PACIFIC groundwater GROUP

Technical Memorandum

To: Kathleen Deason, FCCD

From: Stephen Swope, PGG

Re: Groundwater Time of Travel Contours, McCarteney Creek and Rattlesnake Springs Areas

Date: January 19, 2010

Groundwater travel times to McCartney Creek and Rattlesnake Springs were estimated for use in basin planning and are presented in Figure 1. County-wide groundwater contours were used as the basis to create a groundwater head elevation grid. Further investigation of Ecology well log data was conducted, especially around the edges of the estimated Moses Coulee groundwater basin and within the basin where internal divides occur. Wells were moved to more accurate positions based on property records, water right documents, and aerial photography. The groundwater contours were modified to fit the new well locations.

The new groundwater contours were then converted in ArcGIS to a continuous Groundwater Head Elevation surface grid with a 125-foot cell size using Spatial Analyst's Topo to Raster method. Anomalous sinkholes in the grid were filled using the Fill Sinks tool.

Flow direction and magnitude for each cell was calculated using the Darcy Velocity tool in ArcMap using the groundwater head grid and the following parameters:

- Hydraulic Conductivity = 5 ft/day. This value was derived from the median hydraulic conductivity for Columbia River Basalts presented by Whiteman et al., (1994).
- Porosity = 0.25. Estimated porosity of basalt interflow zones.

To calculate Time of Travel, ArcGIS uses the flow direction and magnitude grids from the Darcy Velocity tool. The flow direction grid values were reversed to allow the particles to flow out from the valleys to the ridges of the basin. The resultant time of travel values were then digitized by hand. Particle trace paths were examined to exclude particles that flowed through or near areas where the head grid was known to be incorrect.

ASSUMPTIONS AND LIMITATIONS

The travel time estimates were developed using the groundwater contour map of the Douglas County developed by PGG (PGG, 2009). Therefore the assumptions and limitations of the map are also incorporated into this travel time assessment. Those include:

- The PLSS locations of many wells were found to be erroneous. Locations were only checked for areas where contours appears spurious It was not possible to quality control the locations of all wells; therefore, some wells may be incorrectly located.
- Deep municipal wells were removed from the analysis but not all wells were checked for the completion aquifer. Therefore, groundwater elevations presented on the map may not be representative of the shallow aquifer but may be from deeper or perched aquifers.
- Limited data was available in areas with few wells. Water levels in these areas were estimated based on adjacent areas with higher well densities. Identification of additional wells and installation of wells with low density would improve accuracy.
- Water levels were gathered from well logs and so were measured over a span of decades. Collection of current, synchronous water level data would improve accuracy.

In addition, further assumptions were made in calculation of the Darcian pore velocities, including the estimated values and homogeneity of hydraulic conductivity and porosity values.

REFERENCES

Pacific Groundwater Group, 2009, *WRIA 44/50 Groundwater Contour Map*. Consultants report to the Foster Creek Conservation District.

Whiteman, K.J.,Vaccaro, J.J., Gonthier, J.B., and Bauer, H.H. 1994. *The Hydrogeologic Framework and Geochemistry of the Columbia Plateau Aquifer System, Washington, Oregon, and Idaho.* U.S. Geological Survey Professional Paper 1413-B.

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Figure 1
Groundwater Travel Times to McCarteney Creek

Updated 1/2010

PgG

Wells from the Ecology Well Log Database

Project Wells

Springs

Groundwater Elevation Contours

Time of Travel to McCarteney Creek

0-10 Years

11-20 Years

21-30 Years

31-50 Years

51-75 Years

76-100 Years

101-150 Years

WRIA Boundaries

Perennial Streams

Intermittent Streams

Ephemeral Streams

Lakes

0 Feet 20,000

0 Miles 5

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