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Debris slide at Kampung Sg. Chinchin, Gombak, Selangor

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Abstract: On 21st September 2001, at about 6.00 pm, a landslide occurred on the hill slopes of Bukit Guling Ayam at Sg. Chinchin at the 8th milestone of Jalan Gombak. In this incident, two houses were damaged and one person was killed.

Investigations carried out showed that the quartz reef along the top of the ridge at Bukit Guling Ayam intrudes into granite. The foot slopes of the hill are generally gentle to moderately steep, varying from 0° to 25°. The mid slopes are more steep with a gradient of 25° to 35° and towards the upper reaches of the slopes, the gradient is about 35° to 45°. The hill slopes are generally composed of colluvium with abundant boulders.

The landslide scar measured about 15 m wide near the crown and the sides of the scar had slumped about 1 to 1.5 m. Scouring by the slide debris which was estimated to be 4,000 cu metres in volume had left behind a scar of about 120 m long. The landslide was triggered off by the heavy rainfall which had occurred a few hours earlier.

The hillslopes in the vicinity of the landslide are potentially unstable as they are generally steep with gradients more than 30° and are underlain by colluvium. There are also some loose rock blocks in the quartz reef along the ridge which pose potential rockfall dangers.

Abstrak: Pada 21hb September 2001, jam 6.00 petang, satu geolongsoran tanah telah berlaku di tebing Bukit Guling Ayam, Kampung Sungai Chinchin, Batu 8, Jalan Gombak, dimana dua buah rumah telah musnah dan seorang terbunuh.

Hasil siasatan menunjukkan bahawa permatang kuarza sepanjang rabung Bukit Guling Ayam telah menerobos ke dalam batuan granit. Kecerunan di bahagian cerun kaki bukit tersebut didapati tidak begitu curam dengan kecondongan antara 0° hingga 25°, manakala di bahagian pertengahan cerun, kecuraman cerun adalah di antara 25°–35° dan kecuraman di bahagian atas cerun didapati berukuran antara 35°–45°. Bahan yang melandasi cerun bukit ini umumnya terdiri daripada koluvium dengan bongkah-bongkah batuan.

Kesan gelongsoran ini berukuran lebih kurang 15 m lebar di kawasan puncak runtuhan dengan penurunan di bahagian tepi diantara 1 m hingga 1.5 m. Kaukan tanah runtuh ini yang dianggarkan 4,000 meter padu telah meninggalkan satu kesan berukuran 120 m panjang. Gelongsoran tanah ini telah dicetuskan oleh hujan lebat yang turun beberapa jam sebelum kejadian.

Cerun-cerun bukit disekitar kawasan kejadian juga berpotensi untuk berlakunya kejadian geobencana tanah runtuh memandangkan kecuraman cerun yang umumnya melebihi 30° dan pada masa yang sama didasari oleh bahan koluvium. Terdapat juga blok-blok batuan longgar pada permatang kuarza disepanjang rabung Bukit Guling Ayam yang berpotensi untuk berlakunya kejadian geobencana jatuhan batuan.

INTRODUCTION

On the evening of 21st September 2001 at about 6.00 pm, a large debris slide occurred on a side slope of a ridge at Kampung Sg. Chinchin, Gombak, Selangor, resulting in the damage of two houses and the demise of a resident. The Minerals and Geoscience Department, Selangor conducted an investigation from late September to October and a report was prepared for the Selangor State Government (Jabatan Mineral dan Geosains, 2001).

OBJECTIVES OF INVESTIGATION

The objectives of the investigation are:

i) To determine the geological factors which contributed to the debris slide

ii) To identify the surrounding areas which are not suitable for development.

The investigation site is located along the northern flank of Bukit Guling Ayam at Kampung Sg. Chinchin at the 8th milestone of Jalan Gombak (Fig. 1). The site is accessible via the old Jalan Gombak trunk road leading to Bentong or via the new Middle Ring Road, passing through the International Islamic University

METHODOLOGY

A detailed tachymetric survey was undertaken with a Total Station Topcon GTS 702 to prepare a topography map of the site on a scale of 1:1000 and to conduct surface geological mapping. Aerial photograph studies were also conducted on aerial photographs from the 1966 series on a scale of 1:25,000 to map out geological structures such as faults and fractures in the outcrops, and to detect evidences of instability such as soil creep and scars of former landslides. To determine the engineering characteristics and lithology of the soil profile, 16 Mackintosh Probe holes and 12 hand anger holes were sunk. Disturbed soil samples were collected for testing.

