WALLA WALLA BASIN
WATERSHED COUNCIL

Water Year 2022

Oregon Walla Walla Basin Aquifer Recharge Report

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Oregon Walla Walla Basin Aquifer Recharge Report

Prepared by:

Walla Walla Basin Watershed Council

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February 2023

EXECUTIVE SUMMARY

This report summarizes aquifer recharge operations at the Anspach, Barrett, Chuckhole, East Trolley Lane, Fruitvale, Gallagher, Johnson, LeFore, Locust Road, Miller Road, Mud Creek, North Sunquist, NW Umapine, Ruby Lane, Triangle Road, Trumbull, and West Ringer Road sites during water year (WY) 2022 and supporting water quality, spring flow, and groundwater level data. Fifteen aquifer recharge sites were operated under Limited License 1848 (LL-1848) issued by Oregon Water Resources Department. This report was prepared per Condition 10 of LL-1848, which requires annual reporting of aquifer recharge site operations.

Source water for the 15 aquifer recharge sites was diverted from the Walla Walla River at the Little Walla Walla Diversion in Milton-Freewater, OR. The water was delivered through existing irrigation water delivery systems to each site's turnout. The WY 2022 recharge season started November 22, 2021 and ended May 15, 2022 but recharge did not occur continuously during this period due to operational and maintenance considerations. The total amount of water diverted and recharged under LL-1848 for the WY 2022 recharge season, including estimated seepage losses from the conveyance system, was 6,036 acre-feet (ac-ft.). One of the objectives of conducting managed recharge is to mimic lost floodplain processes. If this year's recharge water had instead been flood waters, the volume recharged would have covered the roughly 13 mi^2 central portion of the alluvial fan with almost one foot of water if it had been released instantaneously.

Groundwater level, spring flow, and water quality data were collected in accordance with the approved monitoring plan for LL-1848. At several groundwater monitoring wells located near recharge sites, groundwater levels increased at the start of recharge and decreased after recharge ended. At other wells, water levels responded to seepage from other sources, such as rivers, streams, irrigation ditches or canals, and deep percolation from irrigation.

Flow data from Little Mud Creek and Swartz Creek, both spring-fed creeks down-gradient of multiple recharge sites, show an increase in flows since the recharge program expanded in 2012-2013.

Groundwater and surface water quality data collected during aquifer recharge activities indicate that aquifer recharge activities are not degrading groundwater quality; rather, recharge activities typically improve groundwater quality due to the generally high quality of the source water.

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List of Acronyms

ac-ft.	acre-foot
bgs	below ground (or grade) surface
°C	degrees Centigrade
cfs	cubic feet per second
EPA	U.S. Environmental Protection Agency
gpm	gallons per minute
FWUA	Fruitvale Water Users Association
GW_##	Groundwater monitoring well #, e.g. GW_14, GW_171
HBDIC	Hudson Bay District Improvement Company
LL	Limited License
mg/L	milligrams per liter
ND	not detected
ODEQ	Oregon Department of Environmental Quality
OWRD	Oregon Water Resources Department
µg/L	micrograms per liter
µS/cm	microsiemens per centimeter
WWBWC	Walla Walla Basin Watershed Council
WWRID	Walla Walla River Irrigation District
WY	water year

INTRODUCTION

This report describes groundwater level data, surface and groundwater quality data, and aquifer recharge operations during water year (WY) 2022 (October 1, 2021 – September 30, 2022) for the managed aquifer recharge program conducted by the Walla Walla Basin Watershed Council (WWBWC) in cooperation with the Hudson Bay District Improvement Company (HBDIC), Fruitvale Water Users Association, and Walla Walla River Irrigation District. The recharge program began operating in 2004 at one site and gradually expanded to the 15 sites operational in WY 2022. Figure 1 shows recharge volumes by year.

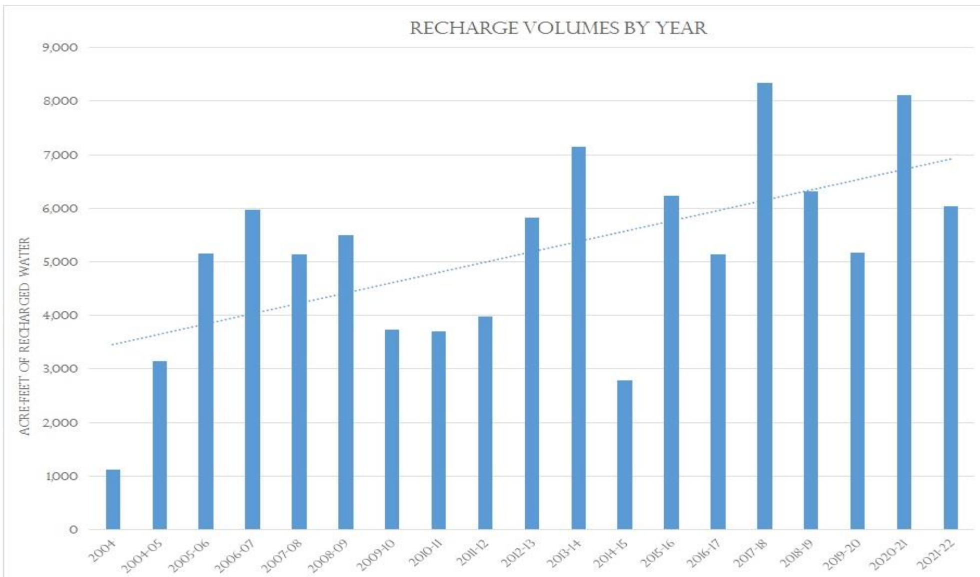

Figure 1. Recharge volumes by year

In the Walla Walla basin, declines in the alluvial aquifer and interconnected surface waters have resulted from the channelization of the Walla Walla River distributary system, increased irrigation efficiencies, and increased use of groundwater (pumping) for irrigation and drinking water. As described in the *Walla Walla Basin Aquifer Recharge Strategic Plan* (WWBWC, 2013), the following benefits are expected if the annual volume recharged reaches 20,000 ac-ft.:

> "Reversing the loss of storage within the alluvial aquifer will minimize seepage loss in the valley's rivers and streams, increase spring performance and related groundwater input to surface water features, and allow groundwater resources of the alluvial aquifer to continue to be used as a sustainable resource with a secondary or alternative-use benefit to surface water." (p. 79).

During WY 2022, active recharge sites were Anspach, Barrett, Chuckhole, East Trolley Lane, Fruitvale, Gallagher, Johnson, Locust Road, Miller Road, Mud Creek, NW Umapine, Ringer Road, Ruby Lane, Triangle Road, and Trumbull. Figure 2 shows WY 2022 recharge volumes by site, including estimated conveyance losses (i.e. canal seepage) that become groundwater recharge. The Lefore and Sunquist recharge sites didn't operate because site management and operational procedures were not yet fully developed.

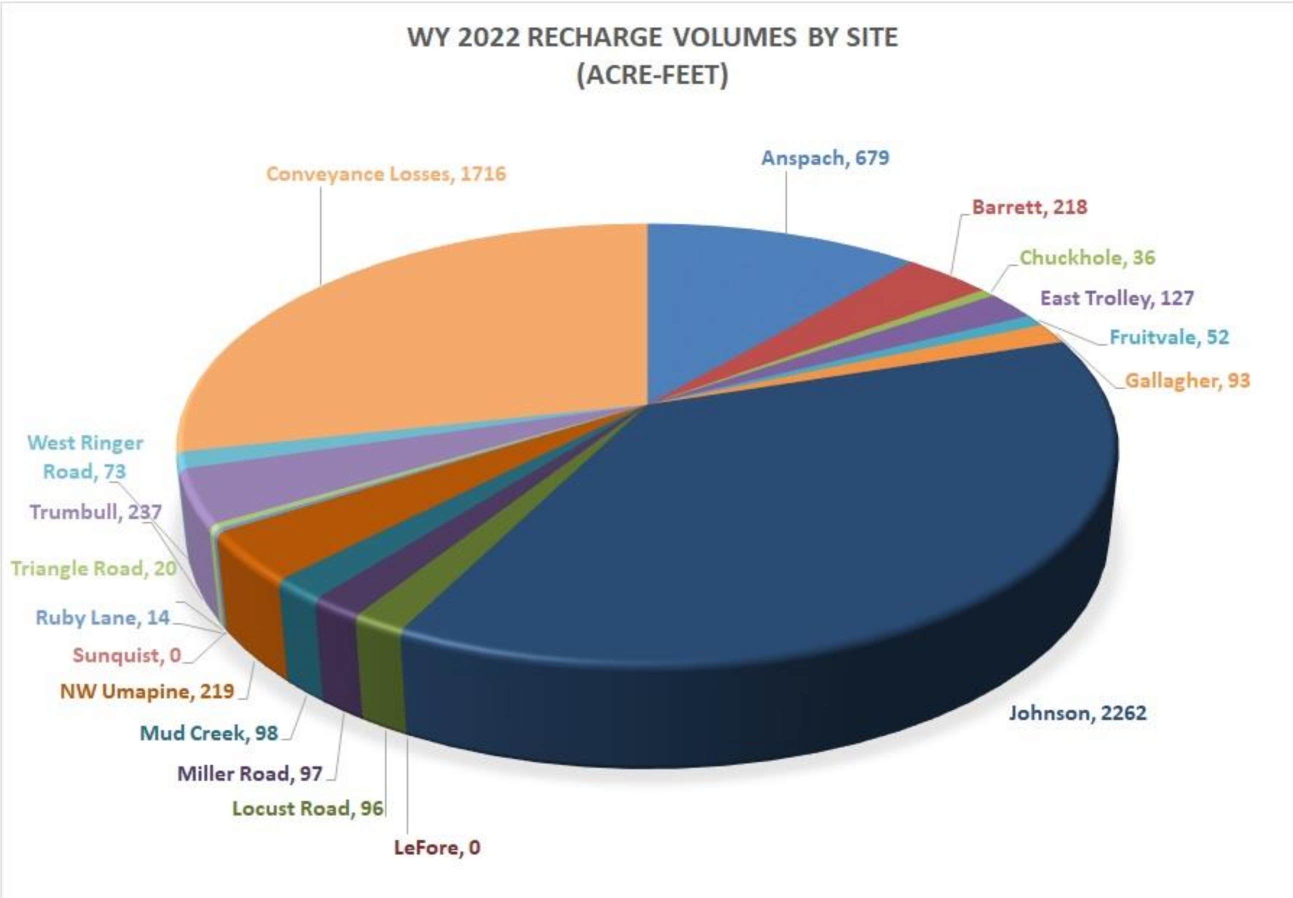

Figure 2. Recharge volumes by site during WY 2022.

The sites were operated under Limited License LL-1848 (Appendix A) issued on January 04, 2021 by the Oregon Water Resources Department (OWRD). Source water for aquifer recharge was diverted from the Walla Walla River near Milton-Freewater between November 22, 2021 and May 15, 2022. The various recharge sites operated from 35 to 114 days depending primarily on water availability and landowner participation. The total amount of water diverted was 6,036 acre-feet (ac-ft.)[1], with the Johnson site and conveyance losses recharging the highest proportions of the total diversion amount, 37% and 28%, respectively (Figure 2 and Table 1). While the smaller recharge sites contribute a relatively small proportion, they are still an integral and important part of the program due, in part, to the conveyances losses that occur during water delivery to the sites as well as the distribution of recharge over a larger area of the alluvial fan.

[1] One acre foot is the amount of water needed to cover one acre (a little less than a football field) with one foot of water.

Table 1. Annual recharge volumes (ac-ft.) by site, WY 2004-2022.

Recharge Year	Anspach	Barrett	Chuckhole	East Trolley	Fruitvale	Gallagher	Johnson	LeFore	Locust	Miller Road	Mud Creek	NW Umapine	Ruby Lane	Sunquist	Triangle Rd	Trumbull	West Ringer Rd	Conveyance Losses	*Sum*	Excluding conveyance los
2004	--	--	--	--	--	--	409	--	--	--	--	--	--	--	--	--	--	714	***1,123***	409
2004-05	--	--	--	--	--	--	1,871	--	--	--	--	--	--	--	--	--	--	1,277	***3,148***	1,871
2005-06	--	--	--	--	--	--	2,813	--	--	--	--	--	--	--	--	--	--	2,342	***5,155***	2,813
2006-07	--	--	--	--	--	--	3,234	--	--	--	--	--	--	--	--	--	--	2,739	***5,973***	3,234
2007-08	--	--	--	--	--	--	2,739	--	--	--	--	--	--	--	--	--	--	2,406	***5,145***	2,739
2008-09	--	--	--	--	--	--	2,840	--	--	--	--	--	--	--	--	--	--	2,667	***5,507***	2,840
2009-10	--	--	--	--	--	--	3,734	--	--	--	--	--	--	--	--	--	--	not	***3,734***	3,734
2010-11	--	--	--	--	--	--	3,700	--	--	--	--	--	--	--	--	--	--	estimate	***3,700***	3,700
2011-12	--	--	--	--	--	--	3,974	--	--	--	--	--	--	--	--	--	--	d	***3,974***	3,974
2012-13	12	--	--	--	--	--	4,556	--	--	--	--	--	--	--	--	84	--	1,175	***5,827***	4,652
2013-14	127	210	--	--	--	--	4,515	--	--	--	--	499	--	--	--	421	--	1,385	***7,157***	5,772
2014-15	23	200	--	--	--	--	1,560	--	--	--	--	190	--	--	--	116	--	696	***2,785***	2,089
2015-16	532	286	--	--	--	--	3,959	--	--	--	--	170	--	--	--	262	--	1,021	***6,230***	5,209
2016-17	660	383	13	--	17	--	2,732	--	--	--	8	183	--	--	13	170	--	968	***5,147***	4,179
2017-18	251	179	25	52	35	--	3,518	78	56	--	32	233	--	--	103	67	--	3710	***8,339***	4,629
2018-19	135	181	25	45	51	16	2,794	3	56	--	45	111	--	--	72	45	111	2,631	***6,321***	3,690
2019-20	302	70	30	58	27	39	2,559	1	91	--	65	103	--	--	67	92	68	1,601	***5,173***	3,572
2020-21	642	223	9	160	57	86	3221	0	68	152	238	417	1	0	105	297	262	2183	**8121**	5938
2021-22	679	218	36	127	52	93	2262	0	96	97	98	219	14	0	20	237	73	1716	**6036**	4320
Sum	3,362	1,950	139	442	239	235	56,989	82	367	249	485	2,125	15	0	380	1,792	514	29,231	98,595	69,364

HYDROLOGIC SETTING

The Walla Walla River system is a bi-state watershed located in northeast Oregon and southeast Washington (Figure 3). The headwaters are located in the Blue Mountains, the crest of which defines the eastern extent of the watershed. The Walla Walla River, Mill Creek and the Touchet River are the three primary surface water channels of the system. They coalesce within the Walla Walla Valley then flow to the Columbia River. The scope of this report is the Oregon portion of the basin, including the Walla Walla River and its distributary network, especially where they flow onto and across the Milton-Freewater alluvial fan.

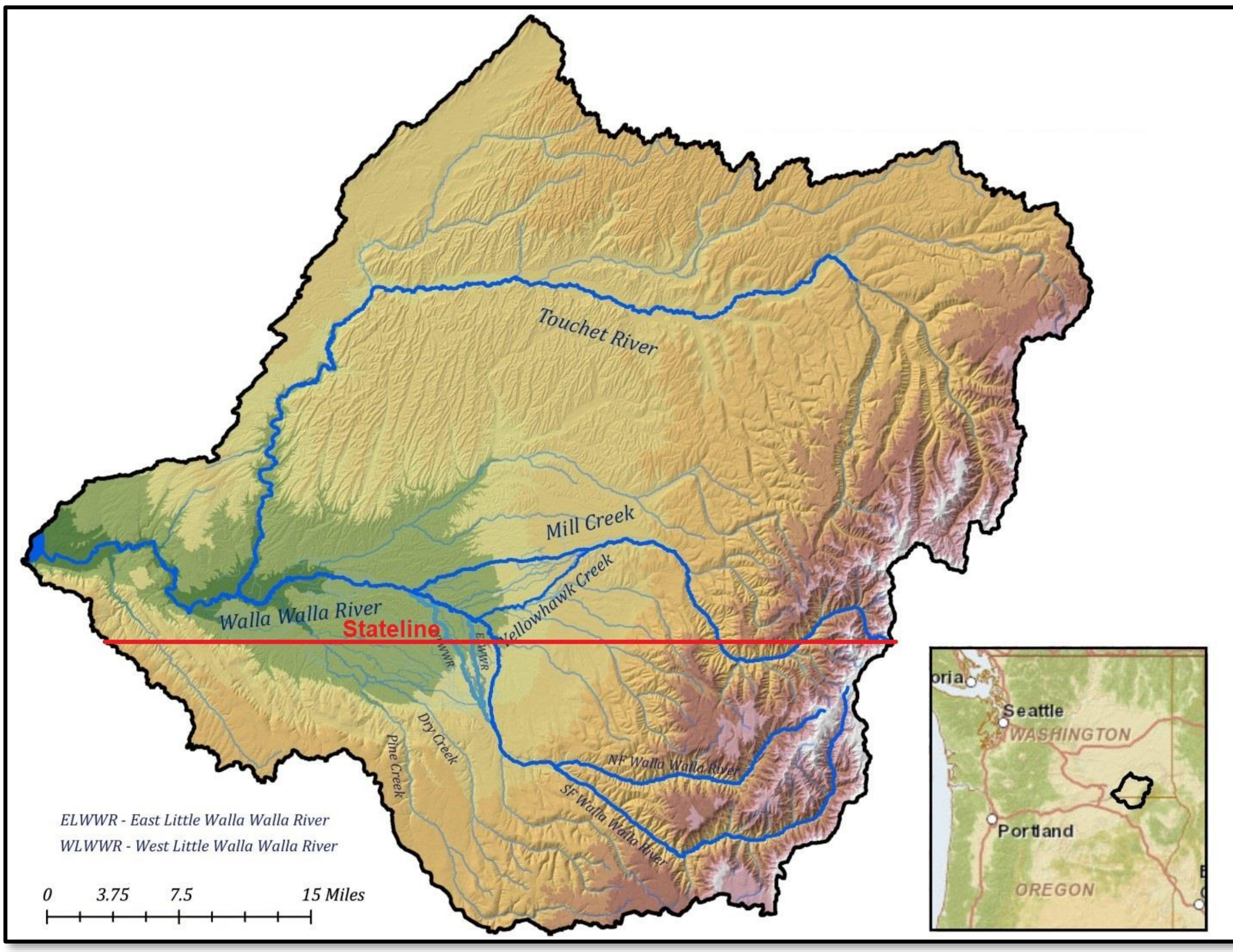

Figure 3. The Walla Walla Watershed, including the Walla Walla River and its major tributaries and distributaries.

Groundwater in the Walla Walla basin occurs in two principal aquifer systems: (1) the unconfined to confined suprabasalt sediment (alluvial) aquifer system; and (2) the underlying confined basalt aquifer system (Newcomb, 1965). The basalt aquifer system is regional in character, having limited hydraulic connection to the Walla Walla River, primarily in the canyons of the Blue Mountains. The alluvial aquifer system is the focus of the aquifer recharge program because of its high degree of hydraulic connection with streams on the valley floor. The alluvial aquifer system, or alluvial aquifer, is found within a sequence of continental clastic sediments overlying the top of basalt, the Mio-Pliocene strata (upper coarse, fine and lower coarse units) and the Quaternary coarse unit. Beneath the Walla Walla Valley floor these sediments, and the alluvial aquifer system, is up to 800 feet thick. The majority of the productive portions of the alluvial aquifer system are hosted by the Mio-Pliocene conglomerate although, at least locally, it is hosted in the overlying Quaternary coarse unit. The alluvial aquifer is generally characterized as unconfined, but it does, at least locally, display evidence of confined conditions. Preferential groundwater flow within the alluvial aquifer is inferred to largely reflect the distribution of coarse sedimentary strata. General groundwater flow direction is from east to west based on contoured groundwater elevations in the alluvial aquifer (Figure 4).

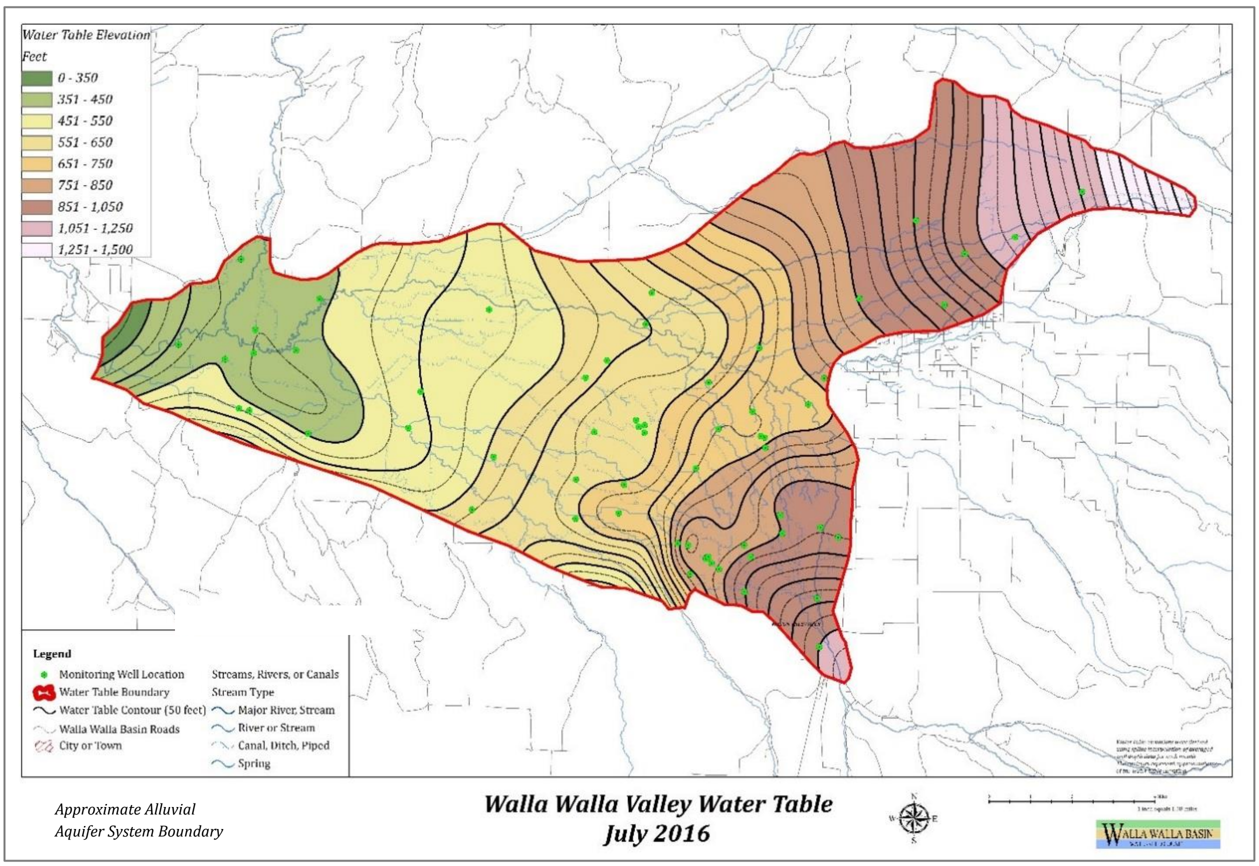

Figure 4. Water table elevation contours for the alluvial aquifer system in July 2016.

South of Milton-Freewater, the Walla Walla River exits the steep-walled canyon in the foothills surrounding the valley, divides into a distributary stream system on an alluvial fan on the valley floor, and then, as the distributary streams flow west, coalesce into the main Walla Walla River (Figure 5). A similar pattern exists in the Mill Creek distributary system in Washington. The distributary channels are known today as the East Little Walla Walla River, West Little Walla Walla River, Mud Creek, Yellowhawk Creek, and Garrison Creek.

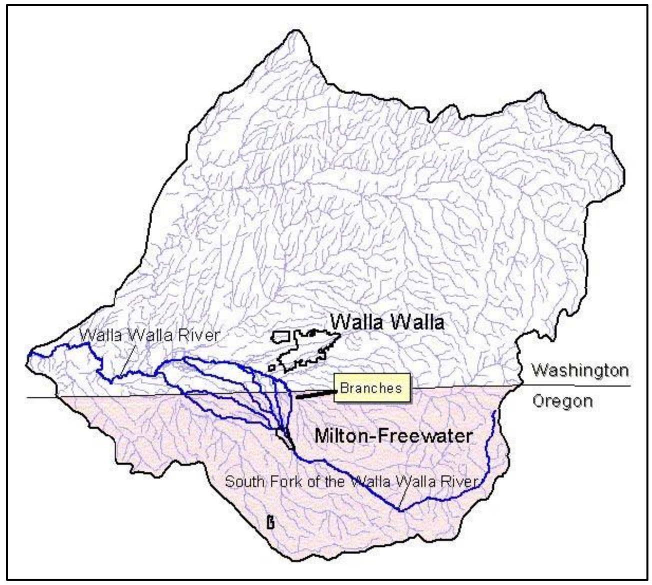

Figure 5. Distributary stream networks of the Walla Walla River originating on the Milton-Freewater alluvial fan.

Prior to the development of water resources in the valley, the distributary channels conveyed large amounts of energy and water across the alluvial fan. The complex channels provided habitat for aquatic species, recharge to the alluvial aquifer system, and cooler water to the Walla Walla River in the form of springs and subsurface inflows to the river resulting from recharge to the aquifer. A headgate installed in the Little Walla Walla River in the 1930's shunted wintertime flows away from the Little Walla Walla River, significantly reducing the system's complexity. Then, in the 1950's, seven miles of levees were constructed along the Walla Walla River to protect the Milton-Freewater area from flooding, severing the connection between the floodplain and the alluvial aquifer. Increasing development led to increasing reliance on the alluvial aquifer as a source of water for irrigation and drinking. In recent years, the listing of steelhead and bull trout as threatened under the Endangered Species Act and the reintroduction of spring Chinook salmon led to out-of-court settlement agreements between irrigators and federal fishery agencies to enhance flows in the Walla Walla River. Since 2003, HBDIC and the Walla Walla River Irrigation District leave 25 to 27 cfs of their surface water rights in the Walla Walla River – roughly one-quarter of their typical summertime diversions during the 1990s – further de-watering the Little Walla Walla River.

Alluvial aquifer groundwater levels have declined in some places. Of the 11 long-term OWRD observation wells in the alluvial aquifer, all had downward groundwater level trends and three were completely dry by 2009 (Bower and Lindsey, 2010). Declines at observation well GW_19 located near Old Milton Highway illustrate the long-term trend in portions of the aquifer (Figure 6).

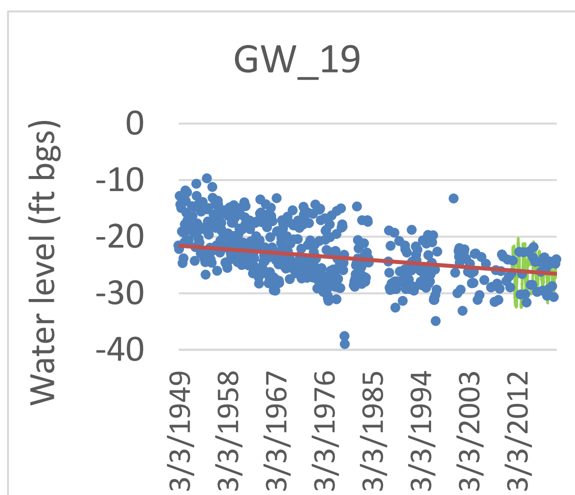

Figure 6. Long-term hydrograph for monitoring well GW_19.

Because of the interconnectedness between the alluvial aquifer and the streams in the basin, declining groundwater levels result in decreased groundwater contributions to the Walla Walla River and other surface waters, including during critical low-flow periods. The loss of groundwater to streams affects not only the amount of flow in the river but also leads to increased surface water temperature during the low-flow periods, affecting aquatic species and the stream ecosystem. Historically, the estimated yield from 57 mapped springs on the Milton-Freewater and Mill Creek alluvial fans was 50,000 ac-ft. (Oregon State Water Resources Board, 1963), or 69 cfs on an annual basis. In contrast, in 2017 the combined annual discharge from five of the largest springs sourced in the Milton-Freewater alluvial fan was 15.5 cfs (WWBWC, 2019). Flows at McEvoy and Dugger springs were 4-6 cfs and 8-10 cfs, respectively, during summers in the 1930s. By 2009 both springs were dry for portions of the summer (Figure 7). However, even under altered modern conditions, groundwater still provides a cooling function to the river. In one study conducted in the summer of 2009, cold water inflows into the Walla Walla River just south of the state line provided an effective cooling of approximately 3.15 ˚C (Gryczkowski, 2015). The cold water inflows consisted of groundwater discharge and hyporheic[2] exchange. Groundwater discharge was calculated to contribute 20% of the total flow in the river during the study. The steep gradients and high hydraulic connectivity between the groundwater levels and water in the river results in high seepage losses -- in some reaches greater than 30 percent (WWBWC, 2017) (Figure 8).

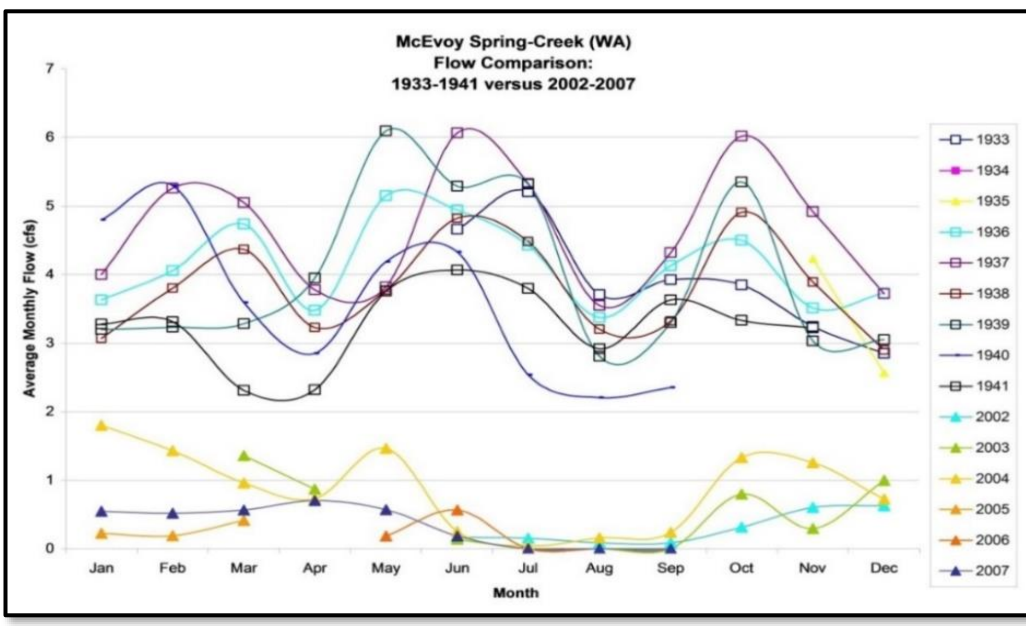

Figure 7. Hydrograph for McEvoy Spring Creek, 1933-1941 versus 2002-2007.

[2] The hyporheic zone is a porous area beneath and alongside a stream bed, where shallow groundwater and surface water mix together.

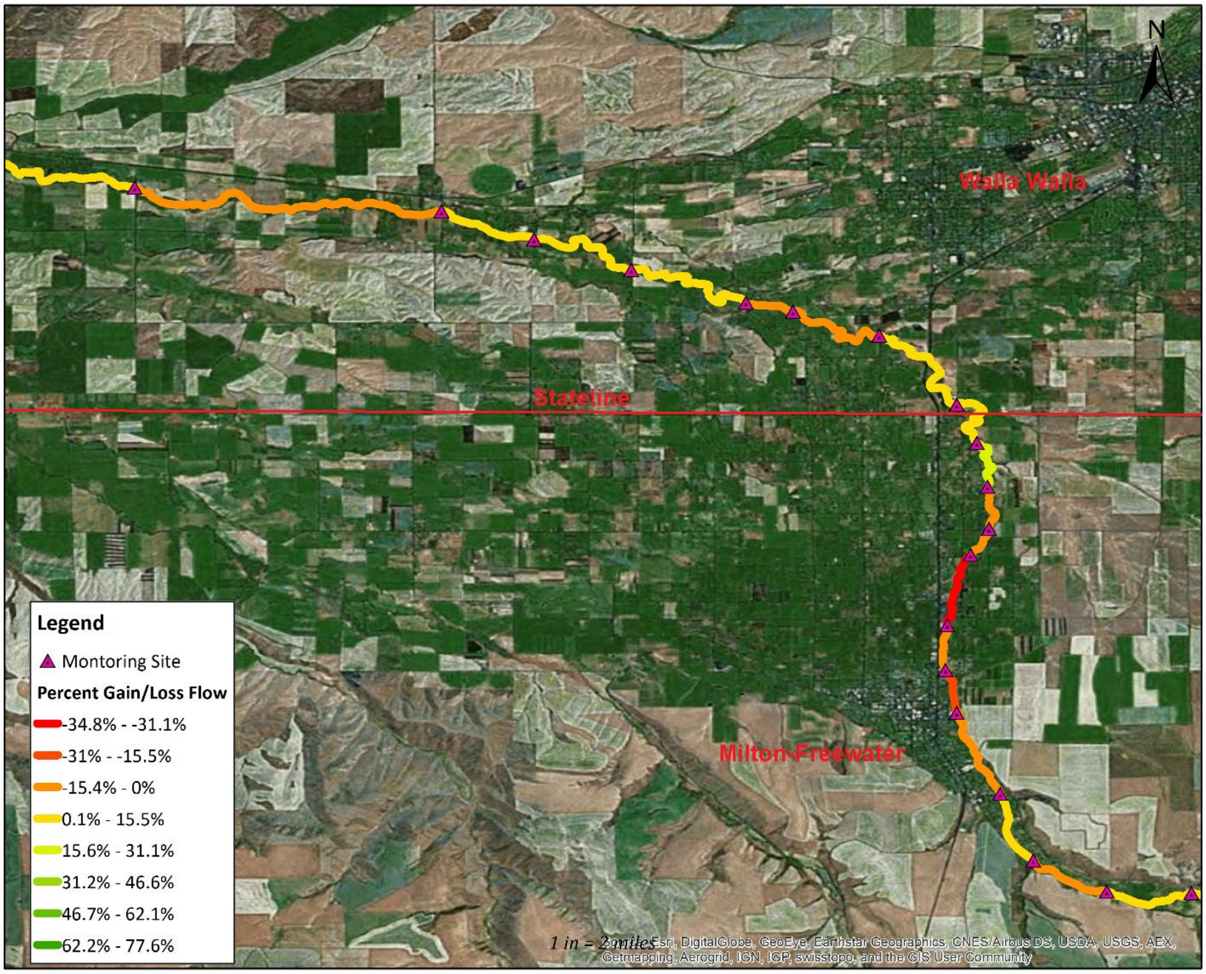

Figure 8. Average percent gains or losses in flow of a segment of the Walla Walla River during seepage runs conducted 2004-2016. Gains (positive values, greens and yellows) indicate groundwater discharging to the river. Losses (negative values, reds and oranges) indicate surface water seeping into the ground (see WWBWC, 2017, for details).

