Assessment of Groundwater in Storage, Eastern Pasco Basin, Washington

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The Miocene Columbia River Basalt Group and younger sedimentary deposits of lacustrine, fluvial, eolian, and cataclysmic-flood origin compose the aquifer system of the Pasco Basin in eastern Washington. Irrigation return flow and canal leakage from the Columbia Basin Irrigation Project has recharged this aquifer system under parts of the Pasco Basin since 1952. Groundwater levels in the sedimentary overburden have risen substantially in some areas of the Pasco Basin, which contributes to landslides along the Columbia River and septic system failures, among other problems. State and local water resource managers are considering extraction of the additional stored groundwater to supply increasing demand, as well as possibly mitigating problems caused by the increased water levels. To manage future groundwater allocations, an assessment of increased groundwater storage is required. The U.S. Geological Survey developed a transient groundwater model of the Pasco Basin that quantifies changes in groundwater flow and storage, and can predict the effects of future withdrawals on groundwater levels. The model utilizes a 1-km finite difference grid with MODFLOW-NWT and is constrained by 846 well logs in the study area. Seven model layers represent five overburden hydrogeologic units and two underlying basalt formations. Head-dependent flux boundaries represent the Columbia and Snake rivers to the west and south, respectively, underflow to/from adjacent areas to the northeast, and discharge to agricultural drains and springs. Specified flux boundaries represent discharge through groundwater withdrawal wells and recharge from “natural” and anthropogenic sources, including irrigation return flow and leakage from water-distribution canals. The model was calibrated with the parameter-estimation code PEST to groundwater levels observed from 1907 through 2013 and discharge to springs and agricultural drains. The simulated increase in groundwater storage since predevelopment represents the contribution of anthropogenic sources to the aquifer system. The model can be used to evaluate the efficacy of groundwater withdrawals in reducing groundwater levels near landslide-prone areas.