Reinforced Water - Engineering and Environmental Considerations in Construction over Peat
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Modelling Scottish peat stratigraphy using integrated electrical geophysics

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Abstract

The British Geological Survey is undertaking a holistic investigation of an upland catchment near Talla Linnfoots Reservoir in the Southern Uplands. The main aim of the study is to develop an integrated earth model of the site to aid the understanding of landscape evolution and environmental change in response to climate change over the past 12.000 years. To do this we are building an attributed 3D geological model of the site. One advantage of a 3D geological model over a conventional paper based or 2D GIS approach is the ability to generate volumetric data, for example the total thickness of peat deposits. This type of data could be useful when making landslide hazard assessments of large blanket peat bogs prior to electricity generation developments, as recognised in the recent Best Practice Guide produced by the Scottish Executive in 2006[1].

To build the 3D geological model of the site we used traditional site investigation data, including geological and soil surveying. Initial auguring proved a variable thickness of peat over the site. Trial pits, boreholes and light-weight penetrometer techniques did not provide sufficient data density for the resolution required. Shallow geophysical techniques were applied to provide information between borings. Terrestrial LiDAR techniques were used to create a high resolution (1m cell size) Digital Terrain Model (DTM) to provide the ground surface layer to the 3D geological model. Ground investigation data was assembled in the GSI3D software package enabling the visualisation of all observations and measurements in their true

3D spatial positions. We used a combination of shallow geophysical techniques, including Ground Penetrating Radar (GPR) and Electrical Resistivity Tomography (ERT). One great advantage of these techniques is that they provided a continuous linear dataset, which could be imported into the modelling software. Borehole and penetrometer control was used to validate and interpret the geophysical model. This study showed that the application of geophysical techniques to assessment of peatland stratigraphy enables rapid and accurate data collection with minimal environmental impact.

Future work at Talla site will involve constraining the lithostratigraphic model using absolute dating techniques including C14 and cosmogenic methods. This will provide insight into the timing of de-glaciation and the onset of peat growth since the Late Glacial in the Scottish Lowlands.

[1] Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments. December 2006. Scottish Executive. ISBN: 0-7559-6378-4