The existing 17 aquifer recharge sites are distributed across the Milton-Freewater alluvial fan (Figure 9), mimicking the floodplain process of recharge to the aquifer that was lost when the headgate shunted wintertime water to the Walla Walla River and the levees nearly eliminated flooding near Milton-Freewater.

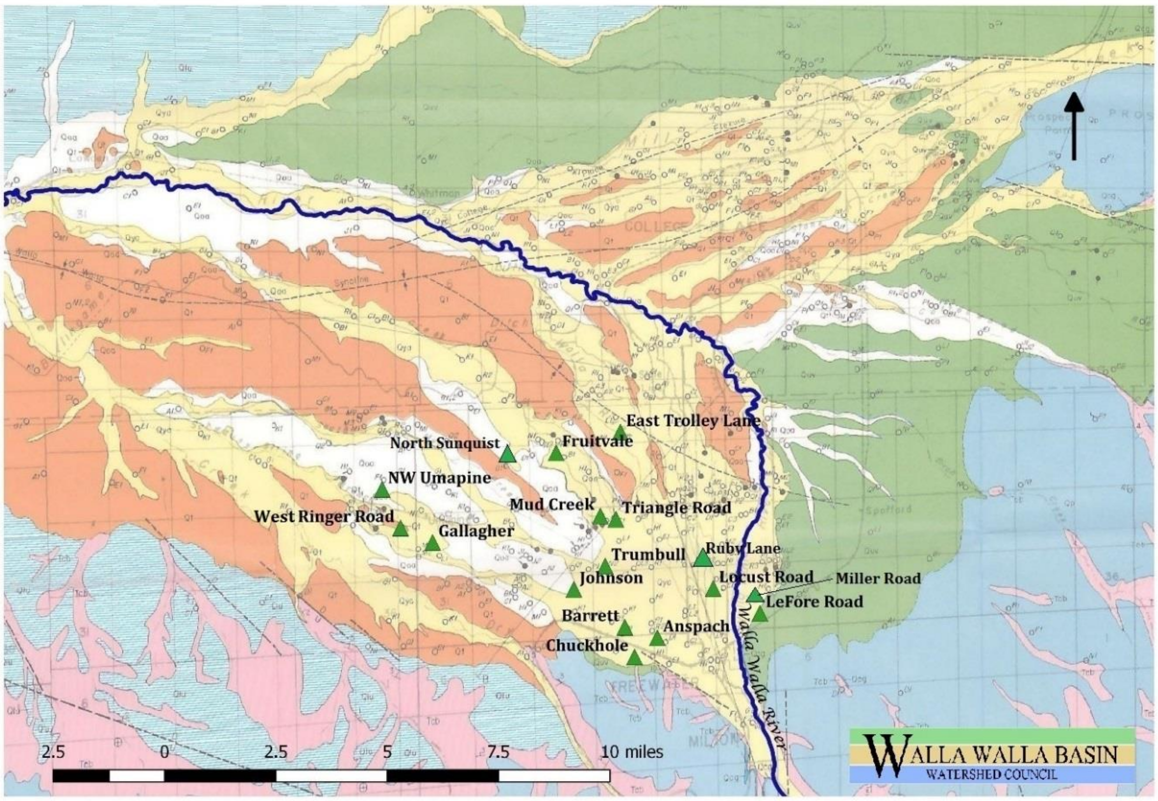

Figure 9. Recharge sites in the Oregon portion of the Walla Walla basin during WY 2022 and their location across the alluvial fan.

OPERATIONS

Managed aquifer recharge program operations are summarized, by site, in Table 2. As in previous years, sites typically operated at less than the maximum design capacity listed in the limited license. Depending on the site, this is commonly due to site conditions or operational limitations such as the volume of the source water being unable to completely fill the site's inflow pipe, biofouling of inlet screens, frozen ditches, reduced infiltration rates, competing demands for water (stock watering or irrigation), equipment failures, plugged subsurface inlet lines, etc.

Table 2. Summary of MAR operations in WY 2022.

Site	Operated by	Number of Days Operated	Average Recharge Rate (cfs)	Operational Comments
Anspach	WWBWC	108	3.18	Meter at infiltration gallery 1 sustained damage and is not functioning properly, estimated total.
Barrett	HBDIC	91	1.21	Head pressure issue when irrigation water is needed downstream, causes the flow meter to read empty pipe.
Chuckhole	Landowner	36	0.51	Intermittent head pressure issue, causes the flow meter to read empty pipe. The flow meter didn't capture all the water that went into the site.
East Trolley	Landowner	112	0.57	Landowner removed screen debris daily
Fruitvale	Landowner	82	0.32	Landowner turned off the site when he needed water for irrigation. Ran fewer days due to ditch maintenance, freezing weather, and irrigation needs.
Gallagher	WWBWC/ Landowner	101	0.53	Landowner turns off the site intermittently when he needs water for irrigation.
Johnson	HBDIC/ WWBWC	108	12.03	Lower infiltration rate in the basins than in past years. Possible maintenance needed.
LeFore	Landowner	0	--	Developing operational procedures with landowner.
Locust Rd	Landowner	114	0.42	The screen had to be regularly cleaned to sustain recharge rates.
Miller Road	WWBWC	41	1.19	Reduced recharge rate this season due to water emerging out of the ground last season.
Mud Creek	FWUA	87	0.57	Recharge volume calculated based on manual flow measurements with velocity meter taken at basin inflow and outflow. Ran fewer days due to ditch maintenance, freezing weather.
North Sunquist	Landowner	0	--	Developing operational procedures with landowner.
NW Umapine	HBDIC	85	1.30	--
Ruby Lane	WWBWC	107	0.07	The screen had to be regularly cleaned to sustain recharge rates.
Triangle Road	FWUA/Landowner	35	0.29	Ran fewer days due to ditch maintenance, freezing weather and holes in the pond caused by rodents.
Trumbull	HBDIC	101	1.18	--
West Ringer Road	WWBWC	45	0.82	Ran fewer days due to site management issues. The screen had to be regularly cleaned to sustain recharge rates.

MONITORING

This section describes water availability, individual site operations, groundwater level monitoring, and source and groundwater quality monitoring results. Laboratory water quality testing results are provided in Appendix B. Diverted surface water volumes, recharge volumes and rates, groundwater levels, source water quality and ground-water quality data were collected in accordance with the approved monitoring plans for LL-1848. Groundwater level data in the OWRD-requested digital format will be submitted separately to OWRD.

LL-1848 allows for up to 45 cfs to be diverted from the Walla Walla River for the purpose of testing artificial recharge. Per the conditions of LL-1848, a minimum instream flow amount is required to remain in the Tum-A-Lum reach of the Walla Walla River depending on the time of year (Table 3). WWBWC coordinated with HBDIC to ensure that this condition of LL-1848 was met during recharge operations in WY 2022. Managed recharge under the limited license did not begin until November 22, 2021 because minimum flow requirements were not met prior to this date. Recharge was interrupted from December 31st to February 28th for the annual maintenance of fish screens at the Little Walla Walla River diversion, which ceases delivery of water to canals and ditches from which the recharge sites receive their water. The longer than usual shutoff period was due to freezing temperatures. Diversions for aquifer recharge ended on May 15, 2022, as required by the limited license.

Table 3. Minimum instream flows that must be met before water can be diverted for recharge under LL-1848

Minimum Instream Flow Values for Limited License 1848		
Nov 1 thru Nov 30	***Dec 1 thru Jan 31***	***Feb 1 thru May 15***
64 cfs	***95 cfs***	***150 cfs***

Not all the water diverted from the Walla Walla River reaches the recharge sites due to seepage through unlined portions of the canal and ditch system and/or evaporative losses. Because recharge operations occur during winter and spring months, evaporative losses are assumed to be negligible. To estimate ditch seepage losses during diversion, different seepage rates were applied to different segments of the conveyance system for the duration of recharge (Table 4). The seepage rates were calculated based on measured seepage losses, diversion rates needed to supply the maximum inflow rates to each recharge site, and duration of the recharge periods. The resulting estimated cumulative seepage loss for WY 2022 was 1,715 ac-ft.

Table 4. Seepage loss estimates by site

Site	Segment (s)	Seepage Rate cfs/mi	Seepage Rate AF/day	Length miles	Seepage rate AF/mi/day	Recharge duration (days)	Seepage loss AF	Basis
Anspach	LWWR Diversion to the Anspach turnout/Zerba Weir			2.37	0.00	108	0	Piped from the White Ditch, no additional open canal. White Ditch seepage already accounted for in Johnson calculation. Anspach operated only when Johnson was also operating during WY 2022.
Barrett	LWWR Diversion to Barrett turnout			3.01	0.00	91	0	Piped from the White Ditch, no additional open canal. White Ditch seepage already accounted for in Johnson calculation. Barrett operated only when Johnson was also operating during WY 2022.
Johnson	LWWR Diversion to the Duff Weir + Duff Weir to Johnson			3.78	1.56	108	637	Seepage rate in the upper White Ditch sourced from Patten, 2014, who subtracted recharge inflow rates from LWW diversion flows during a period when the diversion was delivering recharge water only.
Trumbull	Duff Weir to Trumbull pipeline			0.71	1.56	101	112	Seepage in the White Ditch from the LWW diversion to the Duff Weir is already accounted for in the Johnson calculation. Trumbull operated only when Johnson was also operating in WY 2022.
NW Umapine	Richartz Ditch to NW Umpine		2.82			85	240	Rate calculated in 2014 during a 30 day period when the Richartz Ditch was feeding only NW Umapine recharge and 1 other diversion. Volume at Richartz Weir - recharge volume at NW Umapine during those 30 days = ditch loss during that time, enabling us to calculate an AF/day rate of loss.
Gallagher	LWW Diversion to Johnson site +1.06 miles White Ditch from Hodgen Rd to Meharry Rd + 0.91 miles of Dugger Creek to Gallagher turnout.		0.00			101	0	1.06 mi of white ditch from Hodgen Rd to S407, then 0.91 miles of Dugger creek. Based on Reach 1 of WWBWC's unpublished 2017 White Ditch seepage study. Negligible losses are likely in this section of the White Ditch and probably Dugger Creek as well. Used a 0 seepage rate to avoid overestimating recharge volumes.

Chuckhole	Powell and Milton pipelines		0.00			36	0	Fed from Powell and Milton pipelines. No open ditches.
East Trolley	Fruitvale diversion (S318) to East Trolley	0.50		1.82	0.99	112	202	See seepage rate explanation for Fruitvale Recharge Site below. Segment length calculated from Fruitvale diversion (S318) to East Trolley Recharge because seepage losses up-gradient of S318 are accounted for in Fruitvale Recharge calculations.
Fruitvale	From Frog to Fruitvale	0.50		5.09	0.99	82	414	Seepage rate based on CTUIR and The Freshwater Trust study that found 0.8 cfs lost/mile in the Little Walla Walla system. We assumed a lower rate (0.5 cfs loss/mile) since their study was conducted during summer flows, when the ditch was full and ground was empty. Recharge season occurs when ditch flow is lower and ground saturation is higher, presumably reducing the seepage rate.) This rate should be updated when more data become available.
LeFore	Eastside Diversion to LeFore recharge turnout	0.00				0	0	Fed from pipeline, no open ditches.
Locust Rd	From Frog to Locust Rd recharge turnout	0.50		0.98	0.99	114	111	See seepage rate explanation for Fruitvale Recharge Site.
Mud Creek	From Frog to Mud Creek recharge pond	0.50		3.48	0.99	0	0	See seepage rate explanation for Fruitvale Recharge Site. Days operated is 82 total days run - 82 days Fruitvale running (since losses during those 82 days are already accounted for).
Triangle Rd	Frog to Triangle Rd turnout	0.00			0.00	35	0	Seepage losses accounted for in Fruitvale and Mud Creek calculations.
West Ringer Rd	White Ditch, Gallagher to Ringer Rd		0.00			45	0	Based on Reach 2 data from WWBWC's unpublished 2017 White Ditch seepage study. Seepages losses negligible during spring. Losses more likely during fall. Used a 0 seepage rate to avoid overestimating recharge volumes.
SUM							1,715	

GROUNDWATER LEVELS

The groundwater monitoring network for the aquifer recharge program consists of 28 wells (Figure 10). The following section presents, by site, the amount of water recharged during WY 2022, a map of groundwater monitoring wells associated with each site, and results from monitoring groundwater levels. Each well's hydrograph and the annual shallowest and deepest groundwater levels (the peaks and troughs in the hydrographs) are evaluated.

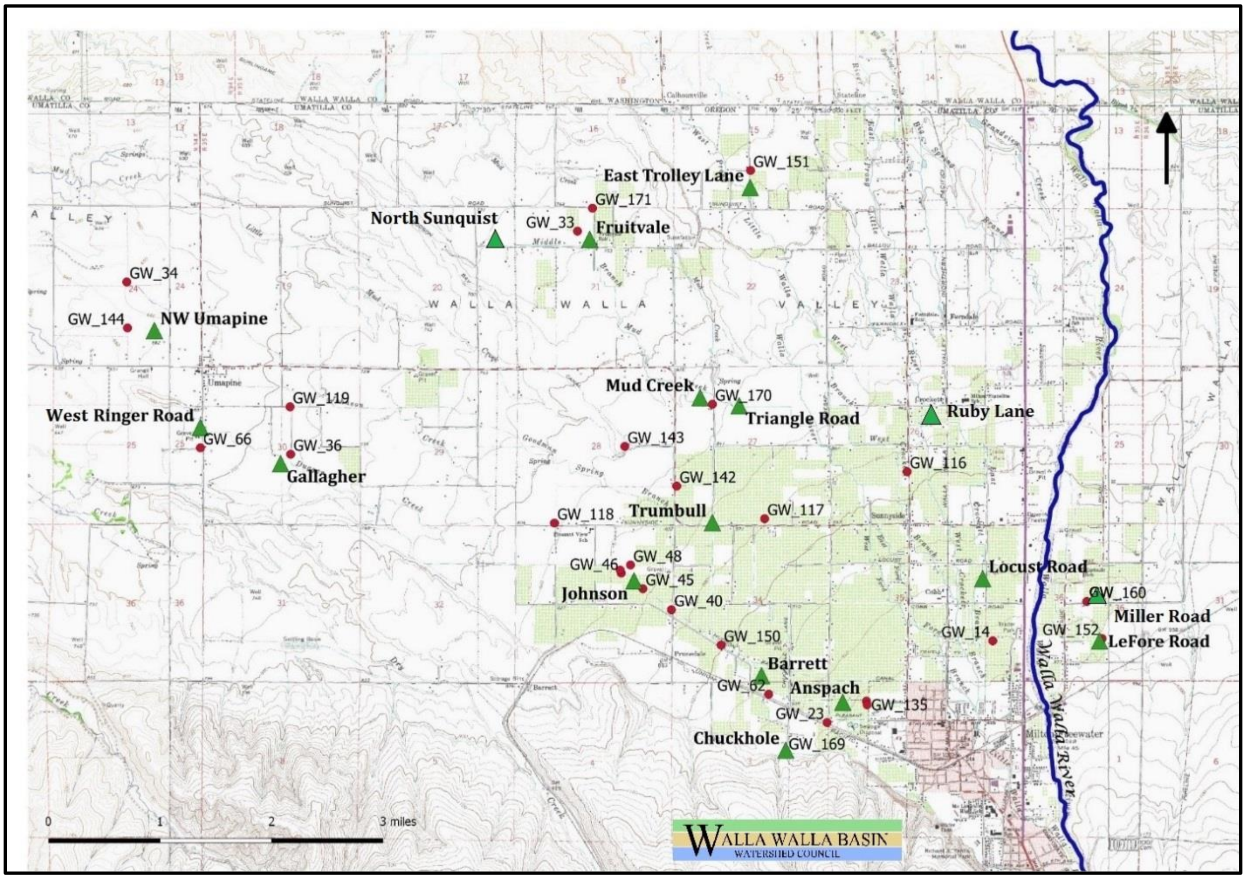

Figure 10. Groundwater monitoring wells (red dots) and aquifer recharge sites (green triangles).

ANSPACH RECHARGE SITE

The Anspach site operated for 108 days (11/22/21 – 12/31/21, 3/8/22 - 5/15/22), recharging 678.8 ac-ft. of water at an average rate of 3.18 cfs.

The site has two up-gradient wells, GW_135 and GW_141, and one cross-gradient well, GW_23 (Figure 11). The shallowest groundwater elevations at GW_141 rose by more than 10 feet during the early years of managed recharge (Figure 12). This year's groundwater trends look similar to the 2016 and 2017 seasons, both of which were high-volume recharge years at Anspach. While GW_135 and GW_141 are up-gradient of the recharge site, the timing of the seasonal patterns (Figure 13 and 14) suggests both wells are influenced by managed recharge operations, perhaps as a result of groundwater mounding under the Anspach site. At cross-gradient GW_23, quarterly readings preclude observing changes between each month; between years, groundwater levels may be stabilizing after declines in the three previous decades (Figure 15).

Figure 11. Anspach monitoring recharge locations.

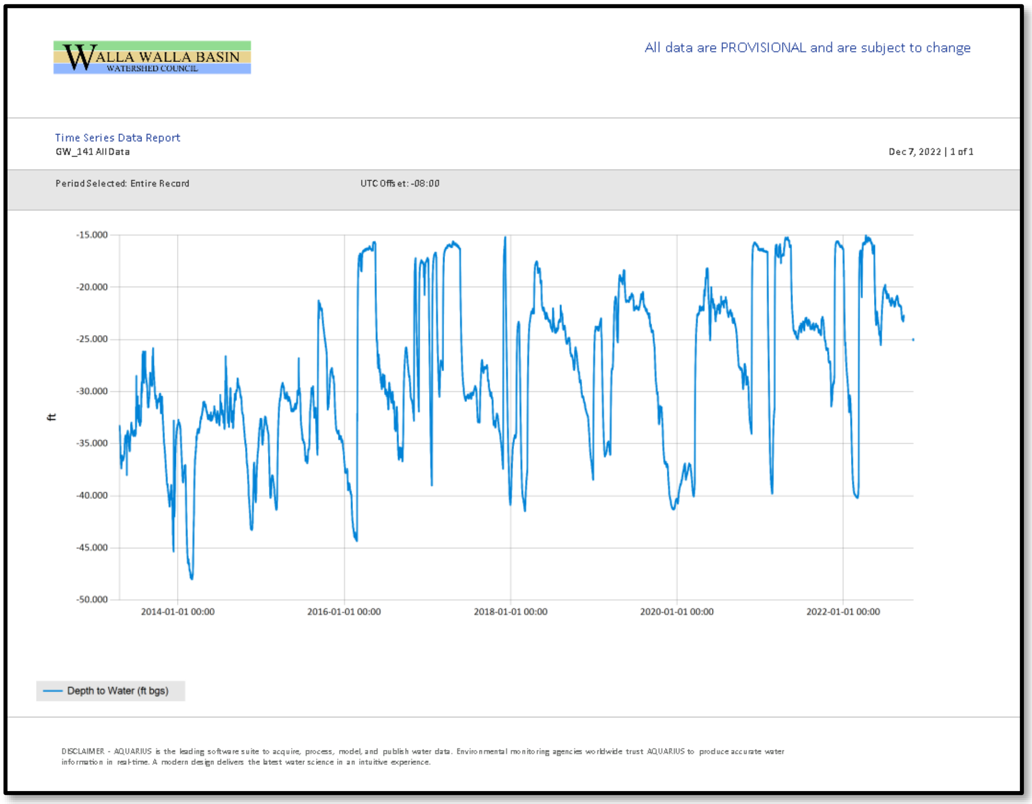

Figure 12. GW_141 hydrograph from WY 2013 -2022.

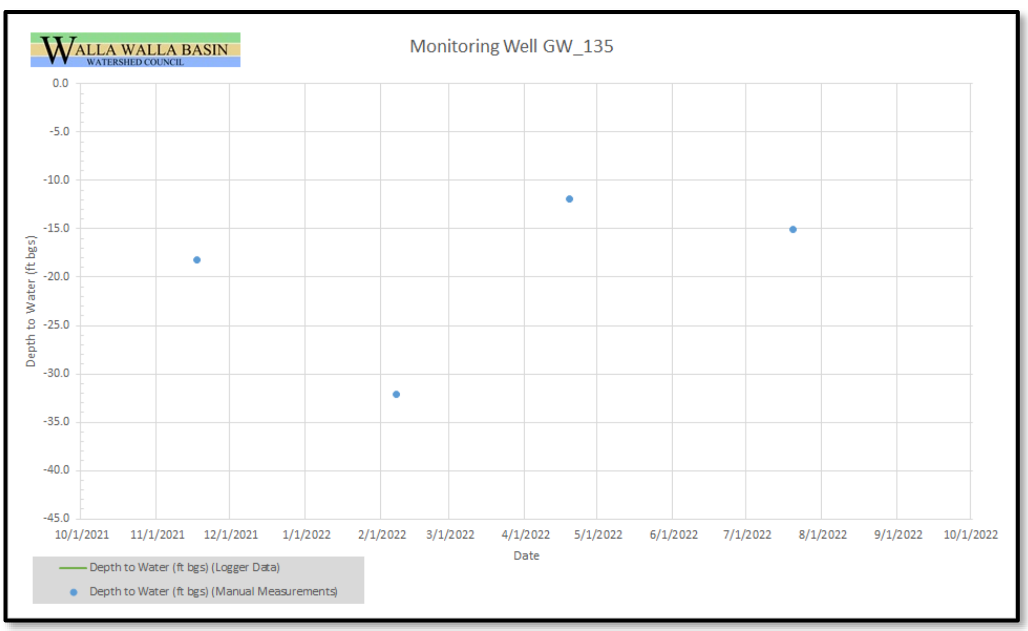

Figure 13. GW_135 hydrograph from WY 2022.

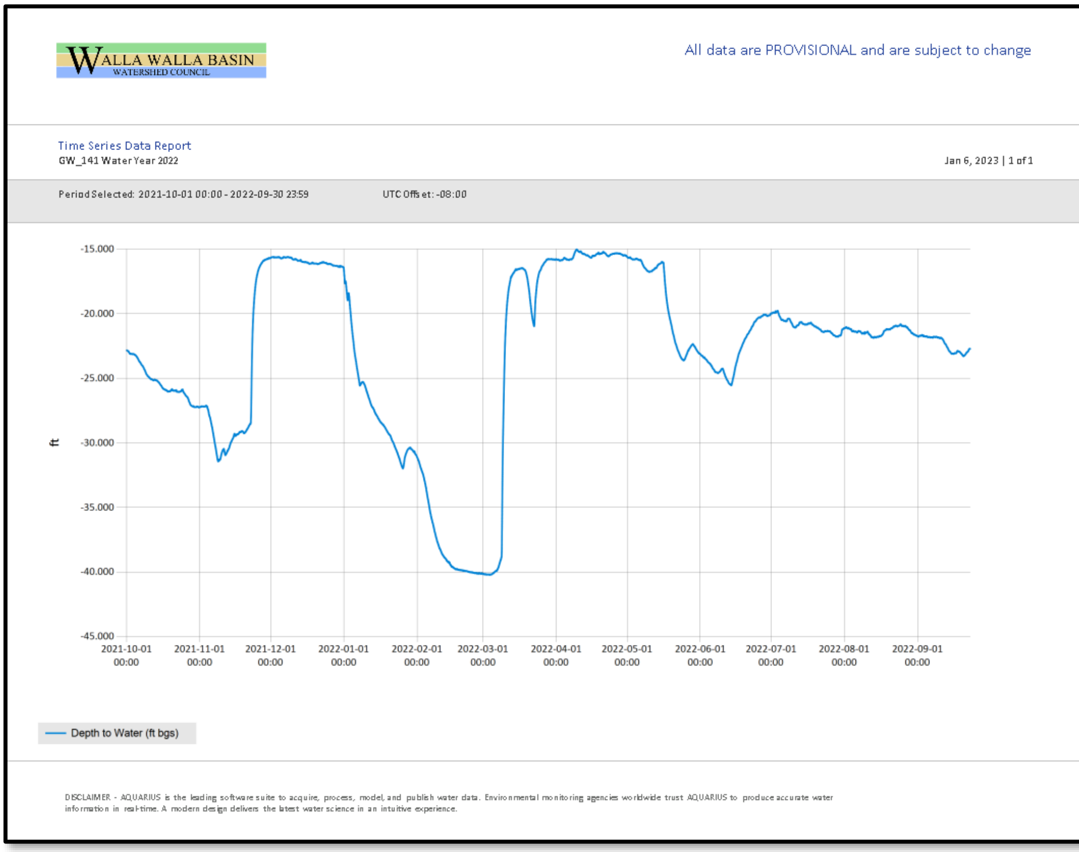

Figure 14. GW_141 hydrograph from WY 2022.

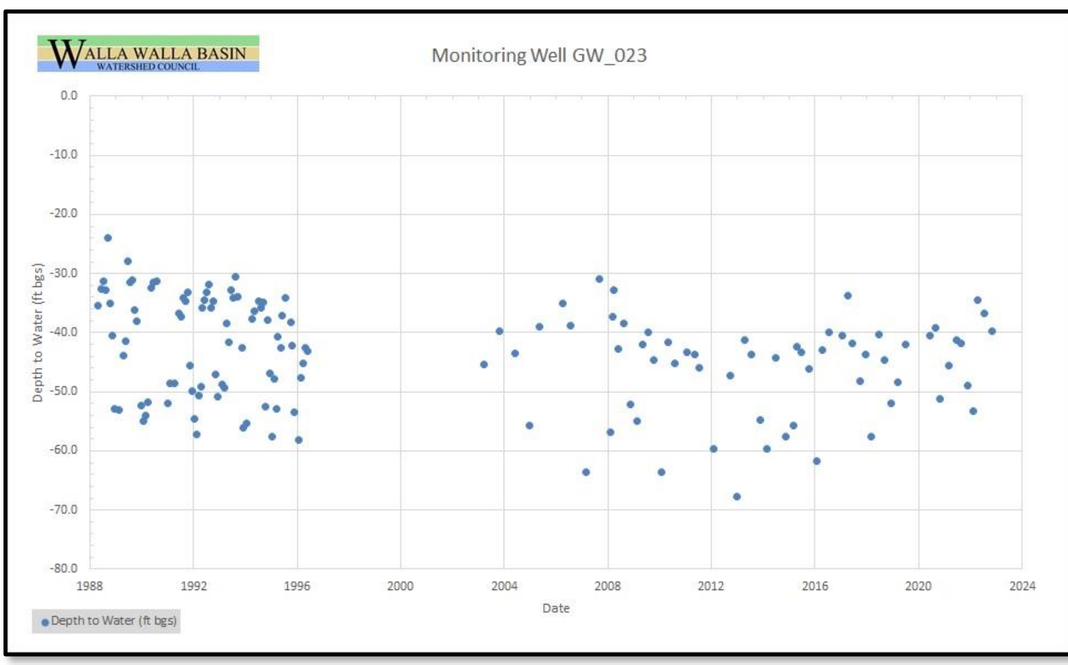

Figure 15. GW_23 hydrograph from WY 1988-2022.

BARRETT RECHARGE SITE

The Barrett site operated for 91 days (12/9/20 – 12/31/21, 3/8/22 - 5/15/22), recharging 218.3 ac-ft. at an average rate of 1.21 cfs.

GW_62 is up-gradient of the site (Figure 16). Response to recharge operations at the Barrett site were observed at the up-gradient groundwater monitoring well, GW_62, and includes influences from the Chuckhole recharge site (see below). Groundwater levels in the monitoring well increased to peak levels during recharge operations and decreased when recharge operations stopped (Figure 17). The 2006-2022 hydrograph for GW_62 is included for longer term groundwater levels at the Barrett site, which began operation in WY 2014 (Figure 18).

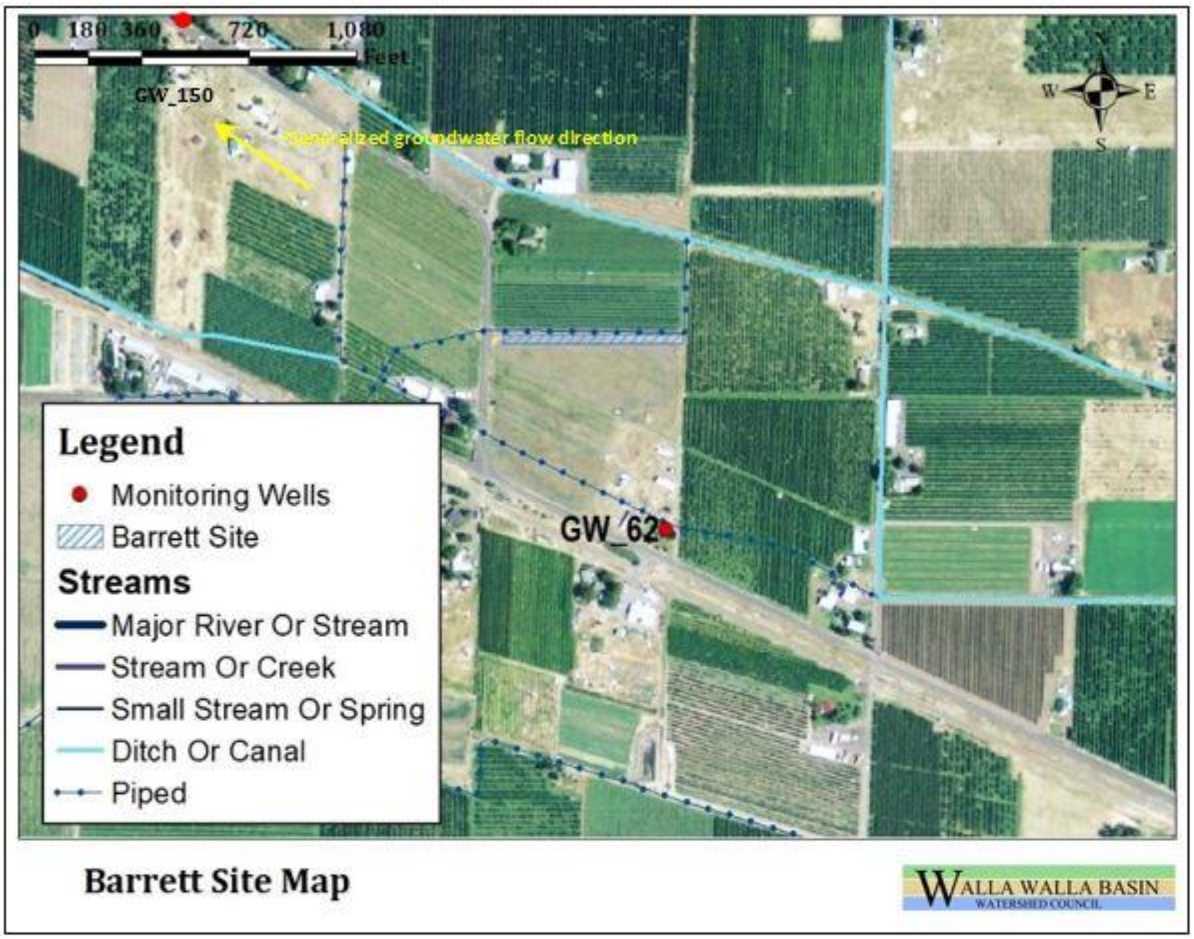

Figure 16. Barrett monitoring well locations.

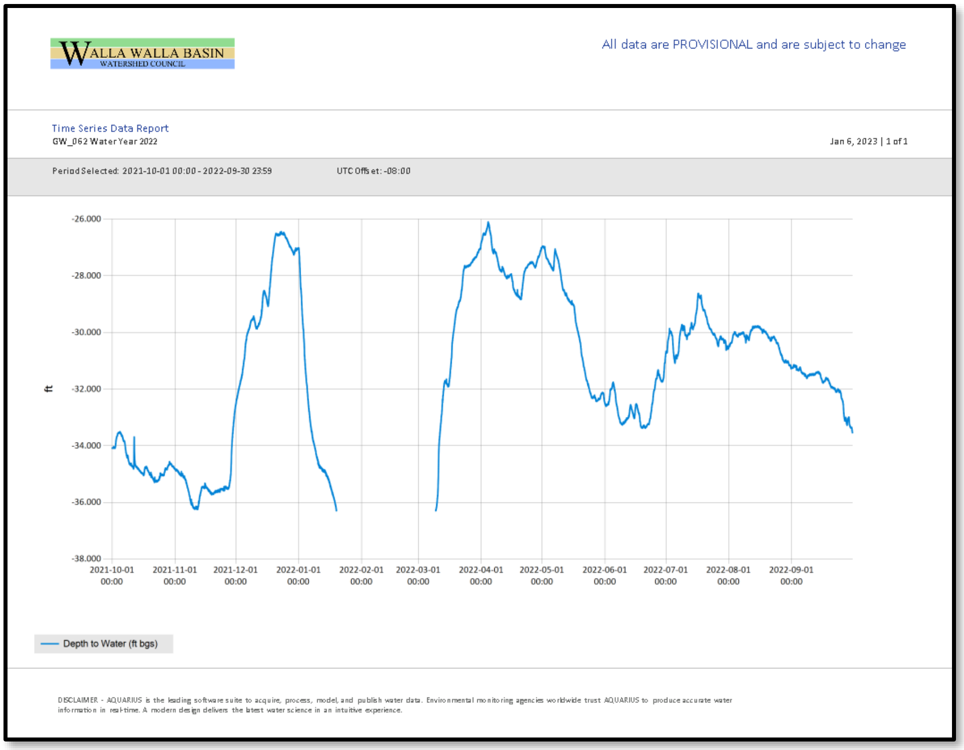

Figure 17. GW_62 hydrograph from WY 2022.

