SECTION 2: REPORT ON THE RAINSTORM AND LANDSLIDES OF 1-4 JULY 1997

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FOREWORD

This Report presents a review of the severe rainstorm of 1-4 July 1997 and the landslides which occurred as a result. The maximum rolling 24-hour rainfall recorded during this event was 799 mm on 2-3 July at the Chinese University, Sha Tin. A rainstorm black warning was issued on 1 July and rainstorm red warnings were issued on 1, 2 and 3 of July. Landslip and flood warnings were also issued. In total, 192 incidents were reported to the Geotechnical Engineering Office (GEO). Of these, 172 were classified as genuine landslides, 27 of which were major. The magnitude of this event warrants a separate report in addition to the report on rainfall and landslides which is usually produced annually.

The District Divisions of the GEO provided details of most of the landslides. Supplementary landslide data were provided by the GEO's 1997 Landslide Investigation Consultants, the Agriculture and Fisheries Department, Architectural Services Department, Drainage Services Department, Fire Services Department, Highways Department, Housing Department and Water Supplies Department. The Hong Kong Observatory provided rainfall information. All contributions are gratefully acknowledged.

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ABSTRACT

This Report presents a review of the severe rainstorm of 1-4 July 1997 in Hong Kong and the landslides that occurred as a result. Rainfall information has been obtained from the Geotechnical Engineering Office (GEO) automatic raingauge system and from the Hong Kong Observatory (HKO). Most of the landslide data have been taken from the records of incidents reported to the GEO which can be attributed to the severe 1-4 July rainstorm. Supplementary data have been obtained from the GEO's 1997 Landslide Investigation Consultants and other Government Departments.

The maximum rolling 24-hour rainfall of 799 mm was recorded at the Chinese University, Sha Tin, on 2-3 July 1997. A total of 192 incidents attributable to the 1-4 July rainstorm were reported to the GEO. Of these, 172 were classified as genuine landslides, 27 of which were major.

CONTENTS

1. INTRODUCTION

This Report describes the rainstorm of 1-4 July 1997 and the landslides that occurred as a result. Rainfall information has been obtained from the Geotechnical Engineering Office (GEO) and the Hong Kong Observatory (HKO). Most of the landslide data have been taken from the records of incidents reported to the GEO. Supplementary data have been obtained from the GEO's 1997 Landslide Investigation Consultants and other Government Departments.

In this Report, a landslide is defined as the detachment or excessive lateral displacement of a soil or rock mass, and includes the failure of fill slopes, cut slopes, natural slopes, retaining walls and rock or boulder falls. A 'major' landslide is defined as a failure in which the volume of the detached mass is 50 m^3 or more, or where a fatality has occurred. The arrangement of this Report is similar to previous rainfall and landslide reports on individual rainstorms (Choot, 1993; Evans, 1993; Hudson, 1993; Tang, 1993).

The rainstorm of 1-4 July 1997 was followed by a period of relatively dry weather. The next significant rainfall fell on 10 July. It is therefore considered reasonable to assume that landslides occurring between 1 and 9 July inclusive can be attributed to the 1-4 July rainstorm. The above rationale results in a total of 192 reported incidents attributable to the rainstorm. Of these, 172 were genuine landslides, 27 of which were major.

2. RAINFALL

2.1 The Raingauge System

In the rugged terrain of Hong Kong, the distribution and intensity of rainfall during a storm can vary dramatically with respect to both geography and time. In order to provide sufficient coverage for a meaningful analysis of rainfall distribution, the HKO has installed a network of raingauges which, in 1997, comprised 24 automatic and 51 manual raingauges at 68 locations. Three automatic raingauges have also been installed by the Drainage Services Department (DSD). The 'principal' raingauge is located at the HKO's headquarters in Tsim Sha Tsui, and a continuous rainfall record has been kept at this location since 1884.

Since 1978 the GEO, in cooperation with the HKO, has commenced to establish an automatic raingauge system (comprising 48 automatic raingauges in 1997) which transmits real-time rainfall data via telephone lines to the GEO and the HKO at five-minute intervals. The locations of the GEO automatic raingauges (Figure 1) were selected to supplement the network of other types of raingauges and to provide specific information in areas of particular geotechnical interest.

In this Report, the 'maximum 24-hour' rainfall refers to the maximum rolling 24-hour rainfall (calculated from rolling rainfall amounts using one clock-hour data) and the 'daily' rainfall refers to the 24-clock-hour rainfall (midnight to midnight). The 'daily' rainfall is based on an arbitrary fixed period which does not necessarily represent the maximum rainfall over a 24-hour period. When rainfall is quoted without reference to the location of measurement, it can be assumed to be from the HKO headquarters in Tsim Sha Tsui.

2.2 Hong Kong Observatory Records

The 1-4 July rainstorm was described in the Monthly Weather Summary for July 1997 (HKO, 1997b) as follows :

> "In the first four days in July, there were more showers and heavy rain and a total of 345 millimetres of rainfall were recorded at the Hong Kong Observatory".
>
> "... On 1 July, over 170 millimetres of rainfall were recorded over east Kowloon and the northern side of Hong Kong Island where rainfall was the heaviest".
>
> "Heavy rain occurred on 2 July... A rain-gauge at the Chinese University recorded nearly 360 millimetres between 3 a.m. and noon and another 430 millimetres between 1 p.m. and 1 a.m. the next morning".
>
> "Rainfall was more evenly distributed on 3 July than the previous two days, most areas recorded over 100 millimetres".

Some rainfall rolling maxima for the 1-4 July rainstorm are shown in Table 1, together with some data on the resulting landslide consequences, and these are compared with similar data for selected previous major rainstorms.

The daily rainfall at the HKO from 1 June to 9 July and the maximum 24-hour rainfall recorded at the GEO raingauge stations in the whole of Hong Kong for the same period are shown in Figures 2a and 2b, together with the numbers of landslides reported to the GEO in Figure 2c.

Figure 3 shows the total monthly rainfall distribution for June. Figure 4 shows the total rainfall distribution from 1 to 4 July 1997 and the locations of resulting landslides reported to have occurred in the period from 1 to 9 July 1997. Figure 5 shows the hourly rainfall intensities at the HKO for the maximum 24-hour rainfall in the period from 1 to 4 July 1997. Figure 6 shows the hourly and 15-minute rainfall intensities for the most intense rainfall location at the Chinese University for the maximum 24-hour rainfall. More rainfall records from GEO automatic rainguages during this period are presented in the next section.

