FACTUAL REPORT ON HONG KONG RAINFALL AND LANDSLIDES IN 2003

GEO REPORT No. 186

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GEOTECHNICAL ENGINEERING OFFICE
CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

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PREFACE

In keeping with our policy of releasing information which may be of general interest to the geotechnical profession and the public, we make available selected internal reports in a series of publications termed the GEO Report series. The GEO Reports can be downloaded from the website of the Civil Engineering and Development Department (http://www.cedd.gov.hk) on the Internet. Printed copies are also available for some GEO Reports. For printed copies, a charge is made to cover the cost of printing.

The Geotechnical Engineering Office also produces documents specifically for publication. These include guidance documents and results of comprehensive reviews. These publications and the printed GEO Reports may be obtained from the Government's Information Services Department. Information on how to purchase these documents is given on the last page of this report.

R.K.S. Chan
Head, Geotechnical Engineering Office
September 2006

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FOREWORD

This report presents a summary of the factual information on rainfall and landslides in Hong Kong throughout 2003. Details of most of the landslides were obtained from the records of incidents reported to the Geotechnical Engineering Office (GEO). Supplementary information was collected from the Agriculture, Fisheries and Conservation Department, Architectural Services Department, Drainage Services Department, Fire Services Department, Highways Department, Housing Department, Lands Department, Water Supplies Department and the GEO's landslide investigation consultants. The Hong Kong Observatory provided weather and rainfall information. The Special Projects Division carried out a review of the available rainfall records and rainfall analysis, and prepared Section 2 of this report. All contributions are gratefully acknowledged.

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ABSTRACT

This report presents a summary of the factual information on rainfall and landslides in Hong Kong throughout 2003. Rainfall information was obtained from the Geotechnical Engineering Office (GEO) and the Hong Kong Observatory (HKO). Details of most of the landslides were obtained from the records of incidents reported to the GEO. Supplementary information was collected from the Agriculture, Fisheries and Conservation Department, Architectural Services Department, Drainage Services Department, Fire Services Department, Highways Department, Housing Department, Lands Department, Water Supplies Department and the GEO's landslide investigation consultants.

Rainfall at the HKO's Principal Raingauge at Tsim Sha Tsui in 2003 amounted to 1942 mm, which was about 12% lower than the mean rainfall of 2214 mm recorded between 1961 and 1990. One Red Rainstorm Warning was issued on 5 May 2003 and 17 Amber Rainstorm Warnings were issued between 8 April 2003 and 3 September 2003.

One Landslip Warning was issued on 5 May 2003. A total of 224 incidents that occurred in 2003 was reported to the Government. Of these, 201 were classified as genuine landslides. Of the 201 genuine landslides, 11 were major failures (i.e. events with a failure volume of 50 m^3 or more, or where a fatality has occurred).

No injury or fatality was reported as a result of the landslide incidents that occurred in 2003. Notable consequences of the landslides included temporary evacuation of three squatter dwellings, one village house and one temple. Eleven landslides resulted in the temporary closure of sections of roads and another 15 landslides resulted in the temporary closure of sections of pedestrian pavements, footpaths and other forms of minor access.

CONTENTS

1. INTRODUCTION

This report presents a summary of the factual information on rainfall and landslides that occurred in Hong Kong throughout 2003. Rainfall information was obtained from the Geotechnical Engineering Office (GEO) and the Hong Kong Observatory (HKO). Details of most of the landslide were obtained from the records of incidents reported to the GEO. Supplementary information was collected from the Agriculture, Fisheries and Conservation Department (AFCD), Architectural Services Department (Arch SD), Drainage Services Department (DSD), Fire Services Department (FSD), Highways Department (HyD), Housing Department (HD), Lands Department (Lands D), Water Supplies Department (WSD) and the GEO's landslide investigation consultants.

In this report, a landslide is defined as the detachment or excessive displacement of soil or rock mass, and includes failure of fill slope, cut slope, retaining wall, natural hillside, disturbed terrain, together with rockfall and boulder fall. A 'major' landslide is defined as a failure in which the estimated/recorded volume of the detached or displaced mass is $\geq$50 m^3, or where a fatality has occurred. A 'very minor' landslide is defined as a failure that is small in scale (i.e. $\leq$5 m^3 for failure involving soil or $\leq$0.1 m^3 for rockfall/boulder fall) and does not give rise to notable consequences (e.g. casualty, 'near-miss', evacuation of buildings or squatter dwellings, road closure, nuisance to the public, etc.). Landslides that are not classified as 'major' landslides or 'very minor' landslides are taken as 'minor' landslides. This report presents rainfall and landslide information throughout the year rather than highlighting any specific rainstorm or landslide.

Diagnosis of landslides occurred in 2003 and recommendations for improving the performance of the slope safety system will be presented separately in a report on the review of the 2003 landslides.

2. RAINFALL

2.1 The Raingauge System

The GEO, in cooperation with the HKO, operates an automatic raingauge system that transmits real-time rainfall data through telephone lines to the GEO and HKO at five-minute intervals. During 2003 this system comprised 86 GEO raingauges and 24 HKO raingauges. The locations of all the raingauges are shown in Figure 1. The raingauges are of the tipping-bucket type, tipping every 0.5 mm of rainfall.

2.2 Rainfall Records

The data from the raingauge system are checked, verified and stored by the GEO in an Oracle database, from which they can be extracted and analysed. This report presents a selection of rainfall parameters for the year, for individual month and individual storm. Further analyses can be carried out for specific tasks if required.

The weather in 2003 was described by the HKO, in the Monthly Weather Summary for December 2003 (HKO, 2004), as follows:

"The year 2003 was the fifth warmest year since records began in 1884. The mean temperature, 23.6 degrees, was 0.6 degrees above normal. It was largely due to milder weather in the first few months of 2003 when there were more sunshine and less frequent cold surges than normal. The year was also relatively dry, with rainfall about 12 per cent below normal. July 2003 was the driest July on record, with only about one third of the normal amount of rainfall for July. This exceptionally dry month was the main contributing factor of the below-normal annual rainfall. The very dry weather in July was associated with the ridge of high pressure over the Pacific being exceptionally strong and extending west to cover south China, bringing a long spell of fine weather to Hong Kong from late June to late July."

"The number of tropical cyclones occurring in the western North Pacific in 2003 was less than normal. In Hong Kong, the tropical cyclone season started late in the year. The first tropical cyclone warning signal was issued on 20 July, a month later than normal. Only 4 tropical cyclones, against the mean of 6, necessitated the issuance of tropical cyclone warnings locally. In contrast to 2002 in which no tropical cyclone entered the South China Sea from the western Pacific, all tropical cyclones that affected Hong Kong in 2003 originated from the Pacific. This was likely to be a result of the change in atmospheric flow associated with the decay of El Nino during the year."

"January was sunnier and slightly warmer than usual. It was warmer and drier than usual from February to April. An area of active thunderstorms affected Hong Kong in the evening of 8 April and the Thunderstorm Warning and the Amber Rainstorm Warning were issued for the first time of the year. May was slightly drier than usual while June was wetter than usual"

"July was warmer and drier than usual. The monthly mean minimum temperature of 27.6 degrees equaled the record high value set in 1993. The monthly rainfall of 101.8 millimetres, less than one third of the normal figure of 323.5 millimetres, was the lowest on record. Waterspouts and funnel clouds occurred over Hong Kong waters on 1, 6, 9 and 31 July. With the approach of Severe Tropical Storm Koni, the first Tropical Cyclone Warning Signal of the year was issued on 20 July. The first Number 3 signal and later the first Number 8 Tropical Cyclone Warning Signal of the year were issued on 23 July as Typhoon Imbudo approached Hong Kong."

"August was cloudier and wetter than usual. Typhoon Krovanh necessitated the issuance of the No. 3 Strong Wind

> Signal in Hong Kong. It was wetter than usual again in September. As Typhoon Dujuan skirted the north of Hong Kong about 30 kilometres from the Hong Kong Observatory on 2 September, the Increasing Gale or Storm Signal No. 9 was issued for the first time since 1999. October was sunnier and much drier than normal. November was wetter than normal. December had only a trace of rainfall recorded. The monthly rainfall ranked the second lowest together with seven other years since records began."

The cumulative rainfall for 2003 recorded at the HKO amounted to 1942 mm, which was about 12% lower than the mean rainfall of 2214 mm recorded between 1961 and 1990. The cumulative rainfall for 2003 is compared with the highest, the lowest and the mean rainfall in Figure 2.

Figures 3a, 3b, 3c and 3d show the total monthly rainfall distribution in 2003.

Figure 4 shows the total annual rainfall distribution during 2003, together with the locations of reported landslides.

2.3 Rainstorms in 2003

The maximum 24-hour, five-hour and one-hour rolling rainfall (with five-minute basic units) for the six storms during 2003 in which rainfall exceeded 50 mm at the HKO are given in Table 1, together with the maximum amounts at any of the GEO raingauges. Also included are the 4-day and 15-day antecedent rainfall at the HKO, as well as the number of reported landslides. Similar data from selected previous major rainstorms are included for comparison.

Figures 5 to 10 show isohyets of the maximum rolling 24-hour rainfall during these six storms, together with landslide locations and the locations and values of maximum rainfall for durations from five minutes to 48 hours.

Only two storms generated significant numbers of landslides. The storms of 5-6 May 2003 and 7-12 June 2003 generated 89 and 29 reported landslides respectively. No other storms produced more than five reported landslides.

There were 19 storms that generated more than 50 mm of rainfall in 24 hours if all the GEO raingauges are considered (including the six storms summarised in Table 1). Rainfall parameters for these 19 storms are shown in Appendix A, Table A1.

2.4 Warnings Issued by the Hong Kong Observatory

Table 2 gives details of the Thunderstorm, Flood, Landslip, Tropical Storm and Rainstorm Warnings issued by the HKO and the GEO in 2003. One Red Rainstorm Warning was issued on 5 May 2003 and 17 Amber Rainstorm Warnings were issued between 8 April 2003 and 3 September 2003. One Landslip Warning was issued on 5 May 2003.

3. LANDSLIDES

3.1 Landslide Occurrence in 2003

The numbers of landslides reported to the GEO and other Government departments in 2003 are summarised in Table 3.

A total of 224 landslides was reported to the Government (see Figure 4). These include 185 landslides reported to the GEO and 39 landslides reported only to other Government departments (i.e. AFCD, Arch SD, DSD, FSD, HyD, HD, Lands D and WSD). Of these 224 landslides, 20l landslides were classified as genuine landslides (see details in Appendix B). The other reported incidents either did not involve landslides (e.g. tree fall) or were of no geotechnical concern (e.g. very small surface erosion or washout incidents) and were therefore not considered in the analysis below.

Of the 201 genuine landslides, 11 (5.5%) were major landslides (see Table B1 in Appendix B), 158 were minor landslides and 32 were very minor landslides with negligible consequence.

Selected notable landslides are presented in Section 4 and illustrated in Plates 1 to 7. For those landslide incidents inspected by the GEO, the information about the landslides was recorded in GEO Incident Reports (and in Landslip Cards for major landslides). For those landslide incidents attended to by other Government departments responsible for slope maintenance, landslide incident reports were prepared by the respective departments to document the key information. The above information, together with the scanned images of all incident reports and Landslip Cards prepared by the GEO and other Government departments, have been uploaded onto the Slope Information System (SIS), which is accessible by the general public through computer terminals in the GEO. Further details of these failures can be found in the incident files of the three District Divisions and the Landslip Investigation Division of the GEO.

Wherever possible, the dates and times of the landslides were assessed by geotechnical engineers. Some incidents were not reported to the GEO or other Government departments until several days or weeks after they had occurred. For these landslides, it is difficult to establish the exact times of occurrence. Of the 201 genuine landslides, the times of occurrences were determined to within one day for a total of 165 incidents.

It should be noted that there were almost certainly other landslides which were not reported, many of which would have occurred in remote areas with no immediate consequences.

3.2 Consequence of Landslides

3.2.1 General

The consequence of landslides in terms of the number of landslide incidents affecting various types of facility (e.g. buildings, roads, squatter dwellings, etc.) in Hong Kong, Kowloon and the New Territories is shown in Table 4. It should be noted that a failure may affect more than one type of facility. Significant consequences of landslides (e.g. casualties,

evacuation of buildings or squatter dwellings, closure of roads, etc.), as classified with respect to the type of slope failure, are listed in Table 5. Table 6 shows the distribution of the different facility groups affected by major landslides. Further descriptions of selected notable landslides are presented in Section 4 below.

3.2.2 Buildings

Fifteen landslides affected buildings, one of which was major. Of the 15 landslides, one resulted in the temporary closure of a village house and one resulted in the temporary evacuation of a temple. Landslide Incidents Nos. 2003/05/0020 and 2003/06/0111 are described in Section 4.

3.2.3 Roads and Transport Facilities

Twenty-seven landslides (none of which was major) affected sections of roads. Nine landslides resulted in the temporary closure of sections of roads. Landslide Incident No. 2002/05/0009 is described in Section 4.

3.2.4 Squatter Dwellings

Ten landslides, none of which was major, affected squatter dwellings (i.e. dwellings that contain tolerated squatter structures which were surveyed in Housing Department's 1982 Squatter Structure Survey). Two landslides resulted in the temporary evacuation of a total of three squatter dwellings.

3.2.5 Construction Sites

Three landslides affected active construction sites, one of which was major. Landslide Incident No. 2003/09/0191 is described in Section 4.

3.2.6 Catchwaters and Reservoirs

Seven landslides affected catchwaters. None of these was major.

3.2.7 Other Facilities

Other facilities affected by landslides included pedestrian pavements, footways, minor footpaths, minor access facilities, carparks, playgrounds, parks, gardens, backyards, open areas, etc. Seventy-one landslides (three of which were major) affected pedestrian pavements, footways, minor footpaths and access facilities. Of these 71 landslides, 15 resulted in the temporary closure of sections of pedestrian pavements, footpaths and other forms of minor access. Seventy-two landslides affected carparks, playgrounds, parks, gardens, backyards, open areas, etc. and six of these were major. Landslide Incidents Nos. 2003/05/0031, 2003/05/0052 and 2003/05/0098 are described in Section 4.

3.3 Types of Slope Failures

3.3.1 General

Landslides reported to the GEO and other Government departments have been classified into five types of slope failures, i.e. fill slope, cut slope, retaining wall, natural hillside and disturbed terrain. The numbers of different types of slope failures are shown in Table 7.

3.3.2 Fill Slopes

There were 16 fill slope failures, comprising about 8% of all landslides reported. Three of these failures were major. Landslide Incidents Nos. 2003/05/0052 and 2003/09/0191 are described in Section 4.

3.3.3 Cut Slopes

There were 137 cut slope failures, comprising about 68% of all landslides reported. These were classified further according to the types of material involved, i.e. soil, soil/rock and rock.

There were 105 landslides on soil cut slopes (two of which were major) and 25 landslides on soil/rock cut slopes (one of which was major). Landslide Incidents Nos. 2003/05/0009, 2003/06/0098 and 2003/06/0111 are described in Section 4.

There were seven landslides on rock cut slopes, none of which was major.

3.3.4 Retaining Walls

There were twelve landslide incidents involving the failure of retaining walls, which amounted to about 6% of all landslides reported. None of these was major.

3.3.5 Natural Hillside

There were 32 natural hillside failures, comprising about 16% of all landslides reported. Three of these were major. Landslide Incidents Nos. 2003/05/0020 and 2003/05/0031 are described in Section 4.

3.3.6 Disturbed Terrain

There were four disturbed terrain failures reported, comprising about 2% of all landslides reported. Two of these were major.

3.4 Landslide Volume Distribution

Tables 8 and 9 show the distribution of landslide volumes for all the reported landslides. A total of 121 landslides (about 60%) involved less than 5 m^3 of material. Eleven of the reported landslides (about 5.5%) involved a failure volume of 50 m^3 or more. Of these 11 major failures, three affected fill slopes, two affected soil cut slopes, one affected a soil/rock slope, three affected natural hillsides and two affected disturbed terrain.

4. NOTABLE LANDSLIDES

4.1 General

Out of the 201 genuine landslides reported to the Government in 2003, seven are described in more detail below. These seven landslides have been selected mainly on the basis of their failure volumes, consequence or technical interest.

4.2 The 13 June 2003 Rockfall on Slope No. 11NE-D/C373 behind a Temple at Rehab Path, Kwun Tong (Incident No. 2003/06/0111)

(A rockfall from a soil/rock cut slope which destroyed a flimsy structure and resulted in the temporary closure of a temple at the slope toe, Plate 1)

At about 7.00 a.m. on 11 June 2003, when an Amber Rainstorm Warning was in force, a rockfall with a failure volume of about 15 m^3 (Incident No. 2003/06/0111) occurred on the rock portion of a soil/rock cut slope (slope No. 11NE-D/C373). The rockfall involved the detachment of several large rock blocks at the southeast portion of the slope. These rock blocks travelled about 20 m downhill and destroyed a flimsy structure at the slope toe, which was built against the rear wall of a temple and was used for storage. The flimsy structure was completely destroyed as a result of the rockfall incident and the temple was closed temporarily following the incident.

The source area of the June 2003 rockfall, which is located within the portion of the slope under the responsibility of the private owner, was in a poor state of maintenance with dilated subvertical back release joints that were partly infilled with soil debris. Presence of undesirable vegetation growth in the joints probably resulted in jacking action on the rock blocks.

4.3 The 5 May 2003 Washout on Slope No. 10SW-C/FR11 at South Lantau Road, Lantau (Incident No. 2003/05/0052)

(Major washouts on a recently upgraded fill slope during heavy rainstorm, Plate 2)

On the morning of 5 May 2003, when a Red Rainstorm Warning and a Landslip Warning were in force, major washout (Incident No. 2003/05/0052) occurred at the north and south portions of a fill slope (slope No. 10SW-C/FR11) below South Lantau Road, Lantau. The volumes of debris arising from the north and south scars were about 80 m^3 and 70 m^3 respectively. The debris was washed down to a stream course at the slope toe and no

casualty or road closure was reported.

The fill slope is located below a sharp bend of South Lantau Road, which is also a local low point for a length of about 150 m along the road. The road drainage was found to have been partially blocked with soil debris and vegetation at the time of the landslide. The local geometry of the road and the overall site setting (i.e. a sizeable catchment upslope of South Lantau Road), together with the partial blockage of the road drainage, promoted concentration of surface water flow towards the fill slope. Blockage of the road drainage and inadequate attention to the detailing of the slope drainage provisions were probable contributory factors to the incident.

4.4 The 5 May 2003 Landslide on Slope No. 6NE-B/C8 at Fan Kam Road, Pat Heung (Incident No. 2003/05/0009)

(A landslide from a soil cut slope and a boulder fall from the natural hillside above, which resulted in the temporary closure of one traffic lane, Plate 3)

At about 5:00 a.m. on 5 May 2003, when a Red Rainstorm Warning was in force, a landslide with a failure volume of about 20 m³ (Incident No. 2003/05/0009) occurred in the upper, unsupported cut portion of slope No. 6NE-B/C8 (which is a 23 m high, 40° steep vegetated cut slope). Some of the landslide debris was deposited on the northeast-bound lane of Fan Kam Road below. One lane of Fan Kam Road was closed temporarily as a result of the incident. A boulder fall involving a large boulder (approximately 4.2 m³ in volume) that originated from the natural terrain some 60 m above the crest of slope No. 6NE-B/C8 occurred about one to two hours after the 5 May 2003 landslide. The boulder travelled down the cut face and across both lanes of Fan Kam Road before coming to rest on the pedestrian pavement on the opposite side of the road. The large boulder narrowly missed a vehicle that was parked on the opposite side of the road, shortly after the driver got out of the vehicle. No casualty was reported as a result of the incident.

The slope was upgraded about three years before the landslide and the upgrading works comprised installation of soil nails (except for the uppermost 7 m of the soil cut where the source of the 5 May 2003 landslide was located), and the replacement of the pre-existing hard surface cover with a vegetated cover.

4.5 The 5 May 2003 Landslide on the Natural Hillside behind House No. 51, Wong Chuk Yuen Village, Yuen Long (Incident No. 2003/05/0020)

(A natural hillside failure which resulted in the temporary closure of a village house for five months, Plate 4)

Between 4:00 a.m. and 5:00 a.m. on 5 May 2003, when a Red Rainstorm Warning was in force, a major landslide with a failure volume of about 160 m³ (Incident No. 2003/05/0020) occurred on the hillside behind house No. 51 Wong Chuk Yuen Upper Village, Yuen Long. The landslide debris entered an existing depression immediately below the source area and became a debris flow. The debris blocked a stream course at the toe of the hillside and partly damaged a brick fence wall at the back of house No. 51. Debris outwash entered a

village house and a total of three occupants was evacuated from the house shortly after the landslide. The house was closed temporarily for about five months following the landslide incident. No casualty was reported as a result of the incident.