RESULTS OF INVESTIGATION

Geology and geomorphology

The investigation site forms part of the well-known Klang Gates Quartz Reef which trends in a westerly to west-northwesterly direction (Fig. 2) (Jabatan Mineral dan Geosains, 1998). The quartz reef was observed to intrude into granite. Alluvial deposits were found in the low-lying areas at Kampung Sg. Chinchin.

The crown of the landslide which had destroyed the two houses was located near to the summit of the ridge. The landslide measured about 15 m wide at the crown, and about 120 m long

The contact between the quartz reef and the granite was not distinct. Outcrops of granite were observed on the northern bank of Sg. Chinchin. The granite is greyish, coarse-grained and megacrystic with several sets of joints intersecting the outcrops.

The quartz reef which forms the ridge of the hill is intersected by a few joint sets, giving rise to some loose rock blocks. Some of these joints are infilled with secondary recrystallised vein quartz. The quartz outcrops which were found lower downslope are more fresh and massive, and are texturally finer-grained.

The dominant joint set strikes approximately in the 360° to 045° directions, dipping at 45° to 75° towards either east to southeast or west to northwest.

Morphologically, the gradient of the foot slopes are generally gentle to moderately steep varying from 0° to

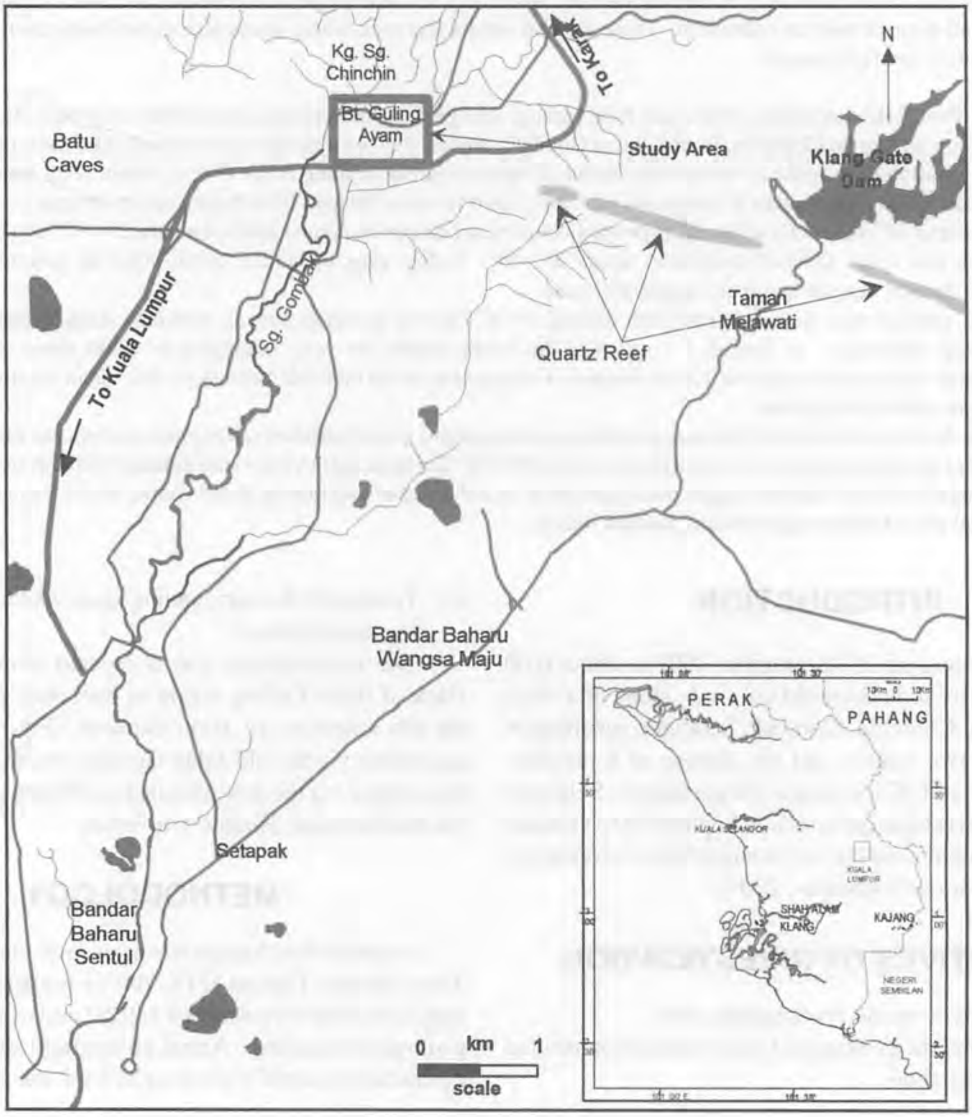

Figure 1. Location of the study area.