2.3 Geotechnical Engineering Office Records

The maximum 24-hour, maximum five-hour and maximum one-hour rainfalls (rolling rainfall amounts using one clock-hour rainfall as the basic unit) recorded by the GEO raingauges during the period from 1 to 4 July 1997 are given in Table 1. A maximum 24-hour rainfall of 799 mm was recorded at raingauge station (N09) at the Chinese University from 3:00 a.m. on 2 July 1997 to 3:00 a.m. on 3 July 1997 (see Figure 2b).

Appendix A contains hourly rainfall data recorded by the GEO raingauges during the period from 1 to 4 July 1997.

2.4 Rainfall Distribution

Rainfall distribution with time and location can be assessed by referring to detailed GEO and HKO records. Previous reports have used rainfall at the HKO for determining the 24-hour period to which maximum 24-hour rainfall isohyets are referred, and this approach has been adopted here. Determining the period from maximum 24-hour rainfall records from the Chinese University would make little difference for this rainstorm event. Isohyets of 24-hour rainfall from 1 to 4 July are shown in Figures 7 to 9 using the period determined from the maximum 24-hour rainfall at the HKO.

Figure 7 shows that heavy rainfall occurred on 1 July in the urban areas. Heavy rain occurred on 2 July as intensified rainbands moved over the Tsuen Wan and Sha Tin areas (Figure 8). Rainfall was fairly evenly distributed on 3 July over the whole of Hong Kong (Figure 9). Most areas recorded more than 100 mm, and rainfall continued until the early hours of 4 July in the urban areas and over the western New Territories.

2.5 Warnings Issued by the Hong Kong Observatory

Relevant warnings issued by the HKO and Landslip Warnings jointly issued by the GEO and the HKO from 1 to 9 July are summarised in Table 2. The Landslip Warning was raised on 1 July from 7:38 a.m. to 2:00 p.m., raised again on 2 July at 6:25 a.m. and not lowered until 8:40 a.m. on 5 July.

2.6 Estimated Return Periods of the 1-4 July Rainstorm

Return periods of recorded rainfall during the period from 1 to 4 July were estimated for durations of one hour to 24 hours based on the rainfall recorded at the HKO. The estimated return periods at the HKO based on Lam & Leung (1994) range from one year to two years (Table 3). However, the heaviest rain was recorded at the raingauge station N09 at the Chinese University in the New Territories, rather than at the HKO (Figures 4 and 8). Table 3 shows the estimated return periods for rainfall durations from one hour to 24 hours at the raingauge station N09 range from about 22 to more than 1 000 years based on the rainfall recorded at the HKO (Lam & Leung, 1994).

It should be noted that the estimated return periods at the raingauge station N09 based on the rainfall recorded at the HKO may not be representative, given the raingauge station N09 at the Chinese University is about 13 km from the HKO. Therefore, using available site-specific rainfall data (1984 to 1997 inclusive) at the raingauge station N09, Table 3 also shows the estimated return periods for rainfall durations from one hour to 24 hours at this location range from about 10 to 45 years.

3. LANDSLIDES

3.1 Landslides Attributable to the Rainstorm of 1-4 July 1997

The rainstorm from 1 to 4 July was followed by a period of relatively dry weather until

the next significant rainfall fell on 10 July. It is therefore considered reasonable to assume that landslides known to have occurred between 1 and 9 July inclusive can be attributed to the 1-4 July rainstorm, as can landslides reported between 1 to 9 July but for which a precise date of failure is unknown. Landslides reported after 9 July for which a precise date is not known have not been attributed to the 1-4 July rainstorm and are not considered further in this report. The above rationale results in a total of 192 incidents reported to the GEO, of which 172 were landslides. Out of the 172 reported landslide incidents, the time of occurrence was recorded to within one day for 152. Of these 152 incidents, the time of occurrence was determined to within one hour for 50. The numbers of incidents reported to various Government departments are shown in Table 4.

Details of all 192 incidents reported to the GEO are summarized in Appendix B. In total, 172 incidents were classified as genuine landslides, 27 of which were major (summarized in Table B1). The remaining reported incidents were either not landslides or were incidents that were of no geotechnical concern, such as fallen trees. They were therefore not considered in the statistical analysis described below. The locations of all the reported incidents are shown in Drawing No.GCSP 8/18, which is attached to this report. Selected incidents are illustrated in Plates 1 to 18. Further details of these incidents can be found in the incident files of the District Divisions of the GEO and reported detailed landslide studies conducted by GEO's 1997 Landslide Investigation Consultants.

Based on GEO's landslide inspection reports, 46 landslides between 1 and 9 July were considered by the inspecting geotechnical engineers to be associated with poor maintenance. This amounted to about 27% of all the reported landslides.

It should be noted that there were other landslides which were not reported to the GEO, many of which will have occurred in remote areas with no immediate consequences.

3.2 Facilities Affected by Landslides

3.2.1 General

The numbers of landslides including major landslides affecting various types of facility (building lot, road, etc.) in Hong Kong, Kowloon and the New Territories are shown in Table 5. It should be noted that one failure may affect more than one type of facility. Landslide consequences, classified according to failure type, are shown in Table 6.

3.2.2 Squatter Areas

A total of 30 landslides affected squatter areas and five were major (Table 5). These landslides led to the permanent evacuation of 71 squatter huts and the temporary evacuation of seven huts (Table 6). Two major incidents ME 97/7/5 and MW 97/7/27 are described in Sections 4.4 and 4.8.

3.2.3 Building Lots

Twenty-nine landslides affected building lots and private properties, of which nine were major (Table 5). These landslides resulted in the temporary evacuation of ten houses and five flats in part or in totals (Table 6). Incidents ME 97/7/3 and MW 97/7/10 are described in Sections 4.3 and 4.7.

3.2.4 Roads and Access

Eighty-two landslides affected sections of road, access, footpath and pedestrian pavement. Nineteen of these were major (Table 5). Thirty-six landslides resulted in the blockage of sections of road, pedestrian pavement and/or access (Table 6). Incidents ME 97/7/1, ME 97/7/3, ME 97/7/5, ME 97/7/51, MW 97/7/10 and MW 97/7/70 are described in Sections 4.2, 4.3, 4.4, 4.6, 4.7 and 4.9.