The natural hillside has a history of retrogressive failures. The source area of the landslide was locally over steepened (about 60º), which was probably due to the presence of an existing scarp formed by erosion or previous instability within the deeply weathered granodiorite.

4.6 The 14 September 2003 Landslide on Slope No. 11NE-D/F10 below Hiu Kwong Street, Sau Mau Ping (Incident No. 2003/09/0191)

(A major landslide on a temporary cut in an existing fill slope within an active construction site, Plate 5)

On 14 September 2003 during moderate rainfall, a major landslide with a failure volume of about 200 m³ (Incident No. 2003/09/0191) occurred on a 12 m high, 55° steep temporary cut in an existing fill slope within an active construction site below Hiu Kwong Street, Sau Mau Ping. The slope upgrading works involved the recompaction of the top 5 m to 6 m of fill material and the temporary cut was formed about 3 days before the incident. The upper portion of the temporary cut was covered with shotcrete and the lower portion was covered with tarpaulin sheet at the time of failure. Landslide debris was deposited on the fill platform below the temporary cut and did not travel beyond the site boundary. No casualty or damage was reported as a result of the incident.

An existing horizontal drainage blanket, about 300 mm thick (with raking drains above the drainage blanket), was identified about 2.5 m below the crown of the backscarp. Post-failure inspection revealed signs of seepage at several locations at the backscarp. At the time of the landslide, surface runoff from the upper part of the existing fill slope travelled along a haul road above the temporary cut and was directed towards the edge of the failure scar.

4.7 The 6 June 2003 Rockfall Incident on Slope No. 11SE-B/C101 at Tung Kin Road, A Kung Ngam (Incident No. 2003/06/0098)

(A major rockfall from a soil/rock cut slope which affected a fenced-off open area that was previously occupied under a former Short Term Tenancy (STT) Agreement until November 2000, Plate 6)

At about 12:00 p.m. on 6 June 2003 during moderate rainfall, a major rockfall (Incident No. 2003/06/0098) occurred at the northwest-facing portion of a 50 m high soil/rock cut (slope No. 11SE-B/C101) at Tung Kin Road, A Kung Ngam, which has a history of failure. The volume of the rockfall was about 70 m^3. The rockfall debris comprised predominantly boulder- and cobble-sized rock blocks of slightly to moderately decomposed granite. The debris was deposited within a fenced-off open area within a former STT site, which was cleared in November 2000. No casualty or damage was reported as a result of the incident.

The source area of the rockfall extended from 10 m to 30 m above the slope toe. The rockfall was structurally controlled and occurred along a persistent planar joint having a similar orientation to the local slope face. Persistent seepage, adverse jointing and tree root action probably contributed to the rockfall.

4.8 The 5 May 2003 Landslide on the Natural Hillside at Kau Lung Hang Shan, Tai Po (Incident No. 2003/05/0031)

(A natural hillside failure which resulted in the complete closure of the sole vehicular access road to the Cloudy Hill Transmitter Station, Plate 7)

At about 4:00 a.m. on 5 May 2003, when an Amber Rainstorm Warning was in force, a major landslide with a total failure volume of about 200 m^3 (Incident No. 2003/05/0031) occurred on the natural hillside north of Kau Lung Hang Village, Tai Po. The landslide debris reached an ephemeral drainage line and turned into a debris flow. The debris flow travelled downhill along the drainage line and completely blocked the sole vehicular access road to the Cloudy Hill Transmitter Station. No casualty was reported as a result of the incident.

The source area of the landslide comprised completely decomposed coarse ash tuff with layers of moderately decomposed siltstone and fine-grained tuff. The decomposed rocks were overlain by colluvium of up to 0.7 m thick. The surface of rupture was located partly along the interface between colluvium and decomposed tuff and partly within the decomposed tuff.

5. CONCLUSIONS

Rainfall at the HKO's Principal Raingauge at Tsim Sha Tsui amounted to 1942 mm in 2003, which was about 12% lower than the mean rainfall of 2214 mm recorded between 1961 and 1990. One Landslip Warning and one Red Rainstorm Warning were issued on 5 May 2003. A total of 224 incidents was reported, of which 201 were genuine landslides. Of the 201 genuine landslides, 11 were major landslides, 158 were minor landslides and 32 were very minor landslides with negligible consequence.

None of the landslide incidents in 2003 resulted in injury or death. Notable consequences of landslides in 2003 included the temporary evacuation of three squatter dwellings, one village house and one temple. Eleven landslides resulted in the temporary closure of sections of roads and another 15 landslides resulted in the temporary closure of sections of pedestrian pavements, footpaths and other forms of minor access.

6. REFERENCES

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LIST OF TABLES

Table 1 - Rainfall and Landslides in 2003, Compared with Selected Previous Major Rainstorms

Date[1] of Event	Maximum Rainfall (mm)[2]								Landslide Consequences
	Hong Kong Observatory (HKO)					GEO Raingauges[3]			Number of Landslides[4] Reported to GEO[5]
	24-hr	5-hr	1-hr	Antecedent		24-hours	5-hours	1-hour	
				4 days	15 days				
8-9 Apr 2003	67	60	44	13	17	110.5(H29)	96(N18)	70.5(H01)	0
5-6 May 2003[5]	130	80	44.5	51.5	51.5	505(N36)	322(N23)	118.5(N31)	89
7-12 Jun 2003	149	107.5	65	33.5	58	361.5(H28)	214(H28)	135(H28)	29
21-26 Aug 2003	101	66	45	44.5	107	175(N36)	131.5(N49)	84.5(H29)	4
2-3 Sep 2003	92.5	45.5	12	0	251.5	181.5(N40)	108(N46)	71(N46)	5
14-16 Sep 2003	126	48	25.5	0	155	221.5(N14)	101.5(N44)	57(N13)	3
Selected Previous Major Rainstorms (for comparison only)									
28-29 May 82	394	153	44	1	11	430	237	111	238
17 Jun 83[5]	347	274	69	2	77	460	303	101	155
20-21 May 89[5]	388	149	37	28	42	566	224	51	378
7-9 May 92[5]	324	196	110	65	71	385	244	110	314
15-16 Jun 93[5]	155	129	54	18	275	285	195	111	123
4-5 Nov 93[5]	107	31	9	8	8	742	350	94	394
1-4 Jul 97[5]	110	49	18	183	380	799	296	125	150
8-9 Jun 98[5]	429	164	48	58	181	562	223	98	96
22-26 Aug 99[5]	313	143	51	11	175	565	249	121	269

Notes:
(1) Rainstorms in which rolling 24-hour rainfall at the Hong Kong Observatory, Tsim Sha Tsui, exceeded 50 mm are arranged in order of the intensity of 24-hour rainfall.
(2) The maxima are calculated using 5-minute rainfall as the basic unit, except those recorded at the HKO for the previous major rainstorms. They are the rolling rainfall amounts using one-clock hour rainfall as the basic unit. The 1-hour maximum rainfall at the HKO refers to clock hours.
(3) The maxima are selected from the 86 GEO Raingauges for the rainstorms. The GEO Raingauge reference number is shown in brackets.
(4) Reported totals are for landslides attributed to the events.
(5) Landslip Warnings were issued for these events.

Table 2 - Warnings Issued by the Hong Kong Observatory in 2003[1]

Month	Monthly Total Rainfall (mm)	Dates on which Warnings were in Effect				
		Thunderstorm	Flood	Landslip	Tropical Storm	Rainstorm
January	21.7	-	-	-	-	-
February	15.1	-	-	-	-	-
March	38.6	-	-	-	-	-
April	84.5	8-9, 30	-	-	-	8-9 (Amber)
May	249	3-4, 4, 4-6, 8, 9, 14, 17-18, 24, 24-25, 25	5	5(07:30) - 6(07:00)	-	4 (Amber), 5 (3 x Amber, Red), 18 (Amber)
June	523.5	6, 7, 9, 10, 10-11, 12, 13, 14, 15, 15-16, 16, 20, 20-21, 21, 22, 23, 26, 28	10-11	-	-	9 (Amber), 10 (2 x Amber), 10-11 (Amber), 13 (Amber), 14 (Amber)
July	101.8	10, 10-11, 11, 12, 20, 21, 23	-	-	20-21(1, Koni) 22-24(1-8, Imbudo)	-
August	415	4-5, 5, 6, 7, 8, 9, 12, 14, 15, 16, 16-17, 17, 18, 19, 20, 21, 21-22, 22, 24, 25, 31	-	-	23-25(1-3, Krovanh)	4 (Amber), 17 (Amber), 22 (Amber), 24 (Amber)
September	394	1, 3, 3-4, 5, 5-6, 6-7, 7-8, 10, 14, 15, 16, 19, 20, 21	2	-	1-3(1-9, Dujuan)	2-3 (Amber)
October	48.6	11, 13	-	-	-	-
November	50.1	8	-	-	-	-
December	0.0	-	-	-	-	-
Total	1941.9	71 days	4 days	1 Warning	4 Warnings	16 days (Red, 17 x Amber)

Notes:
(1) Landslip Warnings were issued after consultation between GEO and HKO.
(2) Warnings and signals in this Table were based on HKO.

Table 3 - Number of Landslides in 2003 Reported to Government

Department	Total Number of Landslides	Genuine Landslides
Agriculture, Fisheries and Conservation Department	5 (0)	5 (0)
Architectural Services Department	13 (7)	13 (7)
Drainage Services Department	0 (0)	0 (0)
Fire Services Department	0 (0)	0 (0)
Geotechnical Engineering Office, Civil Engineering Department	185*	162
Highways Department	11 (11)	8 (8)
Housing Department	1 (0)	1 (0)
Lands Department	20 (2)	20 (2)
Water Supplies Department	9 (0)	9 (0)

Legend:

13 (7) Thirteen incidents of which seven were previously reported to the GEO.

Note: * denotes number of landslides reported to the GEO discounting false alarm, duplicate cases, etc.

Table 4 - Number of Landslides Affecting Different Facilities

Affected Facility	Hong Kong Island	Kowloon	New Territories and Outlying Islands	All
Squatter Dwellings	0 (0)	0 (0)	10 (0)	10 (0)
Buildings	2 (0)	1 (0)	12 (1)	15 (1)
Roads	9 (0)	1 (0)	17 (0)	27 (0)
Transportation Facilities (railways, tramways, LRT, etc.)	0 (0)	0 (0)	0 (0)	0 (0)
Pedestrian Pavements/Footways	0 (0)	2 (0)	3 (0)	5 (0)
Minor Footpaths/Access	4 (0)	2 (0)	60 (3)	66 (3)
Construction Sites	0 (0)	1 (1)	2 (0)	3 (1)
Open Areas	8 (1)	1 (0)	28 (1)	37 (2)
Catchwaters	0 (0)	0 (0)	7 (0)	7 (0)
Others (e.g. carparks, parks, playgrounds, gardens, backyards, etc.)	4 (0)	1 (0)	30 (4)	35 (4)

Legend:

8 (0) Eight landslides of which none was a major failure.

Notes: (1) A given landslide may affect more than one type of facility.
(2) Incidents which were not genuine landslides have been excluded.

Table 5 - Landslide Consequence Related to Type of Failure

Type of Failure		No. of Squatter Dwellings Evacuated		No. of Blocks, Houses or Flats Evacuated or Partially Closed	No. of Road Closure			Deaths	Injuries
		Permanent	Temporary		Roads	Pedestrian Pavements	Footpaths, Back Lanes, Private Access		
Fill Slope		0	2	0	1	1	0	0	0
Cut Slope	Soil	0	0	0	3	0	7	0	0
	Soil/Rock	0	0	1	2	0	1	0	0
	Rock	0	0	0	2	1	0	0	0
Retaining Wall		0	1	0	0	0	1	0	0
Natural Hillside		0	0	1	1	0	3	0	0
Disturbed Terrain		0	0	0	0	0	1	0	0

Note: A failure may give rise to more than one type of consequence.

Table 6 - Distribution of Facility Groups Affected by Major Landslides

	Facility Group Affected by Major Landslides (Group Nos.)						
	1a	1b	2a	2b	3	4	5
All Major Landslides	1	0	0	1	0	5	4
Major Landslide on Man-made Slope	0	0	0	1	0	1	4
Major Landslide on Natural Hillside	1	0	0	0	0	4	0

Notes: (1) Facility groups are classified in accordance with that adopted for the New Priority Classification Systems (Wong, 1998).
(2) A given landslide may affect more than one type of facility.

Table 7 - Numbers of Reported Landslides Classified by Type of Failure

Type of Failure		Number	Percentage (%)
Fill Slope		16 (3)	8.0
Cut Slope	Soil	105 (2)	52.2
	Soil/Rock	25 (1)	12.4
	Rock	7 (0)	3.5
Retaining Wall		12 (0)	6.0
Natural Hillside		32 (3)	15.9
Disturbed Terrain		4 (2)	2.0
Total		201 (11)	100

Legend:

16 (3) Sixteen landslides of which three were major failure.

Notes: (1) Where a landslide involved more than one type of failure, the predominant type has been adopted in the above classification.
(2) Incidents which were not genuine landslides have been excluded.

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Table 8 - Landslide Volume Distribution with Respect to Geographical Locations

Volume of Failure (m^3)	Hong Kong Island	Kowloon	New Territories and Outlying Islands	All
<5	17	6	98	121 (60.2%)
≥5 to <10	5	0	32	37 (18.4%)
≥10 to <20	3	1	15	19 (9.4%)
≥20 to <50	0	0	13	13 (6.5%)
≥50 to <200	1	0	8	9 (4.5%)
≥200 to <500	0	1	1	2 (1.0%)
≥500 to <1000	0	0	0	0 (0%)
≥1000	0	0	0	0 (0%)
Total	26	8	167	201 (100%)

Legend:

121 (60.2%) 121 landslides, which amount to 60.2% of the 201 genuine landslides reported to the Government.

Table 9 - Landslide Volume Distribution with Respect to Type of Failure

Volume of Failure (m^3)	Fill Slope	Cut Slope			Retaining Wall	Natural Hillside	Disturbed Terrain	Total
		Soil Slope	Soil/Rock	Rock				
<5	7	64	20	6	6	17	1	121 (60.2%)
≥5 to <10	4	24	0	0	5	4	0	37 (18.4%)
≥10 to <20	1	10	3	1	0	4	0	19 (9.4%)
≥20 to <50	1	5	1	0	1	4	1	13 (6.5%)
≥50 to <200	2	2	1	0	0	2	2	9 (4.5%)
≥200 to <500	1	0	0	0	0	1	0	2 (1.0%)
≥500 to <1000	0	0	0	0	0	0	0	0 (0%)
≥1000	0	0	0	0	0	0	0	0 (0%)
Total	16 (8.0%)	105 (52.2%)	25 (12.4%)	7 (3.5%)	12 (6.0%)	32 (15.9%)	4 (2.0%)	201 (100%)

Legend:

16 (8.0%) Sixteen landslides which amount to about 8% of the 201 genuine landslides reported to the Government.

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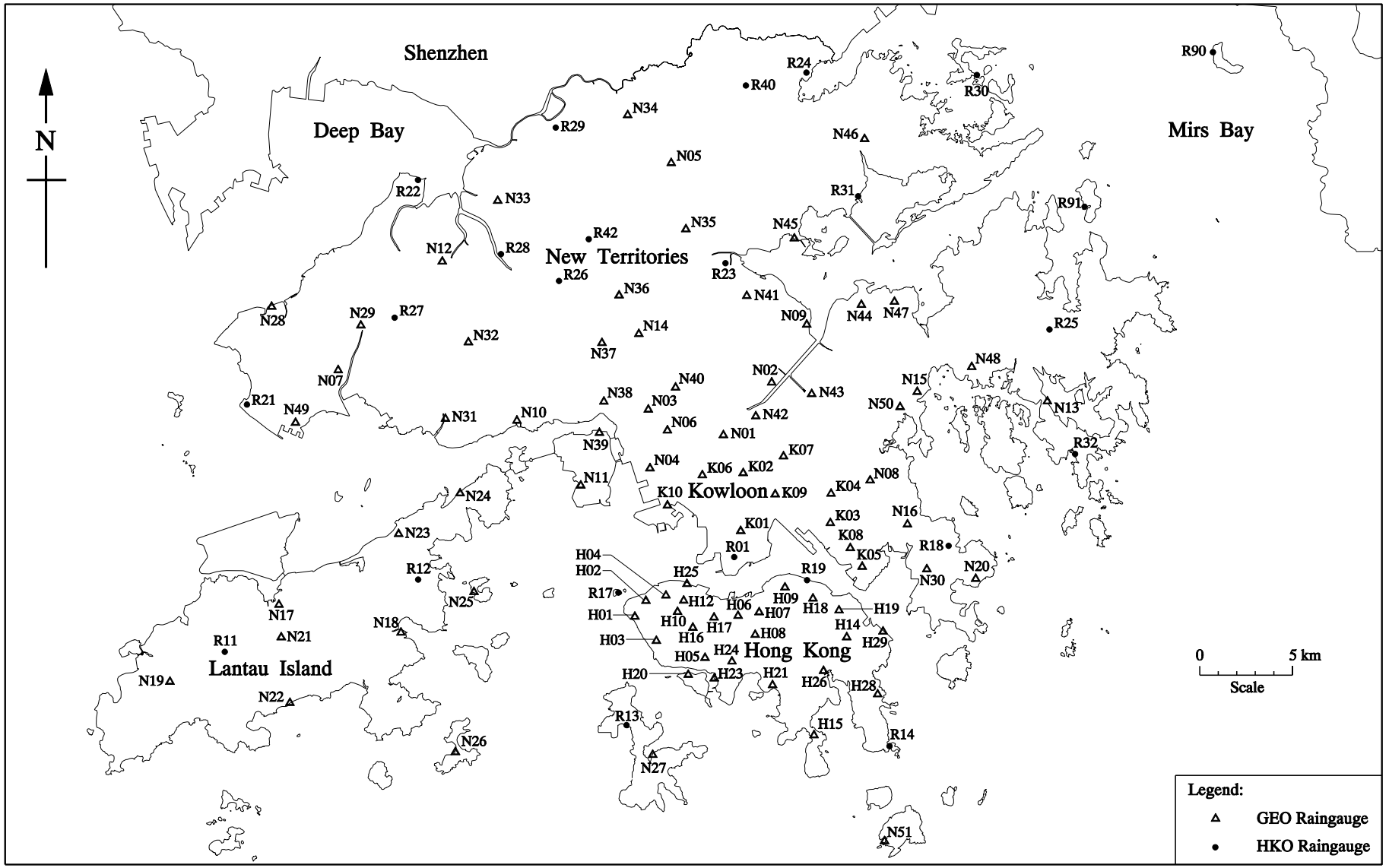

Figure 1 - Locations of GEO and HKO Automatic Raingauges

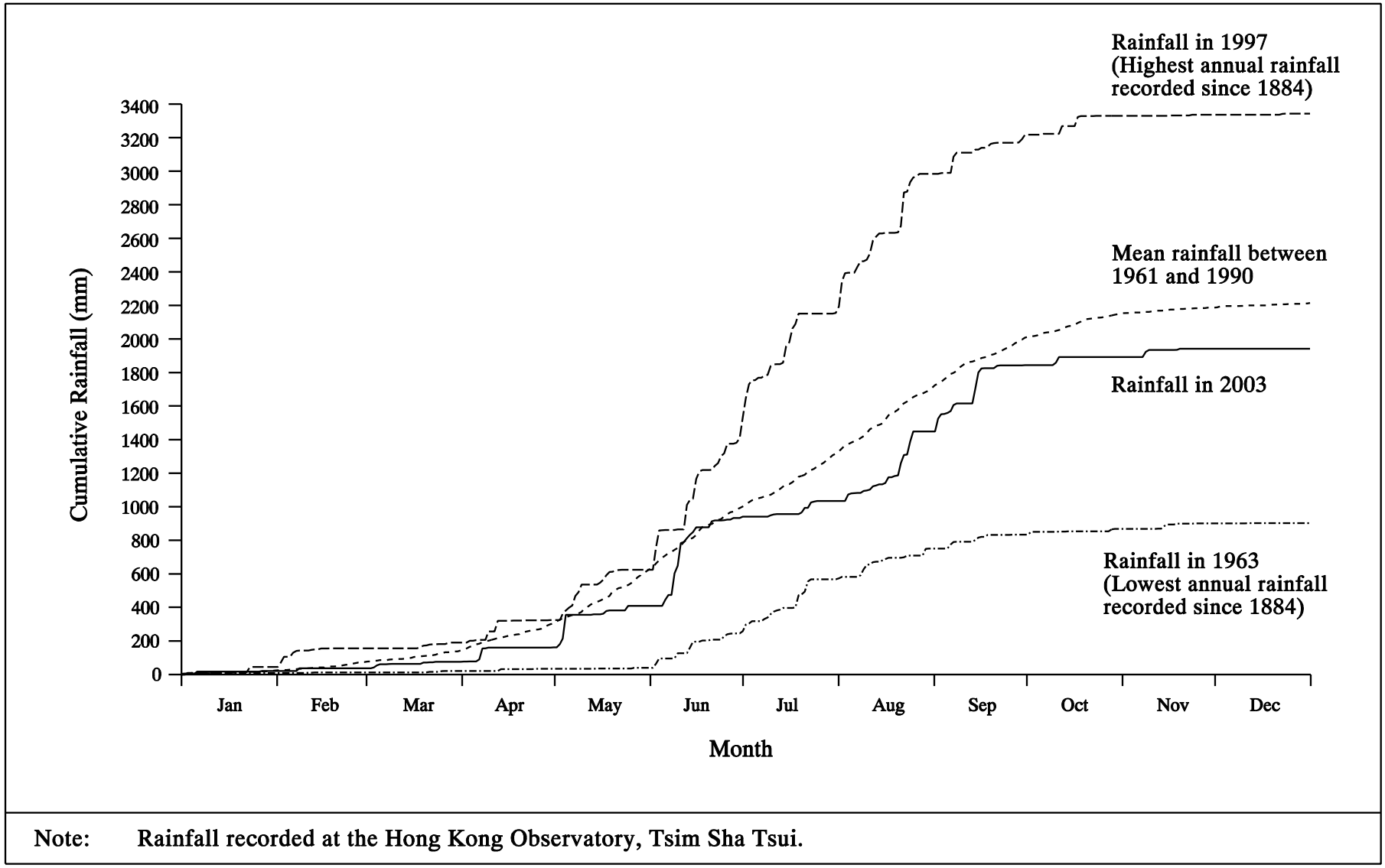

Figure 2 - Cumulative Rainfall for 2003 at the Hong Kong Observatory and its Recorded Highest, Mean and Lowest Cumulative Rainfalls

