TECHNICAL MEMORANDUM

Date:	May 28, 2020
То:	Lindsey Ozbolt, Planning Official Dan Carlson, Director of Kittitas County Community Development Services
From:	Al Wald, Senior Hydrogeologist Nathan Boroughs, GIS Analyst Mike Thai, Environmental Scientist
Project Name:	Kittitas CAO Update
Project Number:	181229



Subject: Critical Aquifer Recharge Area Remapping

The purpose of this memorandum is to update the 2014 Critical Aquifer Recharge Areas (CARA) delineation for Group B public drinking water supply systems (Group B systems) in Kittitas County, WA. The report includes review of a previous delineation, additional analysis of aquifer characteristics, and subsequent recommendations for map changes. Title 17A of Kittitas County Code, Critical Areas Ordinance (CAO), contains the CARA regulations.

Location

Kittitas County is located east of the Cascade crest in central Washington state, between Chelan County to the north and Yakima County to the south. Much of the study area lies along the Yakima River and its tributaries which drain from the crest of the Cascade Mountains to the Yakima River canyon below Ellensburg (Figure 1).

Kittitas County is on the western margin of the Columbia Plateau Geographic Province and includes geologic elements of the Yakima Fold Belt Subprovince. It includes areas of three major watersheds: WRIA 38 (Naches), WRIA 39 (Upper Yakima), and WRIA 40 (Alkali-Squilchuck). The county is 2,333 square miles in area with a 2018 population of 47,364 residents (<u>https://www.co.kittitas.wa.us/).</u>

Geology

The geology of Kittitas County is characterized by metamorphic and volcanic bedrock in the foothills of the Cascade Mountains, the Columbia River Basalt Group along the Columbia River to the southeast, and valley-fill deposits in the Kittitas Valley along the Yakima River (Figure 2).

The Kittitas and Roslyn Basins are synclinal valleys between prominent anticlinal ridges (USGS, 1963; USGS, 2009). They are separated by the Lookout Mountain bedrock feature. The Kittitas Basin (KB) area is about 270 square miles with a maximum thickness of 700 ft. The Roslyn Basin (RB) area is about 70 square miles with a maximum thickness of 2,010 ft. Each structural basin is a topographic basin and a groundwater subbasin (USGS, 1963).

Valley-fill deposits are typically unconsolidated to weakly consolidated glacial, glacio-fluvial, lacustrine, and alluvial sediments interspersed with landslide deposits, talus, loess, and ash layers (USGS, 2014). Valley-fill stratigraphy is typically Ellensburg Formation (confined), with overlying Thorp Gravel and Fan deposits (unconfined), with overlying surficial alluvium or glaciofluvial materials (unconfined) (USBR, 2011).

A geologic profile shows the relative thickness and composition of the strata in cross-section (Figure 3).

Hydrogeology

Groundwater occurs in fracture zones in the bedrock and basalt units, semi-consolidated sand and gravels in the Ellensburg Formation, and unconsolidated valley-fill deposits (WDOE, 1985). Consolidated bedrock in the Cascade Range is basically devoid of water (ibid). Specific capacity (a measure of potential well yields) for wells in the bedrock is generally less than 0.001 gpm/ft of depth. Specific capacity for wells in the basalt and valley-fill deposits are generally 0.9 and 2.8 gpm/ft, respectively (USGS, 2009).

The water table gradient, or horizontal direction of groundwater movement is from upslope recharge to discharge in the Yakima River and its tributaries. Water table gradients downslope generally follow the steeper topographic gradients (USBR, 2011). Groundwater contours and depth-to-water records for wells in the Kittitas Reclamation District suggest the valley-fill deposits are recharged from east Kittitas Valley (USBR, 2013). Ambient vertical hydraulic gradients in the upslope areas show increasing depth to water with increasing well depth (decreasing hydraulic head with depth) typical of groundwater recharge (USBR, 2011). Much of the recharge from deep percolation of runoff, snowmelt, and canal leakage drains to local streams and the Yakima River. Regional groundwater recharge to deeper units is generally on long flow paths, on the order of 5 to 50 miles, with travel times of 10's to 100's of years (USGS, 2009).

