

Hydrogeologic Assessment of the water-supply well at Keller Ferry Campground, Lake Roosevelt National Recreation Area

Keller Ferry Campground is located on the south shore of Lake Roosevelt directly opposite the mouth of Sanpoil Bay (Figure 1). The campground was developed on the point of a large terrace just above 1,300-foot elevation immediately west of the ferry landing. The campground is about 25 miles east of Grand Coulee or 15 miles north of Wilbur, WA. The campground has 55 sites and is open all year long, but the water system is only available seasonally from May to September. The campground has vault toilets scattered throughout the area and flush toilets in a comfort station at the campground.

The water system consists of a drilled well, submersible pump, and continuous disinfection. Water is pumped to a 2,000-gallon storage tank and a series of pressure tanks (Figure 2). It is then distributed to a comfort station, a fish cleaning station, a trailer dump station, and several hosebibs scattered throughout the campground. An undetermined quantity of water is used for irrigation in the campground and day-use area.



Figure 1. Location of Keller Ferry Campground.

Water is supplied to facilities at Gifford campground from an 8-inch, 131-foot well that was constructed by Bach Drilling in July 1971. The well is screened with five feet of 0.040" slot. The well is 95 feet from the normal full-pool shoreline of the lake.



Figure 2. Keller Ferry campground well is inside a building at the campground. The building also houses the chlorinator, a storage tank to provide chlorine contact time, and several pressure tanks.

There may be some confusion regarding well records in the WA Dept. of Ecology database for this site. In the database (accessed on May 16, 2014), tag # AFA238 is assigned to a 43-foot dug well (30" diameter) that was constructed in 1959. Additionally, the same well tag is assigned to a well in Snohomish County (Keith Gentry, owner).

The drillers log for the well showed;

Sand and silt.....	0-10 feet
Sand and some cobbles	10-120 feet
Sand and gravel, good water-bearing.....	120-131 feet

Water use at the Keller Ferry campground is fairly constant through the summer months (Figure 3). Average daily use is 25,000 gallons/day, or 17 gallons/minute.

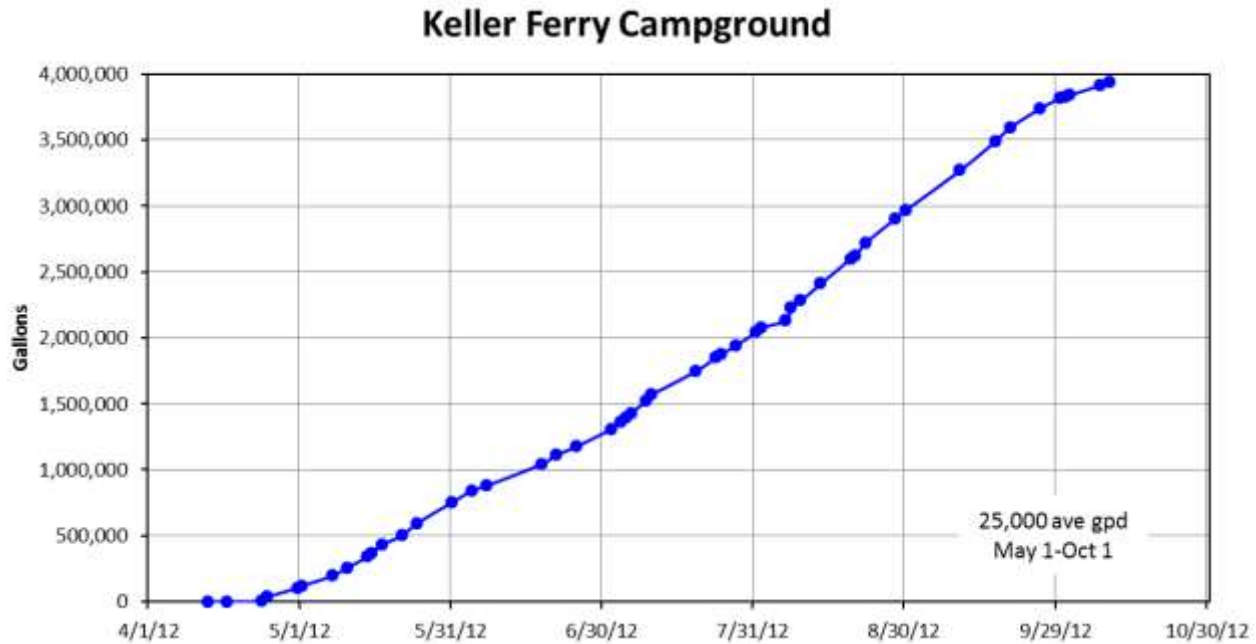


Figure 3. Water use at the Keller Ferry campground, 2012.

