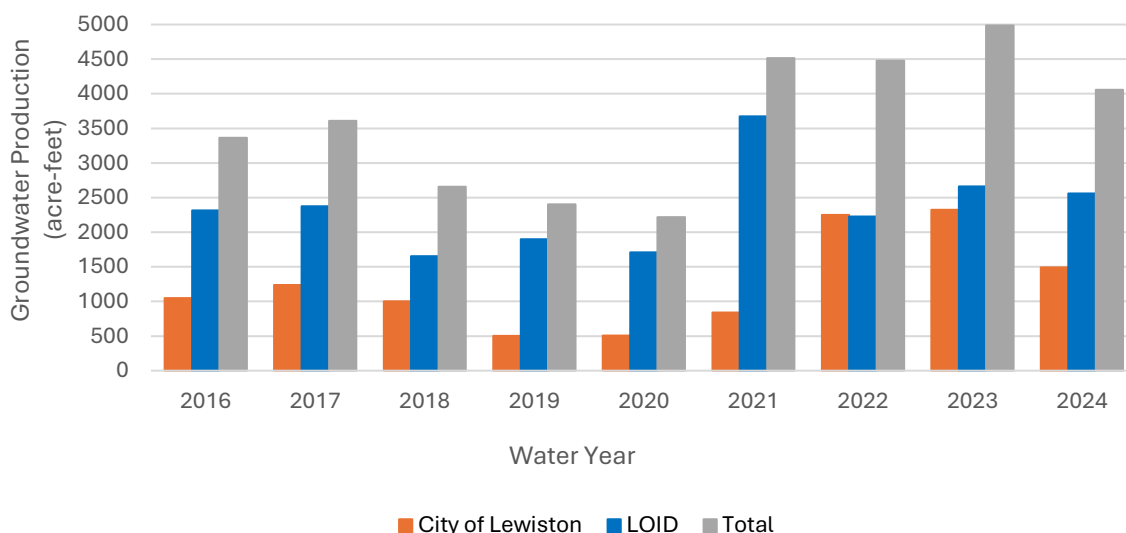


Figure 5-4. Annual groundwater production from the Grande Ronde Regional Aquifer for major municipalities.

Table 5-3. Summary of allocated groundwater resources diverting from the Grande Ronde Regional Aquifer.

Beneficial Use	Total Diversion Rate (cfs)	Allocated Annual Volume (acre-feet)
Municipal - City of Lewiston	12.51	NA (1,000-3,000 estimated ²)
Municipal – Lewiston Orchards Irrigation District	26.56 ¹	NA (1,500-3,500 estimated ²)
Municipal – Red Pheasant Water Company	2.82 ¹	665
Municipal –Small Systems	0.29	98
Industrial/Commercial	10.17	>846
Irrigation Only	3.28	982
Domestic, Stock, and Irrigation	6.23	1963
Estimated Total	61.9	>11,000

1. Estimate includes licensed and permitted water rights.

2. Based on annual production data from the City of Lewiston and Lewiston Orchards Irrigation District.

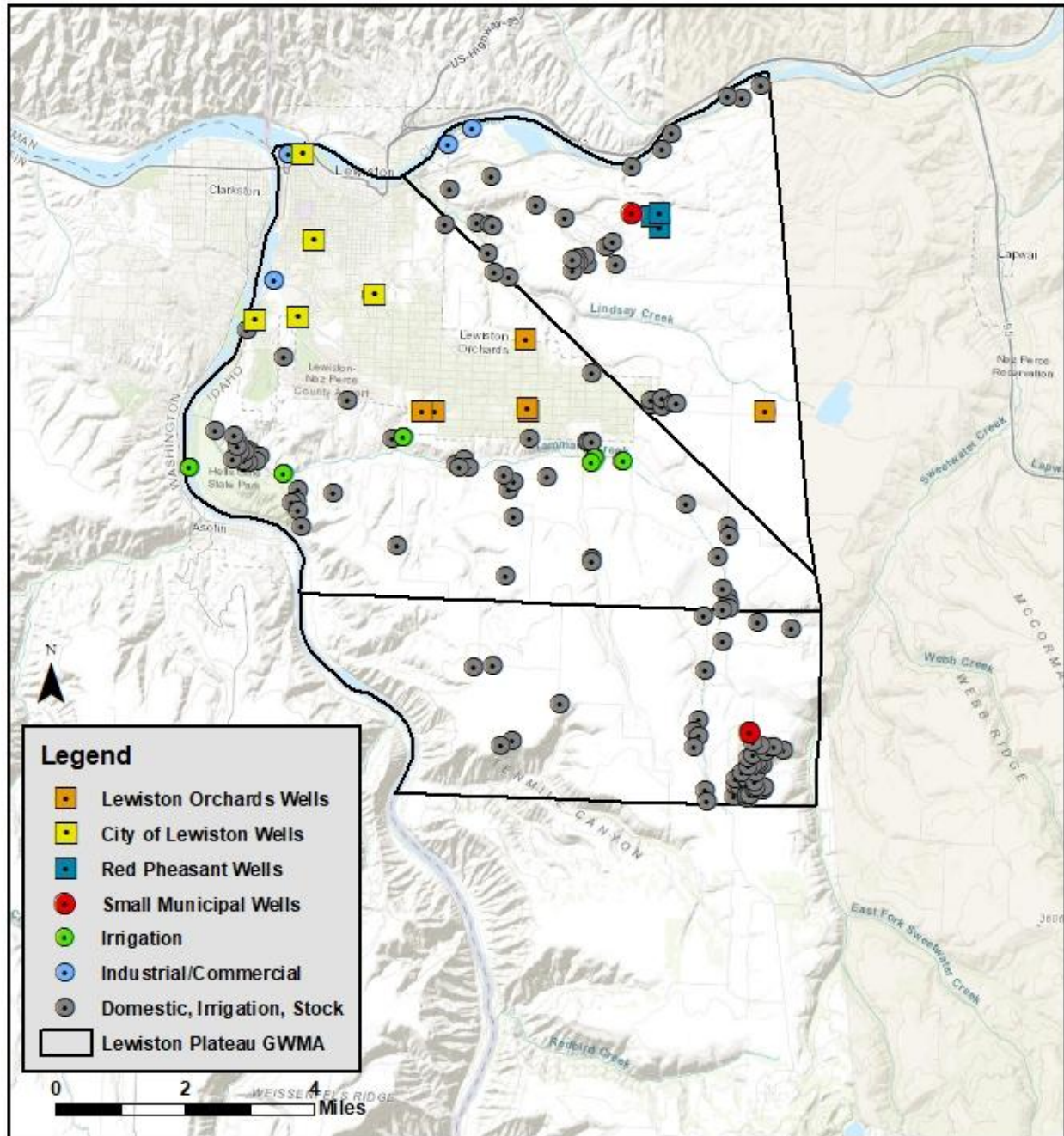


Figure 5-5. Location of wells completed in the Grande Ronde Regional Aquifer within the GWMA and beneficial use.

6. Groundwater Monitoring Network

6.1 Saddle Mountains Aquifer

IDWR currently monitors water levels at 13 wells completed in the Saddle Mountains Aquifers, with eight in the north aquifer and five in the south aquifer (Figure 6-1). Groundwater levels are measured twice each year at all wells, typically in April and September or early October, coinciding with high and low seasonal levels. Three wells are equipped with dataloggers that record water levels every one to four hours. Wells in the groundwater level monitoring network for the Saddle Mountains Aquifers are summarized in Table 6-1.

Development of the Saddle Mountains Aquifers is sparse with monitoring limited to two residential developments in the south aquifer. Additionally, since IDWR restricts new wells from the Saddle Mountains Aquifers, there are limitations on expanding the network.

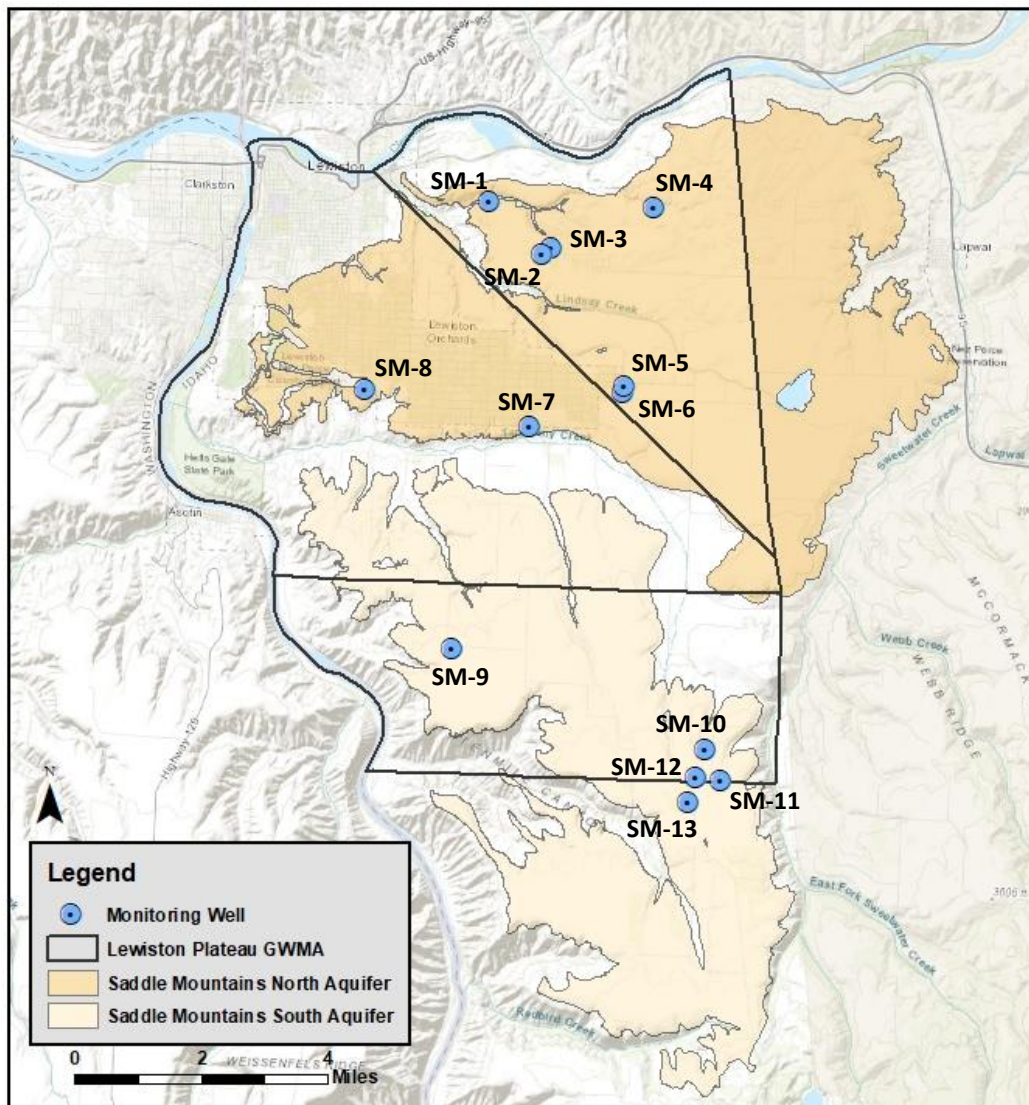


Figure 6-1. Groundwater monitoring network for the Saddle Mountains Aquifers.

Table 6-1. Groundwater level monitoring network for the Saddle Mountains Basalt Aquifers.

Map No.	Well Number	Use	Ground Elevation (feet)	Latitude (WGS84)	Longitude (WGS84)	Total Depth (feet)	Open Interval (feet)	Period of Record	Pressure Transducer
SM-1	36N 05W 34CCD1	Domestic	1,156	46.41356	-116.9560	142	39-142	1981-2024	No
SM-2	35N 05W 02CCB1	Domestic	1,370	46.40198	-116.9380	243	26-243	1991-2023	No
SM-3	35N 05W 02CBD2	Unused	1,380	46.40337	-116.9350	238	26-238	1991-2023	No
SM-4	35N 05W 01AAB1	Domestic, Stock	1,450	46.41342	-116.9010	285	54-285	1987-2023	Yes
SM-5	35N 05W 13CDA1	Unused	1,590	46.37219	-116.9083	198	37-198	2000-2023	Yes
SM-6	35N 05W 13CDD1	Domestic	1,593	46.37104	-116.9090	197	19-197	2000-2023	No
SM-7	35N 05W 22ADD1	Irrigation	1,466	46.36225	-116.9400	260	18-260	1988-2023	No
SM-8	35N 05W 20BAB1	Unused	1,394	46.36931	-116.9950	225	Unknown	2020-2024	No
SM-9	34N 05W 09AAB2	Domestic	2,069	46.31034	-116.9630	217	45-217	1994-2023	No
SM-10	34N 04W 18ADD1	Unused	2,480	46.28952	-116.8778	125	18-125	2000-2023	No
SM-11	34N 04W 17CCD1	Domestic, Irrigation, Stock	2,552	46.28261	-116.8720	200	25-200	2001-2022	No
SM-12	34N 04W 18DDC1	Domestic	2,552	46.28300	-116.8800	125	19-125	1999-2023	Yes
SM-13	34N 04W 19ACA1	Domestic, Stock	2,555	46.27707	-116.8820	190	102-190	2010-2023	No

6.2 Wanapum Aquifer

IDWR has collected water levels at twenty wells completed in the Wanapum Aquifer. Monitoring wells are shown in Figure 6-2. IDWR currently monitors eighteen wells. Well W-20 was deepened into the Grande Ronde Regional Aquifer in 2021, and Well W-12 is no longer accessible. Groundwater levels are measured twice each year at all wells, typically in April and September or early October. Three wells are equipped with dataloggers that record water levels every hour. Wells in the groundwater level monitoring network for the Wanapum Aquifer are summarized in Table 6-2.

IDWR continues to expand water level monitoring in the Wanapum Aquifer with a focus on existing wells along the Snake and Clearwater Rivers, and areas near the upper extent of the Wanapum Aquifer. Since IDWR restricts new wells from the Wanapum Aquifer, there are limitations on expanding the network. IDWR will need to consider drilling dedicated monitoring wells to continue to assess the Wanapum Aquifer in the Lewiston Plateau GWMA.

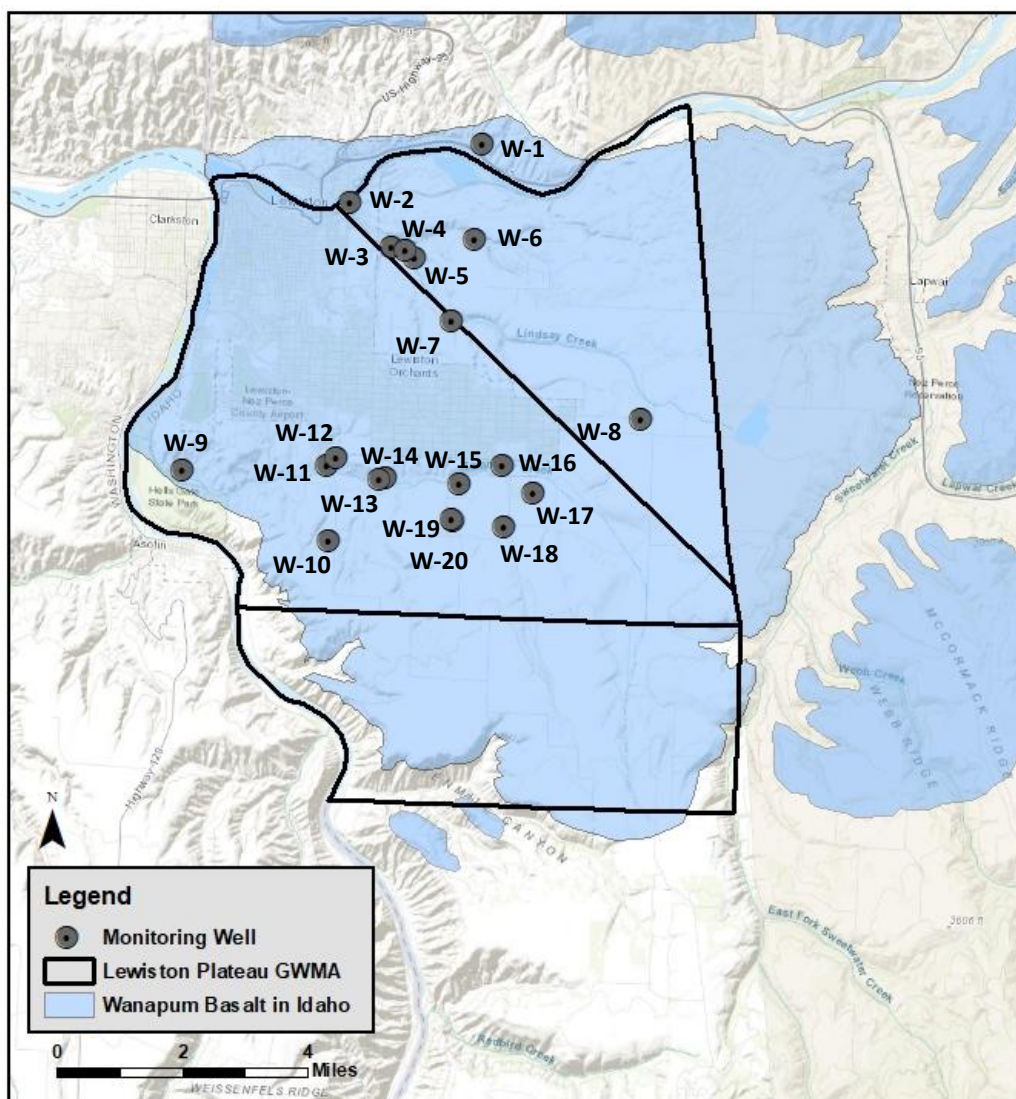


Figure 6-2. Groundwater monitoring network for the Wanapum Aquifer.

Table 6-2. Groundwater level monitoring network for the Wanapum Aquifer.

Map No.	Well Number	Use	Ground Elevation (feet)	Latitude (WGS84)	Longitude (WGS84)	Total Depth (feet)	Open Interval (feet)	Period of Record	Pressure Transducer
W-1	36N 05W 27ACD1	Community, Irrigation	871	46.43536	-116.9462	300	260-300	2015-2024	Yes
W-2	36N 05W 32ACC1	Municipal	747	46.42079	-116.9900	358	Unknown	1964-2024	Yes
W-3	35N 05W 04BBD1	Community, Irrigation	859	46.41058	-116.9758	295	83-295	1999-2024	No
W-4	35N 05W 04BAD1	Domestic	886	46.41016	-116.9706	249	122-249	1990-2024	No
W-5	35N 05W 04ACA2	Domestic	997	46.40843	-116.9676	420	243-420	2008-2024	No
W-6	36N 05W 34DCC1	Domestic	1,111	46.41326	-116.9478	367	224-367	1977-2024	No
W-7	35N 05W 10BCA1	Domestic	1,070	46.39413	-116.9543	350	250-350	2005-2024	No
W-8	35N 04W 18CDB1	Domestic	1,662	46.37291	-116.8897	425	218-425	2001-2024	No
W-9	35N 06W 24CCA1	Domestic	968	46.35718	-117.0430	182	25-182	1976-2024	No
W-10	35N 05W 29CDA1	Domestic, Irrigation	1,542	46.34220	-116.9928	530	297-530	2004-2024	No
W-11	35N 05W 20CAC1	Domestic	1,108	46.35960	-116.9946	200	18-200	2008-2024	No
W-12	35N 05W 20CAA1	Domestic	1,206	46.36154	-116.9914	203	140-203	2007-2021	No
W-13	35N 05W 21CCA1	Community, Irrigation	1,238	46.35690	-116.9770	228	95-228	1991-2024	No
W-14	35N 05W 21CDB1	Domestic, Irrigation	1,242	46.35728	-116.9750	190	88-190	1975-2024	No
W-15	35N 05W 22CDD1	Domestic, Irrigation	1,321	46.35626	-116.9499	268	112-268	1977-2024	No
W-16	35N 05W 23CBA1	Domestic	1,406	46.36117	-116.9356	279	177-279	1990-2024	Yes
W-17	35N 05W 23DCD1	Domestic, Irrigation	1,414	46.35500	-116.9253	355	78-355	1992-2024	No
W-18	35N 05W 26CBA1	Domestic, Stock	1,518	46.34672	-116.9344	150	Unknown	2019-2024	No
W-19	35N 05W 27BDD1	Domestic	1,472	46.34809	-116.9519	448	147-448	1994-2024	No
W-20	35N 05W 27BDD2	Domestic	1,478	46.34772	-116.9516	323	153-323	1997-2021	No

6.3 Grande Ronde Regional Aquifer

IDWR monitors water levels at 36 wells completed in the Grande Ronde Regional Aquifer within the Lewiston Plateau GWMA. Monitoring well locations are shown in Figure 6-3 with the monitoring well network summarized in Table 6-3. IDWR also monitors groundwater levels at 18 wells outside of the GWMA but within the EPA Sole Source Aquifer Area. Of the 36 monitoring wells in the Grande Ronde Regional Aquifer, 21 are equipped with dataloggers recording water levels hourly. Groundwater levels are measured twice each year, in April or May and early October, coinciding with the irrigation season.

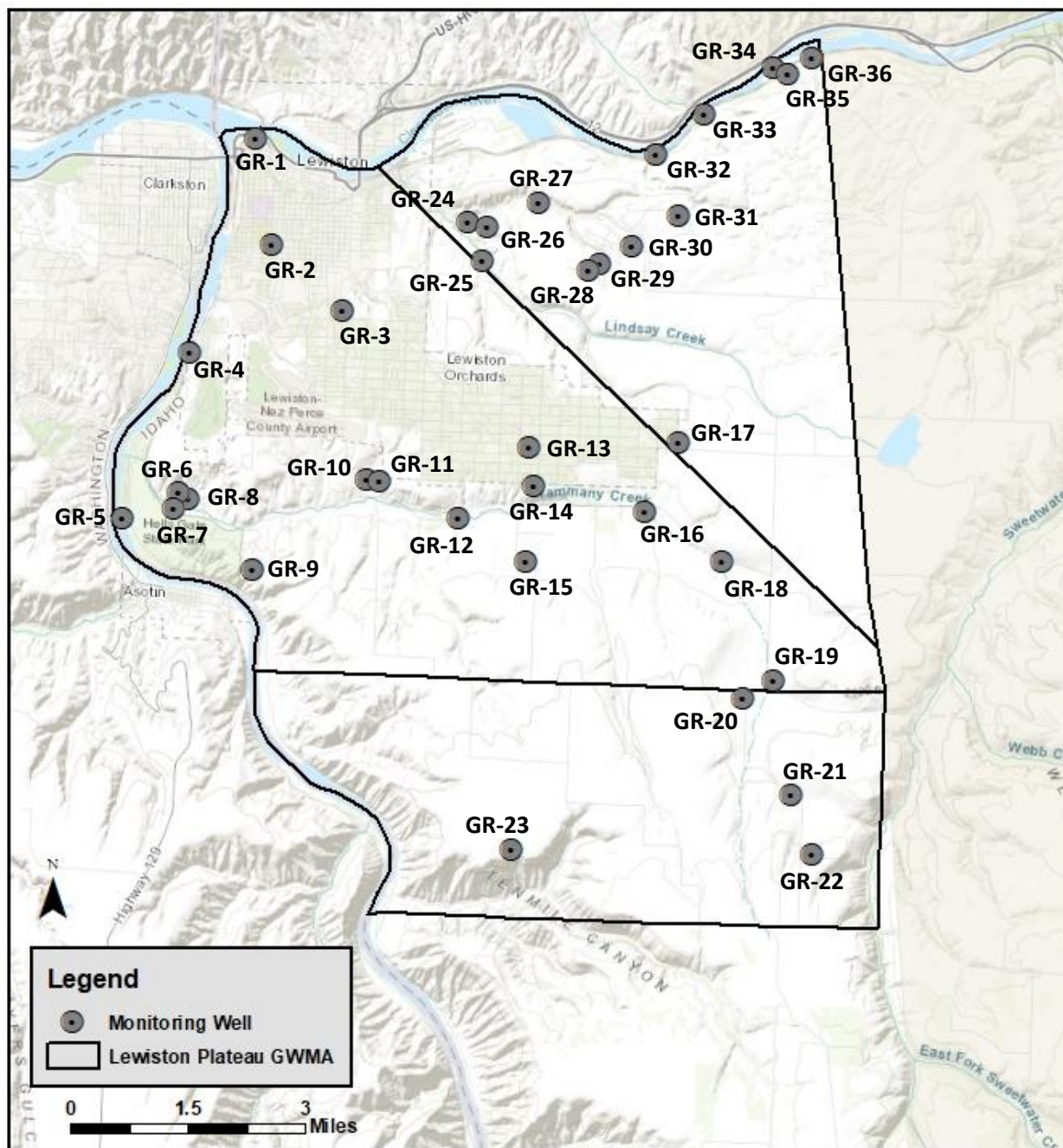


Figure 6-3. Groundwater monitoring network for the Grande Ronde Regional Aquifer in the GWMA.

Table 6-3. Groundwater level monitoring network for the Grande Ronde Regional Aquifer in the Lewiston Plateau GWMA.

Map No.	Well ID	Use	Ground Elevation (feet)	Latitude (WGS84)	Longitude (WGS84)	Total Depth (feet)	Open Interval (feet)	Period of Record	Pressure Transducer
GR-1	36N 06W 36ADB1	Municipal	730	46.42377	-117.0279	735	182-735	1962-2024	Yes
GR-2	35N 06W 01DAA1	Municipal	845	46.40461	-117.0227	600	394-600	1953-2024	Yes
GR-3	35N 05W 07ADD1	Municipal	1,245	46.39277	-117.0033	2,150	900-2,150	2021-2024	No
GR-4	35N 06W 13BBB1	Domestic	788	46.38387	-117.0433	400	260-400	2008-2024	No
GR-5	35N 06W 26BBC1	Irrigation	753	46.35286	-117.0599	266	205-266	2009-2024	No
GR-6	35N 06W 23DDA1	Irrigation	970	46.35796	-117.0452	475	278-475	2015-2024	Yes
GR-7	35N 06W 23DDC1	Domestic	885	46.35507	-117.0462	320	250-320	2023-2024	No
GR-8	35N 06W 24CCA2	Domestic	958	46.3570	-117.0426	304	37-304	1988-2024	No
GR-9	35N 06W 25DAD1	Irrigation	1,476	46.34427	-117.0244	1,060	900-1,060	2019-2024	No
GR-10	35N 05W 20CAB1	Domestic	1,138	46.36155	-116.9949	650	538-650	2022-2024	Yes
GR-11	35N 05W 20DBB1	Irrigation	1,204	46.36147	-116.9913	765	494-765	2014-2024	Yes
GR-12	35N 05W 21DCC1	Domestic	1,217	46.35517	-116.9699	840	782-840	2016-2024	Yes
GR-13	35N 05W 22BAB1	Municipal	1,555	46.36875	-116.9520	1,795	994-1,795	1978-2024	Yes
GR-14	35N 05W 22CAA1	Domestic	1,589	46.36179	-116.95041	1,220	763-1,220	2016-2024	Yes
GR-15	35N 05W 27BDD2	Domestic	1,477	46.34772	-116.95163	980	458-980	2021-2024	Yes
GR-16	35N 05W 23DDB1	Dom., Irr.	1,419	46.35771	-116.92032	630	93-630	2009-2024	Yes
GR-17	35N 05W 13CDC1	Dom., Irr.	1,589	46.37077	-116.91218	850	398-850	2004-2024	Yes
GR-18	35N 05W 25ADD1	Dom., Irr.	1,530	46.34886	-116.89917	585	336-585	1979-2024	No
GR-19	36N 04W 31DCCA1	Domestic	1,742	46.32714	-116.8844	290	250-290	2006-2024	No
GR-20	34N 04W 06BBA1	Domestic	1,782	46.32385	-116.8923	475	400-470	1979-2024	No
GR-21	34N 04W 07ADA1	Monitoring	2,070	46.30629	-116.87825	700	680-700	2019-2024	Yes
GR-22	34N 04W 17BBA1	Domestic	2,446	46.29553	-116.87247	322	198-322	2011-2024	No
GR-23	34N 05W 15BAC1	Community	2,276	46.29443	-116.95255	1,145	503-1,145	2019-2024	No
GR-24	35N 05W 04BAD2	Domestic	887	46.40999	-116.97045	680	378-680	2023-2024	No
GR-25	35N 05W 04DBC1	Domestic	961	46.40306	-116.96639	700	412-700	2022-2024	No
GR-26	35N 05W 04ACA1	Domestic	1,159	46.4092	-116.96521	1,200	980-1,200	2014-2024	Yes
GR-27	36N 05W 34CDC1	Domestic	1,033	46.41417	-116.95163	560	450-560	2023-2024	No
GR-28	35N 05W 02CCB3	Domestic	1,370	46.40195	-116.93759	1,020	725-1,020	2015-2024	Yes
GR-29	35N 05W 02CBD2	Domestic	1,379	46.40338	-116.93488	1,050	760-1,050	2015-2024	No
GR-30	35N 05W 02ACC1	Irr., Stock	1,406	46.40675	-116.92633	850	480-850	2013-2024	Yes
GR-31	35N 05W 01BBA1	Municipal	1,457	46.41262	-116.9141	1,200	850-1,200	2015-2024	Yes
GR-32	36N 05W 35ADB1	Stock	775	46.4236	-116.9211	180	58-180	2018-2024	Yes
GR-33	36N 05W 25CAD1	Stock	791	46.43147	-116.90852	240	38-240	2018-2024	Yes
GR-34	36N 04W 30BAB1	Stock	775	46.4407	-116.88995	505	40-505	2018-2024	Yes
GR-35	36N 04W 30BAD1	Stock	808	46.43961	-116.88633	125	28-125	2016-2023	Yes
GR-36	36N 04W 19DDC1	Stock	785	46.44298	-116.88018	110	100-110	2018-2023	Yes

7. Observed Water Levels and Trends

Hydrographs of observed groundwater levels at sites described in Section 6 are presented for each aquifer in Appendix A, B, and C. A subset of groundwater levels for the Lewiston Plateau GWMA are presented in this section and are used to estimate linear groundwater level trends in the GWMA. Monitoring wells were selected for trend analysis based on longevity of the observation period and those that generally represent an aquifer and region of the GWMA.

IDWR measures groundwater levels at 13 wells completed in the Saddle Mountains Aquifers; three wells were selected for trend analysis, and five additional wells were selected for qualitative assessment. For the Wanapum Aquifer, seven of the 20 wells IDWR monitors were selected for trend analysis and five wells selected for qualitative assessment. For the Grande Rode Regional Aquifer, nine of the 36 wells were selected for trend analysis and four wells selected for qualitative assessment. Water level records with at least five years of continuous data were selected for trend analysis from each aquifer and region of the Lewiston Plateau GWMA. Only spring or early summer maximum water levels were used for trend analysis. This removes the potential for seasonal fluctuations to influence trend analysis.

The trend in a selected groundwater level data set was determined using the Mann-Kendall Test (Helsel and Hirsch, 2002). Linear trends in the groundwater level data are considered statistically significant if the calculated p-value is less than 0.05 (Helsel and Hirsch, 2002), resulting in a confidence interval of 95% or greater. However, a calculated trend is not always representative of the behavior if there are large water-level fluctuations or if the calculated trend is small. Therefore, a statistical assessment of the calculated trend is an important step in determining the general water-level behavior over time.

7.1 Saddle Mountains Aquifers

Saddle Mountains North

Groundwater levels in the Saddle Mountains North Aquifer range from about 80 feet below ground surface (ft-bgs) to 180 ft-bgs. Measured groundwater levels show mixed trends and fluctuations over the observation period (Figure 7-1). Since 2014, linear trends range from -0.07 feet per year (ft/yr) to +6.1 ft/yr. As summarized in Table 7-1, most groundwater levels appear to have remained stable in the Saddle Mountains North Aquifer with slight response to climate cycles. However, groundwater levels at and near wells SM-5 had a more pronounced response to the wetting cycle from 2017 to 2020. Groundwater levels at well SM-5 increased by approximately 85 feet from 2016 to 2020, with groundwater levels now receding.

With the exception of the long-term water level trend at well SM-4, groundwater level trends in the Saddle Mountain North Aquifer are not statistically significant. Continued monitoring could increase the statistical significance in the Saddle Mountains North Aquifer or allow for cyclical trends to be identified.

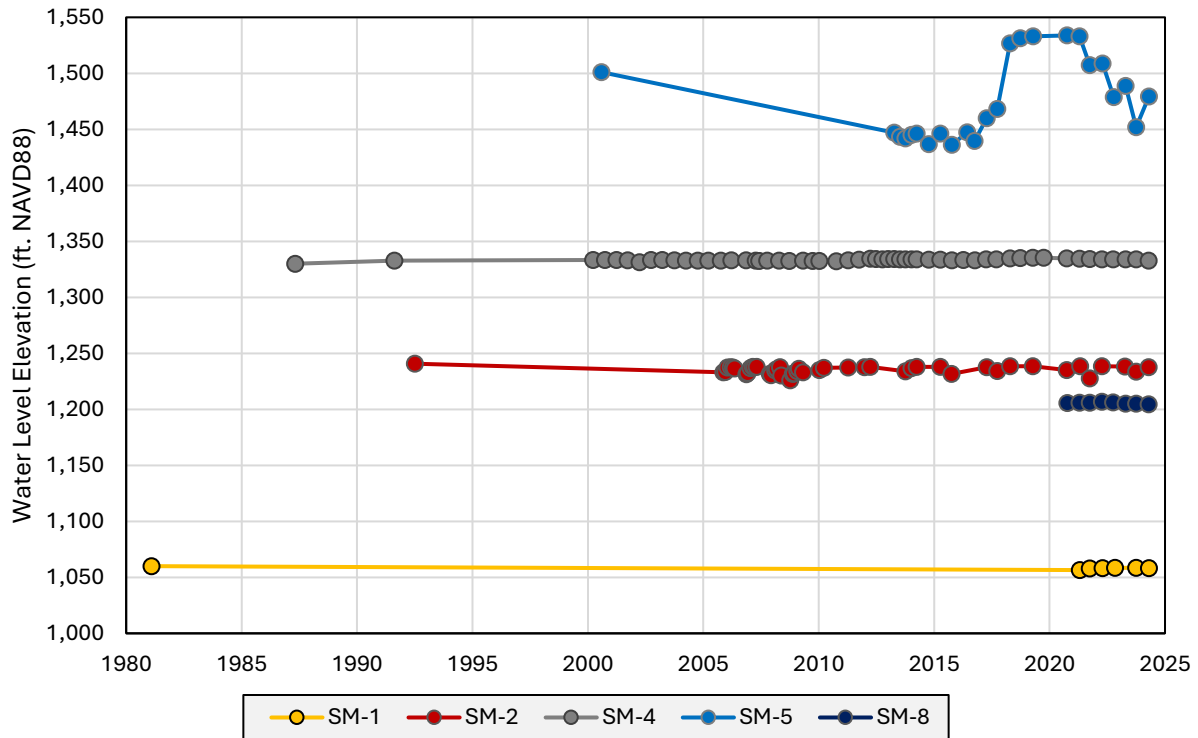


Figure 7-1. Observed groundwater levels in the Saddle Mountains North Aquifer.

Table 7-1. Summary of water level trends in the Saddle Mountains North Aquifer.

Well No.	Well ID	Period Tested	Trend (ft/yr)	p-value	Status Notes
SM-1	36N 05W 34CCD1	Not Tested	NA	NA	Trend not quantified. Short period of record and large data gap. Water level appears stable.
SM-2	35N 05W 02CCB1	2006-2024 2014-2024	+0.06 +0.05	0.04 0.53	Water level appears stable.
SM-4	35N 05W 01AAB1	2000-2024 2014-2024	+0.06 +0.03	0.01 0.54	Water level appears stable.
SM-5	35N 05W 13CDA1	2014-2024	+4.6	0.09	Large fluctuations. Responded to wetting period from 2017 to 2020.
SM-8	35N 05W 20BAB1	Not Tested	NA	NA	Trend not quantified. Short period of record. Water level appears stable. Possible slight decline since 2022.

Saddle Mountains South

Groundwater levels in the Saddle Mountains South Aquifer can range from about 40 ft-bgs to 160 ft-bgs. Most wells in the south aquifer appear to have responded to the recent climate cycles. Water levels at wells SM-10 and SM-13 increased by approximately 30 feet from the Spring 2016 to Fall 2020 (Figure 7-2). Groundwater level monitoring at well SM-9 did not begin until Fall 2021, after the drought of 2021. It is unknown if groundwater levels at well SM-9 responded similarly to the high snowfall year in 2017, as observed at the other wells.

Most wells monitored in the Saddle Mountains South Aquifer have short periods of record or large gaps between observations. SM-10 was selected for trend analysis based on a longer continuous period of record. Linear regression analysis shows a trend approximately -2.8 ft/yr from 2016 to 2024 (Table 7-2). However, a p-value of 0.05 the trend is statistically significant at 95% confidence. Continued monitoring of water levels in the Saddle Mountains South Aquifer will allow for future trend analysis, increase the statistical significance of linear trends, and identify cyclical trends in the south aquifer.