Increasing water levels with depth (increasing vertical hydraulic gradients) in wells in the lower valley result from geostatic pressure of overlying strata and hydrostatic pressure from uplifted

strata in the anticlines. The Kittitas Basin around the City of Ellensburg has one of highest concentrations of flowing artesian wells in the Columbia Plateau Province (WDOE, 1961). The depth of flowing artesian wells ranges from 50 to 400 feet with specific capacities of 5.4 to 9.5 gpm/ft of drawdown. Wells in the Thorp gravels and Ellensburg Formation may have contributing artesian conditions due to water-bearing zones of sands and gravels with high primary porosity confined beneath layers of lacustrine silts, ash deposits, and glacial till. The units have low susceptibility to contamination from surface sources due to increasing hydraulic heads with depth and semi-consolidated clay-shale or ash layers which limit deep percolation and vertical conductivity.

Well Logs

See the well logs (Figures 6 - 8) for a description of the general lithology of bedrock, basalt, and valley-fill strata.

https://appswr.ecology.wa.gov/wellconstruction/map/WCLSWebMap/default.aspx

CARA Criteria

Much of Kittitas County does not meet the criteria for classification of critical aquifer recharge areas. National Forests, Wilderness Areas, and the Yakima Firing Range are in federal jurisdiction. State parks and wildlife areas are in state jurisdiction. Incorporated cities and towns are in local jurisdiction and usually have their own CAO programs. WRIA 38 (Naches) has little development, one Group B system of very low susceptibility, and does not meet the criteria for classification of critical aquifer recharge areas. WRIA 40 (Alkali-Squilchuck) has very little development, only a few Group B systems along the Columbia River, and does not meet the criteria for classification of critical aquifer recharge areas. There are no identified Sole-Source Aquifers in Kittitas County (EPA, 2020). Aquifers in bedrock units with low vertical hydraulic conductivity (on the order of 0.0005 ft/day) and limited fracture permeability do not meet susceptibility criteria for critical aquifer recharge areas. Aquifers in basalt units with low vertical hydraulic conductivity (on the order of .01 ft/day) and massive basalt flows with semiconsolidated, low permeability interbeds do not meet susceptibility criteria for critical aquifer recharge areas.

Group A public drinking water supply systems (Group A systems), municipal water utilities, and incorporated water districts are regulated under Chapter 246-290 WAC by Washington State Department of Health (DOH). DOH source water protection programs for Group A systems require regular monitoring and reporting to assure water quality meets state standards. Proposed well locations are reviewed for time of travel calculations, delineation of wellhead protection areas, and other siting criteria (WAC 246-100). Single-family domestic wells are exempt from water right permitting requirements but are regulated by Washington Department of Ecology driller licensing and well construction standards. Exempt wells are typically dispersed locations with relatively low withdrawal rates. Group A systems and exempt wells do not typically meet vulnerability criteria for critical aquifer recharge areas.

Groups B public drinking water supply systems (Group B systems) are regulated under Chapter 245-291 WAC by DOH. Group B system wells require a minimum sanitary control area of 100 ft and sanitary seals for well casings to prevent surface contamination from reaching local sources. Group B systems with 10 to 14 service connections are regulated by DOH, Office of Drinking Water Programs. Group B systems with less than 10 service connections are regulated under county health programs. There are about 373 Group B systems in Kittitas County.

New developments in critical aquifer recharge areas are reviewed by the county and subject to CARA requirements where a spill incident, waste water infiltration, or significant groundwater withdrawal could result in contamination of public drinking water supplies. CARA reviews typically include hydrogeologic assessment of aquifer susceptibility (based on stratigraphy and hydrogeologic factors) and vulnerability (based on structural controls, geologic controls, and risk of contamination). Potential sources of contamination of wells in critical aquifer recharge areas include septic systems, landfills, stormwater infiltration basins, leaking underground storage tanks, and injection wells used for waste disposal.

CARA Recommendations for Kittitas County

Based on this study, a proposed update to the Critical Aquifer Recharge Areas delineation for Kittitas County includes local recharge areas for unconsolidated aquifers in valley-fill deposits of the Roslyn and Kittitas Basins, as shown in Figure 5.

