

## Characterization of Near Subsurface Conditions at McMurdo Station, Antarctica

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### ABSTRACT

The National Science Foundation has been recently approved to move forward with the major infrastructure rebuilding at McMurdo Station (MCM). Efforts to rebuild MCM require knowledge of geology, ground conditions, and geotechnical information of the ice-cemented layer. Therefore, 200 and 400 MHz ground-penetrating radar (GPR) surveys were collected in McMurdo during January, October, and November of 2015 to detect the active layer, permafrost or massive ice, fill thickness, solid bedrock depth, and buried utilities or construction and waste debris. Soil pits were excavated to collect soil, ice, and rock samples for gradation, density, and moisture content tests. Frozen cores were collected in various locations using a chilled air drilling system. Information extracted from the soil pits and the cores were used to corroborate the GPR profiles. The studies revealed distinct features, including ice-bonded fractured basaltic boulders, rocks, and gravelly sand; massive ice; constructed (friable) and contaminated fill layers. A considerable amount of near-surface excess ice found was likely due to the anthropogenic origins from runoff draining and refreezing. If the foundation is placed in contact with the ground allowing heat transfer to take place, removal of contaminated materials and ground ice is recommended so that a new structural base layer is constructed with suitable (processed on-site) fill materials at optimum moisture content and compaction. Recommendations from these studies would allow the benefits in lower construction material needs, increased energy efficiency, minimized drainage issues, and snow/ice accumulation prevention for the new infrastructure at MCM.

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