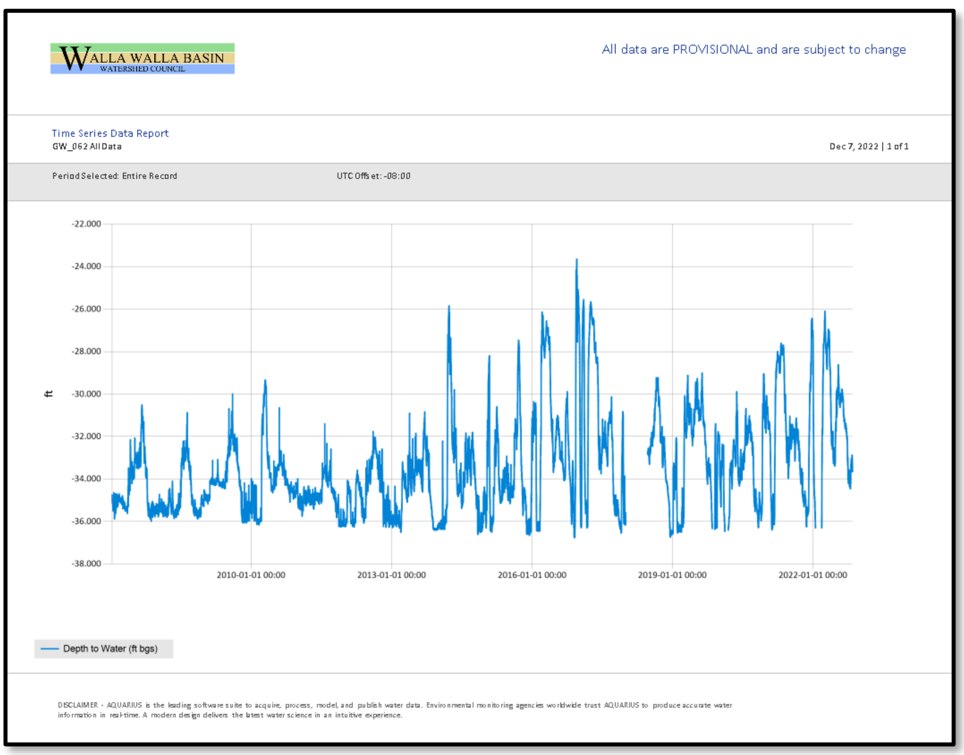

Figure 18. GW_62 hydrograph from WY 2006-2022.

CHUCKHOLE RECHARGE SITE

The Chuckhole site operated for 36 days (4/10/22 - 5/15/22), recharging 36.2 ac-ft. at an average of 0.51 cfs.

Three monitoring wells are in the vicinity of the site: GW_169 up-gradient, GW_62 down-gradient, and GW_23 cross-gradient (Figure 19). As discussed above, GW_62 water levels show the influence of the Barrett recharge site and the influence of the Chuckhole site. GW_62 groundwater levels increase in November with the start of recharge at the Barrett site and peak in March/April, coinciding with the start of recharge at the Chuckhole site. Groundwater level decrease in mid-May when recharge operations at both sites are concluded for the year. At GW_169 groundwater levels have increased during recharge season since the site began operating in 2016 (Figure 20). Each spring, the water level drops below the elevation of the sensor, producing the gaps seen on the hydrograph. At cross-gradient GW_23, the static water level measurement collected during the brief 6-week recharge season was 20 feet above the lowest elevation measured for the year, taken in February (Figure 21).

Figure 19. Chuckhole monitoring well locations.

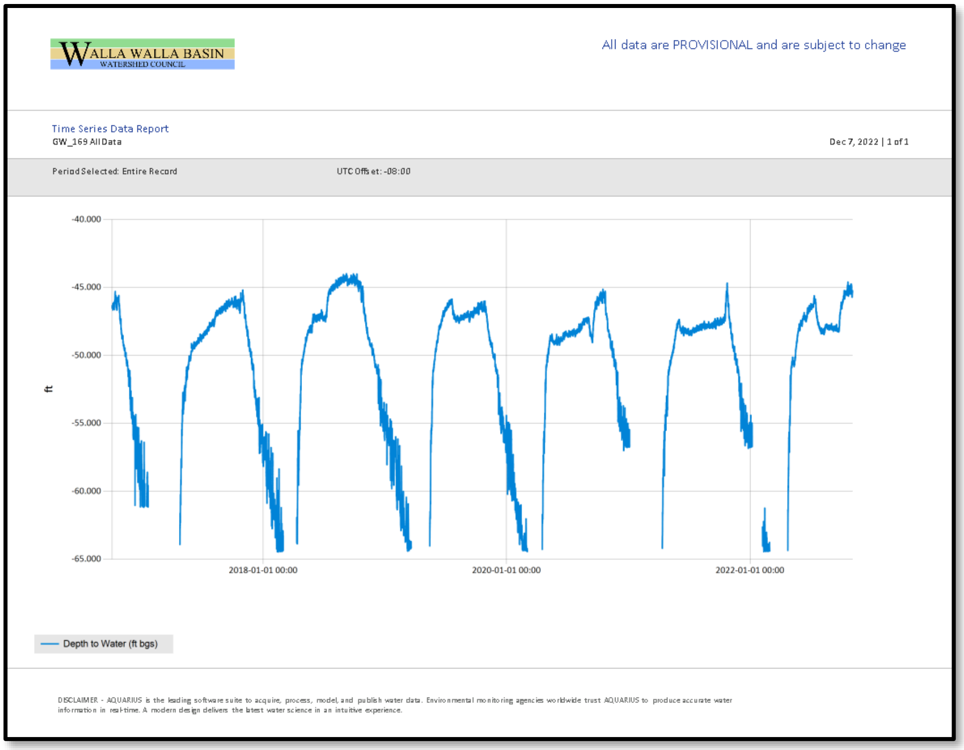

Figure 20. GW_169 hydrograph from WY 2017-2022. Springtime data gaps represent times when the water level drops below the elevation of the sensor.

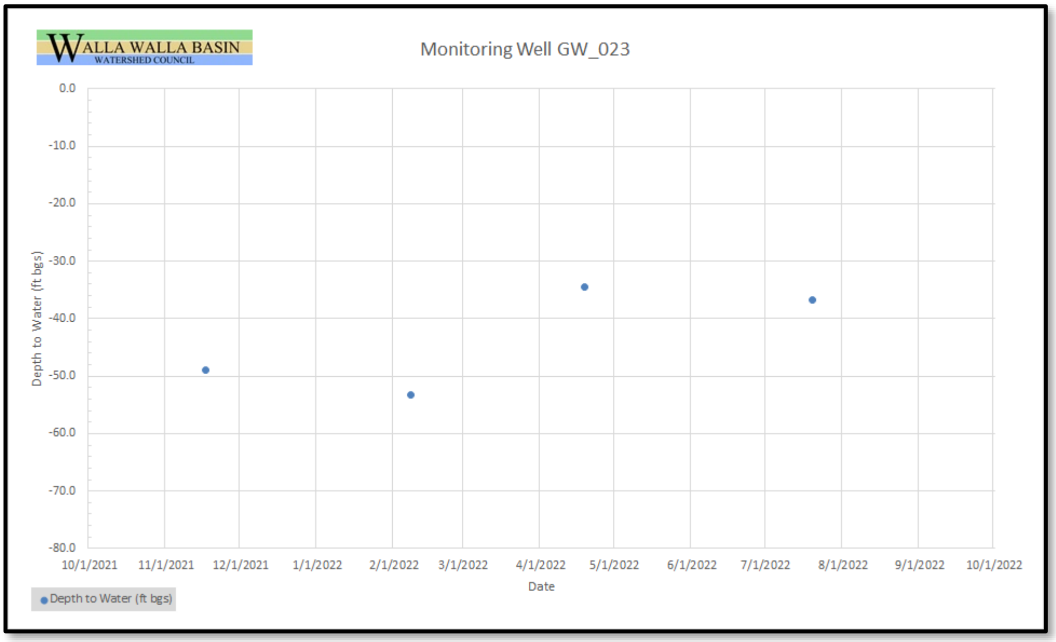

Figure 21. GW_23 hydrograph from WY 2022.

EAST TROLLEY RECHARGE SITE

The East Trolley site operated for 112 days (11/23/21 – 12/31/21, 2/28/22 – 5/15/22), recharging 126.8 ac-ft. at an average rate of 0.57 cfs. The landowner cleaned the intake screen daily to maximize recharge rates.

GW_151 is at the distal end of the infiltration gallery (Figure 22). The magnitude and timing of the changes in groundwater levels suggest multiple influences on the seasonal water table (Figures 23-24). The springtime peak does appear to reflect the slightly lower volume recharged this year compared to the 2020-21 season, but the longer term trend since the site became active in 2017-2018 recharge season remains inconclusive.

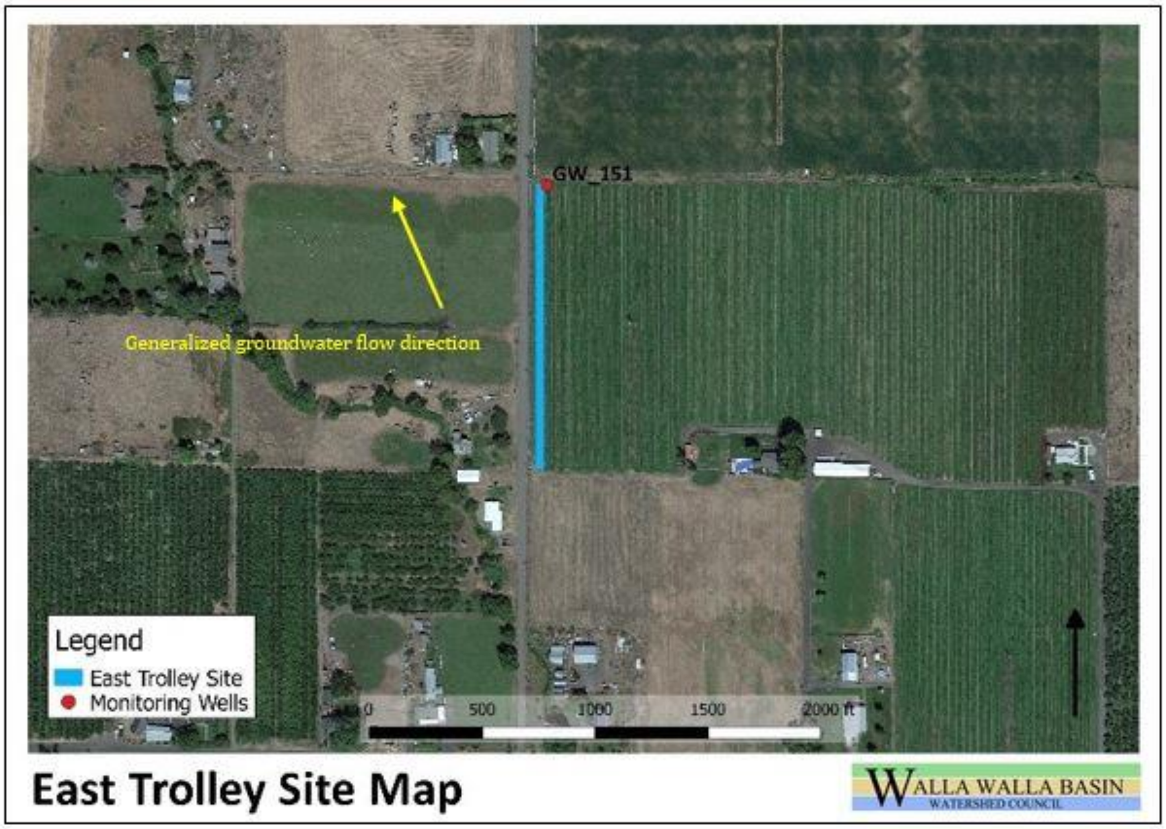

Figure 22. East Trolley monitoring well location.

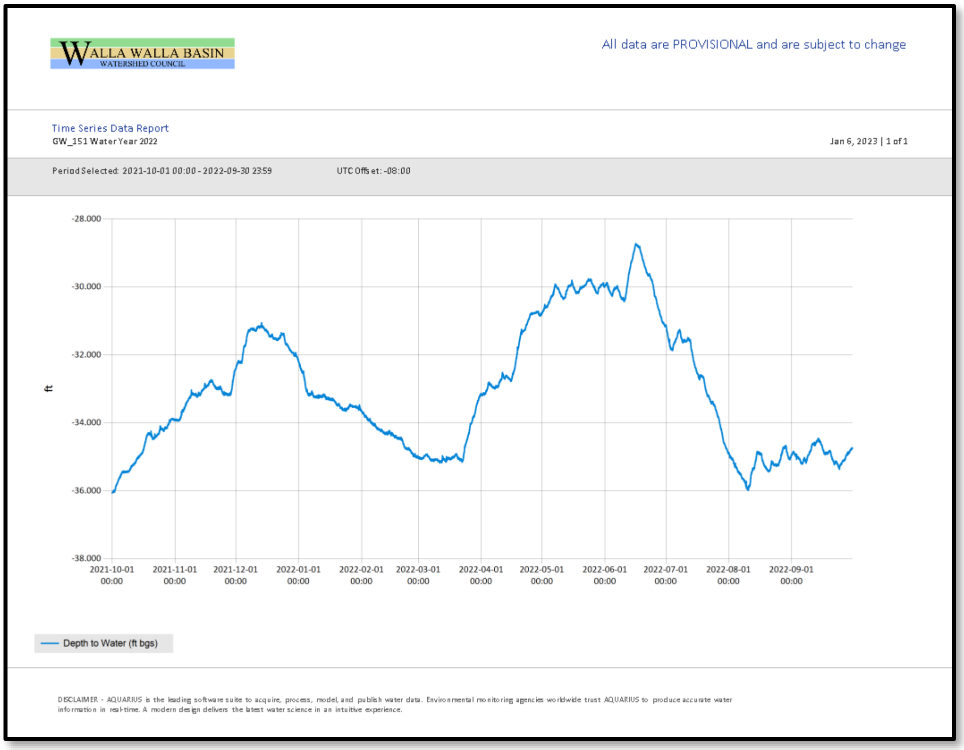

Figure 23. GW_151 hydrograph from WY 2022.

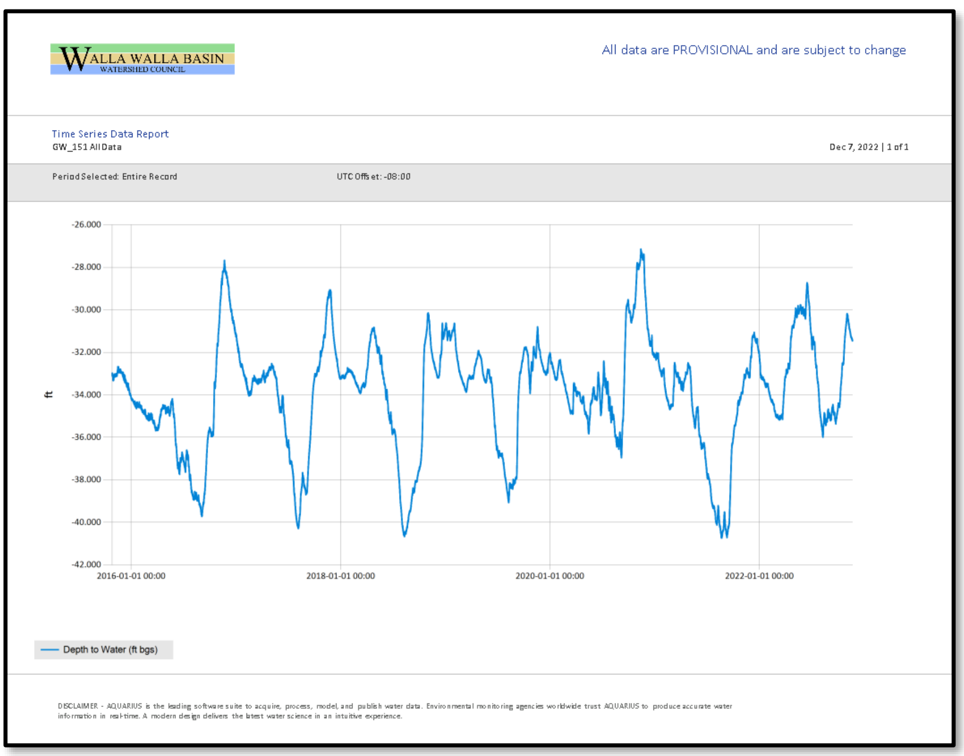

Figure 24. GW_151 hydrograph from WY 2016-2022.

FRUITVALE RECHARGE SITE

The Fruitvale site operated for 82 days (11/22/21 – 12/31/21, 3/4/22 – 3/31/21, 4/30/22 – 5/15/22), recharging 51.8 ac-ft. at an average rate of 0.32 cfs.

This site is located between the inner and middle zone of springs described by Newcomb (1965). The landowner has described that springs used to surface near this site. Groundwater monitoring wells GW_33 and GW_171 are down-gradient of the site (Figure 25). At both locations, peaks and troughs correlate with recharge season (Figures 26-27). At GW_33, the seasonal high and low values since the site became active in the 2016-2017 recharge season are generally shallower than those documented prior to the site becoming active. Increased spring yield at nearby monitoring sites has been observed by WWBWC (see WWBWC, 2019) and suggests increased groundwater storage in the vicinity.

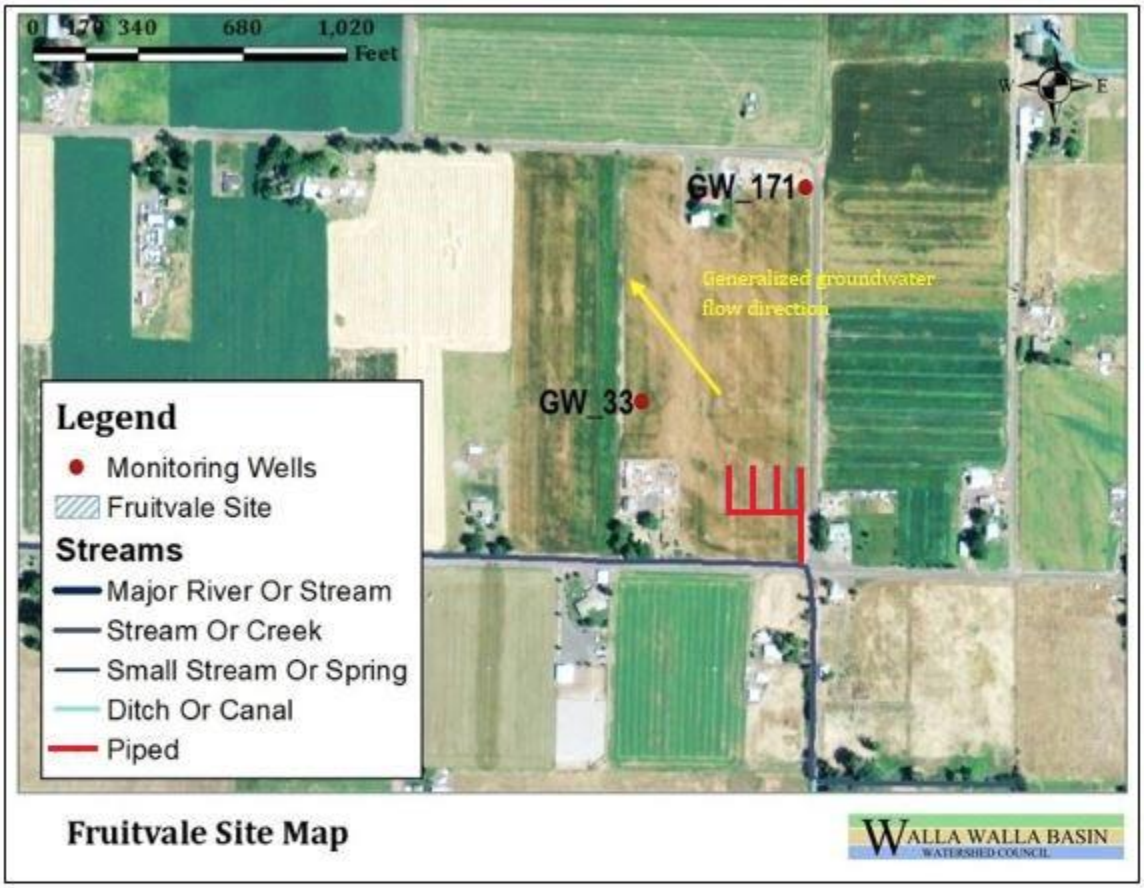

Figure 25. Fruitvale monitoring well locations.

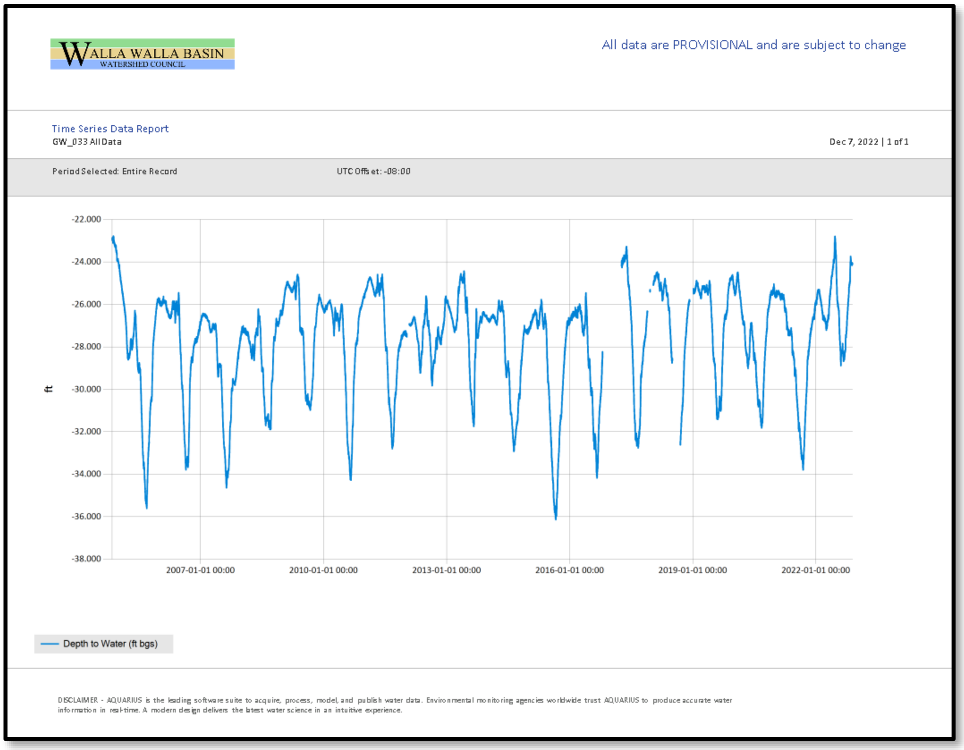

Figure 26. GW_33 hydrograph from WY 2004-2022.

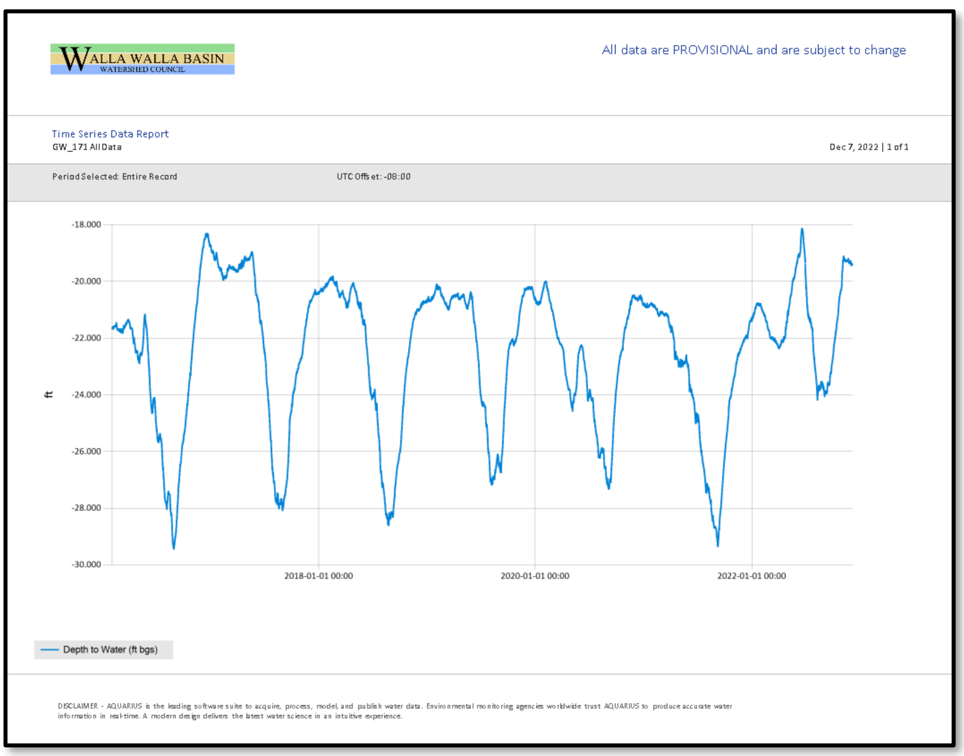

Figure 27. GW_171 hydrograph from WY 2016-2022.

Gallagher Recharge Site

The Gallagher site, which includes a recharge basin and infiltration galleries, operated for 101 days (11/22/21 – 12/31/21, 3/4/21 – 5/15/21), recharging 93.2 ac-ft. at an average rate of 0.53 cfs.

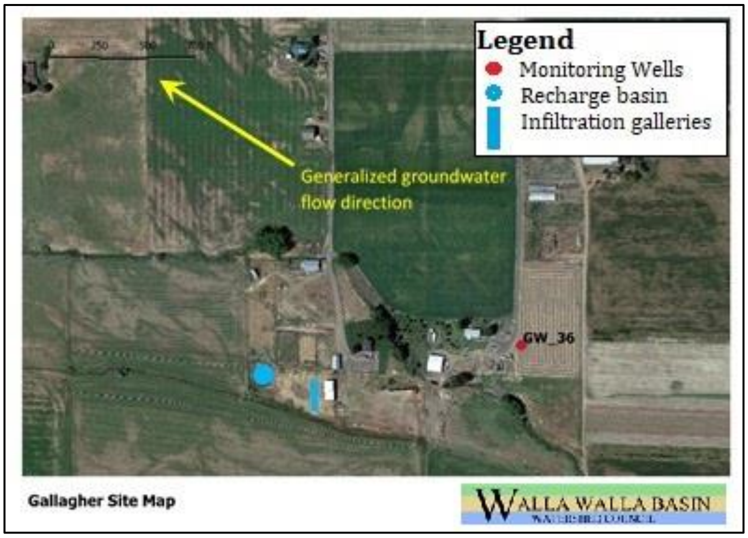

Figure 28. Gallagher monitoring well location.

GW_36 is up-gradient of the site (Figure 28). Only one of the quarterly measurements occurred during the 101 days the Gallagher site operated. The hydrograph for GW_36 (Figure 29) doesn't show a direct influence from the recharge site, although, the well is only measured four times out of the year and continuous data are not available for this well. Water level data at down-gradient wells GW_144 and GW_034 are shown in Figure 56-59 and are likely responding to multiple factors, including recharge at the Gallagher site.

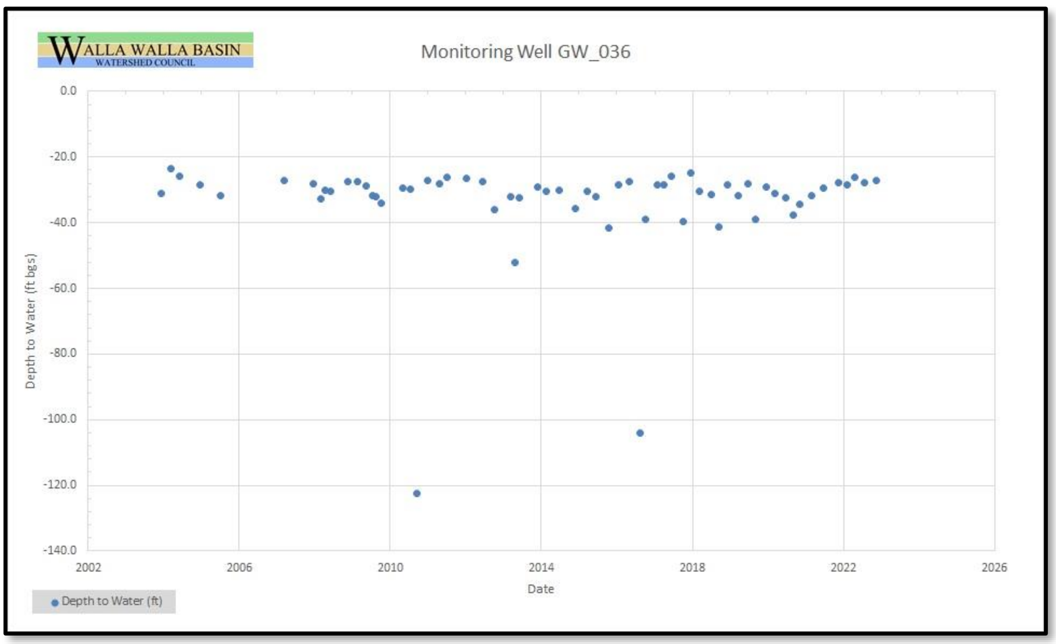

Figure 29. GW_36 hydrograph from WY 2004-2022.

JOHNSON RECHARGE SITE

The Johnson site operated for 108 days (11/22/21 – 12/31/21, 3/8/22 – 5/15/22), recharging 2,261.6 ac-ft. at an average rate of 12.03 cfs. The ten spreading basins received 1,838.95 ac-ft. and three active infiltration galleries received 422.68 ac-ft.

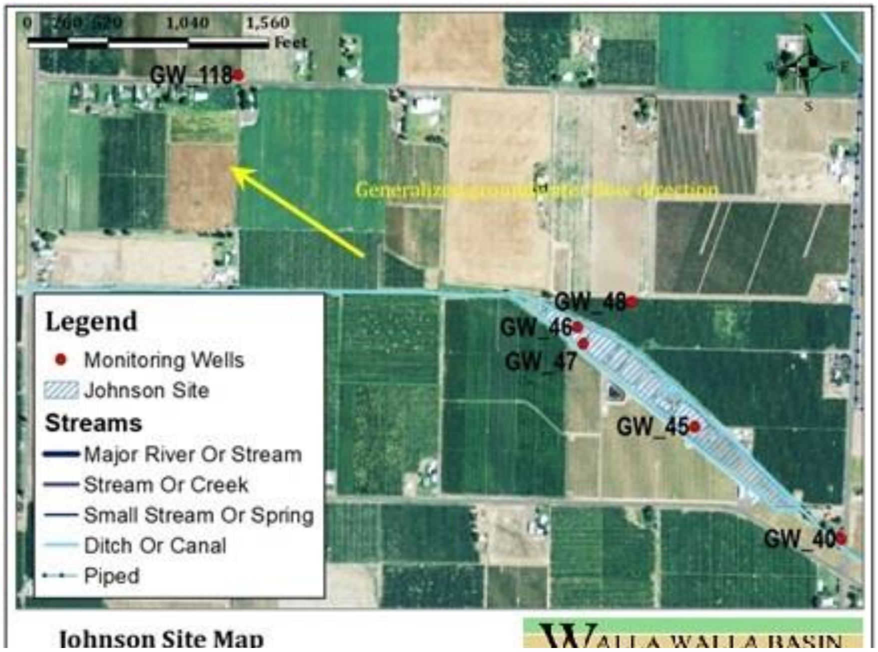

Figure 30. Johnson monitoring well locations.

Six monitoring wells are on or near the site (Figure 30). During recharge season, groundwater levels under the Johnson site (GW_45, GW_46, and GW_47) are roughly 15-20 ft. closer to the ground surface than at the up-gradient well (GW_40). The shallowest groundwater levels in down-gradient GW_118 are similar to levels under the Johnson site during the recharge season.

Groundwater monitoring wells (Figures 31-37) near the Johnson site were all observed to have a distinct increase in water levels in November shortly after operations began at the site. Up-gradient monitoring well GW_40 also showed a strong response to recharge operations with water levels increasing rapidly during recharge operations and decreasing after recharge operations were suspended. GW_40 water levels also show a response to nearby White Ditch flows during the fall.

Water levels in GW_45, GW_46 and GW_47 were observed to decrease approximately 30-40 feet between approximately December 31st and March 8th, 2022, when recharge operations were interrupted, and again at the end of recharge season. However, water levels after the end of recharge season decreased slower than the rate of water level increase at the beginning of recharge operations, suggesting that groundwater storage was occurring beneath the site.