3.2.5 Construction Sites

One landslide affected a construction site, and was major (Table 5). This incident (MW 97/7/70) is described in Section 4.9.

3.2.6 Carparks, Playgrounds, Gardens and Yards

Six landslides affected carparks, playgrounds, gardens and yards, of which one was major. This major incident (ME 97/7/51) is described in Section 4.6.

3.2.7 Catchwaters and Reservoirs

Landslides affecting catchwaters and reservoirs were usually dealt with separately by the Water Supplies Department (WSD). A total of 43 incidents were reported to the WSD, of which 41 were landslides, five of which affected catchwaters. No landslide in this category was reported to GEO.

3.2.8 Other Areas

Other areas affected by landslides included country and urban parks, open areas and hillside, a cemetery and graves. A total of four areas within the country and urban parks were reported to have been affected by landslides, two of which were major (ME 97/7/51 and Shing Mun Main (Upper) Dam) and which are described in Sections 4.6 and 4.10. Twenty-three landslides affected open areas and hillside and three of these were major. One major landslide affected a cemetery. These landslide incidents (ME 97/7/5 and ME 97/7/69) are described in Section 4.4.

3.3 Types of Failures

3.3.1 General

Landslides reported to the GEO have been classified into six types of failure, i.e. fill slopes, cut slopes, natural slopes, retaining walls, rock/boulder falls and others. The numbers of different types of failure are shown in Table 7.

3.3.2 Fill Slopes

There were fifteen fill slope failures, forming 8.7% of all landslides reported. Five of these failures were major. Incidents ME 97/7/69 and MW 97/7/27 are described in Sections 4.4 and 4.8.

3.3.3 Cut Slopes

There were 110 cut slope failures, forming 63.9% of all landslides reported. There were 97 incidents reported in soil cut slopes, eleven of which were major (Incidents ME 97/7/1, ME 97/7/3 and ME 97/7/70 are described in Section 4.). There were nine soil/rock cut slope failures, one of which was major. There were four rock cut slope failures, one of which was major (Shing Mun Main (Upper) Dam is described in Section 4.10).

3.3.4 Retaining Walls

There were twelve reported failures of retaining walls, forming 7.0% of all landslides reported. Two of these incidents were major. ME 97/7/5 is described in Section 4.4.

3.3.5 Natural Slopes

There were 32 natural slope failures recorded in the incident reports, forming 18.6% of all landslides. Seven incidents were major. Incidents ME 97/7/30, ME 97/7/51 and MW 97/7/10 are described in Section 4.

3.3.6 Rock and Boulder Falls

There were three cases of rock and boulder falls, forming 1.8% of all landslides. None of these were major.

3.4 Landslide Volume Distribution

Tables 8 and 9 show the distribution of landslide volume for all landslide incidents which were reported to the GEO. Fourty-nine (about 28.5%) involved less than 5 m^3 of material, while 27 (about 15.7%) involved a failure volume of 50 m^3 or above. Of these 27

major failures, five were fill slopes, eleven were soil cut slopes, one was a soil/rock slope, one was a rock cut slope, seven were natural slopes and two were retaining walls.

3.5 Rainfall-Landslide Relationships

The relationship between rainfall and landslides during the 1-4 July rainstorm is illustrated in plots of total rainfall distribution from 1 to 4 July in Figure 4, and 24-hour rainfall isohyets and landslides in Figures 7 to 9. Figure 4 shows the total rainfall distribution from 1 to 4 July and the locations of landslides which resulted from the 1-4 July rainstorm. Figures 7 to 9 show the locations of landslides for which both the time and date of occurrence are known.

To further show the relationship between rainfall and landslides for the 1-4 July rainstorm, Figure 10 shows the maximum 24-hour rainfall distribution in the rainstorm of 1-4 July and the locations of landslides that occurred as a result. In addition, Figure 11 shows the maximum hourly rainfall distribution in the rainstorm of 1-4 July and locations of landslides that occurred as a result. The maximum 24-hour rainfall distribution in Figure 10 and the maximum hourly rainfall distribution in Figure 11 were plotted based on the maximum rolling 24-hour rainfall and the maximum hourly rainfall, respectively, from raingauge stations in the whole of Hong Kong.

4. NOTABLE LANDSLIDES

4.1 General

Out of the 172 landslides reported to the GEO, ten are described in more detail here. These landslides have been selected on the basis of their failure volume, consequence or technical interest.

4.2 Incident ME 97/7/1 : Lai Ping Road, Kau To Shan, Sha Tin

(A major soil cut slope failure resulting in the total blockage of Lai Ping Road and one lane of Tai Po Road, Plate 1)

On 2 July 1997, the landslide occurred on a soil cut slope (7NE-C/C95) along Lai Ping Road in Kau To Shan, Sha Tin. The landslide consisted of several discrete failures but two were dominant. The first dominant failure occurred at around 8:00 p.m. on 2 July 1997 with an estimated volume of 2 250 m^3. The travel angle, that is the inclination of the line jointing the distal end of the debris and the crest of the landslide, was about 21°. A subsequent dominant failure occurred between 10:00 p.m. and midnight on 2 July 1997 with an estimated volume of 1 250 m^3. The travel angle of the failure debris was about 18°. The landslide comprised several discrete failures and extended along a 135-m section of the cut slope. The total volume of the detached failures was about 4 000 m^3. The landslide debris totally blocked Lai Ping Road and trapped a truck driver, who was rescued.

A major backscarp complex was found in the densely-vegetated terrain, 30 to 50 m

beyond the crest of the cutting. Evidence of fresh ground disturbance with up to several metres of both vertical and horizontal displacements were observed. The total volume of this potentially unstable mass was estimated to be about 100 000 m^3.

A comprehensive investigation into this landslide is being carried out by the GEO. Details of the investigation and its findings will be given in the investigation report.