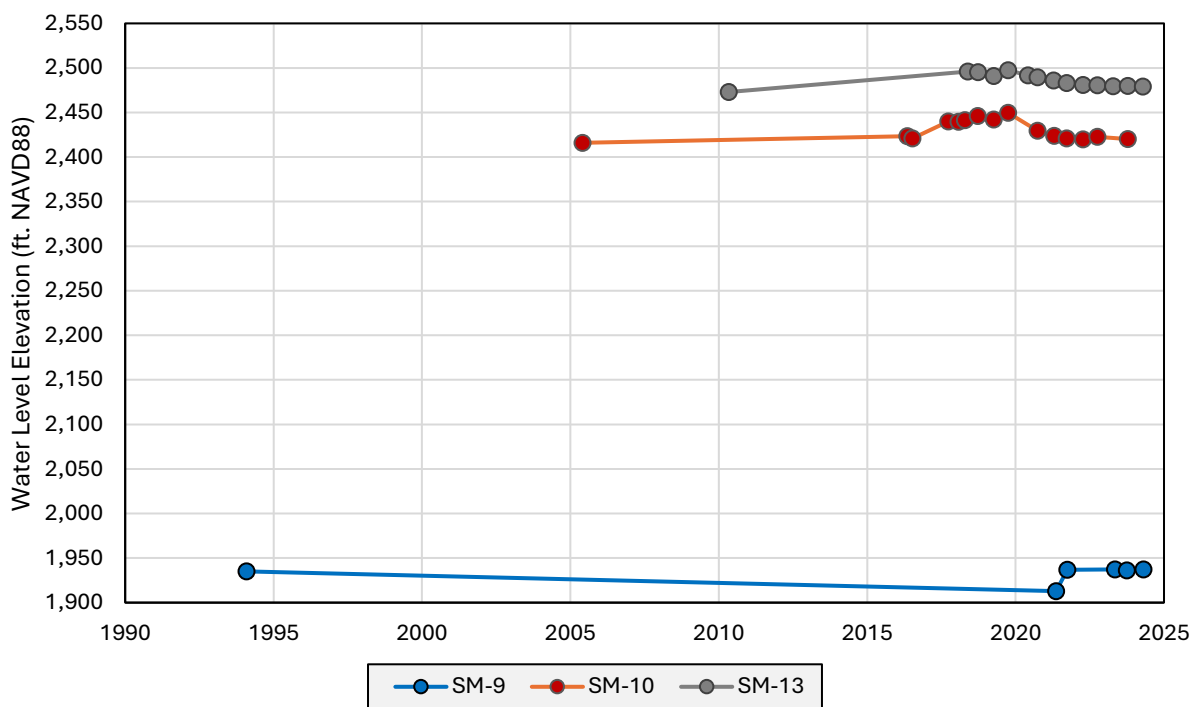


Figure 7-2. Observed groundwater levels in the Saddle Mountains South Aquifer.

Table 7-2. Summary of water level trends in the Saddle Mountains South Aquifer.

Well No.	Well ID	Period Tested	Trend (ft/yr)	p-value	Status Note
SM-9	34N 05W 09AAB2	Not Tested	NA	NA	Trend not quantified. Short period of record or large data gaps. Water level appears stable.
SM-10	34N 04W 18ADD1	2016-2024	-2.8	0.05	Large fluctuations. Responded to wetting period from 2017 to 2020.
SM-13	34N 04W 19ACA1	Not Tested	NA	NA	Trend not quantified. Short period of record or large data gaps. Appears to have responded to wetting period from 2017 to 2020.

7.2 Wanapum Aquifer

Lindsay Creek Area

Groundwater levels in the Wanapum Aquifer in the Lindsay Creek area range from about 150 ft-bgs at well W-2 to 300 ft-bgs at well W-7. In this area of the Lewiston Plateau, groundwater levels have been declining at rates ranging from -0.3 ft/yr to -1.5 ft/yr from 2016 to 2024 (Figure 7-3; Table 7-3).

Calculated p-values for the linear trends are less than 0.01, indicating these trends are statistically significant at a 99% confidence interval.

The greatest amount of decrease in water levels in the Wanapum Aquifer are found at the lower reach on Lindsay Creek at well W-2 (Lewiston #4) and well W-3 (domestic well). In 2024, the measured water level at well W-2 was 100 feet lower than in 1965. At well W-3, the water level in 2024 was 82 feet lower than in 1999 when the well was constructed. However, the City of Lewiston ceased production from the Wanapum Aquifer in 2021 during construction of their new water treatment plant. This has allowed groundwater levels in the vicinity of well W-2 to begin recovering. Groundwater levels have increased at rates of about 4 feet per year to 5.5 feet per year recently at wells W-2 and W-3.

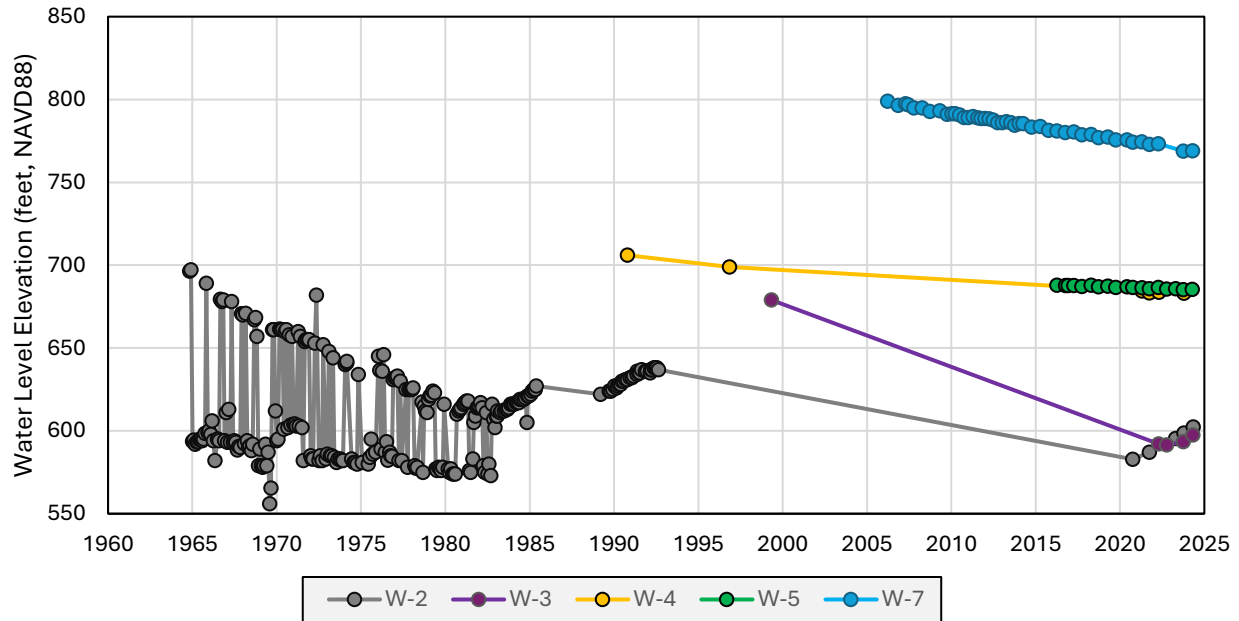


Figure 7-3. Observed groundwater levels in the Lindsay Creek area.

Table 7-3. Summary of water level trends in the Lindsay Creek area.

Well No.	Well ID	Period Tested	Trend (ft/yr)	p-value	Status Note
W-2	36N 05W 32ACC1	Not Tested	NA	NA	Trend not quantified. Short period of record for recent data, large data gap. Recovering since 2021 at 5.5 ft/yr.
W-3	35N 05W 04BBD1	Not Tested	NA	NA	Trend not quantified. Short period of record and large data gaps. Recovering since 2022 at 3.9 ft/yr.
W-4	35N 05W 04BAD1	Not Tested	NA	NA	Trend not quantified. Short period of record. Water level appears to be declining at a rate similar to W-5.
W-5	35N 05W 04ACA2	2016-2024	-0.3	<0.01	Continued and steady decline.
W-7	35N 05W 10BCA1	2006-2024 2016-2024	-1.6 -1.5	<0.01 <0.01	Continued and steady decline.

Tammany Creek Area

Groundwater levels in the Wanapum Aquifer in the Tammany Creek area typically range from approximately 130 ft-bgs to 190 ft-bgs. Groundwater levels can be 30 ft-bgs and as high as 350 ft-bgs in some wells. Flowing artesian conditions have been observed in the Wanapum Aquifer just south of Tammany Creek. Russell (1901) noted four wells drilled in the vicinity of Tammany Creek between 1896 and 1900 encountered flowing artesian pressure at depths of about 100 feet to 300 feet. In 2023, a domestic well (IDWR well number D0094980) encountered approximately 70 feet of flowing artesian pressure.

Measured groundwater levels in the vicinity of Tammany Creek show a range of trends and fluctuations (Figures 7-4 and 7-5). From 2014 to 2024, analysis show groundwater level trends ranging from -1.4 ft/yr to +0.7 ft/yr. Some wells responded to above average precipitation in 2017 through 2020, with wells W-16 and W-17 showing increases in groundwater levels from 2017 to 2021. Well W-14 began to stabilize after 30 years of water level decline. Well W-20, however, showed continuous water level decline of 0.9 ft/yr over the observation period. This was deepened in early 2021 due to low yield.

Calculated p-values for the linear trends range from less than 0.01 to 0.45 (Table 7-4). Linear trends at wells W-14 and W-20 between 2014 and 2024 in the Tammany Creek area are statistically significant. Continued monitoring could increase the statistical significance of trends in this area.

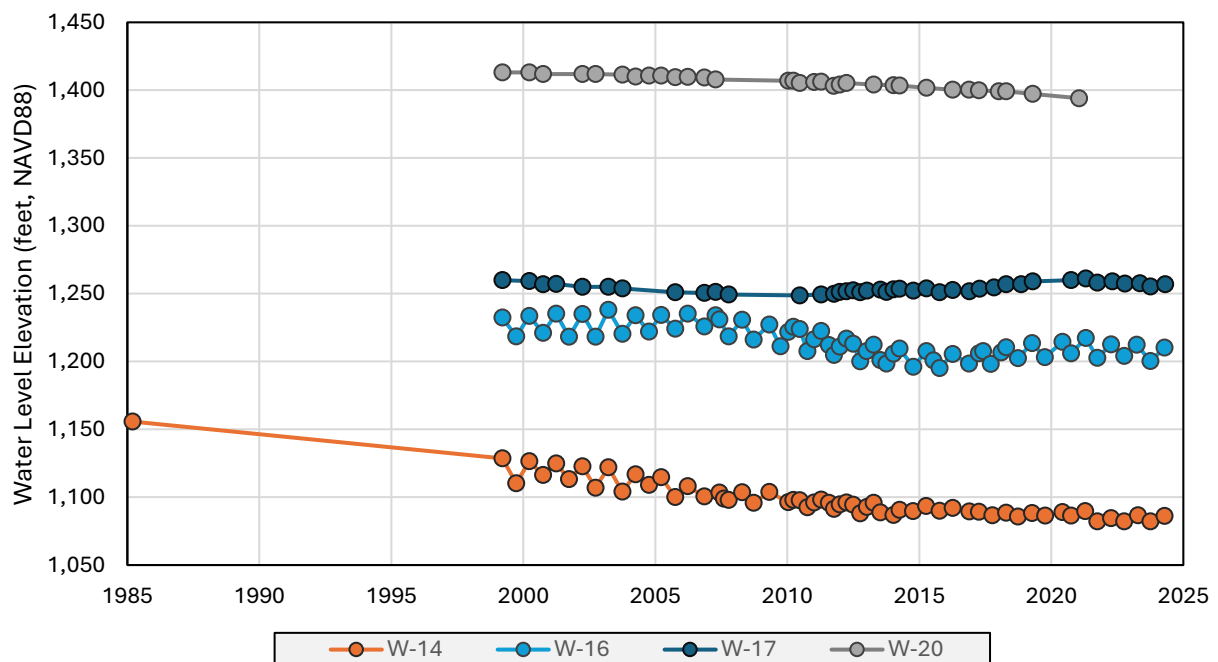


Figure 7-4. Observed groundwater levels in the Tammany Creek area.

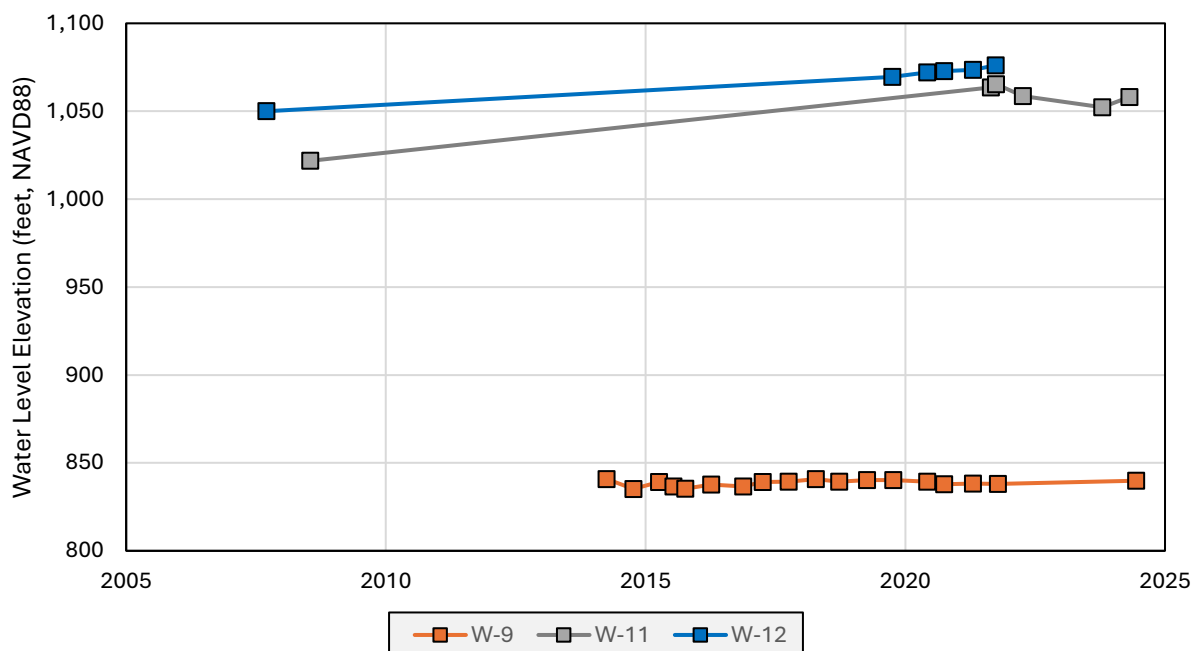


Figure 7-5. Additional observed groundwater levels in the Tammany Creek area.

Table 7-4. Summary of water level trends in the Tammany Creek area.

Well No.	Well ID	Period Tested	Trend (ft/yr)	p-value	Status Note
W-9	35N 06W 24CCA1	2014-2024	-0.13	0.47	Water level appears stable.
W-11	35N 05W 20CAC1	Not Tested	NA	NA	Trend not quantified. Short period of record and large data gaps. Water level appears to be relatively stable.
W-12	35N 05W 20CAA1	Not Tested	NA	NA	Trend not quantified. Short period of record and large data gap. Water level appears to be increasing. Well is no longer monitored.
W-14	35N 05W 21CDB1	1999-2024 2014-2024	-1.7 -0.5	<0.01 <0.01	Continued decline. Water level appears to be stabilizing since 2018.
W-16	35N 05W 23CBA1	1999-2024 2014-2024	-1.2 +0.6	<0.01 0.14	Oscillatory behavior. Water level increasing from 2017-2021. Responded to the wetting period in 2017-2020.
W-17	35N 05W 23DCD1	1999-2024 2014-2024	+0.2 +0.7	0.22 0.06	Oscillatory behavior. Water level increasing from 2017-2021. Responded to the wetting period in 2017-2020.
W-20	35N 05W 27BDD2	1999-2021 2014-2021	-0.9 -1.4	<0.01 <0.01	Continued and increasing decline. Well was deepened in 2021.

7.3 Grande Ronde Regional Aquifer

Upper Tammany Creek Area

Wells completed in the Grande Ronde Regional Aquifer in the upper reaches of Tammany Creek can range in total depth, from about 300 feet to 1,200 feet. Groundwater levels can also range by several hundred feet with a depth to water of about 1,100 ft-bgs and a minimum depth to water of about 250 ft-bgs.

Observed groundwater levels for the Grande Ronde Regional Aquifer in this area of the Lewiston Plateau show mixed trends over the observation period (Figure 7-6). From 2016 to 2024, positive linear trends are observed, ranging from +0.3 ft/yr to +1.1 ft/yr (Table 7-5). However, p-values indicate these trends are not statistically significant. Continued monitoring could increase the statistical significance of linear trends or identify cyclical characteristics.

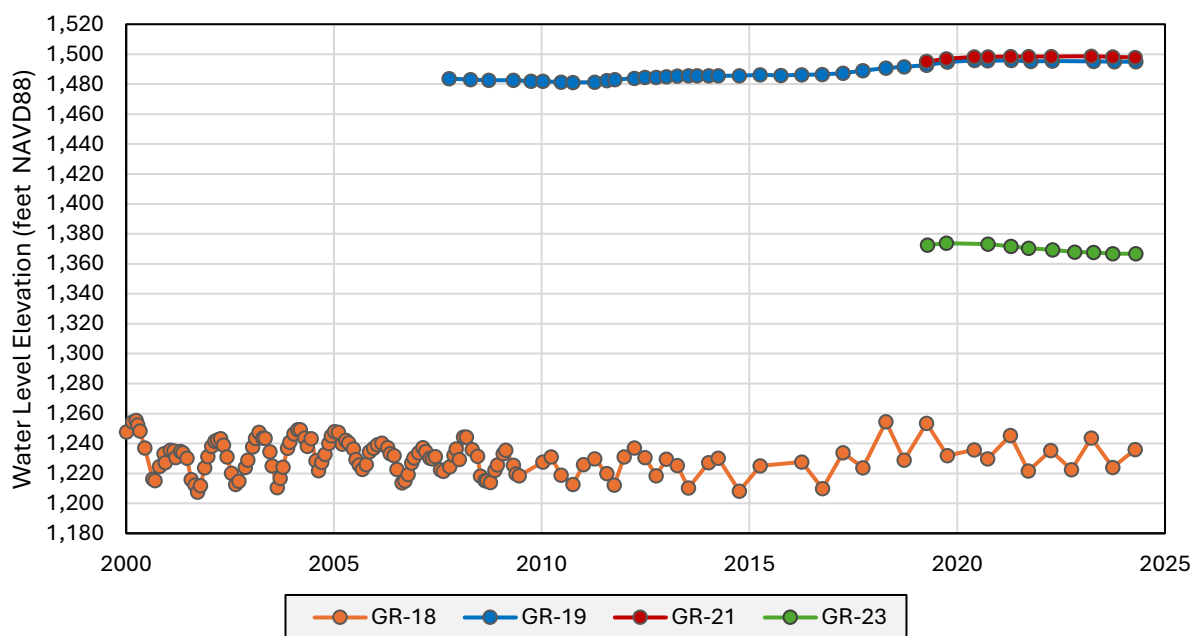


Figure 7-6. Observed water levels for the upper Tammany Creek area.

Table 7-5. Summary of water level trends for the upper Tammany Creek area.

Well No.	Well ID	Period Tested	Trend (ft/yr)	p-value	Status Note
GR-18	35N 05W 25ADD1	2000-2024 2016-2024	-0.4 +0.3	0.18 0.75	Cyclical behavior. Declining since 2020.
GR-19	35N 04W 31DCCA1	2007-2024 2016-2024	+1.0 +1.1	<0.01 0.12	Possible cyclical behavior. Declining since 2021.
GR-21	34N 04W 07ADA1	Not Tested	NA	NA	Trend not quantified. Short period of record. GR-21 appears to correlate to GR-19.
GR-23	34N 05W 15BAC1	Not Tested	NA	NA	Trend not quantified. Short period of record. Declining since 2020.

Middle and Lower Tammany Creek Area

Wells completed in the Grande Ronde Regional Aquifer in the middle and lower reaches of Tammany Creek can range in total depth, from about 300 feet near the Snake River to 2,000 feet at the Lewiston Orchards Irrigation District wells. Groundwater levels can range in depths from about 30 ft-bgs at lower elevations near the Snake River to 900 ft-bgs at well GR-13 in the Lewiston Orchards.

Observed groundwater levels in this area of the Lewiston Plateau show generally stable water levels during most of the observation period (Figure 7-7). Water levels began to decline during the summer of 2021 and continue to decline. Linear regression analysis of water level records from 2016 to 2024 show trends are generally declining at rates of about -0.6 ft/yr to -0.1 ft/yr (Table 7-6). Groundwater level trends at wells in the middle to lower reaches of Tammany Creek are not statistically significant with p-values between 0.5 to 0.9.

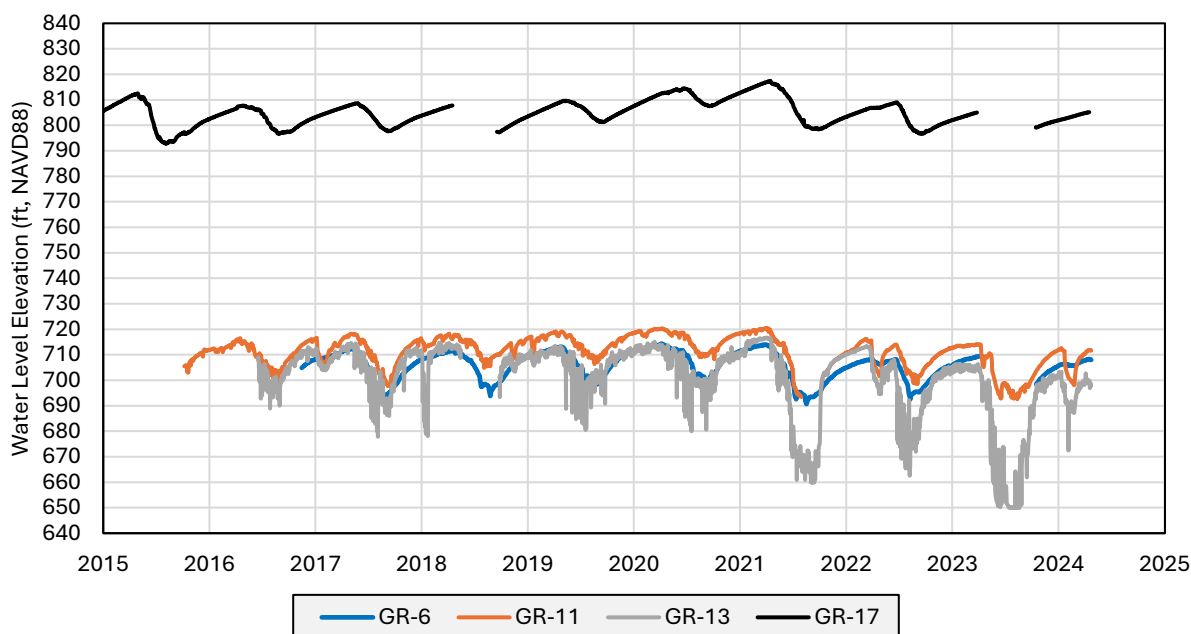


Figure 7-7. Observed water levels for the middle and lower reach of the Tammany Creek area.

Table 7-6. Summary of water level trends for the middle and lower reach of the Tammany Creek area.

Well No.	Well ID	Period Tested	Trend (ft/yr)	p-value	Status Note
GR-6	35N 06W 23DDA1	2016-2024	-0.3	0.60	Declining since 2021.
GR-11	35N 05W 20DBB1	2016-2024	-0.5	0.53	Declining since 2021.
GR-13	35N 05W 22BAB1	2016-2024	-0.6	0.47	Declining since at least 2021.
GR-17	35N 05W 13CDC1	2016-2024	-0.1	0.87	Declining since 2021.

Lindsay Creek and Clearwater River Area

Depths of wells completed in the Grande Ronde Regional Aquifer in the vicinity of Lindsay Creek and along the Clearwater River range from about 200 feet to 1,200 feet. Groundwater levels along the Clearwater River are about 10 ft-bgs to 15 ft-bgs. Flowing artesian conditions exist at well GR-33 during the spring months. Groundwater levels near Lindsay Creek can range from about 200 ft-bgs at lower elevations to 650 ft-bgs at high elevations.

Observed groundwater levels in this area of the Lewiston Plateau show stable to slightly declining trends over the observation period (Figure 7-8). Observed water levels from 2016 to 2024 show linear trends for range from approximately -0.4 ft/yr to 0.0 ft/yr (Table 7-7). Trends are not statistically significant.

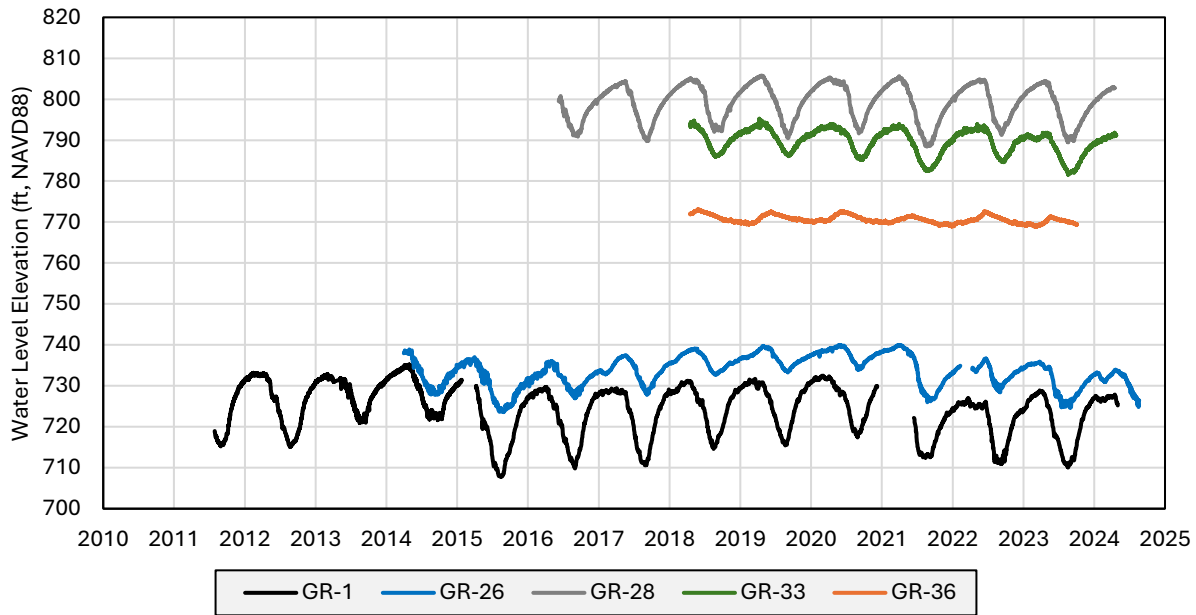


Figure 7-8. Observed water levels in the Lindsay Creek and Clearwater River area.

Table 7-7. Summary of water level trends for the Lindsay Creek and Clearwater River area.

Well No.	Well ID	Period Tested	Trend (ft/yr)	p-value	Status Note
GR-1	36N 06W 36ADB1	2012-2024 2016-2024	-0.5 -0.4	<0.01 0.35	Periods of decline. Stable since 2022.
GR-26	35N 05W 04ACA1	2016-2024	-0.2	0.75	Declining since 2021.
GR-28	35N 05W 02CCB3	2016-2024	0.0	NA	No trend. Stable with slight decline since 2021.
GR-33	36N 05W 25CAD1	Not Tested	NA	NA	Trend not quantified. Short period of record. Declining since 2019.
GR-36	36N 04W19DDC1	Not Tested	NA	NA	Trend not quantified. Short period of record. Influenced by the Clearwater River.

Recent Water Level Declines

In general, groundwater levels in the Grande Ronde Regional Aquifer within the GWMA have been declining since 2021. Water level declines have been the most pronounced in the Lewiston Orchards area along the middle reach of Tammany Creek. In this area, groundwater levels are lower by as much as 16 feet between spring 2021 and spring 2024 (Figure 7-9). This decline corresponds with increased groundwater production within the Lewiston Plateau GWMA during that period, particularly by the Lewiston Orchards Irrigation District (LOID).

LOID is largest groundwater user in the Lewiston Plateau GWMA. In 2021, LOID began relying more heavily on using two new wells, LOID 5 and 6, to fill Mann Lake (Reservoir A). In 2021, LOID doubled their groundwater production (Figure 7-10). Though total production for the LOID system has decreased since 2021, there continues to be more groundwater production compared to 2018, 2019, and 2020 when groundwater levels appeared stable or increasing.

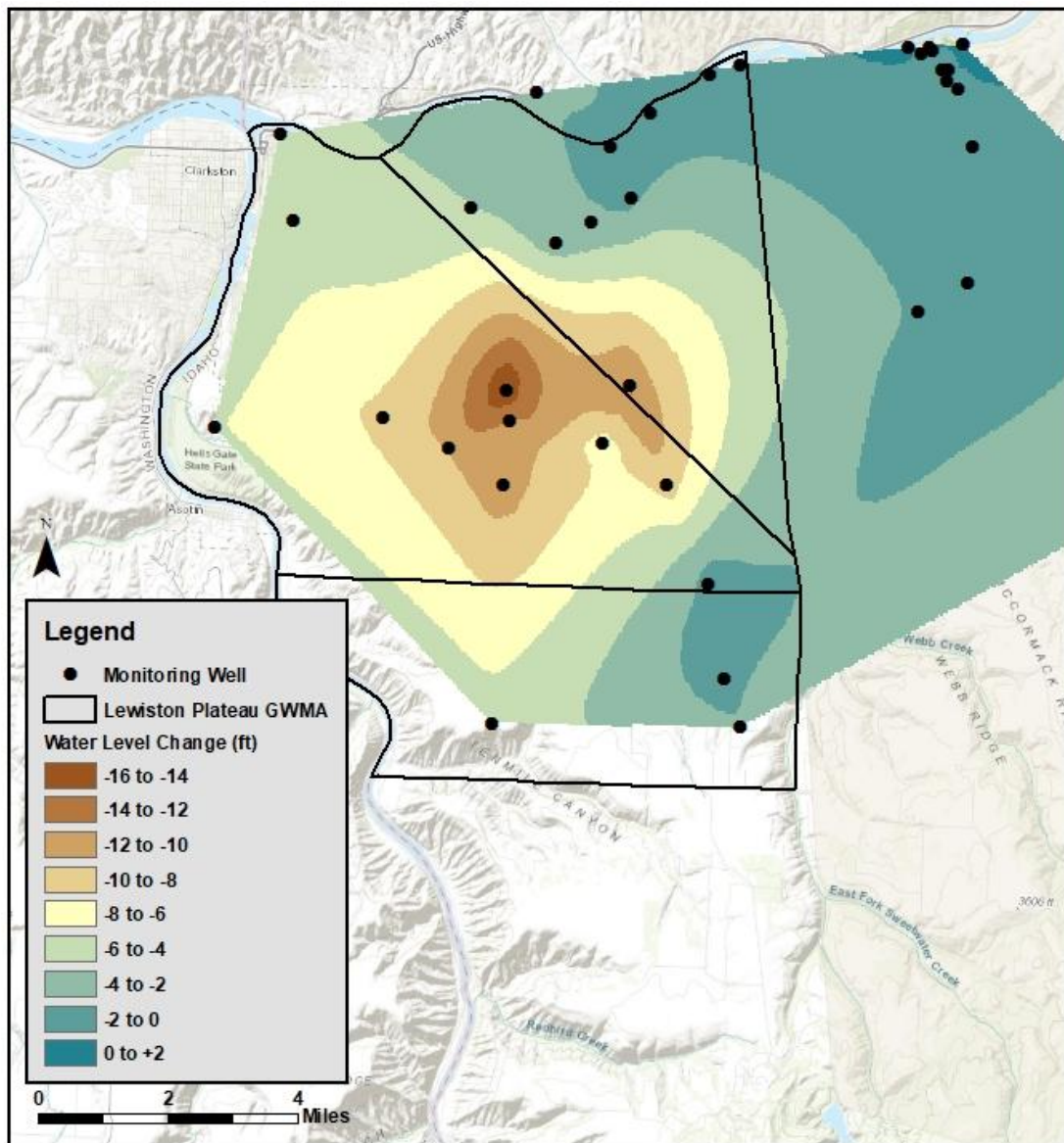


Figure 7-9. Difference between groundwater levels in Spring 2024 compared to Spring 2021.

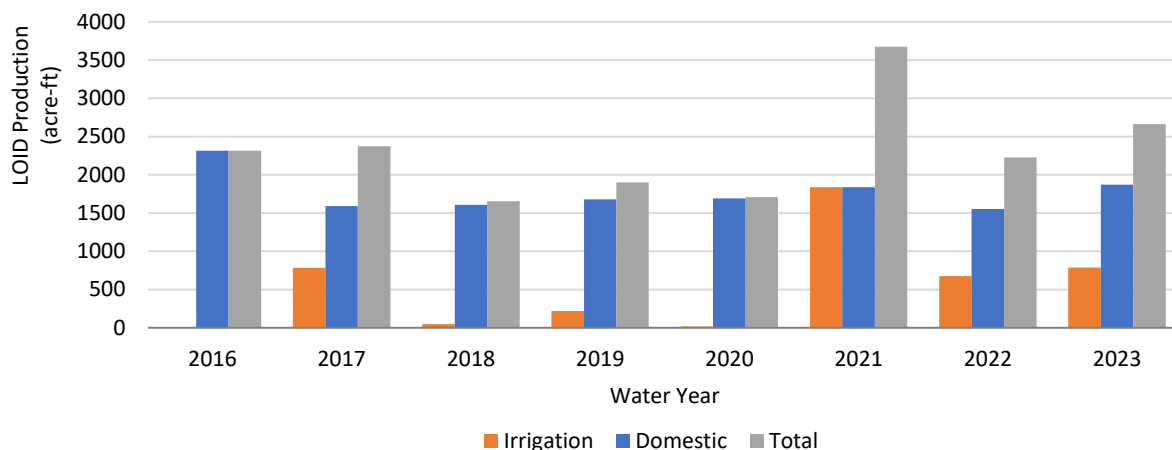


Figure 7-10. Lewiston Orchards Irrigation District (LOID) groundwater production.

8. Summary of Observations

8.1 Saddle Mountains Aquifers

The Saddle Mountains Basalt Formation in the Lewiston Plateau GWMA is separated into two distinct areas by Tammany Creek. This defines two separate aquifers in the Saddle Mountains Basalt Formation, a north aquifer and a south aquifer. As summarized in Table 5-1, 176 acre-feet per year of groundwater has been allocated from the Saddle Mountains South Aquifer and 600 acre-feet per year has been allocated from the Saddle Mountains North Aquifer.

Observed groundwater levels for the Saddle Mountains aquifers appear to be stable or respond to local climatic cycles. Wells with long-term water level data beginning in the late 1980s or early 2000s show positive trends. Other wells in the Saddle Mountains Aquifers responded by 20 feet to 70 feet to the high snowfall year in 2017. Groundwater levels at these wells have since then receded to levels observed in 2016.

Issues associated with the Saddle Mountains Aquifers in the Lewiston Plateau GWMA appear to be related to low yield, water quality, and potential well interference in areas with a high density of wells, particularly during the irrigation season. Low yield from the wells is associated with aquifer properties and not necessarily caused by overallocation of the resource.

8.2 Wanapum Aquifer

Groundwater level observations in the Wanapum Aquifer located within the Lewiston Plateau GWMA show various trends. In the Tammany Creek area, some wells appear to respond to climatic cycles. Wells completed in the Wanapum Aquifer south of Tammany Creek have high water level elevations compared to the north side of Tammany Creek and appear to be generally stable. Wells completed

north of Tammany Creek have experienced water level declines and production issues. At least five domestic wells within a quarter mile of wells W-13 and W-14 (Figure 6-2) have been deepened or replaced since the late 1990s. At least four wells within a half mile of well W-16 (Figure 6-2) were deepened in the early to late 1990s, during or just after the drought cycle from about 1985 to 1994. Most of these wells were deepened into the Grande Ronde Regional Aquifer.

In general, groundwater levels in the Lindsay Creek area continue to decline at rates of approximately 0.5 feet per year to 2 feet per year, similar to those reported by Neely (2012). Numerous domestic wells in the Lindsay Creek area have had issues. Since 1996, at least eight wells originally completed in the Wanapum Aquifer have been deepened or replaced. A majority of the wells originally completed in the Wanapum Aquifer are now completed in the Grande Ronde Regional Aquifer.

Municipal pumping from the Wanapum Aquifer in the Lindsay Creek area is affecting groundwater levels. Since the City of Lewiston temporarily ceased pumping Lewiston Well #4 (Figure 6-2), groundwater levels began recovering. The water level at Lewiston Well #4 is approximately 20 feet higher than it was in the Fall of 2020. The water level at well W-3, located approximately one mile southeast of the city well, has recovered about six feet since 2022. Over time, additional wells in the Lindsay Creek area could respond to the positive trend related to a reduction or elimination of pumping at Lewiston Well #4.

8.3 Grande Ronde Regional Aquifer

IDWR has expanded the groundwater level monitoring network for the Grande Ronde Regional Aquifer within Lewiston Plateau GWMA from five wells in 2013 to 36 wells in 2024. Eleven wells have been added to the network over the past five years. Increased monitoring of groundwater levels in the Grande Ronde Regional Aquifer allows for a more detailed assessment of aquifer response to pumping, connections to surface water, and general groundwater flow in the Lewiston Plateau GWMA.

In general, groundwater levels in the Grande Ronde Regional Aquifer have been declining since 2021. Water level declines have been the most pronounced in the Lewiston Orchards area, where water levels are lower by as much as 16 ft since 2021. Observed groundwater level declines can be attributed to increased groundwater production in the area, particularly by the Lewiston Orchards Irrigation District and the City of Lewiston. During the 2020 water year, both entities pumped approximately 2,200 acre-feet of groundwater from the regional aquifer. Total groundwater pumping increased to approximately 4,500 acre-feet during the 2021 water year and reached a peak of 5,000 acre-feet during the 2023 water year.