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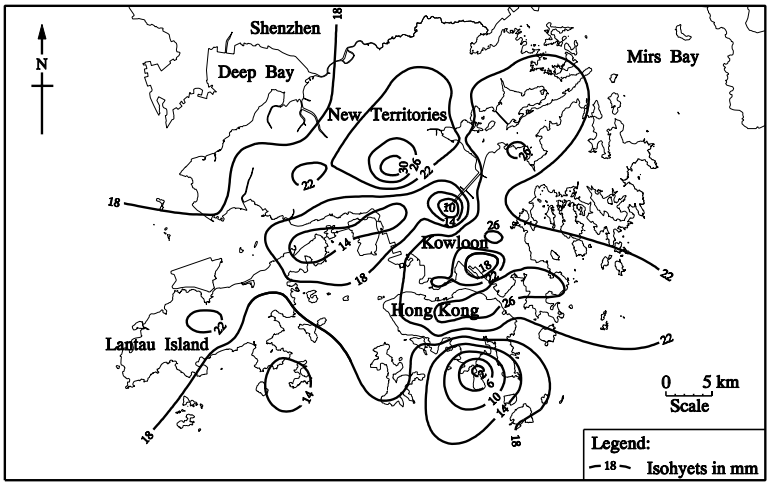

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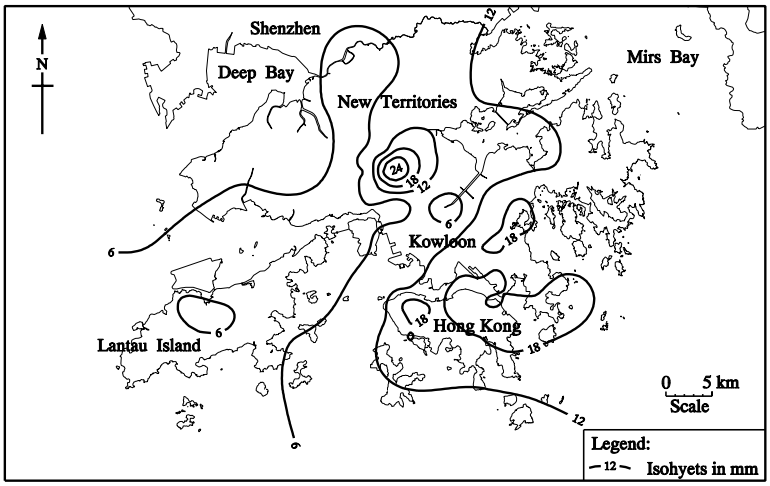

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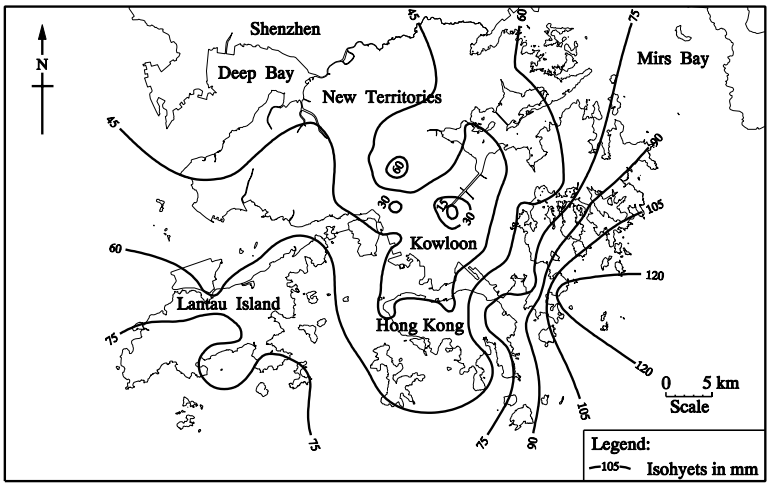

March 2003

Note: Isohyets are based on all the GEO raingauges and the raingauges at the Hong Kong Observatory.

Figure 3a - Total Monthly Rainfall Distribution in 2003

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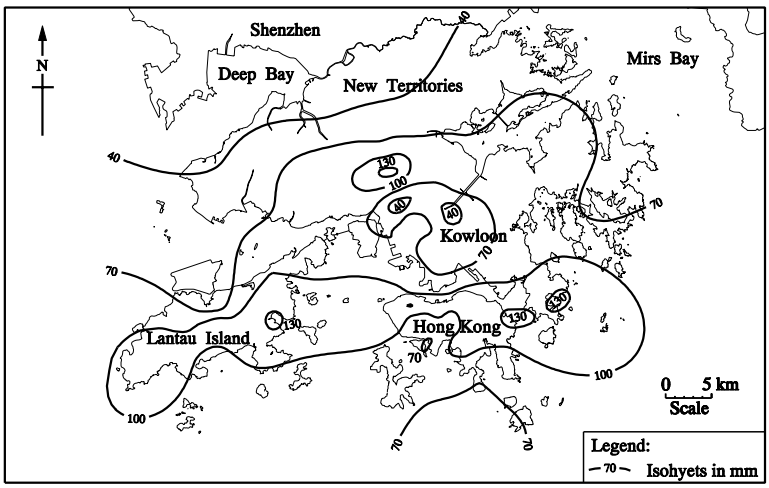

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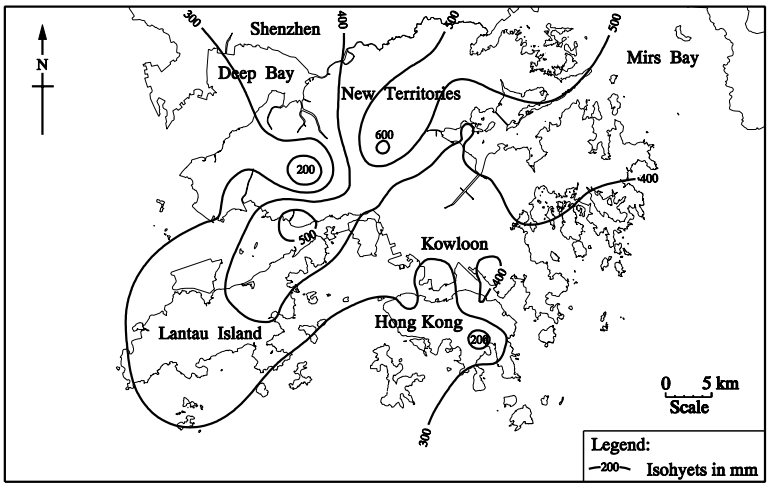
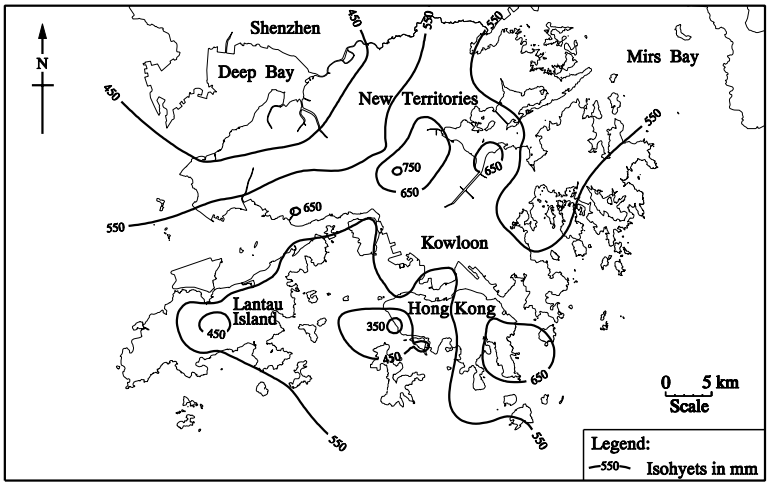


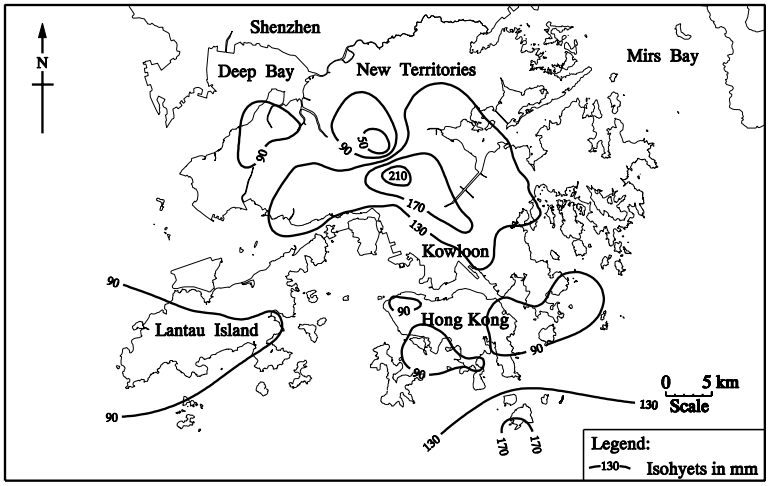
May 2003



June 2003

Note: Isohyets are based on all the GEO raingauges and the raingauges at the Hong Kong Observatory.

Figure 3b - Total Monthly Rainfall Distribution in 2003



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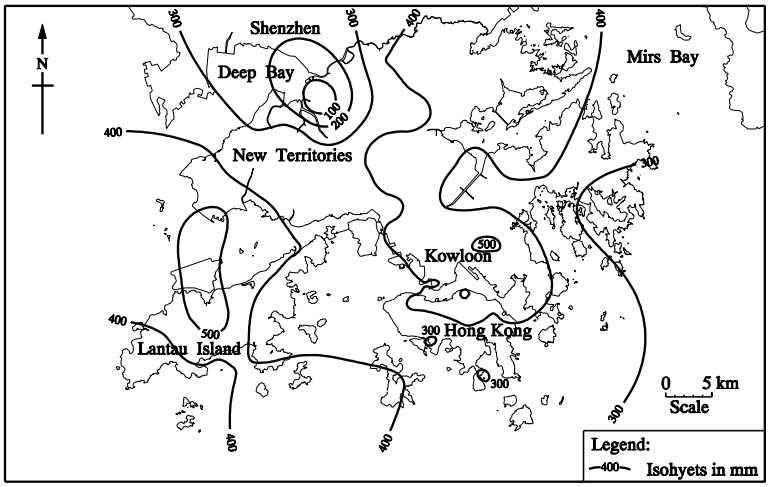

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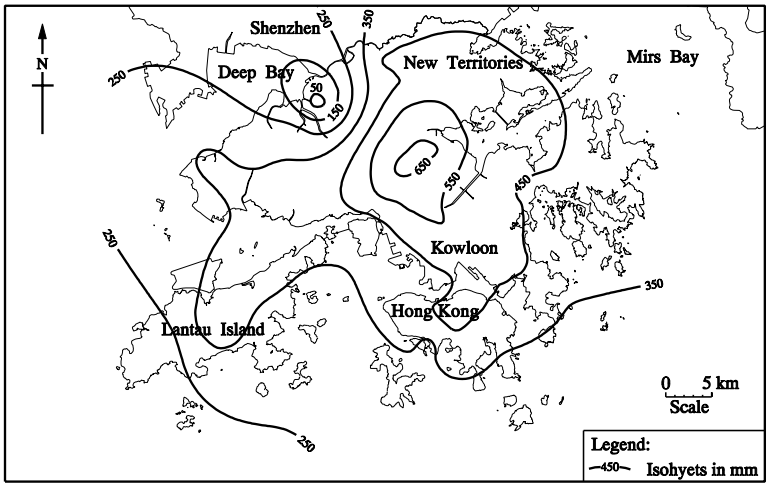

September 2003

Note: Isohyets are based on all the GEO raingauges and the raingauges at the Hong Kong Observatory.

Figure 3c - Total Monthly Rainfall Distribution in 2003

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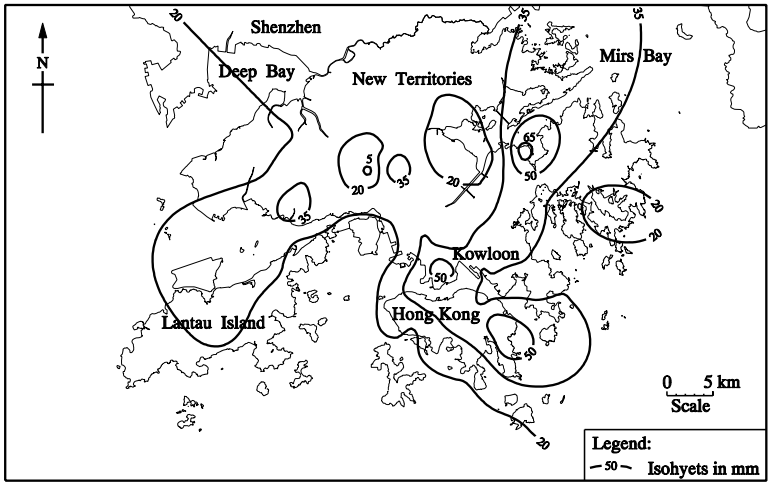

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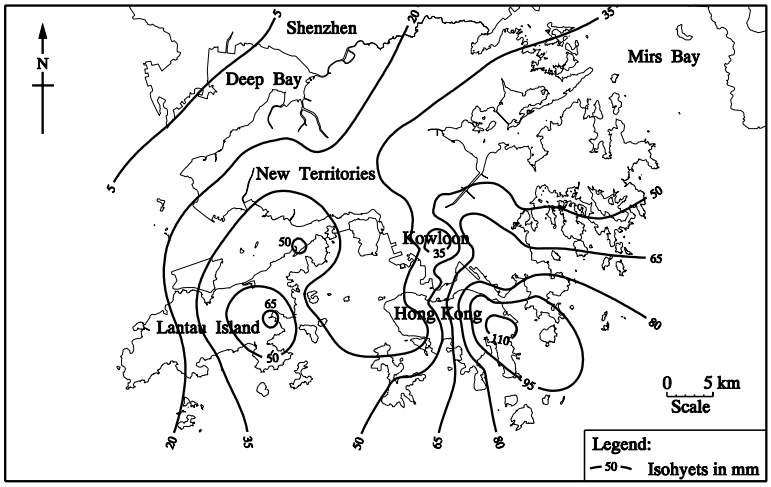

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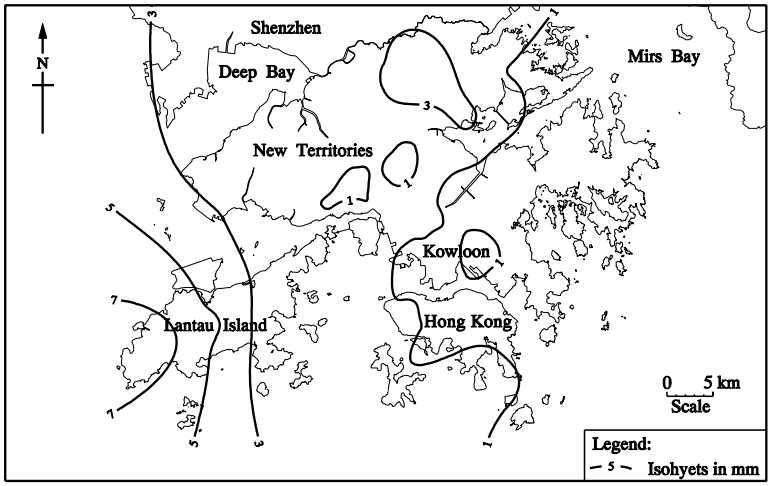

December 2003

Note: Isohyets are based on all the GEO raingauges and the raingauges at the Hong Kong Observatory.