4.3 Incident ME 97/7/3 : Ten Thousand Buddhas' Monastery, Sha Tin

(Major soil cut slope failure which resulted in one fatality, one injury and building damage, Plates 2 and 3)

This landslide occurred at the Ten Thousand Buddhas' Monastery, Sha Tin at 6:15 a.m. on 2 July 1997. The landslide involved the collapse of part of the registered soil cut slope No.7SW-B/C116 and part of the hillside above. About 1 500 m^3 of debris was released during the landslide, leaving a main scarp about 25 m wide with a rupture surface about 25 m long and 6 m deep on the southwest flank, and about 1 m deep on the northeast flank. The maximum horizontal travel distance of the debris was about 40 m, as measured from the crest of the landslide to the distal end of the debris. The travel angle of the landslide was about 32°. Copious seepage was observed from about 2 m below ground level in the main scarp of the landslide. Seepage flow and surface water runoff resulted in the formation of gullies along both sides of the debris. A building known as Kun Yam Din was damaged and an adjacent annex building was buried by the landslide debris. The landslide resulted in one fatality in the annex building and one person in Kun Yam Din was slightly injured.

The landslide at Ten Thousand Buddhas' Monastery was probably caused by elevated water pressure along adversely oriented discontinuities in the weathered granite of the slope, following the heavy rainfall that immediately preceded the failure. A lack of maintenance of the cut slope prior to the failure had probably resulted in local progressive slope deterioration.

A comprehensive investigation into the landslide was carried out by the GEO's 1997 Landslide Investigation Consultants. Details of the investigation and its findings can be found in GEO (1998a).

4.4 Incidents ME 97/7/5 and ME 97/7/69 : Tao Fung Shan Christian Cemetery, Sha Tin

(Major fill slope failure and retaining wall failure resulting in closure of the cemetery, permanent evacuation of four huts and temporary evacuation of one hut, Plates 4, 5 and 6)

On 2 July 1997 at 6:30 a.m., two landslides occurred on the northern (ME97/7/69, Plate 4) and eastern (ME97/7/5, Plates 5 and 6) boundaries of Tao Fung Shan Christian Cemetery.

The main scarp of the northern landslide (ME97/7/69) was 52 m wide and comprised two back scarps separated by an area of vegetated loose fill which did not collapse in the failure. The larger back scarp to the east was about 32 m wide, 15 m long and 3 m high.

The smaller back scarp to the west was about 10 m wide, 10 m long and 2 m high. The failure was shallow (about 0.3 m to 1 m). The volume of debris derived from the main scarp was estimated to be about 600 m^3 and an estimated volume of about 300 m^3 of soil and debris was entrained as the landslide displaced down the natural hillside. The overall travel angle of the landslide was about 30°. The northern landslide resulted in a closure order for the cemetery.

The eastern landslide (ME97/7/5) primarily involved the failure of two retaining walls at the eastern end of the cemetery. Most of the landslide debris from behind the retaining walls travelled down slope, stripping about 150 m^3 of additional material from the natural hillside, and came to rest on the cut and fill platform below the cemetery, demolishing part of house No. 163. The estimated total volume of landslide debris was 400 m^3. The travel angle of the landslide was about 35°. The main scarp extended about 2 m up slope from the original position of the retaining wall and was about 28 m wide and 2 m high. During an inspection of the landslide on 2 July, a heavy flow of water was observed over the terrace behind the failed walls and down the slope. The chunam cover on the terrace was severely cracked and numerous cracks were also observed in the paving of the cemetery above the retaining walls. The eastern landslide resulted in the permanent evacuation of four huts, temporary evacuation of one hut and the closure of the cemetery.

The probable cause of the landslides was saturation of the fill slopes, with contributory factors including : (a) substandard formation and construction of fill platforms, terraces and retaining walls, (b) inadequate maintenance of the fill platforms, terraces, and retaining walls, and (c) inadequate drainage provision for surface water runoff from the fill platforms and terraces.

A comprehensive investigation into the landslides was carried out by the GEO's 1997 Landslide Investigation Consultants. Details of the investigation and its findings can be found in GEO (1998b).

4.5 Incident ME 97/7/30 : Near Fo Tan Station of the Kowloon-Canton Railway, Sha Tin

(Major failure of a partly modified natural hillside which occurred about 250 m southwest of Fo Tan Station along the Kowloon-Canton Railway (KCR), resulting in the derailment of a northbound train and significant disruption of rail services, Plates 7, 8 and 9)

This landslide occurred between 0:40 a.m. and 5:54 a.m. on 2 July 1997, at about 250 m southwest of the Fo Tan Station. The landslide originated from the upper part of a partly modified natural hillside and produced a failure scar about 15 m long and 8 m wide with an average depth of about 1.5 m. The volume of failure was estimated to be about 100 m^3. The shape of the main scarp of the landslide suggests that there might have been two phases of movement. The first phase of failure was a translational debris slide with an estimated volume of 80 m^3, occurred immediately north of the squatter platform. The travel angle of this first phase of failure was about 30°. The second phase of failure was also a translational debris slide, involving about 20 m^3 of debris. The travel angle of this second phase of failure was about 38°. Debris from the landslide obstructed the northbound KCR rail track. The first northbound train of the day was derailed by the landslide debris, causing

significant disruption to rail services. No fatalities or injuries were reported.

Surface water flowing along the platform at the crest of slope was observed by KCRC staff on the day of the failure. Part of the surface water flow was channelled into the landslide. The washout action of the surface water flow eroded a gully below the rupture zone of the failure and significantly reworked the debris at the toe of the slope.

The probable cause of failure was build-up of transient water pressure due to heavy rainfall within the soil mass along an adversely oriented sheeting joint system.

A comprehensive investigation into the landslides was carried out by the GEO's 1997 Landslide Investigation Consultants. Details of the investigation and its findings can be found in GEO (1998c).