Observed groundwater levels in the Grande Ronde Regional Aquifer near the City of Lewiston and Lewiston Orchards are approximately 10 feet to 40 feet below the Lower Granite Dam pool elevation. Municipal pumping from the regional aquifer appears to have developed depressed groundwater levels in the GWMA.

In addition to recent groundwater level declines and depressed groundwater levels in the regional aquifer, long-term groundwater level data for Lewiston Orchards Irrigation District Well #1 (well GR-13, Figure 6-3) shows periods of groundwater level decline. Groundwater levels at well GR-13 were approximately 790 feet-bgs in the 1990s (Stevens 1994). From 2000 to 2011, the groundwater levels were approximately 830 feet-bgs and from 2017 to 2021, groundwater levels were approximately 840

feet-bgs. In 2024, the depth to water at GR-13 was approximately 853 feet. Since 1991, groundwater levels at GR-13 have declined approximately 60 feet.

Groundwater levels in the upper reach of Tammany Creek and in Subarea B, approximately four miles or more south of the major municipal wells, have been improving. Long-term groundwater level data from wells GR-19 and GR-22 (Figure 6-3) indicate that regional aquifer levels have risen by 8 feet to 13 feet since 2011.

Observed groundwater level declines in the Grande Ronde Regional Aquifer, particularly in the area of the Lewiston Orchards Irrigation District wells, have prompted the Lewiston Orchards Irrigation District, Bureau of Reclamation, and the Nez Perce Tribe to explore options to replace groundwater diversions with surface water from the Clearwater River for irrigation. Groundwater levels in the regional aquifer are anticipated to improve if large municipal pumping demands decrease.

9. Continued Assessment Efforts

IDWR will continue to measure groundwater levels at current monitoring sites in the Lewiston Plateau GMWA. Continued measurements should increase the statistical significance of linear trends in the groundwater levels or identify cyclical trends such as those caused by climatic cycles. IDWR also plans to expand groundwater level monitoring for all aquifers in the Lewiston Plateau GWMA, as opportunities arise. However, expanding the groundwater monitoring network for the Saddle Mountains Aquifers and the Wanapum Aquifer is limited due to restrictions on constructing new wells, which are typically required to be completed in the Grande Ronde Regional Aquifer. IDWR will need to consider installing dedicated monitoring wells in areas of interest including those near surface water bodies, natural recharge areas, and areas with complex hydrogeologic conditions.

In addition to continued water level monitoring, efforts will be made to constrain water budget parameters for the various aquifers in the GWMA. Though efforts have been made in this report to estimate groundwater withdrawal from the Saddle Mountains Aquifer, the Wanapum Aquifer, and the Grande Ronde Regional Aquifer, inflows from various sources need to be identified and rates estimated.

Finally, IDWR plans to continue collecting and analyzing geological data to constrain the location and extent of the basalt formations in the region. Geological information assists in interpreting existing well logs, estimating appropriate drilling and seal depths for new wells, and assessing observed water levels and water level fluctuations at wells in the monitoring network.

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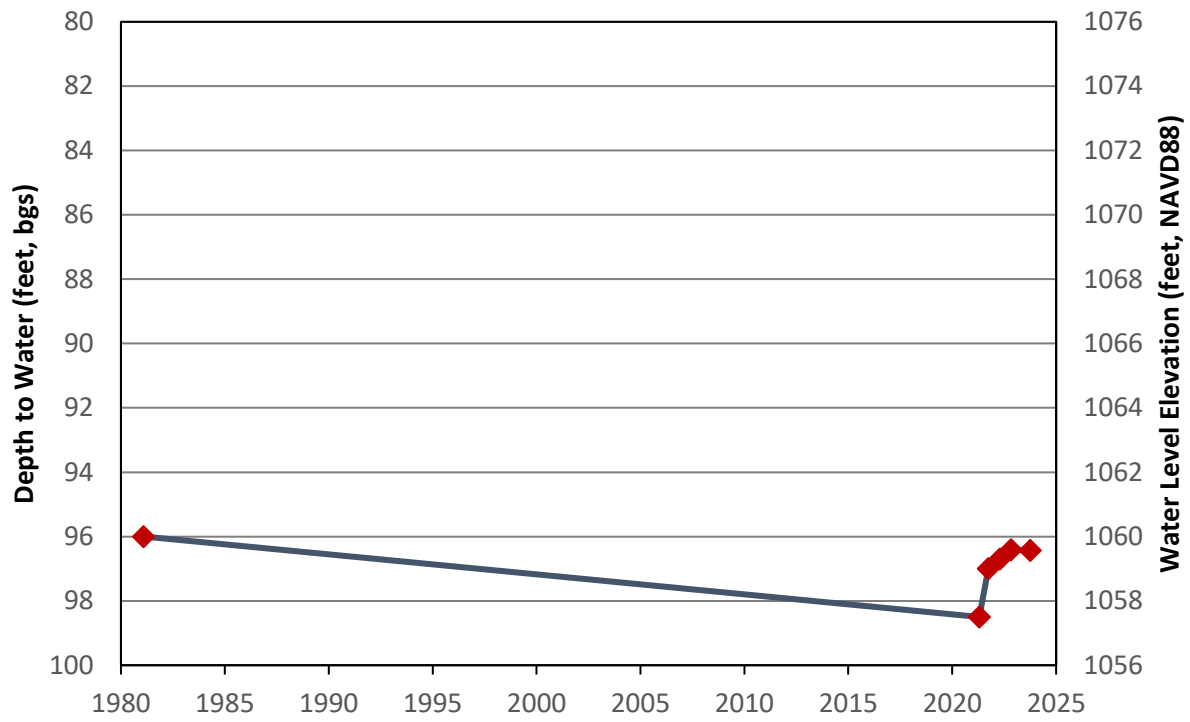
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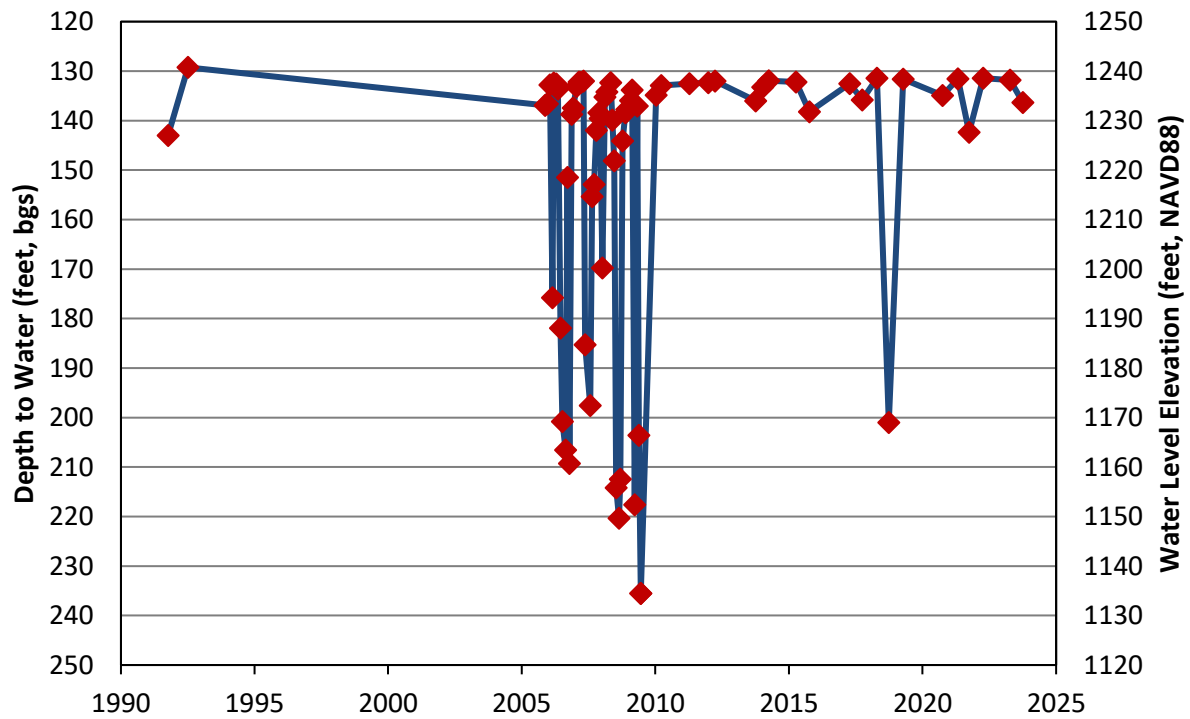
Appendix A

Hydrographs for the
Saddle Mountain North and South Aquifers

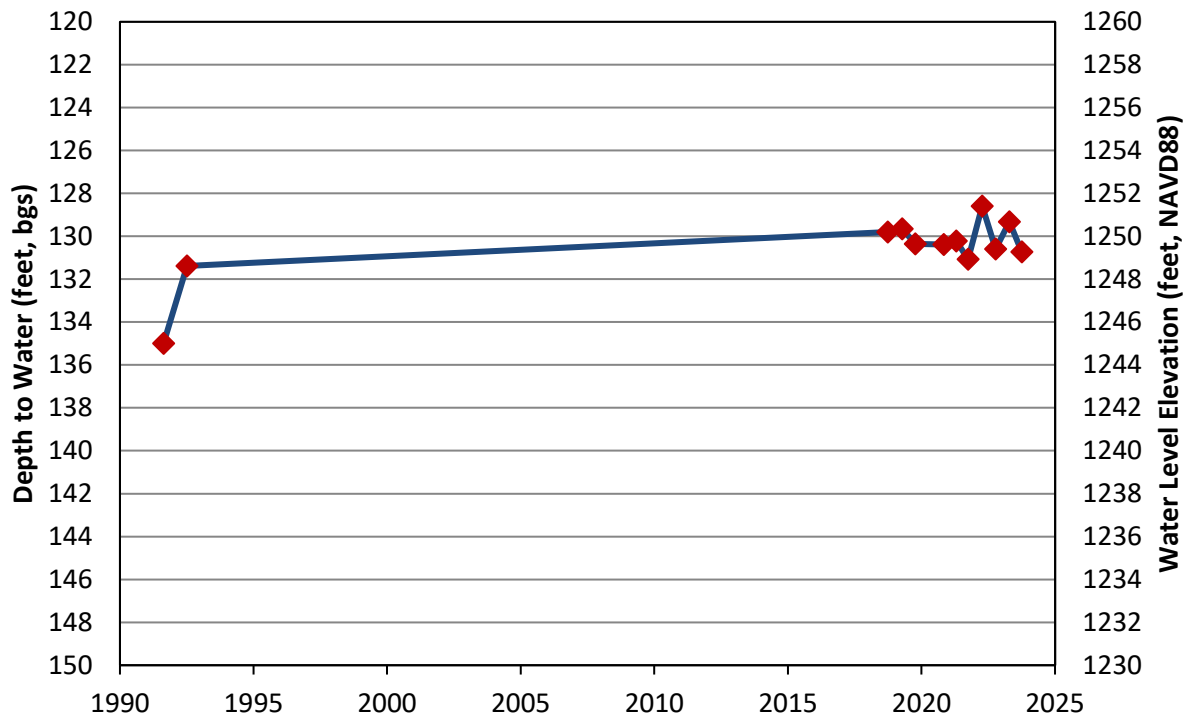
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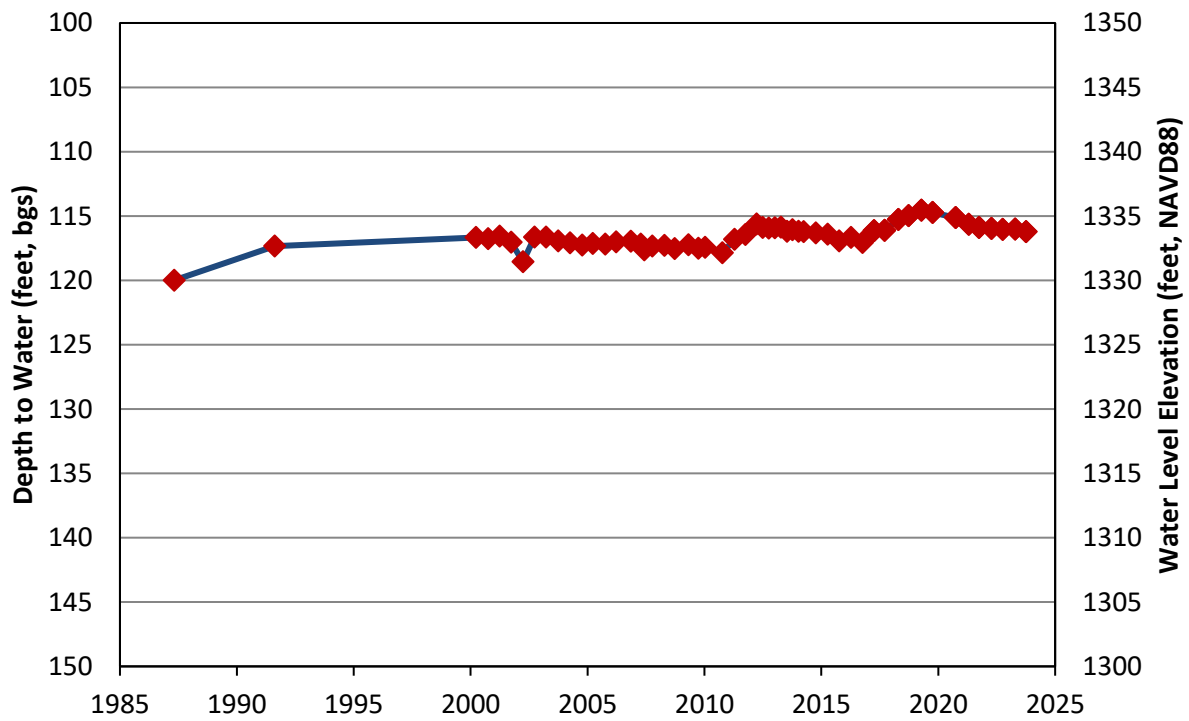
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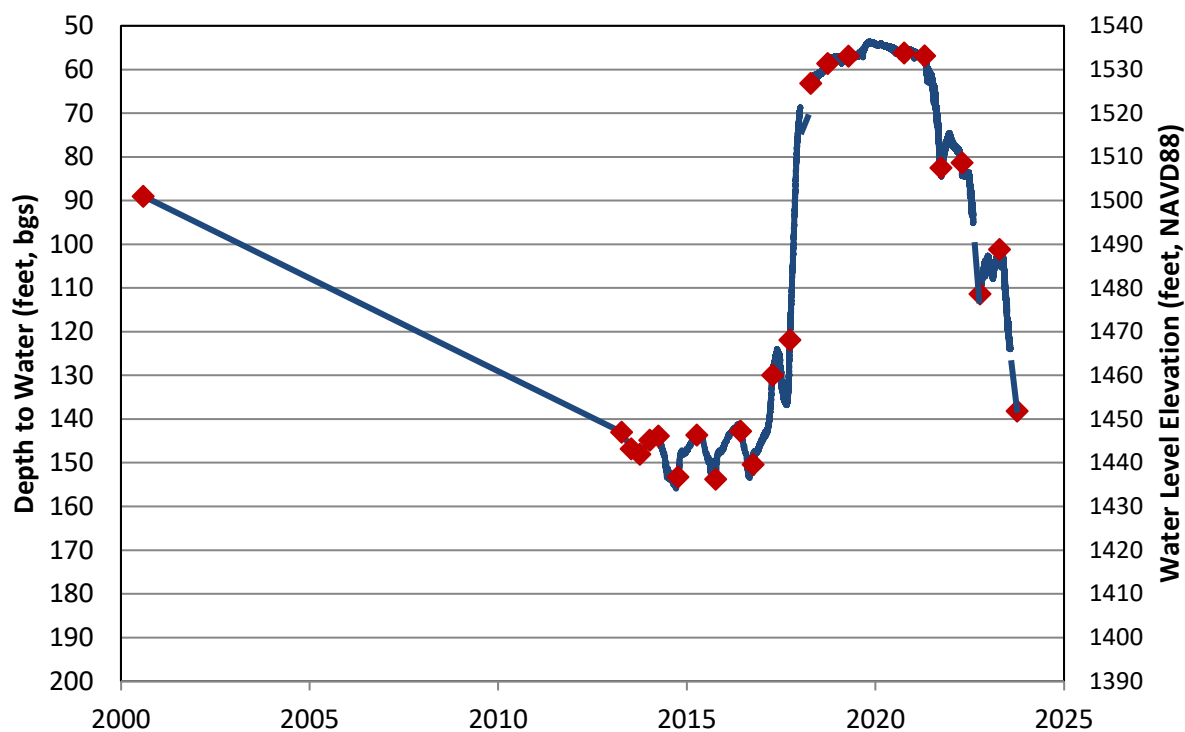
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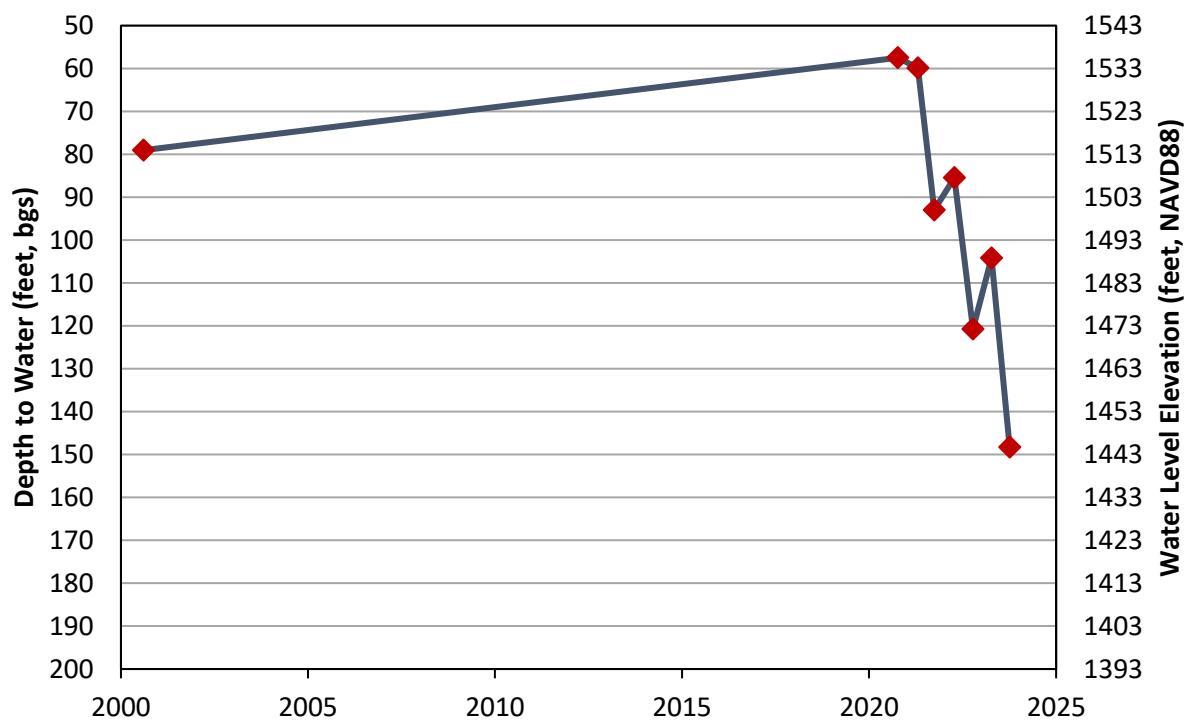
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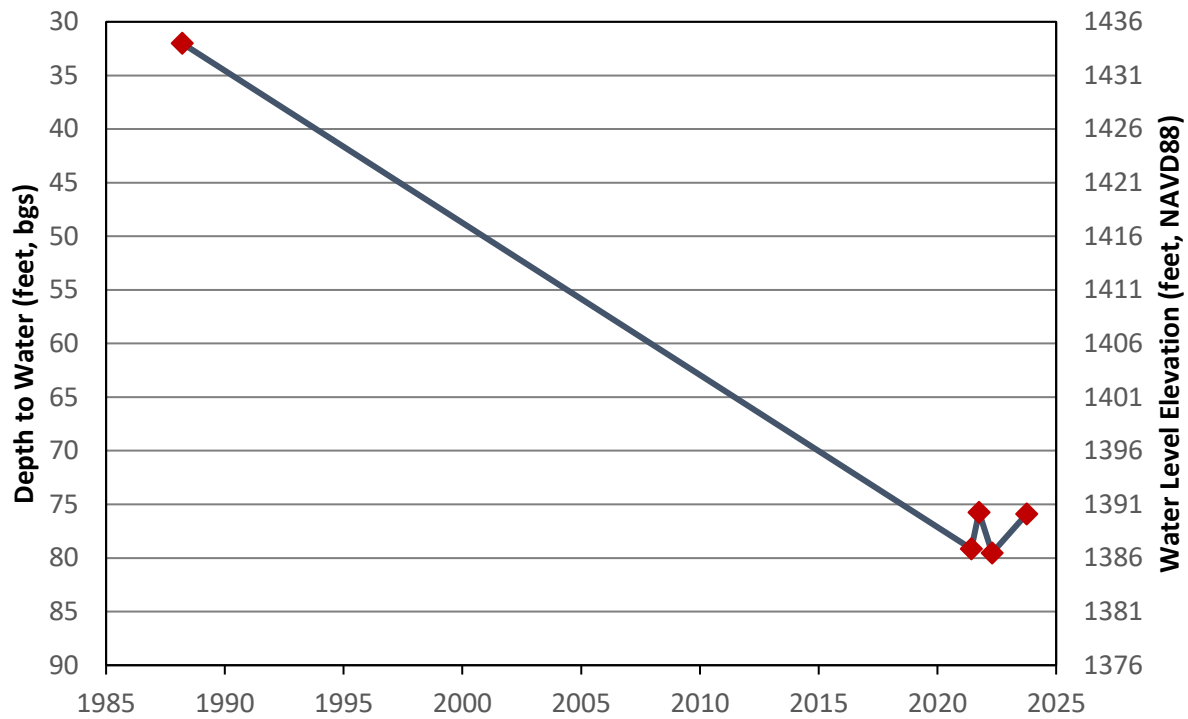
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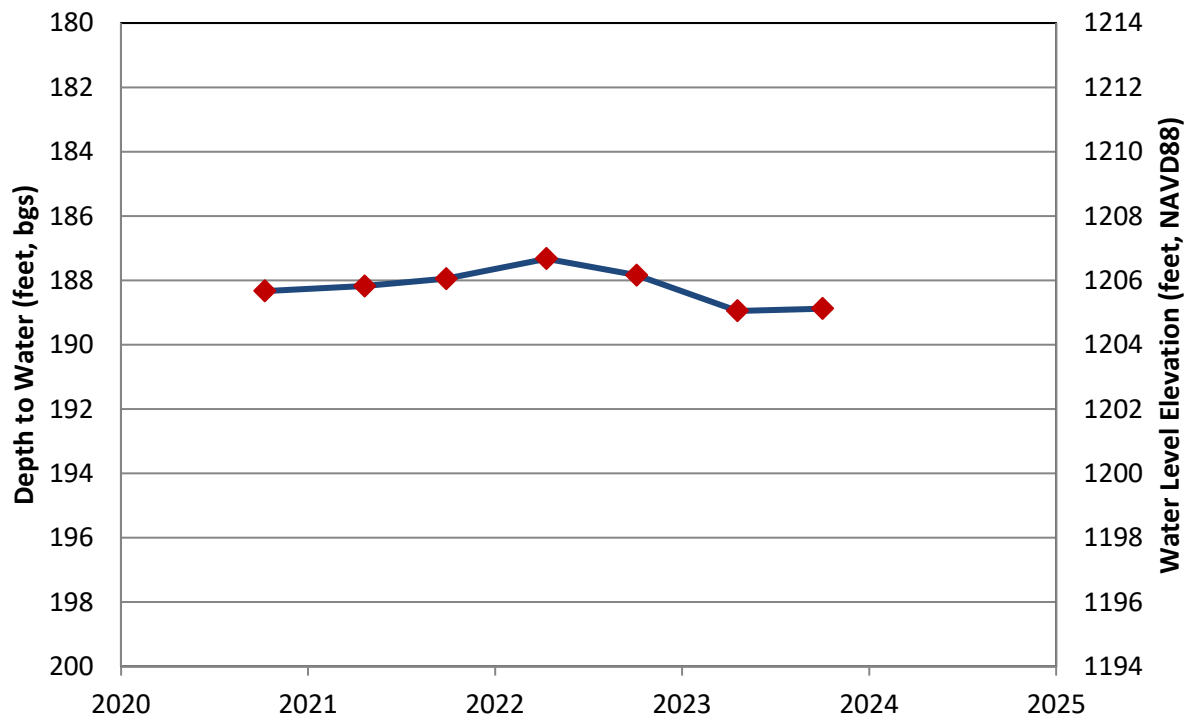
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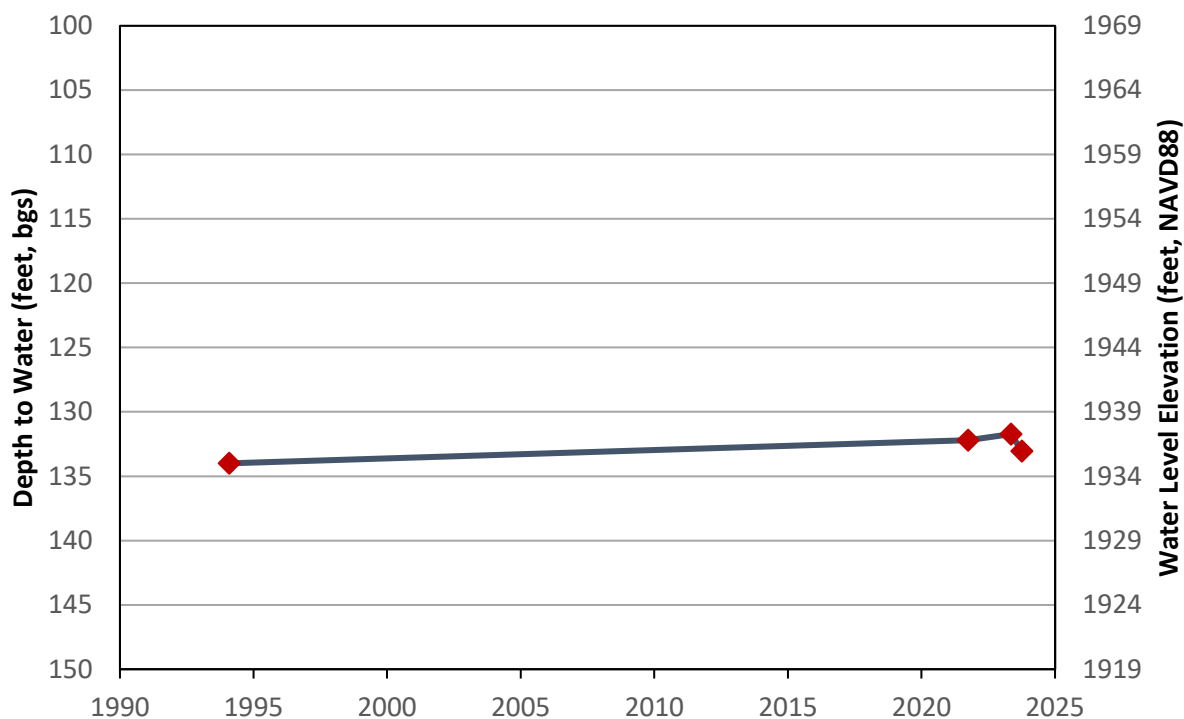
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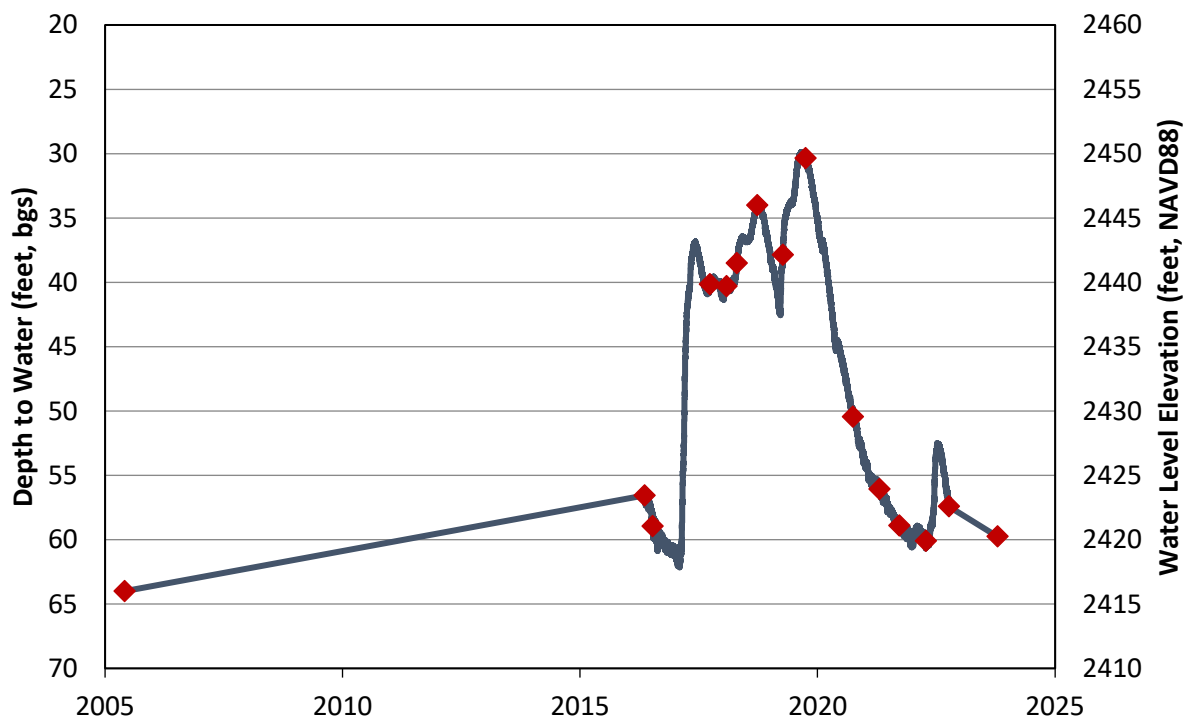
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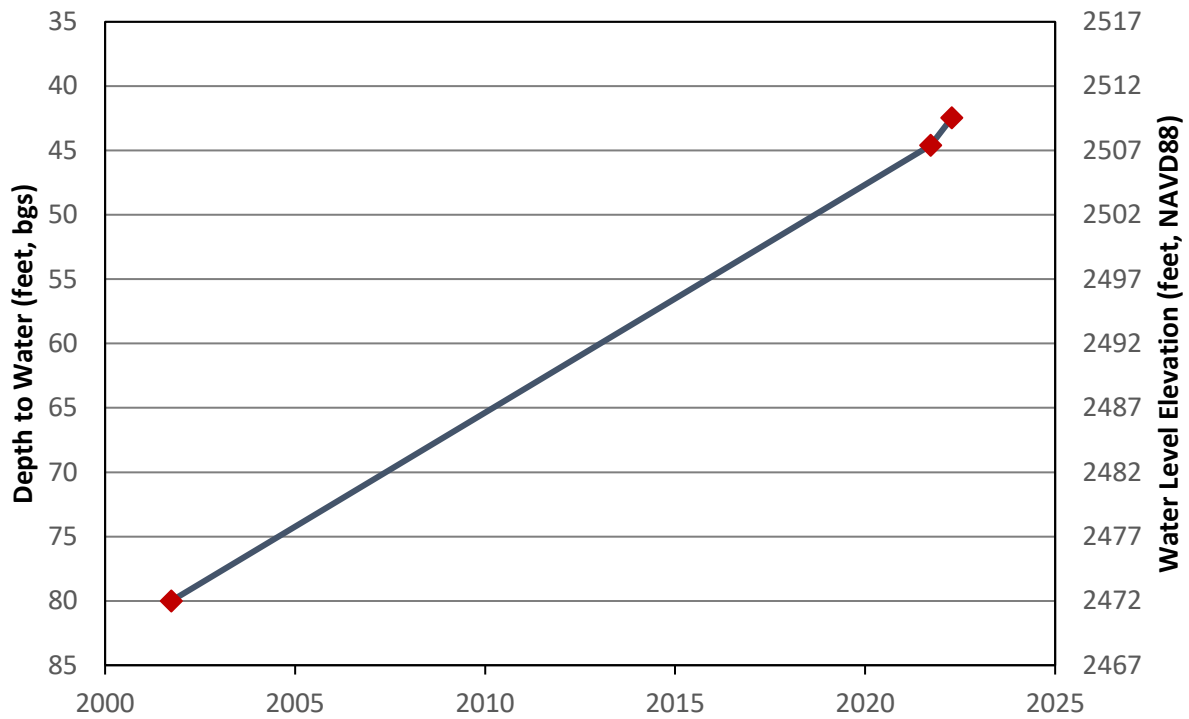
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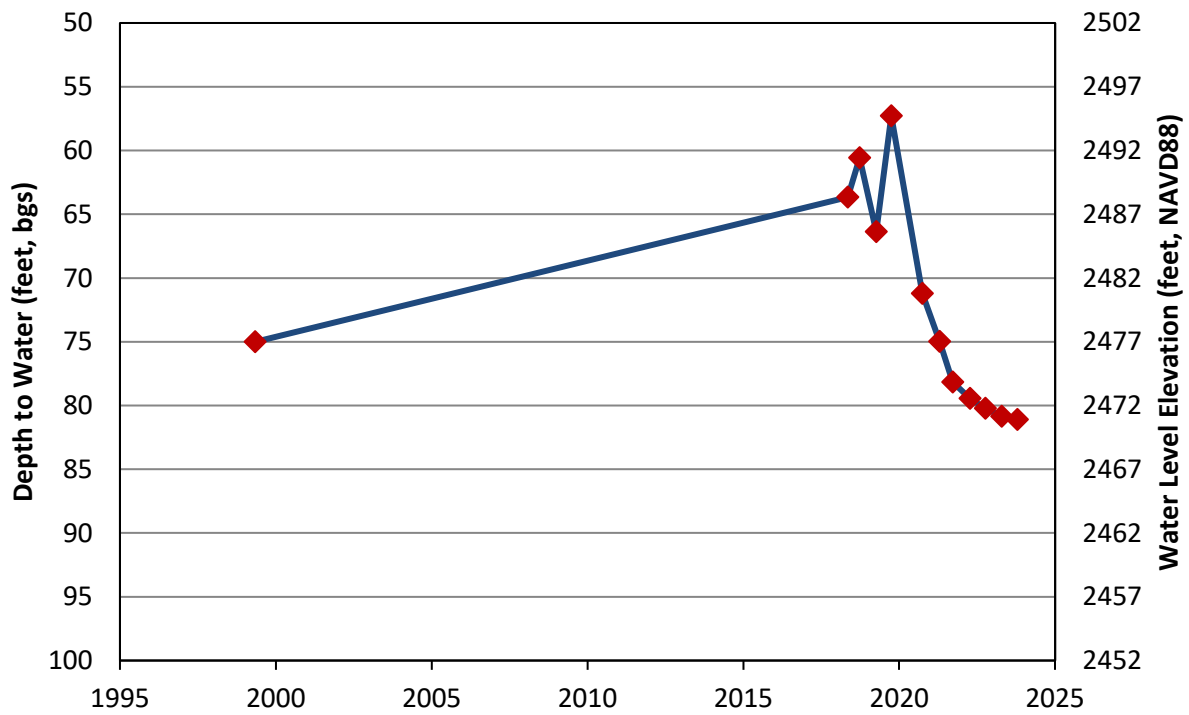
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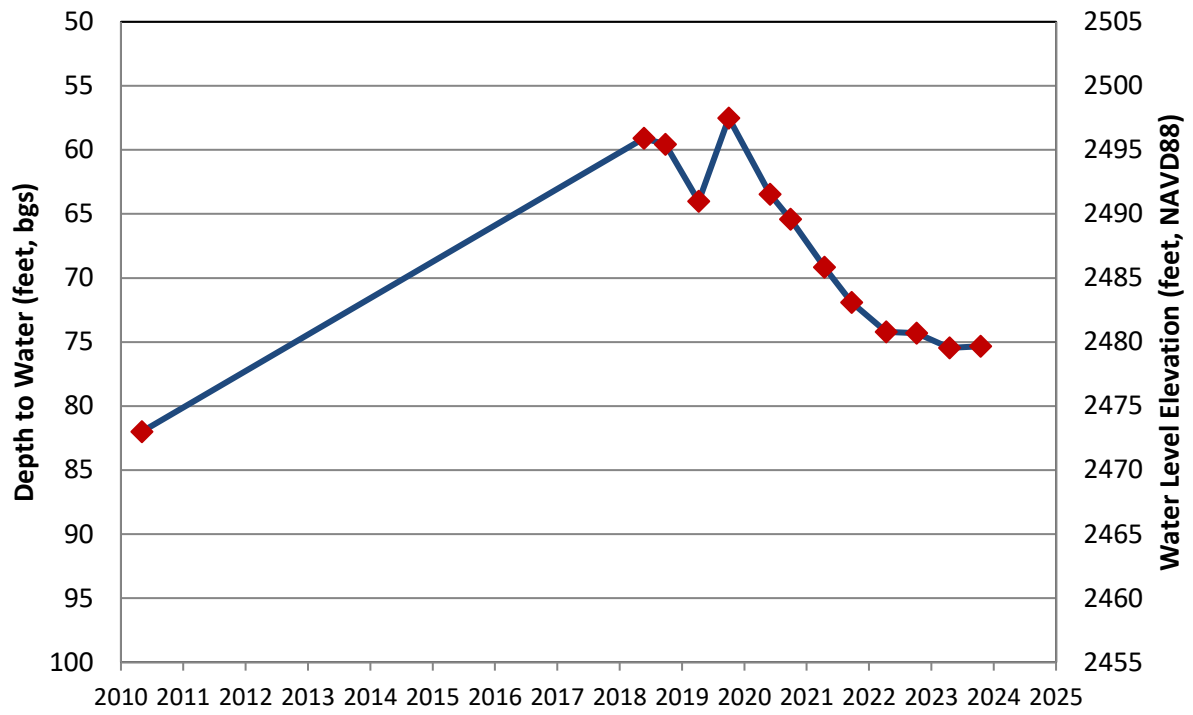
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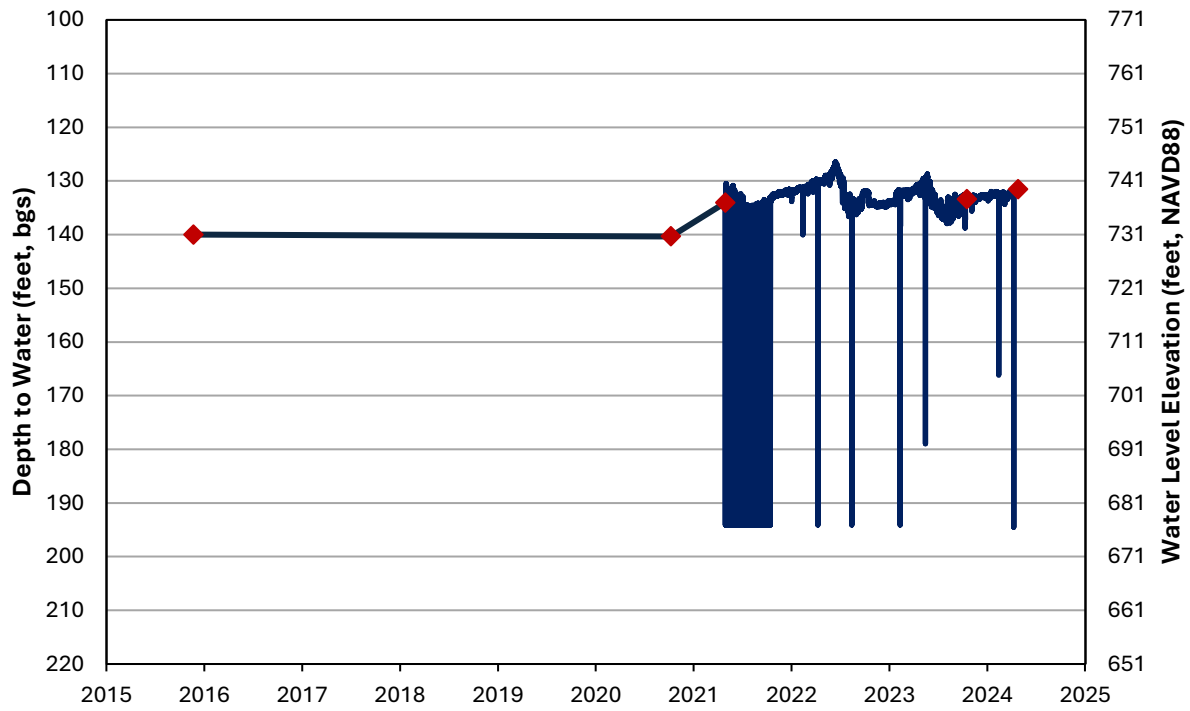
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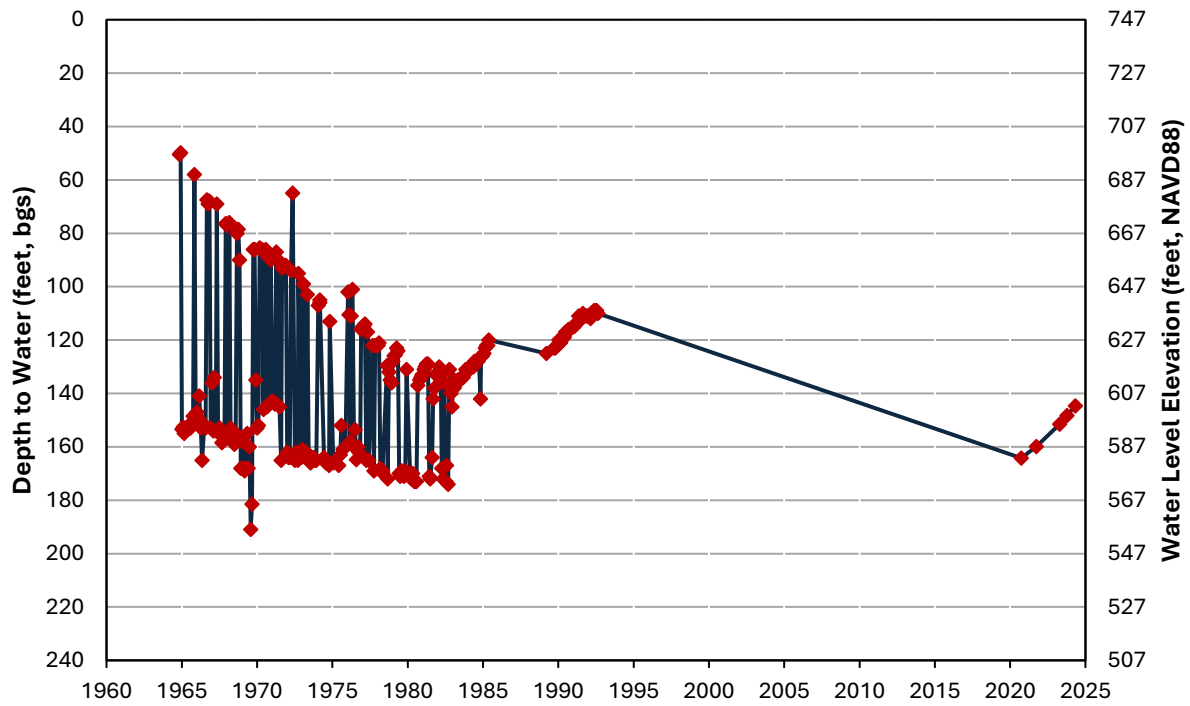
Appendix B

