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Airborne electromagnetic mapping of hydrogeological framework in areas of erosional bedrock remnants and its control on recharge and water quality within Sarpy County, Nebraska

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In 2016 an approximately 1,020 line-kilometer Airborne Electromagnetic (AEM) Survey was flown with the SkyTEM 304M system in the Sarpy County area of the Papio-Missouri River Natural Resources District (P-MRNRD) of Eastern Nebraska. The purpose was to map the hydrogeologic framework and provide insights into the impacts of recharge on water quality and drainage into the Platte River. This survey added to a 60 line-kilometer reconnaissance level AEM survey flown with the SkyTEM508 system in 2015 by the Eastern Nebraska Water Resources Assessment. AEM system calibration was critical in survey integration. Careful and diligent processing and inversion was required to provide high fidelity images of the subsurface. The hydrogeology of the area is controlled by the glacial and fluvial processes that eroded the Cretaceous Dakota Group into small erosional remnants that serve as aquifers. These Cretaceous Dakota remnants overlay 0 to 200-meter deep Pennsylvanian limestone aquicludes. Quaternary-aged glacial and alluvial materials overlie the area and serve as aquifers where containing coarse grained materials. The ability of the Quaternary materials to allow recharge has a direct impact on the water quality of the area and the groundwater recharge that maintains the aquifers. The recharge is also controlled by the approximately 100 m of elevation change in the area driving surface runoff. The AEM provided a 3D hydrogeological framework complemented by approximately 1,000 supply and test wells. The Cretaceous Dakota was categorized as either sandstone/sand dominant or shale/clay dominant based on the resistivities of the materials. Interconnections of the Cretaceous Dakota to the overlaying Quaternary materials were also mapped. Quaternary materials were classified as non-, marginal, principle, and coarse aquifer materials based on the resistivity ranges. These interconnections coupled with the recharge potential of the surface materials provided 3D maps used to effectively manage land use. The P-MRNRD is utilizing this information to update and enhance their Groundwater Management Plan. Ongoing activities aimed at improving water quality include: fertilizer management, proper well abandonment, enhanced water quality monitoring, improved well depth determinations, and wellhead protection.