4.6 Incident ME 97/7/51 : Ma On Shan Road, near the Shing On Temporary Housing Area, Ma On Shan

(Major failure of a natural slope affecting Country Park, Plates 10 and 11)

Some time between the early morning of 2 July 1997 and 4:00 p.m. on 3 July 1997, a landslide occurred on the hillside opposite Shing On Temporary Housing Area, Ma On Shan. The landslide consisted of five morphological elements: (a) an upper elongated concave scar in the gully within the natural hillside, (b) a central planar scar controlled by a pre-existing planar discontinuity obliquely intersecting the natural hillside and the cut slope, (c) a narrow deeply incised channel in the upper fill platform, (d) an arcuate scar and landslide debris abutting the west side of the incised channel, and (e) landslide debris on gentle sloping ground. The estimated total failure volume of the landslide was about 3 000 m^3. The travel angle of the landslide was 26°. The rupture surface of the upper concave scar within the natural hillside was 12 m wide, 35 m long and 3 m deep. The estimated volume from this failure scar was 1 300 m^3. The central planar failure scar intersected the natural hillside and the cut slope (Slope No. 7NE-D/C159) was triangular-shaped in plan and having a width of about 20 m that narrowed downslope. The estimated volume from this central planar failure scar was 1 200 m^3. Failure volume of the cut slope (Slope No. 7NE-D/C159) above the fill platform was about 300 m^3 and localised failure of the fill platform was about 200 m^3. Debris from the landslide accumulated on a gentle sloping grassed area adjacent to a footpath/bicycle track at the toe of the slope.

The landslide was probably triggered by intense rainfall. The contributing factors to the failure include : (a) the presence of a pre-existing gully that led to concentrated surface water flowing into the area of the landslide, (b) the presence of a persistent, planar discontinuity, (c) the oversteep soil cut slope above the fill platform, (d) the presence of loose fill, and (e) infiltration of rainfall and surface water directly into the slope and natural hillside above.

A comprehensive investigation into the landslides was carried out by the GEO's 1997 Landslide Investigation Consultants. Details of the investigation and its findings can be found in GEO (1998d).

4.7 Incident MW 97/7/10 : Castle Peak Road, Lido Beach

(A major failure of a partly modified natural slope, resulting in complete closure of Castle Peak Road and an access road, evacuation of four flats and eight injuries, Plates 12 and 13)

On the morning of 2 July 1997 at 8:00 a.m. a large washout of a sandy fill occurred from the Ting Kau Bridge construction site, about 200 m east of the major failure. The fill material washed onto the Castle Peak Road blocking one lane. At around 8:30 a.m., workers from the Ting Kau Bridge Contractors (TKBC) commenced clearing the debris, but fifteen minutes later a second large washout of sand reached Castle Peak Road and spread as far as Edinburgh Villas, accumulating to a depth of around 300 mm. A double decker bus became stuck in the debris at 9:00 a.m., resulting in the closure of both lanes of Castle Peak Road. An excavator and a six-wheel dump truck with five workers from TKBC were mobilized to undertake the clearance work. By 11:45 a.m., the TKBC workers had cleared most of the debris from Castle Peak Road and were clearing up in front of Edinburgh Villas. At 11:45 a.m., a major landslide occurred on a 15-m high partly modified natural slope beneath the property on the crest. Landslide debris ran over the access road and lifted the truck and carried it down the slope towards the swimming pool at Riviera Apartment. The landslide also affected a registered fill slope (Slope No.6SE-C/F3) downhill. The rupture surface of the landslide was 25 m wide, 20 m long and up to 3 m deep. The travel angle of the landslide, measured from the crest of the main scarp to a point on top of the debris on the downslope side of Castle Peak Road was 20°. Approximately 750 m^3 of debris from the landslide completely blocked Castle Peak Road and an access road to six abandoned properties. Eight persons were injured.

No obvious seepage was noted in the main scarp during the inspections on 2 July and 3 July 1997. However, on 7 July 1997 when the debris had been removed from the lower part of the slope and rockfill had been placed, a moderately strong seepage was observed at two locations near the toe of the slope.

The probable landslide trigger was a rise in the groundwater table created by the combined effects of direct infiltration from rainfall and from surface water around the flooded abandoned properties.

A comprehensive investigation into the landslides was carried out by the GEO's 1997 Landslide Investigation Consultants. Details of the investigation and its findings can be found in GEO (1998e).

4.8 Incidents MW 97/7/27 : Milestone 6-1/2, Tai Po Road, Sha Tin Heights, Sha Tin

(A major fill slope failure resulting in permanent evacuation of six squatter huts, Plate 14)

A landslide was reported at Milestone 6-1/2, Tai Po Road, Sha Tin Heights at 2:00 p.m. on 4 July 1997. The landslide occurred in a fill slope (Slope No.7SW-D/F158) with poor vegetation cover and no surface drainage system. A tension crack was observed near the scarp. The failure involved a scar about 10 m wide and 5 m high. The estimated failure

volume was about 50 m^3. The landslide debris punched through a corner of a squatter hut on the slope and damaged a second hut near the toe. Six squatter huts were permanently evacuated as a result.

The probable landslide trigger was infiltration during the heavy rainfall.

4.9 Incident MW 97/7/70 : Ching Cheung Road, Cheung Sha Wan

(Major failure of a soil cut slope followed by two successively large progressive failures on 17 July and 3 August 1997, completely blocking Ching Cheung Road, Plates 15 and 16)

A cut slope failure occurred at 9:00 a.m. on 7 July 1997, followed by two progressive failures on 17 July and 3 August 1997. The initial slope failure involved about 500 m^3 of soil detached from the lower part of the central eastern portion of the cut slope (Slope No. 11NW-A/C55). The debris just reached a section of Ching Cheung Road which was closed as part of construction works for a Highways Department Improvement Project. The observed failure scar was confined to the lower two batters, and affected a 52 m length of slope that extended up to 15 m above Ching Cheung Road. The exposed failure surface was apparently shallow but variable in depth, typically less than 2 m. A second progressive failure occurred on 17 July 1997 and involved an estimated volume of 700 m^3 of soil from the concave section of the slope immediately above the western part of the first failure. The failure debris run out was again confined to the closed section of Ching Cheung Road. The failure reached up to 30 m above the road and was 30 m long, 15 m wide and about 5 m deep (maximum). A third progressive failure occurred on 3 August 1997 and resulted in the complete blockage of a 50 m section of Ching Cheung Road, trapping a car travelling on the westbound carriageway. The driver of the car was uninjured. The estimated failed volume of the landslide was 2 000 m^3. The travel angle of the 3 August 1997 failure was about 20°. A depression was formed up to 7 m deep and 20 m wide extending 30 m above Ching Cheung Road and the earlier landslide scars were deepened and eroded.