Hydrographs for the
Wanapum Aquifer

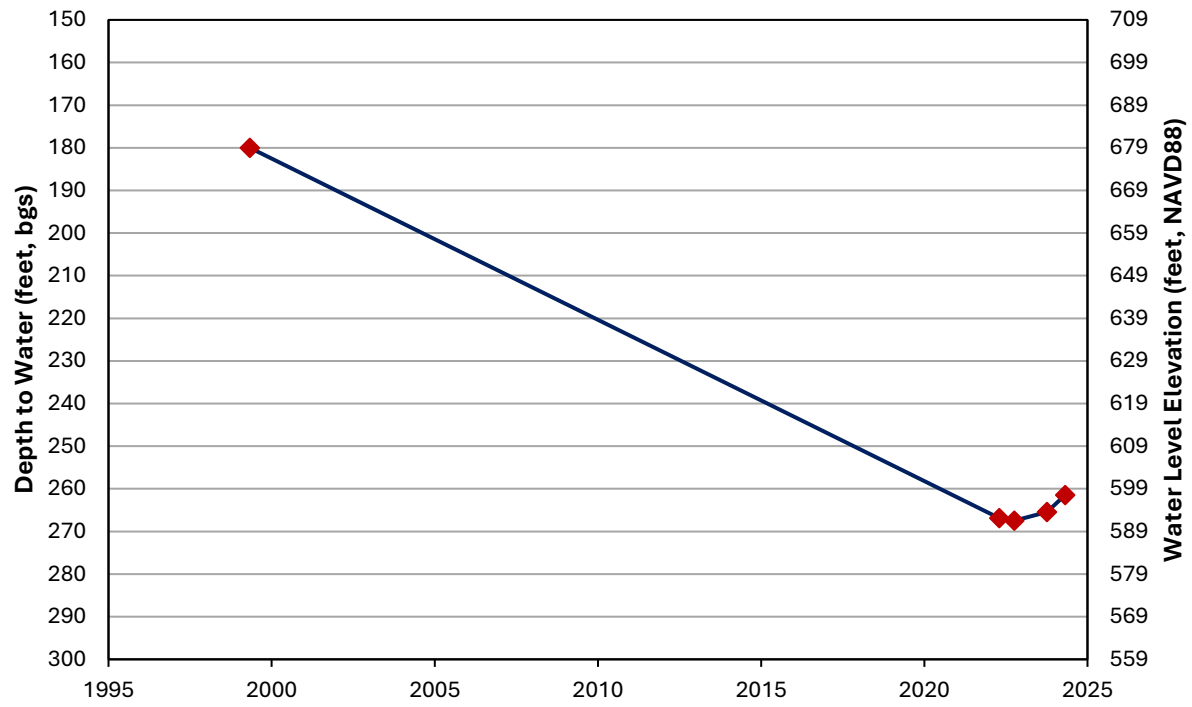
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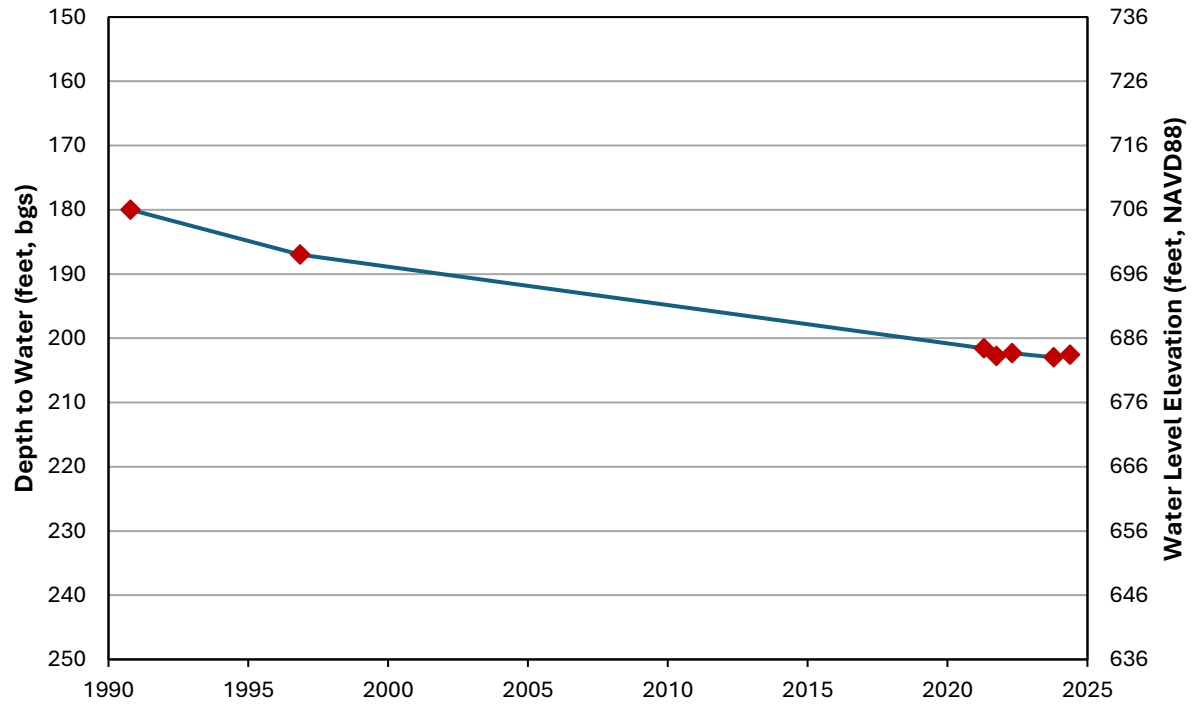
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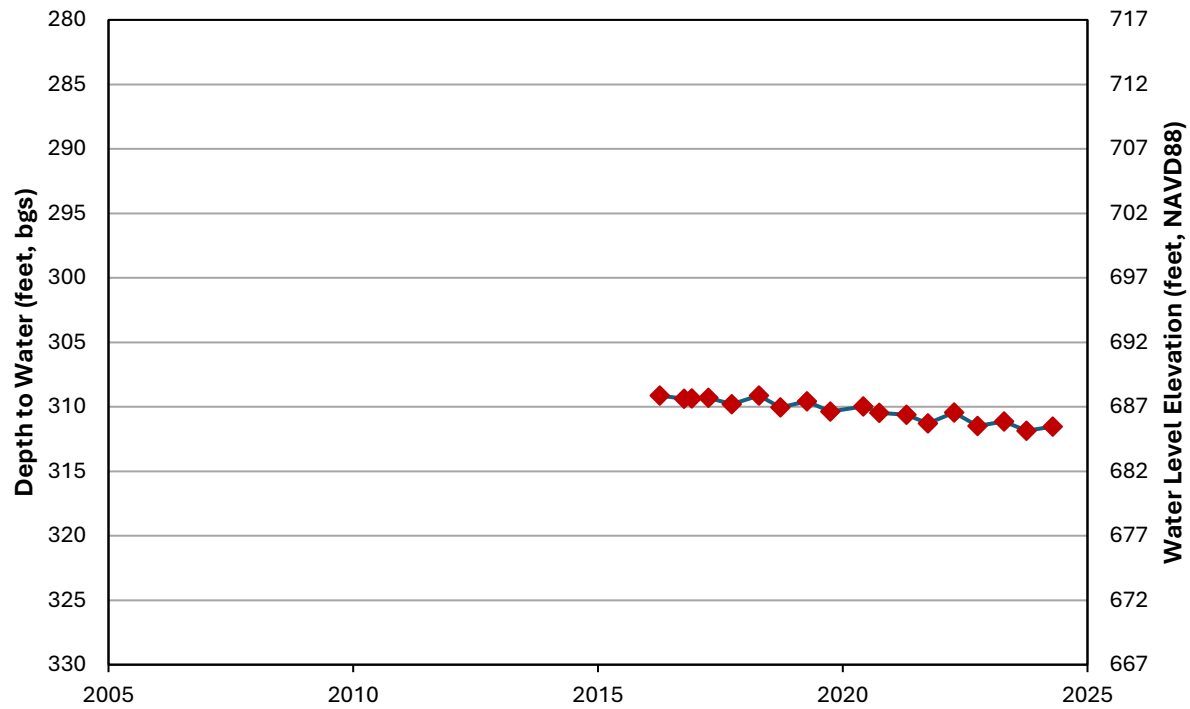
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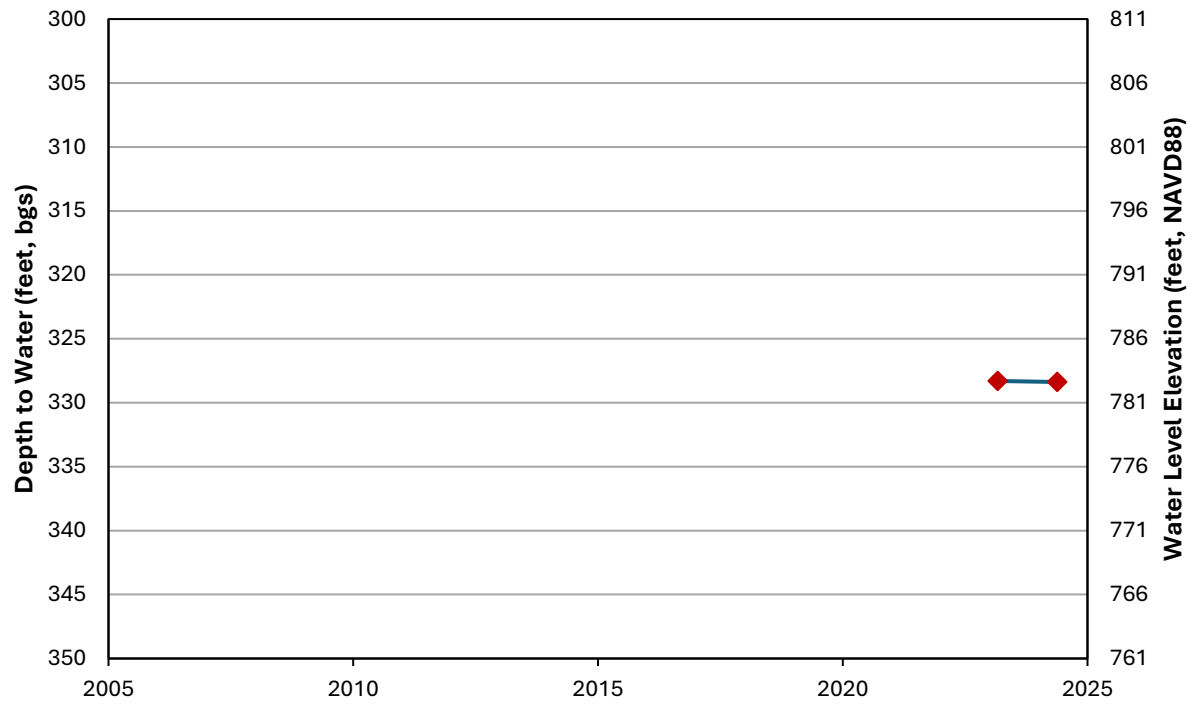
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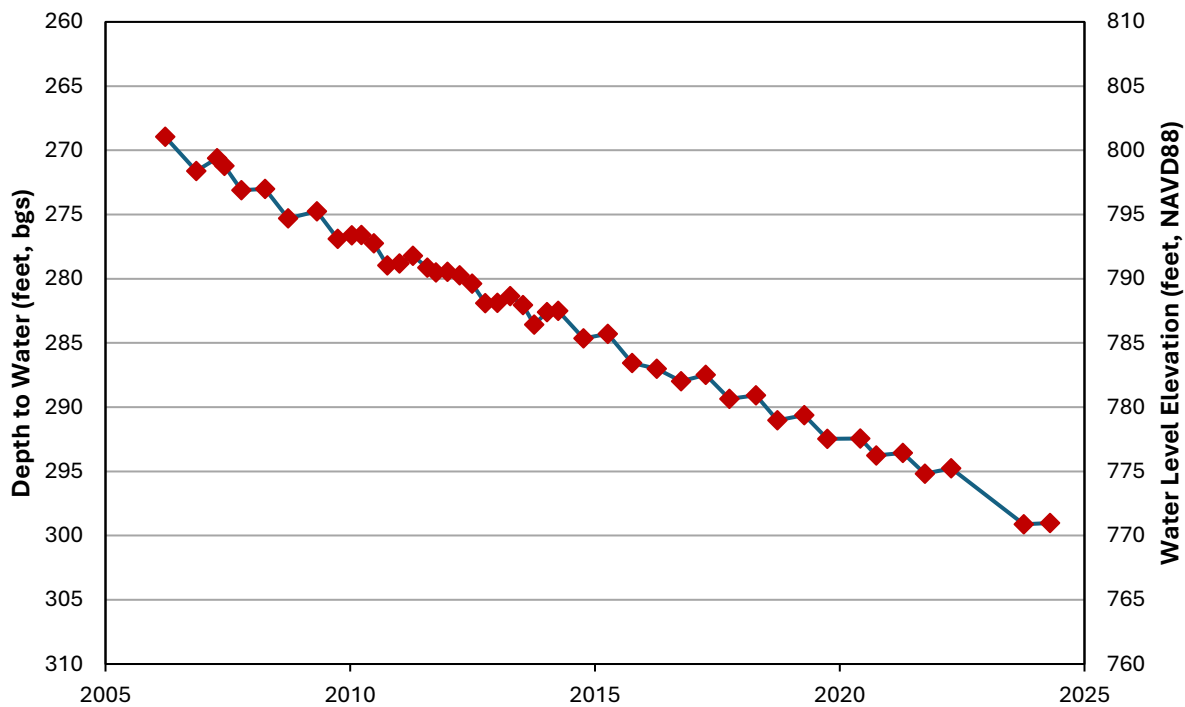
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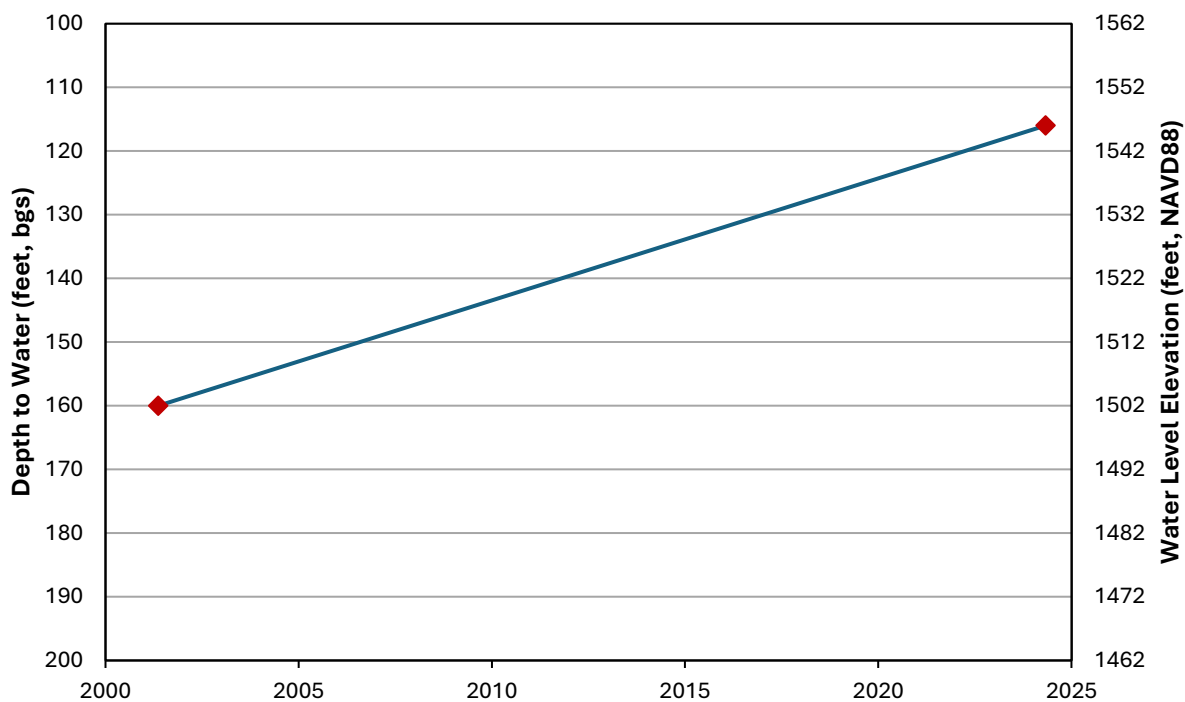
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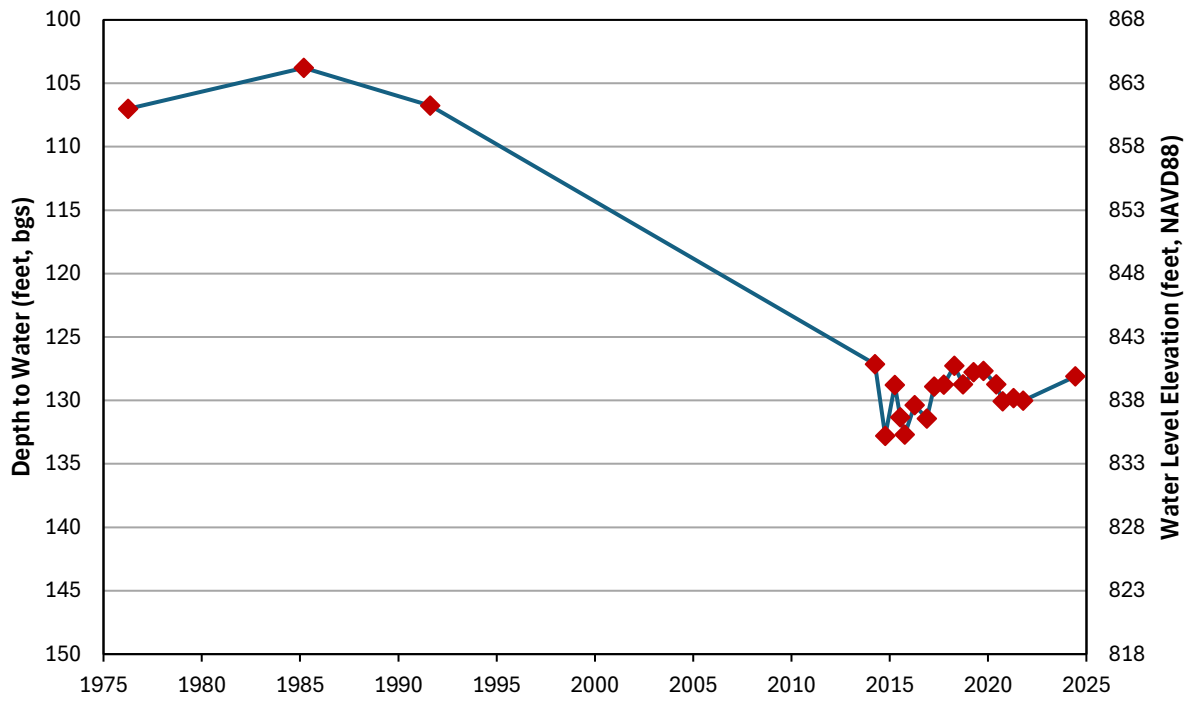
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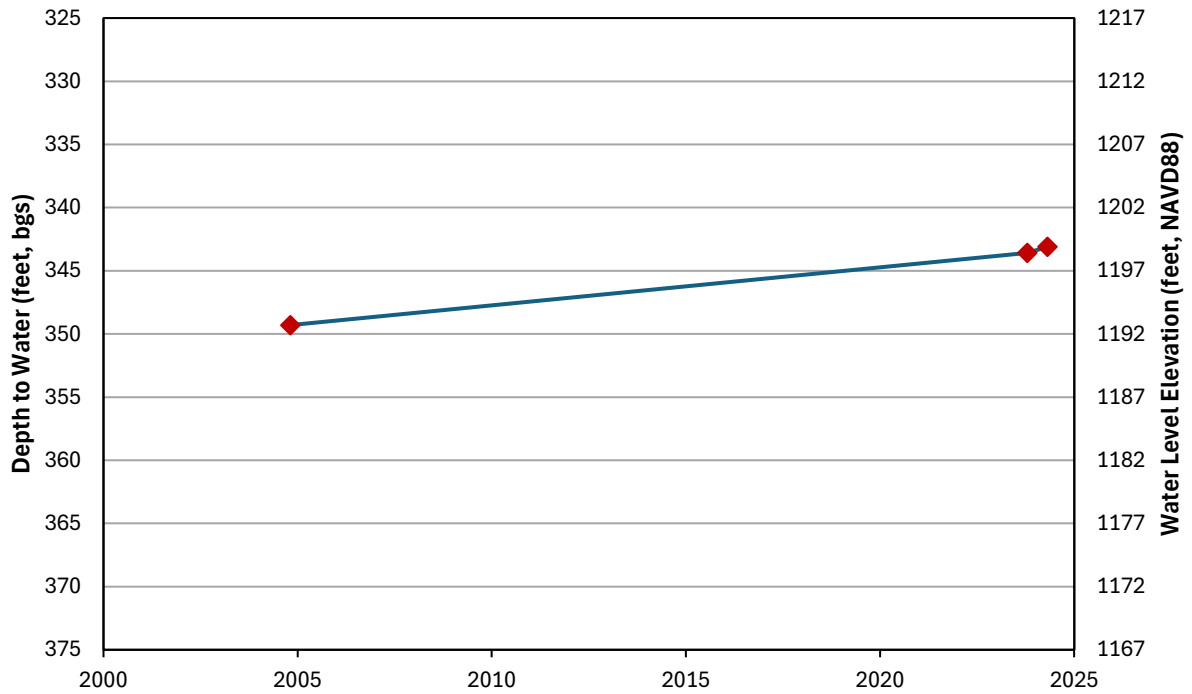
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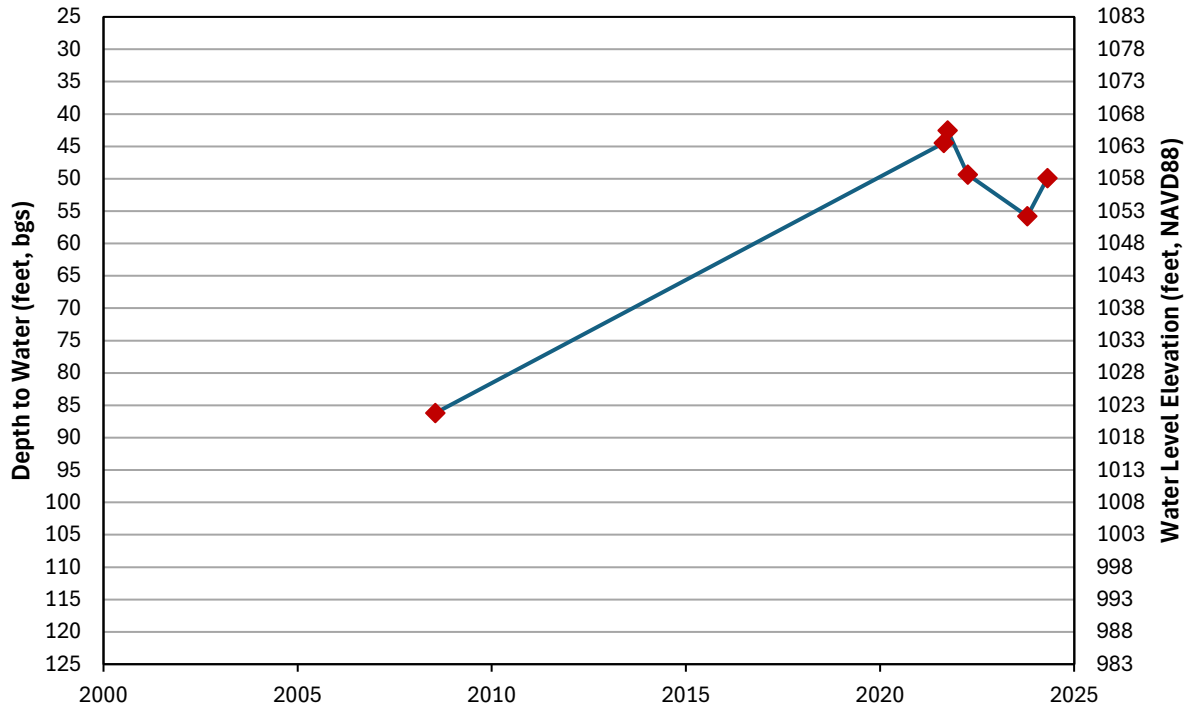
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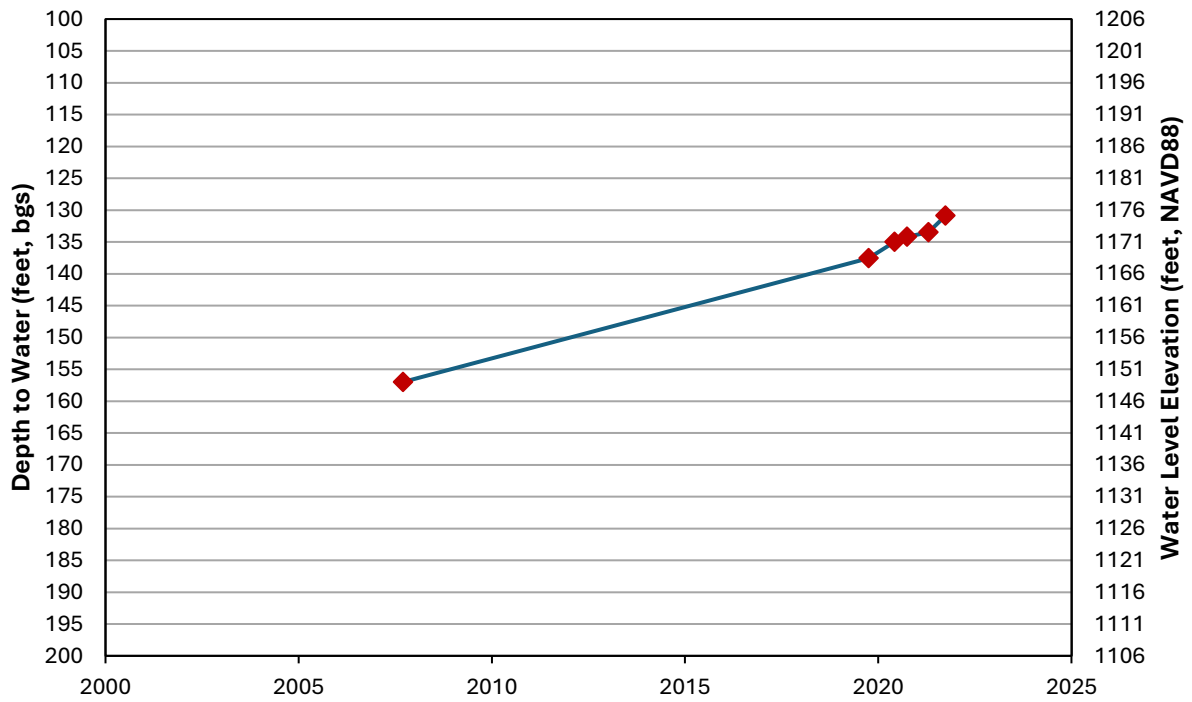
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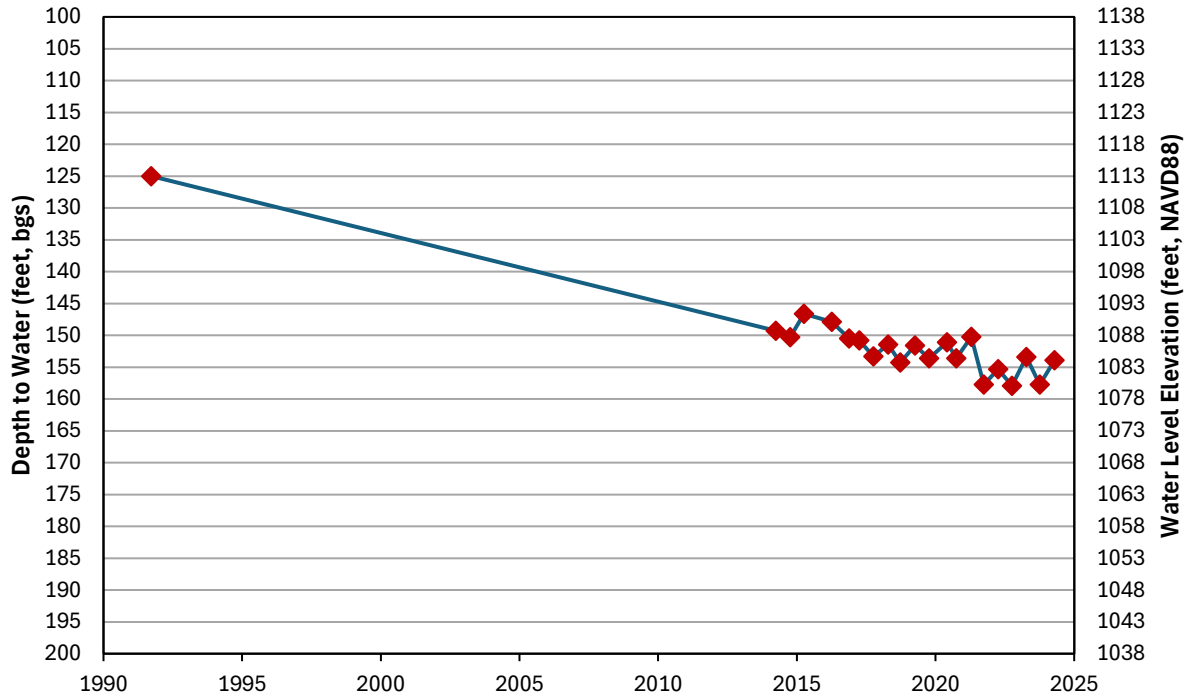
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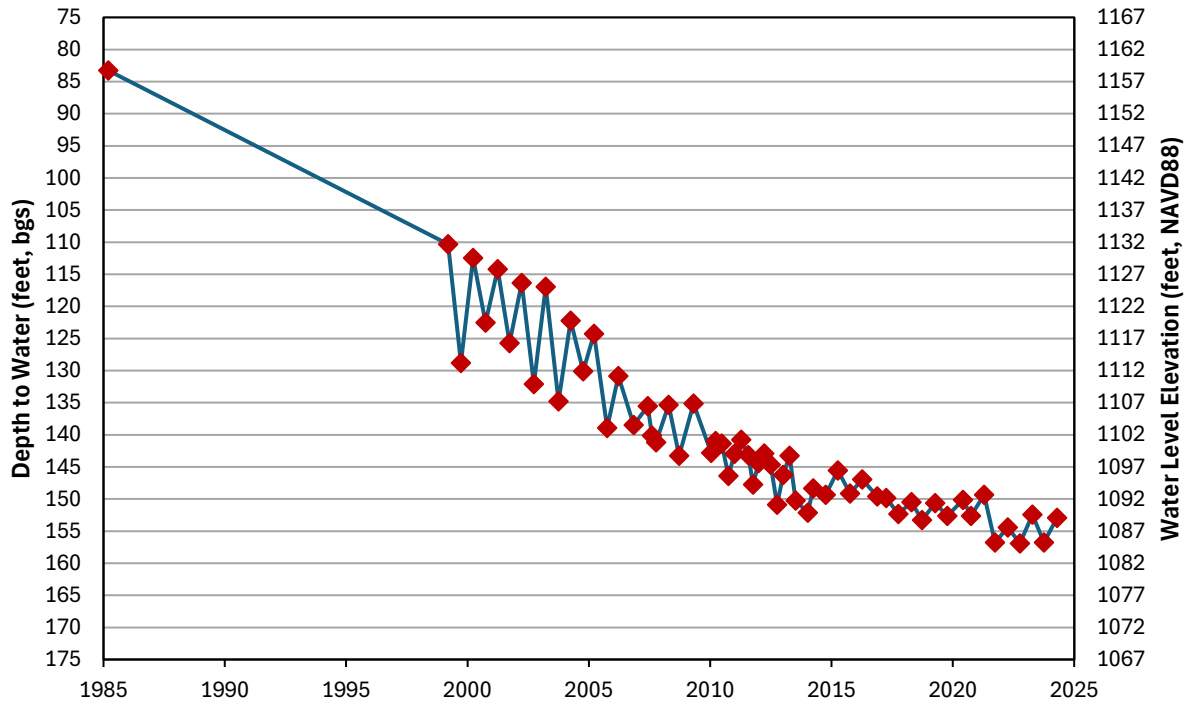
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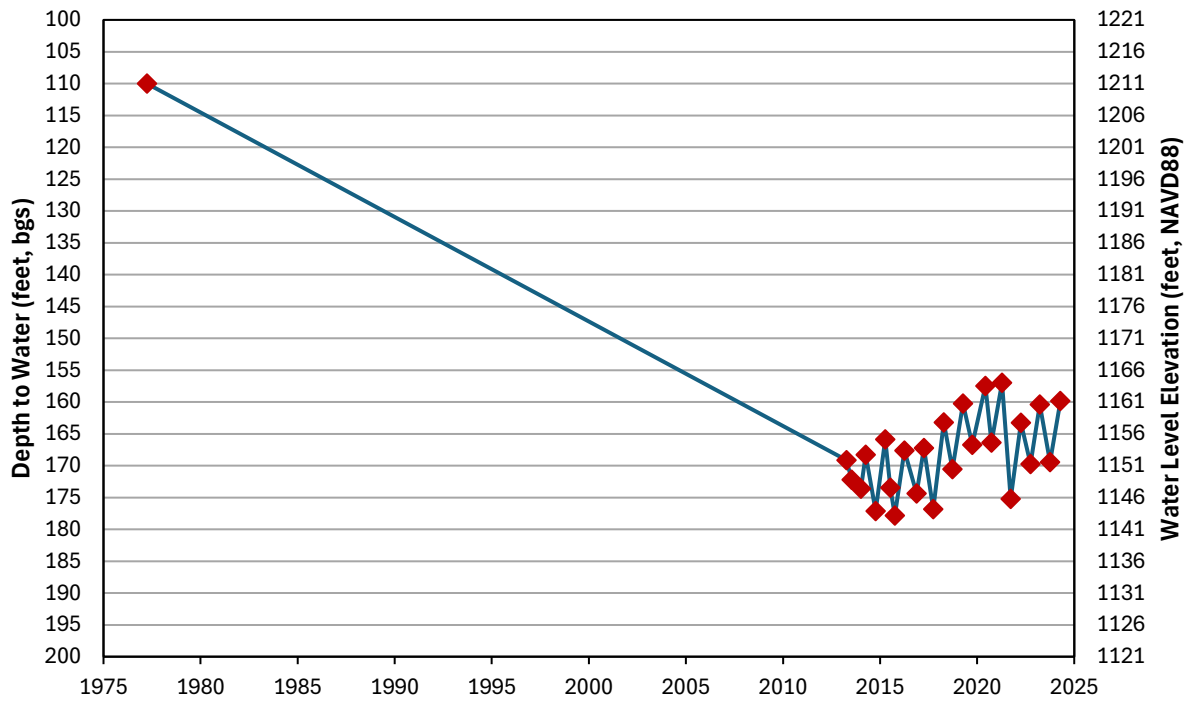
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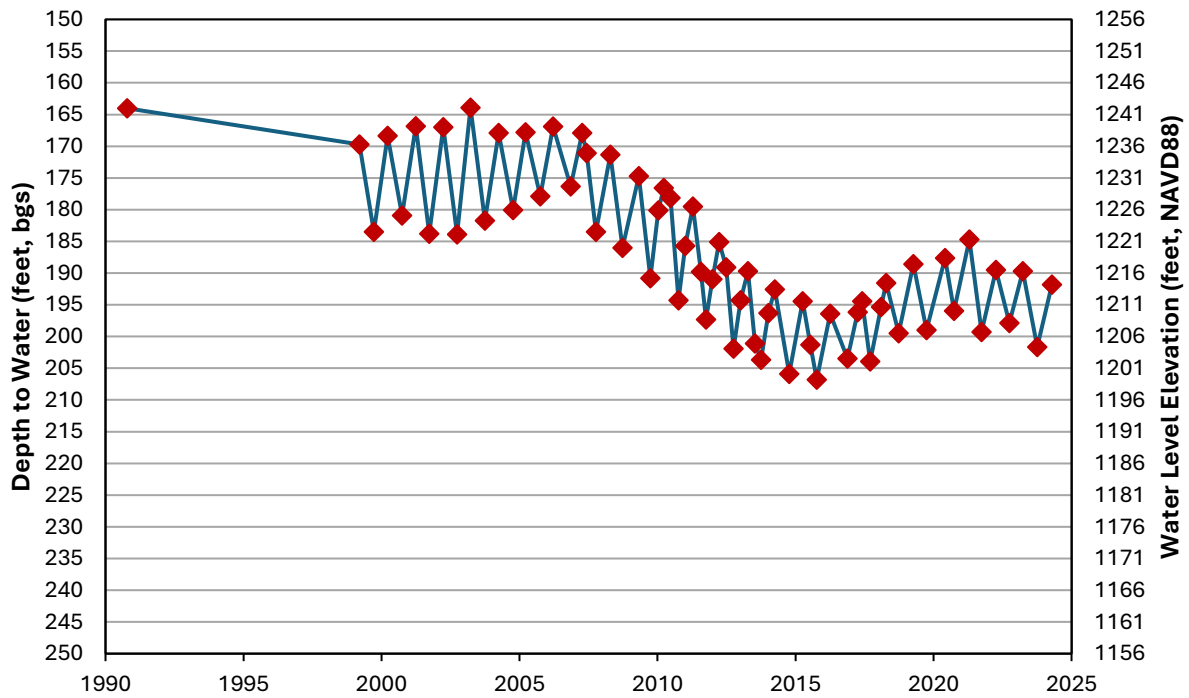
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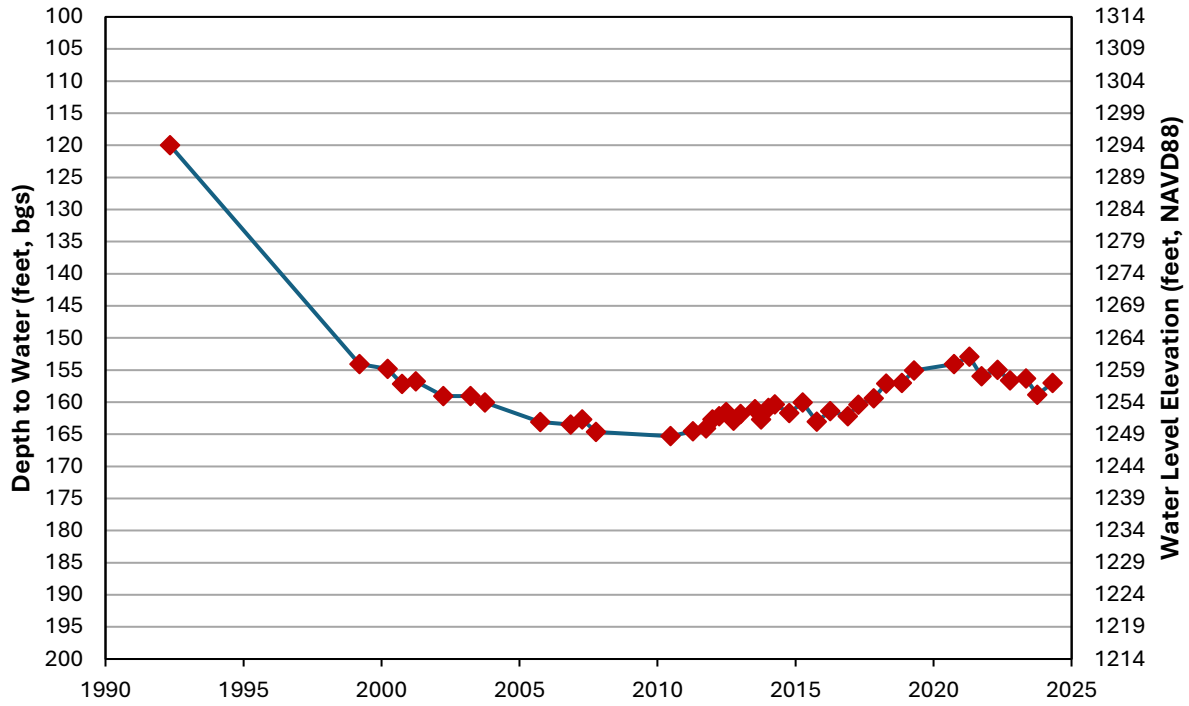
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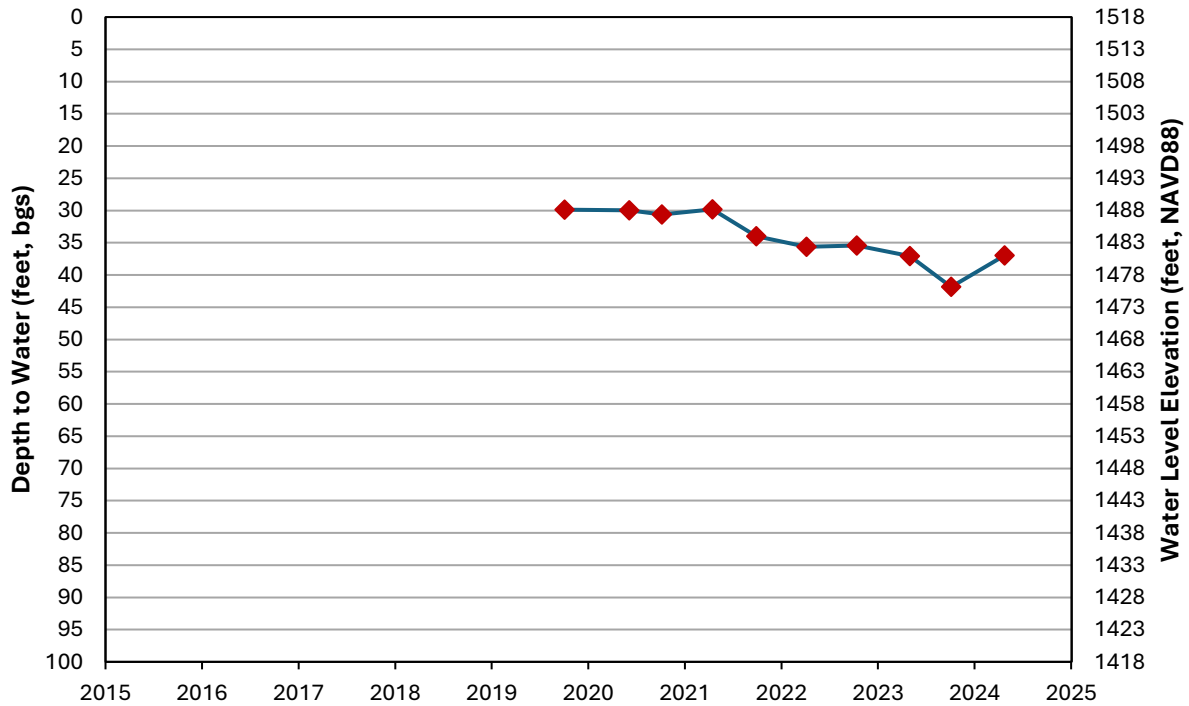
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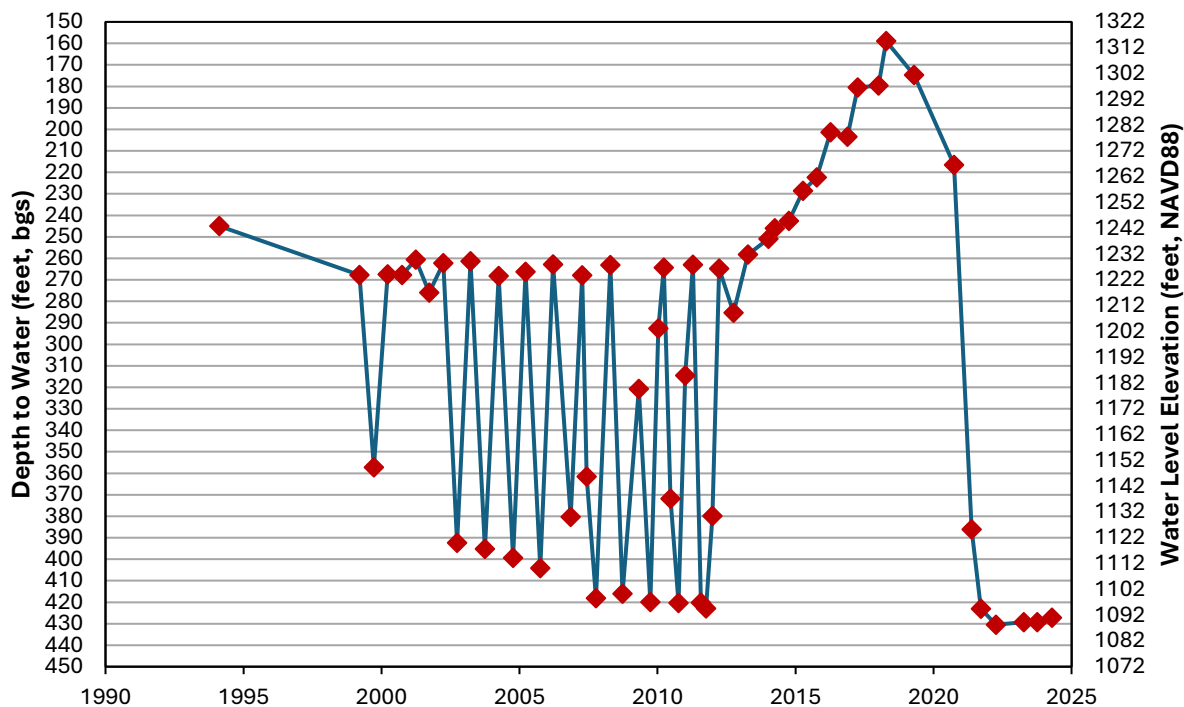
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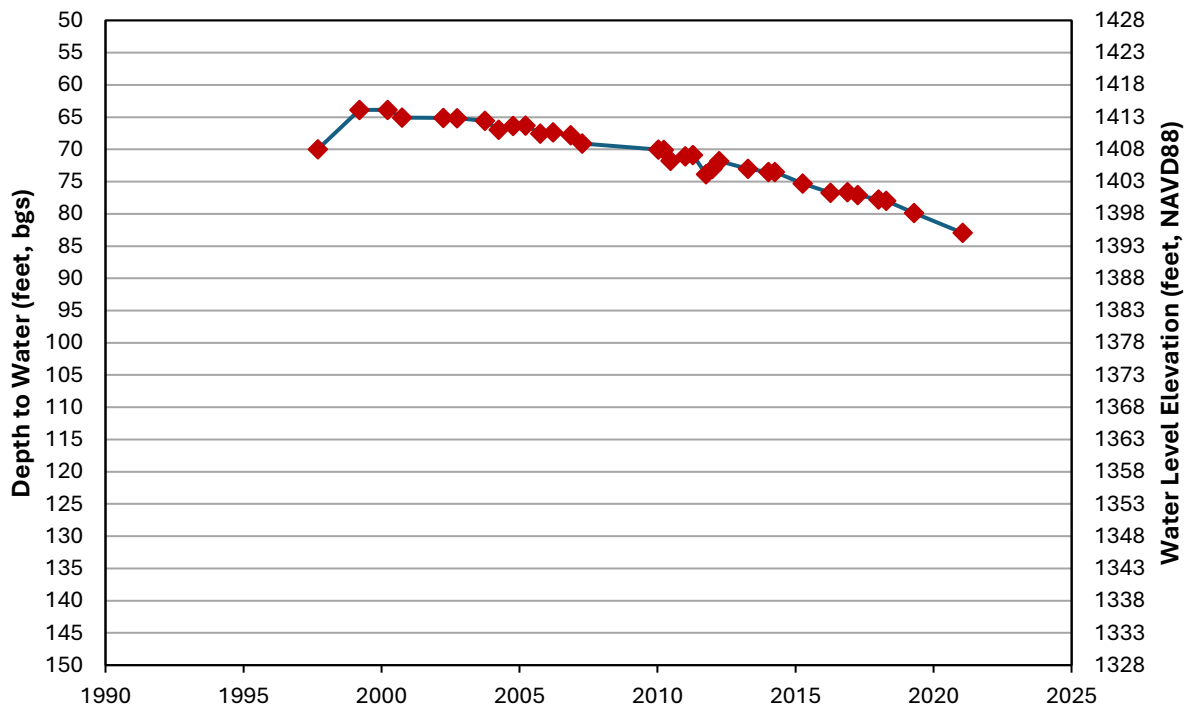
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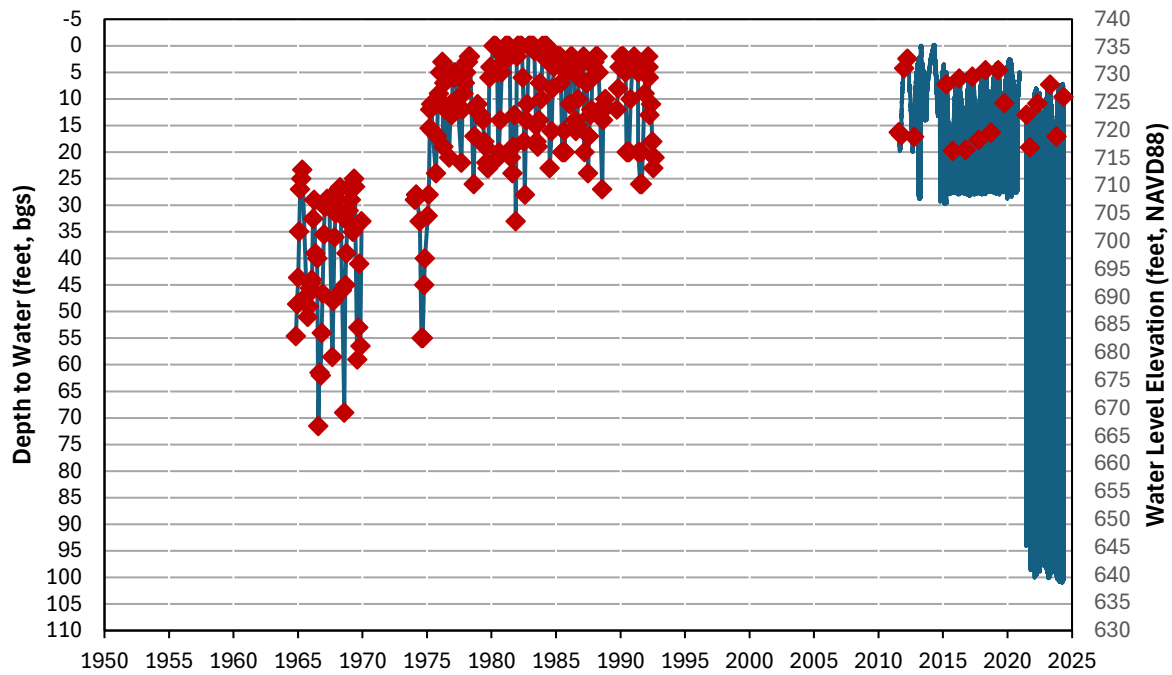
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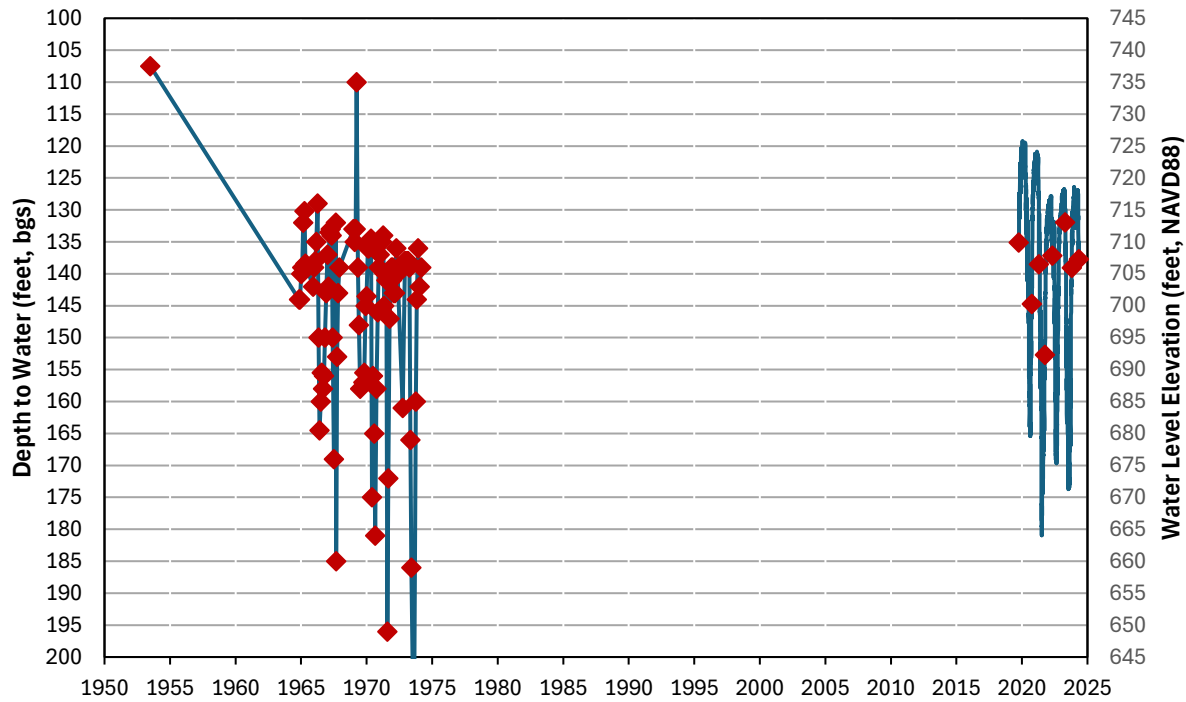
Appendix C

