Section 3. Identification of diversion records for junior ground water pumping available to the Department

Groundwater use in the Wood River Valley

Prior to 2013, most groundwater diversions in the Wood River Valley were not measured or recorded. Water District 37 regulated and recorded a few groundwater diversions north of Bellevue. Water District 37M regulated and recorded exchange well diversions conveyed through Silver Creek. These data are included in the watermaster reports (Water Districts 7 & 11, various years, 1920-1970; Water Districts 37 & 37M, various years, 1971-2013). Larger municipal water providers in the Wood River Valley measure and record their diversions for their own use. Prior to 2013, municipal diversions were not reported to the water district, but municipal providers did submit monthly diversion data to the USGS to assist with development of the Wood River Valley Groundwater Flow Model. These data will be included in the model data sets when the USGS publishes the model.

In 2013, water users began installing flowmeters to comply with a measuring device order, and Water District 37 began recording annual groundwater diversions in the Wood River Valley. Data collected for 2013 and 2014 are stored in IDWR's Water Management Information System (WMIS) (https://www.idwr.idaho.gov/apps/wm/WMIS/). Many groundwater diversions in the Wood River Valley were still unmeasured in 2013 and 2014.

Unmeasured groundwater diversions from the Wood River Valley from 1995 through 2010 are being estimated for development of the Wood River Valley Groundwater Flow Model. Estimated monthly groundwater diversions are calculated using evapotranspiration (ET), precipitation, surface water diversion data, and estimated irrigation efficiency. ET and precipitation data are used to calculate irrigation water demand within subareas of the model boundary. In areas served only by groundwater, consumptive use of groundwater is assumed to be equal to the irrigation water demand and groundwater diversions are assumed to be equal to the irrigation water demand divided by irrigation efficiency. In areas served by both surface water and groundwater, the portion of the irrigation demand met by surface water is estimated by deducting canal seepage and irrigation inefficiency from recorded surface water diversions. The remaining irrigation demand not met by surface water is assumed to be met by groundwater. Because the irrigation efficiency is unknown, it is an adjustable parameter during calibration of the groundwater flow model. Estimated groundwater diversions used to calibrate the groundwater flow model will be included in the model data sets when the USGS publishes the model.

Groundwater use on the Camas Prairie

Prior to 1923, groundwater use on the Camas Prairie was limited to a few wells used for stockwater and domestic water supply. Early agriculture on the Camas Prairie consisted primarily of non-irrigated wheat (Piper, 1925; Walton, 1962). Between 1923 and 1924, about 50 deep wells were drilled into the upper artesian aquifer (Walton, 1962). Flowing wells developed during this time period yielded between 2 and 100 gallons per minute (gpm). Total groundwater diversions in 1924 were estimated to be approximately 600 acre-feet (AF). Groundwater development increased in the early 1950s. In 1957, Walton (1962) estimated groundwater withdrawals for irrigation and municipal use were approximately 1,350 AF. Walton (1962) also performed an inventory of flowing wells, and estimated the total discharge from flowing wells and springs was about 200 AF.

Another significant increase in groundwater withdrawals for irrigation occurred between 1974 and 1977 (Young, 1978). In 1977, Young (1978) quantified groundwater use using totalizing flowmeters, discharge measurements, power records, and estimates of municipal use. Groundwater withdrawals for irrigation and municipal use were approximately 9,500 AF in 1977, approximately seven times the estimated 1957 withdrawals.

In 2014, groundwater withdrawals reported in the Water District 37B Watermaster's Report (Kramer, 2015) total approximately 13,800 AF, an increase of approximately 45% over the 1977 withdrawals. In 2014, most of the wells were measured using totalizing flow meters. Some withdrawals were determined using power consumption coefficients. A few small diversions were estimated. The watermaster did not report the number of acres irrigated by groundwater in 2014.

