Application of SWAT-MODFLOW Software to Evaluate Groundwater-Surface Water Interaction in West-Central Alberta

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Responsible watershed management is emerging as a key issue as humanity continues to place demands on water resources. To meet future demands, it has become imperative that water resources be managed as a holistic system rather than solely focusing on individual aspects. Hydro(geo)logic models are one tool that can help us to understand the complex factors controlling water supply and management. Historically, hydro(geo)logic models have focused on either surface water or groundwater processes separately. However, there has been a recent push to develop models that consider both systems. This study applies a coupled surface water-groundwater (SW-GW) tool, SWAT-MODFLOW, to the Little Smoky River watershed in the Fox Creek area of Alberta, Canada in order to study the dynamics of a water supply and demand system in an area of high industrial activity. The coupled model properly integrates hydro(geo)logical processes of physical flow, providing a more accurate representation of the dynamic relationships between natural and anthropogenic factors that control the SW and GW of a region's flow system.

The primary objective of this study is to test SWAT-MODFLOW's ability to simulate a larger, more variable region, as previous studies had a greater focus on the surface system's interaction with shallow groundwater aquifers in smaller watersheds, and in more temperate climates. To that end, the model used in this project includes seven layers in MODFLOW that correspond to geologic formations, ranging widely in terms of their thicknesses and hydraulic properties. The model was subjected to snow and glacial influence, and each component model (SWAT and MODFLOW) was built and calibrated separately during the study. The coupled model is currently being refined to understand the influence of regional SW-GW flow patterns

and their dynamic interactions, and may support water management decisions for industry or government.