Hydrographs for the Grande Ronde Regional Aquifer

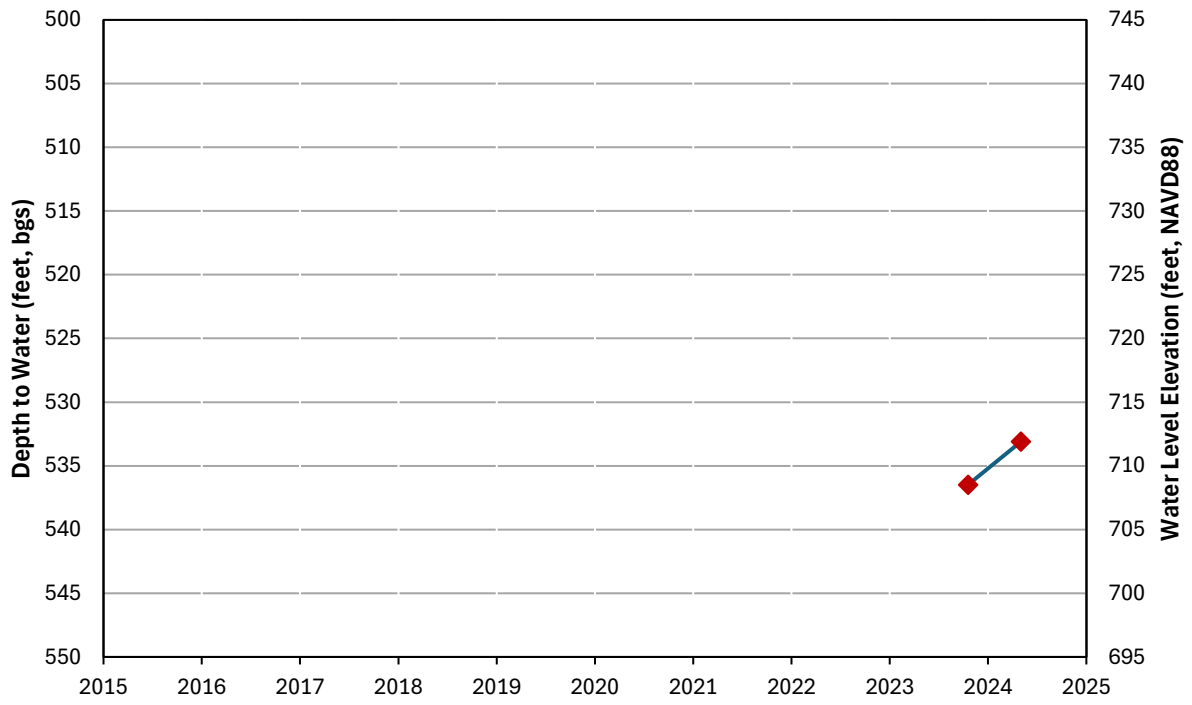
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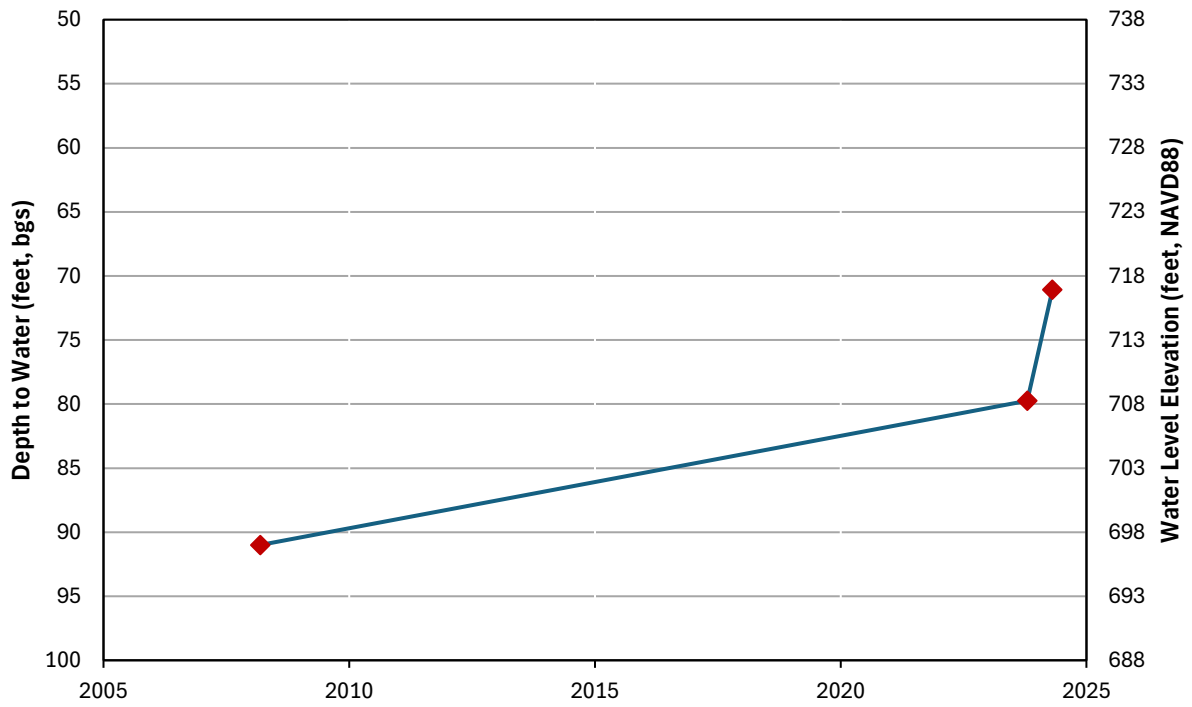
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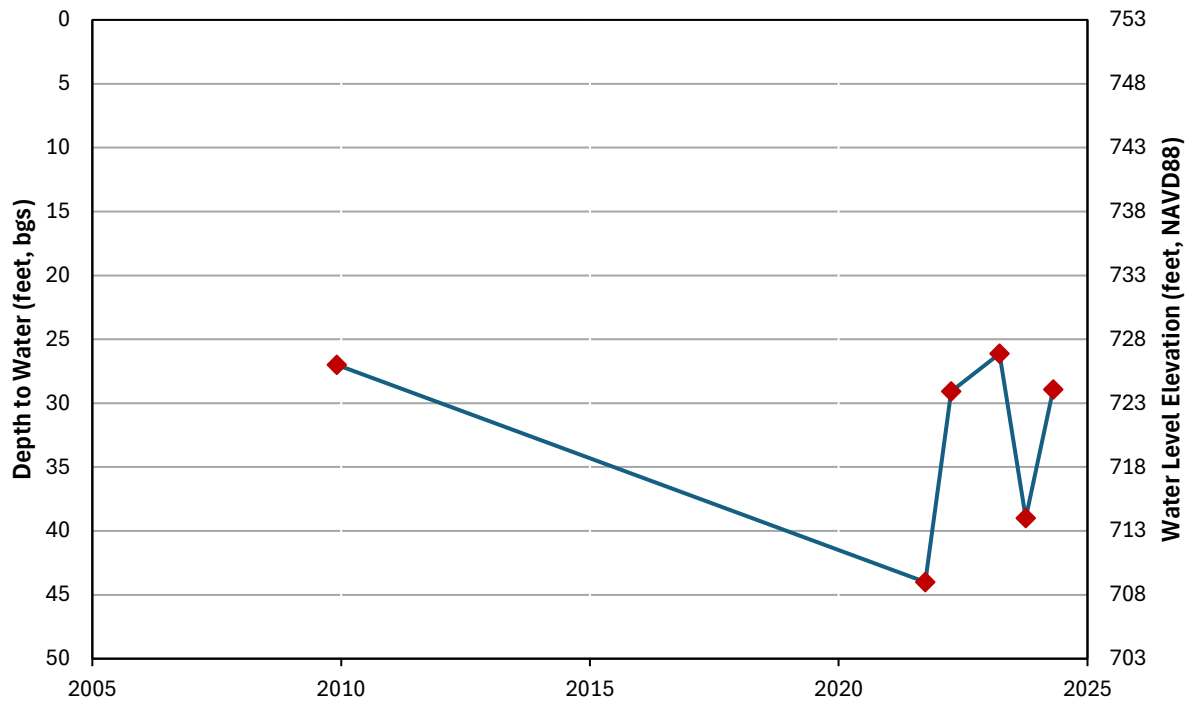
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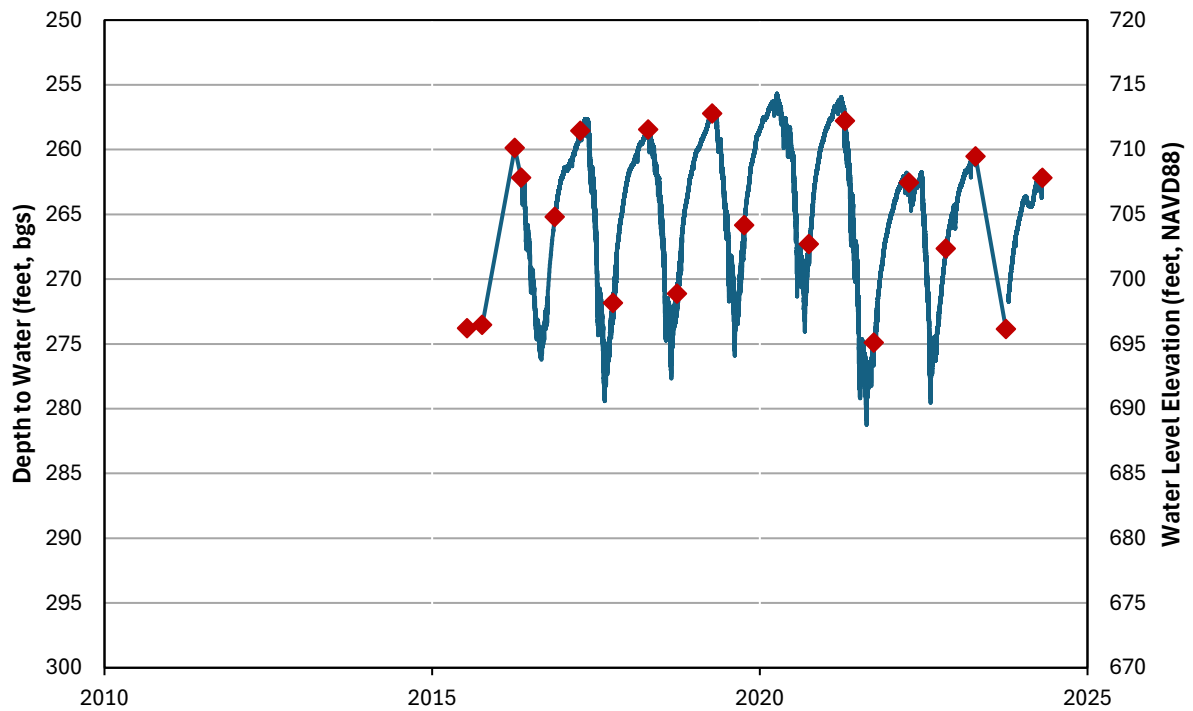
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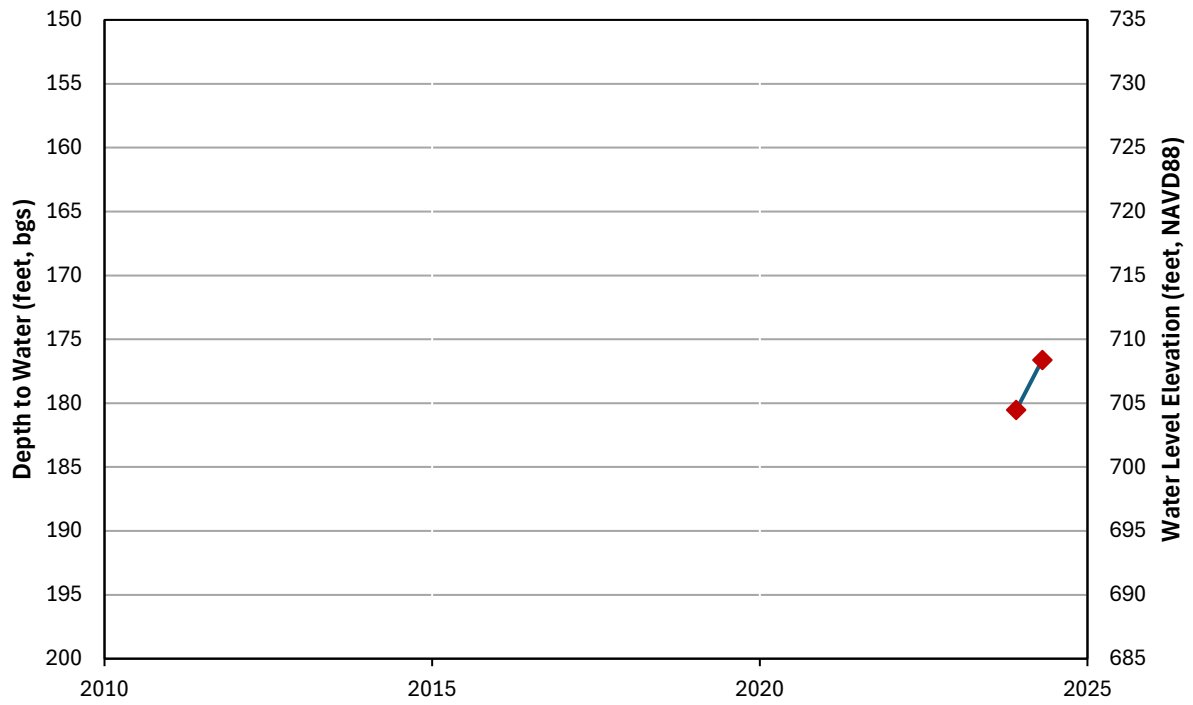
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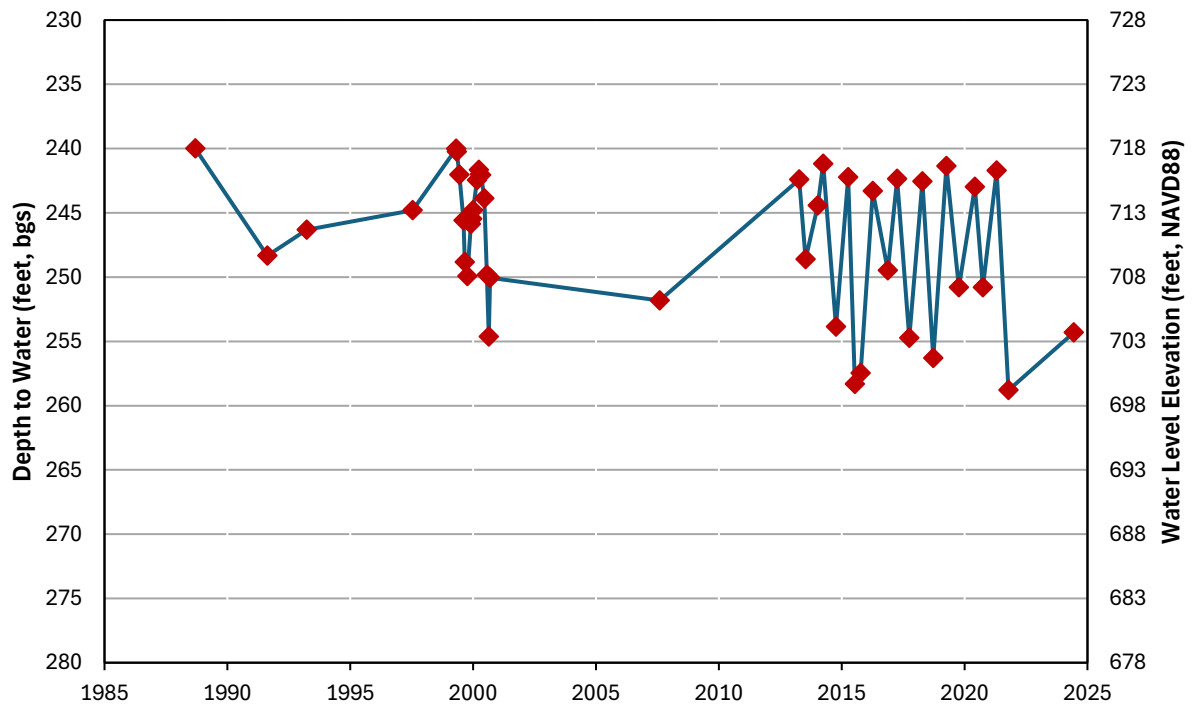
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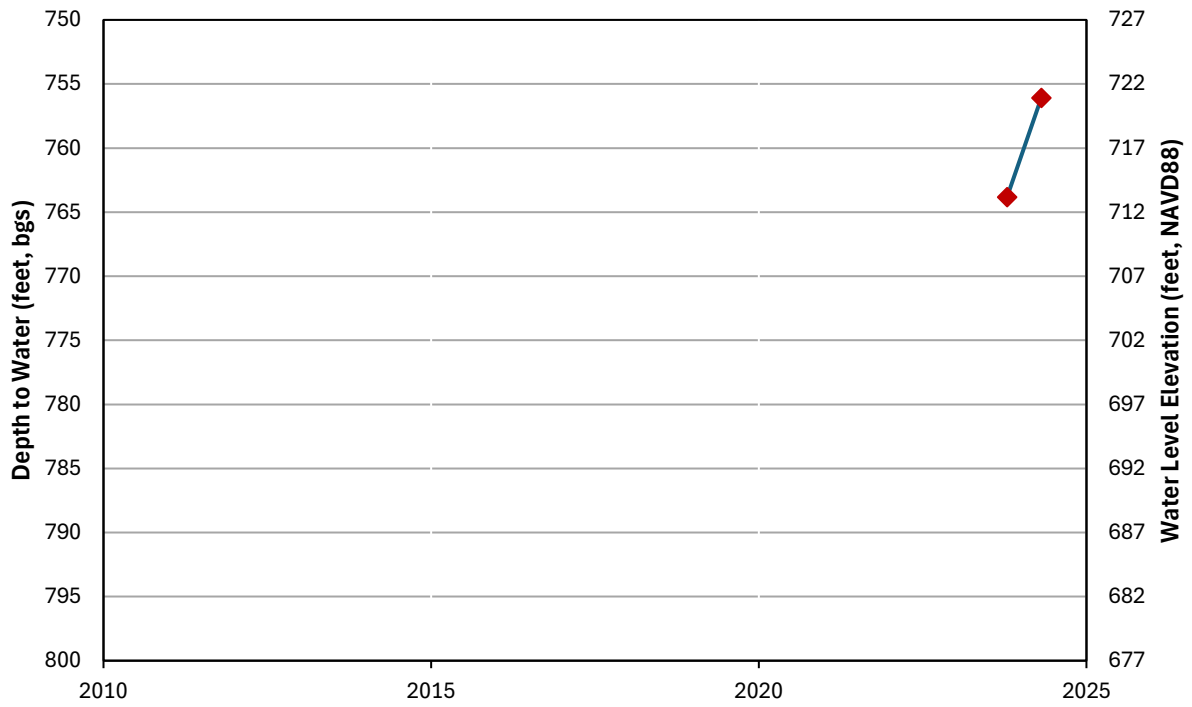
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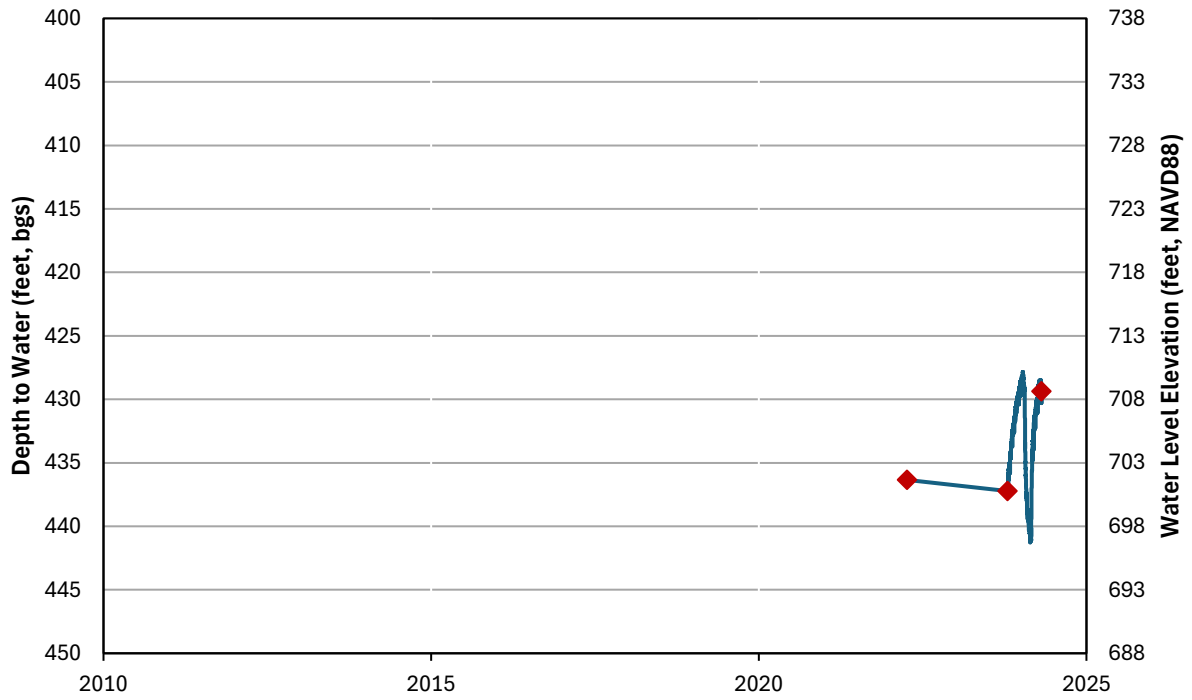
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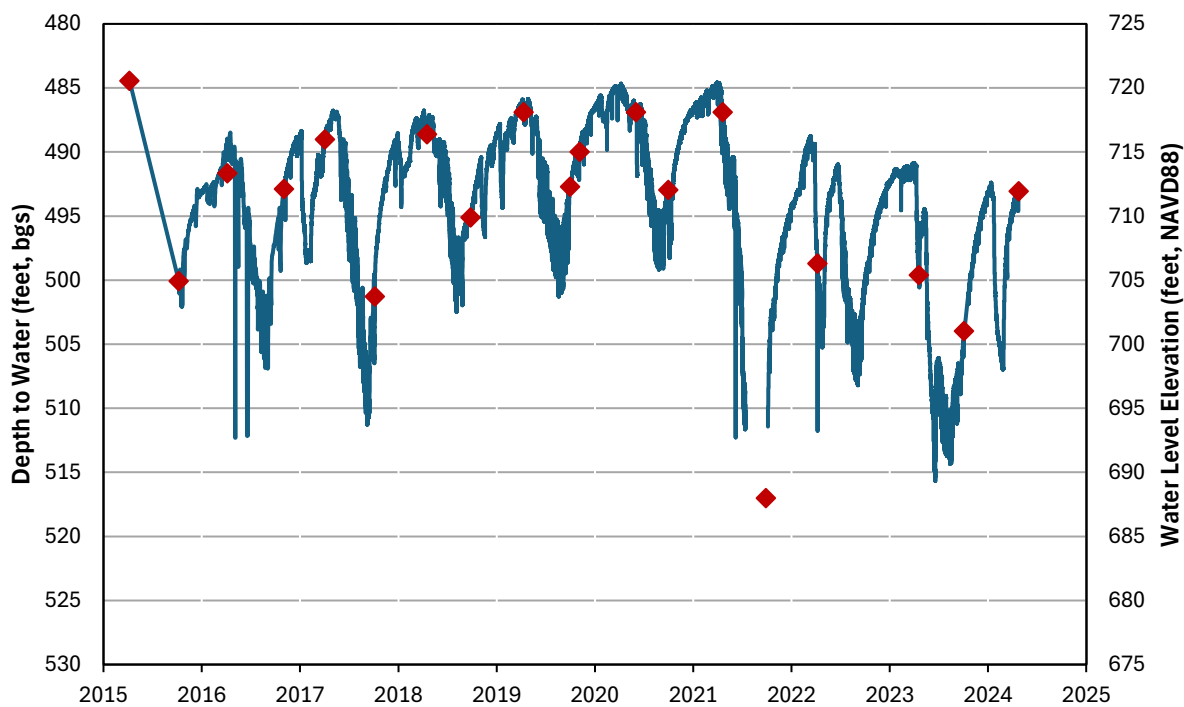
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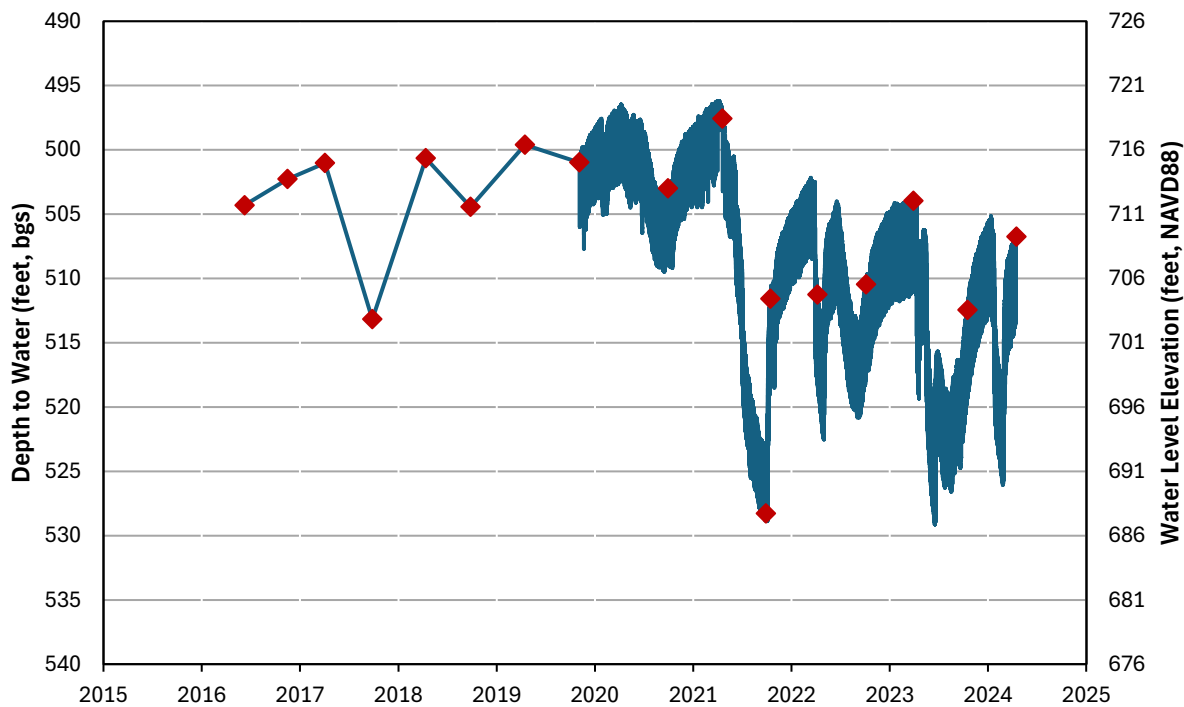
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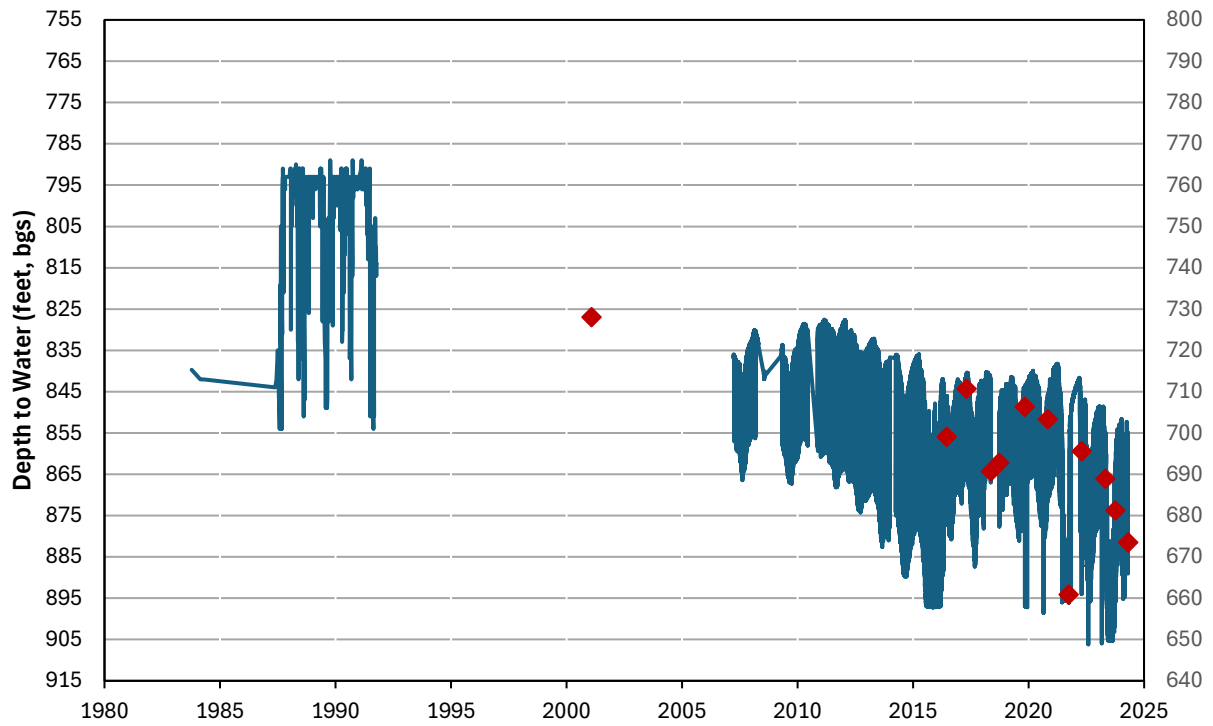
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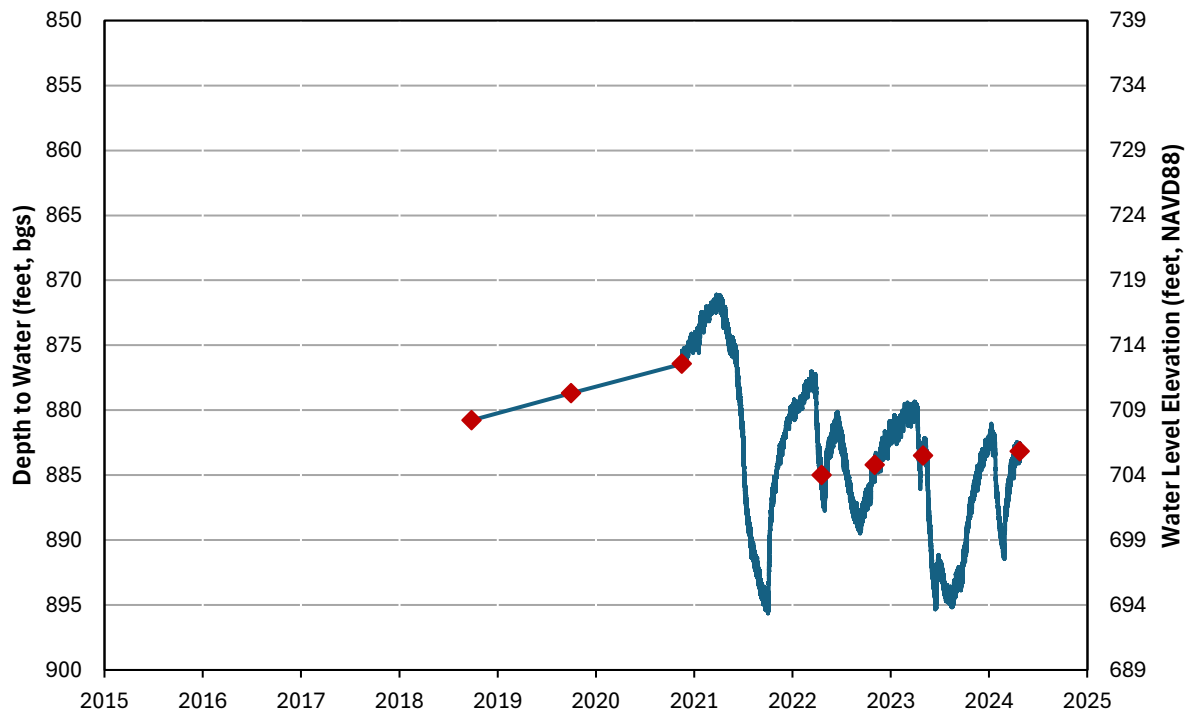