Figure 3d - Total Monthly Rainfall Distribution in 2003

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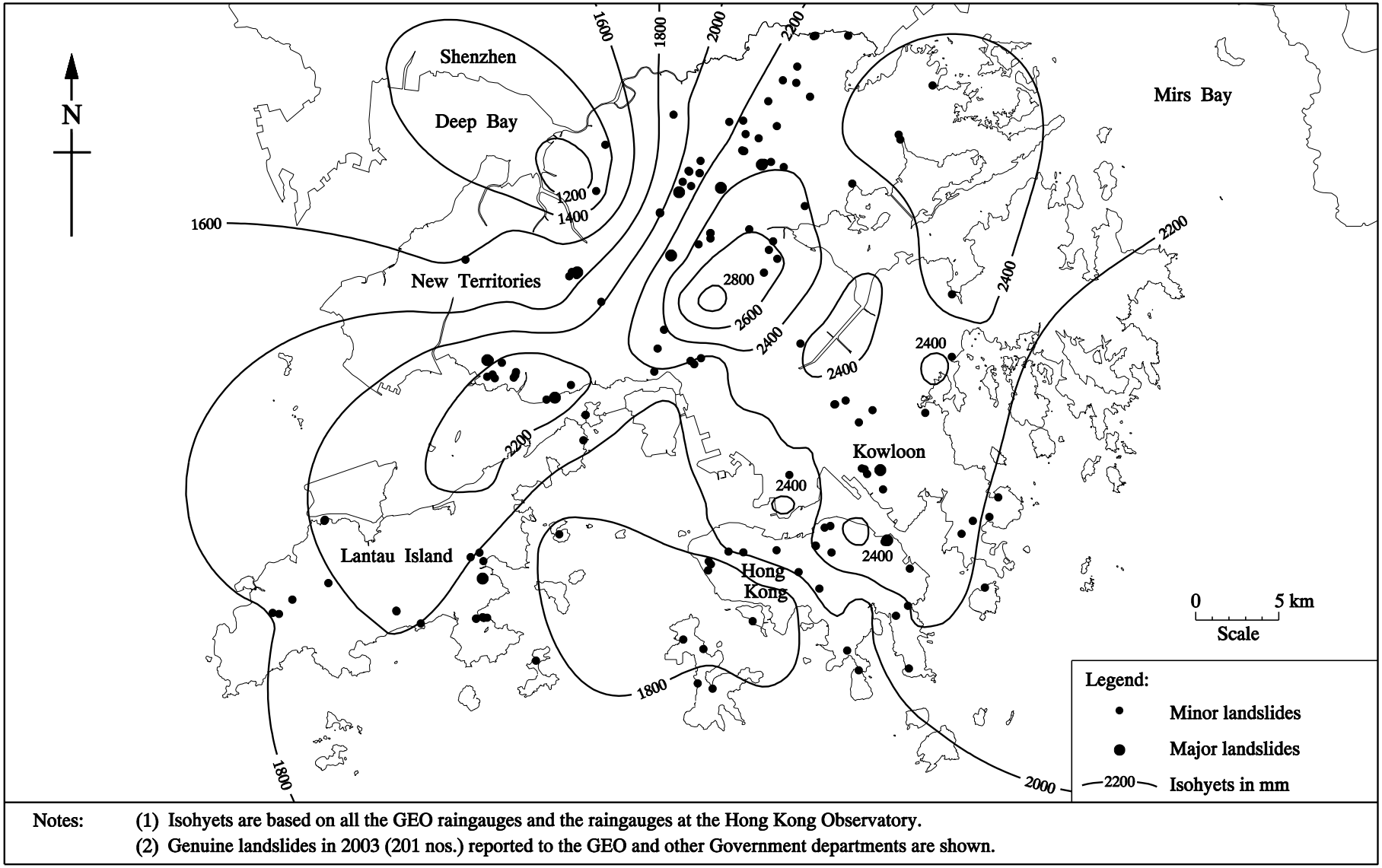
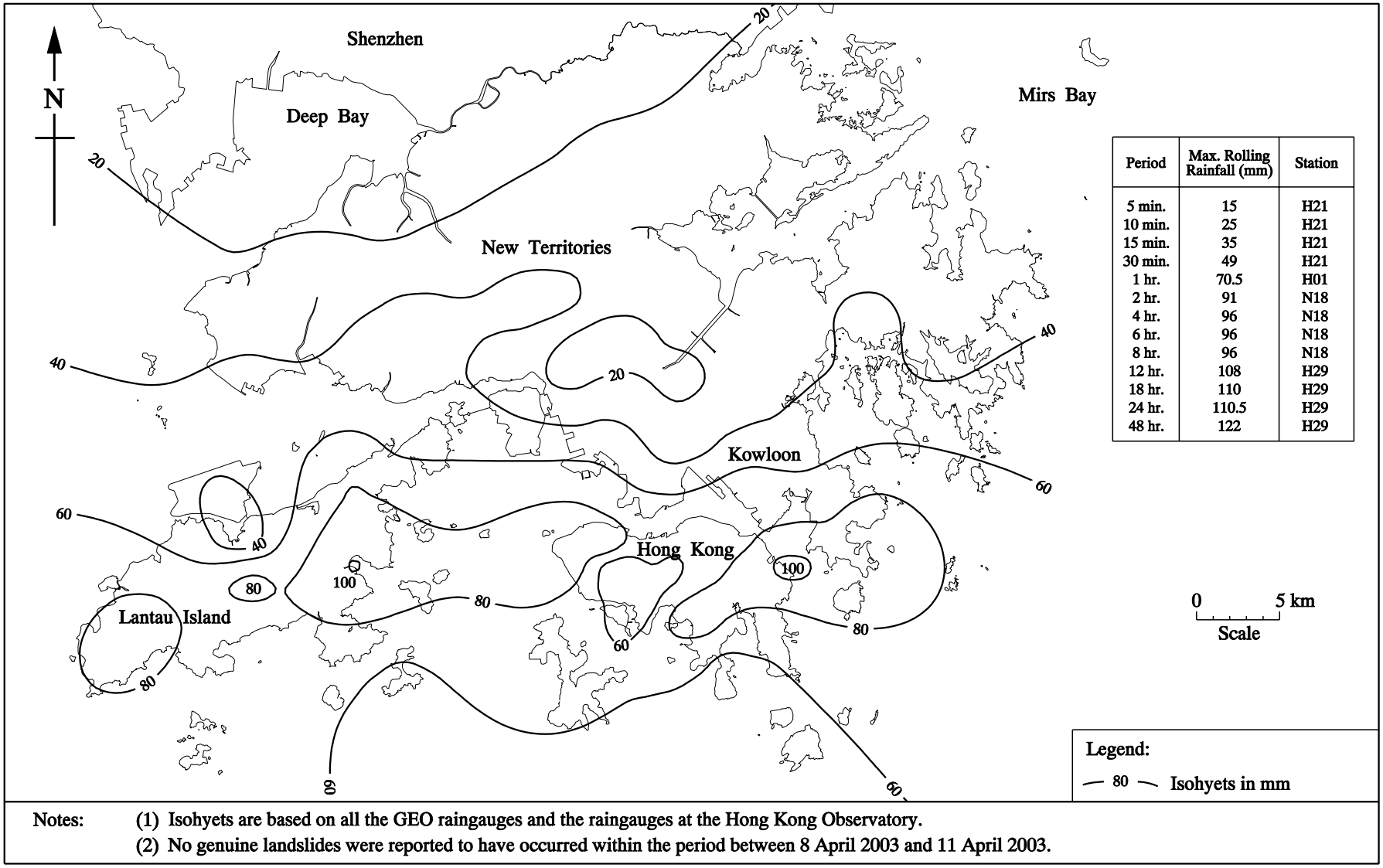


Notes: (1) Isohyets are based on all the GEO raingauges and the raingauges at the Hong Kong Observatory.
(2) Genuine landslides in 2003 (201 nos.) reported to the GEO and other Government departments are shown.

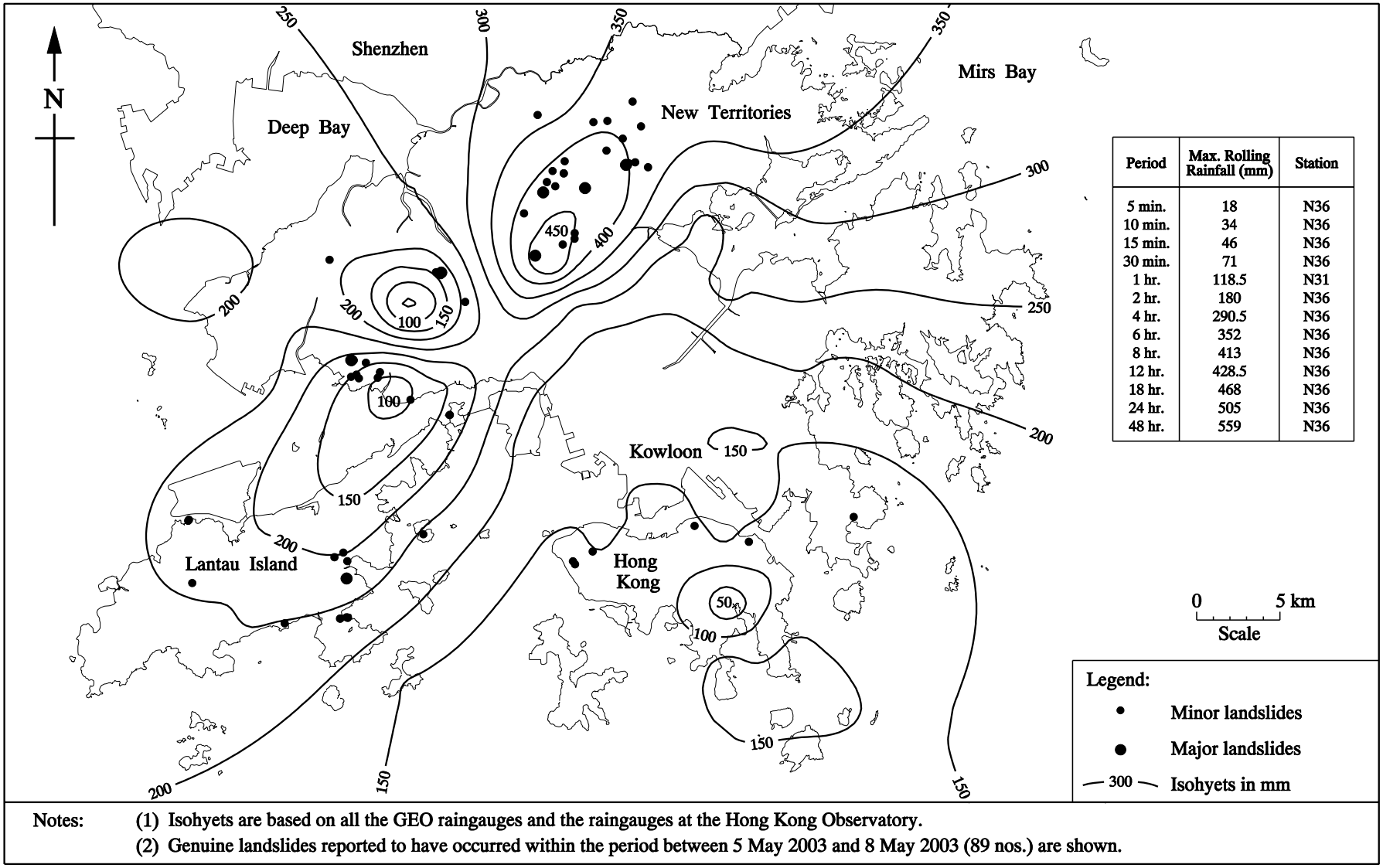
Figure 4 - Total Annual Rainfall Distribution and Locations of landslides in 2003



Period	Max. Rolling Rainfall (mm)	Station
5 min.	15	H21
10 min.	25	H21
15 min.	35	H21
30 min.	49	H21
1 hr.	70.5	H01
2 hr.	91	N18
4 hr.	96	N18
6 hr.	96	N18
8 hr.	96	N18
12 hr.	108	H29
18 hr.	110	H29
24 hr.	110.5	H29
48 hr.	122	H29

Notes: (1) Isohyets are based on all the GEO raingauges and the raingauges at the Hong Kong Observatory.
(2) No genuine landslides were reported to have occurred within the period between 8 April 2003 and 11 April 2003.

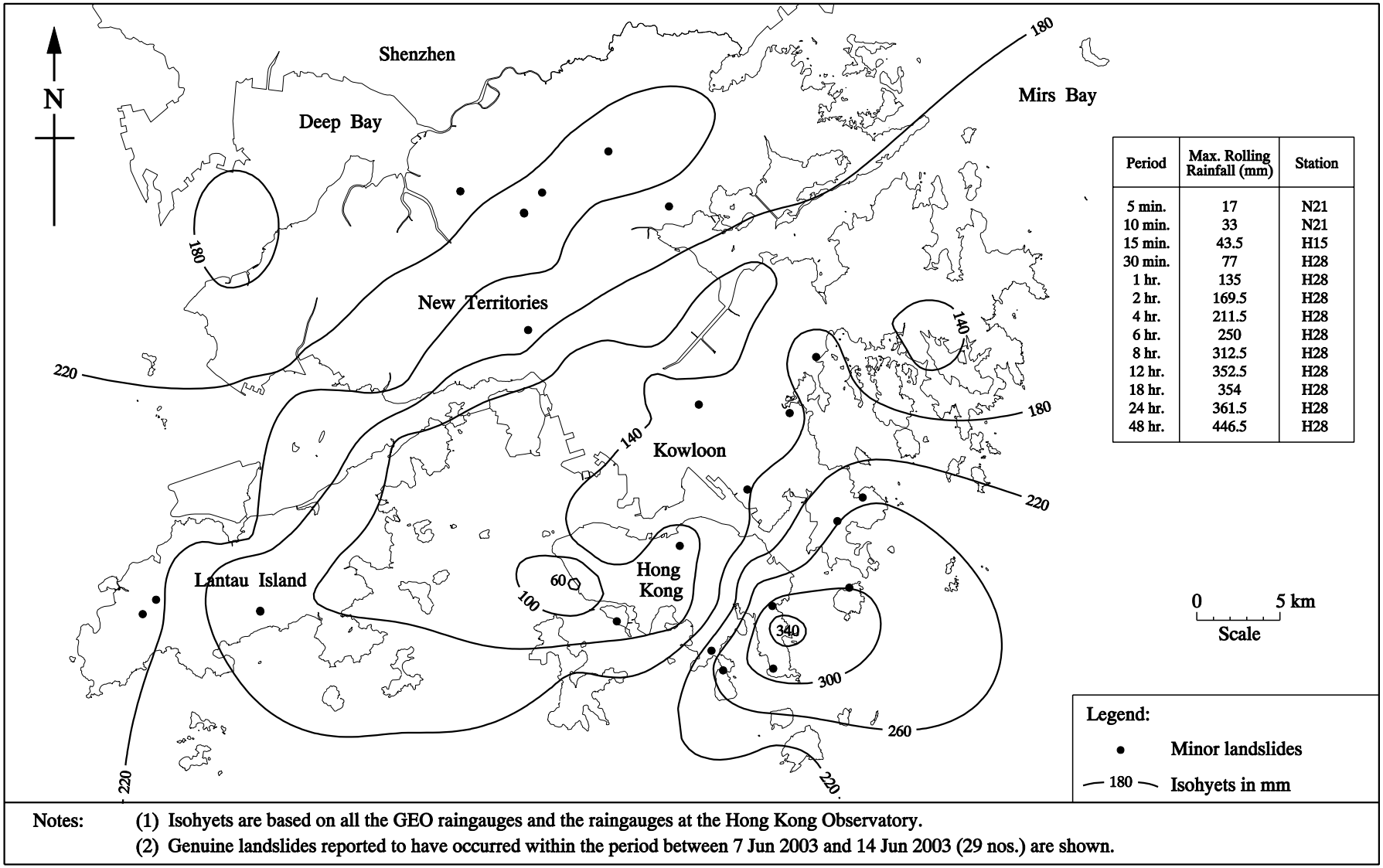
Figure 5 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 00:00 on 8 April 2003 and 23:55 on 9 April 2003 and Locations of Landslides



Period	Max. Rolling Rainfall (mm)	Station
5 min.	18	N36
10 min.	34	N36
15 min.	46	N36
30 min.	71	N36
1 hr.	118.5	N31
2 hr.	180	N36
4 hr.	290.5	N36
6 hr.	352	N36
8 hr.	413	N36
12 hr.	428.5	N36
18 hr.	468	N36
24 hr.	505	N36
48 hr.	559	N36

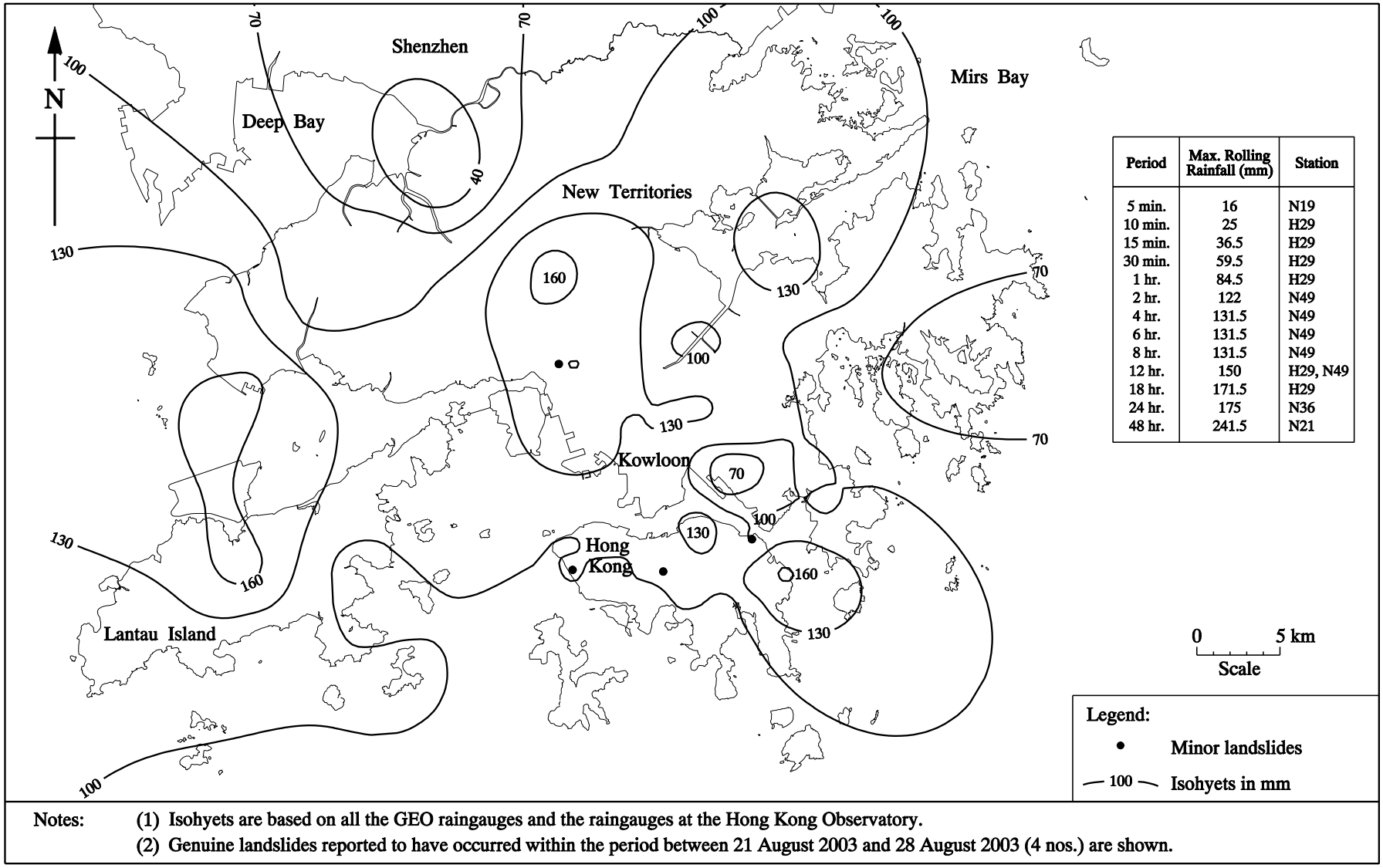
Notes: (1) Isohyets are based on all the GEO raingauges and the raingauges at the Hong Kong Observatory.
(2) Genuine landslides reported to have occurred within the period between 5 May 2003 and 8 May 2003 (89 nos.) are shown.

Figure 6 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 00:00 on 5 May 2003 and 23:55 on 6 May 2003 and Locations of Landslides



Period	Max. Rolling Rainfall (mm)	Station
5 min.	17	N21
10 min.	33	N21
15 min.	43.5	H15
30 min.	77	H28
1 hr.	135	H28
2 hr.	169.5	H28
4 hr.	211.5	H28
6 hr.	250	H28
8 hr.	312.5	H28
12 hr.	352.5	H28
18 hr.	354	H28
24 hr.	361.5	H28
48 hr.	446.5	H28

Figure 7 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 00:00 on 7 June 2003 and 23:55 on 12 June 2003 and Locations of Landslides



Period	Max. Rolling Rainfall (mm)	Station
5 min.	16	N19
10 min.	25	H29
15 min.	36.5	H29
30 min.	59.5	H29
1 hr.	84.5	H29
2 hr.	122	N49
4 hr.	131.5	N49
6 hr.	131.5	N49
8 hr.	131.5	N49
12 hr.	150	H29, N49
18 hr.	171.5	H29
24 hr.	175	N36
48 hr.	241.5	N21

Notes: (1) Isohyets are based on all the GEO raingauges and the raingauges at the Hong Kong Observatory.
(2) Genuine landslides reported to have occurred within the period between 21 August 2003 and 28 August 2003 (4 nos.) are shown.