Wells in these aquifers have low to medium susceptibility to groundwater quality impacts, depending on local hydraulic gradients, relative conductivity of water-bearing zones, and distance from contamination sources. Review and approval of developments with potential water quality impacts to Group B systems in these areas should require hydrogeologic assessment of siting criteria and potential sources of contamination according to critical areas regulations.

The Watershed Company CARA Remapping Memo Page 5 of 15

Figures

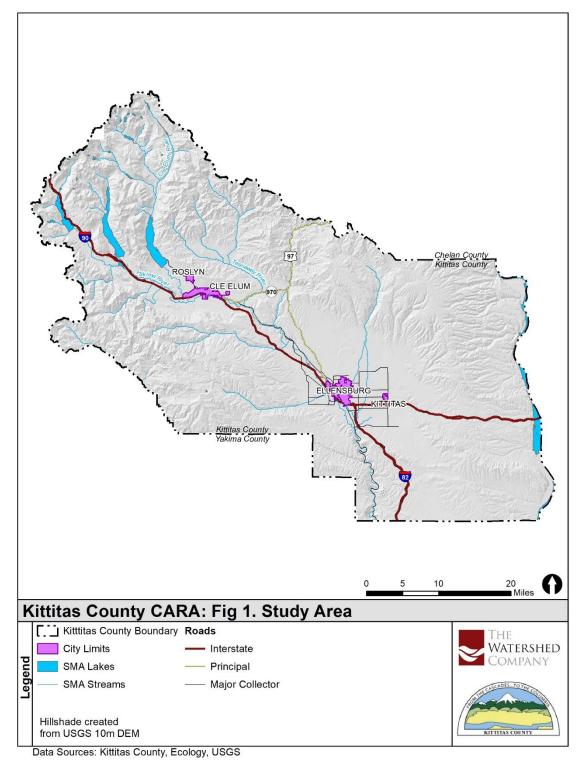


Figure 1. Study area. General location and simplified geology along the upper Yakima River.

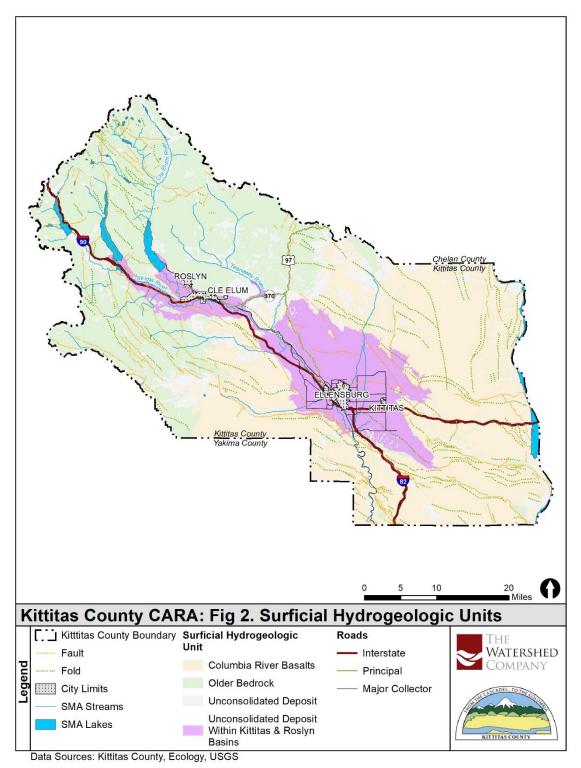


Figure 2. Surficial hydrogeologic units showing unconsolidated valley-fill deposits of the Kittitas and Roslyn Basins.