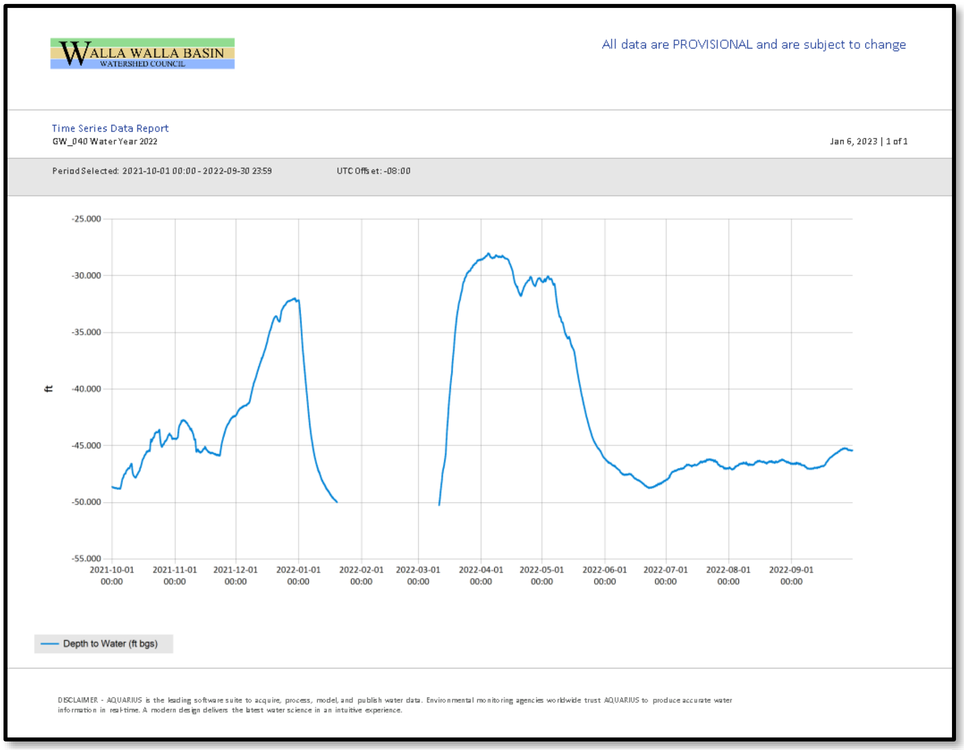

Figure 31. GW_40 hydrograph from WY 2022.

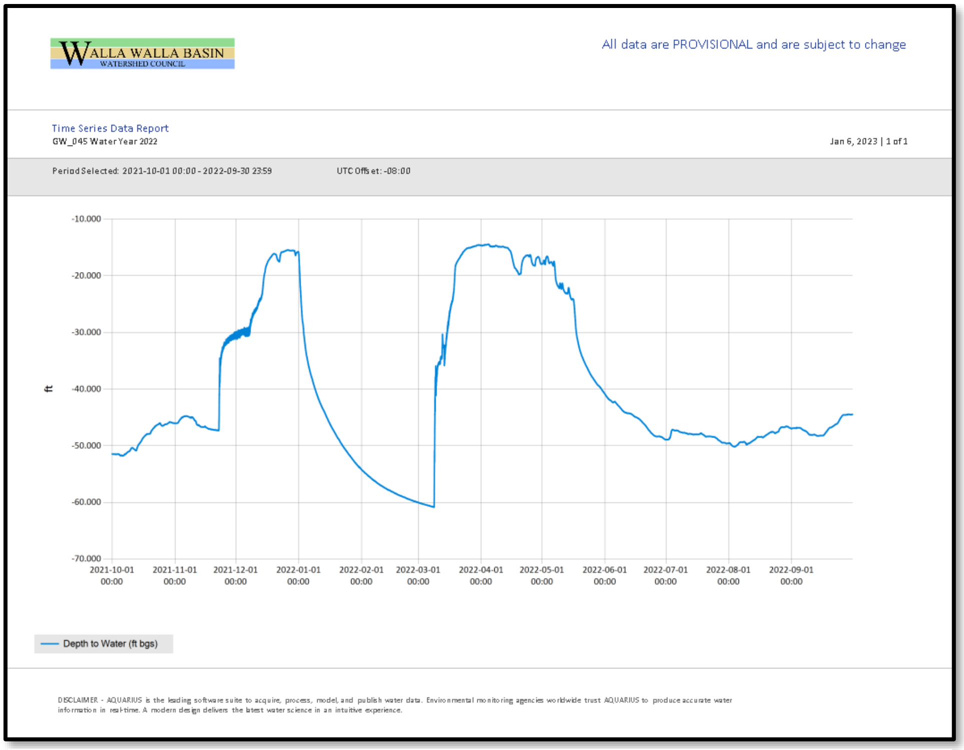

Figure 32. GW_45 hydrograph from WY 2022.

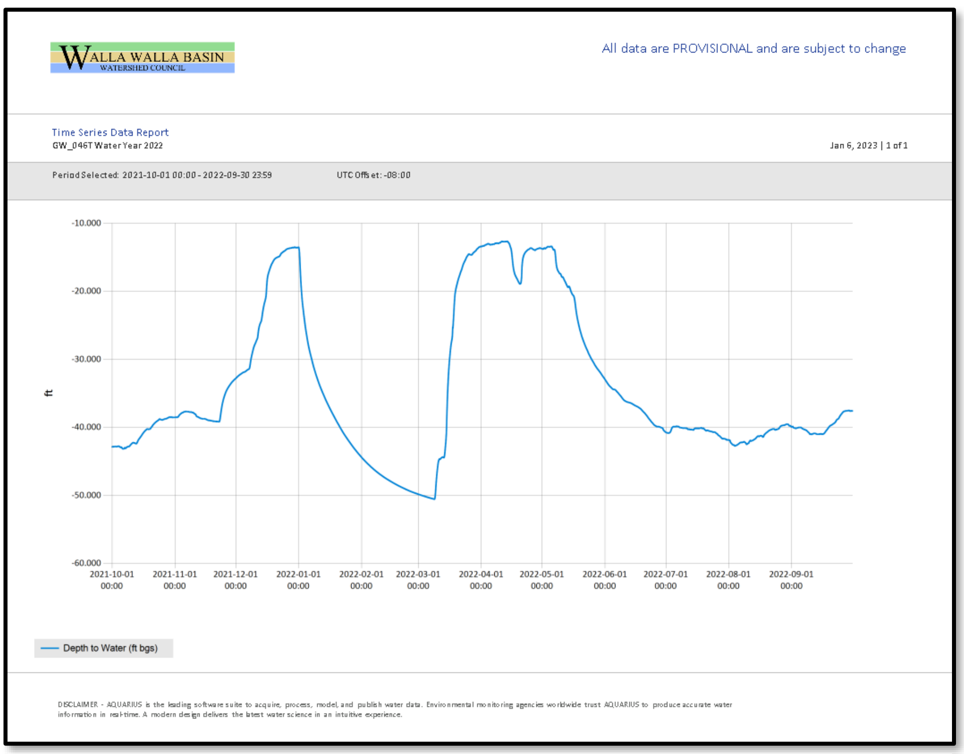

Figure 33. GW_46 hydrograph from WY 2022.

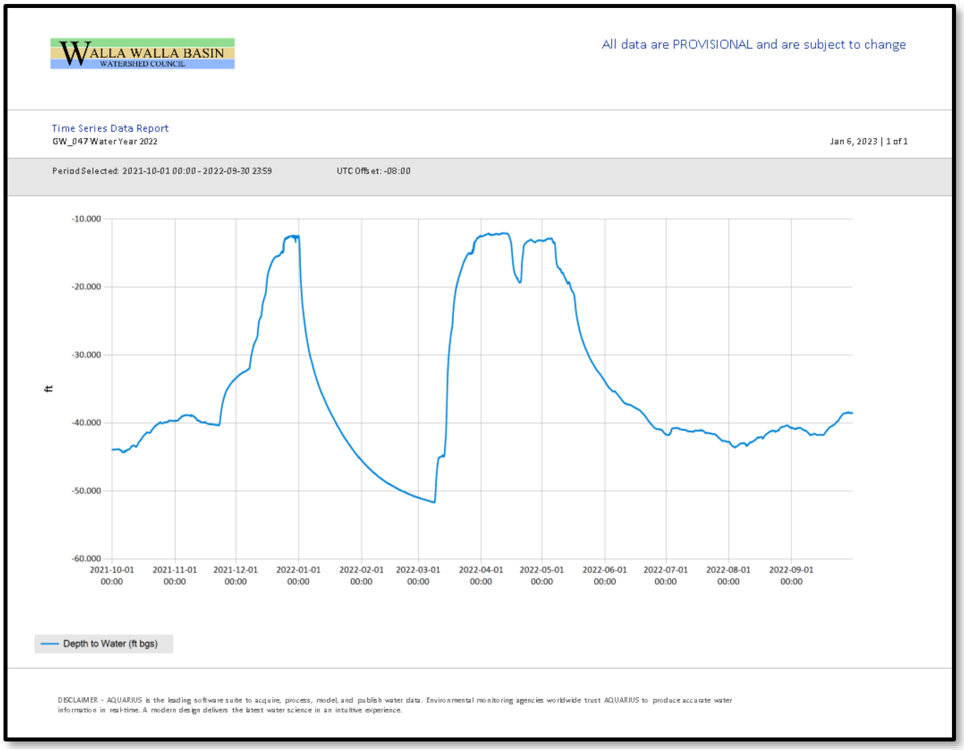

Figure 34. GW_47 hydrograph from WY 2022.

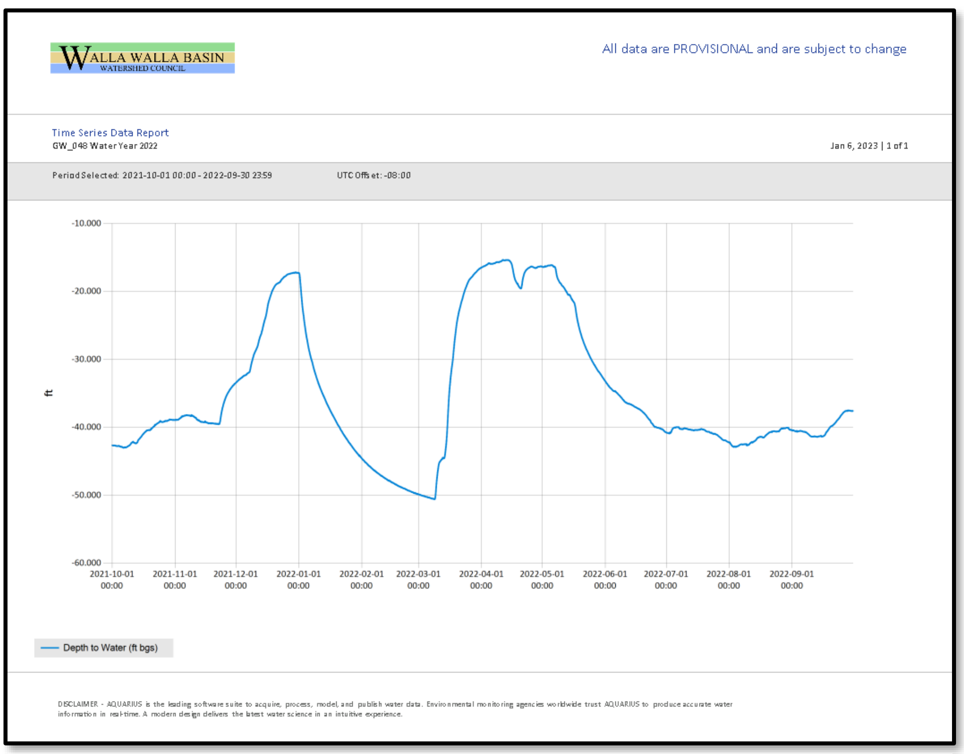

Figure 35. GW_48 hydrograph from WY 2022.

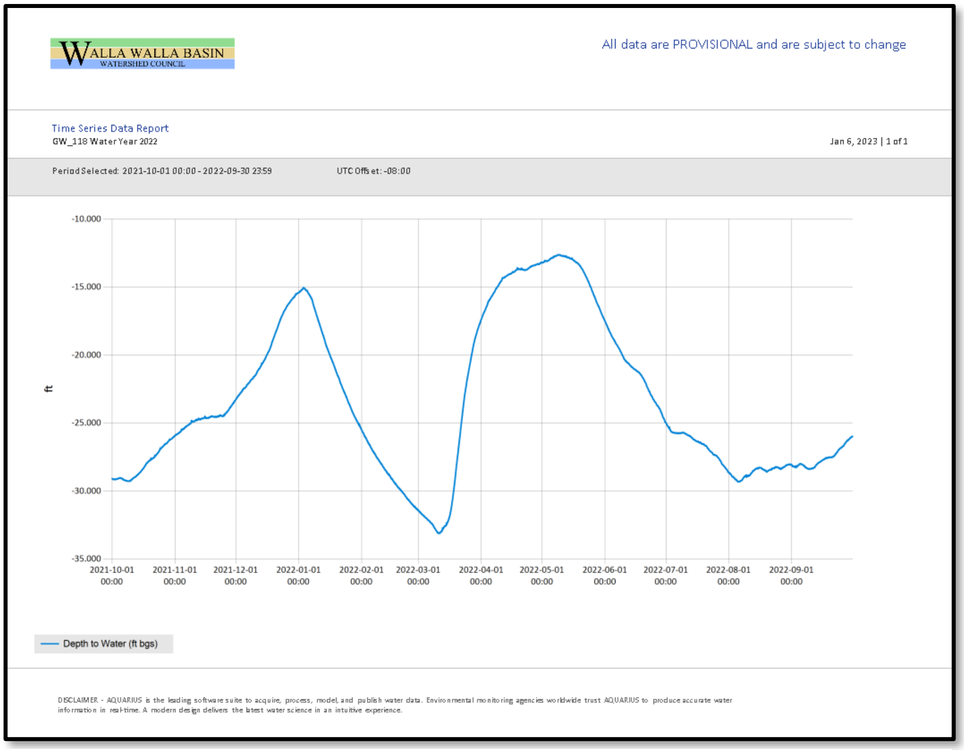

Figure 36. GW_118 hydrograph from WY 2022.

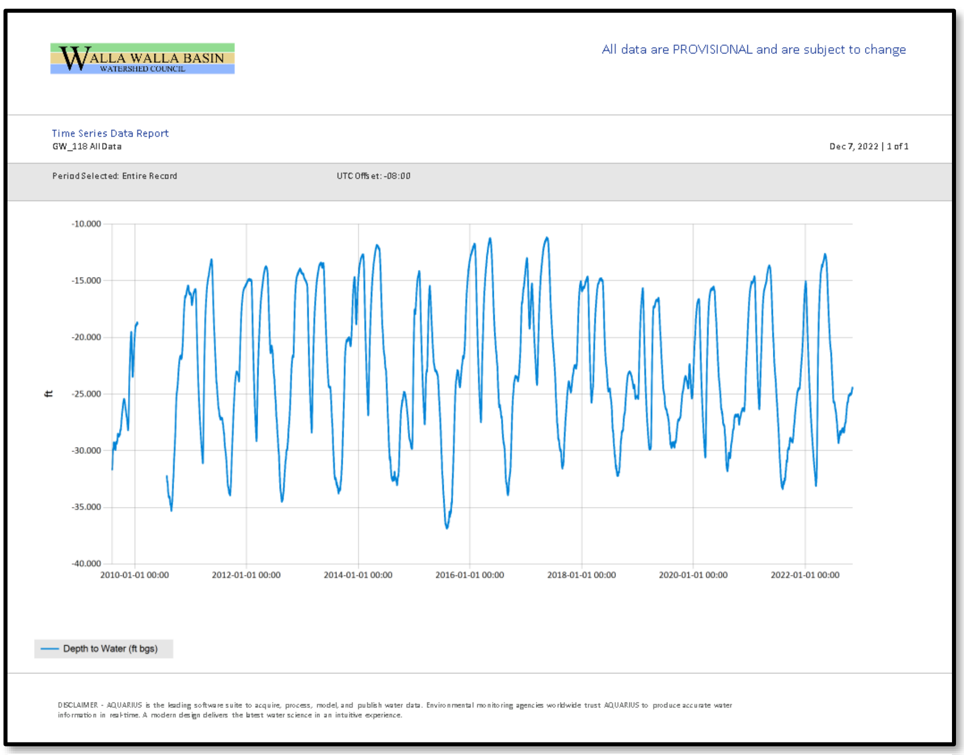

Figure 37. GW_118 hydrograph from WY 2010-2022.

LeFore Recharge Site

The LeFore Site did not operated during the 2022 water year because WWBWC was developing operational arrangements with the landowner.

Figure 38. LeFore monitoring well locations.

GW_152 is down-gradient and GW_160 is cross-gradient of the site (Figure 38). During WY 2020, one day of operations was not adequate to affect groundwater levels. However, the response to operations in WY 2018, when 78 ac-ft. was recharged, is in sharp contrast to the years during which recharge did not occur (Figure 39). The dramatic decline in groundwater elevations measured during the 2020-2022 water years compared to previous years is concerning, and the cause is unknown (Figure 40). The springtime peaks in 2021 and 2022 at GW_160 and, to a lesser extent at GW_152, reflect the first two years of recharge operations at the Miller Road recharge site.

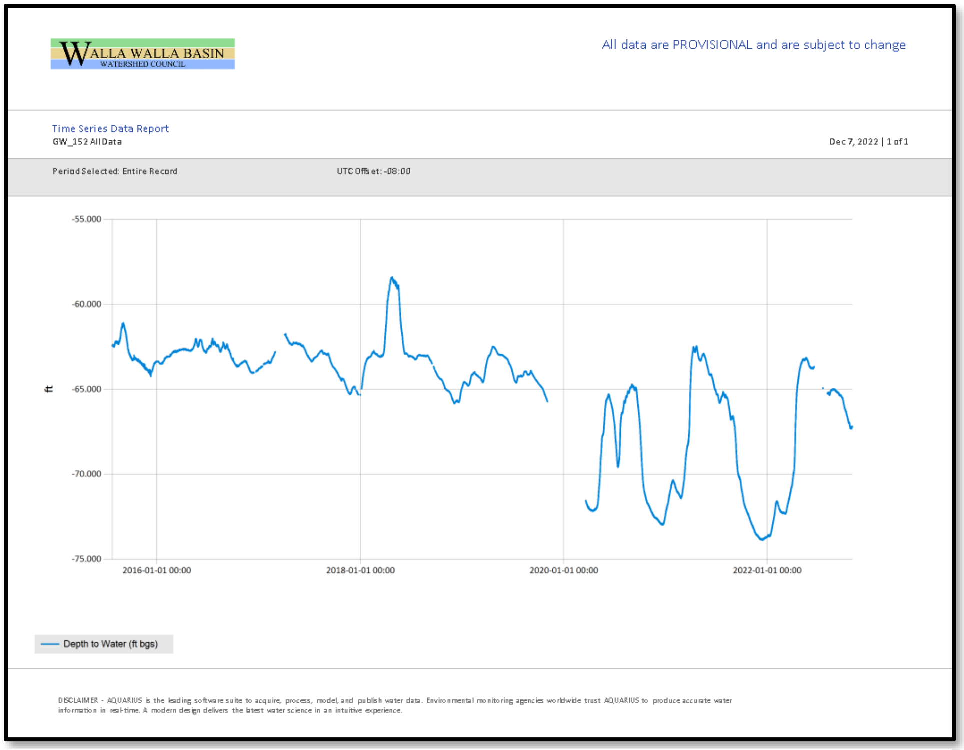

Figure 39. GW_152 hydrograph from WY 2015-2022.

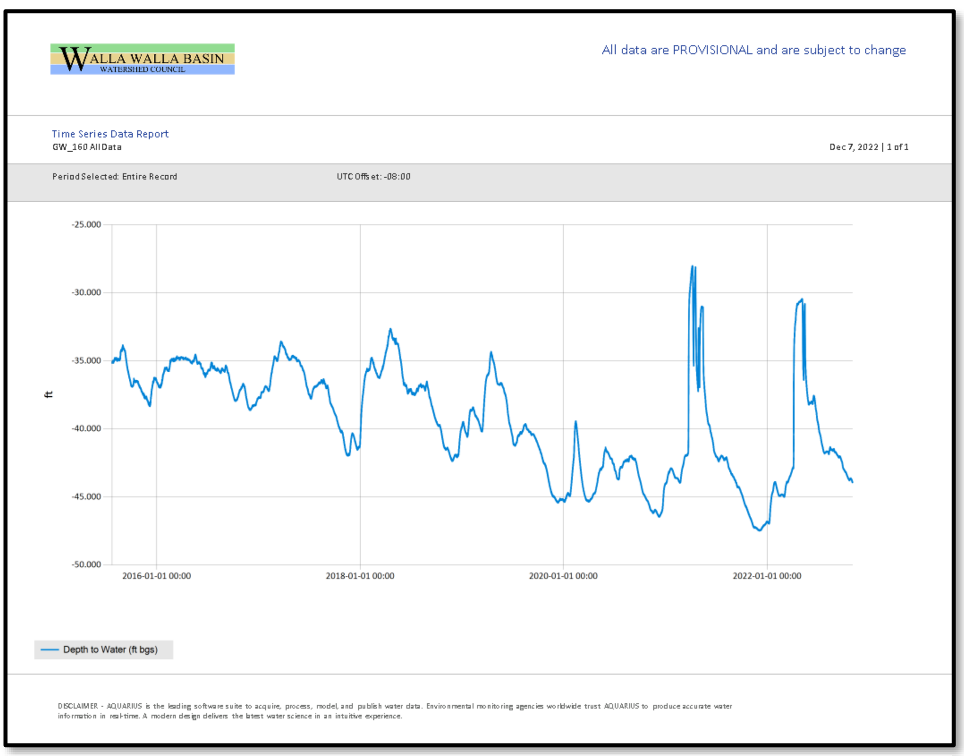

Figure 40. GW_160 hydrograph from WY 2015-2022. The 2021 and 2022 peaks reflect Miller Road recharge operations.

LOCUST ROAD RECHARGE SITE

The Locust Road Site operated for 114 days (11/23/21 – 12/31/21, 3/1/22 – 5/15/22), recharging 95.9 ac-ft. at an average rate of 0.42 cfs, about half the average rate of WY 2022.

Figure 41. Locust Road monitoring well locations.

GW_14 and GW_116 are approximately 0.4 miles up-gradient and 0.8 miles down-gradient of the site, respectively (Figure 41). Since recharge began in the spring of 2018, changes in groundwater levels solely due to recharge are not apparent in either well (Figures 42 and 43). Given the proximity of both GW_14 and GW_116 to the Little Walla Walla River irrigation canal, groundwater fluctuations at those sites appears to be more strongly influenced by seepage losses from the canal than by water recharged at the Locust Road Site. Annual lows at GW_116 appear to be declining since 2015 (Figure 43).

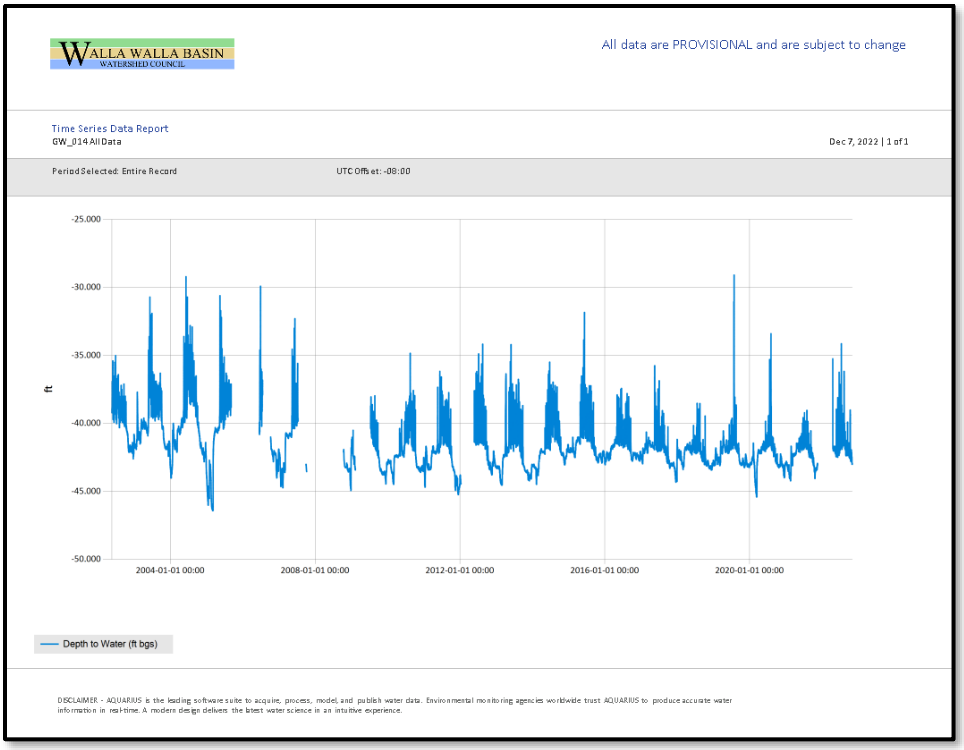

Figure 42. GW_14 hydrograph from WY 2002- 2022.

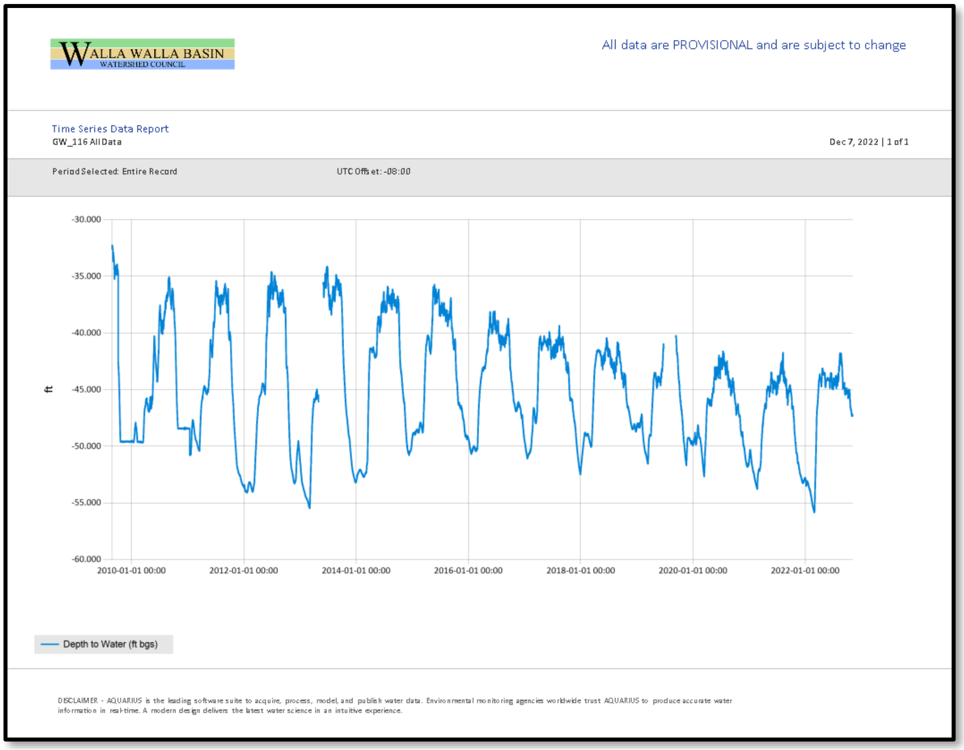

Figure 43. GW_116 hydrograph from WY 2009 to 2022.

MILLER ROAD RECHARGE SITE

The Miller Road site operated for 41 days (4/5/22 – 5/15/22), recharging 96.5 ac-ft. of water at an average rate of 1.19 cfs. Operations were limited to 35 days because this site is fed by the Eastside Pipeline, which only operates in the spring after freezing temperatures have passed.

GW_160 is located at the site of the infiltration galleries, while GW_162 is 0.2 miles and down gradient from the site (Figure 44). WY 2021 was the first season of operation at this site. The hydrographs from GW_160 and GW_162 show a significant influence from the recharged water (Figures 45-46). Annual low groundwater elevations, however, continue to drop at an alarming rate. The Eastside Pipeline is pressurized, allowing for a high rate of water inflow.

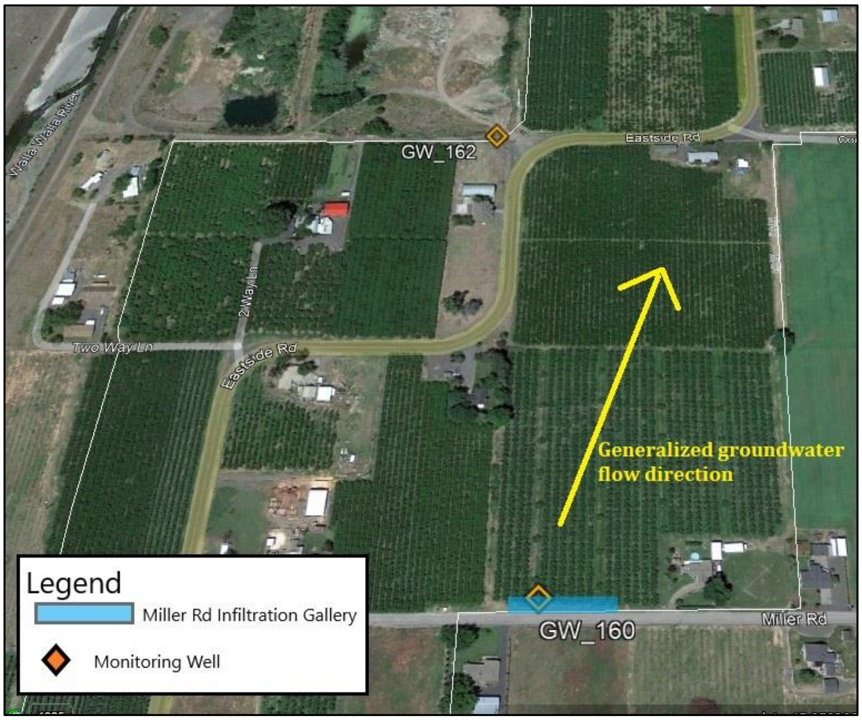

Figure 44. Miller Road monitoring well location

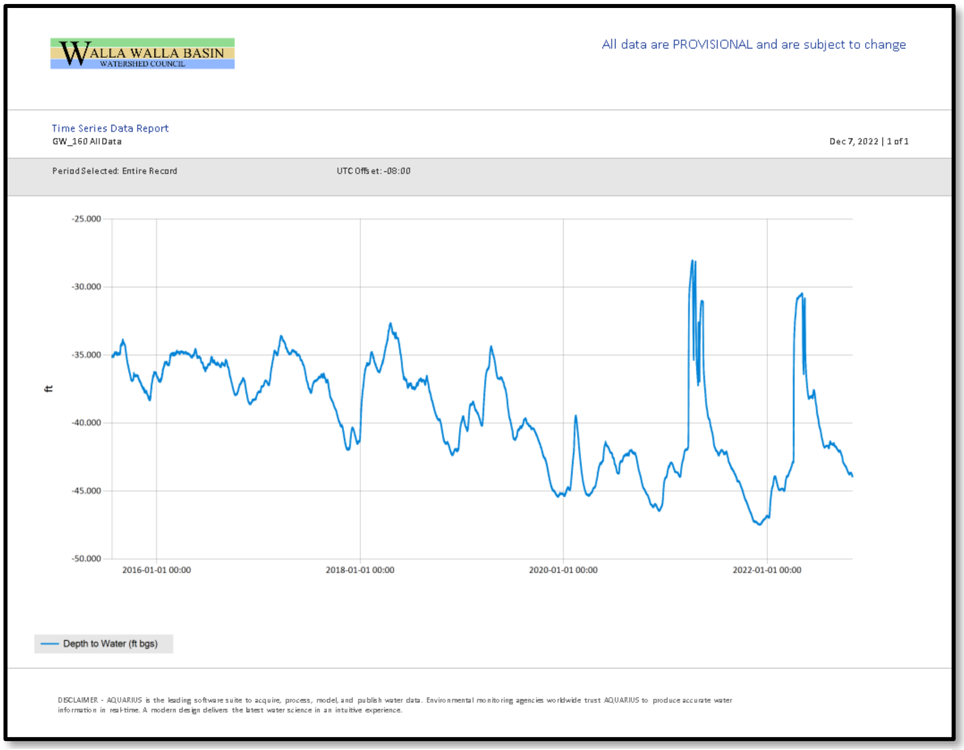

Figure 45. GW_160 hydrograph from WY 2015-2022.

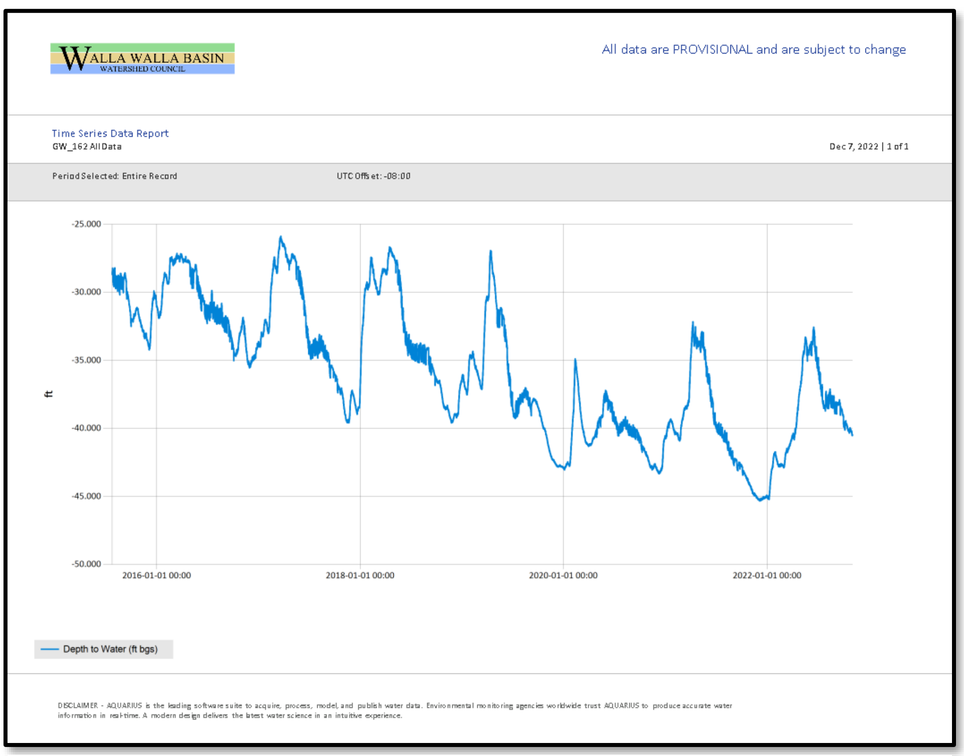

Figure 46. GW_162 hydrograph from 2015-2022.