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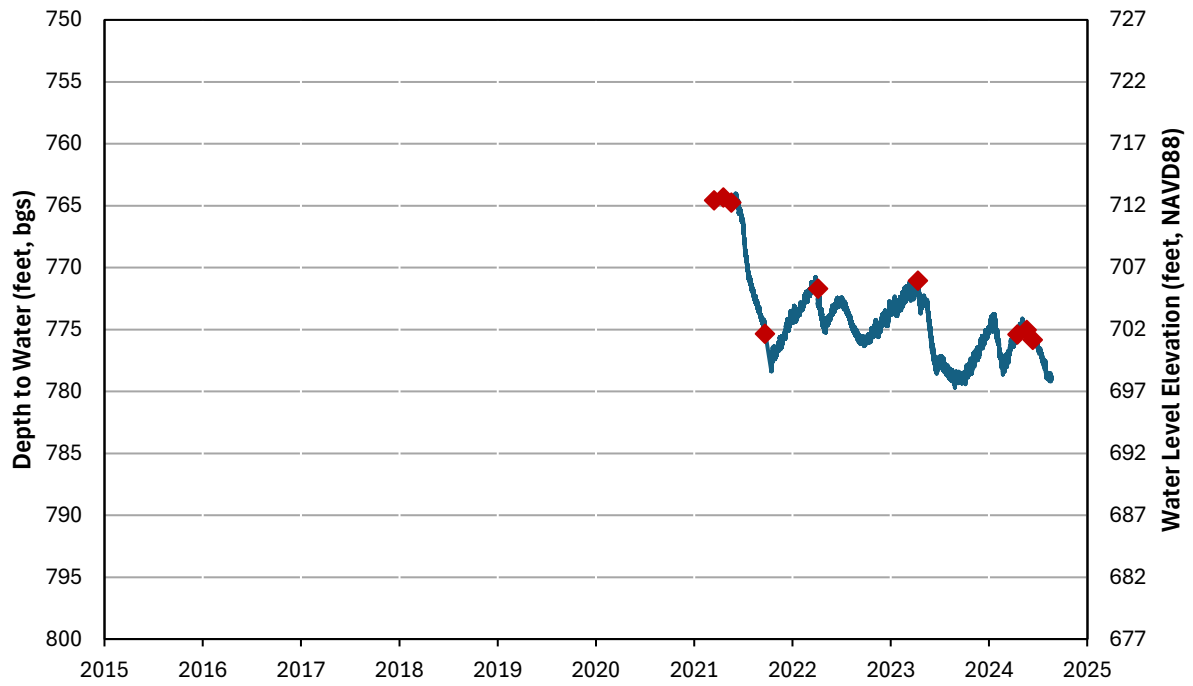
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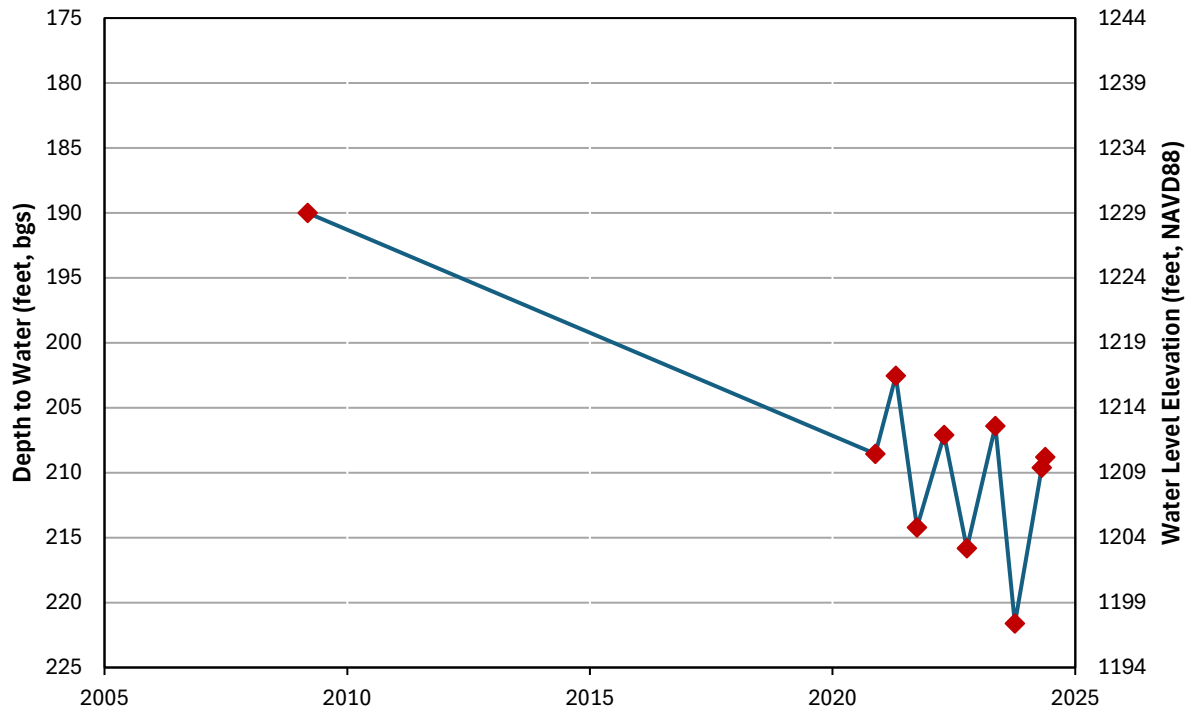
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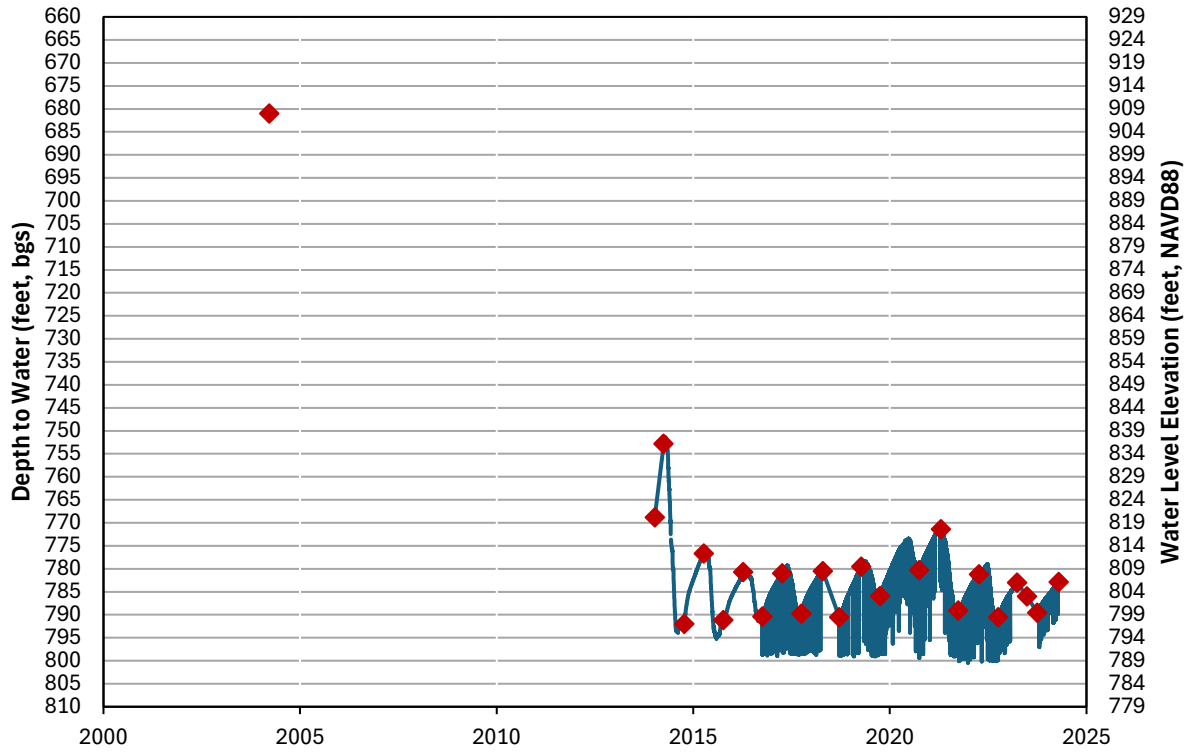
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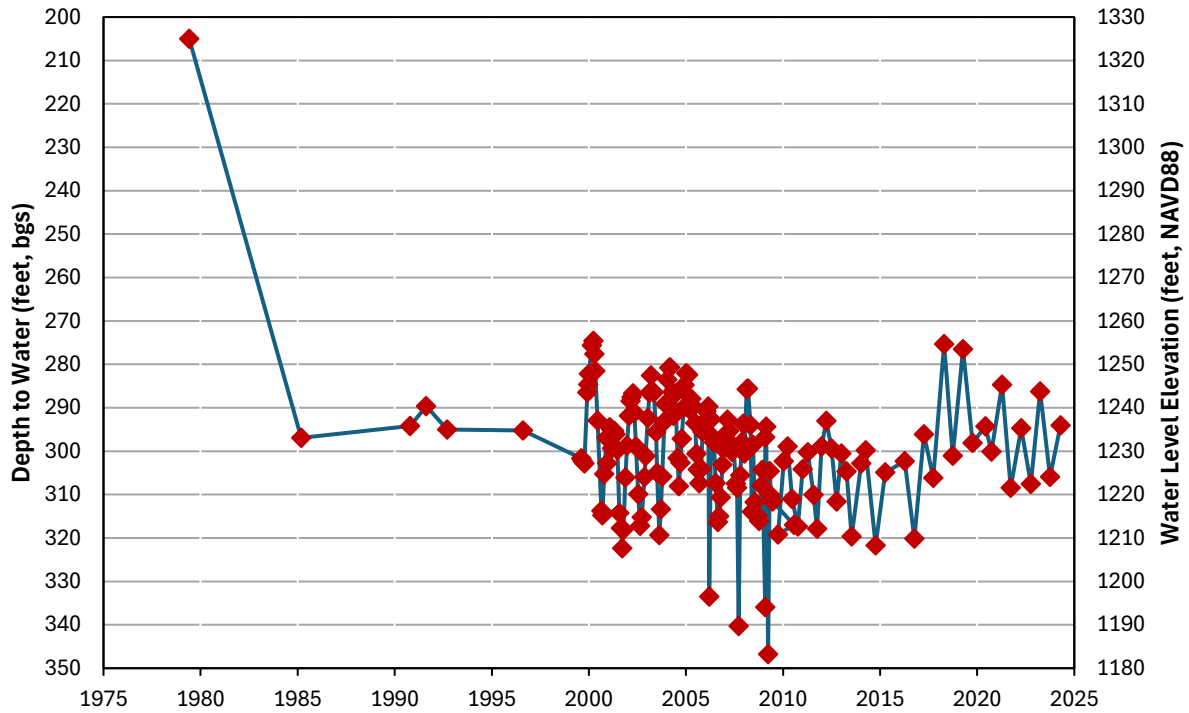
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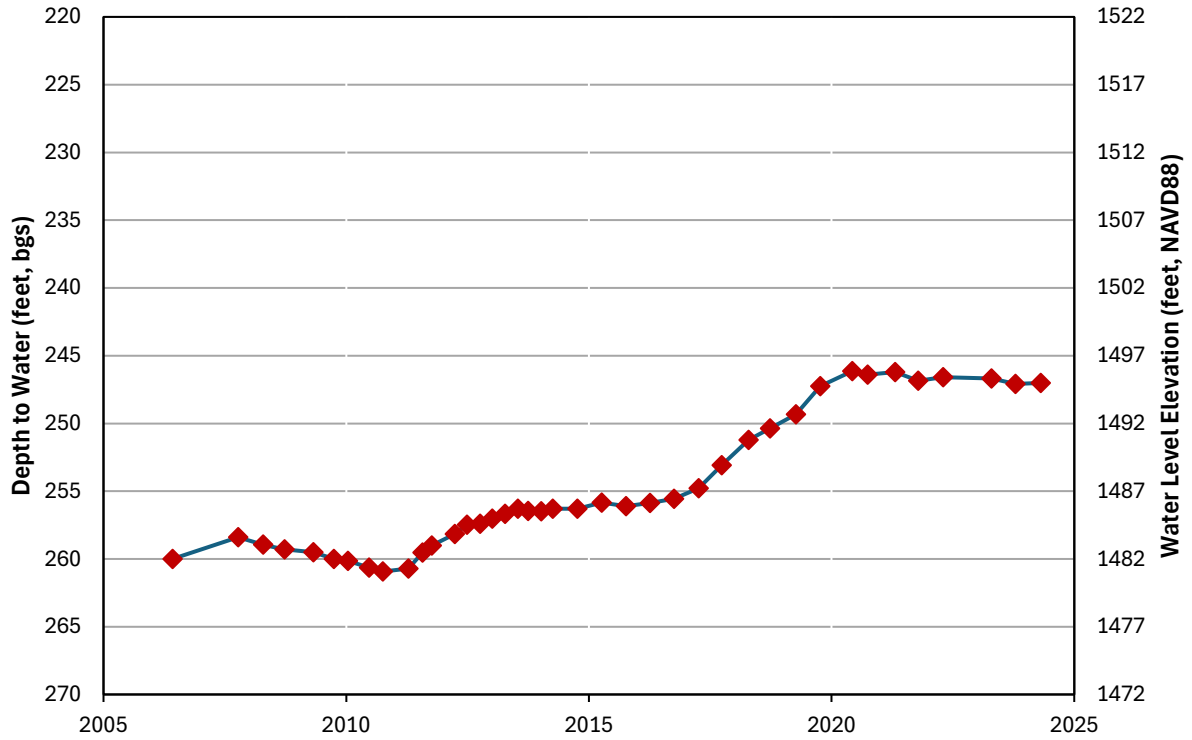
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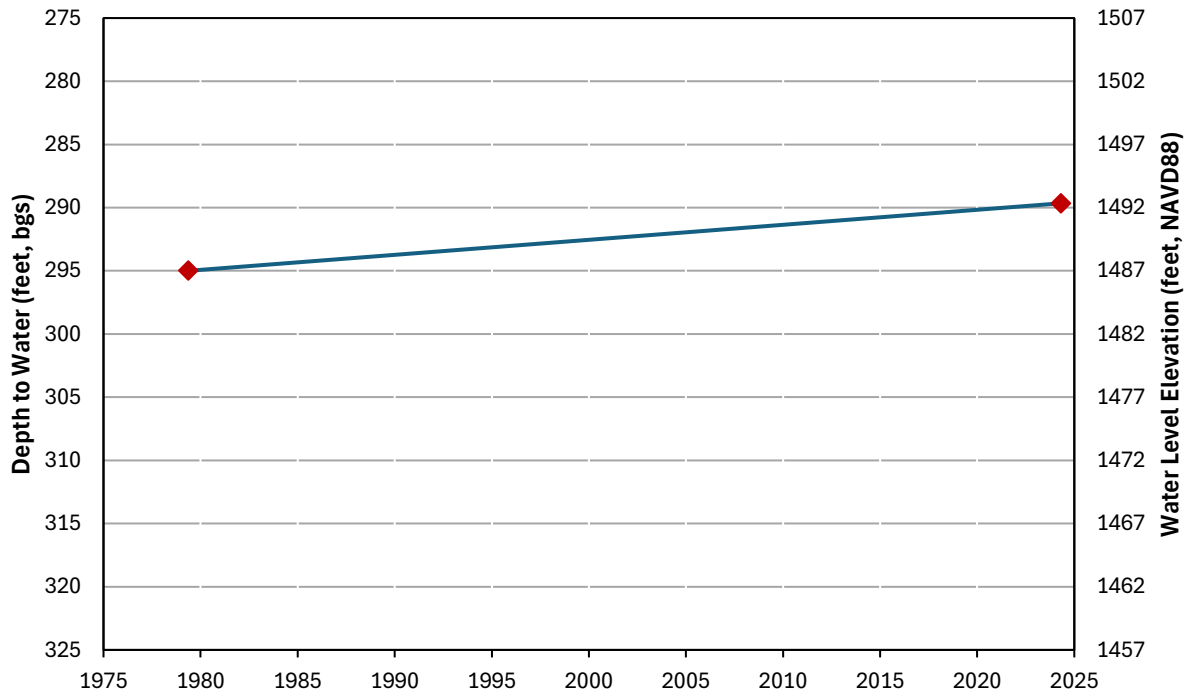
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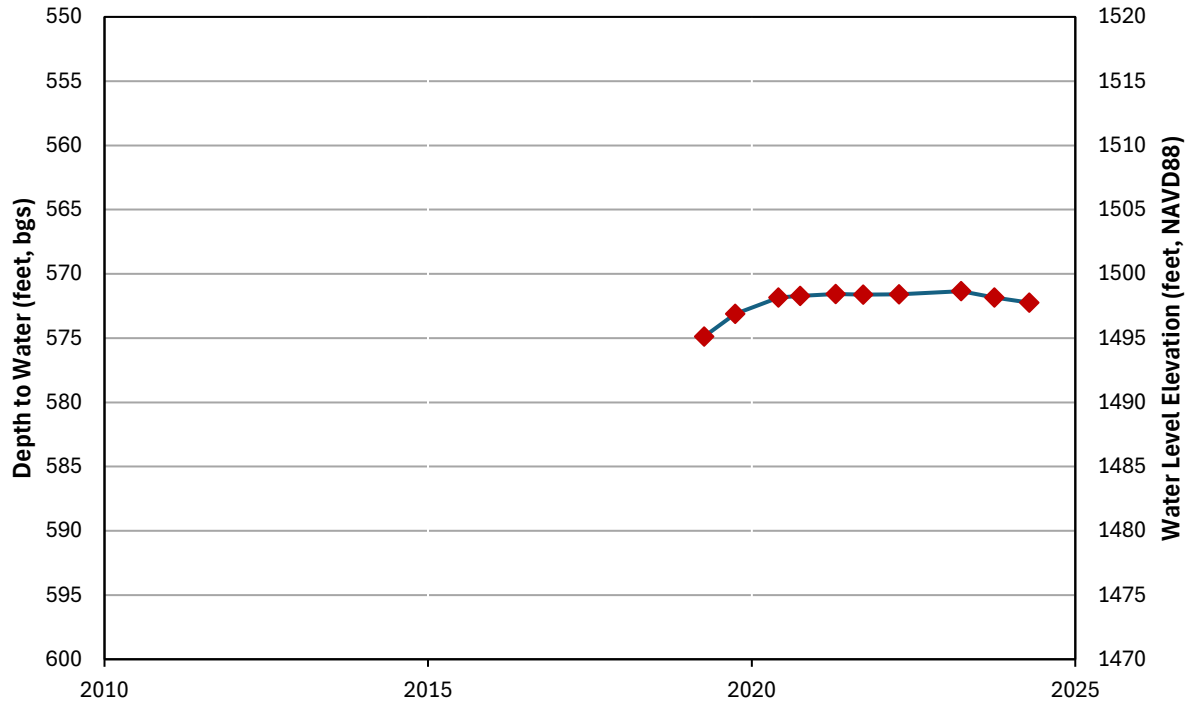
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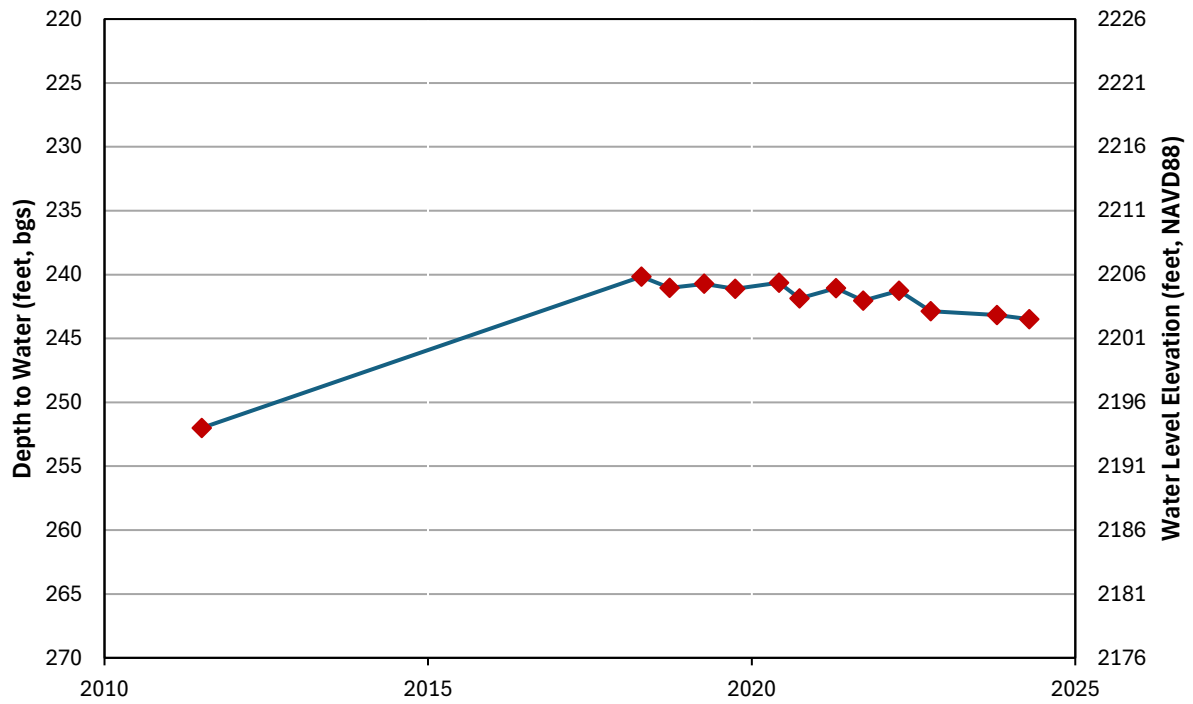
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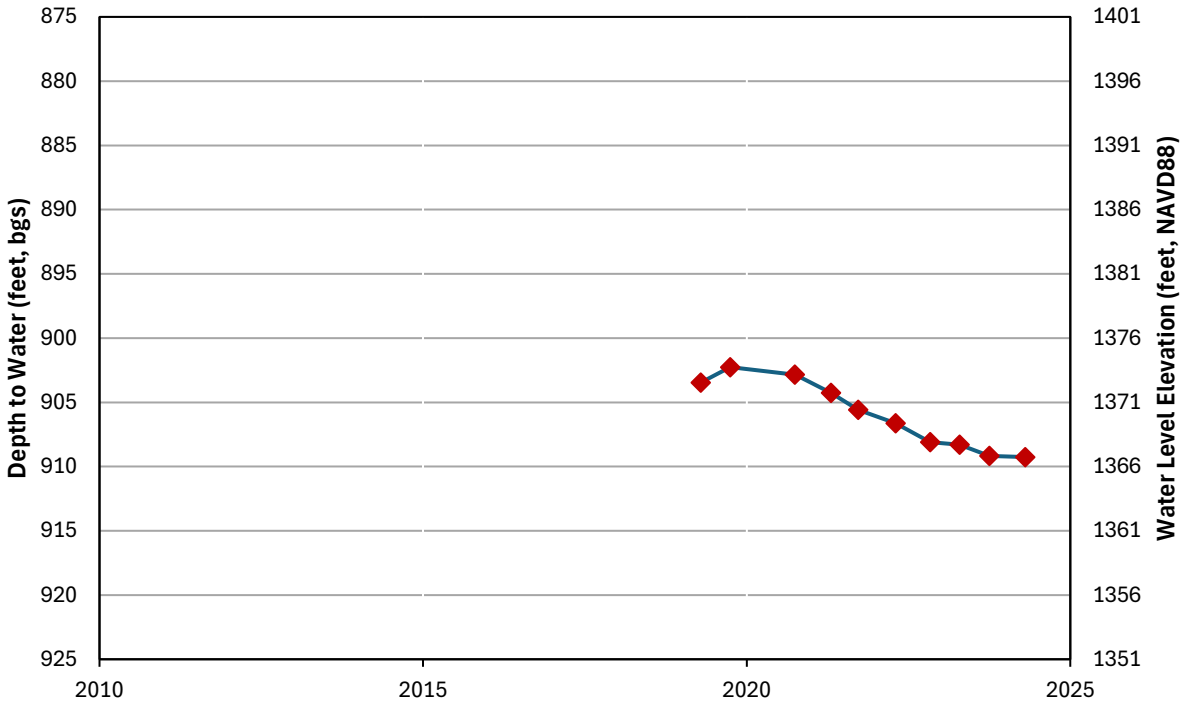
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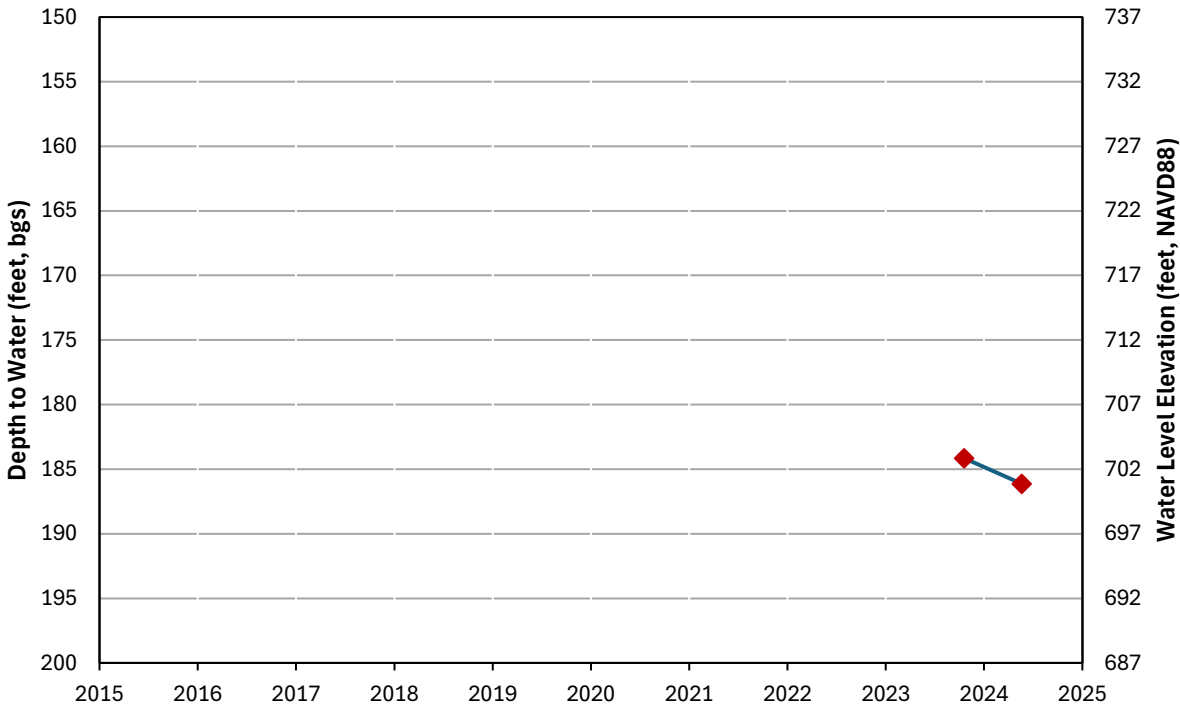
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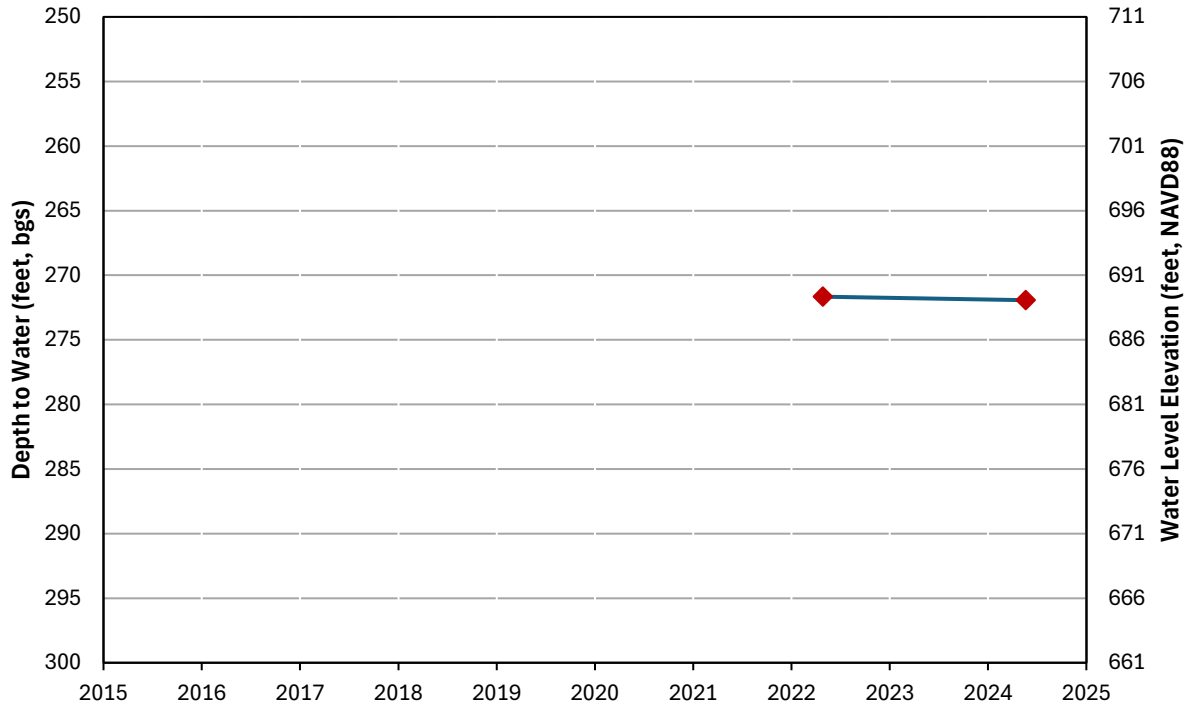