Pumping from the well is not great enough to induce rapid flow of water from the reservoir to the well. However, park staff have noted in the past that the water level in the well varies with the water level in the reservoir. Thus, it is likely that groundwater pumped from the well is recharged by lateral infiltration from the reservoir.

A pumping test of the well was conducted in February 1989 in response to complaints about the reliability of the supply from the well and water quality (Nessen Engineering, 1989). The investigation determined that;

- The concern about the quality of water being supplied to houseboats on the lake was not due to the quality of groundwater being pumped from the well. Rather, it was due to failure to regularly flush and disinfect the water storage tanks on the houseboats.
- The maximum pumping rate for the well should be limited to 122 gpm. This rate was determined from the optimal entrance velocity of water through the well screen of 0.1 ft/sec and the size of the screen openings.
- The reported water shortages during August of the preceding years was due to operational failure and the design of the water system. Water for the irrigation system was routed through the hydropneumatic tank, which became airlocked when water was flowing through the system at a fast rate to supply irrigation water.

Geology

The well at Keller Ferry campground was developed on a point of a large terrace just above 1,300-foot altitude immediately west of the ferry landing (Figure 4). The campground is on a terrace which is underlain by a sand and gravel channel deposit (Figure 5). The deposit becomes coarser toward the center of the lake.



Figure 4. GoogleEarth view of Keller Ferry Campground area. View is to the northeast.

The geologic map (Figure 5) of Kiver and Stradling (1995) describes the material underlying the campground area as;

Qes/Qa - Quaternary eolian sand over Quaternary alluvial fan deposits

The unit immediately to the southeast is mapped as;

Qa - Quaternary alluvial fan deposit

The alluvial fan in this area is rather large, more than a mile wide and at least a half mile long (north-south). Further to the south the next geologic unit is labeled on the map as;

Qem/Qfg/Qlz - Quaternary eolian silt over Quaternary flood gravel over Quaternary flood cobbles (mostly coarse gravel to cobbles) over Quaternary lacustrine clay and/or silt interbedded sand.



Figure 5. Surficial geology in the vicinity of Keller Ferry campground.
From NPS Geologic Resources Inventory Program. (2009).

It appears that during the large megafloods, sediment was deposited on the downstream side of the bedrock outcrops. Subsequent erosion of the sediment toward the river resulted in formation of an alluvial fan overlying the flood deposits. The area closest to the river was then covered by eolian sand.

Other wells in the area

A well was constructed near the ferry landing, a short distance east of the campground. The well penetrated sand and gravel all the way to bedrock which is 154 feet below high-water level in Roosevelt Lake. The bedrock surface is probably even deeper below the campground area (Anderson, 1969).

NPS constructed a well south of the marina in 1989 to provide water for the marina, store, and associated facilities. The well is 160 feet deep and is screened in a sand and gravel zone from 145-160 feet. This well has a tag number of AFA213.

Alternative Water Sources for Keller Ferry Campground

It is likely that a deeper well could be constructed in the campground area that would obtain water from greater depth. Additionally, locating a new well farther from the reservoir (and drilling deeper) would lessen concerns about groundwater interconnection with the surface water of the reservoir. Neither of these alternatives would alleviate the concerns regarding the potential for groundwater in the area to be hydraulically connected with surface water in the reservoir.

Conclusions

Groundwater pumped from the well at Keller Ferry campground is most likely from lateral infiltration of water from the reservoir into the sediments underlying the area. Water levels in the well fluctuate in response to the elevation of the water surface in the reservoir, providing a fairly good indication that the reservoir is the source of water for the well. Therefore, we must assume that the water pumped from the well is hydraulically connected with the adjacent surface water. MPA tests should be conducted to determine the degree of filtration that occurs as the water flows from the reservoir to the well.

References

- Anderson, Henry W., 1969, *Water Supplies for Coulee Dam National Recreation Area*, Washington, U.S. Geological Survey Open-File Report OFR-69-8, 141 pp.
- Kiver E.P. and Stradling, D.F., 1995, *Geology of the Franklin D. Roosevelt Reservoir Shoreline: Glacial Geology, Terraces, Landslides, and Lineaments*, report to Bureau of Reclamation (BOR), 148 p., 21 geologic maps, scale 1:24,000 or 1:62,500
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- NPS Geologic Resources Inventory Program. 2009. Digital Surficial Geologic Map of the Bangs Mountain quadrangle, Washington (NPS, GRD, GRI, LARO, BAMO digital map). NPS Geologic Resources Inventory Program. Lakewood, CO. Geospatial Dataset-1047534.

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July 11, 2014