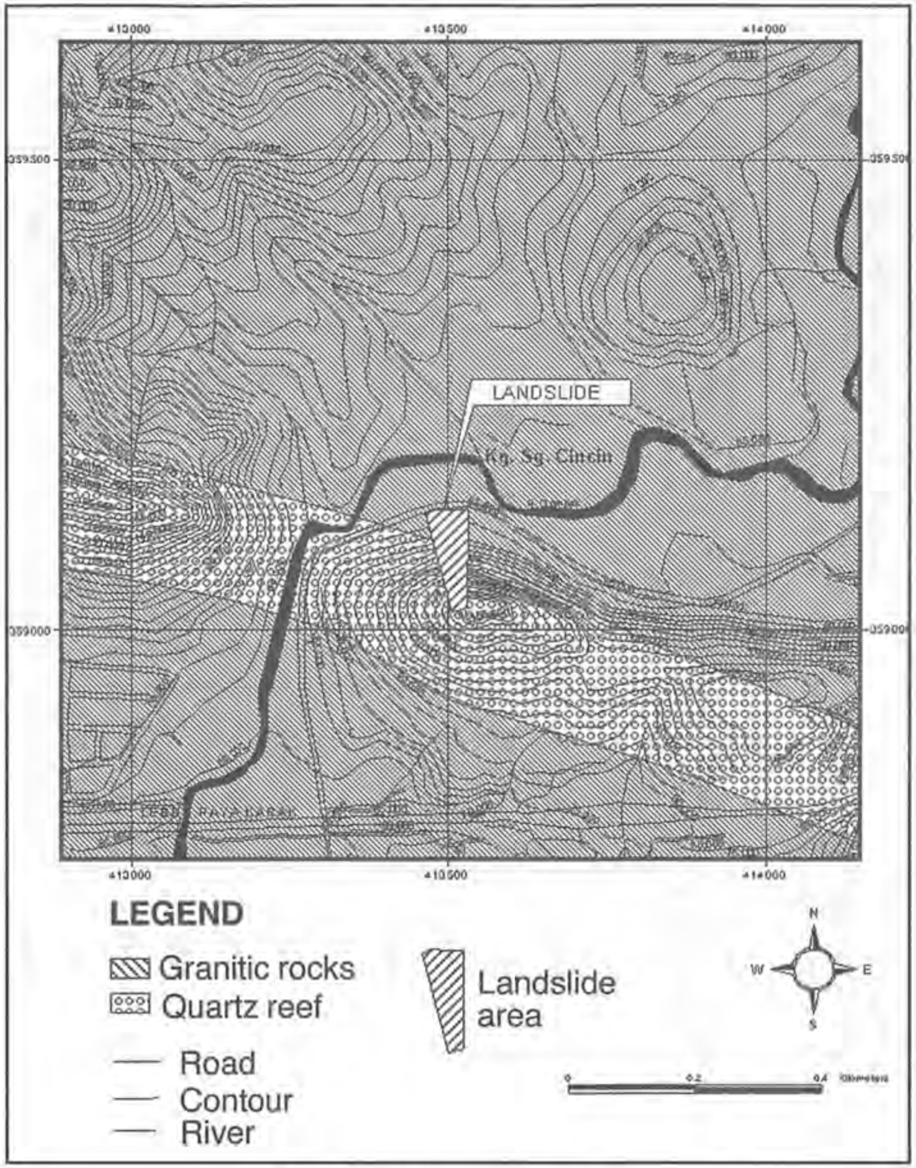

Figure 2. Geology of the study area.