Figure 8 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 00:00 on 21 August 2003 and 23:55 on 26 August 2003 and Locations of Landslides

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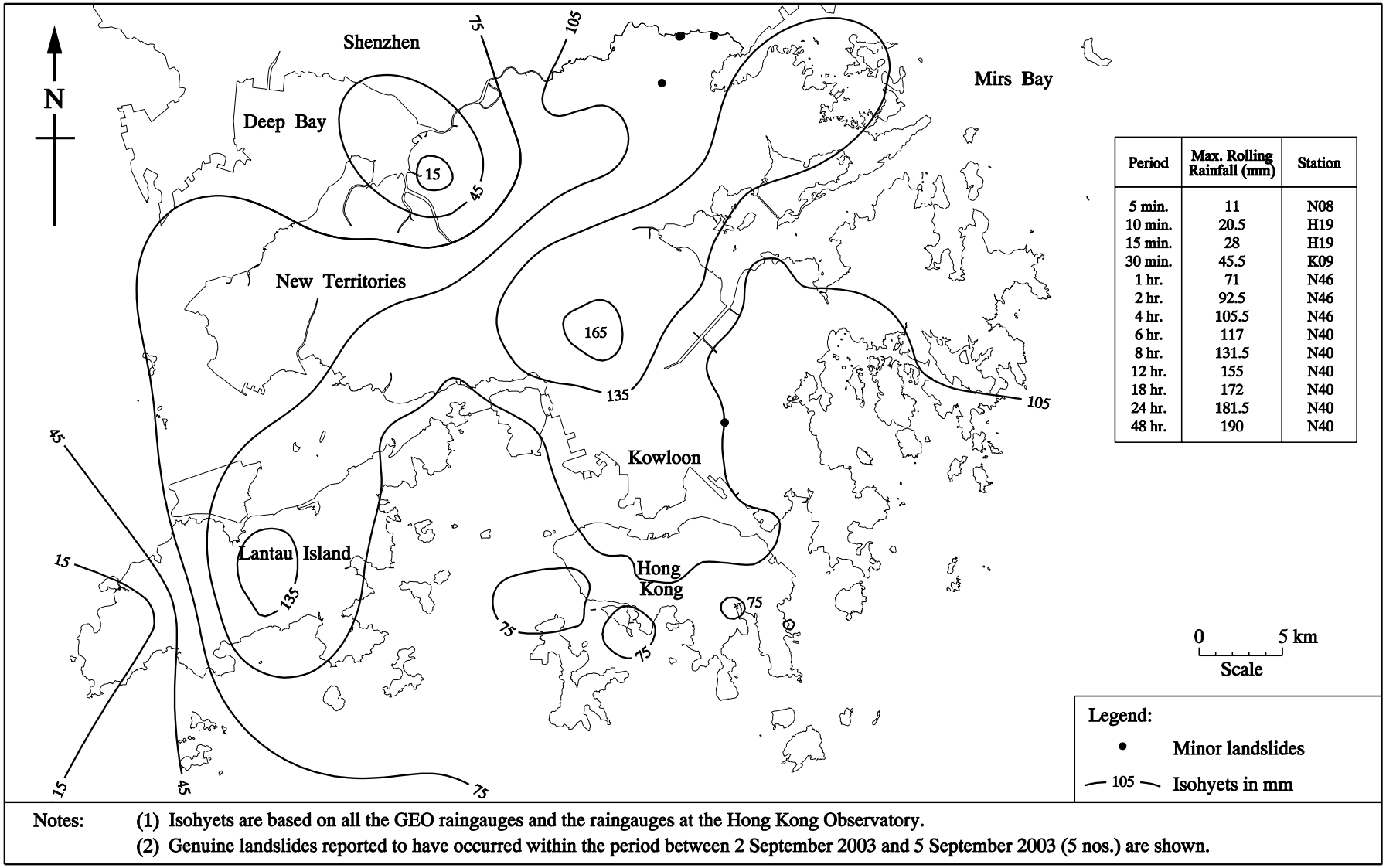
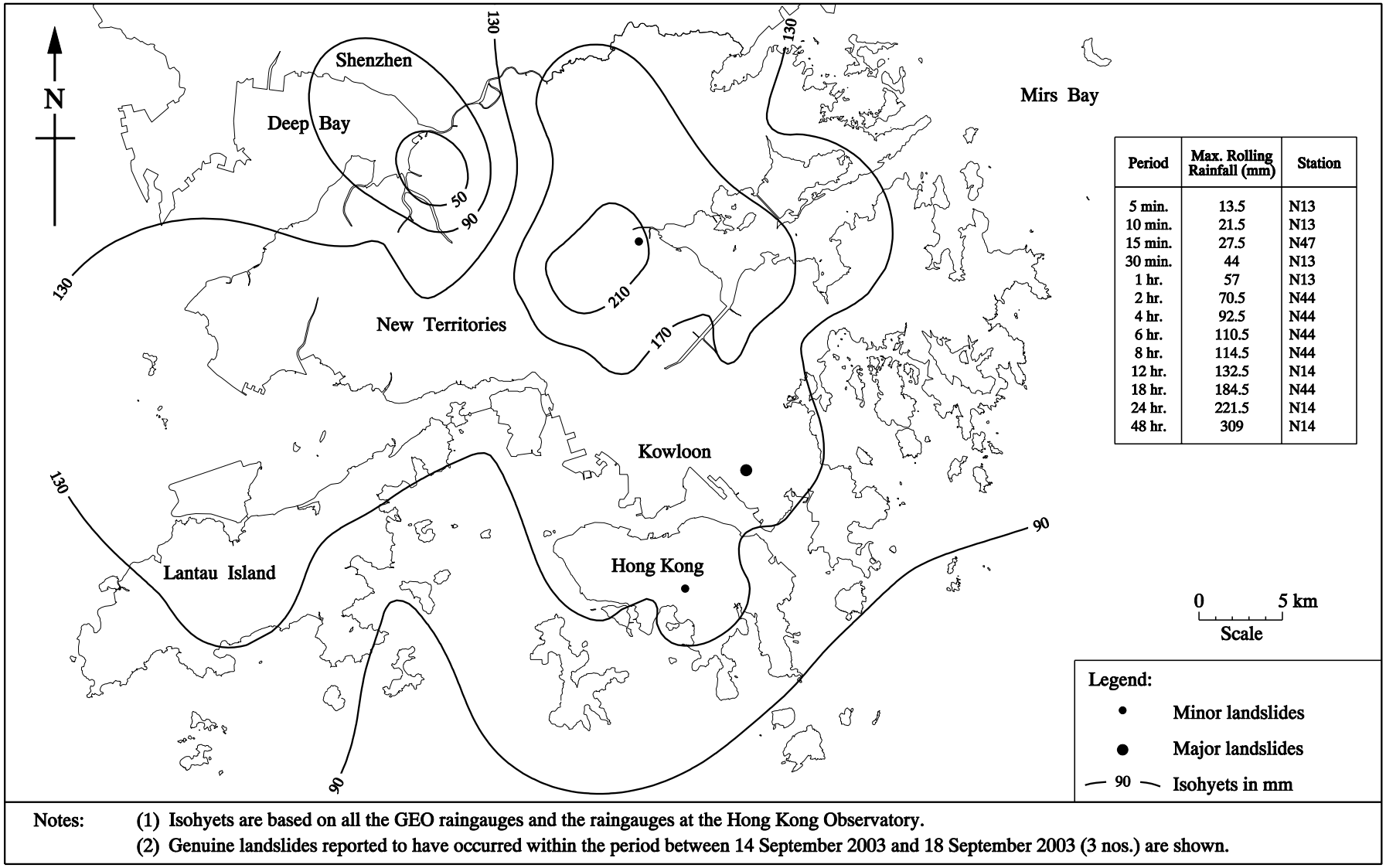


Period	Max. Rolling Rainfall (mm)	Station
5 min.	11	N08
10 min.	20.5	H19
15 min.	28	H19
30 min.	45.5	K09
1 hr.	71	N46
2 hr.	92.5	N46
4 hr.	105.5	N46
6 hr.	117	N40
8 hr.	131.5	N40
12 hr.	155	N40
18 hr.	172	N40
24 hr.	181.5	N40
48 hr.	190	N40

Figure 9 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 00:00 on 2 September 2003 and 23:55 on 3 September 2003 and Locations of Landslides



Period	Max. Rolling Rainfall (mm)	Station
5 min.	13.5	N13
10 min.	21.5	N13
15 min.	27.5	N47
30 min.	44	N13
1 hr.	57	N13
2 hr.	70.5	N44
4 hr.	92.5	N44
6 hr.	110.5	N44
8 hr.	114.5	N44
12 hr.	132.5	N14
18 hr.	184.5	N44
24 hr.	221.5	N14
48 hr.	309	N14

Notes: (1) Isohyets are based on all the GEO raingauges and the raingauges at the Hong Kong Observatory.
(2) Genuine landslides reported to have occurred within the period between 14 September 2003 and 18 September 2003 (3 nos.) are shown.

Figure 10 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 00:00 on 14 September 2003 and 23:55 on 16 September 2003 and Locations of Landslides

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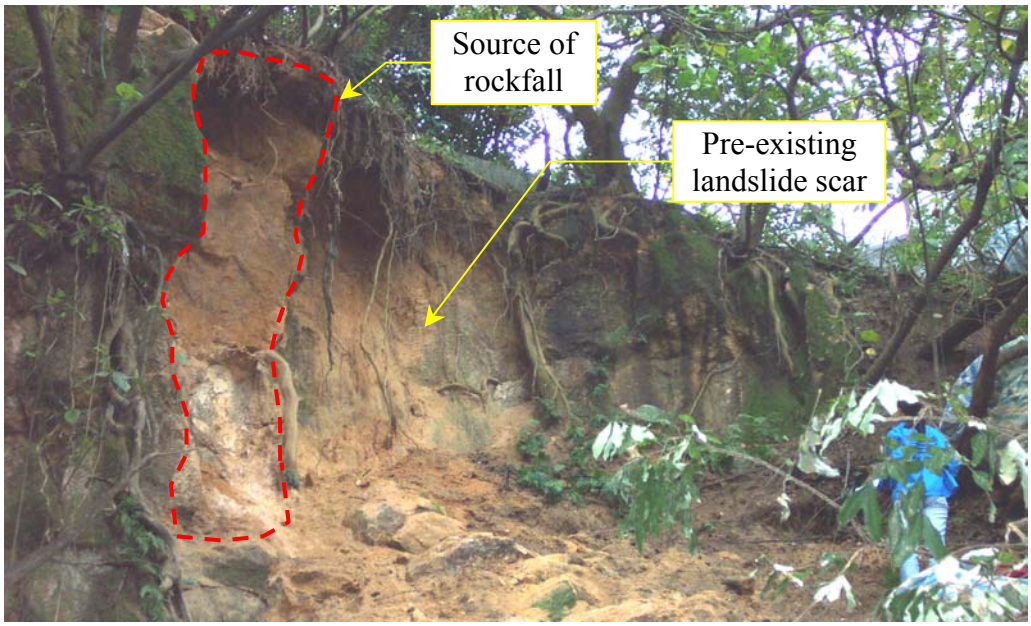
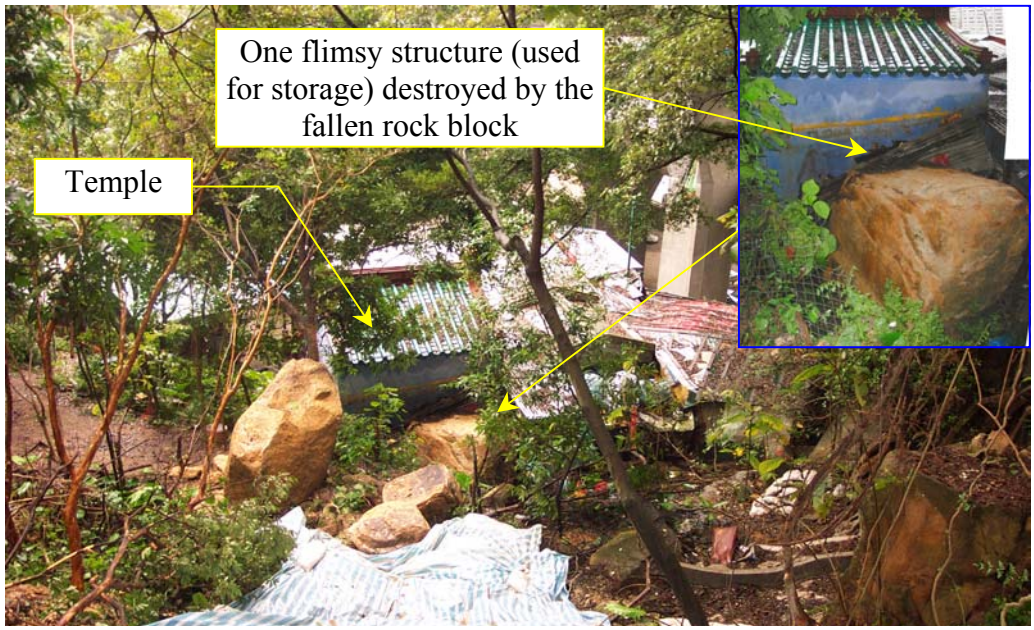


(a) View of the source of the rockfall



(b) View of the fallen rock blocks and the temple

Description: A rockfall from a soil/rock cut slope which destroyed a flimsy structure and resulted in the temporary closure of a temple at the slope toe.

Plate 1 - The 13 June 2003 Rockfall on Slope No. 11NE-D/C373 behind a Temple at Rehab Path, Kwun Tong (Incident No. 2003/06/0111)

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The southern failure

The northern failure

Description: Major washout on a recently upgraded fill slope during heavy rainstorm.

Plate 2 - The 5 May 2003 Washout on Slope No. 10SW-C/FR11 at South Lantau Road (Incident No. 2003/05/0052)

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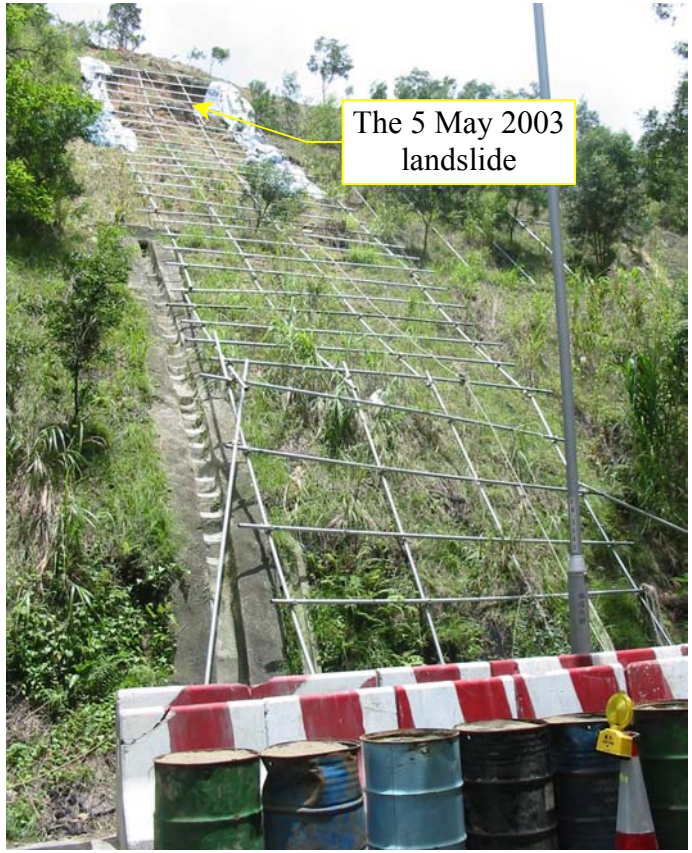

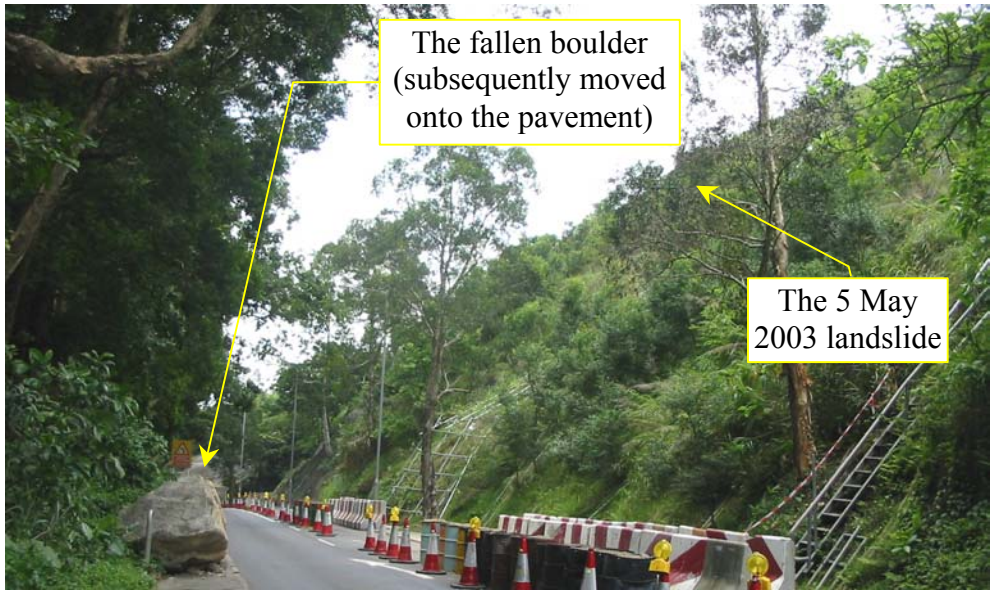

Description: A landslide from a soil cut slope and a boulder fall from the natural hillside above, which resulted in the temporary closure of one traffic lane.

Plate 3 - The 5 May 2003 Landslide on Slope No. 6NE-B/C8 at Fan Kam Road, Pat Heung (Incident No. 2003/05/0009)

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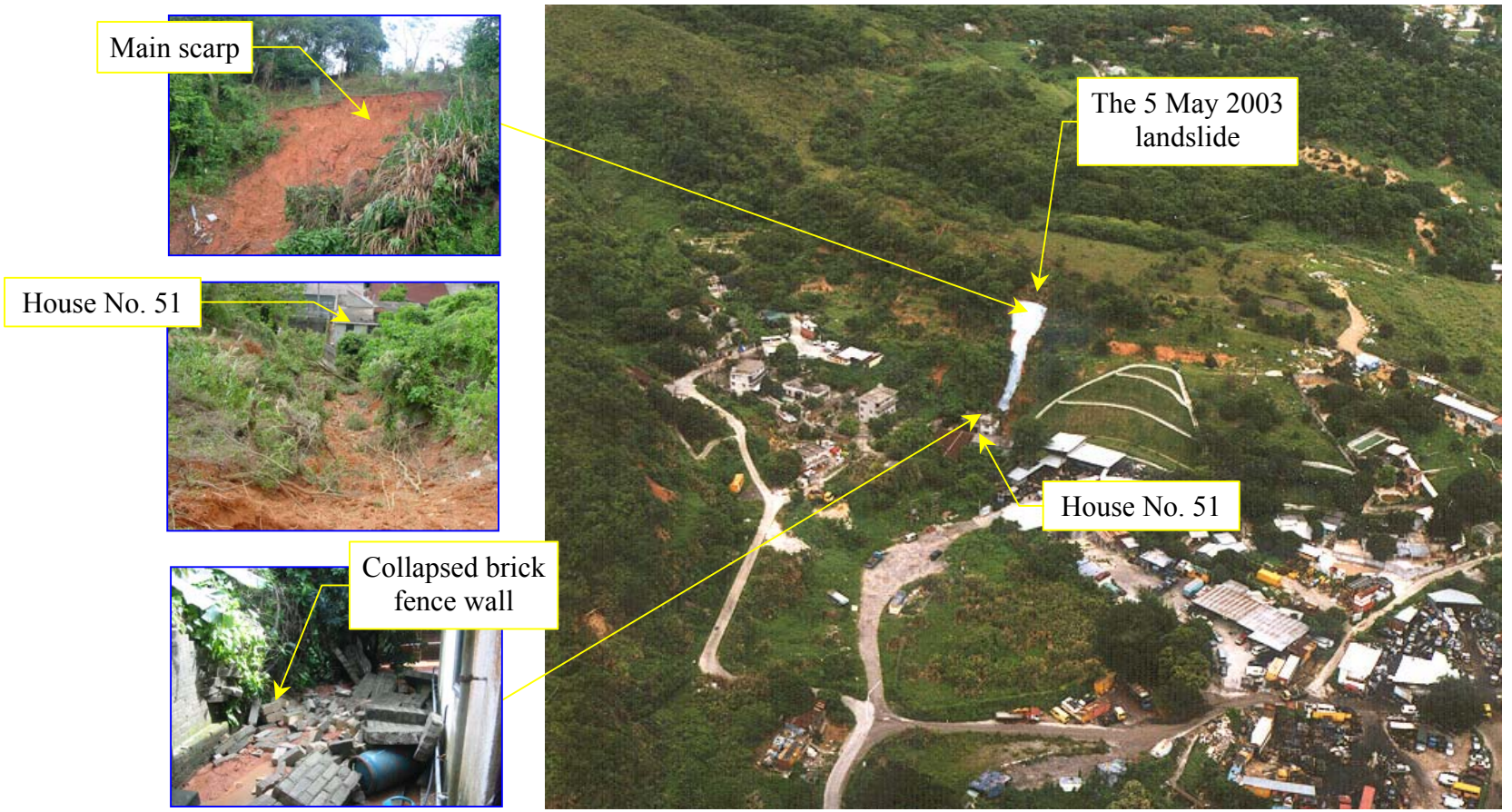

Description: A natural hillside failure which resulted in the temporary closure of a village house for five months.