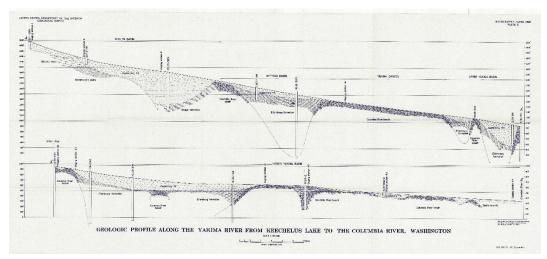
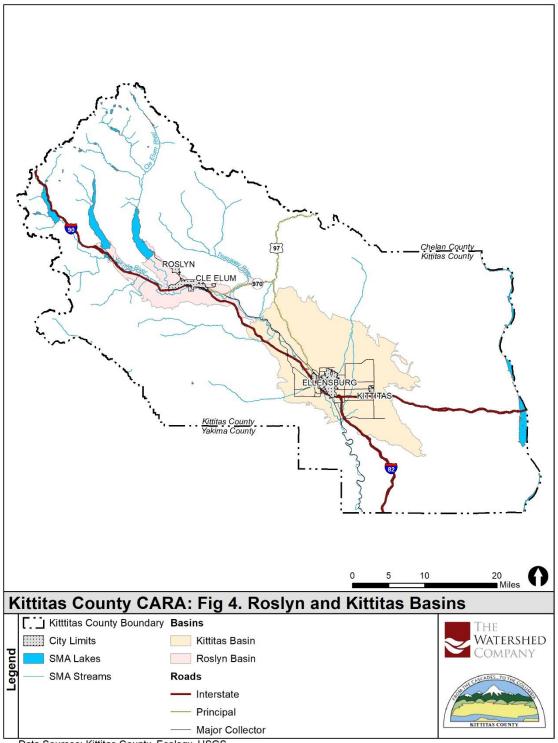


Figure 3. Cross-sections showing relative depth of Quaternary fill and associated strata in the Kittitas and Roslyn Basins (USGS,1963)



Data Sources: Kittitas County, Ecology, USGS

Figure 4. Showing the Roslyn and Kittitas Basins separately.

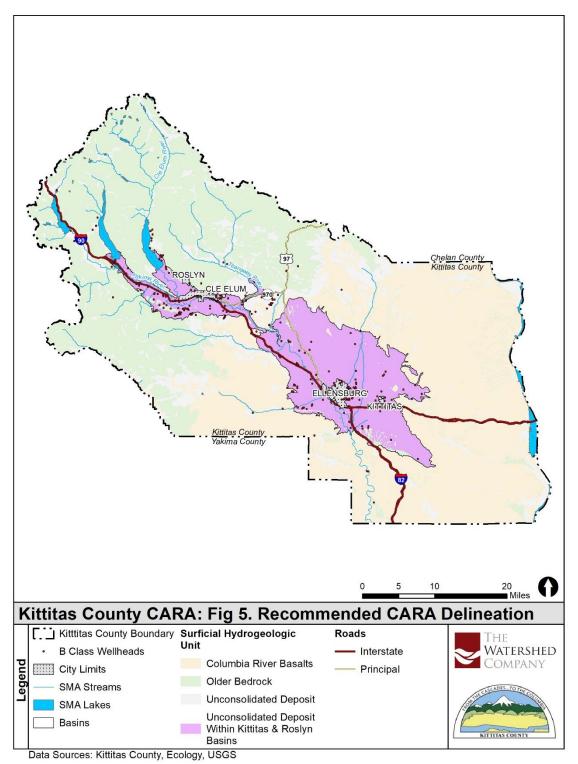


Figure 5. Recommended CARA delineation, Kittitas County, WA.

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Figure 6. Well log for bedrock strata (note changes in lithology at 29 and 150 ft).

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Figure 7. Well log for basalt strata (note change in lithology at 290 ft).

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Antesian water is controlled by f10WS 30 gpm (Cap valve etc) WELL CONSTRUCTION CERTIFICATION (9) WELL TESTS Drawdown is amount water level is lowered below static level Was a pump test made? X§ Yes □ No If yes by whon? HDI & R & N Yieldgal/min withft drawdown afterhrs Yieldgal/min withft drawdown afterhrs Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level) I constructed and/or accept responsibility for construction of this well and compliance with all Washington well construction standards. Matenals and the information reported above are true to my best knowledge and the second pair of Corporation) (Type of Print) NAME HOKKAIDO DRILLING, INC (Person Firm or Corporation) (Type of Print) Addrass P 0 BOX 100, GRAHAM, WA 9833 Time Water Level Time Water Level 14 min f10Ws	5	Static levelest		above mean sea level ft_below top of well	2050 _{Date} 2/28/2000	<u>_</u> *	Work Started _1/15/2000 Complete		000	
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Figure 8. Well log for valley-fill strata (note changse in lithology at 44 and 228 ft).

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