The principal cause of failure was adverse transient groundwater conditions, which developed following severe rainfall in early July 1997 and the previous month. The site was unusual in that it had a long history of deep-seated failures and had a well-developed natural pipe system which controlled the hydrogeology. A system of raking drains, installed in the slope in 1972, was unable to prevent the critical water pressures developing.

A comprehensive investigation into the landslides was carried out by the GEO's 1997 Landslide Investigation Consultants. Details of the investigation and its findings are given in GEO (1998f).

4.10 Shing Mun Main (Upper) Dam, Tsuen Wan

(Major failure of a rock cut slope affecting Country Park, Plates 17 and 18)

A failure of a rock cut slope first noted by GEO on 3 July 1997 and which almost certainly occurred on 2 July 1997, was located approximately 200 m below the Shing Mun

Main (upper) Dam. The main scarp of the failure was about 45 m wide, 8 m to 10 m deep and at an elevation of about 175 m. The estimated failed mass was about 10 m deep and from 3 m wide in the south to 20 m wide in the north with an estimated volume of about 3 000 m^3. The landslide debris travelled a maximum distance of 70 m (in plan), with a maximum fall of about 60 m, passing over two steep rock steps at elevations of approximately 125 m and 150 m. A considerable proportion (perhaps 40%) of the debris remained on the site of the failure, on the landslide scar below the failure, or in the stream course which passes down the northern side of the landslide. The remaining debris came to rest as a debris lobe on flat ground at an elevation of about 115 m. The toe of the landslide has a travel angle of about 38° to 41° to the main scarp. Seepage was noted at the top of the cut slopes adjacent to the landslide, at the elevation of the crest of the second rock step.

The probable causes of failure were adverse geological conditions and water filling up a number of open sub-vertical joints at the slope crest by direct infiltration, giving rise to high water pressures and lateral forces behind and at the base of the joints.

A study into the rock slope failure was carried out by Planning Division and Special Projects Division of the GEO. Details of the study and its findings are given in GEO (1997a and b).

5. CONCLUSIONS

The rainstorm of 1-4 July 1997 resulted in 192 incidents being reported to the GEO, 172 of which were classified as genuine landslides, and 27 of which were major. One fatality and nine injuries occurred. The consequences resulting from the landslides included the temporary evacuation of seven squatter huts, ten houses and five flats, the permanent evacuation of 71 squatter huts, and 36 landslides resulted in the blockage of sections of road, pedestrian pavement and/or access.

Based on GEO's landslide inspection reports, 46 of the landslides (about 27%) which occurred were considered by the inspecting geotechnical engineers to be related to poor slope maintenance.

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LIST OF TABLES

Table 1 - Rainfall and Landslides in the Period 1-4 July 1997, Compared with Selected Previous Major Rainstorms

Date[1] of Event	Maximum Rainfall (mm)[2]								Landslide Consequences			
	Hong Kong Observatory					GEO Raingauges[3]			Number of Reported Landslides[4]		Persons Killed (Injured)	Number of Huts Evacuated Permanently
	24-hr	5-hr	1-hr	Antecedent		24-hours	5-hours	1-hour	GEO[6]	FSD[6]		
				4 days	15 days							
1-2 Jul 97 [5]	149	111	45	35	337	244 (N16)	183 (K08)	80 (K03)	93	6	1(1)	54
2-3 Jul 97 [5]	110	49	18	183	380	799 (N09)	296 (N09)	99 (N02)	117	6	0(8)	54
3-4 Jul 97 [5]	81	32	18	292	459	142 (N17)	76 (N12)	43 (N12)	48	0	-	0
Selected Previous Major Rainstorms (for comparison only)												
29 May 82	394	153	44	1	11	430	237	111	551	15	22(26)	1153
17 Jun 83	347	274	69	2	77	460	303	101	155	5	(2)	149
20-21 May 89	388	149	37	28	42	566	224	51	340	3	2(3)	199
8 May 92	324	196	110	65	71	385	244	110	350	9	3(5)	92
4-5 Nov 93	107	31	9	8	8	742	350	94	377	2	-	25

Notes :
(1) The events are arranged in order of the intensity of 24-hour rainfall recorded at the Hong Kong Observatory, Tsim Sha Tsui.
(2) The 24-hour and five-hour maximum rainfall are the rolling rainfall amounts using one-clock hour rainfall as the basic unit. The 1-hour maximum rainfall refers to clock hours.
(3) The maxima are selected from the 48 GEO Raingauges for the rainstorms. The GEO Raingauge reference number is shown in brackets.
(4) Reported totals are for genuine reported landslides known to have occurred on specific dates.
(5) Landslip warnings were issued for these events.
(6) GEO = Geotechnical Engineering Office; FSD = Fire Services Department.

Table 2 - Warnings Issued by the Hong Kong Observatory in the Period 1-9 July 1997

Period	Total Rainfall (mm)	Dates on Which Warnings Were in Effect			
		Thunderstorm	Flood	Landslip	Rainstorm
1-9 July	376.6	1, 2, 2-3, 3-4, 6, 7, 8, 9	1, 2, 2-3, 3-4	1(7:38a.m.-2:00p.m.), 2(6:25a.m.) - 5(8:40a.m.)	1(Red, Black) 2(Red) 3(Red)

Notes : (1) Landslip Warnings were issued after consultation between GEO and HKO.
(2) Information in this Table was based on HKO (1997b).

Table 3 - Maximum Rainfall Recorded at the Hong Kong Observatory and the Chinese University in the1-4 July 1997 Rainstorm and Their Estimated Return Periods

The Hong Kong Observatory

Duration	Rainfall[2] (mm)	Ending Time		Estimated Return Period (Years)[1]
		Date	Time	
1 hour	45	1/7/97	8:00	1
4 hours	107	1/7/97	9:00	2
8 hours	117	1/7/97	11:00	1
12 hours	121	1/7/97	15:00	1
24 hours	149	2/7/97	5:00	1

Notes : (1) Return periods were assessed from the Gumbel's method, based on 100 years (1884 - 1939 and 1947 - 1990) rainfall data at the Hong Kong Observatory, after Lam & Leung(1994).
(2) Rainfall maxima as recorded at the Hong Kong Observatory, Tsim Sha Tsui.