MUD CREEK RECHARGE SITE

The Mud Creek site operated for 87 days (11/22/21 – 12/3/21, 3/1/22– 5/15/22) recharging 97.8 ac-ft. at an average rate of 0.57 cfs.

Monitoring wells GW_170 and GW_117 are located up-gradient approximately 0.1 and 0.9 miles from the site, respectively (Figure 47). The roughly 40-foot difference in groundwater levels between the two wells illustrate the highly variable conditions in the alluvial aquifer (Figures 48-49). At nearby GW_170, groundwater levels increased during the recharge season, particularly from March-May. However, the springtime elevation increase was present prior to when Mud Creek recharge operations began in WY 2017, suggesting groundwater levels are responding to other factors as well, possibly recharge at the down-gradient recharge sites (Figure 50).

GW_117 water levels rose during recharge season, peaked in May and leveled off at a higher summertime elevation compared to the fall (Figure 49). The 2009-2022 dataset from GW_117 suggests multiple influences (Figure 51).

Figure 47. Mud Creek monitoring well locations.

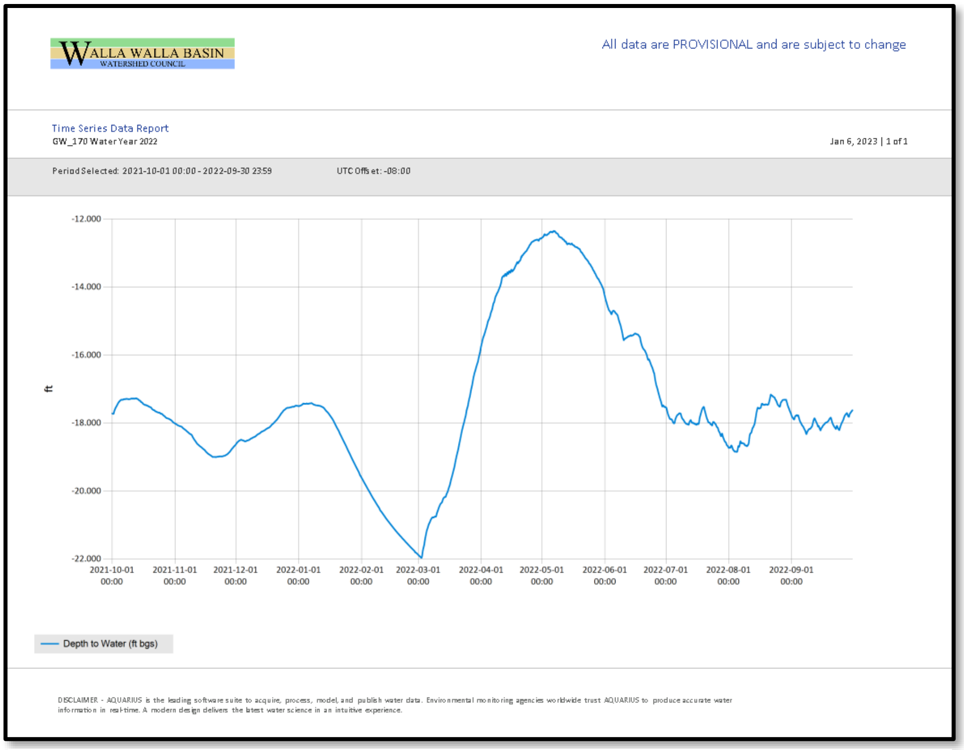

Figure 48. GW_170 hydrograph from WY 2022.

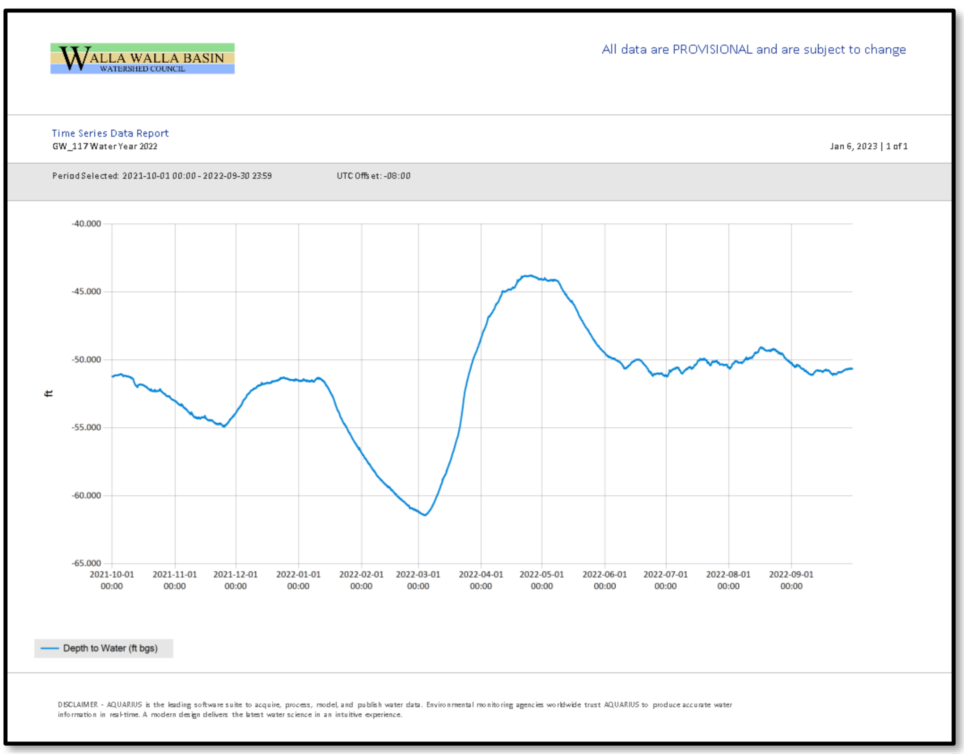

Figure 49. GW_117 hydrograph from WY 2022.

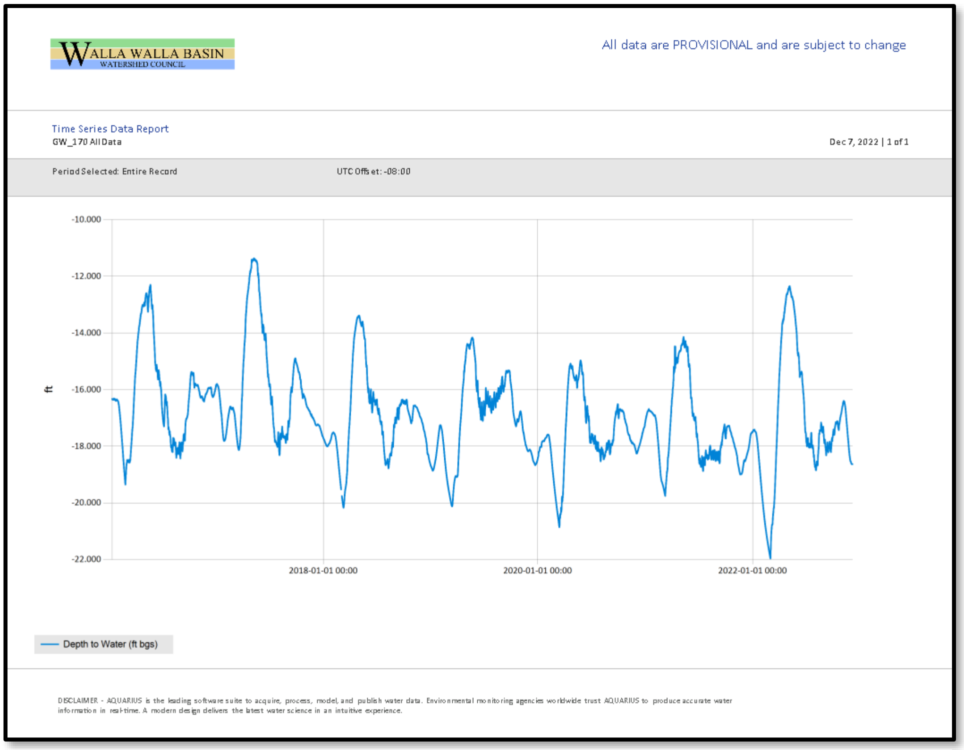

Figure 50. GW_170 hydrograph from WY 2016-2022.

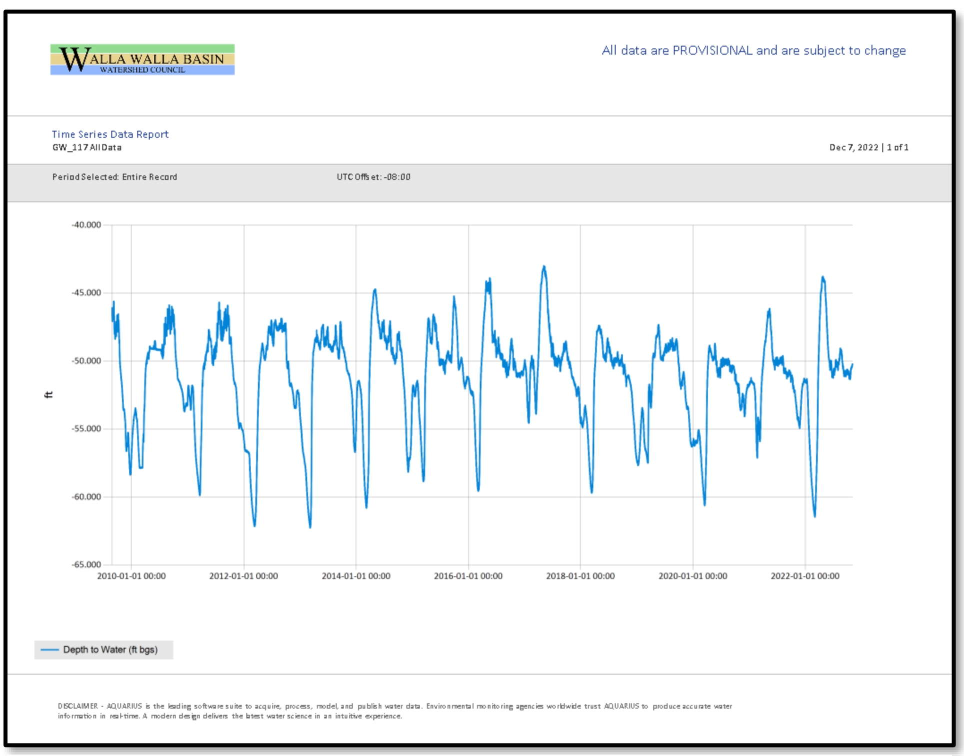

Figure 51. GW_117 hydrograph from WY 2009-2022.

NORTH SUNQUIST RECHARGE SITE

The North Sunquist Site was not operated during the 2022 water year because the WWBWC was developing operational arrangements with the landowner.

GW_33 and GW_171 are up-gradient of the site (Figure 52), both discussed in the Fruitvale site. This recharge site is about 0.5 miles west of the Fruitvale Recharge Site.

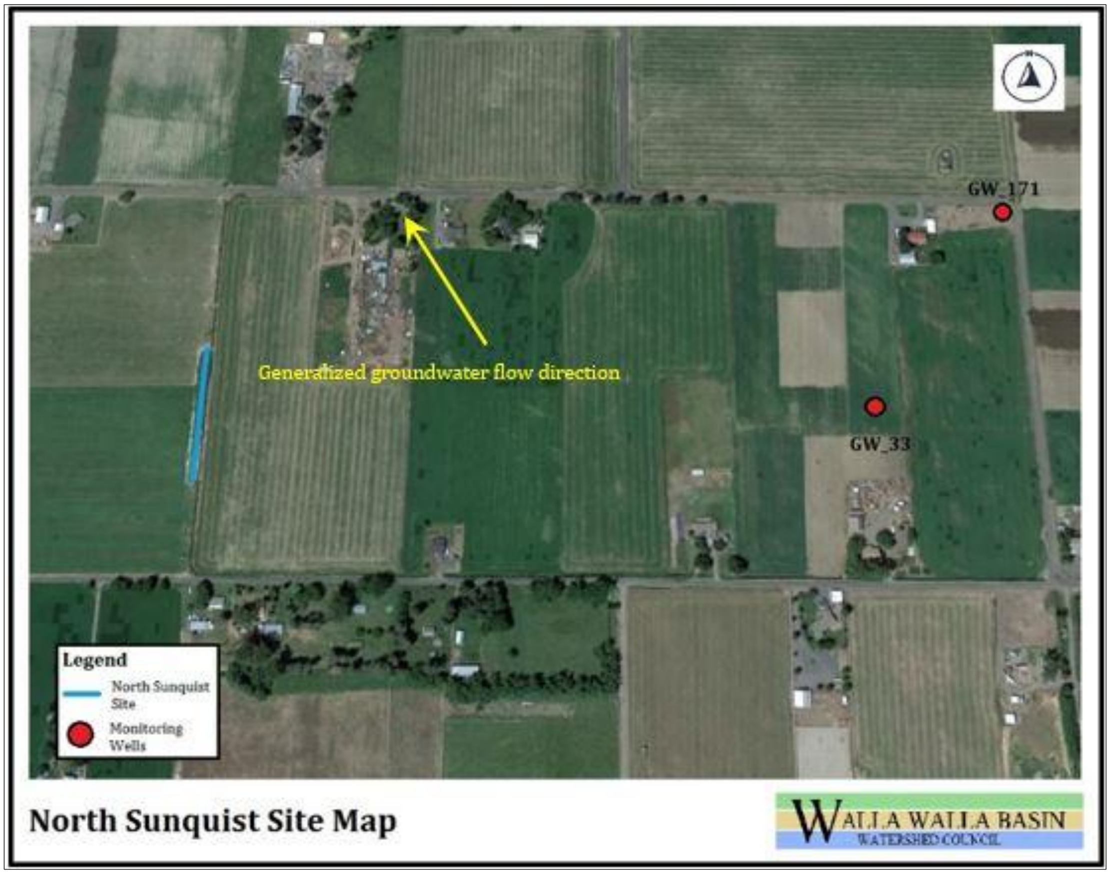

Figure 52. North Sunquist monitoring well location.

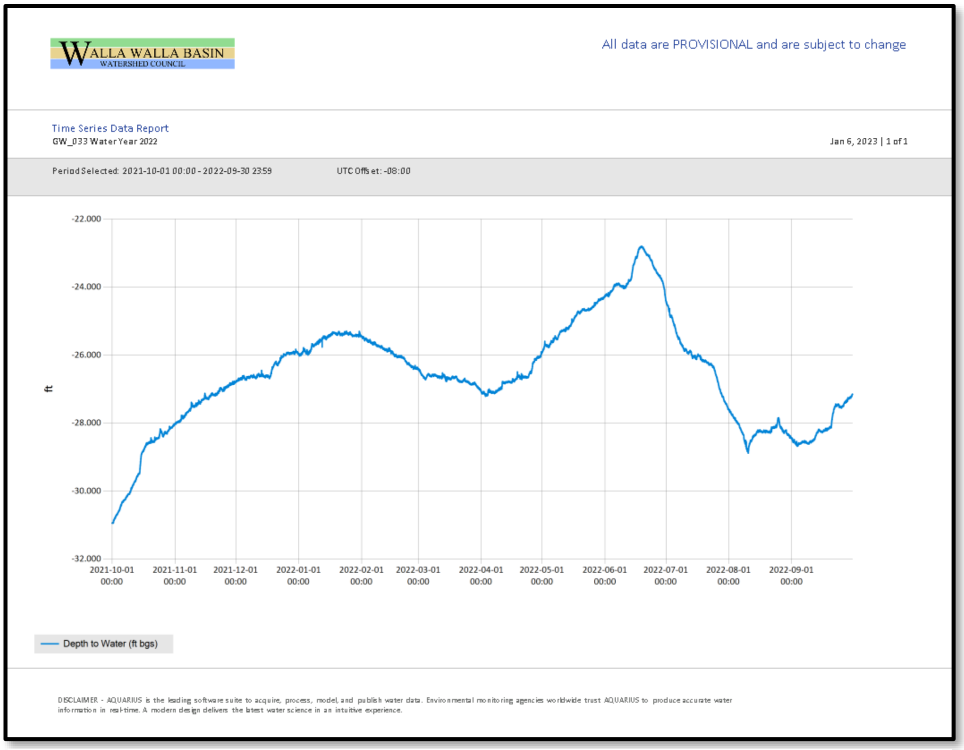

Figure 53. GW_33 hydrograph from WY 2022.

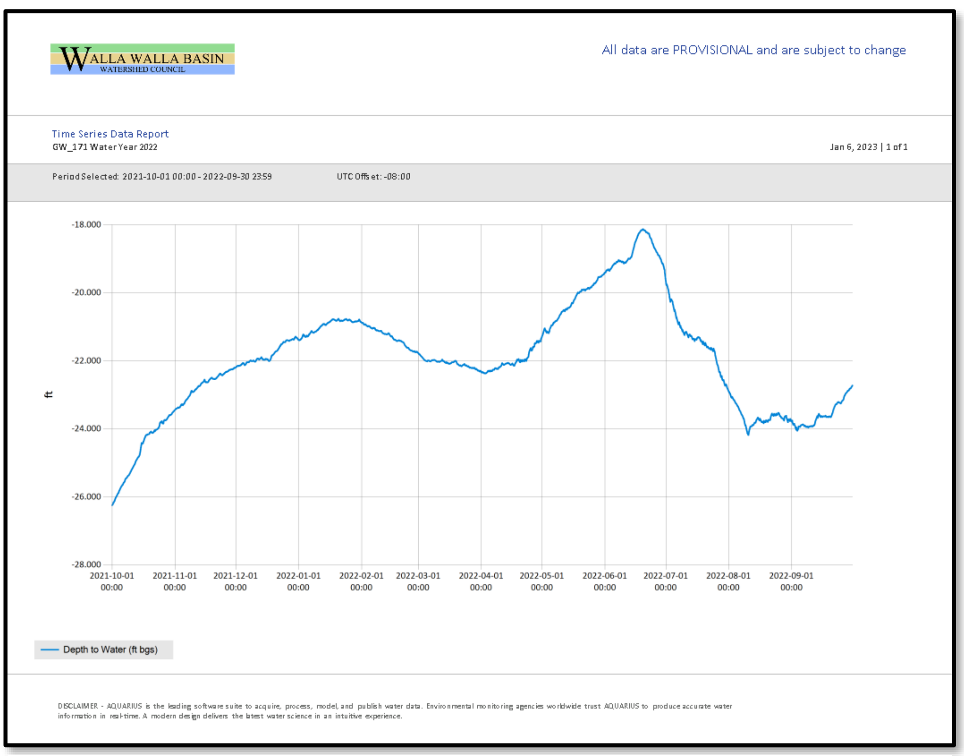

Figure 54. GW_171 hydrograph from WY 2022.

NW Umapine Site

The NW Umapine site operated for 85 days (11/24/21 – 12/31/21, 3/13/22 – 3/19/22, 5/5/22 – 5/15/22), recharging 219.3 ac-ft. at an average rate of 1.30 cfs.

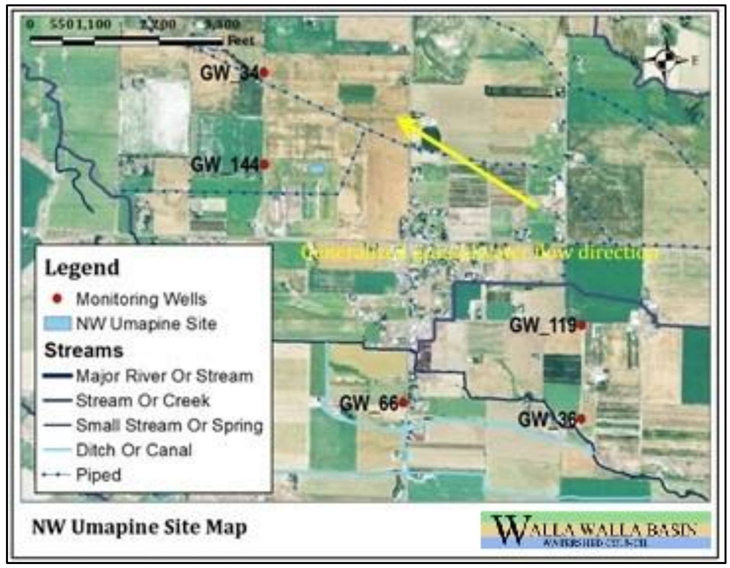

Figure 55. NW Umapine monitoring well locations.

Five monitoring wells are in the area of the site (Figure 55). GW_66 is discussed under the West Ringer Road site and GW_036 is reported under the Gallagher site. The annual groundwater cycle in the down-gradient wells GW_34 and GW_144 correlates with the recharge season (Figures 56-57), but that cycle was present prior to WY 2014, when the NW Umapine site began operation (Figure 58). The long-term datasets also show the yearly minimum and maximum groundwater levels at GW_34, GW_144, and GW_119 appearing to be relatively stable, with this year's annual lows at GW_144 and GW_119 being the shallowest on record (Figures 58-60). Groundwater levels at up-gradient GW_119 appear similar in the years before and after NW Umapine recharge began in WY 2014.

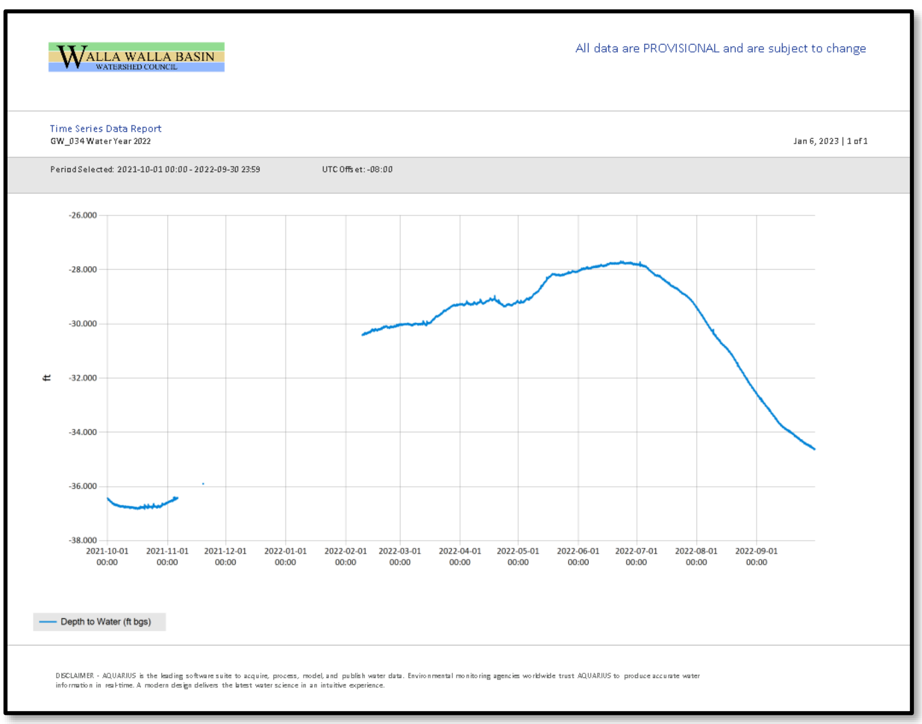

Figure 56. GW_34 hydrograph from WY 2022.

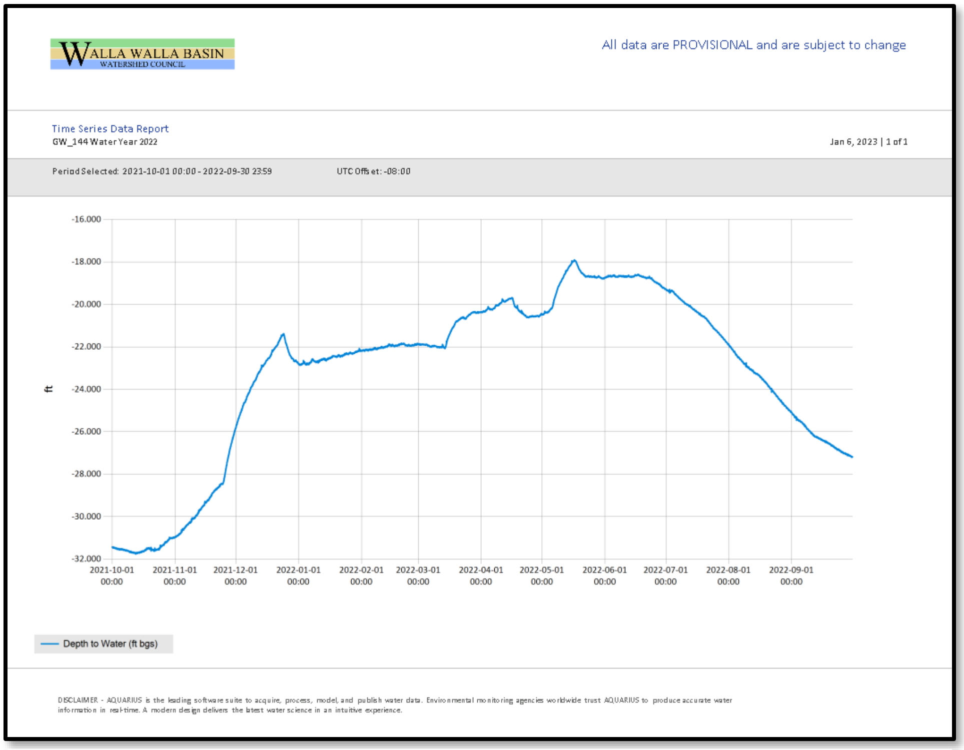

Figure 57. GW_144 hydrograph from WY 2022.

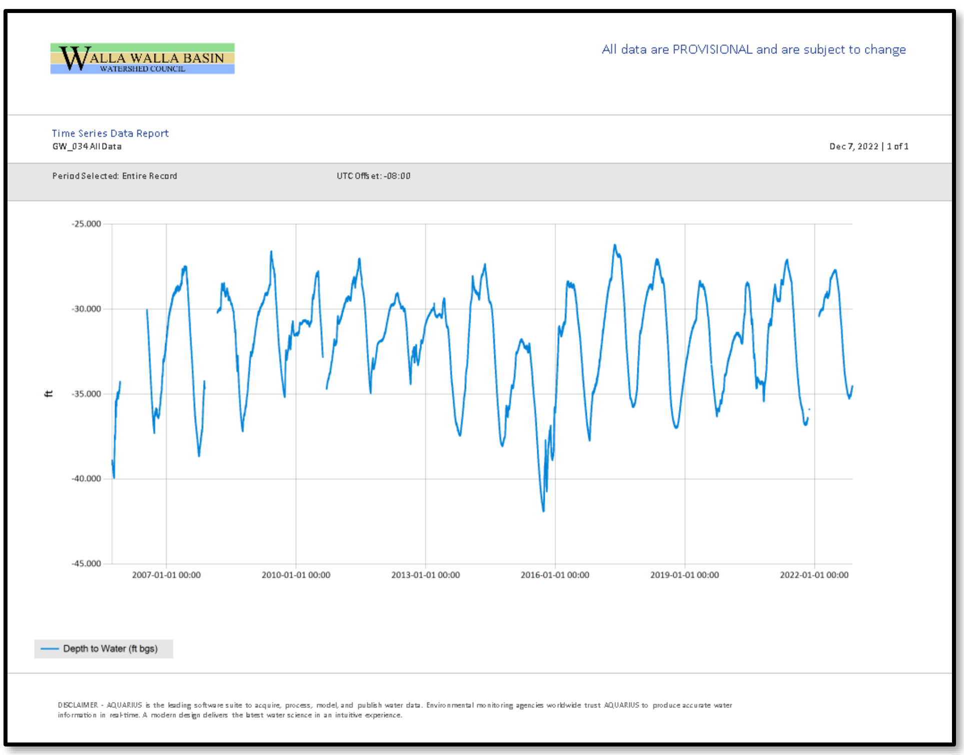

Figure 58. GW_34 hydrograph from WY 2006-2022.

Figure 59. GW_144 hydrograph from WY 2013-2022.

Figure 60. GW_119 hydrograph from WY 2009-2022.

RUBY LANE RECHARGE SITE

The Ruby Lane site operated for 107 days (11/22/21 – 12/31/21, 3/9/22 – 5/15/22), recharging 13.9 ac-ft. of water at an average rate of 0.07 cfs.

GW_116 is 0.3 miles up-gradient of the site and GW_19 is 0.2 miles down-gradient of the site (Figure 61). WY 2021 was the first year of Ruby Lane recharge operation, and we encountered difficulty getting enough water into the recharge site intake pipeline. There was inadequate water available in the irrigation ditch to back up and enter the infiltration gallery intake. In WY 2022, we experienced issues with keeping the screen to the intake clean, limiting the amount of recharge. Based on the timing of annual peaks and troughs, groundwater levels in both the up and down-gradient wells appear to be more influenced by high summertime flow rates and conveyance losses in the Little Walla Walla River than by the limited recharge operations at Ruby Lane (Figures 62-63).

Figure 61. Ruby Lane monitoring well locations.

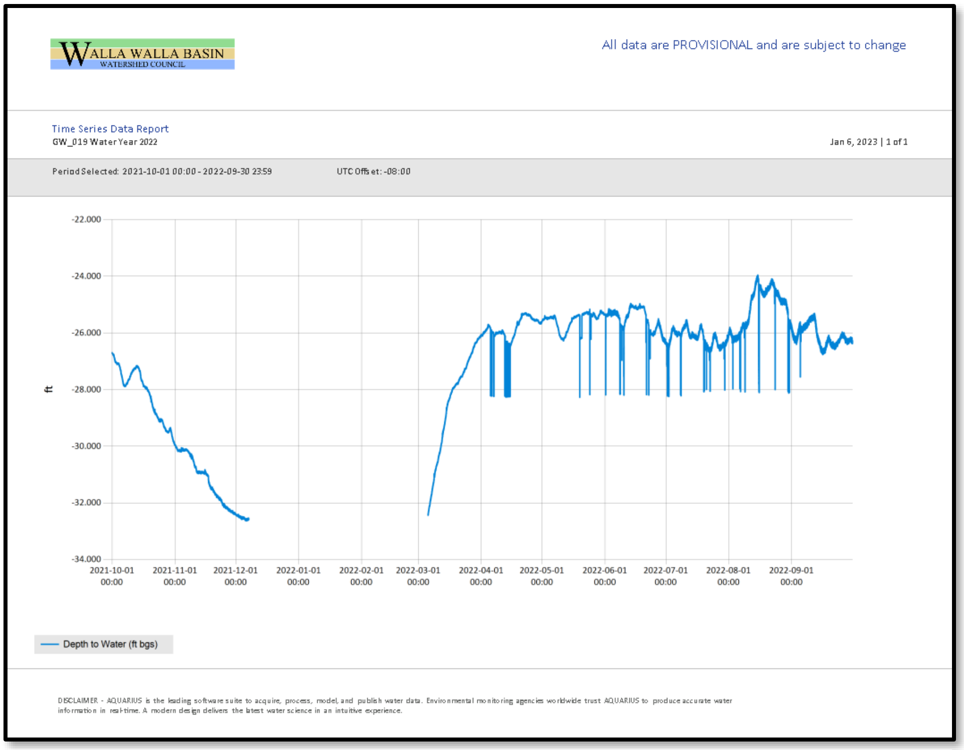

Figure 62. GW_19 hydrograph from WY 2022.

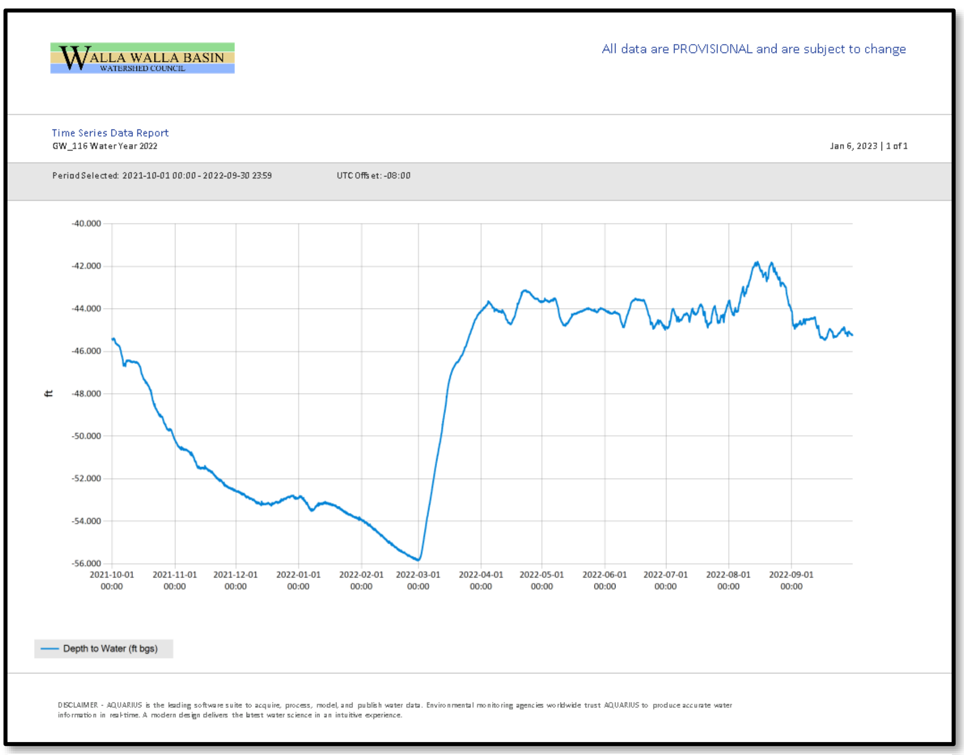

Figure 63. GW_116 hydrograph from WY 2022.