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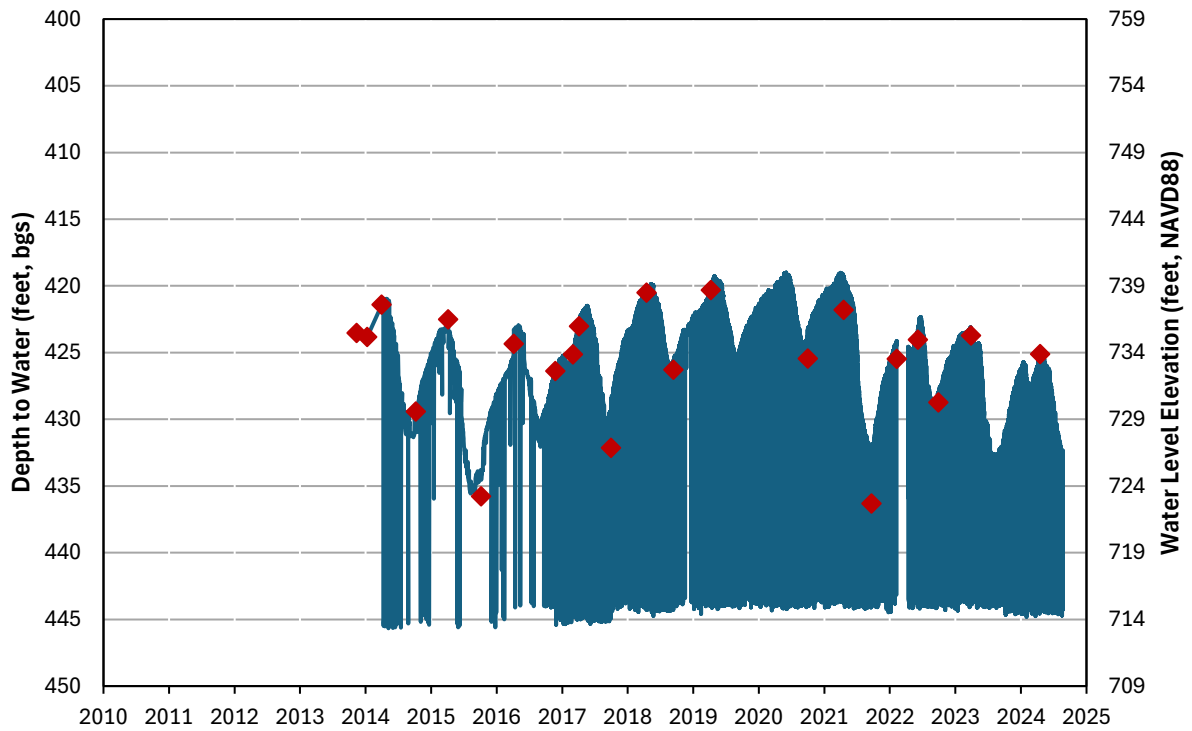
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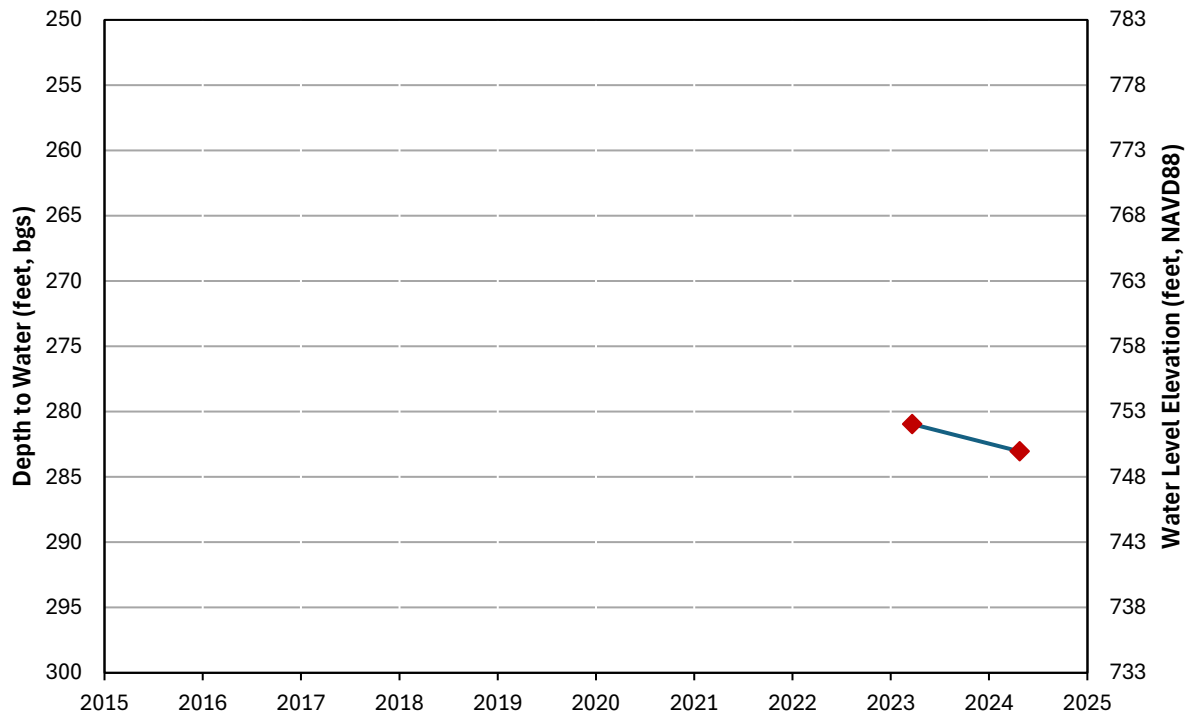
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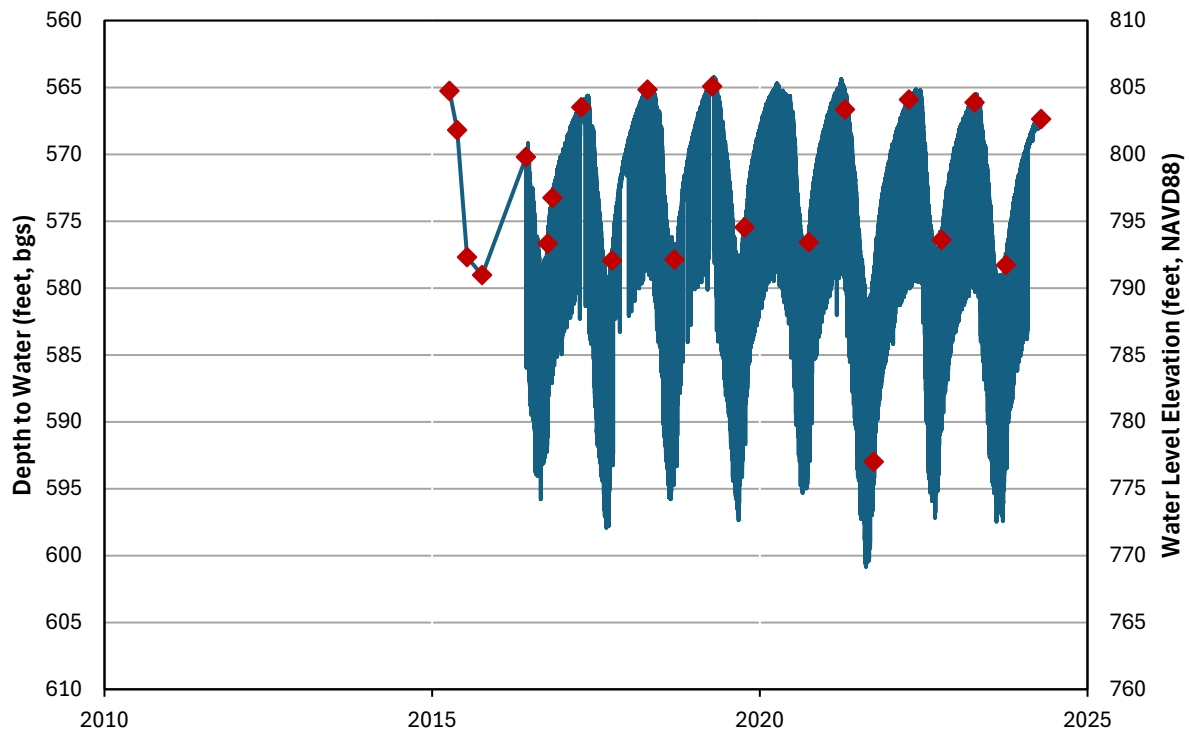
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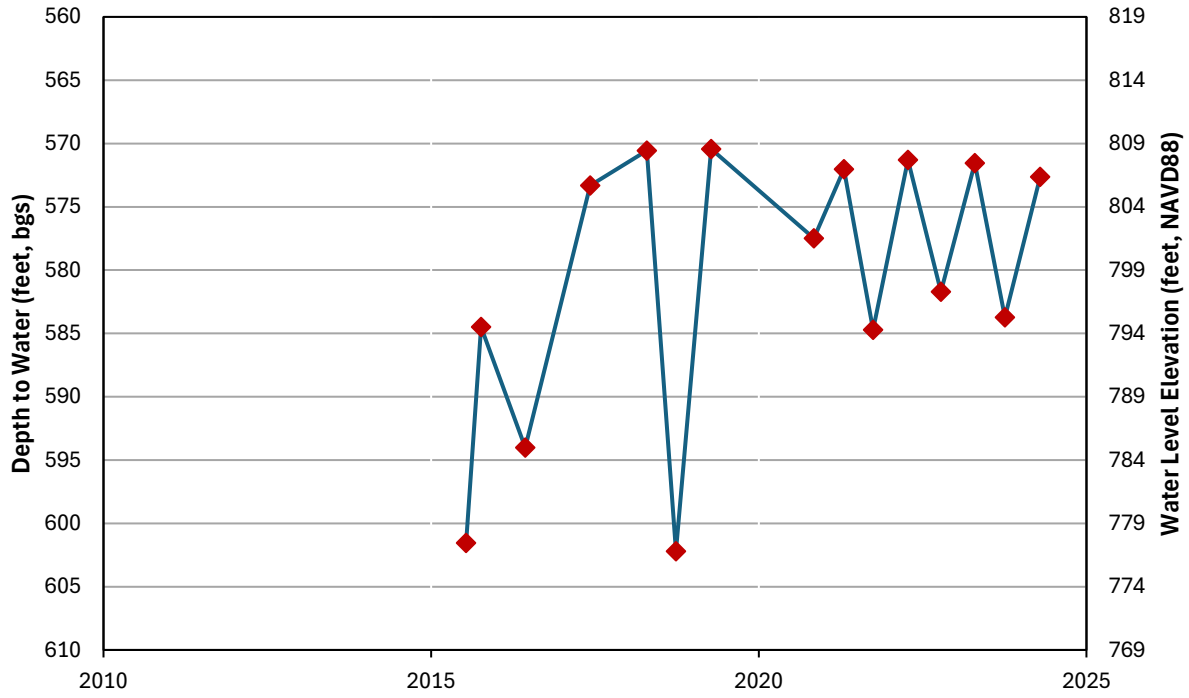
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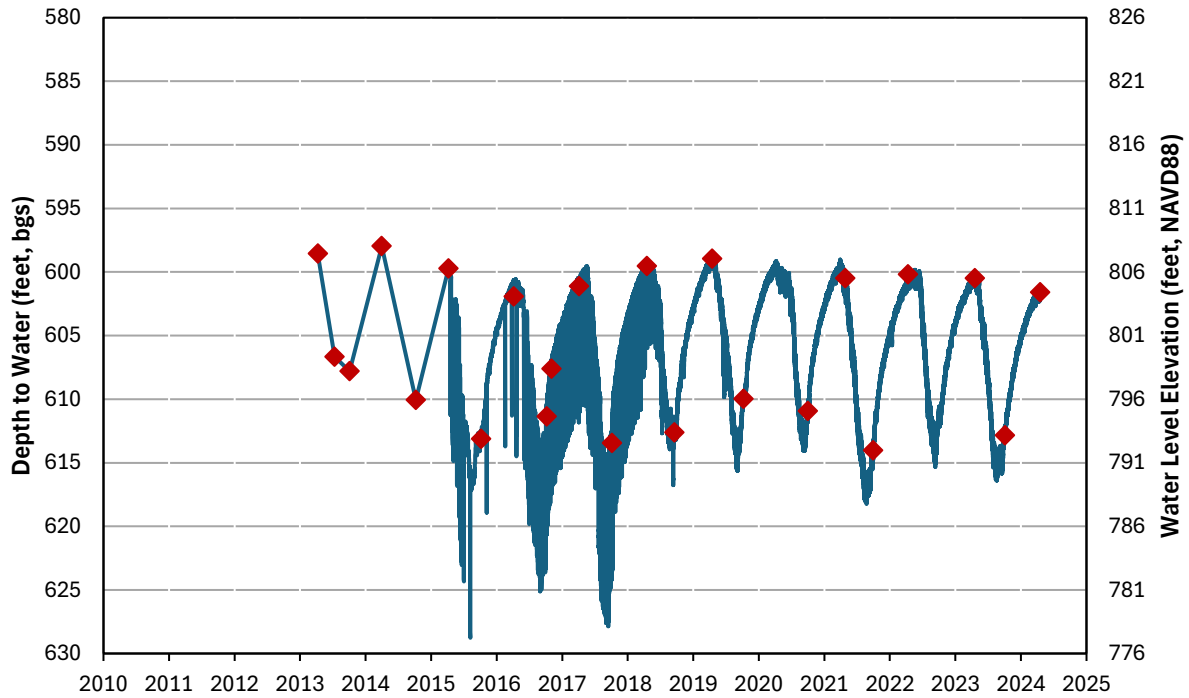
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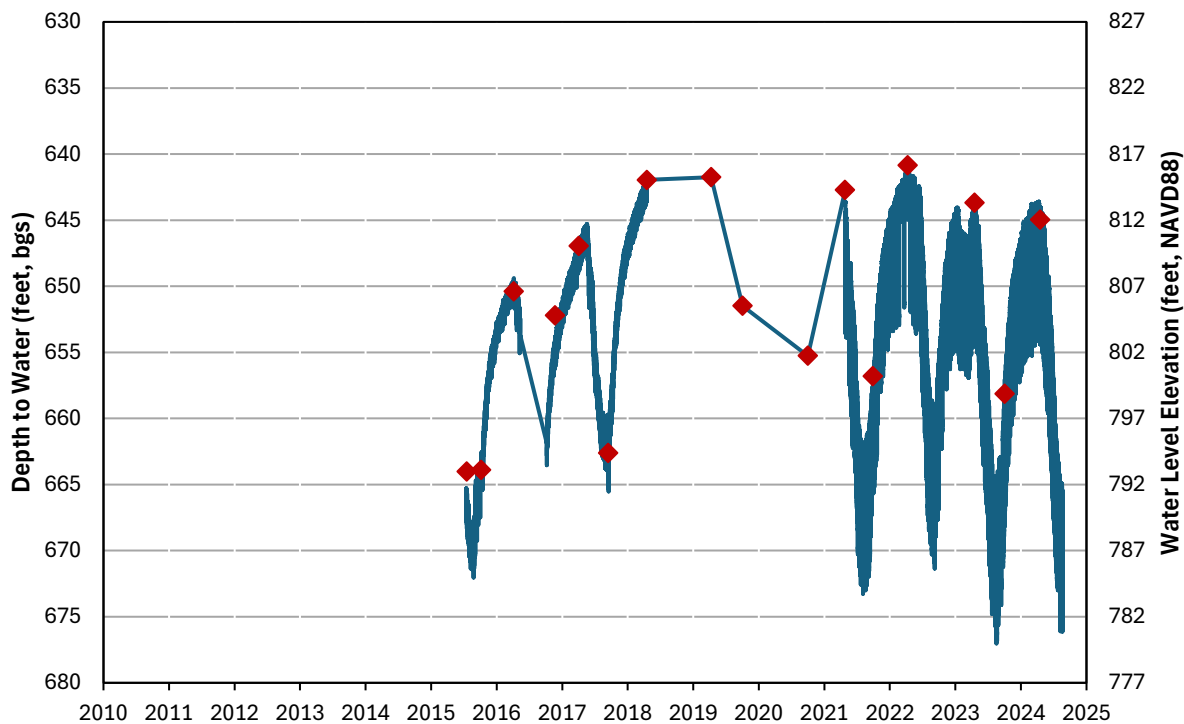
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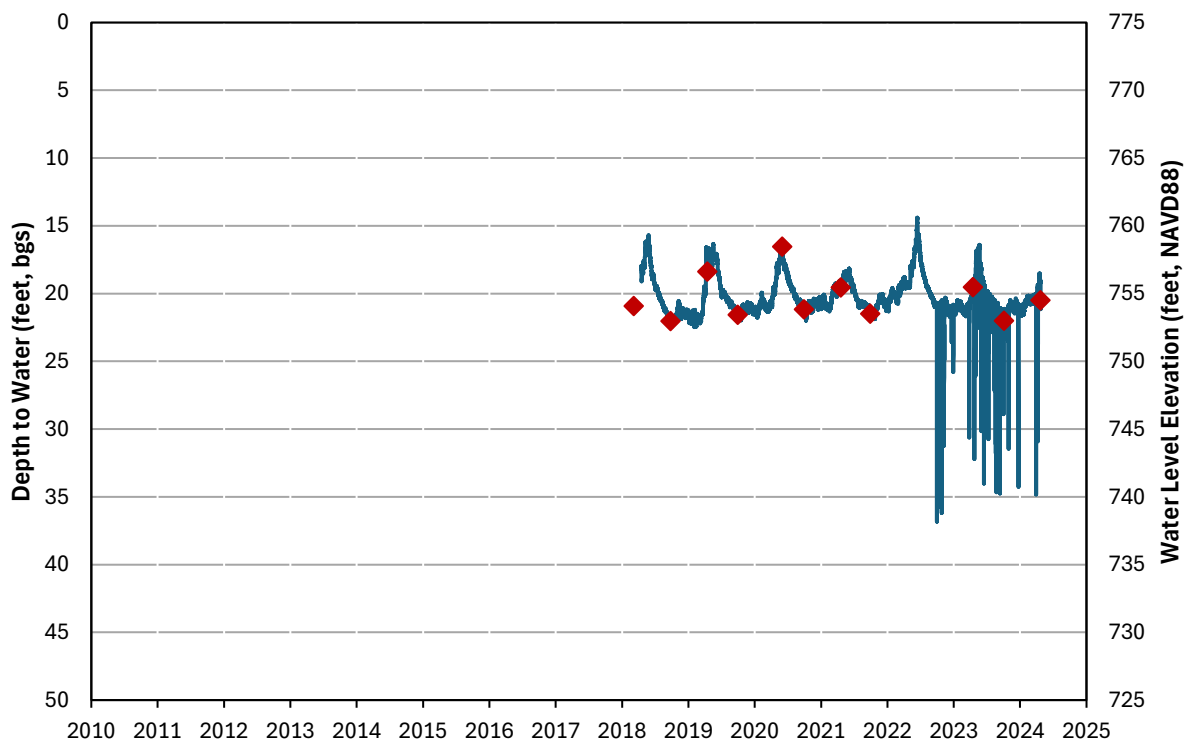
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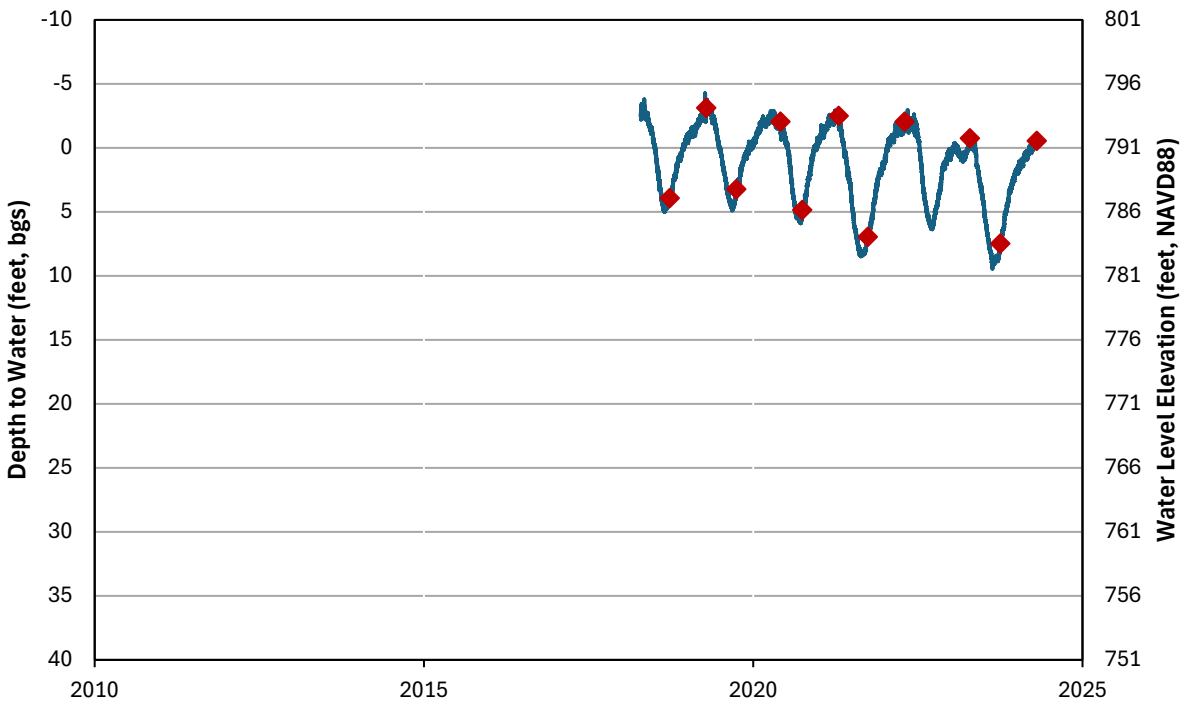
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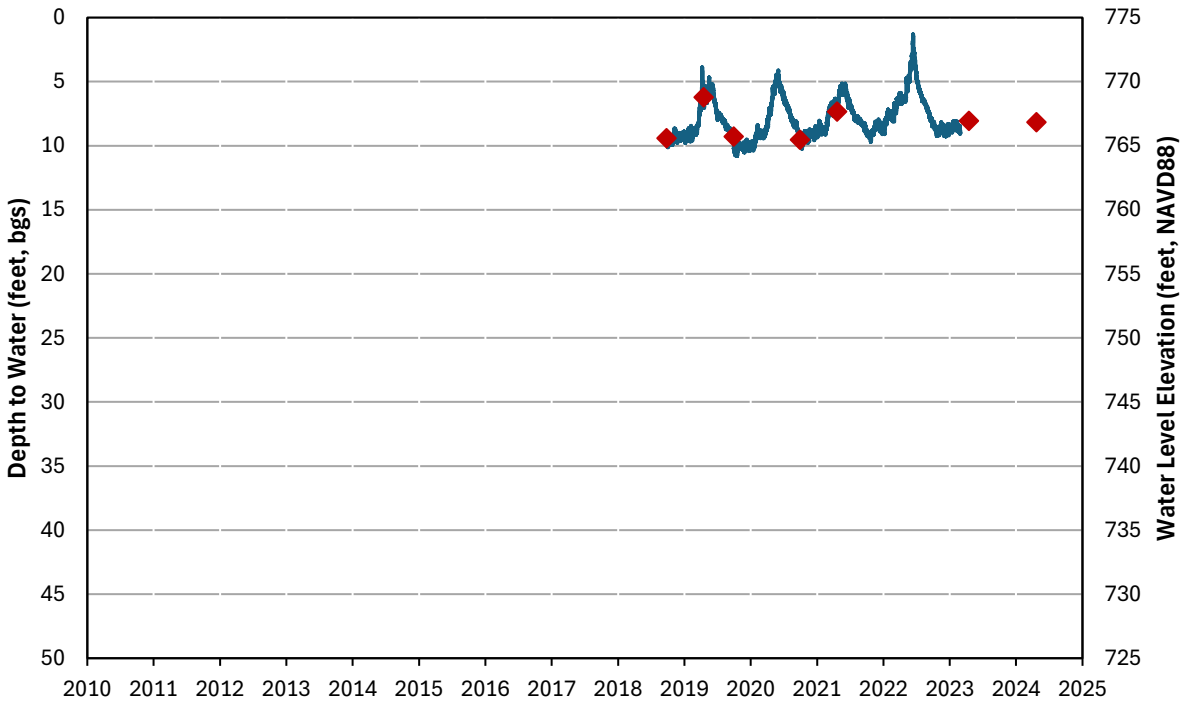
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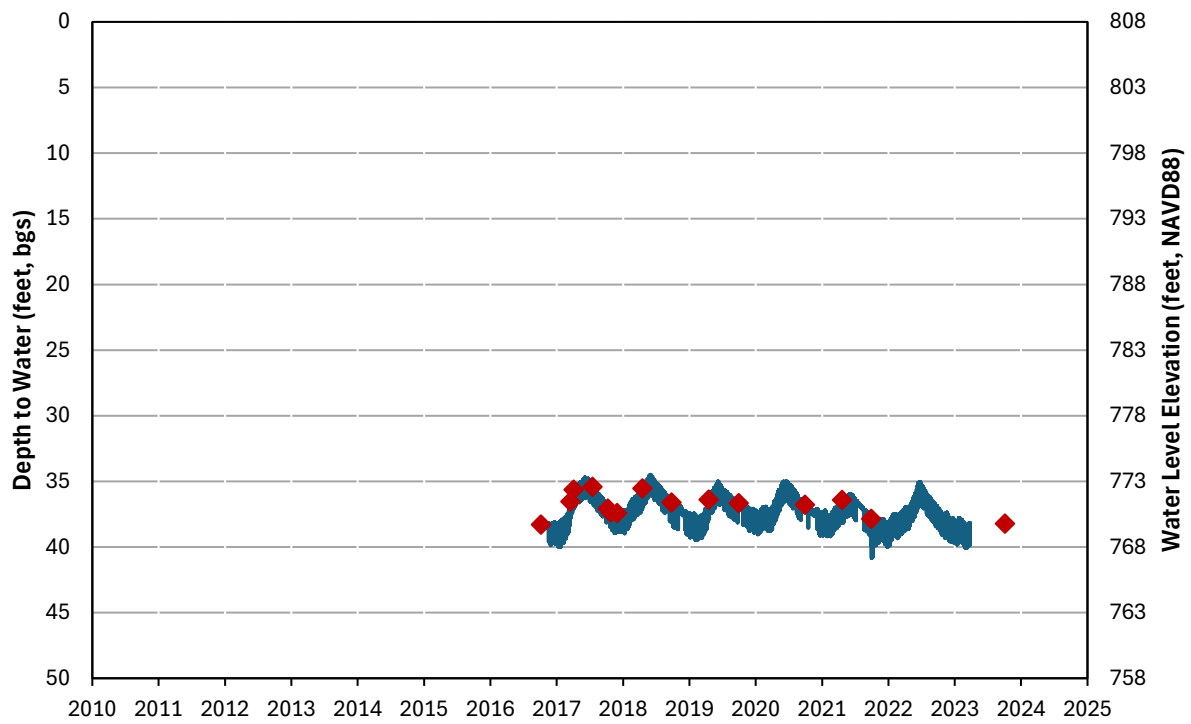
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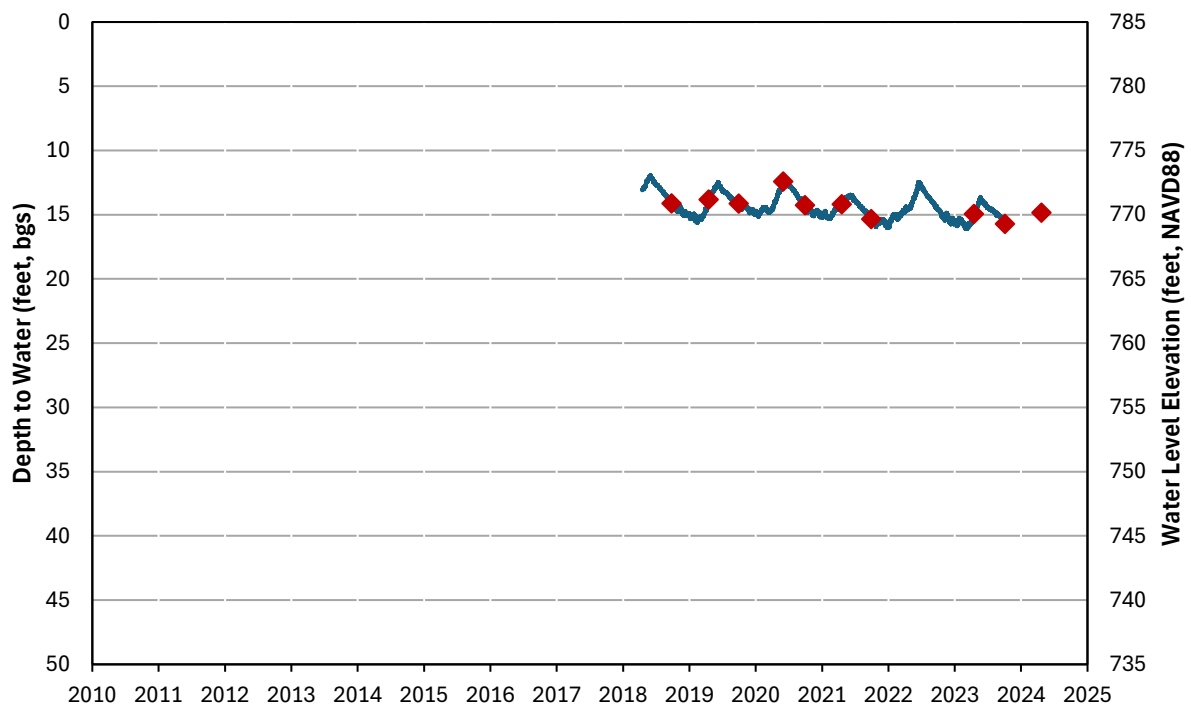
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GR-35. 36N 04W 30BAD1



