**Case Study: Construction Dewatering**

CEEn 544 – Seepage and Slope Stability

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**Background**

A grocery store will be constructed in the Foxboro development in North Salt Lake on a parcel of ground containing a high groundwater elevation. The site consists primarily of silt, silty clay, and clay with sand lenses to a depth of fifty feet. Groundwater surface elevations were measured with a piezometer to be as small as two feet below grade in some locations. Geotechnical site reconnaissance was performed by Bingham Engineering.

The client would like to lower the groundwater elevation for the construction of a grocery store and for the development of a nearby storm water detention basin. One of the possible dewatering solutions was a set of permanent French drains connected to the existing storm drain network. The impacts of the French drains on the subsurface water elevations were modeled using MODFLOW.

**Analysis**

MODFLOW is a three-dimensional finite difference numerical solution model developed by the United States Geological Survey (USGS). This model can perform steady state and transient time groundwater flow analysis. MODFLOW is most effectively utilized when coupled with at least one of the available preprocessors/postprocessors/GUIs such as GMS or ModelMuse.

Inputs required for the MODFLOW model were soil layers, hydraulic conductivity (vertical and horizontal), specific yields, and boundary conditions. Inputs were selected using CPT, borehole, test pit data, and experience from past observations. The model was run twice, once for a high range of expected hydraulic conductivities and once for a low range of hydraulic conductivities. A transient analysis was performed and groundwater piezometric surface elevations were calculated for 30 days, 60 days, 1 year, and 3 years after installation of the French drains. A steady state MODFLOW analysis was also completed. This procedure was performed for various spacings of the French drains.

The results indicate that groundwater drainage would occur at a very slow rate, even with the high range of hydraulic conductivities and a relatively close drain spacing. Also, even with a piezometric surface lowering, clays would remain at a saturation close to unity due to their low specific yield.

**Conclusion**

This case study highlights the conundrum for a balance between time and money: more time and resources spent on the project results in higher costs for the client. It also demonstrates that sometimes a conventional solution may not be enough to satisfy the customer’s needs. A refinement for the model could have been achieved by performing pump tests, increasing the layer count, calibrating the model using more observed heads, and improving the boundary conditions. Although the model shows that with enough French drains the client’s problem could be resolved, conclusions drawn indicate that the installment of French drains is not a feasible solution to lower the groundwater table in the vicinity of the grocery store.

**References**

Harbaugh, A. W. (2005). MODFLOW-2005, The U.S. Geological Survey Modular Ground-Water Model—the Ground-Water Flow Process. Retrieved from http://pubs.usgs.gov/tm/2005/tm6A16/

Johnson, A. I. (1963). Compilation of Specific Yields for Various Materials. Retrieved from http://pubs.usgs.gov/of/1963/0059/report.pdf

Powers, J. P., Corwin, A. B., Schmall, P. C., & Kaeck, W. E. (2007). Construction Dewatering and Groundwater Control. doi:10.1002/9780470168103

Winston, R.B., 2009, ModelMuse—A graphical user interface for MODFLOW–2005 and PHAST: U.S. Geological Survey Techniques and Methods 6–A29, 52 p., available only online at http://pubs.usgs.gov/tm/tm6A29.