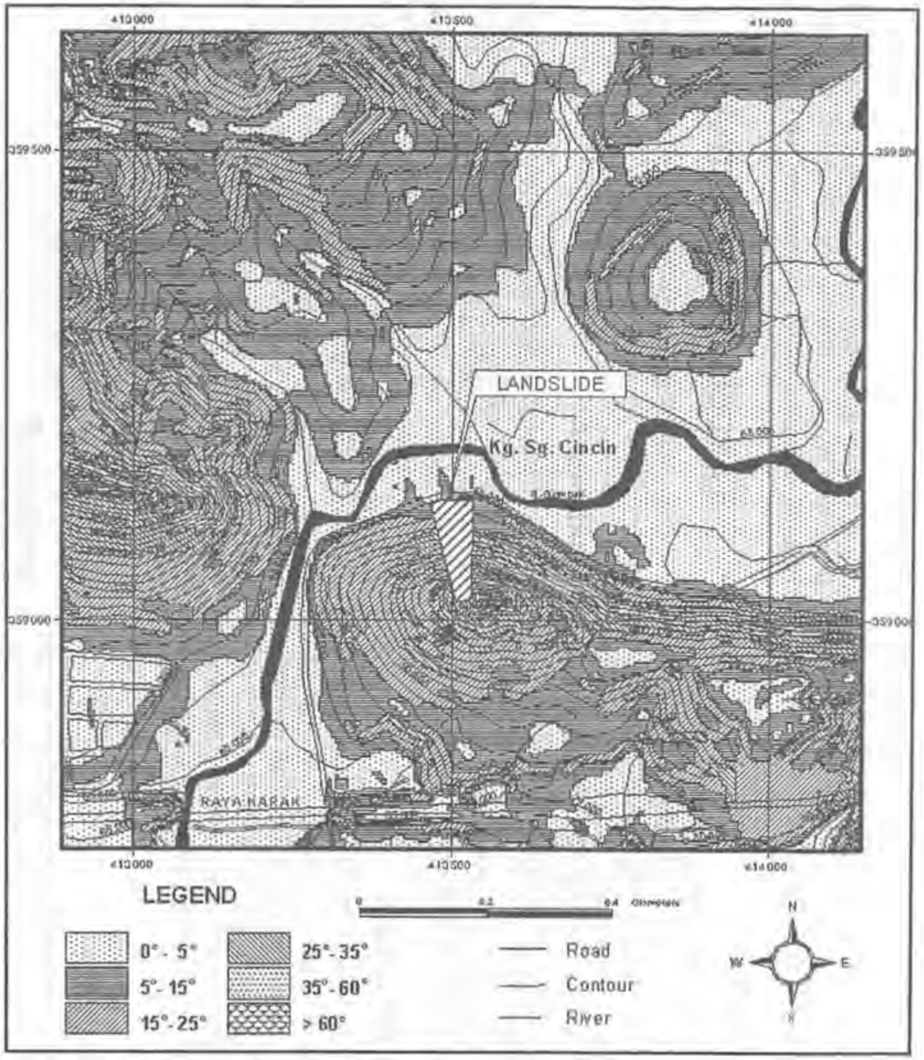

Figure 3. Gradient of slopes in the study area.

25°. The mid-slopes are more steep, with a gradient of 25° to 35° and towards the upper reaches of the slope, the gradient is about 35° to 45°. Near the crest of the hill, the slopes are more than 45° (Fig. 3).

Hand augering results

A total of 12 holes was augered with a hand auger out of which, 4 holes were sited over the landslide scar. Results showed that in general, the top soil is shallow, averaging only about 0.1 m thick. Auger hole AH2 had the thickest top soil, reaching a depth of about 0.35 m. Beneath the top soil is colluvial soil and the deepest refusal depth was at 4.8 m in auger hole AH3 (Table 1). A majority of the auger holes have refusal depths of less than 2.0 m and it is probable that these had bottomed on boulders or gravels

Mackintosh Probe results

A total of 16 Mackintosh Probe holes was bored and the results are shown in Table 2. In general, the uppermost layer of soil is loose (with less than 40 blows per 30 cm) varying from a thickness of 0.3 m (at MP7) to 2.7 m (at MP13). Some of the holes had encountered boulders at very shallow depths of less than 1 m (at MP3, MP4, MP5, MP7, MP12).

Laboratory tests

Laboratory tests conducted on disturbed soil samples showed that the soil contained high percentages of sand (Table 3). In general, the content of sand decreased with the depth of the soil profile.

Most of the samples tested were composed of silty or clayey sand or silty sand with gravels.

Rainfall

A few hours prior to the occurrence of the landslide, there was heavy rainfall in the Kampung Sg. Chinchin area, in particular, in the proximity of the landslide site.

