BEAVER CREEK

METHOW RIVER CLOSED TRIBUTARY REPORT

by

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INTRODUCTION

Ground water that feeds surface water is said to be in hydraulic continuity with the surface water body. Hydraulic continuity between ground and surface water results in a single, continuous system, instead of two or more discrete water regimes. Pumping from a well in hydraulic continuity with a stream reduces streamflow. The reduction in streamflow is either direct or indirect. Water infiltrating from the affected stream to the cone of depression created by the pumping well, is an example of direct continuity. Indirect continuity is illustrated by the interception of ground water by a pumping well, water that would otherwise flow to a stream. It does not matter if the intercepted water would have entered the stream adjacent the well site, or at a location farther down-channel. In both instances, indirect hydraulic continuity is in operation.

The sands and gravels deposited by the melting Pleistocene Epoch glaciers constitute the principal Methow Valley aquifer. The nature of the sediment influences the interaction of ground water with the Methow River and its tributaries. Information developed in the main valley from aquifer tests, seismic and resistivity surveys, well-level monitoring, and evaluation of sediment composition and distribution have established the extent of the sediments' porosity and permeability. These sands and gravels are so porous and permeable that a high degree of hydraulic continuity is virtually guaranteed. The similarity between the sediments in the main valley and those of the tributary basins has led Department of Ecology staff to the judgement of corresponding ground water behavior. Ecology staff concluded that ground water in the unconsolidated sediments of the tributary basins is, more likely than not, in hydraulic continuity with the tributary streams.

The purpose of this report is to support the Ecology Permanent Rule Making process with substantive, verifiable information on the hydrogeologic conditions of the Beaver Creek basin, with emphasis upon the conditions of hydraulic continuity that apply there.

RESEARCH RESOURCES AND METHODS

To determine the hydrogeologic circumstances of the Methow tributaries subject to the Emergency Rule, especially hydraulic continuity, we examined the extent and composition of the glacial-fluvial sediments within each basin. To accomplish this task, we examined topographic and geologic maps of the tributary basins, including Beaver Creek (Figure 1). Logs of wells drilled within the basins furnished sediment thickness, depth to bedrock, and estimates of water availability. We made field visits to each basin, noting sediment exposure and character, and bedrock outcrop. We sought to locate any geologic structures that might isolate ground water from surface water. We conducted at least one stream discharge measurement on each of the tributaries.

BEAVER CREEK

Draining the west flank of the mountainous divide between the Methow and Okanogan River Valleys, the Beaver Creek basin has an area of 62 square miles and an average elevation of 4,800 feet. Principal tributaries of Beaver Creek are, from south to north, Frazer Creek, Wolf Canyon Creek, South Fork Beaver Creek, Middle Fork Beaver Creek, Lightning Creek, and Volstead Creek.

Privately owned land in the Beaver Creek basin is concentrated in the bottoms of Frazer Creek and Beaver Creek's main fork, and along the west side of the highland forming the west flank of the Beaver Creek drainage. State Department of Wildlife, Department of Natural Resources, and U.S.D.A. Forest Service-managed lands comprise the remainder of the basin, with the National Forest as the largest landholder of the high ground to the north and east.

Geology

The headwaters of Beaver Creek's west-flowing tributaries all rise on the igneous and metamorphic rocks of the Okanogan Complex. These rocks are leucocratic tonalites, trondhjemites, and gneisses, outcropping in linear bands that strike north-northwest. The controlling structure of these crystalline units is the Chewack-Pasayten Fault, the eastern boundary to the Methow structural basin. The fault, mapped as a west-verging thrust at Coyote Ridge can be traced north to a location immediately downstream from the Beaver Creek Guard Station. The fault separates Coyote Ridge Quartz Diorite Gneiss, on the upper, east plate, from Cretaceous-Jurassic aged Frazer Creek Quartz Diorite and the Red Shirt Gabbro of the same age, on the lower plate. The fault disappears beneath the valley fill as it crosses Beaver Creek, but can be followed north-northwest across Section 14, T. 34 N., R. 22 E.W.M. The fault steepens along this portion of its length and its apparent displacement is altered, from a westerly thrust to right lateral strike-slip The Coyote Ridge rocks on the east side of the fault are, at this location, faced by Paleocene aged Pipestone Canyon Formation, on the west side. The Chewack-Pasayten Fault continues into the Bear Creek basin, and beyond. Except for about 2 square miles of the Pipestone Canyon Formation that lies east of the highest point on Balky Hill Road, the southern portion of the Beaver Creek basin is underlain by the Frazer Creek Quartz Diorite intrusive.

Glacial-fluvial sediments blanket most of the Beaver Creek basin. The deposits range from unsorted till to sandy gravel, and extensive sequences of clay are reported on basin well logs. The thickness of the sediments varies with location. In lower Volstead Creek, a well log records 170 feet of clay and sandy gravel. Three wells in Wolf Canyon show gravel deposits between 45 and 95 feet thick. Along Balky Hill Road near the middle of Section 34, two wells have drilled through 138 feet of sandy gravel. South of this location, 2/3 of a mile, sandy gravel and clay-rich gravel deposition is between 48 and clay, up to 170 feet thick. The highest water yield estimates for Beaver Creek wells completed in the sedimentary deposits are also from valley bottom wells, with reported water production estimates of between 20 to 40 gpm. Sedimentary wells not located in a drainage bottom report water yield estimates of 5 to 15 gpm. Field work in the Frazer Creek canyon reveals thick, bedded units of clay-rich silt and sand. These glacial lake sediments were probably laid down in an ice-dammed glacial lake that pooled at the confluence of Frazer and Beaver Creeks. The ground-water underflow to the Methow River probably increases below Frazer Creek. The possibility of thick clay sequences constraining hydraulic continuity between the ground water and Beaver Creek increases downstream of Frazer Creek.

Of the total of 26 wells drilled in the Beaver Creek basin, for which Ecology has drilling logs, 12 penetrate to the subsediment bedrock. Nearly every one of these 12 is completed in the igneous quartz diorite of the Frazer intrusive. A 460 foot deep well in the SW 1/4 of Section 13, t. 33 N., R. 22 E.W.M., drilled through 140 feet of clay before encountering bedrock and continuing for 320 feet. Bedrock wells produce water yield estimates between 1/8 and 20 gpm. A well located in Section 36, T. 34, R. 22 E.W.M. is drilled through 100 feet of igneous intrusive bedrock and produces a water yield estimate of 12 gpm. A neighboring well drilled 105 feet into the bedrock produces only 1 gpm. The presence of the thrust-faulted section of the Chewack-Pasayten Fault through this area, may exert some control on well production.

SUMMARY

Our office and field investigations have found that the glacial-fluvial sediments deposited in Beaver Creek are generally similar to those in the Methow Valley. We acknowledge the presence of clay deposits recorded in several Beaver Creek well logs. However, we learned of no specific situations where ground water was definitely isolated from Beaver Creek. If such conditions do occur, we believe them to be limited in spacial extent and confined to the lowest reach of Beaver Creek. We conclude that there exists a high degree of hydraulic continuity between the ground water of the glacial-fluvial sediments and Beaver Creek.

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