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3D Geological Models: Evolution from "Nice to Have" to "Non-explicit Requirement"

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The use of three-dimensional (3D) geological models has become a critical and valuable component of essentially every hydrogeological investigation. The value is particularly evident for larger project sites with potential for hydrogeological issues to arise over the long-term related to climatic cycles and seasonal variability. Stantec Consulting Ltd. has recently made effective use of 3D geological models for large urban development areas in both Edmonton and Calgary ranging in size from one to twenty quarter sections. This presentation will summarize three examples in which 3D geological modeling was critical to synthesize and interpret data and highlights the evolution of employing them to provide solutions for clients and/or regulators despite the differences in hydrogeological settings.

Two examples located in the Capital region, and one on the north side of Calgary show the progression on both the part of the clients compared to scenarios presented two years ago at the same venue (i.e., emergency calls for forensic hydrogeologic assessment). Developers are starting to understand both the value and why 3D geological models are an essential tool to understand potential hydrogeological issues at the pre-development stage. Both Edmonton and Calgary have Design and Construction Standards in place and are more strictly enforcing the spirit and intent of the standards as increasingly marginal lands are developed to understand and mitigate effects of seasonal or permanent close-to-surface groundwater with urban developments. These effects span from potential interactions between the groundwater system and local wetlands to potential underlying aquifer units that may pose risks to construction. This allows developers to assess the feasibility of incorporating mitigation measures into a development area. Further, it avoids risk and expense associated with remediating issues later on, such as the interaction of shallow groundwater (i.e., groundwater interference) with buildings and infrastructure such as roads, storm water management ponds, and utilities. The examples presented show the adaptability of the 3D geological modeling workflow, products such as groundwater interference maps, and allows for a telescopic approach to identify areas of concern that may require additional study in large development areas.

Christian Nägeli

Christian is a hydrogeologist/geological engineer with over 25 years of international experience in the planning, development, and supervision of works and coordination of regional and site specific hydrogeologic assessments as they relate to water supply, groundwater movement, groundwater monitoring, EIA, and subsurface contaminants. Christian's experience in hydrogeology covers different aspects of the water cycle including developments in groundwater-supported wetland areas, flooding assessment in urban and rural areas, seawater intrusion in groundwater, drilling, modeling (groundwater flow and transport), and water treatment (drinking water and re-use of wastewater).

Joe Riddell

Joe is a physical hydrogeologist at Stantec Consulting Ltd. responsible for hydrogeological assessments at a variety of scales from site-scale to regional-scale. Joe has a diverse background that has included working as a consultant, in academia, and as a government regulator. This has provided a unique perspective and refined technical expertise enabling him to deliver innovative and cost effective solutions for a wide range of hydrogeological projects.