Plate 4 - The 5 May 2003 Landslide on the Natural Hillside behind House No. 51, Wong Chuk Yuen Village, Yuen Long (Incident No. 2003/05/0020)

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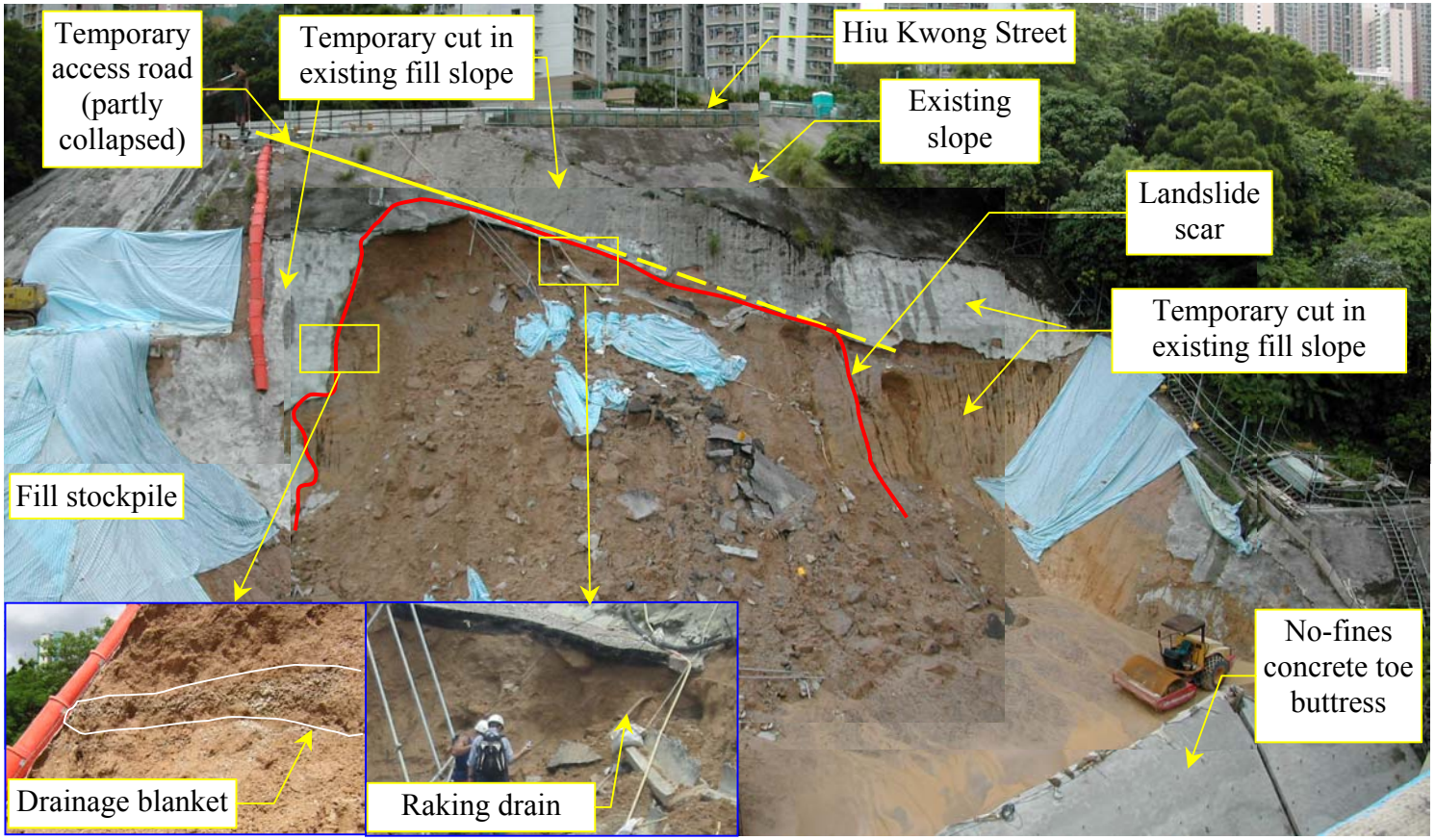

Description: A major landslide on a temporary cut in an existing fill slope within an active construction site.

Plate 5 - The 14 September 2003 Landslide on Slope No. 11NE-D/F10 below Hiu Kwong Street, Sau Mau Ping (Incident No. 2003/09/0191)

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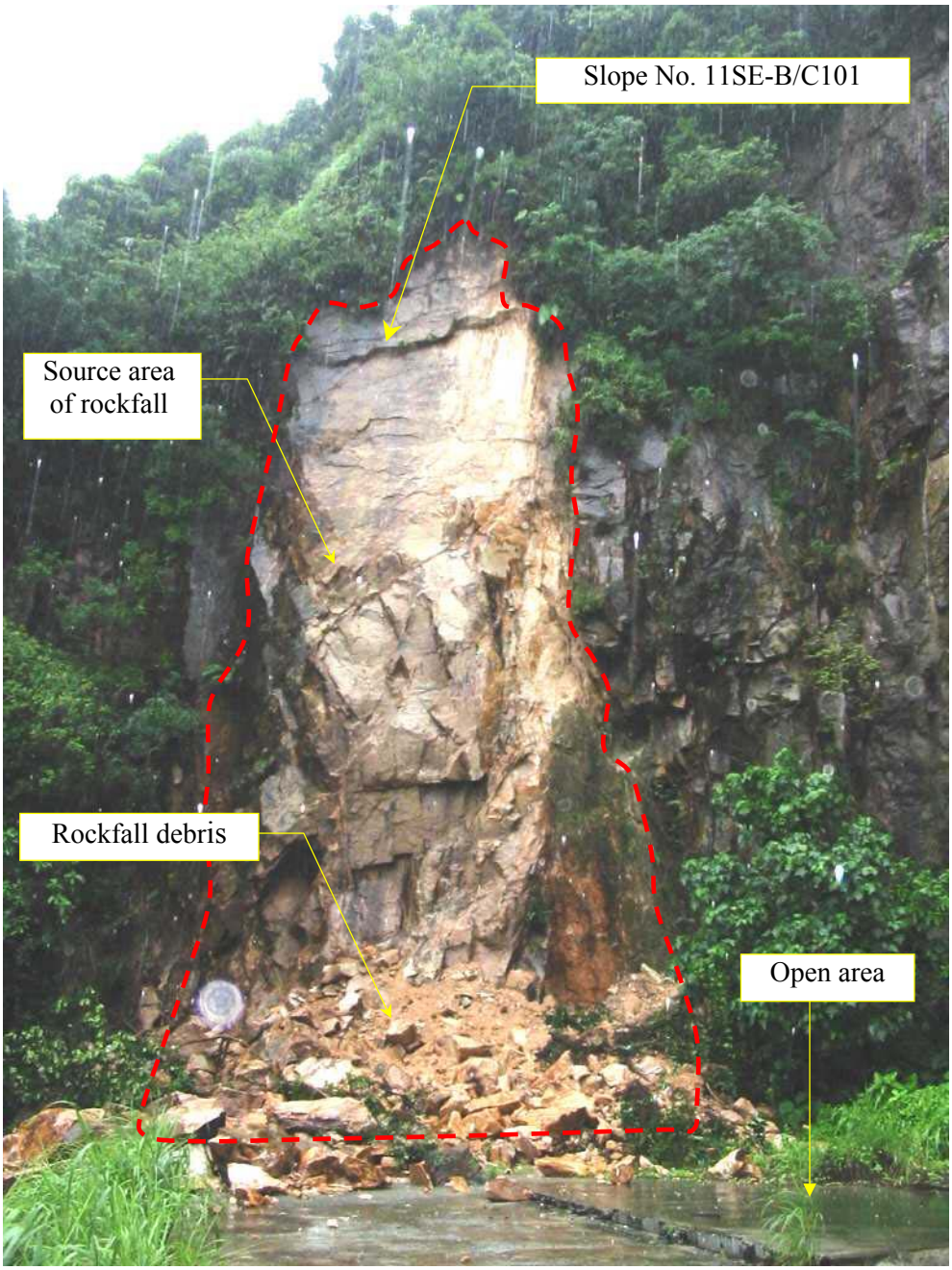

Description: A major rockfall from a soil/rock cut slope which affected a fenced-off open area that was previously occupied under a former Short Term Tenancy (STT) Agreement until November 2000.

Plate 6 - The 6 June 2003 Rockfall on Slope No. 11SE-B/C101 at Tung Kin Road, A Kung Ngam (Incident No. 2003/06/0098)

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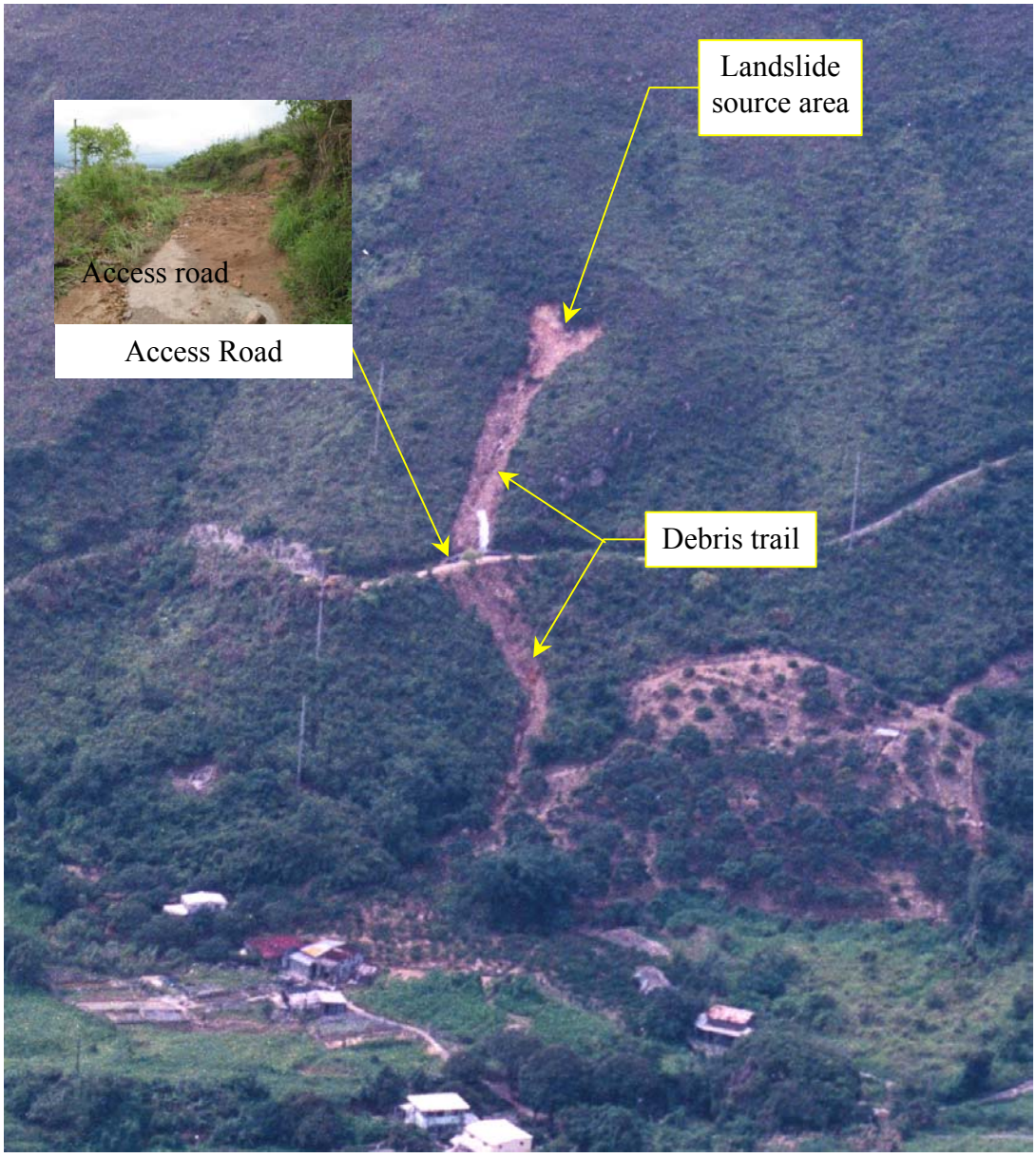

Description: A natural hillside failure which resulted in the complete closure of the sole vehicular access road to the Cloudy Hill Transmitter Station.

Plate 7 - The 5 May 2003 Landslide on the Natural Hillside at Kau Lung Hang Shan, Tai Po (Incident No. 2003/05/0031)

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APPENDIX A

RAINFALL OF SELECTED RAINSTORMS RECORDED AT GEO RAINGAUGES

LIST OF TABLES

Table A1 - Rainstorms in which Rolling 24-hour Rainfall Exceeded 50 mm at any GEO Raingauge (Sheet 1 of 3)

Rainstorm (2003)		5 min		10 min		15 min		30 min	
		Max. rainfall (mm)	Station	Max. rainfall (mm)	Station	Max. rainfall (mm)	Station	Max. rainfall (mm)	Station
1	4-5 Mar 2003	12	N20	21	N20	27.5	N20	37	N20
2	8-9 Apr 2003	15	H21	25	H21	35	H21	49	H21
3	3-6 May 2003	19	N45	34	N36	46	N36	75.5	H29
4	18-19 May 2003	12.5	N24	22	N24	29	H15	37.5	H15
5	25-26 May 2003	11.5	N40	20	N40	24.5	N40	34.5	H25
6	6-17 Jun 2003	17	N21	33	N21	43.5	H15	77	H28
7	20-23 Jun 2003	13.5	N50	24.5	N50	30	N50	44	N50
8	27-28 Jun 2003	10.5	N14	15.5	N14	16.5	N14, N46	28	N46
9	20-24 Jul 2003	12.5	N14, N37	21	N51	31	N50	55	N51
10	4-7 Aug 2003	12	N46	23	N46	31.5	N46	49	N46
11	9 Aug 2003	8.5	K01	13.5	K09	16.5	K09	27.5	N08
12	16-19 Aug 2003	15	K08	29	K08	42.5	K08	73.5	K08
13	21-26 Aug 2003	16	N19	25	H29	36.5	H29	59.5	H29
14	2-4 Sep 2003	11	N08	20.5	H19	28	H19	45.5	K09
15	7-8 Sep 2003	9	K04, K07, N07	14.5	K07	17	N48	25	N46
16	14-16 Sep 2003	13.5	N13	21.5	N13	27.5	N47	44	N13
17	21-22 Sep 2003	13	N41	26	N41	36	N41	58	N41
18	11-12 Oct 2003	10	N47	19.5	N47	24	N47	36.5	N47
19	8-9 Nov 2003	9.5	H26	17.5	H26	20.5	H26	27.5	H29

Table A1 - Rainstorms in which Rolling 24-hour Rainfall Exceeded 50 mm at any GEO Raingauge (Sheet 2 of 3)

Rainstorm (2003)		1 hr		2 hr		4 hr		6 hr	
		Max. rainfall (mm)	Station	Max. rainfall (mm)	Station	Max. rainfall (mm)	Station	Max. rainfall (mm)	Station
1	4-5 Mar 2003	38	N20	38.5	N20	40	N20	49	N20
2	8-9 Apr 2003	70.5	H01	91	N18	96	N18	96	N18
3	3-6 May 2003	118.5	N31	180	N36	290.5	N36	352	N36
4	18-19 May 2003	46	N06	68.5	N38	80	N38	80	N38
5	25-26 May 2003	45.5	H25	53.5	K10	53.5	K10	53.5	K10
6	6-17 Jun 2003	135	H28	169.5	H28	211.5	H28	250	H28
7	20-23 Jun 2003	52	N50	55.5	N50	78	N29	98.5	N07
8	27-28 Jun 2003	44.5	N46	53	N46	58.5	N46	62	N46
9	20-24 Jul 2003	91	N51	114	N51	114.5	N51	115	N51
10	4-7 Aug 2003	74	N46	78	N46	79.5	N46	79.5	N46
11	9 Aug 2003	41	K03	45.5	K03	50	K04	53	K04
12	16-19 Aug 2003	129.5	K03	160	K03	160	K03	160	K03
13	21-26 Aug 2003	84.5	H29	122	N49	131.5	N49	131.5	N49
14	2-4 Sep 2003	71	N46	92.5	N46	105.5	N46	117	N40
15	7-8 Sep 2003	36	N46	55	N46	59.5	N46	69.5	N50
16	14-16 Sep 2003	57	N13	70.5	N44	92.5	N44	110.5	N44
17	21-22 Sep 2003	73.5	N35	73.5	N35	73.5	N35	73.5	N35
18	11-12 Oct 2003	53.5	N47	60.5	N47	62.5	N47	63	N47
19	8-9 Nov 2003	38	H29	46.5	H29	62.5	H29	86.5	N20

Table A1 - Rainstorms in which Rolling 24-hour Rainfall Exceeded 50 mm at any GEO Raingauge (Sheet 3 of 3)

Rainstorm (2003)		8 hr		12 hr		18 hr		24 hr		48 hr	
		Max. rainfall (mm)	Station	Max. rainfall (mm)	Station	Max. rainfall (mm)	Station	Max. rainfall (mm)	Station	Max. rainfall (mm)	Station
1	4-5 Mar 2003	63	N20	68.5	N20	75	N20	86.5	N20	104	N20
2	8-9 Apr 2003	96	N18	108	H29	110	H29	110.5	H29	122	H29
3	3-6 May 2003	413	N36	428.5	N36	468	N36	505	N36	559	N36
4	18-19 May 2003	80.5	N38	80.5	N38	80.5	N38	81	N38	85	N38
5	25-26 May 2003	53.5	K10	53.5	K10	55.5	H10	56	H10	56	H10
6	6-17 Jun 2003	312.5	H28	352.5	H28	354	H28	361.5	H28	446.5	H28
7	20-23 Jun 2003	100.5	N07	114.5	N29	136.5	N29	140.5	N29	183	N14
8	27-28 Jun 2003	63.5	N46	67.5	N46	69	N46	84	N46	107	N46
9	20-24 Jul 2003	115.5	N51	115.5	N51	116	N51	116.5	N51	145	N51
10	4-7 Aug 2003	81.5	N46	81.5	N46	81.5	N46	104.5	N46	129.5	N46
11	9 Aug 2003	53	K04	53.5	K04	57	N15, N50	57	N15, N50	60.5	N15
12	16-19 Aug 2003	160	K03	160	K03	188.5	K03	188.5	K03	202.5	K03
13	21-26 Aug 2003	131.5	N49	150	H29, N49	171.5	H29	175	N36	241.5	N21
14	2-4 Sep 2003	131.5	N40	155	N40	172	N40	181.5	N40	190	N40
15	7-8 Sep 2003	70	N50	76	N50	87	N44	118	K07	143	K07
16	14-16 Sep 2003	114.5	N44	132.5	N14	184.5	N44	221.5	N14	309	N14
17	21-22 Sep 2003	73.5	N35	73.5	N35	73.5	N35	74	N35	76.5	N35
18	11-12 Oct 2003	64	N47	65	N47	66.5	N47	66.5	N47	73	N47
19	8-9 Nov 2003	93.5	N20	103	N20	105	N20	107.5	N20	109.5	N20

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APPENDIX B

LIST OF LANDSLIDE INCIDENTS REPORTED TO THE GOVERNMENT

LIST OF TABLES

Table B1 - List of Major Landslide Incidents

Incident No.	Location	Slope No.	Failure			Facility Affected	Consequence
			Date (Time)	Feature Type	Scale (m^3)		
2003/05/0010	Above Ta Shek Wu Kiu Tau, Pat Heung	Natural hillside	5/5 (02:00)	Natural hillside	150*	Access road	-
2003/05/0020	Above house No. 51, Wong Chuk Yuen Upper Village, Pat Heung	Natural hillside	5/5 (04:00)	Natural hillside	160*	Village house	1 village house temporarily evacuated
2003/05/0031	Above Kau Lung Hang Shan (near slope No. 3SW-C/C108), Tai Po	Natural hillside	5/5 (04:00)	Natural hillside	200*	Access road and orchard	Access road temporarily closed
2003/05/0033	Near No. 60, Sung Shan New Village, Yuen Long	6NE-C/DT30	5/5 (early morning)	Disturbed terrain	70	Access road	Access road temporarily closed
2003/05/0052	Opposite to Lai Chi Yuen, South Lantau Road, Lantau Island	10SW-C/FR11	5/5 (08:30)	Fill	150	Open area	-
2003/05/0054	Wo Hop Shek Cemetery, Fanling	3SW-C/DT94	6/5 (08:00)	Disturbed terrain	50	Urn graves	-
2003/05/0066	Near Lo Tsing Shan Tsuen, So Kwun Wat	6SW-C/C324	5/5 (05:00)	Soil cut	50	Stream course	-
2003/06/0098	Behind a fenced-off area at Tung Kin Road, A Kung Ngam	11SE-B/C101	6/6 (12:00)	Soil/rock cut	70	Open area	-
ArchSD/N/2003/05/0003	Wo Hop Shek Cemetery, Fanling	3SW-C/C792	9/5 (10:51)	Soil cut	60	Cemetery	-
2003/09/0191	Below Hiu Kwong Street, Sau Mau Ping	11NE-D/F10	14/9 (18:00)	Fill slope under construction	200*	Construction site	-
2003/12/0203	Below Castle Peak Road near Tsing Lung Tau	6SW-D/FR84	Unknown	Fill	60	Beach	-

Legend:

* Information obtained by GEO's landslide investigation consultants and agreed with GEO's District Divisions.
\# Very minor landslide with negligible consequence (see Section 1 of the report for definition).
(1) The slope feature does not comply with the slope registration criteria given in GEO Circular No. 15.