LANDSLIDES IN STUDY AREA

There were 3 landslides in the study area and details of the landslides are as below:

Landslide A

This was the largest landslide in the study area and the landslide had damaged two houses and caused the demise of one person on the evening of 21st September 2001 (Fig. 4). The slopes were composed of colluvium which is a mixture of loose sandy soil with numerous quartz boulders measuring about 3 m x 2 m x 1.5 m in size. The landslide measured about 15 m wide near the crown and the sides of the landslide scar had slumped about 1 m to 1.5 m. Scouring by the slide debris had left behind a scoured scar of about 120 m long and the debris were spread over another 20 m to 25 m at the foot of the landslide. The volume of slide debris was estimated to be about 4,000 cu metres.

Near to the crown of the landslide are outcrops of vein quartz which form the reef and numerous loose rock boulders were observed on these outcrops.

Landslide B

Landslide B is located about 60 m to the east of Landslide A and was a shallow slide measuring about 5 m wide on a cut slope. The debris had brought down some shrubs on the slope.

Table 1. Summary of auger hole logs.

Auger Hole No.	Depth of top soil (m)	Depth of clayey sand (m)	Depth of silty sand (m)	Refusal depth (m)
AH1	0.0 – 0.20	0.20 – 1.70	-	1.70
AH2	0.0 – 0.35	0.35 – 2.80	-	2.80
AH3	0.0 – 0.60	0.60 – 4.80	-	4.80
AH4	0.0 – 0.10	0.10 – 2.50	-	2.50
AH5	0.0 – 0.15	0.15 – 1.60	-	1.60
AH6	0.0 – 0.15	-	0.15 – 3.60	3.60
AH7	0.0 – 0.10	-	0.10 – 1.00	1.00
AH8	0.0 – 0.15	0.15 – 1.20	-	1.20
AH9	0.0 – 0.15	0.15 – 0.80	-	0.80
AH10	0.0 – 0.10	0.10 – 1.50	-	1.50
AH11	0.0 – 0.15	0.15 – 0.80	-	0.80
AH12	0.0 – 0.10	0.10 – 0.80	-	0.80

Table 2. Summary of Mackintosh Probe results.

Mackintosh Probe Hole No.	Mackintosh Probe Values (No. of blows per 30cm)					
	0 - 40	41 - 80	81 - 120	121 - 160	161 - 200	201 - 250
MP1	0 - 1.8m	-	1.8 - 2.1m	2.1 - 2.4m	-	2.4 - 2.44m
MP2	0 - 2.4m	-	-	-	-	2.4 - 2.43m
MP3	0 - 0.9m	-	-	-	-	0.9 - 1.0m
MP4	0 - 0.9m	-	-	-	-	0.9 - 1.1m
MP5	0 - 0.6m	-	-	-	-	0.6 - 0.77m
MP6	0 - 0.9m	0.9 - 1.2m	-	1.2 - 1.5m	-	1.5 - 1.76m
MP7	0 - 0.3m	-	-	-	-	0.3 - 0.4m
MP8	0 - 1.2m 2.1 - 2.4m	1.8 - 2.1m 2.4 - 2.7m 3.0 - 3.6m	1.5 - 1.8m 2.7 - 3.0m 3.6 - 4.2m			1.2 - 1.5m 4.2 - 4.41m
MP9	0 - 1.8m	-	1.8 - 2.1m	-	-	2.1 - 2.31m
MP10	0 - 0.3m 1.8 - 2.1m 2.4 - 2.7m	0.3 - 0.6m 0.9 - 1.8m 2.1 - 2.4m	2.7 - 3.0m	0.6 - 0.9m 3.6 - 3.9m	3.3 - 3.6m 3.9 - 4.2m	3.0 - 3.3m 4.2 - 4.24m
MP11	0 - 1.2m	-	-	-	-	1.2 - 1.4m
MP12	0 - 0.9m	-	-	-	-	0.9 - 0.98m
MP13	0 - 2.7m	2.7 - 3.0m 3.3 - 3.9m	3.0 - 3.3m 3.9 - 4.2m	-	-	4.2 - 4.4m
MP14	0 - 1.8m	-	1.8 - 2.1m	-	-	2.1 - 2.35m
MP15	0 - 2.1m	2.1 - 3.0m	-	3.0 - 3.3m	-	3.3 - 3.32m
MP16	0 - 1.8m	1.8 - 3.0m 3.3 - 4.2m 4.5 - 5.1m	4.2 - 4.5m	3.0 - 3.3m	-	5.1 - 5.12m

Table 3. Summary of soil gradation tests.