Triangle Road Recharge Site

The Triangle Road site operated for 35 days (3/7/22 – 4/11/22), recharging 20.1 ac-ft. of water at an average rate of 0.29 cfs. The reason for the short recharge operations this season was due to ditch maintenance and rodents digging holes in the pond, causing water to leak out and flood a nearby orchard.

Four monitoring wells are in the vicinity of the site: up-gradient GW_117, cross-gradient GW_143, and down-gradient wells GW_170 and GW_171 (Figure 64, GW_171 not shown). As shown in Figures 49 and 51, GW_117 elevations correlate with recharge season but are likely influenced by other factors as well. Figure 65 shows elevations in GW_143 that correlate with recharge season during the 2022 water year. Annual patterns of groundwater elevations in GW_143, however, are similar to the years before Triangle Road recharge operations began in 2017 (Figure 66). It's likely that GW_143 water levels are influenced more by Johnson and maybe Trumbull Rd operations than by Triangle Road recharge.

At GW_170, groundwater levels increased during the recharge season, particularly from March-May, which may be due to recharge at both Mud Creek and Triangle Road recharge sites (Figures 48 and 50). However, the annual springtime elevation increase was present prior to the start of Mud Creek and Triangle Road recharge operations in WY 2017, suggesting groundwater levels are also responding to other sites/factors.

Figure 64. Triangle Road monitoring well locations (GW_171 not shown).

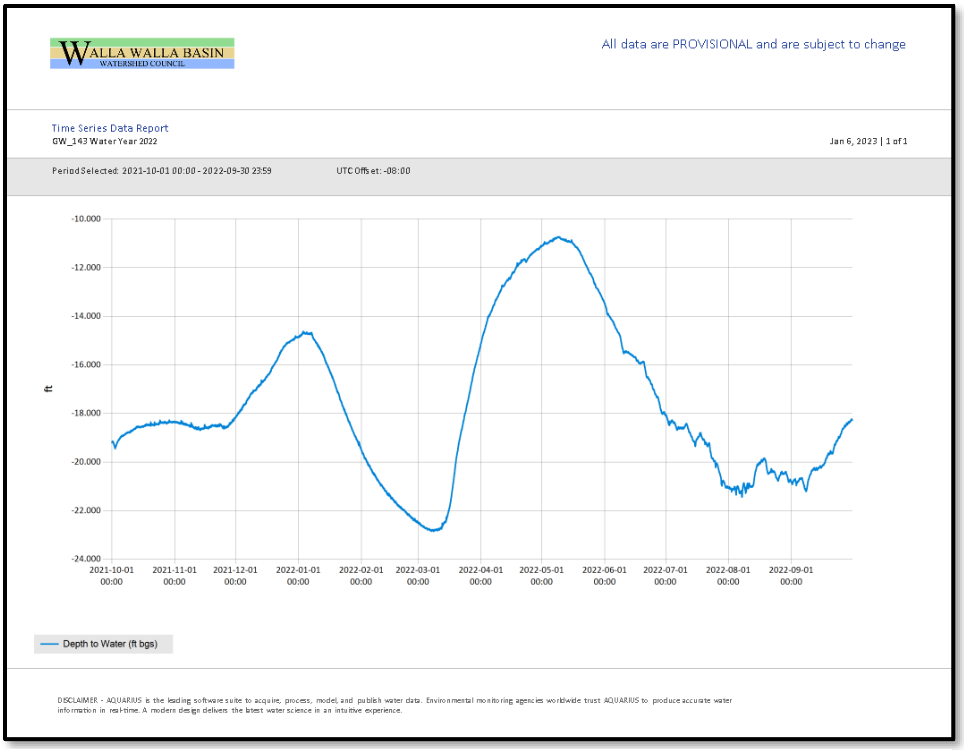

Figure 65. GW_143 hydrograph from WY 2022.

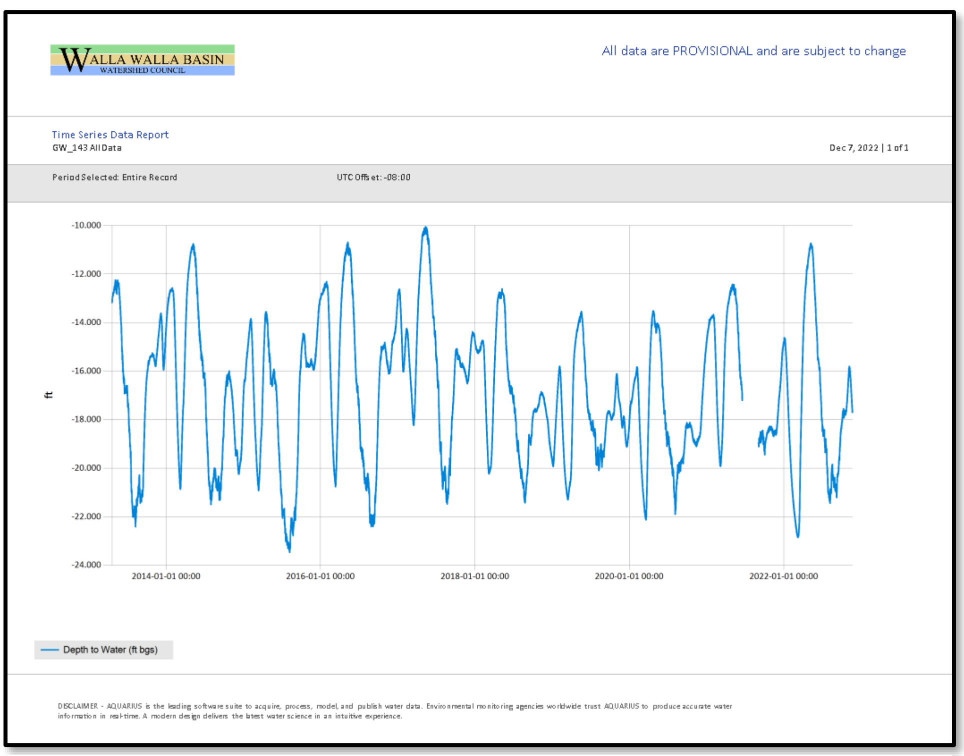

Figure 66. GW_143 hydrograph from WY 2013-2022.

TRUMBULL AQUIFER RECHARGE SITE

The Trumbull site operated for 101 days (11/24/21 – 12/31/21, 3/13/22 -5/15/22), recharging 237.2 ac-ft. at an average rate of 1.18 cfs.

GW_117 is cross gradient and GW_142 is down-gradient of the site (Figure 67). The two wells are approximately 0.6 miles apart. Water levels in GW_117 and GW_142 showed the influence of recharge operations, rising in early December, dropping during the February ditch turn off for diversion maintenance, and rising again during March and April (Figures 68-69).

Operation of the Trumbull site, which began in WY 2013, coincides with a rise in the lowest annual elevations at GW_117, however the 2022 low elevation dropped compared with recent years (Figure 70). At GW_142, the peaks of the hydrograph have declined during the monitoring period (Figure 71). The peak of 2022, however, showed a slight rise compared to recent years.

Figure 67. Trumbull monitoring well locations.

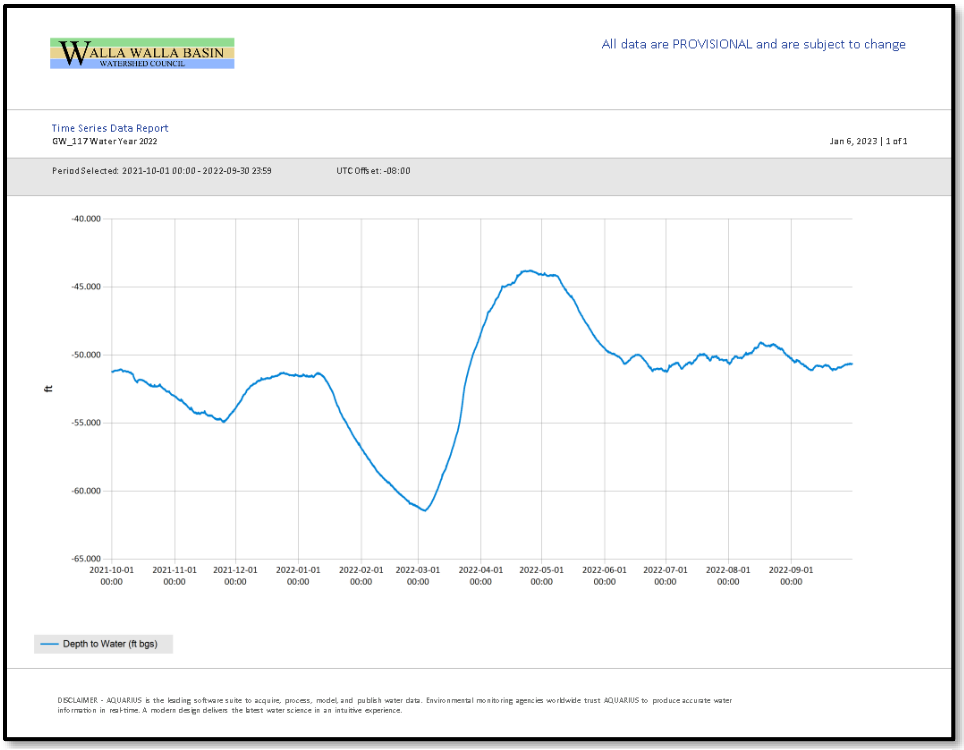

Figure 68. GW_117 hydrograph from WY 2022.

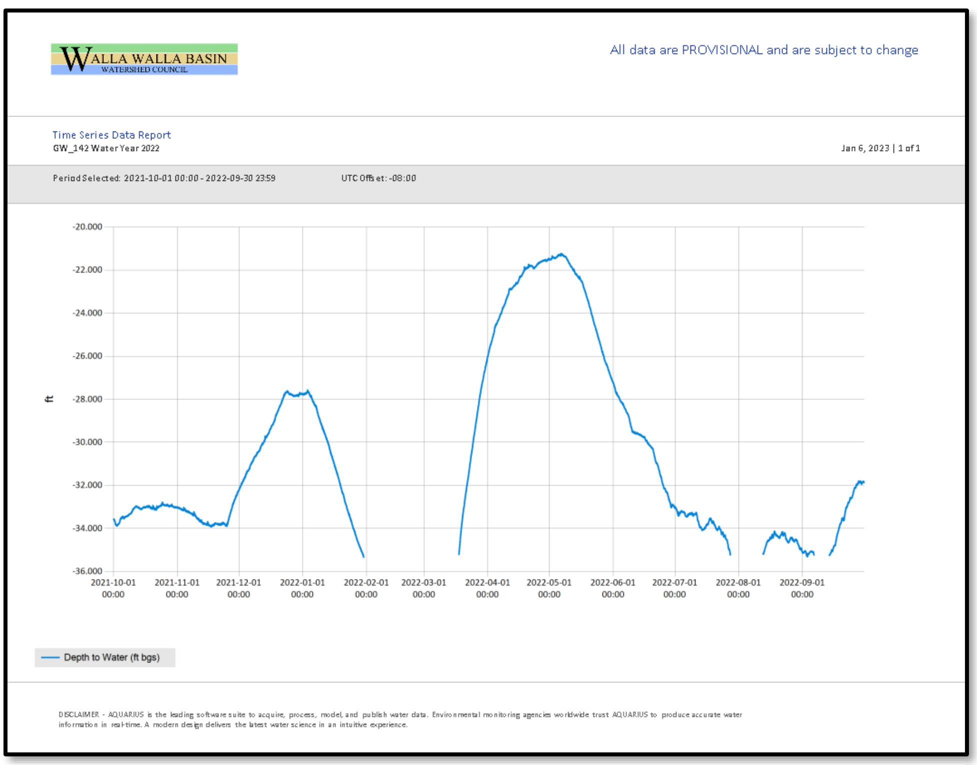

Figure 69. GW_142 hydrograph from WY 2022.

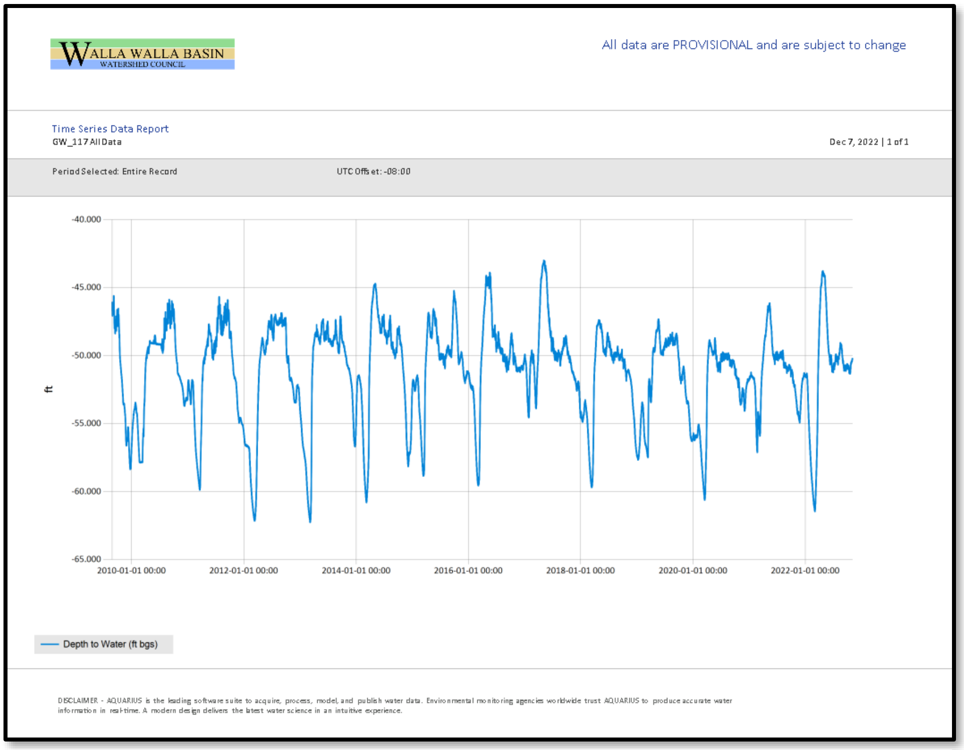

Figure 70. GW_117 hydrograph from 2009-2022.

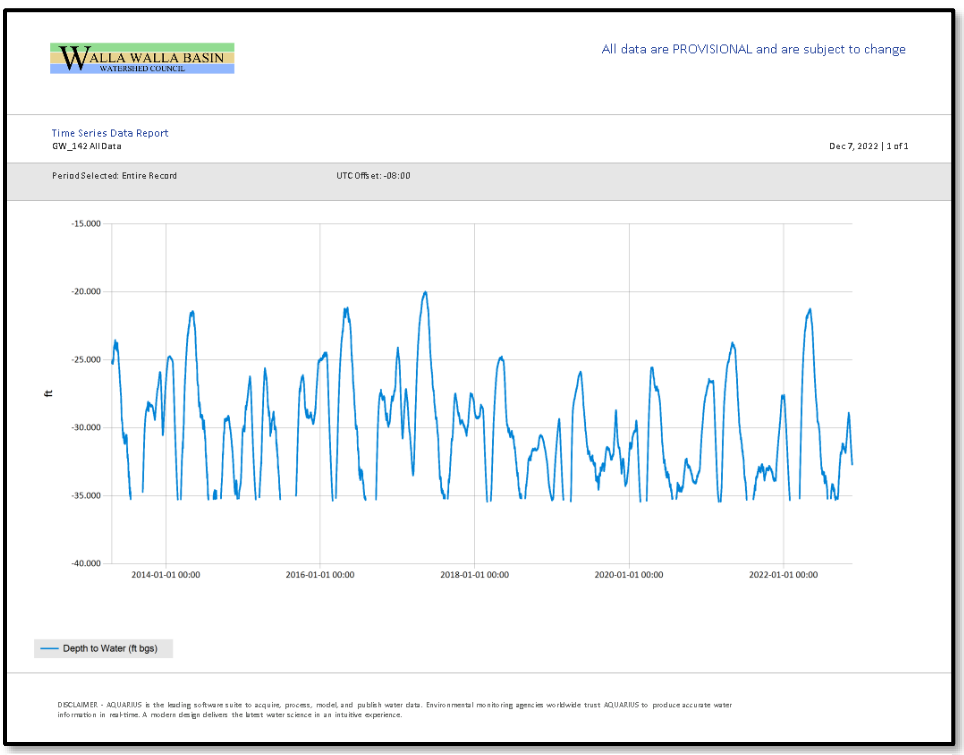

Figure 71. GW_142 hydrograph from WY 2013-2022. Data gaps represent times when the water level dropped below the elevation of the sensor.

WEST RINGER ROAD RECHARGE SITE

The West Ringer Road site operated for 45 days (4/1/22 – 5/15/22), recharging 73.1 ac-ft. of water at an average rate of 0.82 cfs. The reason for the short recharge operations this season was due to operational issues with the landowner.

GW_66 is up-gradient of the site and likely influenced both by Ringer Road operations as well as upgradient recharge operations at other sites (Figure 72). There's a data gap in the hydrograph for the WY 2022 at the time when upgradient recharge sites turned on, making it difficult to detect patterns (Figure 73). Additional years of data and site operation are needed to assess the influence of the Ringer Road site relative to other up-gradient recharge operations (Figure 74).

Figure 72. Ringer Road monitoring well location.

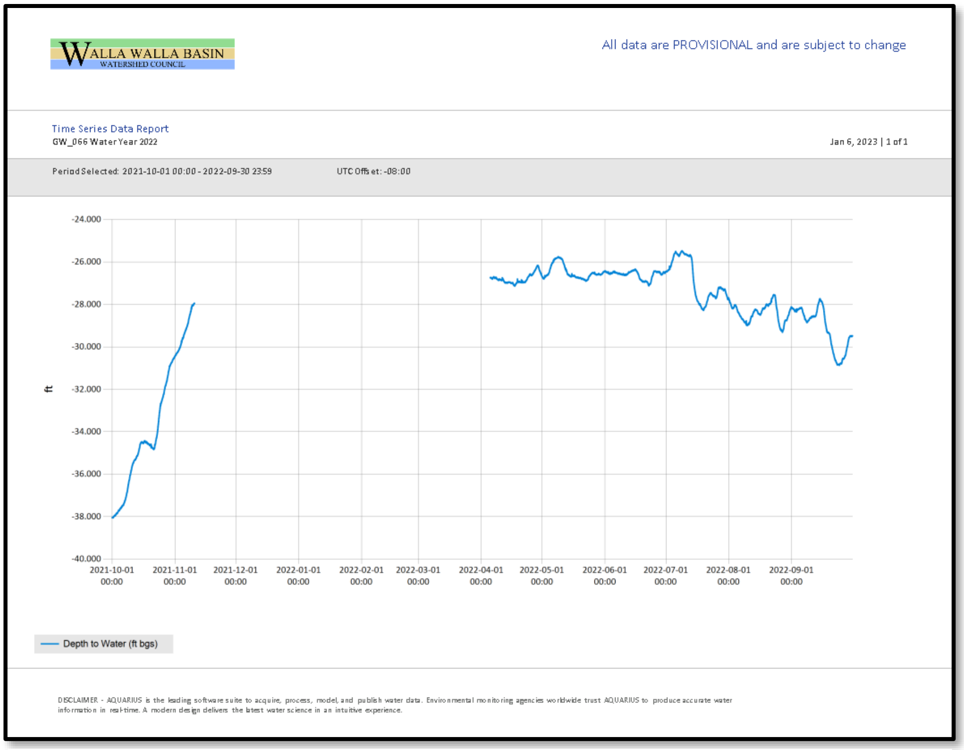

Figure 73. GW_66 hydrograph from WY 2022.

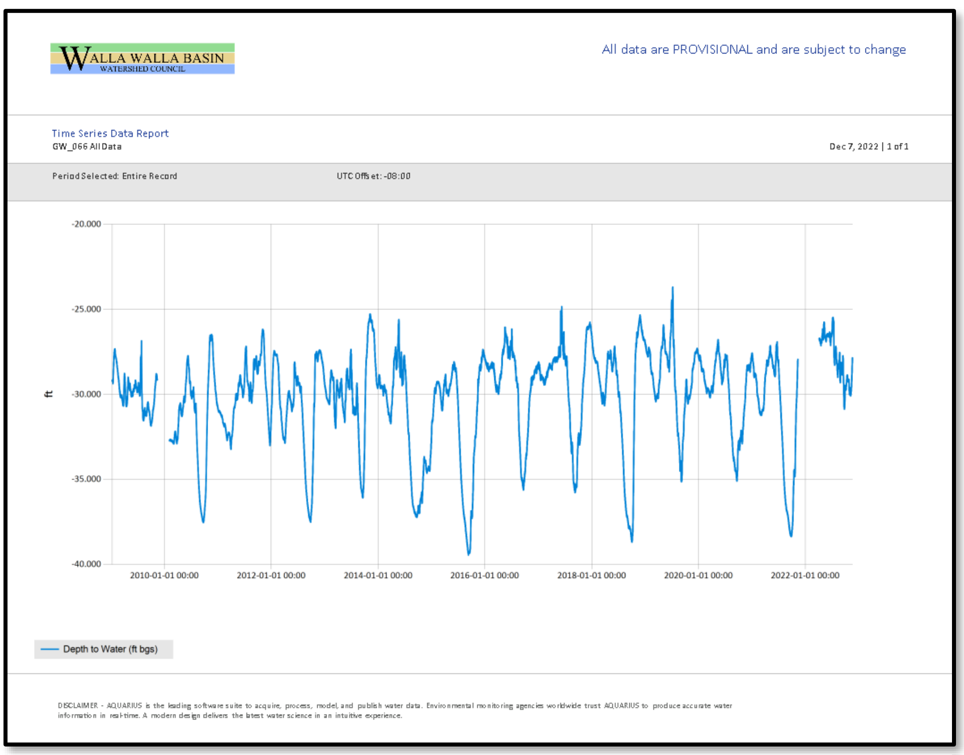

Figure 74. GW_66 hydrograph from WY 2008-2022.

Spring Production

The limited license LL-1848 includes monitoring spring yields to characterize large-scale changes in groundwater storage. Continuous 15-minute water level data were collected at five spring-fed creeks during the 2022 water year (Figure 75). AQUARIUS Time Series software was used to produce rating curves for each site and calculate continuous discharge values. Hydrographs for each site are shown below (Figures 76-80). These sites were chosen due to the availability of historic data, however they are not located directly at the spring sources. Water management factors like irrigation withdrawals and tailwater inputs make it difficult to directly correlate the measured stream flows with recharge activities. Nonetheless, these flow data can indicate trends in spring production and help to evaluate aquifer storage.

In Little Mud Creek (S-405), flow has increased dramatically since 2016, which coincides with an expansion of the Anspach Recharge Site in 2015 (Figure 76). The Little Mud Creek hydrograph also shows annual peaks and valleys that appear to correlate with canal management and recharge operations.

Flow in Big Spring near the state line (S-233) appears to be relatively stable (Figure 77). Annual fluctuations in discharge at this site do not appear to correlate with the timing of recharge operations. Monitoring at this location began in 2015, and more data are needed to assess trends.

Flow in Walsh/Lewis Creek (S-221) shows a marked increase starting in 2015 and 2016 (Figure 78), one year prior to the start of the nearest recharge site, East Trolley. Annual peaks in the hydrograph for this site occur in April, and although aquifer recharge is occurring at that time, the data do not suggest a direct correlation. Similar to Big Spring, this location is not directly down-gradient from a recharge site and likely will not show a marked response without more recharge on an annual basis, resulting in an increase in groundwater storage.

Mud Creek springs emerge near the locations of the Triangle Road, Mud Creek Pond, and Fruitvale Recharge sites. Downstream, at the monitoring location (S-303), flows appear relatively stable (Figure 79). Flow peaks occur in April and May at this site.

The hydrograph for Swartz Creek flow (S-411) shows a notable annual flow increase beginning in 2012-2013, which is when recharge operations began up-gradient at the Anspach, Barrett, and Trumbull sites (Figure 80). It is important to note that this flow monitoring location is downstream of multiple irrigation tailwater inputs, so spring production is not the only factor affecting annual flow volumes. However, the WWBWC is not aware of increases in tailwater inputs upstream of the monitoring location that persist from 2012 to 2022.

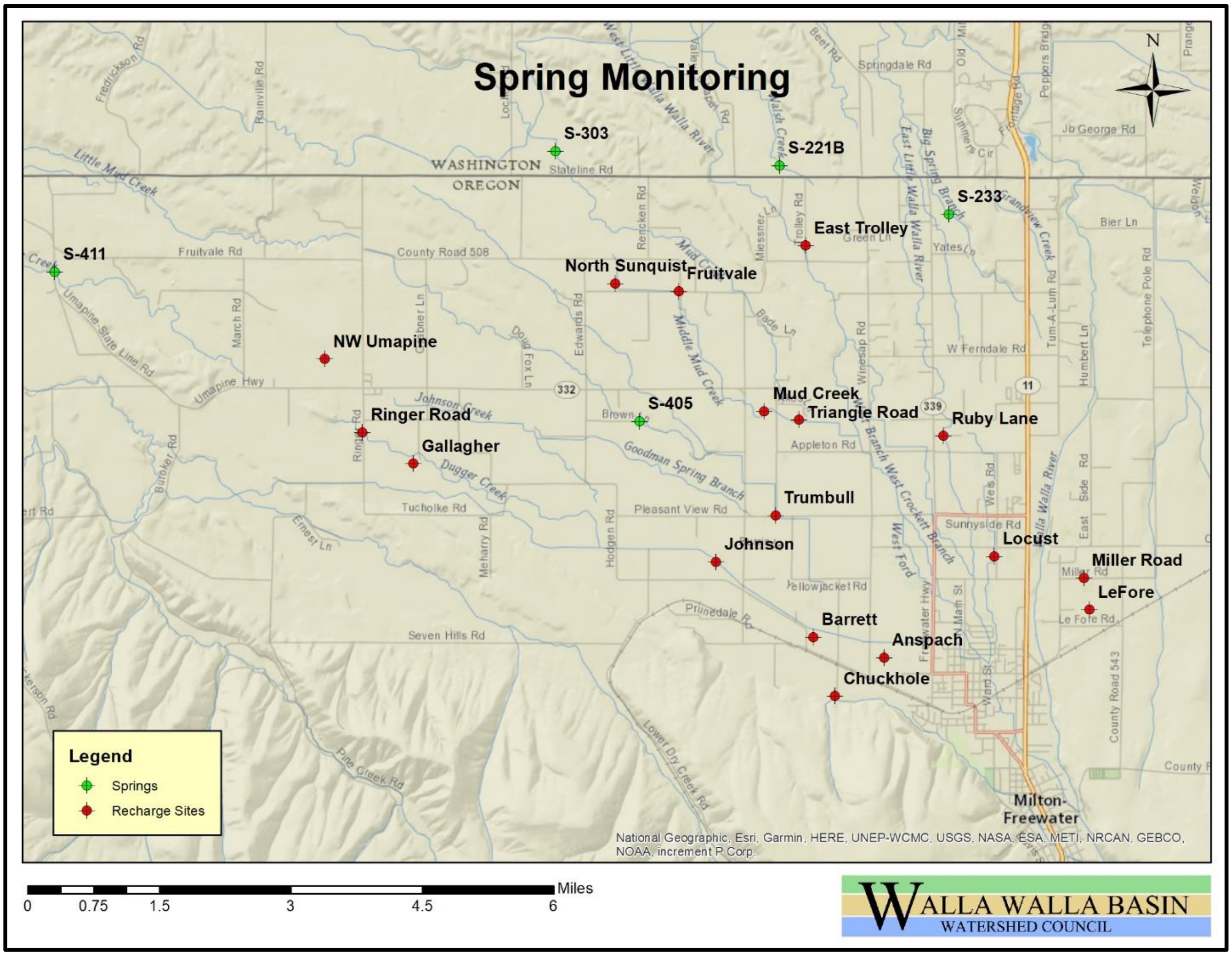

Figure 75. Location of 5 spring monitoring locations in relation to recharge sites.

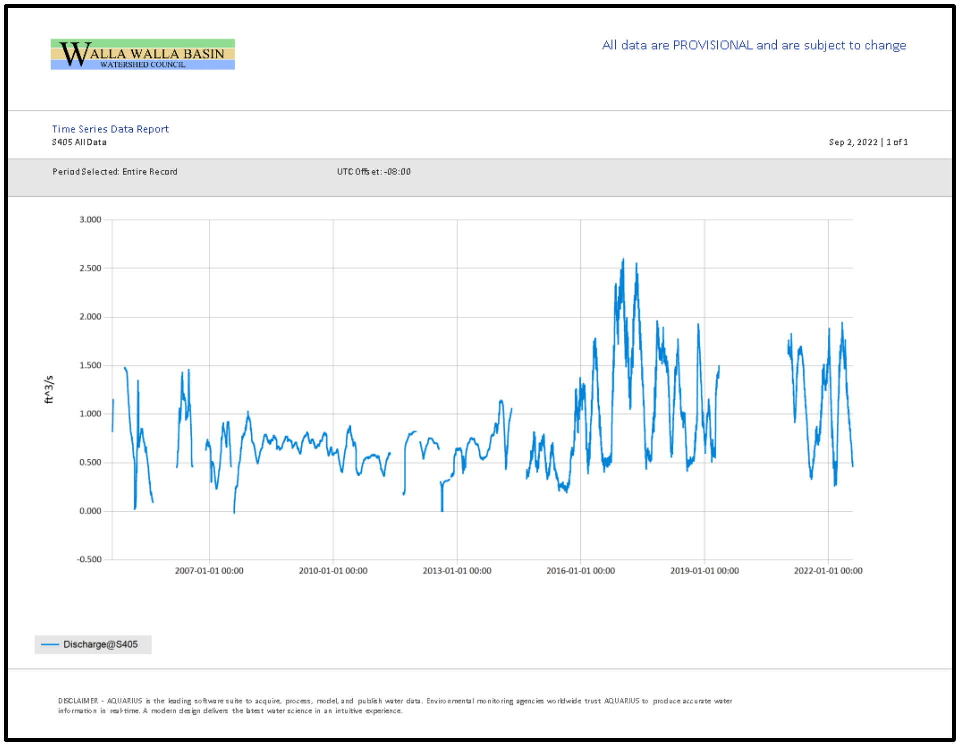

Figure 76. Hydrograph showing stream flow at S-405 Little Mud Creek, 2005-2022.

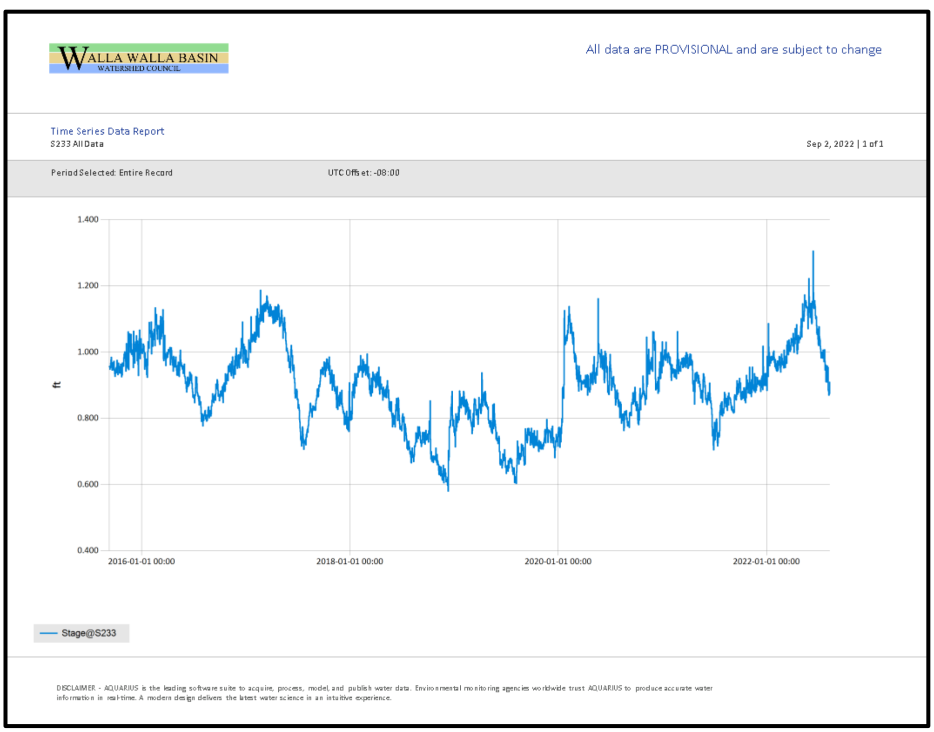

Figure 77. Hydrograph showing stream flow at S-233 Big Spring near Stateline Rd, 2015-2022.

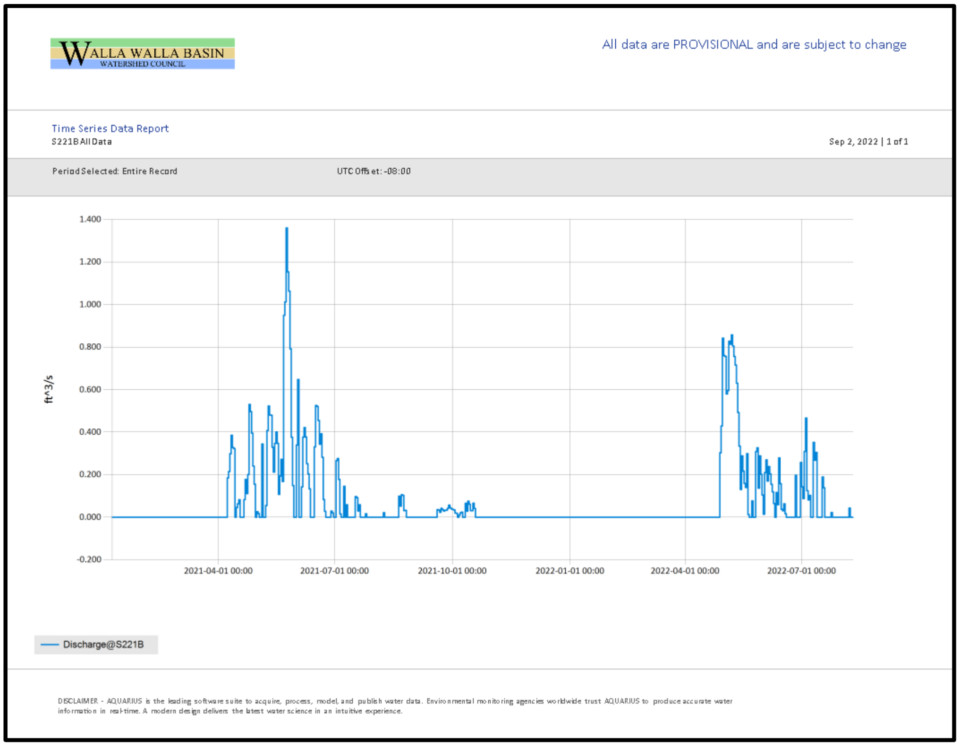

Figure 78. Hydrograph showing stream flow at S-221 Walsh/Lewis Creek, 2005-2022.