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Table B2 - List of Landslide Incidents in Hong Kong Island (Sheet 1 of 2)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2003/03/0007	Above access road from Mt. Austin Road to Lugard Road, Wan Chai	Natural hillside	20/3	HyD	Unknown	Natural hillside	0.16 (Boulder fall)	Access road	
2003/05/0021	No. 31, Peacock Road, Ming Yuen Mansions, North Point	11SE-A/CR169	5/5	Police	5/5 (11:15)	Rock cut	<0.01 (Rock fall)	Carpark	A parked vehicle damaged
2003/05/0029	No. 30, Lugard Road, Wan Chai	11SW-A/CR230	5/5	BD	5/5 (11:00)	Soil/rock cut	0.5	Access road	
2003/05/0035	No. 7, NorthCote Close near Sassoon Road, Pokfulam	11SW-C/CR105	5/5	HyD	5/5 (11:00)	Soil cut	10	Road and access road	Access road temporarily closed
2003/05/0047	No. 23, Bisney Road, Pokfulam	11SW-C/C169	7/5	BD	6/5	Soil/rock cut	<0.1 (Rock fall)	Backlane	
2003/05/0059	Shan Pin Terrace, near Miu Tung Street, Shau Kei Wan Main Street East	Unregistered at time of failure	12/5	Public	5/5 (23:00)	Masonry wall	8	Open area	
ArchSD/E/2003/05/0001	Mount Parker Road, Quarry Bay	11SE-C/C531	12/5	AFCD	Unknown	Soil/rock cut	1 (Rock fall)	Road	
2003/05/0085	Monmouth Terrace, Kennedy Road, Wan Chai	Temporary Stockpile	25/5	Police	25/5 (18:30)	Fill	1	Road	2 lanes of road temporarily closed
2003/06/0098	Behind a fenced-off area at Tung Kin Road, A Kung Ngam	11SE-B/C101	6/6	Public	6/6 (12:00)	Soil/rock cut	70 (Rock fall)	Open area	
2003/06/0103	Staff Quarters in Ma Hang Prison, Stanley	1.9 m high soil cut slope (1)	9/6	CSD	9/6	Soil cut	1.5	Backlane	
2003/06/0105	Above Lee Lok Street, Ap Lei Chau	Natural hillside	10/6	Police	10/6 (08:00)	Natural hillside	0.1 (Boulder fall)	Buildings	
2003/06/0108a#	Cape D'Aguilar Road, Shek O	15NE-D/C39	10/6	HyD	9/6	Soil cut	5	Road	
2003/06/0108b							10		
2003/06/0109	Wong Ma Kok Road, Stanley	15NE-C/C15	11/6	Police	11/6	Soil/rock cut	0.5 (Rock fall)	Road	
2003/06/0112	Above Lai Yin Street, Tai Hang	Natural hillside	11/6	HyD	Unknown	Natural hillside	1	Road	

Table B2 - List of Landslide Incidents in Hong Kong Island (Sheet 2 of 2)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2003/06/0114	Near No. 32, Tung Lo Wan Road, Tai Hang	1.5 m high soil cut slope (1)	11/6	HyD	11/6 (11:00)	Soil cut	3	Open area	
2003/06/0141a	Northern end of Big Wave Bay Road, Shek O	15NE-B/C141	24/6	DLO	11/6	Soil cut	9	Open area	
2003/06/0141b#							1		
2003/08/0167	Sir Cecil's Ride, Tai Hang	2.9 m high soil cut slope (1)	22/8	Public	Unknown	Soil cut	15	Footpath	Footpath temporarily closed
2003/08/0168	No. 50, Sassoon Road, Pokfulam	11SW-C/CR161	25/8	HyD	24/8 (22:00)	Soil cut	5	Road	1 lane of road temporarily closed
2003/08/0169	Near Federal Industrial Building, Tung Kin Road, A Kung Ngam	11SE-B/C101	25/8	BD	25/8 (03:00)	Rock cut	0.6 (Rockfall)	Building	
2003/08/0171	Above Rosaryhill School, Stubbs Road, Wan Chai	Natural hillside	22/8	ICC	21/8 (18:00)	Natural hillside	6	Carpark	
2003/09/0187	Opposite to No. 4, Repulse Bay Road, Stanley	11SE-C/C168	15/9	ICC	15/9	Soil/rock cut	3	Road	1 lane of road temporarily closed
2003/09/0194	Near St. Michael's Primary School, Fortress Hill Road, North Point	11SE-A/FR48	23/9	HyD	21/9 (15:00)	Fill	2	Open area	
2003/11/0200	Near No. 396, Chai Wan Road, Chai Wan	11SE-D/CR22	8/11	Police	8/11 (14:30)	Soil cut	1	Open area	
2003/11/0201	Below Shek O Road, Shek O	15NE-B/FR31	10/11	HyD	Unknown	Fill	Significant signs of distress	Open area	

Legend:

* Information obtained by GEO's landslide investigation consultants and agreed with GEO's District Divisions.

\# Very minor landslide with negligible consequence (see Section 1 of the report for definition).

(1) The slope feature does not comply with the slope registration criteria given in GEO Circular No. 15.

Table B3 - List of Landslide Incidents in Kowloon

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2003/02/0003	Near Kung Lok Road, Kwun Tong	11NE-C/FR99	23/2	Police	22/2	Fill	1 (Rock blocks from tree ring)	Pedestrian pavement	Pedestrian pavement temporarily closed
2003/05/0091	Near Man Kiu Association Primary School, Kwun Tong	11NE-C/C28	28/5	Public	26/5 (before 16:30)	Soil/rock cut	0.2 (Rock fall)	Open area	
2003/06/0099	Below St. Catharine's School for Girls, Kung Lok Road, Kwun Tong	11NE-C/C71	6/6	Arch SD	6/6 (13:19)	Rock cut	1 (Rock fall)	Pedestrian pavement	Pedestrian pavement temporarily closed
2003/06/0111	Below Margaret Trench Medical Rehabilitation Centre, Rehab Path, Lam Tin	11NE-D/C373	11/6	Public	11/6 (07:00)	Soil/rock cut	15* (Rock fall)	Temple and storage structure	One temple temporarily evacuated and a flimsy structure destroyed
2003/07/0149	Near No. 22 Ho Man Tin Street, Ho Man Tin	1.2 m high masonry wall (1)	4/7	BD	4/7 (09:30)	Masonry Wall	2	Access footpath	Access footpath temporarily closed
HD/03/03	On Tin Street, Lam Tin	11NE-D/C764	12/6	HD	12/6 (15:30)	Soil/rock cut	0.015 (Rock fall)	Access road	
2003/09/0177	Above Jat's Incline, Tsz Wan Shan	Natural hillside	4/9	HyD	3/9 (06:00)	Natural hillside	1 (Boulder fall)	Road	
2003/09/0191	Below Hiu Kwong Street, Sau Mau Ping	11NE-D/F10	14/9	Public	14/9 (18:00)	Fill	200*	Construction site	

Legend:

* Information obtained by GEO's landslide investigation consultants and agreed with GEO's District Divisions.

\# Very minor landslide with negligible consequence (see Section 1 of the report for definition).

(1) The slope feature does not comply with the slope registration criteria given in GEO Circular No. 15.

Table B4 - List of Landslide Incidents in New Territories and Outlying Islands (Sheet 1 of 13)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2003/03/0006	Sung Shan New Village, Yuen Long	Natural hillside	5/3	DLO	Unknown	Natural hillside	2	Open area	
2003/04/0008	Shatin Pass Road, Sha Tin	11NE-A/C284	7/4	HyD	7/4 (18:30)	Rock cut	0.5 (Rock fall)	Road	1 lane of road temporarily closed
LandsD/YL/ 2003/01/0001#	Sung Shan New Village, Yuen Long	Natural hillside	10/4	Lands D	January	Natural hillside	3	Open area	
2003/05/0009a	Fan Kam Road, Pat Heung	6NE-B/C8	5/5	HyD	5/5 (05:00)	Soil cut	20*	Road	1 lane of road temporarily closed
2003/05/0009b		Natural hillside			5/5 (06:00)	Natural hillside	4.2* (Boulder fall)		
2003/05/0010	Above access road, Ta Shek Wu Kiu Tau, Pat Heung	Natural hillside	5/5	Public	5/5 (02:00)	Natural hillside	150*	Access road	
2003/05/0013	Near No.5, Tong Hang Village, Fanling	2.9 m high soil cut slope (1)	5/5	Public	4/5 (05:00)	Soil cut	11	Footpath	Footpath temporarily closed
2003/05/0018	Near No. 109, Siu Sau Sheung Tsuen, Milestone $17^1/_2$, Castle Peak Road, Tuen Mun	2.5 m high soil cut slope (1)	5/5	Public	5/5 (03:00)	Soil cut	3	Open area	
2003/05/0019	Near No. 9, Shek Wu San Tsuen, Ma Sik Road, Sheung Shui	0.75 m high toe wall (1)	5/5	FSD	5/5 (03:00)	Retaining wall	25	Squatter dwelling	1 squatter dwelling temporarily evacuated
2003/05/0020	Above house No. 51, Wong Chuk Yuen Upper Village, Pat Heung	Natural hillside	5/5	Public	5/5 (04:00)	Natural hillside	160*	Village house	1 village house temporarily evacuated
2003/05/0022	Near house No. 31, Pak Ngau Shek Sheung Tsuen, Tai Po	7NW-A/C206	6/5	ICC	5/5	Soil cut	4	Village house	
2003/05/0023	Fan Kam Road, Yuen Long	2.7 m high soil cut slope (1)	5/5	Public	5/5 (05:45)	Soil cut	5	Access road	

Table B4 - List of Landslide Incidents in New Territories and Outlying Islands (Sheet 2 of 13)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2003/05/0025	Lo Tsing Shan Tsuen, So Kwun Wat	6SW-C/C327	5/5	DO	5/5 (04:00)	Soil cut	3	Backlane	
2003/05/0026	Tai Lung Village, Sheung Shui	Natural hillside	5/5	Public	5/5 (05:00)	Natural hillside	16	Access road	
2003/05/0027a	Tai Wo Village, Lau Shui Heung Road, Fanling	3SW-B/CR307	5/5	Public	5/5 (09:00)	Soil cut	2	Backlane	
2003/05/0027b							1		
2003/05/0028	Below house No. 13, Ka Loon Tsuen, Castle Peak Road, Tsing Lung Tau	Slope under construction	5/5	HyD's consultant	5/5 (early morning)	Fill	30	Squatter dwellings and construction site	2 squatter dwellings temporarily evacuated
2003/05/0030	Near No.19, Wing Lung Street, Peng Chau	10SW-B/C132	5/5	Public	5/5 (11:00)	Soil cut	5	Open area	
2003/05/0031	Kau Lung Hang Shan, Tai Po	Natural hillside	5/5	DO	5/5 (04:00)	Natural hillside	200*	Access road and orchard	Access road temporarily closed
2003/05/0032	Siu Lam Tsuen, Siu Lam Road, Tuen Mun	6SW-D/C695	5/5	Public	5/5 (06:00)	Soil cut	1.5	Open area	
2003/05/0033	Near No. 60, Sung Shan New Village, Yuen Long	6NE-C/DT30	5/5	Public	5/5 (early morning)	Disturbed terrain	70	Access road	Access road temporarily closed
2003/05/0037	Near No. 2, Tong Hang Village, Fanling	3SW-A/C158	6/5	Public	5/5	Soil cut	5	Squatter dwelling	
2003/05/0039	Near Tai Wan Tau Road, Sai Kung	1.2 m high brick wall (1)	6/5	Public	6/5 (03:00)	Retaining wall	5	Open area	
2003/05/0040a	Siu Lam Tsuen, Siu Lam Road, Tuen Mun	6SW-D/C581	6/5	Public	6/5 (04:00)	Soil cut	5	Footpath	
2003/05/0040b							0.25		
2003/05/0041	Near No. 41, Sung Shan New Village, Yuen Long	2.8 m high soil cut slope (1)	5/5	Public	5/5 (06:00)	Soil cut	20	Squatter dwelling	

Table B4 - List of Landslide Incidents in New Territories and Outlying Islands (Sheet 3 of 13)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2003/05/0042	Near No. 8, Lo Tsing Shan Tsuen, So Kwun Wat	6SW-C/C75	6/5	Public	6/5 (mid-night)	Soil/rock cut	2	Footpath	Footpath temporarily closed
2003/05/0043	Near house No.67, Pak Ngan Heung, Mui Wo	10SW-C/C347	6/5	Police	5/5 (21:00)	Soil cut	3	Backlane	
2003/05/0044	Near No. 71, Sung Shan New Village, Yuen Long	6NE-C/C89	6/5	Public	5/5 (05:00)	Soil cut	10	Open area	
2003/05/0045	Near Chee Hung Temple, Ngong Ping	1.7 m high soil cut slope (1)	6/5	Police	5/5 (23:15)	Soil cut	1.5	Backlane	Backlane temporarily closed
2003/05/0046	Near No. 28, Ma Wan Back Street, Ma Wan	10NE-A/C9	7/5	Lands D	6/5	Soil/rock cut	30	Cottage	
2003/05/0048	Near Cheung Shan Temple, Wo Keng Shan Road, Ta Kwu Ling	3NW-D/CR81	5/5	Police	4/5 (05:00)	Soil cut	7	Squatter dwelling	
2003/05/0049	Access road to So Kwun Wat Village, So Kwun Wat	6SW-D/C109	8/5	HyD	5/5 (23:00)	Soil cut	6	Access road	
2003/05/0050	Near house No. 6, Ma Po Mei Village, Lam Tsuen, Tai Po	7NW-A/C223	6/5	HyD	5/5 (08:00)	Soil cut	1.7	Open area	
2003/05/0051	Sai Chuk Lam, Ha Fa Shan, Tsuen Wan	1 m high fill slope (1)	6/5	DO	26/4	Fill	3	Footpath	
2003/05/0052	Opposite to Lai Chi Yuen, South Lantau Road, Lantau Island	10SW-C/FR11	7/5	GEO	5/5 (08:30)	Fill	150	Open area	
2003/05/0053	Near No. 65A, Tai Lung Village, Sheung Shui	2 m high soil cut slope (1)	5/5	Public	5/5	Soil cut	4	Access road	
2003/05/0054	Wo Hop Shek Cemetery, Fanling	3SW-C/DT94	7/5	Arch SD	6/5 (08:00)	Disturbed terrain	50	Urn graves	
2003/05/0055	Wo Hop Shek Cemetery, Fanling	3SW-C/DT93	7/5	Arch SD	6/5 (07:00)	Disturbed terrain	20	Urn graves	

Table B4 - List of Landslide Incidents in New Territories and Outlying Islands (Sheet 4 of 13)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2003/05/0057	Near No. 58, Chung Hau Village, Mui Wo	10SW-C/C264	9/5	GEO	5/5 (08:15)	Soil cut	8	Squatter dwelling	
2003/05/0060#	Near No. 28, Ma Wan Back Street, Ma Wan	2.8 m high soil cut slope (1)	7/5	Lands D	6/5	Soil cut	2	Open area	
2003/05/0062	Yick Yuen Tsuen, Castle Peak Road, Yuen Long	Temporary stockpile	5/5	GEO	5/5 (morning)	Fill	5	Storage shed	
2003/05/0063	Near Lo Tsing Shan Tsuen, So Kwun Wat	1.8 m high masonry wall (1)	6/5	Public	6/5 (mid-night)	Masonry Wall	3	Open area	
WSD/2003/5/1/ NTW	Near Sham Tseng Settlement Basin, Sham Tseng	6SE-C/C221	6/5	WSD	5/5 (15:38)	Soil cut	10	Barbecue area in country park	
WSD/2003/5/2/ NTW#	Access road to Tai Lam Chung Reservoir, So Kwun Wat	6SW-B/C137	6/5	WSD	5/5 (14:08)	Soil cut	5	Access road	
WSD/2003/5/3/ NTW#	Access road to Tai Lam Chung Reservoir, So Kwun Wat	6SE-A/CR245	6/5	WSD	5/5 (14:08)	Soil cut	3	Access road	
WSD/2003/5/4/ NTW	Tai Lam Chung Catchwater, So Kwun Wat	6SE-A/CR187	6/5	WSD	6/5 (11:30)	Soil cut	10	Catchwater	
WSD/2003/5/5/ NTW#	Tai Lam Chung Catchwater, So Kwun Wat	6SE-A/C134	6/5	WSD	6/5 (12:30)	Soil cut	5	Catchwater	
2003/05/0064	Tsing Lung Tau San Tsuen, Tsing Lung Tau	6SE-C/C522	13/5	GEO	May	Soil cut	1	Open area	
2003/05/0065	Near Tin Hau Temple, Yau Kom Tau, Tsuen Wan	Two stepped walls of 1.9 m and 1.5 m high (1)	13/5	DO	Unknown	Retaining wall	3	Open area	
2003/05/0066	Near Lo Tsing Shan Tsuen, So Kwun Wat	6SW-C/C324	13/5	DO	5/5 (05:00)	Soil cut	50	Stream course	
2003/05/0067	Near Lo Tsing Shan Tsuen, So Kwun Wat	6SW-C/C324	13/5	DO	5/5 (05:00)	Soil cut	10	Open area	

Table B4 - List of Landslide Incidents in New Territories and Outlying Islands (Sheet 5 of 13)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2003/05/0068#	Near Lo Tsing Shan Tsuen, So Kwun Wat	6SW-C/C281	13/5	DO	5/5 (05:00)	Soil cut	5	Open area	
2003/05/0069#	Near Lo Tsing Shan Tsuen, So Kwun Wat	6SW-C/C281	13/5	DO	5/5 (05:00)	Soil cut	1.5	Open area	
2003/05/0071	Above house No. 169, Lai Chi Wo, Sha Tau Kok	Natural hillside	14/5	DO	Unknown	Natural hillside	2.5	Stream course	
2003/05/0072	Chi Ma Wan Road, Chi Ma Wan	14NW-A/C69	14/5	ICC	5/5 (08:00)	Soil cut	4	Road	
2003/05/0073#	Chi Ma Wan Road, Chi Ma Wan	14NW-A/C203	14/5	ICC	5/5 (08:00)	Soil cut	1	Road	
2003/05/0074	Opposite to No. 24, Chi Ma Wan Road, Chi Ma Wan	2 m high soil cut slope (1)	14/5	ICC	5/5 (08:00)	Soil cut	3	Road	
2003/05/0075	Chi Ma Wan Road, Chi Ma Wan	2.5 m high soil cut slope (1)	14/5	ICC	5/5 (08:00)	Soil cut	3	Road	
2003/05/0076#	Chi Ma Wan Road, Chi Ma Wan	2.7 m high soil cut slope (1)	14/5	ICC	5/5 (08:00)	Soil cut	0.5	Road	
2003/05/0077	Wang Tong Village, Tung Wan Tau Road, Mui Wo	Natural hillside	16/5	DO	5/5 (08:00)	Natural hillside	8	Footpath	Footpath temporarily closed
2003/05/0078a#	Po Kak Tsai Road, Fanling	3SW-B/C202	20/5	DO	5/5	Soil/rock cut	1	Access road	
2003/05/0078b#							0.5		
2003/05/0079	Kau Lung Hang Shan, Tai Po	2.8 m high soil cut slope (1)	20/5	ArchSD	5/5	Soil cut	6	Access road	Access road temporarily closed
2003/05/0082	Siu Sau Tsuen, Tuen Mun	6SW-C/C674	23/5	Public	5/5 (mid-night)	Soil cut	3	Village house	
2003/05/0083	Siu Sau Tsuen, Tuen Mun	6SW-C/CR433	22/5	Public	5/5 (mid-night)	Soil cut	5	Open area	
2003/05/0084#	Tai Yeung Che, Tai Po	Natural hillside	24/5	DO	5/5	Natural hillside	2.5	Footpath	

Table B4 - List of Landslide Incidents in New Territories and Outlying Islands (Sheet 6 of 13)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2003/05/0086#	San Wai Tsuen, Lung Yeuk Tau, Fanling	2 m high soil cut slope (1)	26/5	DO	5/5	Soil cut	3	Cultivation land	
2003/05/0087	Near Ping Che, Fanling	1.8 m high soil cut slope (1)	22/5	DLO	5/5	Soil cut	1.5	Village house	
2003/05/0089	Access road to Kau Lung Hang Shan, Tai Po	2 m high soil cut slope (1)	20/5	Arch SD	5/5	Soil cut	2	Access road	Access road temporarily closed
2003/05/0090	Kau Lung Hang Shan, Tai Po	2.9 m high soil cut slope (1)	26/5	Arch SD	5/5	Soil cut	5	Access road	Access road temporarily closed
2003/05/0092	Chuk Tsai Hang Village, Ying Pun, Sheung Shui	Unregistered at time of failure	28/5	Lands D	6/5 (10:00)	Soil cut	2	Footpath	
2003/05/0093	Tsung Tsai Tsuen, Ping Kong, Sheung Shui	1.7 m high brick retaining wall (1)	26/5	DO	6/5 (08:00)	Brick retaining wall	2	Squatter dwelling	
2003/05/0094	Chuk Tsai Hang Village, Ying Pun, Sheung Shui	Natural hillside	29/5	DO	6/5 (09:00)	Natural hillside	8	Footpath	Footpath temporarily closed
2003/06/0096a	Cheung Sha Upper Village, South Lantau Road, Lantau Island	2.2 m high soil cut slope (1)	5/6	GEO	5/5 (08:00)	Soil cut	0.3	Backlane	
2003/06/0096b							0.2		
2003/06/0102	Near house No. 10, Sai Kung Main Street, Sai Kung	8SW-C/CR38	9/6	FSD	9/6 (13:30)	Soil cut	8	Village house	
2003/06/0107#	Tai Lung Road, Sheung Shui	2 m high soil cut slope (1)	26/5	DO	21/5 (10:00)	Soil cut	2	Access road	
2003/06/0110	Bride's Pool Road, Tai Po	3SE-B/C156	11/6	HyD	Unknown	Soil cut	25	Road	1 lane of road temporarily closed
2003/06/0115	Che Tak Lin Yuen, Upper Keung Shan, Lantau Island	Natural hillside	11/6	BD	10/6 (09:00)	Natural hillside	0.8 (Boulder fall)	Backlane	