Sample No	Depth	Gradation				Properties			
		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PI (%)	MC (%)	Classfication
AH 1/S1	0.2-1.2m	28.6	20.9	49.5	0.5	49.78	22.85	22.82	Clayey sand
AH 1/S2	1.2-1.7m	41.5	19.7	38.8	0.0	54.26	27.00	19.82	Sandy clay
AH 2/S1	1.0-1.8m	17.3	29.3	51.4	2.0	34.18	10.96	22.23	Silty sand
AH 2/S2	2.0-2.5m	14.2	20.4	51.7	13.7	31.72	10.02	12.28	Silty sand with gravels
AH 2/S	2.6-2.8m	11.2	18.4	47.4	22.7	24.66	7.15	12.28	Silty sand with gravels
AH 3/S1	0.6-1.7m	15.9	14.2	33.2	36.7	48.86	22.42	21.21	Sandy gravel
AH 3/S3	2.9-4.8m	33.9	21.7	44.1	0.0	61.58	32.23	22.46	Sandy clay
AH 4/S1	0.1-2.3m	21.8	26.7	48.5	3.0	45.89	20.00	20.47	Silty sand
AH 4/S2	2.3-2.5m	27.4	18.0	51.1	3.5	-	-	18.16	Clayey sand
AH 5/S1	1.2-1.5m	14.9	24.4	53.6	14.9	32.45	8.55	20.87	Silty sand
AH 6/S1	0.15-1.1m	3.2	20.0	49.6	27.2	34.04	9.05	14.05	Silty sand with gravels
AH 6/S3	2.0-3.0m	13.1	26.1	52.0	8.8	30.12	11.85	13.37	Silty sand with gravels
AH 7/S1	0.1-1.0m	1.7	21.0	57.1	20.2	-	-	12.86	Silty sand with gravels
AH 8/S1	1.2-1.8m	10.4	26.5	55.4	7.7	-	-	17.48	Silty sand with gravels
AH 11/S1	0.6-0.8m	14.5	30.6	49.2	5.7	39.6	13.82	23.23	Silty sand with gravels
AH 12/S1	0.5-0.7m	2.6	16.1	40.4	40.9	29.09	4.87	16.45	Sandy gravel