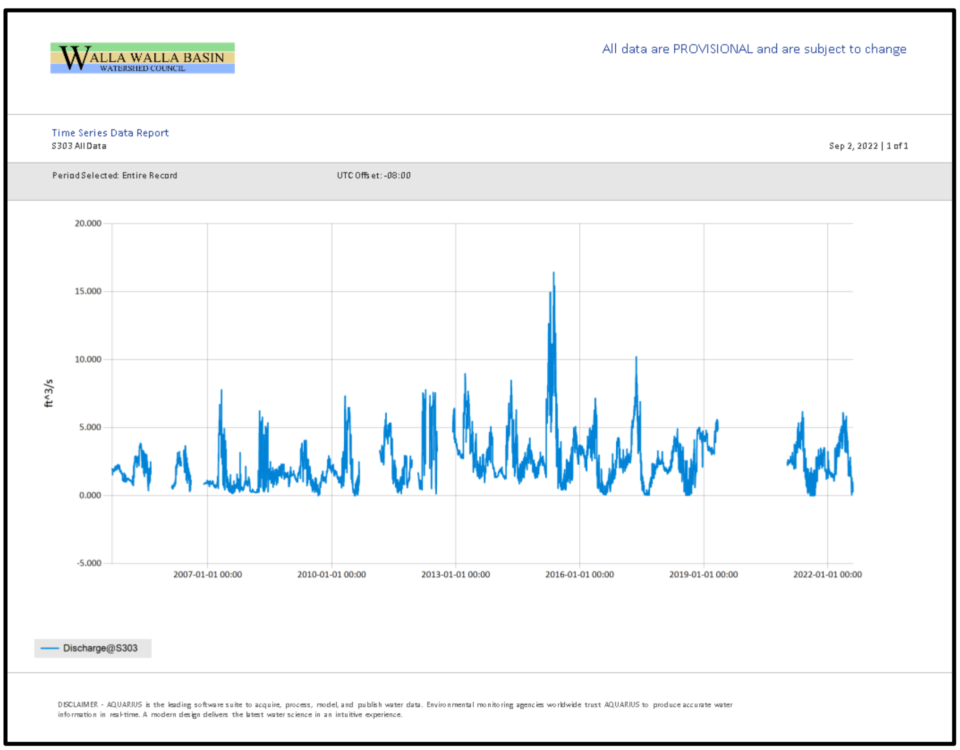

Figure 79. Hydrograph showing stream flow at S-303 Mud Creek near Stateline Rd, 2004-2022.

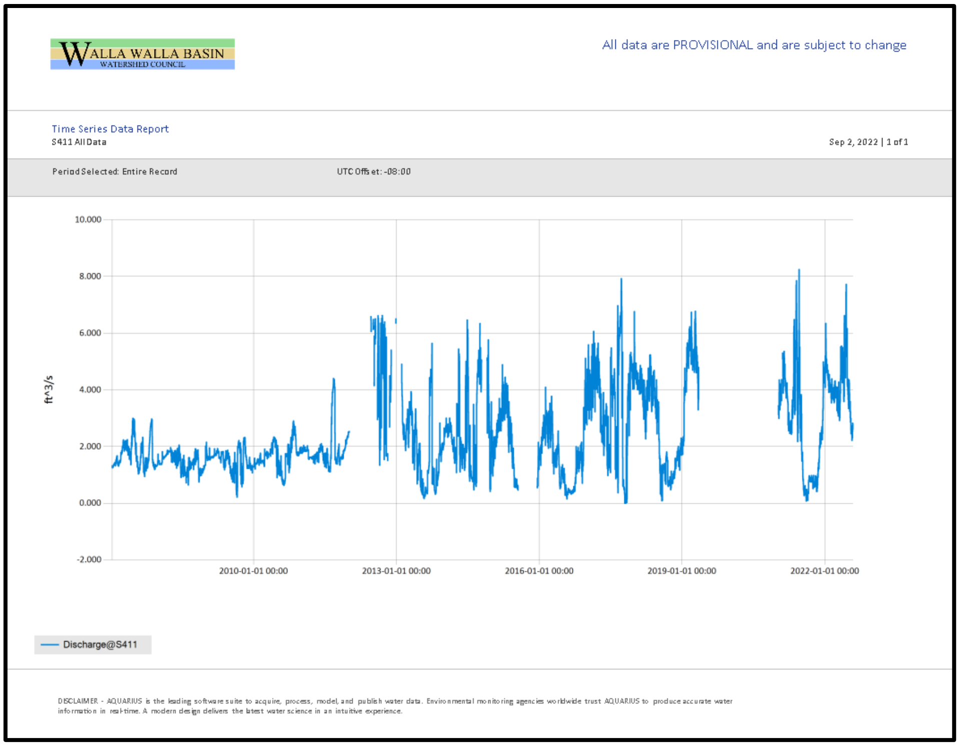

Figure 80. Hydrograph showing stream flow at S-411 Swartz Creek near Umapine Highway, 2007-2022.

Water Quality Monitoring

Methods

In accordance with limited license LL-1848, samples were collected once before and once after the recharge season. Grab samples of source water at five locations and groundwater at 8 locations were collected on December 6-7, 2021 and May 24-25, 2022 (Figure 81). The five source water locations were as follows: Source Water #1 (Zerba Weir), Source Water #2 (Duff Weir, S-418), Source Water #3 (Huffman-Richartz Split), Source Water #4 (Fruitvale, S-318), and Source Water #5 (Eastside). The eight groundwater wells were as follows: GW_046, GW_141, GW_144, GW_151, GW_152, GW_160, GW_170, and GW_171.

Table 5 shows the inorganic analytes and synthetic organic constituents evaluated as well as the analytical methods and detection limits for each. The Eco-Tracker analytical method is a cost-effective passive sampling tool that utilizes a resin capsule placed in the sample water for 24 hours to trap and exchange analytes of interest. At the lab, the chemical constituents are extracted with 50 mL 2M HCl. To evaluate concentrations of nitrate, water samples were analyzed by Anatek Labs, Inc. using conventional methods (Table 5).

Table 5. Analyte list, analytical methods, and method reporting limits for WY 2021.

Inorganic Analyte	Analytical Method	Detection Limit (mg/L)
Calcium (mg/L)	Eco-Tracker (Unibest)	0.31
Iron (mg/L)	Eco-Tracker (Unibest)	0.05
Magnesium (mg/L)	Eco-Tracker (Unibest)	0.27
Nitrate-N(mg/L)	EPA 300.0	0.10
Phosphorus (mg/L)	Eco-Tracker (Unibest)	0.02
Potassium (mg/L)	Eco-Tracker (Unibest)	0.18
Sodium (mg/L)	Eco-Tracker (Unibest)	0.17
Sulfur (mg/L)	Eco-Tracker (Unibest)	0.02
Synthetic Organic Constituents		
Azinphos-methyl	8321B	0.12
Chlorpyrifos	8270D	0.06
Diuron	8321B	0.06
Malathion	8270D	0.06

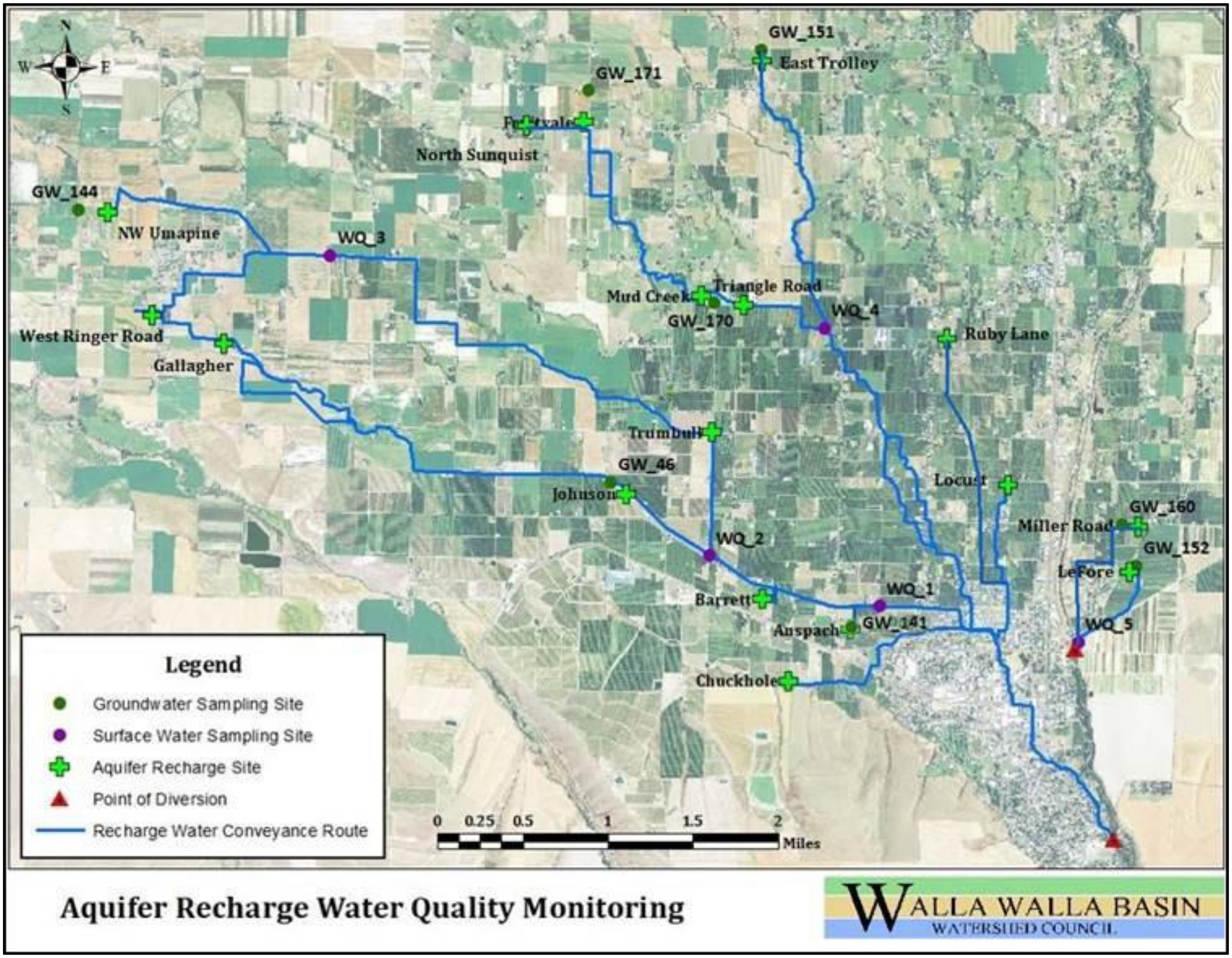

Figure 81. Water quality sampling locations for the managed aquifer recharge program in WY 2022.

To evaluate the impacts to groundwater quality from managed aquifer recharge, analyte concentrations in groundwater were compared to source water concentrations before and after the recharge season. Table 6 lists the source water sites relevant for each groundwater sampling site.

Table 6. Relevant source water site for each groundwater site.

GW site	Relevant source water sampling site
GW_141	WQ_1
GW_046	WQ_2
GW_144	WQ_3
GW_170	WQ_4
GW_171	WQ_4
GW_151	WQ_4
GW_152	WQ_5
GW_160	WQ_5

RESULTS

Tables 7-8 show groundwater quality results alongside the relevant source water results from the Unibest Eco-Tracker analysis. Figures 82-83 display the data in bar graphs for visual comparison of pre- and post-recharge samples and source water samples. The results of conventional lab analyses are shown in Tables 9 and 10. See Appendix B for all laboratory reports.

Field parameters were measured with a multi-parameter Thermo-Scientific Orion meter. Sensors were quality checked and calibrated as needed before each sampling event.

Table 7. Water quality data, Unibest methodology, GW_046, GW_141, GW_144, and GW_151. Relevant source water locations are identified in Table 6.

Site	Constituent	Groundwater (mg/L)		Source water (mg/L)	
		Pre-recharge	Post-recharge	Pre-recharge	Post-recharge
GW_046	Ca	4.91	4.36	4.66	4.02
GW_046	K	1.72	2.20	1.28	2.13
GW_046	Mg	1.74	1.53	1.55	1.37
GW_046	Na	5.41	2.67	3.95	2.52
GW_046	S	14.49	14.59	14.12	14.65
GW_046	Fe	0.10	0.10	0.12	0.11
GW_046	P	0.51	0.19	0.15	0.17
GW_141	Ca	6.81	8.06	5.25	4.16
GW_141	K	2.48	3.50	1.54	1.97
GW_141	Mg	2.34	2.89	1.71	1.40
GW_141	Na	5.57	5.41	4.23	2.47
GW_141	S	14.79	15.83	14.46	16.07
GW_141	Fe	0.22	0.10	0.18	0.18
GW_141	P	0.15	0.20	0.11	0.18
GW_144	Ca	33.54	37.66	4.87	5.85
GW_144	K	6.78	9.76	1.28	2.43
GW_144	Mg	11.79	14.57	1.62	2.04
GW_144	Na	19.05	29.67	4.16	3.70
GW_144	S	19.78	21.80	13.75	14.76
GW_144	Fe	0.10	0.09	0.12	0.12
GW_144	P	0.31	0.24	0.12	0.18
GW_151	Ca	12.99	8.67	4.67	5.44
GW_151	K	3.03	2.96	1.35	1.96
GW_151	Mg	4.24	3.13	1.56	1.51
GW_151	Na	7.09	5.02	4.03	2.92
GW_151	S	19.39	16.83	14.18	15.64
GW_151	Fe	0.11	0.09	0.13	0.11
GW_151	P	0.36	0.23	0.13	0.18

Table 8. Water quality data, Unibest methodology, GW_152, GW_160, GW_170, GW_171. Relevant source water locations are identified in Table 6.

Site	Constituent	Groundwater (mg/L)		Source water (mg/L)	
		Pre-recharge	Post-recharge	Pre-recharge	Post-recharge
GW_152	Ca	18.83	15.15	4.77	3.91
GW_152	K	3.08	3.87	1.40	1.97
GW_152	Mg	6.49	5.57	1.60	1.33
GW_152	Na	10.15	9.44	4.26	2.52
GW_152	S	15.63	16.69	14.23	15.68
GW_152	Fe	0.38	0.11	0.13	0.10
GW_152	P	0.40	0.19	0.14	0.19
GW_160	Ca	7.29	8.05	4.77	3.91
GW_160	K	1.83	3.04	1.40	1.97
GW_160	Mg	2.43	2.75	1.60	1.33
GW_160	Na	4.75	4.13	4.26	2.52
GW_160	S	14.14	16.10	14.23	15.68
GW_160	Fe	0.42	0.10	0.13	0.10
GW_160	P	0.26	0.21	0.14	0.19
GW_170	Ca	13.17	17.67	4.67	5.44
GW_170	K	2.85	4.63	1.35	1.96
GW_170	Mg	4.40	6.45	1.56	1.51
GW_170	Na	6.13	9.41	4.03	2.92
GW_170	S	17.44	22.07	14.18	15.64
GW_170	Fe	0.11	0.08	0.13	0.11
GW_170	P	0.13	0.20	0.13	0.18
GW_171	Ca	20.13	24.19	4.67	5.44
GW_171	K	4.53	6.31	1.35	1.96
GW_171	Mg	7.01	9.05	1.56	1.51
GW_171	Na	8.40	9.96	4.03	2.92
GW_171	S	16.73	17.62	14.18	15.64
GW_171	Fe	0.10	0.09	0.13	0.11
GW_171	P	0.15	0.22	0.13	0.18

Figure 82. Water quality data, Unibest method, GW_046, GW_141, GW_144, and GW_151.

Figure 83. Water quality data, Unibest method, GW_152, GW_160, GW_170, and GW_171.

Table 9. Surface water quality nitrate data, conventional methods.

Monitoring Site	NO3-N (mg/L)	
	Pre	Post
WQ_1	0.100	ND
WQ_2	0.101	ND
WQ_3	ND	0.161
WQ_4	ND	ND
WQ_5	0.121	0.135

ND = not detected

Table 10. Groundwater nitrate constituent concentrations, conventional methods.

Well	NO3-N (mg/L)	
	Pre	Post
GW_046	0.131	0.152
GW_141	0.376	0.633
GW_141_DUP	0.384	0.622
GW_144	7.52	10.1
GW_151	2.72	1.59
GW_152	2.32	2.35
GW_160	0.638	1.57
GW_170	1.31	2.91
GW_171	3.52	6.81

Table 11. Field parameter results

	Temperature (^{o}C)		Specific conductance (uS/cm)		Dissolved oxygen (mg/L)		pH (std units)	
Site	Pre	Post	Pre	Post	Pre	Post	Pre	Post
WQ_1	5.7	8.8	68.4	54.9	12.07	11.49	7.56	7.99
WQ_2	5.8	11.0	68.3	54.1	12.25	11.16	7.67	8.41
WQ_3	5.5	14.6	69.1	83.1	12.80	11.10	9.16	8.59
WQ_4	5.4	11.7	66.1	53.7	12.96	11.85	9.15	7.60
WQ_5	5.5	9.6	67.1	55.0	12.42	10.88	7.86	7.51
GW_046	10.5	11.0	72.1	62.5	9.42	9.38	7.41	7.36
GW_141	13.0	12.4	91.4	102.3	8.75	9.00	6.91	6.80
GW_144	10.7	13.5	355.4	438.9	8.49	7.47	7.12	6.84
GW_151	13.0	10.8	162.9	122.4	6.80	9.39	6.72	7.63
GW_152	10.6	13.4	196.2	268.7	9.12	8.79	7.90	6.96
GW_160	9.7	9.8	99.8	105.9	8.60	9.38	7.23	6.65
GW_170	11.9	13.5	161.1	238.9	9.68	7.56	6.88	6.64
GW_171	12.1	13.4	231.4	292.2	7.89	8.03	6.39	6.78

Discussion

The data suggest it is unlikely that groundwater quality degradation is occurring due to operation of the recharge sites. Often, the groundwater constituent concentrations are lower after recharge ends than before recharge begins. Out of 56 groundwater constituent concentrations measured with the Unibest method prior to and after recharge season, concentrations were lower (improved) after the recharge season in 45% of the values. Constituent concentrations in the source water were lower (better) than in the receiving groundwater in 89% of the pre-recharge and 86% of the post-recharge values. In 14 cases, source water contained a higher concentration than the receiving groundwater for a given constituent in both pre- and post-recharge sampling. In 11 of the 14 cases, this occurred with iron and, in 3 cases, for sulfur (Tables 7-8 & Figures 82-83). The difference in iron concentrations in source water compared to groundwater in these 11 cases ranged from 0.01 to 0.08 mg/L (detection limit for the Unibest method is 0.05 mg/L). The difference in sulfur concentrations in source water compared to groundwater in these 3 cases was 0.06 to 0.24 mg/L (detection limit for Unibest method is 0.02 mg/L).

Iron was detected using the Unibest method in the pre- and post-recharge samples at all groundwater and source water locations (Tables 7-8). Concentrations were substantially below Oregon Department of Environmental Quality's (ODEQ) guidance level of 0.3 mg/L for iron except in GW_152 and GW_160. In GW_152, iron was detected at 0.38 mg/L in the pre-recharge sample and at 0.11 mg/L in the post-recharge sample. Similarly, in GW_160, iron was detected at 0.42 mg/L in the pre-recharge sample and at 0.10 mg/L in the post-recharge sample (Table 8).

Results from conventional lab analysis show that nitrate-nitrogen concentrations increased at 7 of the 8 groundwater sample locations (GW_046, GW_141 GW_144, GW_152, GW_160, GW_170, and GW_171) over the course of the recharge season (Table 9). The drinking water standard for nitrate-nitrogen (10 mg/L) was exceeded in the post-recharge sampling at GW_144 (10.1 mg/L). Nitrate-nitrogen concentrations were very low in both the pre-season source water samples (Not detected to 0.121 mg/L), and post-recharge source water samples (Not detected to 0.161 mg/L), indicating the recharge water infiltrating into groundwater was likely not the source of the increased nitrate-nitrogen concentration in the groundwater (Table 10). The facilities have been operating for 2 to 19 years, and increased nitrate-nitrogen concentration are not likely from flushing nitrate-nitrogen below the facility

The groundwater samples collected at wells GW_144 and GW_171 on May 25, 2022 were also analyzed for the approved targeted list of herbicides and pesticides (azinphos-methyl, chlorpyrifos, diuron, and malathion) using analytical methods EPA 8270D and EPA 8321B. There were no detections of the four constituents in either sample. Analytical laboratory reports are included in Appendix B.

Quality Control

For the synthetic organic compounds, the lab did not identify any quality control issues associated with analysis of the samples.

For the nitrate-nitrogen samples analyzed at Anatek, samples collected on 5/25/22 were received within the holding time but were analyzed one day past the holding time. The lab manager did not believe testing the samples past the holding time would affect results, and nitrate-nitrogen concentrations are similar to those reported in previous years. Because preservation protocols were not followed however, concentrations of nitrate-nitrogen in these samples may not represent actual conditions.

Field replicates were obtained at GW_141 during the pre-recharge and post-recharge sampling events to quantify precision of the nitrate-nitrogen data (Table 12). The results indicate the data have sufficiently high reproducibility for their intended end use.

Table 12. Relative percent difference of replicate samples.

Analyte	**GW_141**			**GW_141**		
	Sample mg/L	**Replicate mg/L**	**Relative percent difference**	**Sample**	**Replicate**	**Relative percent difference**
Nitrate-N	0.376	0.384	2.11%	0.633	0.622	1.75%

SUMMARY

During the WY 2022 recharge season, 6,036 ac-ft. (1.97 billion gallons) of water was recharged to the alluvial aquifer near Milton-Freewater through recharge basins, infiltration galleries, and seepage from canals and ditches delivering the water to the engineered structures. Groundwater levels in wells closest to the sites typically showed the strongest response. Seasonal patterns in groundwater levels at most of the monitoring sites reflect multiple factors influencing their change over time such as seepage from stream channels and the irrigation delivery network, deep percolation past the rooting zone, spring discharge, and upwelling into stream channels. Flow data from Little Mud Creek and Swartz Creek, both spring-fed creeks down-gradient of multiple recharge sites, show an increase in flows since the recharge program expanded in 2012-2013.

As in previous recharge seasons, groundwater and surface water quality data collected during aquifer recharge activities do not indicate that aquifer recharge activities are degrading groundwater quality. The quality of source water delivered to the aquifer recharge sites continues to be of better quality than the receiving groundwater. No exceedances of surface water quality criteria were measured.

The Walla Walla Basin's aquifer recharge program continues to use nature-based infrastructure to simulate the floodplain function of recharge to the aquifer that was lost due to channelization of the distributary system. With continued aquifer recharge activities, WWBWC aims to increase alluvial aquifer water levels and spring production.

PROPOSED AR PROGRAM IN WY 2023

Operation of the current 17 alluvial aquifer recharge sites will continue in WY 2023 under Limited License 1848.

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APPENDIX A – LIMITED LICENSE LL-1848

Oregon Water Resources Department

OREGON WATER RESOURCES DEPARTMENT

Final Order
Limited License Application LL-1848

Appeal Rights

This is a final order in other than a contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60-day time period specified by ORS 183.484(2). Pursuant to ORS 536.075 and OAR 137-004-0080 you may either petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the Director, and if no action is taken within 60 days following the date, the petition was filed, the petition shall be deemed denied.

Requested Water Use

Applicant:	HUDSON BAY DISTRICT IMPROVEMENT COMPANY AND WALLA WALLA BASIN WATERSHED COUNCIL
Date Submitted:	SEPTEMBER 4, 2020
Amount:	45.0 CUBIC FEET PER SECOND (CFS)
Source:	WALLA WALLA RIVER, A TRIBUTARY TO THE COLUMBIA RIVER
Use:	ARTIFICAL GROUNDWATER RECHARGE TESTING
Period of Use:	NOVEMBER 1 - MAY 15 OF EACH YEAR; FROM ISSUANCE DATE THROUGH MAY 15, 2024
County:	UMATILLA COUNTY
POD Locations:	5.00N-35.00E-12 SWNE 5.00N-35.00E-1 NENW
Recharge Sites:	5.00N-35.00E-02 ANSPACH 5.00N-35.00E-03 CHUCKHOLE 6.00N-34.00E-24 NW UMAPINE 6.00N-34.00E-25 WEST RINGER ROAD 6.00N-35.00E-15 EAST TROLLEY LANE 6.00N-35.00E-20 NORTH SUNDQUIST 6.00N-35.00E-21 FRUITDALE 6.00N-35.00E-26 RUBY LANE 6.00N-35.00E-27 MUD CREEK 6.00N-35.00E-27 TRIANGLE ROAD 6.00N-35.00E-27 TRUMBULL ROAD 6.00N-35.00E-30 GALLAGHER 6.00N-35.00E-33 JOHNSON 6.00N-35.00E-34 BARRETT 6.00N-35.00E-35 LOCUST ROAD 6.00N-35.00E-36 MILLER ROAD 6.00N-35.00E-36 LEFORE ROAD

Authorities

The Department may approve a limited license pursuant to its authority under ORS 537.143, 537.144 and OAR 690-340-0030.

ORS 537.143(2) authorizes the Director to revoke the right to use water under a limited license if it causes injury to any water right or a minimum perennial streamflow.

A limited license will not be issued for more than five consecutive years for the same use, as directed by ORS 537.143(8).

Findings of Fact

1. The forms, fees, and map have been submitted, as required by OAR 690-340-0030(1).
2. On September 4, 2020, the Department provided public notice of the application, as required by OAR 690-340-0030(2).
3. This limited license request is limited to an area within a single drainage basin, as required by OAR 690-340-0030(3).
4. The Department has determined that the proposed source has not been withdrawn from further appropriation per ORS 538.200.
5. The Department has determined that water is available for the requested use.
6. Because this use is from surface water and has the potential to impact fish, the Department finds that fish screening is required to protect the public interest.
7. Because the use requested is longer than 120 days and because the use is in an area that has sensitive, threatened or endangered fish species, the use is subject to the Department's statewide rules under OAR 690-033-0310. These rules aid the Department in determining whether a proposed use will impair or be detrimental to the public interest with regard to sensitive, threatened, or endangered fish species.
8. The Department has determined that the use is not subject to its rules under OAR 690-350. However, artificial groundwater recharge testing must be done in a manner that provides a test with results and supplemental information for the user's artificial groundwater recharge permit application. Consistent with this intent, the Department has added conditions pertaining to testing, monitoring, reporting and coordination with Oregon Department of Environmental Quality (ODEQ), Oregon Department of Fish and Wildlife (ODFW) and this Department.
9. The Department has received comments related to the possible issuance of the limited license from the Department of Environmental Quality, which found the August 2020 water quality monitoring plan as acceptable. The Department also received comments from the Department of Fish and Wildlife, which recommended conditions related to instream water rights and bypass flows. The authorization of Limited License LL-1848 is conditioned to satisfactorily address issues raised in these comments.
10. The Department has determined the testing and water quantity monitoring plan submitted as an addendum to the application on November 23, 2020 is sufficient for artificial groundwater recharge testing.

11. Pursuant to OAR 690-340-0030(4)(5), conditions have been added with regard to notice and water-use measurement.

12. Umatilla County has indicated that the proposed use is compatible with the applicable acknowledged comprehensive land-use plan. A copy of the land use compatibility statement is in the file.

Conclusions of Law

The proposed water use will not impair or be detrimental to the public interest pursuant to OAR 690-340-0030(2), as limited in the order below.

Order

Therefore, pursuant to ORS 537.143, ORS 537.144, and OAR 690-340-0030, Application LL-1848 is approved as conditioned below.

1. The authorized use of water under this limited licenses is as follows:

   Amount: 45.0 CFS
   Source: WALLA WALLA RIVER, A TRIBUTARY TO THE COLUMBIA RIVER
   Use: ARTIFICAL GROUNDWATER RECHARGE TESTING
   Duration: NOVEMBER 1 - MAY 15 OF EACH YEAR; FROM ISSUANCE DATE THROUGH MAY 15, 2024

2. The licensee shall give notice to the Watermaster in the district where use is to occur not less than 15 days or more than 60 days in advance of using the water under the limited license. The notice shall include the location of the diversion, the quantity of water to be diverted, and the intended use and place of use. In the case of this application, this order serves as the notice described above.

3. When water is diverted under this limited license, the use is limited to times when the following minimum streamflows are met in the Tum A Lum reach of the Walla Walla River, between the Little Walla Walla River diversion and Nursery Bridge Dam and flowing past Nursery Bridge Dam:

By-Pass Flow Requirement	
November	64 CFS
December and January	95 CFS
February to May 15	150 CFS

4. Nursery Bridge Dam is located just downstream of Nursery Bridge and is downstream of the Little Walla Walla diversion. The District 5 Watermaster, based on gage and/or flow measurements, shall make the determination that the above described streamflows are flowing past Nursery Bridge Dam. Diversion under this limited license shall cease when the above streamflows are unmet.

5. In supporting this license, ODFW retains the prerogative to pursue a future instream water right for the Walla Walla River. A permanent water right for the requested location may fall under the requirements of Division 33 rules, which does not allow the appropriation of direct streamflow during the time period of April 15 to September 30, except as provided in OAR 690-033-0140.

6. The licensee shall follow the operation, water quality and water level monitoring plans described in the document entitled, "WWBWC Alluvial Aquifer AR Program Hydrologic Setting, Site

Descriptions, and Proposed Surface Water and Groundwater Monitoring Plan," received by the Department on November 23, 2020. These plans may be modified after review and approval of changes by the Department.

7. The licensee shall comply with all ODEQ water quality requirements. If monitoring data or other information result in identification of potential water quality concerns, ODEQ may seek modifications to the monitoring and test plan and/or require a permit of its own to address the water quality concerns prior to resumption of artificial groundwater recharge testing.

8. Before water use may begin under this license, the licensee shall install a totalizing flow meter at each point of diversion and at the entry point to each recharge test site. The totalizing flow meters must be installed and maintained in good working order.

9. In addition, the licensee shall maintain a record of all water use, including the total number of hours of diversion, the total volume diverted, and the categories of beneficial use to which the water is applied. During the period of the limited license, the record of use shall be available for review by the Department upon request, and shall be submitted to the Department annually and to Watermaster upon request. This record shall include the amount of water diverted from the Walla Walla River, and the amount delivered to each recharge area.

10. The licensee is required to provide a written annual report by February 15th of each year. This report will detail recharge testing and any subsequent recovery under a secondary limited license from the preceding water year. Reporting shall include, but is not limited to, the results of testing efforts that relate to water quality, water quantity, and operations. Water level data shall be submitted in a Department-specified digital format. The licensee shall consult with ODEQ and OWRD to identify additional specific reporting elements. **The first report is due in February 2021.** The annual report shall be sealed and signed by a professional(s) registered or allowed, under Oregon law, to practice geology.

11. The licensee shall conduct recharge testing as proposed in the application, or as later amended by the licensee, and approved by the Department, and as otherwise conditioned herein.

12. The Director may revoke the right to use water for any reason described in ORS 537.143(2), and OAR 690-340-0030(6). Such revocation may be prompted by field regulatory activities or by any other information.

13. Use of water under a limited license shall not have priority over any water right exercised according to a permit or certificate, and shall be subordinate to all other authorized uses that rely upon the same source.

14. The licensee shall install, use, and maintain fish screening and by-pass devices as required by the Oregon Department of Fish and Wildlife to prevent fish from entering the proposed diversion. See copy of enclosed fish screening criteria for information.

15. By law, the land use associated with this water use must be in compliance with statewide land-use goals and any local acknowledged land-use plan.

16. A copy of this limited license shall be kept at the place of use, and be made available for inspection by the Watermaster or other state authority.

NOTE: This water-use authorization is temporary. Applicants are advised that issuance of this final order does not guarantee that any permit for the authorized use will be issued in the future; any investments should be made with that in mind.

Issued JAN 0 4 2021

Dwight French, Water Right
Services Division Administrator, *for*
Thomas M. Byler, Director
Oregon Water Resources Department

Enclosures - fish screen criteria

cc: Gregory M. Silbernagel, District 5 Watermaster
Danette Faucera, ODFW
Don Butcher, DEQ
Karen Whisler, DEQ
Phil Richerson, ODEQ
Kevin Lindsey, GeoEngineers, Inc.
Surface Water Section
File

If you need further assistance, please contact the Water Rights Section at the address, phone number, or fax number below. When contacting the Department, be sure to reference your limited license number for fastest service.

Remember, this limited license does not provide a secure source of water. Water use can be revoked at any time. Such revocation may be prompted by field regulatory activities or many other reasons.

Water Rights Section
Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem OR 97301-1271
Phone: (503) 986-0817 Fax: (503) 986-0901

FISH SCREENING CRITERIA FOR WATER DIVERSIONS

This summary describes ODFW fish screening criteria for all fish species.

