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An Investigation of the Geotechnical Conditions and Stability of the Town Bush Valley, Pietermaritzburg, South Africa

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The construction of settlements over zones of instability is increasing the impact of natural disasters both in developed and developing nations across the world [1]. Understanding the geotechnical conditions that render these zones hazardous is a challenging aspect of engineering geology. Many regions in the greater Pietermaritzburg region in South Africa are prone to slope instability due to the terrain morphology, high intensity summer rainfall, deep weathering associated with the humid climate and palaeo-landslides combined with a range of geological and structural influences [2]. The prevailing geotechnical conditions and the stability of the slope at the Town Bush Valley has been investigated.

The Town Bush Valley is located on the mid slopes of the Town Hill Escarpment, upslope of the notorious Rickivy Landslide. Historically, the north facing slopes of Town Hill in the Pietermaritzburg area have been affected by a general on-going downslope creep which is exacerbated during periods of intense rainfall. These were made evident by investigations undertaken in incidents of slope instability, aerial photographic studies and engineering investigations into damage caused to structures and roads in the Pietermaritzburg area [3].

Borehole investigations reveal that the site is underlain by late Pleistocene to Holocene age unconsolidated talus deposits which comprise boulders, residual soils and rock fragments derived from several provenance rock types. The residual soils consist of various matrix combination of silt, clay and sand sized particles. The basal bedrock units comprise sandstones of the Vryheid Formation and shales of the Pietermaritzburg Formation and are intruded by dolerites. A conceptual model of the area was constructed based on the available borehole data.

Geotechnical characterization of representative materials comprising the site has been undertaken. The index tests reveal the presence of high plasticity indices with high percentages of sand and clay particles observed in the talus material. The stability of critical sections within the Town Bush Valley area has been assessed considering various scenarios using the Morgenstern and Price method of analysis in Rocscience Slide v.6. Results obtained from the analyses indicate that the slope is marginally stable.

References:

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