The Chinese University

Duration	Rainfall[3] (mm)	Ending Time		Estimated Return Period	
		Date	Time	Years[1]	Years[2]
1 hour	95	2/7/97	7:00	22	10
4 hour	245	2/7/97	9:00	35	20
8 hours	356	3/7/97	1:00	56	30
12 hours	432	3/7/97	1:00	93	30
24 hours	799	3/7/97	3:00	>1000	45

Notes : (1) Return periods were assessed from the Gumbel's method, based on 100 years (1884 - 1939 and 1947 - 1990) rainfall data at the Hong Kong Observatory, after Lam & Leung(1994).
(2) Return periods were assessed from the Gumbel's method (Lam & Leung, 1994), based on fourteen years (1984 - 1997) rainfall data at raingauge N09 at the Chinese University.
(3) Rainfall maxima as recorded at the Chinese University, Raingauge Station N09.

Table 4 - Number of Incidents Reported to Various Government Departments

Department	Total Number (from 1 July to 9 July 1997)	Type of Incident		
		Landslide	Flooding	Others
Agriculture & Fisheries Department	16	16	0	0
Architectural Services Department	4	3	0	1
Drainage Services Department	121	0	121	0
Fire Services Department	13	6	7	0
Geotechnical Engineering Office, Civil Engineering Department	192	172	2	18
Highways Department	196	96	36	64
Housing Department	5	3	1	1
Water Supplies Department	43	41	0	2

Note : "Others" includes minor signs of distress and incidents of no geotechnical concern such as fallen trees.

Table 5 - Number of Landslides Reported to GEO Affecting Different Facilities

Affected Facility	Districts[4]				All
	Hong Kong	Kowloon	New Territories		
			Mainland East	Mainland West	
Squatters	0(0)	0(0)	10(3)	20(2)	30(5)
Building Lots/Properties	1(0)	0(0)	12(5)	16(4)	29(9)
Roads	2(0)	1(0)	10(4)	21(3)	34(7)
Pedestrian Pavements	0(0)	1(0)	7(4)	8(2)	16(6)
Footpaths, Lanes, Private Access, Footbridges	1(0)	0(0)	12(4)	19(2)	32(6)
Construction Sites	0(0)	0(0)	0(0)	1(1)	1(1)
Country and Urban Parks	0(0)	0(0)	2(1)	2(1)	4(2)
Open Areas/Hillside	1(0)	1(0)	9(1)	12(2)	23(3)
Catchwaters/Conduits/Culverts	0(0)	0(0)	0(0)	0(0)	0(0)
Carparks, Playgrounds, Gardens, Yards	0(0)	1(0)	4(0)	1(1)	6(1)
Cemeteries/Graves	0(0)	0(0)	1(1)	0(0)	1(1)
Unclassified	1(0)	0(0)	14(2)	8(0)	23(2)

Legend :

16(6) Sixteen landslides of which six were major

Notes :
(1) Incidents which were not genuine landslides have been excluded.
(2) The numbers of landslides affecting different types of facility are based on Sections 11 and 12 of GEO's Incident Reports.
(3) One landslide may affect more than one type of facility.
(4) Based on GEO's district boundaries, which are shown in Drawing No. GCSP 8/18.

Table 6 - Landslide Consequence Related to Type of Failure

Type of Failure		No. of Squatter Huts Evacuated[2]		No. of Blocks, Houses or Flats Evacuated or Partially Closed[2]	No. of Landslides Involving Blockage or Closure[2]			Deaths (Injuries)
		Permanent	Temporary		Roads	Pedestrian Pavements	Footpaths, Back Lanes, Private Access	
Fill Slope		13	-	-	3	-	1	-
Cut Slope	Soil	53	4	4 houses 1 flat	13	5	1	1(1)
	Soil/ Rock	-	1	3 houses	2	-	1	-
	Rock	-	-	-	2	-	-	-
Natural Slope		1	1	2 houses 4 flats	3	1	-	(8)
Retaining Wall		4	1	1 house	1	-	1	-
Rock/Boulder Fall		-	-	-	2	-	-	-
Others (subsidence)		-	-	-	-	-	-	-

Notes :
(1) Incidents which were not genuine landslides have been excluded.
(2) Based on Sections 11 and 12 of GEO's Incident Reports.
(3) A failure may give rise to more than one type of consequence.

Table 7 - Number of Landslides Reported to GEO Classified by Type of Failure

Type of Failure[1]		Number	Percentage (%)
Fill Slope		15(5)	8.7
Cut Slope	Soil	97(11)	56.4
	Soil/Rock	9(1)	5.2
	Rock	4(1)	2.3
Retaining Wall		12(2)	7.0
Natural Slope		32(7)	18.6
Rock/Boulder Fall		3(0)	1.8
Others (e.g. subsidence)		0(0)	0.0
Total		172(27)	100

Legend :

97(11) Ninety-seven landslides of which eleven were major

Notes : (1) Incidents which were not genuine landslides have been excluded.
(2) Data shown in this Table are based on Sections 5 and 6 of GEO's Incident Reports. Where a landslide involved more than one type of failure, the predominant type has been adopted.

Table 8 - Landslide Volume Distribution

Volume of Failure (m^3)	Districts[2]				All
	Hong Kong	Kowloon	New Territories		
			Mainland East	Mainland West	
<5	6	2	13	28	49(28.5%)
≥5 to <10	0	0	12	25	37(21.5%)
≥10 to <20	0	1	10	17	28(16.3%)
≥20 to <50	0	1	17	12	30(17.4%)
≥50 to <200	0	0	8	5	13(7.6%)
≥200 to <500	0	0	3	1	4(2.3%)
≥500 to <1000	0	0	3	2	5(2.9%)
≥1000	0	0	3	2	5(2.9%)
Not Recorded	0	0	1	0	1(0.6%)
Total	6(3.5%)	4(2.3%)	70(40.7%)	92(53. 5%)	172(100%)

Legend :

49(28.5%) Forty nine landslides, which amount to 28.5% of the 172 landslides reported to the GEO

Notes : (1) Incidents which were not genuine landslides have been excluded.
(2) Based on GEO's district boundaries, which are shown in Drawing No. GCSP 8/18.