Water right priority dates and cumulative maximum diversion rates shown in Figure 7 are generally consistent with the periods of groundwater development described by Walton (1962) and Young (1978). Water right records[2] suggest much of the groundwater development in the Camas Creek basin occurred between 1968 and 1979.

[2] Water right priority dates and diversion rates were extracted from IDWR's database on April 21, 2015. Data are provided in supplemental files accompanying this memorandum.

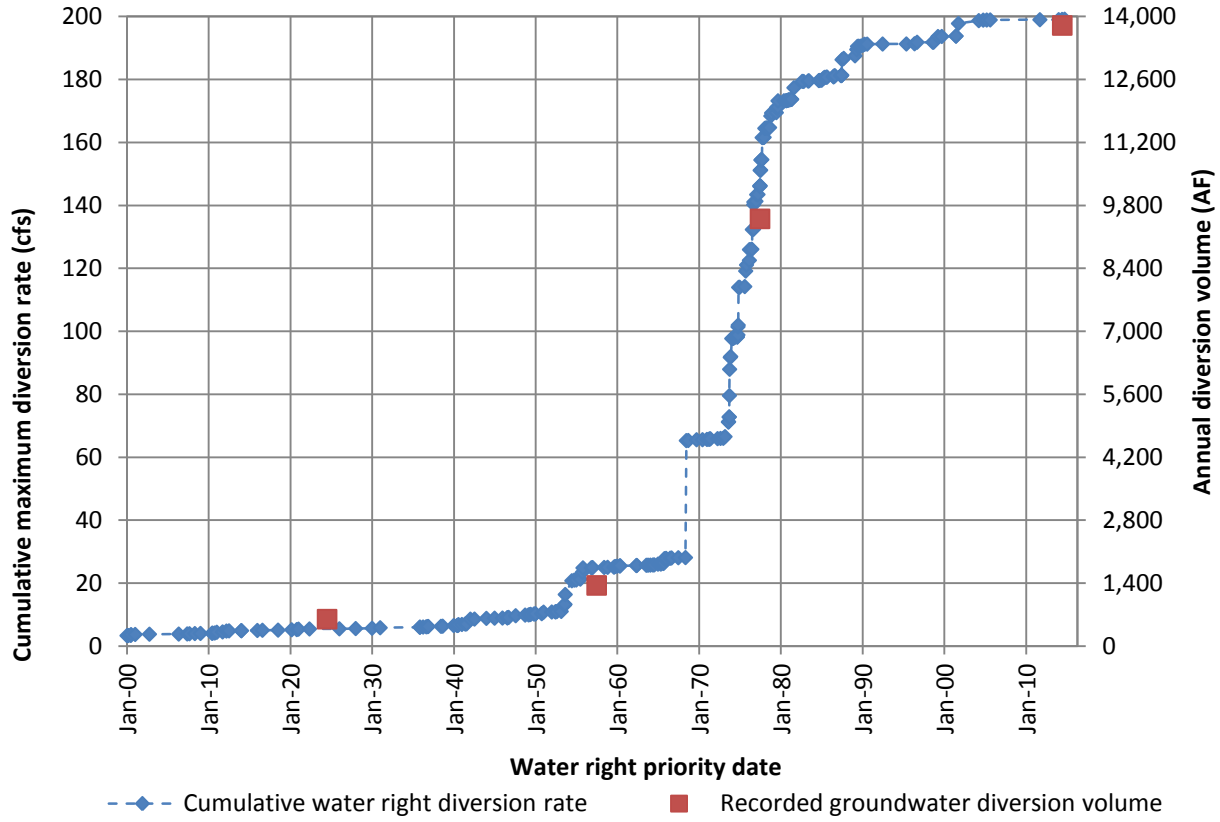

Figure 7. Cumulative maximum groundwater right diversion rate and recorded groundwater pumping in the Camas Creek basin.