GR-36. 36N 04W 19DDC1





Garwood Geoservices

1023 W Jenicek Loop, Post Falls, ID 83854
208-659-9482 garwoodgeoservices@gmail.com

MEMORANDUM

To: Daniel Sturgis, IDWR

From: Dean Garwood, Garwood Geoservices

Subject: Geological Cross Sections and location map, IDWR-CON01318

Date: September 19, 2019

This memo is to explain the Geological Cross Sections and location map. The 9 geological cross sections were completed using X-Ray Fluorescence (XRF) data from wells and surface (outcrop) samples, geologic maps, well logs, and field data collected during this study. The XRF samples were collected or provided by the Idaho Geological Survey, Idaho Department of Water Resources, Ralston Hydrologic Services, Garwood Geoservices and were analyzed at Washington State University or Franklin and Marshall College. During this study over 250 samples from well borings and surface (outcrop) samples were washed, dried, sorted, and analyzed for major and trace element chemistry. This data along with data compiled from the Idaho Geological Survey has been modelled to derive a detailed stratigraphy (Figure 1) of the Columbia River Basalt Group in the Lewiston Basin of Idaho. This stratigraphy is similar to that reported by other researchers in the area (Reidel and Tolan, 2013; Bush and others, 2018).

The cross sections were completed with a vertical exaggeration of 10x. The scale of the map and cross-sections is 1:63,360. Wells used to construct the sections are shown on the maps. Wells with XRF chemistry data were added to the geological sections for reference. Geologic maps included with each cross-section were derived from online map services (100k) from the Idaho Geological Survey and the Washington Division of Geology and Earth Resources (IGS, 2018; WADGER, 2016).

Formation	Symbol	Member	TiO ₂	MgO	Thickness Range (ft.)
Saddle Mountains	Tlm	Lower Monumental	3	5	0-100
	Tt	Tammany Creek	2.9-3.2	3.6-3.8	0-150
	Tem	Elephant Mountain	4.2	3.7	0-250
	Tpom	Pomona	1.6-2	4.5-7.5	0-400
	Twl	Weissenfels Ridge	2.1-3.1	5-8	0-50
	Taw	Asotin-Wilbur Creek	1.3-2.2	3-9	100-200
Latah	Tlis	Sweetwater Creek	Sediments		20-250
Wanapum	Tpr	Priest Rapids-Lolo	2.8-3.5	3.5-6	30-200
Latah	Tliv	Vantage	Sediments		0-50
Grande Ronde R2	Tgr2mr1	Meyer Ridge	1.7	5	50-100
	Tgr2gc1	Grouse Creek	2-2.2	4	50-75
	Tgr2wr1	Wapshilla Ridge	2.55-2.85	2.7-3.4	175-400
	Tgr2wr2		2.3-2.6	2.8-3.7	
	Tgr2mh1	Mt. Horrible	2.2	3.5	30-100
Grande Ronde N1	Tgn1cc1	China Creek	1.9	4.2	175-200
	Tgn1cc2		1.7	4.7	
	Tgn1fp1	Frye Point	2	4	30-120
	Tgn1dg1	Downey Gulch	2.3	3.4	400?
	Tgn1dg2		2	3.7	

Figure 1. Stratigraphic column for the upper part of the Columbia River Basalt Group in the Lewiston Basin, Idaho.

Data Gaps and Recommendations

Additional sections should be drawn east of Lapwai Valley, extend sections into the Washington part of the Lewiston Basin, and additional sections south and east of section J-K. The lower part of the stratigraphy may change as additional samples are collected and more detailed geologic mapping is completed. When additional studies are done and a solid stratigraphy is developed, a new geological map of the Lewiston Basin should be completed with units split at the Member level.

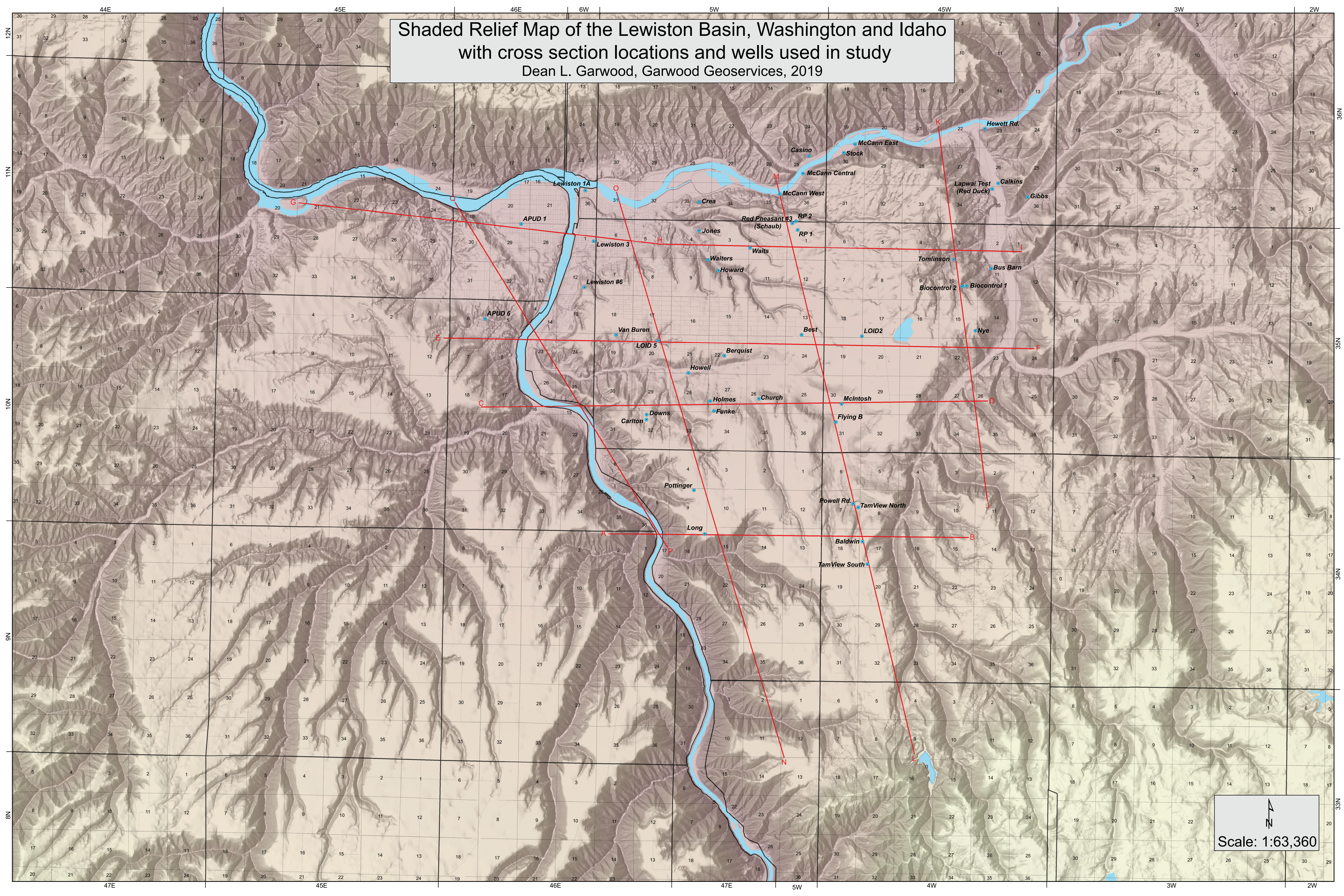
References Cited

J. H. Bush, P. Dunlap, and S. P. Reidel, 2018, Miocene Evolution of the Moscow-Pullman Basin, Idaho and Washington, Idaho Geological Survey Technical Report 18-3, 44p.

Idaho Geological Survey North Idaho Geologic Map Database, 2018, 1:100,000--GIS data, May 2018: Idaho Geological Survey Digital Geologic Map Series DGM-7.

Reidel, S.P., and Tolan, T.L., 2013, The Grande Ronde Basalt, Columbia River Basalt Group, *in* Reidel, S.P., Camp, V.E., Ross, M.E., Wolff, J.A., Martin, B.S., Tolan, T.L., and Wells, R.E., eds., The Columbia River Flood Basalt Province: Geological Society of America Special Paper 497, p. 117–153, doi:10.1130/2013.2497(05).

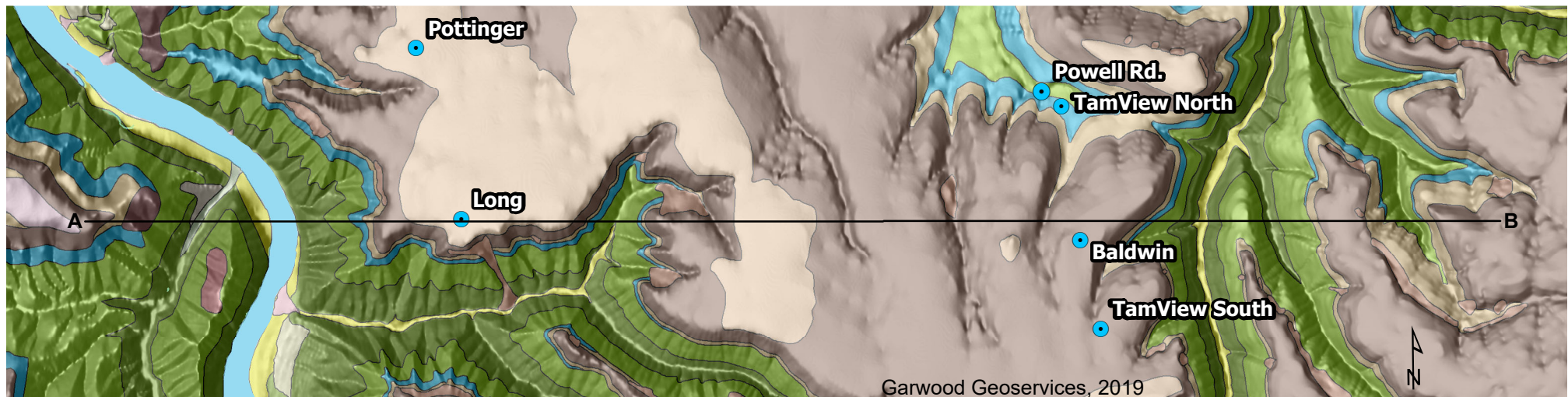
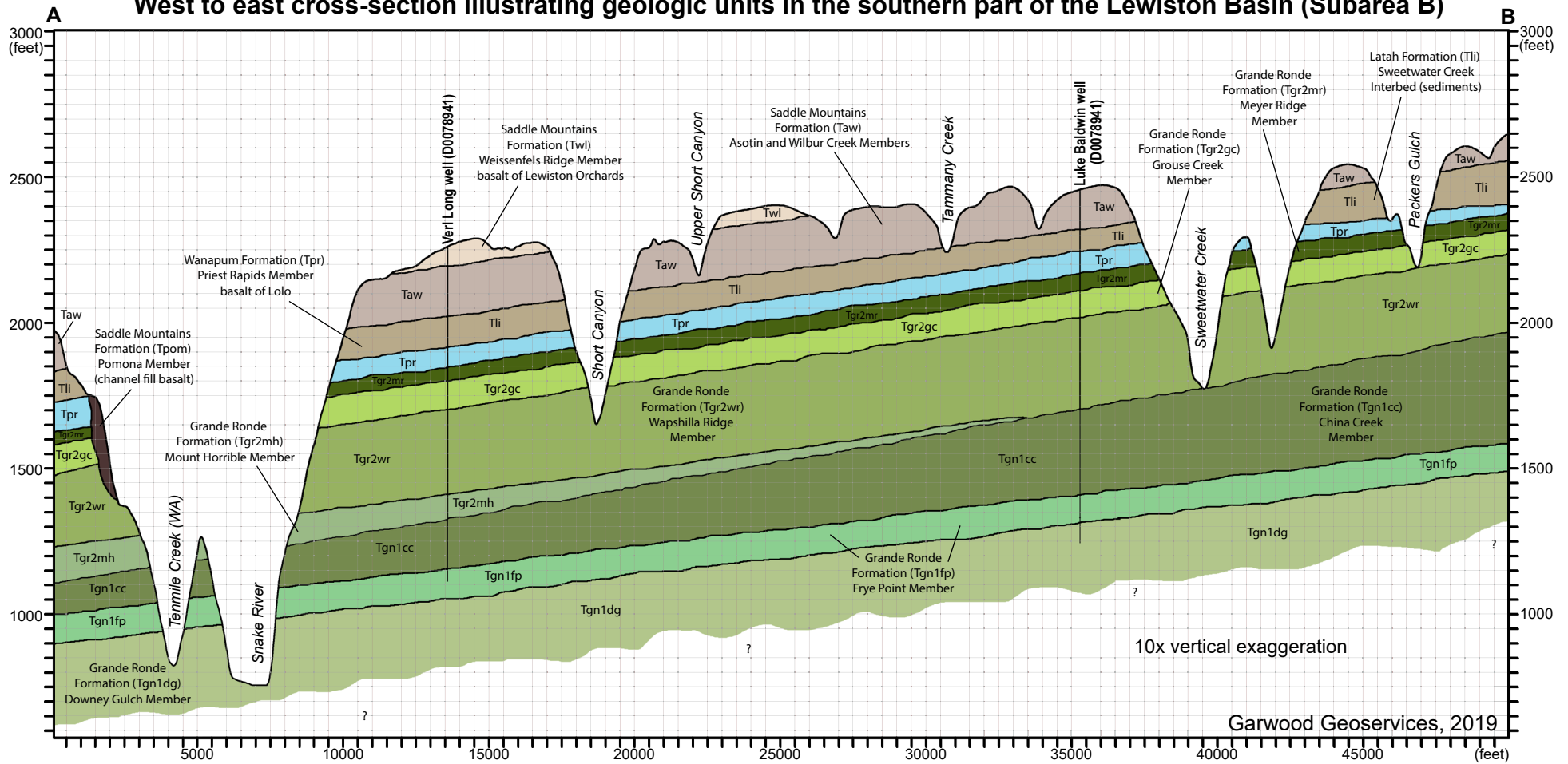
Washington Division of Geology and Earth Resources-Surface geology, 2016, 1:100,000--GIS data, November 2016: Washington Division of Geology and Earth Resources Digital Data Series DS-18, version 3.1.

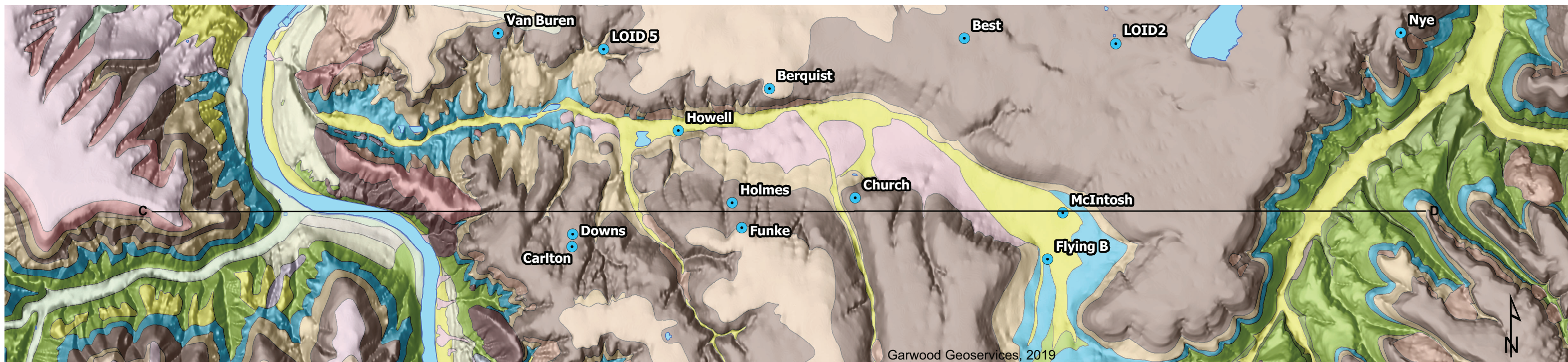
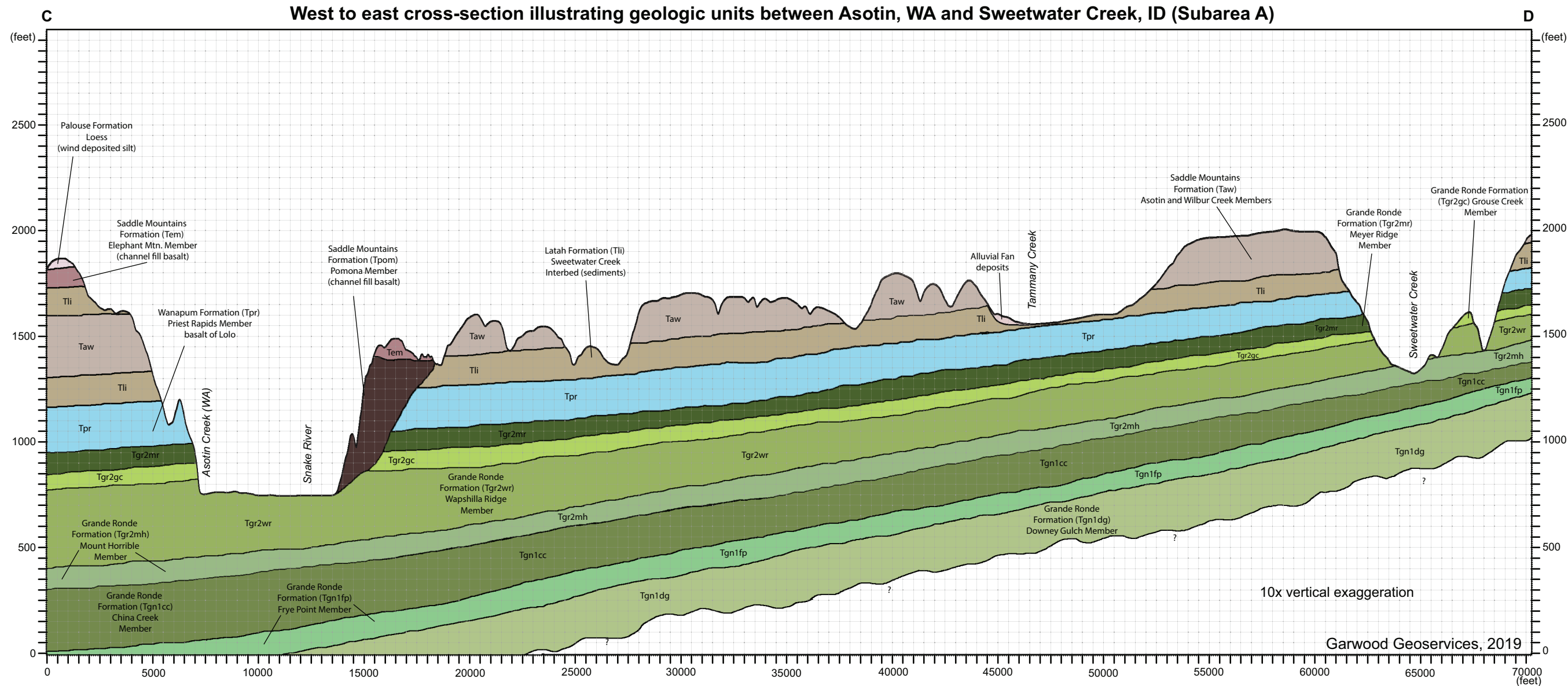


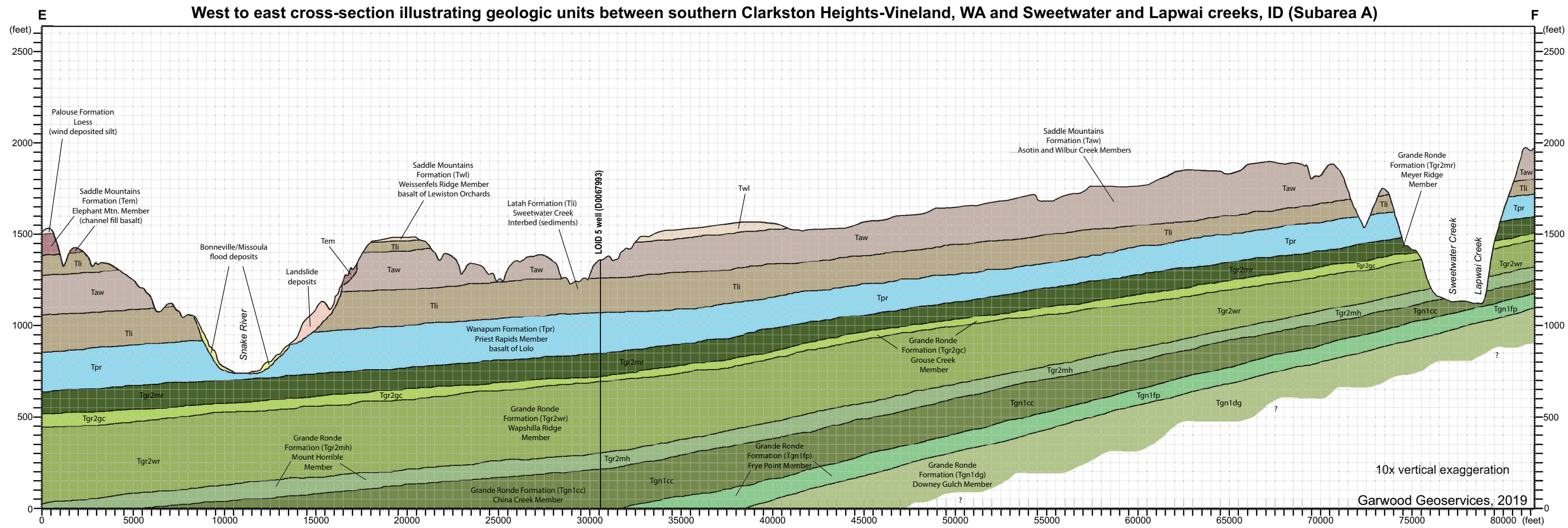
Shaded Relief Map of the Lewiston Basin, Washington and Idaho
with cross section locations and wells used in study
Dean L. Garwood, Garwood Geoservices, 2019

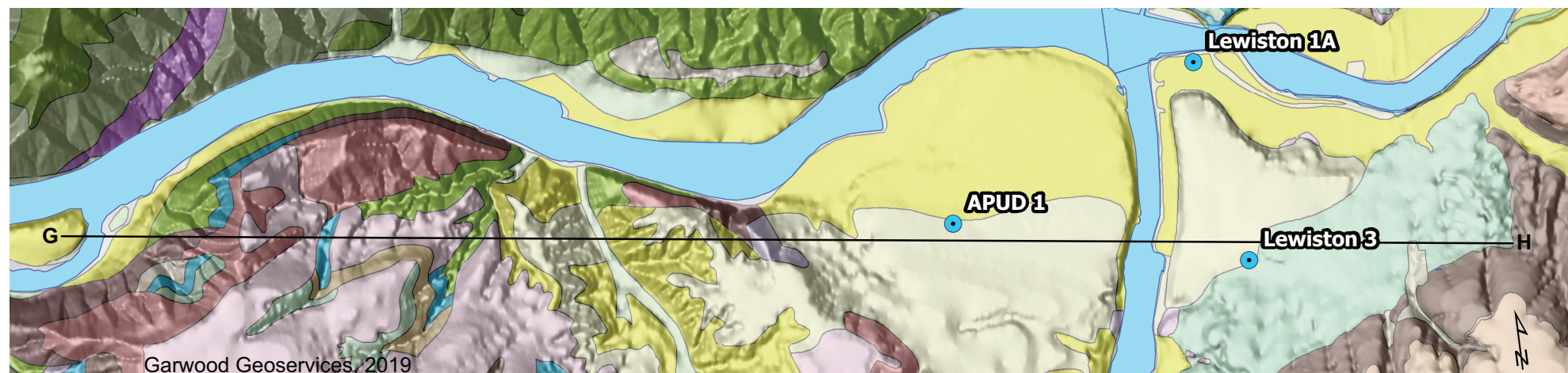
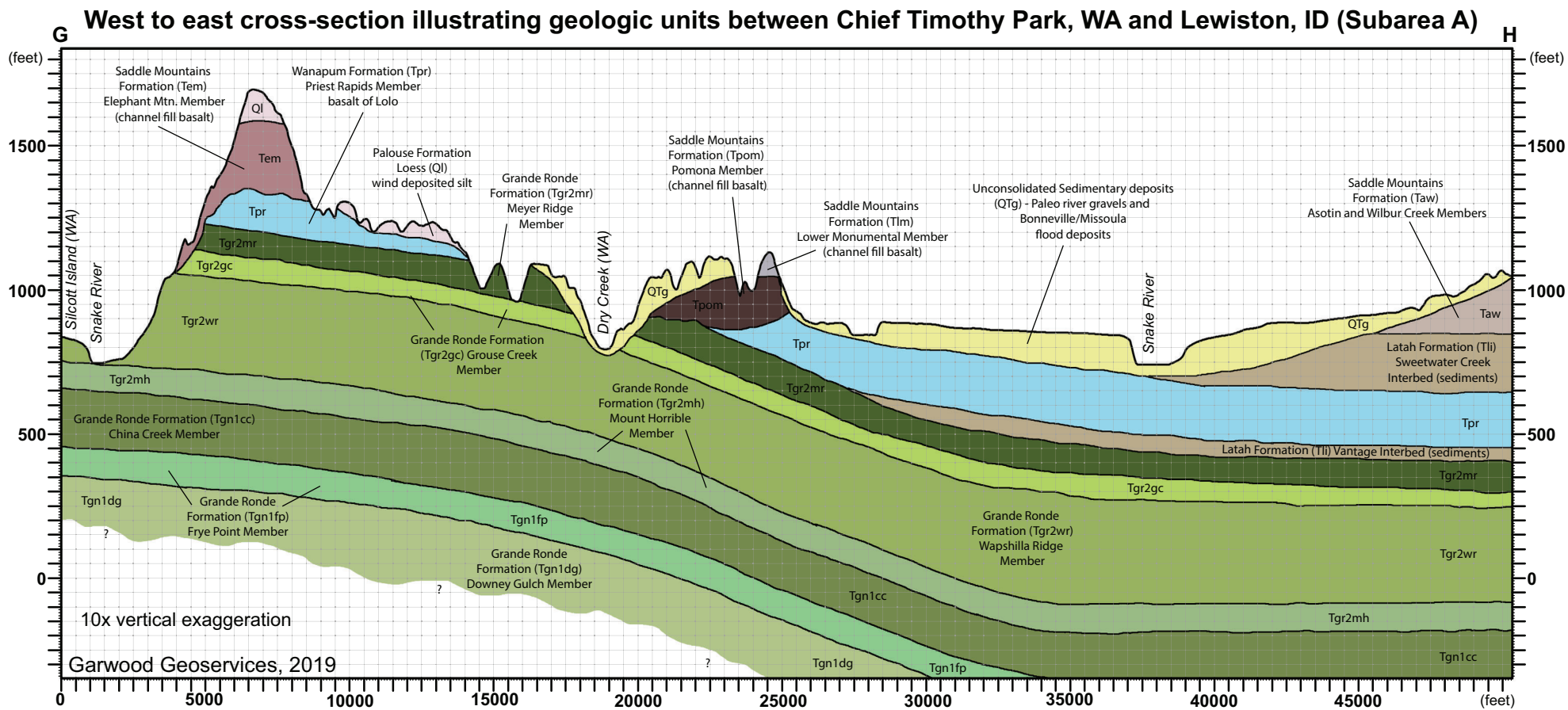
Scale: 1:63,360

West to east cross-section illustrating geologic units in the southern part of the Lewiston Basin (Subarea B)









West to east cross-section illustrating geologic units between Lewiston, ID and Lapwai, ID (Subarea A-1)

(feet)

2000

1500

1000

500

0

0 5000 10000 15000 20000 25000 30000 35000 40000 45000 (feet)

Red Pheasant #3, Schaub (00054425)

Saddle Mountains Formation (Taw)
Weissenfels Ridge Member
basalt of Lewiston Orchards

Latah Formation (Tli)
Sweetwater Creek Interbed (sediments)

Tpr

Tgr2mr

Tgr2gc

Grande Ronde Formation (Tgr2wr)
Wapshilla Ridge Member

Tgr2mh

Grande Ronde Formation (Tgn1cc)
China Creek Member

Tgn1fp

Tgn1dg

Saddle Mountains Formation (Taw)
Asotin and Wilbur Creek Members

Wanapum Formation (Tpr)
Priest Rapids Member
basalt of Lolo

Grande Ronde Formation (Tgr2mr)
Meyer Ridge Member

Soldiers Canyon

Grande Ronde Formation (Tgr2gc)
Grouse Creek Member

Lapwai Creek

Taw

Tpr

Tgr2mr

Tgr2wr

Tgr2mh

Tgn1cc

Tgn1fp

Tgn1dg

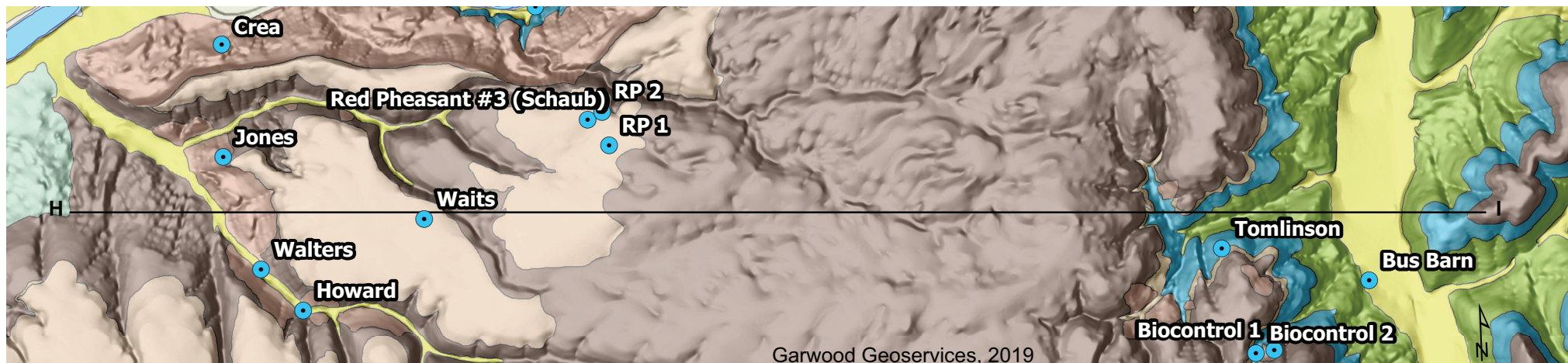
Grande Ronde Formation (Tgr2mh)
Mount Horrible Member

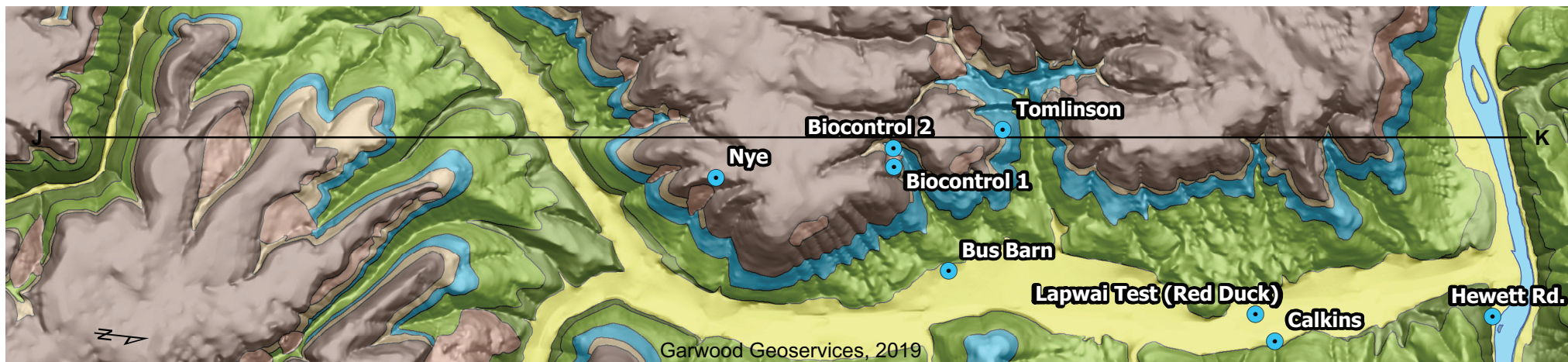
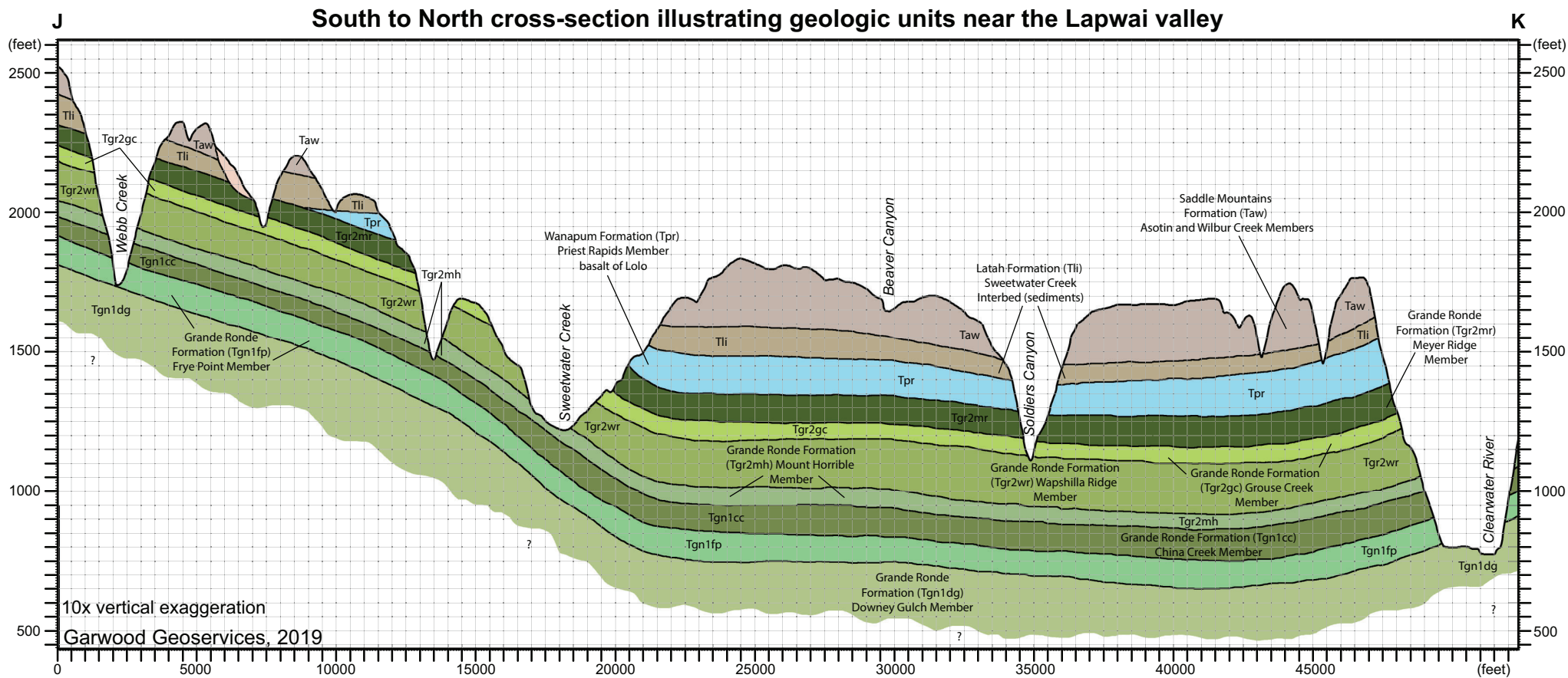
Grande Ronde Formation (Tgn1dg)
Downey Gulch Member

Grande Ronde Formation (Tgn1fp)
Frye Point Member

10x vertical exaggeration

Garwood Geoservices, 2019





South-southeast to north-northwest cross-section illustrating geologic units in the Lewiston Basin from Waha Lake to the Clearwater River (Subarea A-1)