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Table B4 - List of Landslide Incidents in New Territories and Outlying Islands (Sheet 7 of 13)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2003/06/0116	Fei Ngo Shan Road, Tsz Wan Shan	11NE-A/C519	12/6	Public	Unknown	Soil/rock cut	2	Road	1 lane of road temporarily closed
2003/06/0117	Along access road to Lai Pek San Tsuen, Ting Kok Road, Tai Po	1.5 m high soil cut slope (1)	12/6	ICC	Unknown	Soil cut	4.5	Access road	
2003/06/0118	Ta Shek Wu Village, Fan Kam Road, Fanling	Natural hillside	11/6	Lands D	11/6 (01:15)	Natural hillside	15*	Access road	
2003/06/0119	Above Lung Ha Wan Road, Clear Water Bay	12NW-C/C349	13/6	HyD	12/6 (11:00)	Soil cut	3	Road	
2003/06/0120	Near Tong Hang Village, Fanling	Unregistered at time of failure	13/6	Lands D	12/6	Soil cut	1.2	Backlane	
2003/06/0122	Tung Chung Road, Lantau Island	1.8 m high soil cut slope (1)	11/6	ICC	11/6 (10:00)	Soil cut	0.7	Pedestrian pavement	
2003/06/0123	Tung Chung Road, Lantau Island	2.2 m high soil cut slope (1)	11/6	ICC	11/6	Soil cut	0.8	Pedestrian pavement	
2003/06/0125	Above Fan Kam Road, Kam Tin	Natural hillside	13/6	HyD	12/6 (17:02)	Natural hillside	1	Open area	
2003/06/0126	Fan Kam Road, Kam Tin	6NE-B/C8	13/6	HyD	12/6 (15:00)	Soil cut	1	Open area	
2003/06/0127	No. 1B, Ha Hang Village, Ting Kok Road, Tai Po	7NW-B/C595	14/6	DO	14/6 (06:00)	Soil cut	3	Village house	
2003/06/0128	No. 189, Pai Tau Village, Sha Tin	7SW-B/C105	16/6	Public	15/6 (14:00)	Soil/rock cut	1 (Boulder fall)	Open area	
2003/06/0129#	Near Siu Lam Tsuen, Siu Lam Road, So KwunWat	Unregistered at time of failure	9/6	GEO	Unknown	Soil cut	5	Stream course	
2003/06/0130	Shatin Pass Road, Sha Tin	11NE-A/C284	9/6	HyD	7/6	Rock cut	3 (Rock fall)	Road	
2003/06/0132#	Peak Garden, Pun Shan Chau, Tai Mo Shan	1.7 m high soil cut slope (1)	17/6	Lands D	Unknown	Soil cut	1.6	Access road	

Table B4 - List of Landslide Incidents in New Territories and Outlying Islands (Sheet 8 of 13)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2003/06/0135	Along access road to Route Twisk, Tsuen Wan	Unregistered at time of failure	16/6	HyD	14/6	Fill	8	Access road	
2003/06/0137	Opposite to house No. F41, Chung Kuk Path, Ho Sheung Heung, Sheung Shui	2.8 m high soil cut slope (1)	16/6	DO	5/5 (10:00)	Soil cut	3	Access road	
2003/06/0138	Hiram's Highway, Nam Wai	11NE-B/C546	18/6	GEO's Consultant	12/6	Soil/rock cut	12	Access road	
2003/06/0139	Tseung Kwan O Landfill Site, Tseung Kwan O	Natural hillside	18/6	AFCD	10/6	Natural hillside	40	Catchwater	
2003/06/0140	Near Tso Wan, Lantau Island	Unregistered at time of failure	13/6	DO	Unknown	Soil cut	3	Footpath	
WSD/2003/6/3/ NTW	Near Shing Mun Catchwater, Route Twisk, Tsuen Wan	6SE-B/CR195	19/6	WSD	18/6 (14:30)	Soil cut	10	Catchwater	
2003/06/0142	Near house No. 86, Sheung Kok Shan Village, Lo Wai Road, Tsuen Wan	7SW-C/C655	25/6	Public	21/6	Soil cut	1	Open area	
2003/06/0143	Near house No. 10A, Tai Kwai Wan San Tsuen, Cheung Chau	14NW-D/C54	26/6	GEO	Before 12/6	Soil cut	1	Backlane	
2003/06/0144	Thai Temple, Shek Kwu Lung, Shek Lin Road, Tai Po	Unregistered at time of failure	26/6	DO	21/6	Soil cut	8	Village house	
2003/06/0145#	Footpath from Sha Lo Wan Pier to Sha Lo Wan Village, Lantau Island	2.2 m high soil cut slope (1)	24/6	DO	5/5 (08:00)	Soil cut	1.5	Footpath	
2003/06/0146#	Footpath from Sha Lo Wan Pier to Sha Lo Wan Village, Lantau Island	2.2 m high soil cut slope (1)	24/6	DO	5/5 (08:00)	Soil cut	2	Footpath	
2003/06/0147	Footpath from Sha Lo Wan Pier to Sha Lo Wan Village, Lantau Island	2.9 m high rock cut slope (1)	24/6	DO	5/5 (08:00)	Rock cut	1.5 (Unstable rock mass)	Footpath	

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Table B4 - List of Landslide Incidents in New Territories and Outlying Islands (Sheet 9 of 13)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2003/07/0148	Near Ngau Kwo Tin, Tai O	13NW-B/C173	2/7	WSD's consultant	11/6 (13:15)	Soil cut	3	Construction site	
2003/07/0150a#	Wilson Trail (near slope No. 7NW-D/C408), Tai Po	2 m high soil cut slope (1)	15/7	DO	Unknown	Soil cut	0.8	Footpath	
2003/07/0150b#							0.2		
2003/07/0151#	Near Kau Lung Hang Shan, Tai Po	2.8 m high soil cut slope (1)	19/7	GEO	Unknown	Soil cut	5	Access road	
ArchSD/BOR&Is(N)/2003/05/0001	Sandy Ridge Cemetery, Lo Wu	3NW-C/F4	2/6	Arch SD	19/5	Soil cut	15	Footpath	
ArchSD/N/2003/05/0003	Wo Hop Shek Cemetery, Fanling	3SW-C/C792	9/5	Arch SD	9/5 (10:51)	Soil cut	60	Urn graves	
ArchSD/N/2003/05/0002	Wo Hop Shek Cemetery, Fanling	3SW-C/C635	7/5	Arch SD	7/5 (12:23)	Soil/rock cut	3 (Rock fall)	Access road	
LandsD/KT/2003/04/0001	Near Kau Wa Keng San Tsuen, Kwai Chung	11NW-A/C697	14/4	Lands D	12/4	Soil/rock cut	0.5 (Rock fall)	Squatter dwelling	
LandsD/TP/2003/05/0001	Above Yue Kok Village, Ting Kok Road, Tai Po	Natural hillside	6/5	Public	5/5	Natural hillside	15	Pedestrian pavement	
LandsD/LD/YL/2003/05/0001	House No. 27, Shung Shan New Village, Yuen Long	6NE-C/C57	5/5	Lands D	5/5 (mid-night)	Soil cut	2	Backlane	
LandsD/LD/N/2003/05/0002	House No. 46, Ying Pun Village, Fan Kam Road, Kam Tin	2SE-D/C364	7/5	Public	6/5	Soil cut	1	Village house	
LandsD/YL/2003/05/0003	Shek Tong Tsuen, Ta Shek Wu, Kam Tin	Natural hillside	20/5	Lands D	5/5	Natural hillside	35	Footpath	
LandsD/LD/YL/2003/05/0002	Near Ta Shek Wu Tsuen, Fan Kam Road, Kam Tin	2SE-D/C402	12/5	Lands D	5/5	Soil/rock cut	1	Open area	
LandsD/LD/TP/2003/05/0003	House No. 12, Tai Po Au Village, Tai Po	7NW-B/C266	13/5	Public	10/5	Soil cut	1	Village house	
LandsD/TP/2003/05/0004	Near Kau Lung Hang Lo Wai, Tai Po	3SW-D/C99	15/5	Public	7/5	Soil cut	2	Backlane	

Table B4 - List of Landslide Incidents in New Territories and Outlying Islands (Sheet 10 of 13)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
LandsD/N/2003/05/0003	Near house No. 27, Ying Pun Village, Fan Kam Road, Kam Tin	2SE-D/C359	21/5	Public	10/5	Soil cut	5	Backlane	
LandsD/N/2003/05/0004	Near house No. 34A, Ying Pun Village, Fan Kam Road, Kam Tin	2SE-D/C362	24/5	DLO	7/5	Soil cut	1.5	Open area	
LandsD/TM/2003/05/0001	Near Kwun Chui Road, So Kwun Wat	6SW-C/CR113	14/5	Lands D	12/5	Soil cut	1	Backlane	
LandsD/N/2003/06/0001	Near Sha Ling Village, Man Kam To, Lo Wu	3NW-C/C61	11/6	GEO	9/5	Soil cut	1	Backlane	
LandsD/N/2003/06/0002	Near Ying Pun Village, Fan Kam Road, Fanling	2SE-D/C9	11/6	Public	6/6	Soil cut	4	Access road	
LandsD/N/2003/06/0003	Near Tin Ping Shan, Sheung Shui	3SW-A/C90	26/6	DLO	June	Soil cut	8	Access road	
LandsD/N/2003/06/0004#	Near Tin Ping Shan, Sheung Shui	3SW-A/C15	26/6	DLO	June	Soil cut	3	Access road	
AFCD/NT/2003/05/0001	Along Tin Fu Track, Tai Lam Country Park, So Kwun Wat	2.5 m high soil cut slope (1)	14/5	AFCD	5/5	Soil cut	7	Access road	
AFCD/NT/2003/05/0002#	Along Tsing Fai Track, Tai Lam Country Park, So Kwun Wat	6SE-A/C179	14/5	AFCD	5/5	Soil cut	3	Access road	
AFCD/NT/2003/05/0003#	Along Tsing Fai Track, Tai Lam Country Park, So Kwun Wat	6SE-A/C172	14/5	AFCD	5/5	Soil cut	0.5	Access road	
AFCD/NT/2003/05/0004	Along Tai Lam Chung Track, Tai Lam Country Park, So Kwun Wat	6SE-C/C602	14/5	AFCD	5/5	Soil cut	7	Access road	
2003/07/0153	North East New Territories Landfill Site, Sha Tau Kok.	Natural hillside	25/7	Public	May/June	Natural hillside	36	Catchwater	
2003/07/0154	Tai Yeung Che, Lam Kam Road, Tai Po	Natural hillside	25/7	DO	Unknown	Natural hillside	1.5	Open area	

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Table B4 - List of Landslide Incidents in New Territories and Outlying Islands (Sheet 11 of 13)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2003/07/0155	Above Sai Sha Road, Kei Ling Ha San Wai, Sai Kung	Natural hillside	28/7	HyD	27/7 (21:50)	Natural hillside	0.5 (Boulder fall)	Road	
2003/08/0157	Near Ngau Tam Mei, Yuen Long	3 m high rubble fill slope (1)	24/7	DSD	13/6 (14:30)	Fill	10	Stream course	
2003/08/0159#	Near Chi Ma Wan Ferry Pier, Lantau Island	2.5 m high fill slope (1)	4/8	CSD	24/7 (14:00)	Fill	5	Access road	
2003/08/0161	No. 22, Yung Shue Long New Village, Lamma Island	2.8 m high fill slope (1)	6/8	DLO	4/8	Fill	1	Footpath	
2003/08/0163	No. 10, Chung Hoi Village, Sok Kwu Wan, Lamma Island	Two stepped fill slopes of 1.5 m and 2.5 m high (1)	6/8	DLO	May	Fill	0.5	Footpath	
2003/08/0165	South of Lo So Shing Road, Lamma Island	Natural hillside	8/8	LCSD	24/7	Natural hillside	2	Footpath	
2003/08/0166	Behind No. 4, Ha Wun Yiu, Tai Po	7NW-B/CR46	8/8	DO	Unknown	Masonry wall	1 (Masonry block)	Village house	
2003/08/0170	Route Twisk, Tsuen Wan	7SW-C/C362	25/8	Police	25/8 (09:15)	Rock cut	16* (Rock fall)	Road	1 lane of road temporarily closed
2003/09/0174	Yan Lam Monastary, Keung Shan, Tai O	13NW-B/C42	2/9	ICC	4/7 (09:00)	Soil/rock cut	2	Backlane	
2003/09/0178#	Lin Ma Hang Road, Sha Tau Kok	3NE-A/C137	4/9	HyD	2/9	Soil cut	0.8	Road	
2003/09/0182	No. 6B, Man Uk Pin New Village, Wo Keng Shan Road, Ta Kwu Ling	1.3 m high soil cut slope (1)	5/9	Public	2/9	Soil cut	2	Squatter dwelling	
2003/09/0183#	Lin Ma Hang Road, Sha Tau Kok.	3NE-A/R6	5/9	HyD	3/9	Retaining wall	3	Road	
2003/09/0184#	Lin Ma Hang Road, Sha Tau Kok.	3NE-A/R6	5/9	HyD	3/9	Retaining wall	5	Road	

Table B4 - List of Landslide Incidents in New Territories and Outlying Islands (Sheet 12 of 13)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2003/09/0185	Access road to Kwun Yam Shan, Tsz Wan Shan	2.2 m high soil/rock cut slope (1)	9/9	Lands D	Unknown	Soil/rock cut	1	Access road	
2003/09/0186	Near Loi Tong, Fanling	1.2 m high soil/rock cut slope (1)	10/9	Public	Unknown	Soil/rock cut	0.7	Village house	
2003/09/0190	House No. 5, Mai Po Lung Tsuen, Castle Peak Road, San Tin	2 m high soil cut slope (1)	15/9	Public	10/9 (13:00)	Soil cut	2	Squatter dwelling	
2003/09/0192	No. 20, Pak Kiu Tsai Village, Tat Wan Road, Tai Po	2.5 m high masonry wall (1)	17/9	Public	16/9	Masonry wall	6	Footpath	
2003/09/0196	Tai Lam Chung Catchwater, Kwok Shui Road, Pat Heung	Natural hillside	26/9	DLO	5/5 (12:00)	Natural hillside	5	Open area	
2003/09/0197#	Above Wan Po Road, Tseung Kwan O.	Natural hillside	25/9	GEO	Early September	Natural hillside	3	Open area	
2003/08/0158	Nam Tong, Tung Lung Chau	Natural hillside	4/8	Public	9/6	Natural hillside	20	Footpath	
WSD/2003/6/4/ NTE	Near Kei Ling Ha Catchwater, Sai Kung	8NW-C/CR101	23/6	WSD	18/6 (14:30)	Soil/rock cut	0.5	Catchwater	
2003/10/0198	Near Fu Yung Shan, Tsuen Wan	2.8 m high soil cut slope (1)	10/10	GEO	Unknown	Soil cut	0.5	Footpath	
LandsD/N/2003 /08/0001	Near San Tong Po, Lau Shui Heung Road, Lung Yeuk Tau	3SW-B/C108	13/8	Lands D	May	Soil cut	20	Storage area	
LandsD/ST/ 2003/08/0001	Tiu Tso Ngam, Shatin Pass Road, Tsz Wan Shan	Natural hillside	3/9	Lands D	August	Natural hillside	0.2	Access road	
AFCD/NT/ 2003/09/0001	Near Shing Mun Road, Shing Mun Country Park, Kwai Chung	7SW-C/C820	7/10	AFCD	8/9	Soil/rock cut	3	Open area	
WSD/2003/6/1/ HK	Near Tai Long Wan Catchwater, Lantau Island	13NW-B/CR262	11/6	WSD	11/6	Soil cut	20	Catchwater	

Table B4 - List of Landslide Incidents in New Territories and Outlying Islands (Sheet 13 of 13)

Incident No.	Location	Slope No.	Call		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
WSD/2003/6/2/HK	Near Sham Wat East Catchwater, Lantau Island	9SW-D/C129	11/6	WSD	11/6	Soil/rock cut	10	Access road	
2003/10/0199	Near Lo Tik Wan, Lamma Island	15NW-A/F11	22/10	DO	June	Fill	5	Footpath	
2003/11/0202#	Above Bride's Pool Road, Tai Po	Natural hillside	12/11	DLO	Unknown	Natural hillside	3	Footpath	
2003/12/0203	Castle Peak Road near Tsing Lung Tau	6SW-D/FR84	18/12	HyD	Unknown	Fill	60	Beach	
2003/12/0204	Wing Ling Tsuen Sitting-out area, Sui Wan Road, Fanling	2m high retaining wall (1)	22/12	DLO	Unknown	Retaining wall	7	Footpath	
ArchSD/TC/001	Near TWGH C.Y.Ma Charity Fund Practical School, Yau Shin Street, Au Tau	Natural hillside	7/1/04	Arch SD	30/10	Soil cut	14	Backlane	
ArchSD/BOR&Is(N)/2003/12/0001	Sandy Ridge Cemetery, Lo Wu	3NW-C/DT14	15/12	Arch SD	24/11	Disturbed terrain	2	Open area	

Legend:

* Information obtained by GEO's landslide investigation consultants and agreed with GEO's District Divisions.

\# Very minor landslide with negligible consequence (see Section 1 of the report for definition).

(1) The slope feature does not comply with the slope registration criteria given in GEO Circular No. 15.

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GEO PUBLICATIONS AND ORDERING INFORMATION
土力工程處刊物及訂購資料

A selected list of major GEO publications is given in the next page. An up-to-date full list of GEO publications can be found at the CEDD Website http://www.cedd.gov.hk on the Internet under "Publications". Abstracts for the documents can also be found at the same website. Technical Guidance Notes are published on the CEDD Website from time to time to provide updates to GEO publications prior to their next revision.

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MAJOR GEOTECHNICAL ENGINEERING OFFICE PUBLICATIONS
土力工程處之主要刊物

GEOTECHNICAL MANUALS

Geotechnical Manual for Slopes, 2nd Edition (1984), 300 p. (English Version), (Reprinted, 2000).

斜坡岩土工程手冊(1998)，308頁(1984年英文版的中文譯本)。

Highway Slope Manual (2000), 114 p.

GEOGUIDES

Geoguide 1	Guide to Retaining Wall Design, 2nd Edition (1993), 258 p. (Reprinted, 2000).
Geoguide 2	Guide to Site Investigation (1987), 359 p. (Reprinted, 2000).
Geoguide 3	Guide to Rock and Soil Descriptions (1988), 186 p. (Reprinted, 2000).
Geoguide 4	Guide to Cavern Engineering (1992), 148 p. (Reprinted, 1998).
Geoguide 5	Guide to Slope Maintenance, 3rd Edition (2003), 132 p. (English Version).
岩土指南第五冊	斜坡維修指南，第三版(2003)，120頁(中文版)。
Geoguide 6	Guide to Reinforced Fill Structure and Slope Design (2002), 236 p.

GEOSPECS

Geospec 1	Model Specification for Prestressed Ground Anchors, 2nd Edition (1989), 164 p. (Reprinted, 1997).
Geospec 3	Model Specification for Soil Testing (2001), 340 p.

GEO PUBLICATIONS

GCO Publication No. 1/90	Review of Design Methods for Excavations (1990), 187 p. (Reprinted, 2002).
GEO Publication No. 1/93	Review of Granular and Geotextile Filters (1993), 141 p.
GEO Publication No. 1/2000	Technical Guidelines on Landscape Treatment and Bio-engineering for Man-made Slopes and Retaining Walls (2000), 146 p.
GEO Publication No. 1/2006	Foundation Design and Construction (2006), 376 p.

GEOLOGICAL PUBLICATIONS

The Quaternary Geology of Hong Kong, by J.A. Fyfe, R. Shaw, S.D.G. Campbell, K.W. Lai & P.A. Kirk (2000), 210 p. plus 6 maps.

The Pre-Quaternary Geology of Hong Kong, by R.J. Sewell, S.D.G. Campbell, C.J.N. Fletcher, K.W. Lai & P.A. Kirk (2000), 181 p. plus 4 maps.

TECHNICAL GUIDANCE NOTES

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