Screen material openings for ditch (gravity) and pump screens must provide a minimum of 27% open area:

Perforated plate: Openings shall not exceed 3/32 or 0.0938 inches (2.38 mm).
Mesh/Woven wire screen: Square openings shall not exceed 3/32 or 0.0938 inches (2.38 mm) in the narrow direction, e.g., 3/32 inch x 3/32 inch open mesh.
Profile bar screen/Wedge wire: Openings shall not exceed 0.0689 inches (1.75 mm) in the narrow direction.

Screen area must be large enough to prevent fish impact. Wetted screen area depends on the water flow rate and the approach velocity.

Approach velocity: The water velocity perpendicular to and approximately three inches in front of the screen face.
Sweeping velocity: The water velocity parallel to the screen face.
Bypass system: Any pipe, flume, open channel or other means of conveyance that transports fish back to the body of water from which the fish were diverted.
Active pump screen: Self cleaning screen that has a proven cleaning system.
Passive pump screen: Screen that has no cleaning system other than periodic manual cleaning.

Screen approach velocity for ditch and active pump screens shall not exceed 0.4 fps (feet per second) or 0.12 mps (meters per second). The wetted screen area in square feet is calculated by dividing the maximum water flow rate in cubic feet per second (1 cfs = 449 gpm) by 0.4 fps.

Screen sweeping velocity for ditch screens shall exceed the approach velocity. Screens greater than 4 feet in length must be angled at 45 degrees or less relative to flow. An adequate bypass system must be provided for ditch screens to safely and rapidly collect and transport fish back to the stream.

Screen approach velocity for passive pump screens shall not exceed 0.2 fps or 0.06 mps. The wetted screen area in square feet is calculated by dividing the maximum water flow rate by 0.2 fps. Pump rate should be less than 1 cfs.

For further information please contact:

Statewide Fish Screening Coordinator
Oregon Dept. Fish and Wildlife
4034 Fairview Industrial Drive SE
Salem, OR 97302
(503) 947-6229

APPENDIX B – LABORATORY WATER QUALITY TESTING RESULTS

UNIBEST RESULTS:

Eco-Tracker™
Water Quality Monitoring Systems

Eco-Track Services
A division of UNIBEST International, LLC
500 Tausick Way
Walla Walla, WA 99362
1-509-525-3370
www.ecotrackservices.com
www.unibestinc.com

Report Date: 12/16/2021

Retailer Name: WWBWC
Submitter Name: Luke Adams
Email: luke.adams@wwbwc.org
City: Milton-Freewater
State: Oregon
Site Name: Eco-Tracker
Sample Date(s):

All results are in ppm in extracted solution.
These samples were extracted with 50ml 2M HCl.

Barcode	Sample ID	Depth Low (in.)	Depth High (in.)	Total N	NO3-N	NH4-N	Al	B	Ca	Cu	Fe	K	Mg	Mn	Na	P	S	Zn	pH
2102949	WQ1	0	8	7.220	1.120	6.100	0.350	0.010	5.250	0.010	0.180	1.540	1.710	0.010	4.230	0.110	14.460	0.010	0.000
2102691	GW_141	0	8	6.550	1.120	5.430	0.470	0.020	6.810	0.010	0.220	2.480	2.340	0.010	5.570	0.150	14.790	0.010	0.000
2102692	WQ2	0	8	6.410	1.120	5.290	0.430	0.010	4.660	0.010	0.120	1.280	1.550	0.010	3.950	0.150	14.120	0.010	0.000
2103019	GW_141 dup	0	8	6.550	1.120	5.430	0.320	0.010	6.030	0.020	0.110	1.960	2.130	0.010	4.980	0.140	14.660	0.010	0.000
2102832	GW_046	0	8	7.230	1.670	5.560	0.300	0.010	4.910	0.010	0.100	1.720	1.740	0.020	5.410	0.510	14.490	0.010	0.000
2103034	WQ3	0	8	15.480	1.990	13.490	0.320	0.010	4.870	0.010	0.120	1.280	1.620	0.010	4.160	0.120	13.750	0.010	0.000
2102664	GW_144	0	8	9.350	4.230	5.120	0.360	0.010	33.540	0.010	0.100	6.780	11.790	0.010	19.050	0.310	19.780	0.010	0.000
2102598	GW_171	0	8	7.050	1.830	5.220	0.340	0.010	20.130	0.010	0.100	4.530	7.010	0.010	8.400	0.150	16.730	0.010	0.000
2102967	WQ5	0	8	7.310	1.750	5.560	0.350	0.010	4.770	0.020	0.130	1.400	1.600	0.010	4.260	0.140	14.230	0.010	0.000
2102888	GW_152	0	8	10.130	4.750	5.380	0.430	0.010	18.830	0.010	0.380	3.080	6.490	0.100	10.150	0.400	15.630	0.010	0.000
2102819	GW_160	0	8	7.250	2.020	5.230	0.420	0.010	7.290	0.010	0.420	1.830	2.430	0.010	4.750	0.260	14.140	0.010	0.000
2102822	WQ4	0	8	8.330	2.740	5.590	0.330	0.010	4.670	0.010	0.130	1.350	1.560	0.010	4.030	0.130	14.180	0.010	0.000
2102812	GW_170	0	8	15.260	2.100	13.160	0.360	0.010	13.170	0.010	0.110	2.850	4.400	0.010	6.130	0.130	17.440	0.010	0.000
2102860	GW_151	0	8	12.050	6.460	5.590	0.360	0.010	12.990	0.010	0.110	3.030	4.240	0.010	7.090	0.360	19.390	0.010	0.000

Eco-Tracker™
Water Quality Monitoring Systems

Eco-Track Services
A division of UNIBEST International, LLC
1460 N. Louisana St. Suite A PMB 752
Kennewick, WA 99336
1-509-525-3370
www.ecotrackservices.com
www.unibestinc.com

Report Date: 8/11/2022

Retailer Name: WWBWC
Submitter Name: Luke Adams
Email: luke.adams@wwbwc.org
City: Milton-Freewater
State: Oregon
Site Name: Eco-Tracker
Sample Date(s): 05/24/2022 to 05/25/2022

All results are in ppm in extracted solution.
These samples were extracted with 50ml 2M HCl.

Barcode	Sample ID	Depth Low (in.)	Depth High (in.)	Total N	NO3-N	NH4-N	Al	B	Ca	Cu	Fe	K	Mg	Mn	Na	P	S	Zn	pH
2101301	GW_046			1.400	0.19	1.21	0.32	0.01	4.36	0.02	0.1	2.2	1.53	0.01	2.67	0.19	14.59	0.01	7.360
2101335	WQ4 Fruitvale			3.830	0.29	3.54	0.89	0.12	5.44	0.01	0.11	1.96	1.51	0.02	2.92	0.18	15.64	0.02	7.600
2101324	GW_170			4.600	3.31	1.29	0.33	0.01	17.67	0.02	0.08	4.63	6.45	0.01	9.41	0.2	22.07	0.02	6.640
2101248	WQ1 Zerba			2.900	0.12	2.78	0.3	0.01	4.16	0.01	0.18	1.97	1.4	0.01	2.47	0.18	16.07	0.02	7.990
2101388	WQ3 Huffman			1.960	0.2	1.76	0.31	0.02	5.85	0.02	0.12	2.43	2.04	0.02	3.7	0.18	14.76	0.02	8.590
2101379	WQ2 Duff			1.730	0.35	1.38	0.31	0.02	4.02	0.01	0.11	2.13	1.37	0.01	2.52	0.17	14.65	0.02	8.410
2101484	GW_160			13.120	1.73	11.39	0.36	0.02	8.05	0.02	0.1	3.04	2.75	0.02	4.13	0.21	16.1	0.01	6.650
2101365	GW_171			7.920	7.4	0.52	0.54	0.01	24.19	0.01	0.09	6.31	9.05	0.02	9.96	0.22	17.62	0.01	6.780
2101398	GW_152			4.510	3.34	1.17	0.35	0.01	15.15	0.02	0.11	3.87	5.57	0.01	9.44	0.19	16.69	0.02	6.960
2101319	WQ5 Eastside			2.000	0.4	1.6	0.35	0.02	3.91	0.01	0.1	1.97	1.33	0.01	2.52	0.19	15.68	0.01	7.510
2101226	GW_141			2.380	0.81	1.57	0.29	0.02	8.06	0.02	0.1	3.5	2.89	0.01	5.41	0.2	15.83	0.03	6.800
2101316	GW_141 Duplicate			1.560	0.58	0.98	0.31	0.02	6.89	0.01	0.11	3.05	2.53	0.02	4.57	0.19	15.95	0.03	6.800
2101338	GW_151			2.960	1.91	1.05	0.39	0.02	8.67	0.02	0.09	2.96	3.13	0.01	5.02	0.23	16.83	0.02	7.630
2101485	GW_144			21.440	16.35	5.09	0.39	0.01	37.66	0.01	0.09	9.76	14.57	0.02	29.67	0.24	21.8	0.02	6.840

ANATEK RESULTS:

Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

Client: Walla Walla Basin Watershed Council
Address: 810 S. Main Road
Milton-Freewater, OR 97862
Attn: Luke Adams

Work Order: MBL0200
Project: MAR (IOC)
Reported: 12/16/2021 12:53

Analytical Results Report

Sample Location: WQ1
Lab/Sample Number: MBL0200-01   Collect Date: 12/06/21 09:15
Date Received: 12/07/21 10:03   Collected By: Walla Walla Basin Watershed Council
Matrix: Water

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	0.100	mg/L	0.100	10	12/7/21 23:24	BKP	EPA 300.0	

Page 1 of 10

Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

Analytical Results Report

(Continued)

Sample Location:	GW_141		
Lab/Sample Number:	MBL0200-02	Collect Date:	12/06/21 09:53
Date Received:	12/07/21 10:03	Collected By:	Walla Walla Basin Watershed Council
Matrix:	Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	0.376	mg/L	0.100	10	12/7/21 23:46	BKP	EPA 300.0	

Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

Analytical Results Report

(Continued)

Sample Location:	GW_141 Duplicate		
Lab/Sample Number:	MBL0200-03	Collect Date:	12/06/21 09:55
Date Received:	12/07/21 10:03	Collected By:	Walla Walla Basin Watershed Council
Matrix:	Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	0.384	mg/L	0.100	10	12/8/21 0:07	BKP	EPA 300.0	

Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

Analytical Results Report

(Continued)

Sample Location:	WQ2		
Lab/Sample Number:	MBL0200-04	Collect Date:	12/06/21 10:15
Date Received:	12/07/21 10:03	Collected By:	Walla Walla Basin Watershed Council
Matrix:	Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	0.101	mg/L	0.100	10	12/8/21 0:29	BKP	EPA 300.0	

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Analytical Results Report

(Continued)

Sample Location:	GW_046		
Lab/Sample Number:	MBL0200-05	Collect Date:	12/06/21 11:05
Date Received:	12/07/21 10:03	Collected By:	Walla Walla Basin Watershed Council
Matrix:	Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	0.131	mg/L	0.100	10	12/8/21 0:50	BKP	EPA 300.0	

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Analytical Results Report

(Continued)

Sample Location:	WQ3		
Lab/Sample Number:	MBL0200-06	Collect Date:	12/06/21 11:30
Date Received:	12/07/21 10:03	Collected By:	Walla Walla Basin Watershed Council
Matrix:	Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	ND	mg/L	0.100	10	12/8/21 1:11	BKP	EPA 300.0	

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Analytical Results Report

(Continued)

Sample Location:	GW_144		
Lab/Sample Number:	MBL0200-07	Collect Date:	12/06/21 12:18
Date Received:	12/07/21 10:03	Collected By:	Walla Walla Basin Watershed Council
Matrix:	Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	7.52	mg/L	0.100	10	12/8/21 1:33	BKP	EPA 300.0	

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Analytical Results Report

(Continued)

Sample Location:	GW_171		
Lab/Sample Number:	MBL0200-08	Collect Date:	12/06/21 13:21
Date Received:	12/07/21 10:03	Collected By:	Walla Walla Basin Watershed Council
Matrix:	Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	3.52	mg/L	0.100	10	12/8/21 1:54	BKP	EPA 300.0	

Authorized Signature,

Justin Doty For Todd Taruscio, Laboratory Manager

PQL	Practical Quantitation Limit
ND	Not Detected
MCL	EPA's Maximum Contaminant Level
Dry	Sample results reported on a dry weight basis
*	Not a state-certified analyte

MBL0200

Due: 12/21/21

Anatek Labs, Inc.

Sample Receipt and Preservation Form

Client Name: Walla Walla Basin Water shed Council Project:

TAT: Normal RUSH: ______ days

Samples Received From: FedEx (UPS) USPS Client Courier Other: ______________

Custody Seal on Cooler/Box: Yes (No) Custody Seals Intact: Yes No (N/A)

Number of Coolers/Boxes: 1 Type of Ice: Ice/(Ice Packs) Blue Ice Dry Ice None

Packing Material: (Bubble Wrap) (Bags) Foam/Peanuts None Other: ______________

Cooler Temp As Read (°C): 3.6C Cooler Temp Corrected (°C): ______ Thermometer Used: IR-5

				Comments:
Samples Received Intact?	(Yes)	No	N/A	
Chain of Custody Present?	(Yes)	No	N/A	
Samples Received Within Hold Time?	(Yes)	No	N/A	
Samples Properly Preserved?	(Yes)	No	N/A	
VOC Vials Free of Headspace (<6mm)?	Yes	No	(N/A)	
VOC Trip Blanks Present?	Yes	No	(N/A)	
Labels and Chains Agree?	(Yes)	No	N/A	
Total Number of Sample Bottles Received:	8			

Chain of Custody Fully Completed?	(Yes)	No	N/A	
Correct Containers Received?	(Yes)	No	N/A	
Anatek Bottles Used?	(Yes)	No	Unknown	

Record preservatives (and lot numbers, if known) for containers below:

Notes, comments, etc. (also use this space if contacting the client - record names and date/time)

Nitrate - p 125ml x8

Received/Inspected By: ER Date/Time: 12/7/21 10:03

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Client:	Walla Walla Basin Watershed Council	Work Order:	MBL0273
Address:	810 S. Main Road	Project:	MAR
	Milton-Freewater, OR 97862	Reported:	12/16/2021 13:45
Attn:	Luke Adams		

Analytical Results Report

Sample Location:	WQ5		
Lab/Sample Number:	MBL0273-01	Collect Date:	12/07/21 08:50
Date Received:	12/08/21 09:12	Collected By:	x
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Nitrate-N	0.121	mg/L	0.100	12/9/21 17:57	BKP	EPA 300.0	H1

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Analytical Results Report

(Continued)

Sample Location: GW-152

Lab/Sample Number: MBL0273-02 Collect Date: 12/07/21 09:04

Date Received: 12/08/21 09:12 Collected By: x

Matrix: Water

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Nitrate-N	2.32	mg/L	0.100	12/9/21 17:35	BKP	EPA 300.0	H1

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Analytical Results Report

(Continued)

Sample Location:	GW-160		
Lab/Sample Number:	MBL0273-03	Collect Date:	12/07/21 09:47
Date Received:	12/08/21 09:12	Collected By:	x
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Nitrate-N	0.638	mg/L	0.100	12/9/21 15:48	BKP	EPA 300.0	H1

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Analytical Results Report

(Continued)

Sample Location:	WQ4		
Lab/Sample Number:	MBL0273-04	Collect Date:	12/07/21 10:25
Date Received:	12/08/21 09:12	Collected By:	x
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Nitrate-N	ND	mg/L	0.100	12/9/21 19:01	BKP	EPA 300.0	H1

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Analytical Results Report

(Continued)

Sample Location:	GW-170		
Lab/Sample Number:	MBL0273-05	Collect Date:	12/07/21 11:15
Date Received:	12/08/21 09:12	Collected By:	x
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Nitrate-N	1.31	mg/L	0.100	12/9/21 17:14	BKP	EPA 300.0	H1

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Analytical Results Report
(Continued)

Sample Location:	GW-151		
Lab/Sample Number:	MBL0273-06	Collect Date:	12/07/21 12:30
Date Received:	12/08/21 09:12	Collected By:	x
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Nitrate-N	2.72	mg/L	0.100	12/9/21 20:06	BKP	EPA 300.0	H1

Authorized Signature,

Justin Doty For Todd Taruscio, Laboratory Manager

H1	Sample analysis performed past holding time.
PQL	Practical Quantitation Limit
ND	Not Detected
MCL	EPA's Maximum Contaminant Level
Dry	Sample results reported on a dry weight basis
*	Not a state-certified analyte
RPD	Relative Percent Difference
%REC	Percent Recovery
Source	Sample that was spiked or duplicated.

Anatek Labs, Inc.

Sample Receipt and Preservation Form

MBL0273

Due: 12/22/21

Client Name: Walla Walla Basin Project:

TAT: (Normal) RUSH: ______ days

Samples Received From: FedEx (UPS) USPS Client Courier Other: ____________

Custody Seal on Cooler/Box: Yes (No) Custody Seals Intact: Yes No (N/A)

Number of Coolers/Boxes: 1 Type of Ice: (Ice/Ice Packs) Blue Ice Dry Ice None

Packing Material: Bubble Wrap Bags Foam/Peanuts None Other: ____________

Cooler Temp As Read (°C): ~~3.~~ 3.1 EEJI Cooler Temp Corrected (°C): – Thermometer Used: IR-5

				Comments:
Samples Received Intact?	(Yes)	No	N/A	
Chain of Custody Present?	(Yes)	No	N/A	
Samples Received Within Hold Time?	(Yes)	No	N/A	
Samples Properly Preserved?	(Yes)	No	N/A	
VOC Vials Free of Headspace (<6mm)?	Yes	No	(N/A)	
VOC Trip Blanks Present?	Yes	No	(N/A)	
Labels and Chains Agree?	(Yes)	No	N/A	
Total Number of Sample Bottles Received: 6				

Chain of Custody Fully Completed?	(Yes)	No	N/A	
Correct Containers Received?	(Yes)	No	N/A	
Anatek Bottles Used?	(Yes)	No	Unknown	

Record preservatives (and lot numbers, if known) for containers below:

Notes, comments, etc. (also use this space if contacting the client - record names and date/time)

Nitrate – p125mL x 6

Received/Inspected By: JI Date/Time: 12/8/21 9:12

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Client: Walla Walla Basin Watershed Council
Address: 810 S. Main Road
Milton-Freewater, OR 97862
Attn: Luke Adams

Work Order: MCE0766
Project: Walla Walla River
Reported: 5/31/2022 10:06

Analytical Results Report

System ID#
Reference Number: MCE0766-01
Multiple Source Nos:
Date Received: 05/25/22 09:21
Sample Location: GW-170
Matrix: Drinking Water

System Name: Walla Walla Basin Watershed Council
Collect Date: 05/24/22 10:33
Sample Type:
Sample Purpose:

DOH Source #:
County:

Lab/Sample Number: 125-76601

Inorganics

DOH #	Analyte	Result	Units	LRL	SDRL	Trigger	MCL	Analyzed	Analyst	Method	Qualifier
0020	Nitrate-N	2.91	mg/L	0.100	0.5	5	10	5/25/22 15:07	BKP	EPA 300.0	

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Client:	Walla Walla Basin Watershed Council	Work Order:	MCE0766
Address:	810 S. Main Road	Project:	Walla Walla River
	Milton-Freewater, OR 97862	Reported:	5/31/2022 10:06
Attn:	Luke Adams		

Analytical Results Report

System ID#		System Name:	Walla Walla Basin Watershed Council		
Reference Number:	MCE0766-02	Collect Date:	05/24/22 11:17	DOH Source #:	
Multiple Source Nos:		Sample Type:		County:	
Date Received:	05/25/22 09:21	Sample Purpose:			
Sample Location:	GW-151				
Matrix:	Drinking Water				

Lab/Sample Number: 125-76602

Inorganics

DOH #	Analyte	Result	Units	LRL	SDRL	Trigger	MCL	Analyzed	Analyst	Method	Qualifier
0020	Nitrate-N	1.59	mg/L	0.100	0.5	5	10	5/25/22 16:12	BKP	EPA 300.0	

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Client:	Walla Walla Basin Watershed Council	Work Order:	MCE0766
Address:	810 S. Main Road	Project:	Walla Walla River
	Milton-Freewater, OR 97862	Reported:	5/31/2022 10:06
Attn:	Luke Adams		

Analytical Results Report

System ID#		System Name:	Walla Walla Basin Watershed Council		
Reference Number:	MCE0766-03	Collect Date:	05/24/22 08:46	DOH Source #:	
Multiple Source Nos:		Sample Type:		County:	
Date Received:	05/25/22 09:21	Sample Purpose:			
Sample Location:	GW-141				
Matrix:	Drinking Water				

Lab/Sample Number: 125-76603

Inorganics

DOH #	Analyte	Result	Units	LRL	SDRL	Trigger	MCL	Analyzed	Analyst	Method	Qualifier
0020	Nitrate-N	0.633	mg/L	0.100	0.5	5	10	5/25/22 16:33	BKP	EPA 300.0	

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Client: Walla Walla Basin Watershed Council
Address: 810 S. Main Road
Milton-Freewater, OR 97862
Attn: Luke Adams

Work Order: MCE0766
Project: Walla Walla River
Reported: 5/31/2022 10:06

Analytical Results Report

System ID#
Reference Number: MCE0766-04
Multiple Source Nos:
Date Received: 05/25/22 09:21
Sample Location: GW-141 Duplicate
Matrix: Drinking Water

System Name: Walla Walla Basin Watershed Council
Collect Date: 05/24/22 08:50
Sample Type:
Sample Purpose:

DOH Source #:
County:

Lab/Sample Number: 125-76604

Inorganics

DOH #	Analyte	Result	Units	LRL	SDRL	Trigger	MCL	Analyzed	Analyst	Method	Qualifier
0020	Nitrate-N	0.622	mg/L	0.100	0.5	5	10	5/25/22 16:55	BKP	EPA 300.0	

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Client:	Walla Walla Basin Watershed Council	Work Order:	MCE0766
Address:	810 S. Main Road	Project:	Walla Walla River
	Milton-Freewater, OR 97862	Reported:	5/31/2022 10:06
Attn:	Luke Adams		

Analytical Results Report

System ID#		System Name:	Walla Walla Basin Watershed Council		
Reference Number:	MCE0766-05	Collect Date:	05/24/22 09:31	DOH Source #:	
Multiple Source Nos:		Sample Type:		County:	
Date Received:	05/25/22 09:21	Sample Purpose:			
Sample Location:	GW-046				
Matrix:	Drinking Water				

Lab/Sample Number: 125-76605

Inorganics

DOH #	Analyte	Result	Units	LRL	SDRL	Trigger	MCL	Analyzed	Analyst	Method	Qualifier
0020	Nitrate-N	0.152	mg/L	0.100	0.5	5	10	5/25/22 17:16	BKP	EPA 300.0	

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Client: Walla Walla Basin Watershed Council
Address: 810 S. Main Road
Milton-Freewater, OR 97862
Attn: Luke Adams

Work Order: MCE0766
Project: Walla Walla River
Reported: 5/31/2022 10:06

Analytical Results Report

System ID#
Reference Number: MCE0766-06
Multiple Source Nos:
Date Received: 05/25/22 09:21
Sample Location: WQ 1
Matrix: Drinking Water

System Name: Walla Walla Basin Watershed Council
Collect Date: 05/24/22 07:45
Sample Type:
Sample Purpose:

DOH Source #:
County:

Lab/Sample Number: 125-76606

Inorganics

DOH #	Analyte	Result	Units	LRL	SDRL	Trigger	MCL	Analyzed	Analyst	Method	Qualifier
0020	Nitrate-N	ND	mg/L	0.100	0.5	5	10	5/25/22 17:37	BKP	EPA 300.0	

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Client: Walla Walla Basin Watershed Council
Address: 810 S. Main Road
Milton-Freewater, OR 97862
Attn: Luke Adams

Work Order: MCE0766
Project: Walla Walla River
Reported: 5/31/2022 10:06

Analytical Results Report

System ID#
Reference Number: MCE0766-07
Multiple Source Nos:
Date Received: 05/25/22 09:21
Sample Location: WQ 4
Matrix: Water

System Name: Walla Walla Basin Watershed Council
Collect Date: 05/24/22 10:00
DOH Source #:
Sample Type:
County:
Sample Purpose: RC - Routine/Compliance Sample

Lab/Sample Number: 125-76607

Inorganics

DOH #	Analyte	Result	Units	LRL	SDRL	Trigger	MCL	Analyzed	Analyst	Method	Qualifier
0020	Nitrate-N	ND	mg/L	0.100	0.5	5	10	5/25/22 17:59	BKP	EPA 300.0	

Authorized Signature,

Justin Doty For Todd Taruscio, Laboratory Manager

LRL	Lab Reporting Limit
SDRL	State Detection Reporting Limit
ND	Not Detected
MCL	EPA's Maximum Contaminant Level
Dry	Sample results reported on a dry weight basis
SAL	State Action Level
*	Not a certified analyte

MCE0766

Due: 06/09/22

Anatek Labs, Inc.

Sample Receipt and Preservation Form

Client Name: Walla Walla Watershed Council

TAT: (Normal) RUSH: ______ days

Samples Received From: FedEx (UPS) USPS Client Courier Other: ______

Custody Seal on Cooler/Box: Yes (No) Custody Seals Intact: Yes No (N/A)

Number of Coolers/Boxes: 1 Type of Ice: (Wet Ice) Ice Packs Dry Ice None

Packing Material: (Bubble Wrap) Bags Foam/Peanuts Paper None Other: ______

Cooler Temp As Read (°C): 3.3 Cooler Temp Corrected (°C): - Thermometer Used: IR-5

				Comments:
Samples Received Intact?	(Yes)	No	N/A	
Chain of Custody Present?	(Yes)	No	N/A	
Samples Received Within Hold Time?	(Yes)	No	N/A	
Samples Properly Preserved?	Yes	No	(N/A)	
VOC Vials Free of Headspace (<6mm)?	Yes	No	(N/A)	
VOC Trip Blanks Present?	Yes	No	(N/A)	
Labels and Chains Agree?	(Yes)	No	N/A	
Total Number of Sample Bottles Received: 7				

Chain of Custody Fully Completed?	(Yes)	No	N/A	
Correct Containers Received?	(Yes)	No	N/A	
Anatek Bottles Used?	(Yes)	No	Unknown	

Record preservatives (and lot numbers, if known) for containers below:

Notes, comments, etc. (also use this space if contacting the client - record names and date/time)

Nitrate - p125mL x7

Received/Inspected By: JLT Date/Time: 5/25/22 9:21

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Client:	Walla Walla Basin Watershed Council	Work Order:	MCE0822
Address:	810 S. Main Road	Project:	Nitrate
	Milton-Freewater, OR 97862	Reported:	6/8/2022 09:58
Attn:	Luke Adams		

Analytical Results Report

Sample Location:	GW-160		
Lab/Sample Number:	MCE0822-01	Collect Date:	05/25/22 08:41
Date Received:	05/26/22 09:37	Collected By:	LA
Matrix:	Drinking Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	1.57	mg/L	0.100	10	5/26/22 18:04	BKP	EPA 300.0	

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Analytical Results Report

(Continued)

Sample Location: WQ 3

Lab/Sample Number: MCE0822-02 Collect Date: 05/25/22 09:39

Date Received: 05/26/22 09:37 Collected By: LA

Matrix: Drinking Water

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	0.161	mg/L	0.100	10	5/26/22 20:34	BKP	EPA 300.0	

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Analytical Results Report

(Continued)

Sample Location:	WQ 5		
Lab/Sample Number:	MCE0822-03	Collect Date:	05/25/22 07:43
Date Received:	05/26/22 09:37	Collected By:	LA
Matrix:	Drinking Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	0.135	mg/L	0.100	10	5/26/22 17:21	BKP	EPA 300.0	

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Analytical Results Report

(Continued)

Sample Location:	WQ 2		
Lab/Sample Number:	MCE0822-04	Collect Date:	05/25/22 09:22
Date Received:	05/26/22 09:37	Collected By:	LA
Matrix:	Drinking Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	ND	mg/L	0.100	10	5/26/22 20:55	BKP	EPA 300.0	

Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

Analytical Results Report

(Continued)

Sample Location:	GW_152		
Lab/Sample Number:	MCE0822-05	Collect Date:	05/25/22 08:10
Date Received:	05/26/22 09:37	Collected By:	LA
Matrix:	Drinking Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	2.35	mg/L	0.100	10	5/26/22 17:42	BKP	EPA 300.0	

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Analytical Results Report

(Continued)

Sample Location:	GW_171		
Lab/Sample Number:	MCE0822-06	Collect Date:	05/25/22 11:13
Date Received:	05/26/22 09:37	Collected By:	LA
Matrix:	Drinking Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	6.81	mg/L	0.100	10	5/26/22 18:25	BKP	EPA 300.0	

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Analytical Results Report

(Continued)

Sample Location:	GW_144		
Lab/Sample Number:	MCE0822-07	Collect Date:	05/25/22 10:22
Date Received:	05/26/22 09:37	Collected By:	LA
Matrix:	Drinking Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Nitrate-N	10.1	mg/L	1.00	10	5/27/22 14:31	BKP	EPA 300.0	H2

Authorized Signature,

Justin Doty For Todd Taruscio, Laboratory Manager

H2	Initial analysis within holding time, Reanalysis for the required dilution was past holding time.
PQL	Practical Quantitation Limit
ND	Not Detected
MCL	EPA's Maximum Contaminant Level
Dry	Sample results reported on a dry weight basis
*	Not a state-certified analyte
RPD	Relative Percent Difference
%REC	Percent Recovery
Source	Sample that was spiked or duplicated.

MCE0822

Due: 06/10/22

Anatek Labs, Inc.

Sample Receipt and Preservation Form

Client Name: Walla Walla Basin WSC

TAT: (Normal) RUSH: ______ days

Samples Received From: FedEx (UPS) USPS Client Courier Other: ______

Custody Seal on Cooler/Box: Yes (No) Custody Seals Intact: Yes No (N/A)

Number of Coolers/Boxes: 1 Type of Ice: (Wet Ice) (Ice Packs) Dry Ice None

Packing Material: Bubble Wrap Bags Foam/Peanuts Paper (None) Other: ______

Cooler Temp As Read (°C): 5.4 Cooler Temp Corrected (°C): - Thermometer Used: IR-5

				Comments
Samples Received Intact?	(Yes)	No	N/A	
Chain of Custody Present?	(Yes)	No	N/A	
Samples Received Within Hold Time?	(Yes)	No	N/A	
Samples Properly Preserved?	Yes	No	(N/A)	
VOC Vials Free of Headspace (<6mm)?	Yes	No	(N/A)	
VOC Trip Blanks Present?	Yes	No	(N/A)	
Labels and Chains Agree?	(Yes)	No	N/A	
Total Number of Sample Bottles Received: 7				

Chain of Custody Fully Completed?	(Yes)	No	N/A	
Correct Containers Received?	(Yes)	No	N/A	
Anatek Bottles Used?	(Yes)	No	Unknown	

Record preservatives (and lot numbers, if known) for containers below:

Notes, comments, etc. (also use this space if contacting the client - record names and date/time)

Nitrate - p125mL x7

Received/Inspected By: JLL Date/Time: 5/26/22 9:37

Form F19.00 - Eff 8 Feb 2019

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PACIFIC AG LAB RESULTS:

PACAGLAB.COM
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21830 S.W. Alexander Ln
Sherwood, OR 97140

Matrix SCIENCES | PAL PACIFIC AGRICULTURAL LABORATORY

Walla Walla Basin Watershed Council
810 S. Main Street
Milton-Freewater, OR 97862

Report Number: P220689
Report Date: June 10, 2022
Client Project ID: [none]

Analytical Report

Client Sample ID: GW-144
Matrix: water

PAL Sample ID: P220689-01
Sample Date: 5/25/22
Received Date: 5/27/22

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes
Method: Modified EPA 8270D (GC-MS/MS)					
6/01/22	6/1/22	Chlorpyrifos	ND	0.060 ug/L	
6/01/22	6/1/22	Malathion	ND	0.060 ug/L	
Surrogate Recovery: 104 %					
Surrogate Recovery Range: 60-141					
(TPP-d15 used as Surrogate)					
Method: Modified EPA 8321B (LC-MS/MS)					
6/01/22	6/3/22	Azinphos-methyl	ND	0.12 ug/L	
6/01/22	6/3/22	DCPMU	ND	0.060 ug/L	
6/01/22	6/3/22	Diuron	ND	0.060 ug/L	
Surrogate Recovery: 102 %					
Surrogate Recovery Range: 69-120					
(TPP-d15 used as Surrogate)					

Kara Greer, Project Manager

This analytical report complies with the ISO/IEC 17025:2017 Quality Standard.

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Sherwood, OR 97140

Walla Walla Basin Watershed Council
810 S. Main Street
Milton-Freewater, OR 97862

Report Number: P220689
Report Date: June 10, 2022
Client Project ID: [none]

Analytical Report

Client Sample ID: GW-171
Matrix: water

PAL Sample ID: P220689-02
Sample Date: 5/25/22
Received Date: 5/27/22

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes
Method: Modified EPA 8270D (GC-MS/MS)					
6/01/22	6/1/22	Chlorpyrifos	ND	0.060 ug/L	
6/01/22	6/1/22	Malathion	ND	0.060 ug/L	

Surrogate Recovery: 104 %
Surrogate Recovery Range: 60-141
(TPP-d15 used as Surrogate)

Extraction Date	Analysis Date	Analyte	Amount Detected	Limit of Quantitation	Notes
Method: Modified EPA 8321B (LC-MS/MS)					
6/01/22	6/3/22	Azinphos-methyl	ND	0.12 ug/L	
6/01/22	6/3/22	DCPMU	ND	0.060 ug/L	
6/01/22	6/3/22	Diuron	ND	0.060 ug/L	

Surrogate Recovery: 105 %
Surrogate Recovery Range: 69-120
(TPP-d15 used as Surrogate)

Kara Greer, Project Manager

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Sherwood, OR 97140

Walla Walla Basin Watershed Council
810 S. Main Street
Milton-Freewater, OR 97862

Report Number: P220689
Report Date: June 10, 2022
Client Project ID: [none]

Kara Greer, Project Manager

This analytical report complies with the ISO/IEC 17025:2017 Quality Standard.