CHAPTER SIX

6.0 SUMMARY AND CONCLUSIONS

6.1 Summary

The rocks of Ukay Perdana area indicate that the area is a low grade metamorphic terrain and part of the Dinding schist. The petrography of the Dinding schist depicts and confirms that the rocks type comprise quartz-biotite-muscovite schist, quartz schist, and metavolcanic rocks dating lower Palaeozoic. The topography of Ukay Perdana is controlled by the rock type and characterized by steep valley walls and numerous uplands covered mostly by grasses and shrubs. The uplands harbour many residential houses and in most cases along slope angles. The influence of rock types and their distributions in this region gave rise to dendritic drainage system. The relief is generally rugged. This may be as a result of the varying degree of resistance of the schist to processes of weathering and erosion.

Studies about the structural geology of the area put into consideration various structures such as veins, joints, and flow structures. The granite veins are evidence of subsequent phase of the granite era and post-metamorphism. The metasomatised rock encountered marked the last flow-in of the granite intrusion. The original structure of the rock was completely obliterated, and the colour of the rock is black. These various structures are found due to polyphase deformation. There is also super-positioning of minor structures either as a result of the sequential development of structures with progressive deformation during a single phase of deformation, or as a result of two or more separate tectonic events.

Results of laboratory tests on the quartz-mica schist show that unweathered (fresh) rock materials from the Lower Palaeozoic Dinding schist has an apparent

porosity of 2.5% with average dry and saturated unit weights of 25.82 kN/m^3 and 26.08 kN/m^3 respectively. Slightly weathered rock material, however, has an apparent porosity of 8.2% with average dry and saturated unit weights of 23.99 kN/m^3, and 24.78 kN/m^3 respectively. The average of the results of the tilt tests involving diamond sawn surfaces (cut parallel to foliation) of slightly weathered rock material (surfaces B1, B2, and B3) yield a basic friction angle (Φb) of 28^o when the normal and shear stresses acting on the sliding plane are plotted in terms of the Mohr-Coulomb yield criterion, while diamond sawn and non-polished unweathered surfaces E1 and E2 yield 30 ^{o}. The weathering profile of this area clearly distinguished four morphological zones of unweathered bedrock, slightly weathered, moderately weathered, and highly weathered rock materials. Weathering clearly leads to a decrease in the basic friction angle; an effect that is also shown by polishing of the diamond sawn surfaces of unweathered rock blocks. As observed during the rainy season, minor failures were mostly restricted within the highly and completely weathered units.

6.2 Conclusions

In consideration of the recorded physical properties, basic friction angle, topography, rainfall, and vegetation cover of Ukay Perdana, guidelines to prevention of slope failures were outlined. In conclusion, though a high value of 8.2% is recorded for apparent porosity of slightly weathered rock material in the area, there should be a steady evaluation of both weathered and unweathered rock materials emphasizing on other direct and indirect factors of failure.

Summarily, a basic friction angle (Φ_b) of 30^o can be used as an estimate of the minimum residual friction angle (Φ_r) along foliation planes in unweathered quartz-mica schist, though a lower value (23^o) would have to be used for slightly weathered tuff. Results from estimation of the residual friction angle and uniaxial compressive strength show medium values which indicate that the rock mass is of relatively moderate shear strength, though the granite vein yielded high value of uniaxial compressive strength of 240MPa.

Considering the rapid rate of development in the study area, failure of cut slopes can be drastically reduced by construction of benched slopes in locations including parts of Jalan UP5 in Vierra Ukay, Sierra Ukay, and behind Sri Baiduri Apartment in order to break up the flow of surface water. Vegetating of the benched slopes should be encouraged to add more cohesion to the rock mass. To prevent rock falls, sliding and slumping during heavy rainfall, it is very important to employ the use of wire mesh with sprayed concrete weep holes on high and steep slope cuts. More of retaining walls should be built especially behind most apartments bordered by high slope cuts.