

Graduate Student Opportunities in Geotechnical Geophysics



Geophysical Methods for Condition Assessment in Embankment Dams and Dykes/Levees

Developing methods to assess the internal condition of embankment dams and earthen dykes/levees used for hydroelectricity, mine tailings, flood control and other water-retaining applications is increasingly important as many such structures approach their design lives and are exposed to increasing stresses associated with climate change. Researchers at UNB, Mount Allison University, and Memorial University, funded by NSERC, NBIF, and NB Power are working on the development of geophysical monitoring techniques for that purpose.

At the Mactaquac Generating Station, located on the Saint John River, 20 km upstream of UNB's Fredericton campus, research is focused on the development of time-lapse resistivity imaging and distributed temperature sensing (DTS) for seepage monitoring. Survey approaches and data interpretation are guided by numerical modelling that couples seepage to transport of heat and resulting changes in electrical resistivity of the dam's clay-till core.

In the Tantramar region of New Brunswick, where dykes protecting critical infrastructure at the head of the Bay of Fundy are threatened by sea level rise, electrical, electromagnetic and seismic methods are of interest for seeking out the hydrological and geotechnical vulnerabilities of those historic flood barriers and for guiding the design of new ones.



Embankment dam and diversion sluiceway at Mactaquac Generating Station during the spring freshet.



Agricultural dyke during resistivity surveying (left), and during breaching (right), 2021 field season.

We currently have two graduate student research opportunities – one each at the PhD and MSc levels. The PhD project is expected to tackle integrating 3D time-lapse resistivity imaging with hydrological modelling for quantifying anomalous seepage. The MSc project will explore applications of various geophysical methods to reconnaissance for weaknesses in flood control barriers on the Tantramar Marsh, using approaches informed by advanced 3D numerical modelling combined with ongoing geotechnical investigations by provincial authorities. There is scope to adjust the focus of both projects to student interests and career goals.

Ideal candidates will have a background in Earth sciences, geological or civil engineering, physics or a related field, good quantitative skills and an aptitude for instrumentation, and field studies. Funding is available for start dates as early as May 1, 2022, but the start date can be delayed if needed. The positions will be filled as soon as suitable candidates are found.

Students can expect to acquire broad experience in the latest developments of modern geophysical surveying and data interpretation methods. Lessons and skills learned through these projects will be applicable to many industry sectors including exploration, engineering and groundwater applications. This work is a collaboration between geophysical and hydrogeological faculty at UNB (K. Butler, K. MacQuarrie), Mount Allison University (P. Lelievre) and Memorial University (C. Farquharson) and involves engineering professionals from NB Power as well as the New Brunswick Department of Transportation and Infrastructure, and the Nova Scotia Department of Agriculture. Hence, this project can provide the student with many avenues for future academic, government or industry career trajectories.

For further information, or to submit an application, contact

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