Section 4. Identification of methods and data available for analyzing consumptive use associated with junior groundwater pumping

Wood River Valley

As discussed in the previous section, consumptive use associated with groundwater pumping in the Wood River Valley is being estimated for development of the Wood River Valley Groundwater Flow Model. Consumptive use is being calculated monthly for 1995 through 2010 using ET, precipitation, and surface water diversion data, and modeled irrigation efficiency. The data sets, programming code used to calculate groundwater demand, and estimated groundwater diversions will be included with the model when it is published by the USGS.

Camas Prairie

Consumptive use associated with groundwater pumping from the Camas Prairie aquifer system can be estimated from ET, precipitation, and water right place of use. ET rasters generated using

Mapping EvapoTranspiration at High Resolution and Internalized Calibration (METRIC) are available for the irrigation seasons of 1996, 2000, 2002, 2006, 2008, 2009, 2010, and 2011. Raster files are available at http://idwr.idaho.gov/ftp/gisdata/Spatial/Projects/METRIC/. Because METRIC ET does not assume ideal growing conditions nor require knowledge of crop type and management, use of METRIC ET to quantify irrigation season ET is generally preferable to use of other ET data sources such as ET Idaho. Winter ET varies less with crop type. Winter ET data are available from ET Idaho for the Fairfield Agrimet station, Fairfield National Weather Service (NWS) station, and Hill City NWS station (http://data.kimberly.uidaho.edu/ETIdaho/). Annual and monthly precipitation rasters are available from the PRISM Climate Group at Oregon State University (http://www.prism.oregonstate.edu/). Precipitation data for the Fairfield Agrimet station, Fairfield NWS station, and Hill City NWS station are available from ET Idaho (http://data.kimberly.uidaho.edu/ETIdaho/). Water right place of use data are available from IDWR at http://idwr.idaho.gov/GeographicInfo/GISdata/water_rights.htm.

Consumptive use associated with groundwater pumping from the Camas Prairie aquifer system in 2014 can also be estimated from groundwater pumping records (Kramer, 2015) by assuming a reasonable value for irrigation efficiency. Some information on surface water availability for mixed source lands is also provided in the 2014 Watermaster's Report.

Section 5. Identification of any hydrologic or hydrogeologic methods or modeling tools that may be employed in analyzing the impacts of junior ground water pumping on calling senior-priority surface water right holders

Wood River Valley

IDWR staff anticipates the impact of changes in groundwater use in the Wood River Valley can be simulated with the Wood River Valley Groundwater Flow Model after the model is published by the USGS. The Wood River Valley Groundwater Flow Model is a mathematical approximation of the aquifer developed using the numerical model program MODFLOW-USG (Panday et al., 2013), which is freely available to the public at http://water.usgs.gov/ogw/mfusg/. Numerical models are recognized by the USGS as the most robust approach for analyzing the effects of groundwater pumping on streamflow (Barlow and Leake, 2012). The model is expected to predict impacts of changes in consumptive groundwater use on aquifer discharge to the Big Wood River, Willow Creek, Silver Creek, and the ESPA.

Camas Prairie

Because the recognized outlets for net groundwater discharge from the Camas Prairie are limited to ET and discharge to Camas Creek and Magic Reservoir, the impacts of changes in groundwater use on inflow to Magic Reservoir are equal to the change in consumptive use at steady state. Analytical or numerical modeling is not needed to quantify the impacts of consumptive groundwater use at steady state.

Analytical methods could be employed to estimate the seasonal timing of the impacts, but will require several simplifying assumptions regarding aquifer properties and geometry. Predictions of timing are highly dependent on hydraulic conductivity and the coefficient of storage. A wide range of predictions can be generated using the range of reasonable assumptions for hydraulic conductivity and coefficients of storage applicable to the Camas Prairie aquifer system.

Because seasonal measurements of aquifer discharge to lower Camas Creek and Magic Reservoir are not available to correlate changes in aquifer discharge with changes in groundwater use, there are not sufficient data available to calibrate a numerical model to predict the timing of impacts.

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