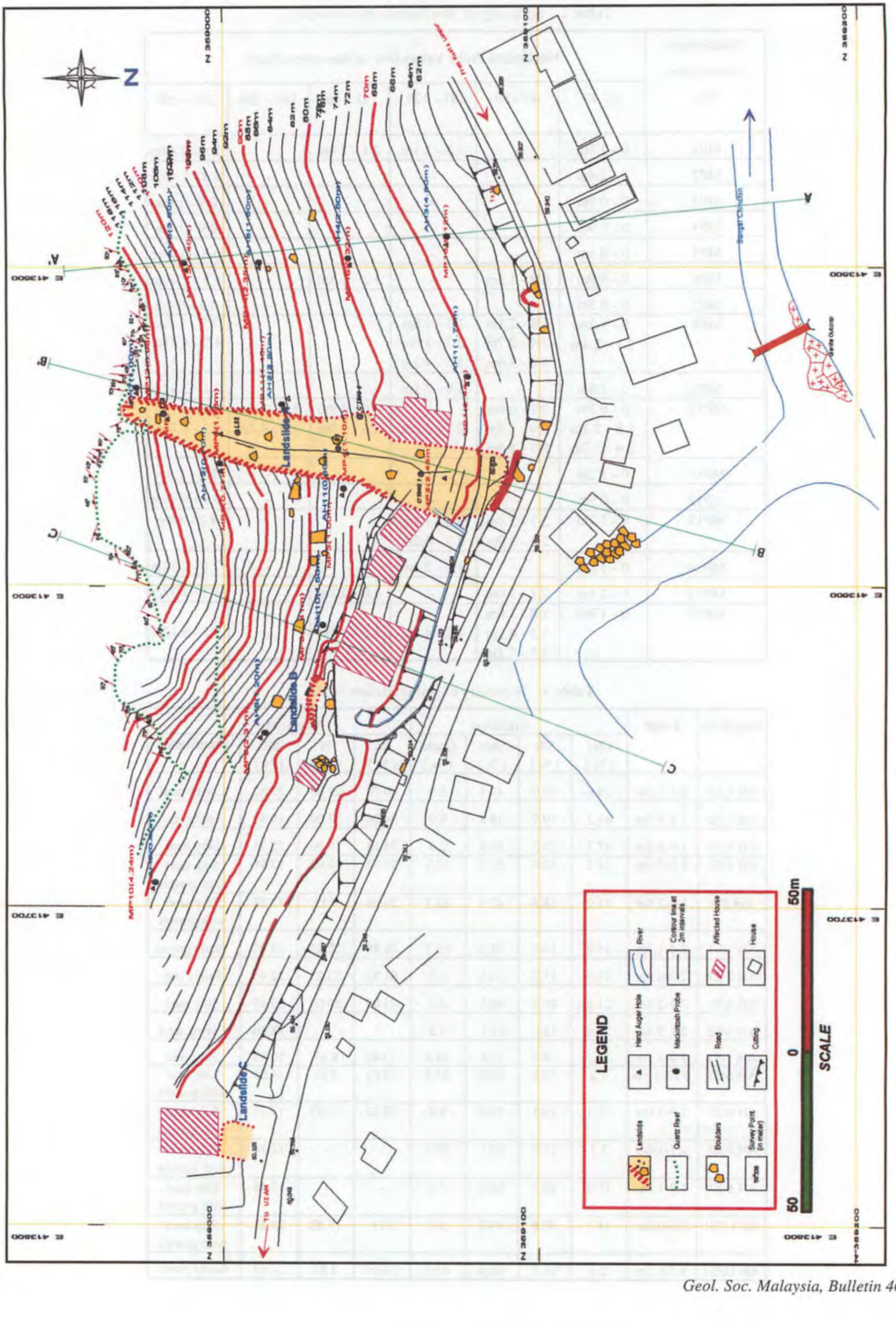

Figure 4. Surface geology in the study ara.

Landslide C

Landslide C is located about 200 m to the east of landslide A on a cut slope. The landslide measured about 4 m wide and 3 m long and a house was located just behind the crown of the landslide. The slope was composed of colluvium with boulders of quartz.

POTENTIAL LANDSLIDES

Potential landslides on hillslope

The study area is prone to the occurrence of landslides as the hill slopes are steep, with a gradient of about 45°–50° and the slopes are underlain by a thick layer of colluvium, reaching up to 4.41 m deep in places. In general, soil creep is evident on the hill slopes as some of the trees and shrubs were tilted down slope. There were some big boulders resting on the slopes and these boulders might roll down should there be a triggering factor such as heavy rainfall. The bases of some of the boulders had been burrowed by some animals, resulting in the formation of big cavities/voids within the soil.

Potential rockfall

The quartz reef is located along a ridge which trends approximately in a WNW-ESE direction. The reef is intersected by a number of joint sets which resulted in the formation of some loose, fractured rock blocks. Some of the joints were also day-lighting and as such, it is likely that some of these rock blocks might have sliding or toppling failures. The main joint sets in the quartz reef are:

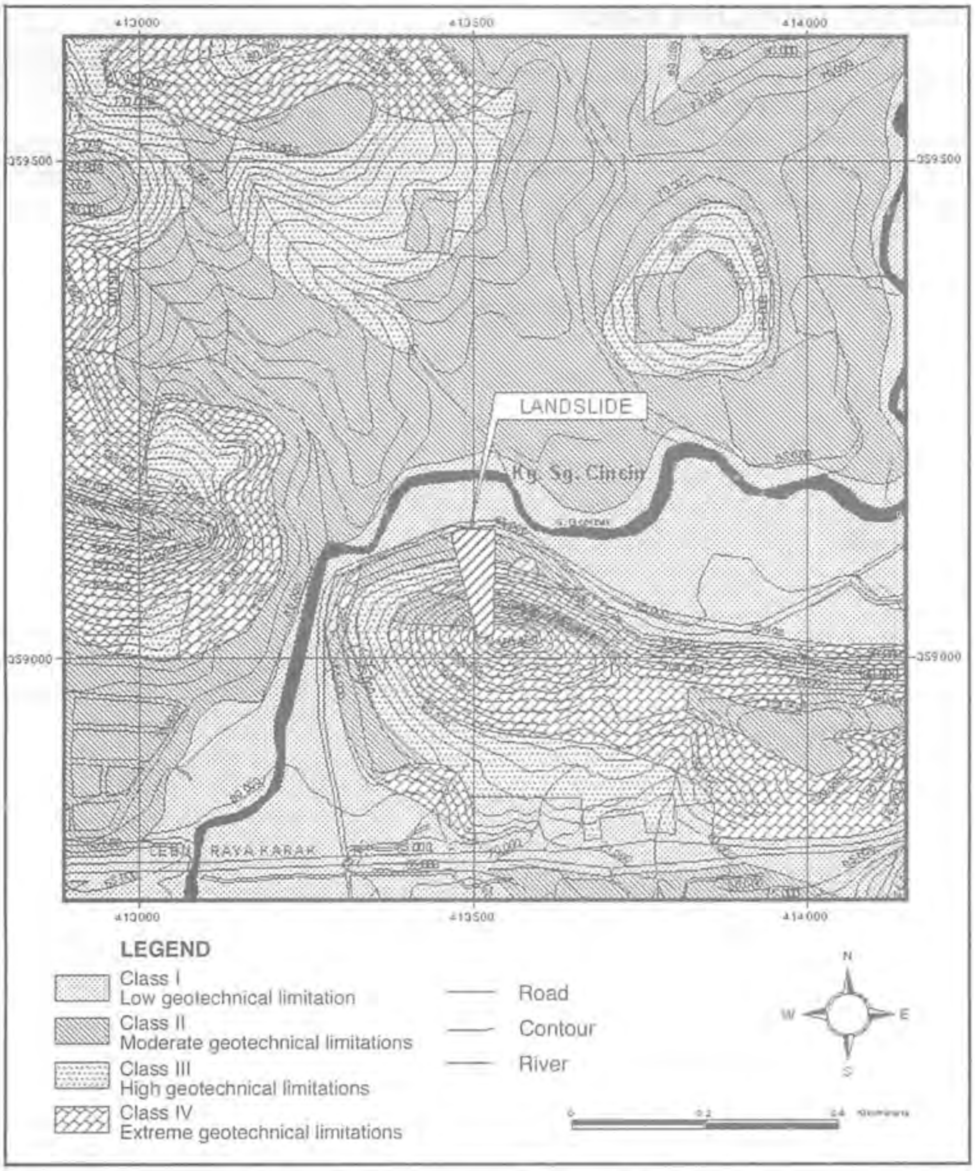

Figure 5. Construction suitability maps of the study area.

J/S_1, 360° to 020°, dipping 70° to 85°SE
J/S_2, 005° to 025°, dipping 65° to 80°NW
J/S_3, 030° to 055°, dipping 65° to 80°SE
J/S_4, 070° to 090°, dipping 65° to 85°S
J/S_5, 300° to 325°, dipping 60° to 70°SW

CAUSES OF LANDSLIDE

The landslide was triggered off by the heavy rainfall which had occurred a few hours earlier. The heavy rainfall would have caused saturation of the unstable colluvial soil whereby the shear strength of the soil was reduced and at the same time, had increased the downslope seepage forces. Debris from the failed slope flowed downhill, scouring the side slope and causing. the debris which was composed of silty sand with gravels and boulders to flow downslope for about 120 m and damaging the two houses.

DEVELOPMENT OF THE KAMPUNG SG. CHINCHIN AREA

Terrain mapping of the Kampung Sg. Chinchin and its surrounding areas (Fig. 5) showed that most parts are flat to undulating, belonging to Classes 1 and 2 whereby development would not face any geotechnical constraints. However, some of the hill slopes are steep particularly in the area where the recent landslide had occurred. These slopes have gradients of 30° to 40° and in parts, 40°–60° and besides, the slopes are underlain by colluvium. These slopes are classified as Classes 3 and 4. Development in Class 3 areas would face serious geotechnical constraints. Development should not be allowed in Class 4 areas.

CONCLUSION

The thick cover of colluvium on the hill slopes is potentially unstable as it is composed of loose sandy soil with embedded boulders and gravels and the slopes have a steep gradient of more than 40°. Should there be triggering factors such as sudden thunderstorms or moderate rainfall over a period of time such as for a few days, there might be further occurrence of landslides in the study area.

REFERENCES

JABATAN MINERAL DAN GEOSAINS, 2001. *Kejadian Gelongsoran Tanah Dan Bongkah Batuan Di Kampung Sungai Chinchin, Daerah Gombak, Selangor Darul Ehsan.* JMG Unpublished Report: JMG.SWP.GS.12/2001.

JABATAN PENYIASATAN KAJIBUMI, 1998. *Gelongsoran Tanah di Bukit Antarabangsa, Hulu Kelang, Selangor.* JPK Unpublished Report: JPK/E(F) 2/98.

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