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

Volume of Failure (m^3)	Fill Slope	Cut Slope			Retaining Wall	Natural Slope	Rock/Boulder Fall	Others (e.g. subsidence)	Total
		Soil	Soil/Rock	Rock					
<5	4	27	3	2	5	7	1	0	49(28.5%)
≥5 to <10	3	27	2	1	0	4	0	0	37(21.5%)
≥10 to <20	1	17	0	0	2	6	2	0	28(16.3%)
≥20 to <50	2	15	3	0	2	8	0	0	30(17.4%)
≥50 to <200	2	7	1	0	1	2	0	0	13(7.6%)
≥200 to <500	2	1	0	0	1	0	0	0	4(2.3%)
≥500 to <1000	1	1	0	0	0	3	0	0	5(2.9%)
≥1000	0	2	0	1	0	2	0	0	5(2.9%)
Not Recorded	0	0	0	0	1	0	0	0	1(0.6%)
Total	15(8.7%)	97(56.4%)	9(5.2%)	4(2.3%)	12(7.0%)	32(18.6%)	3(1.8%)	0(0.0%)	172(100%)

Note : Incidents which were not genuine landslides have been excluded.

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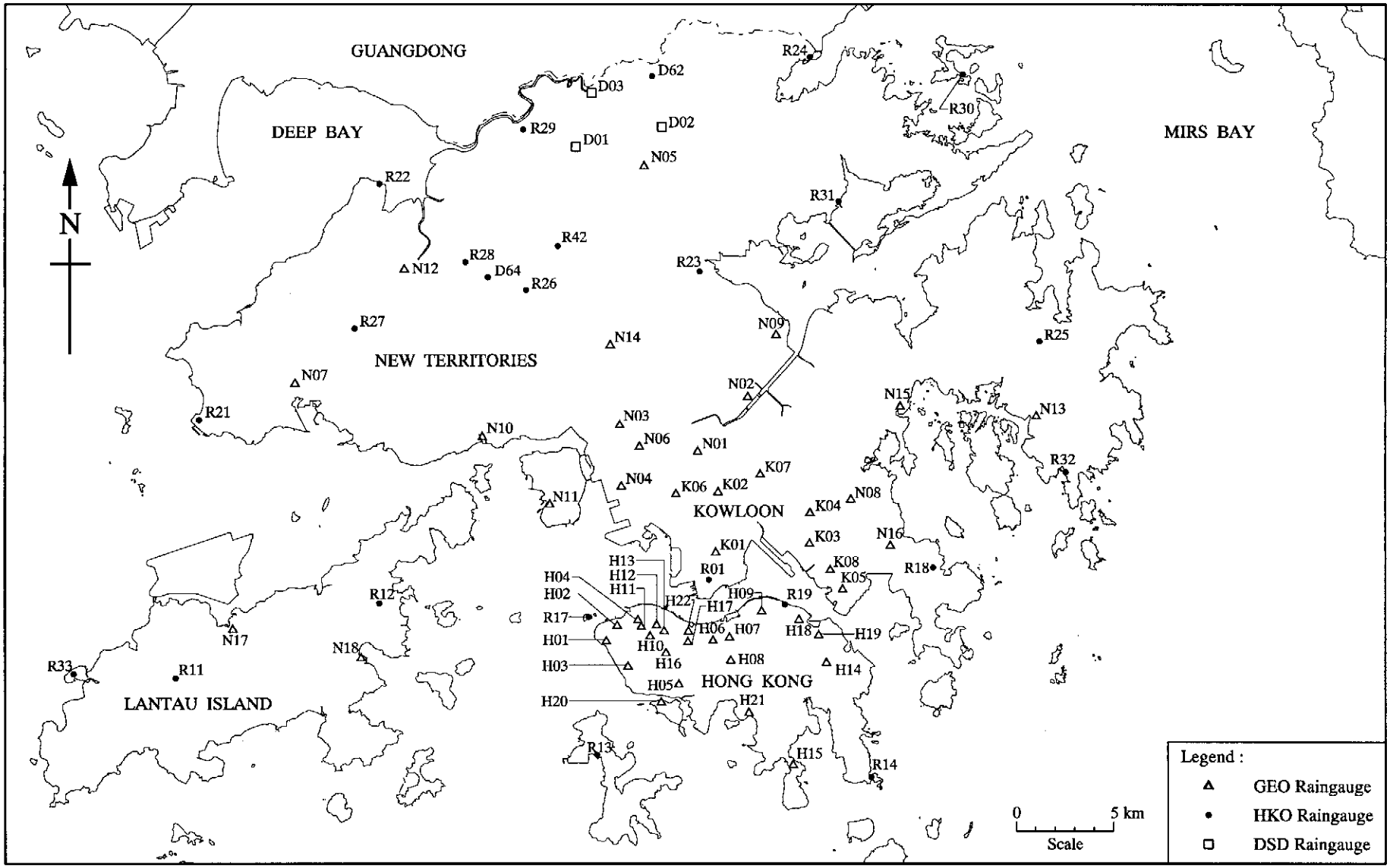
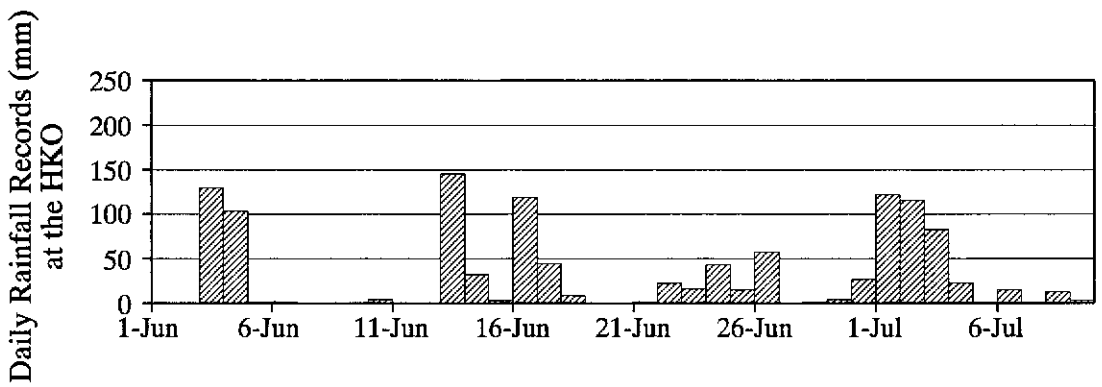
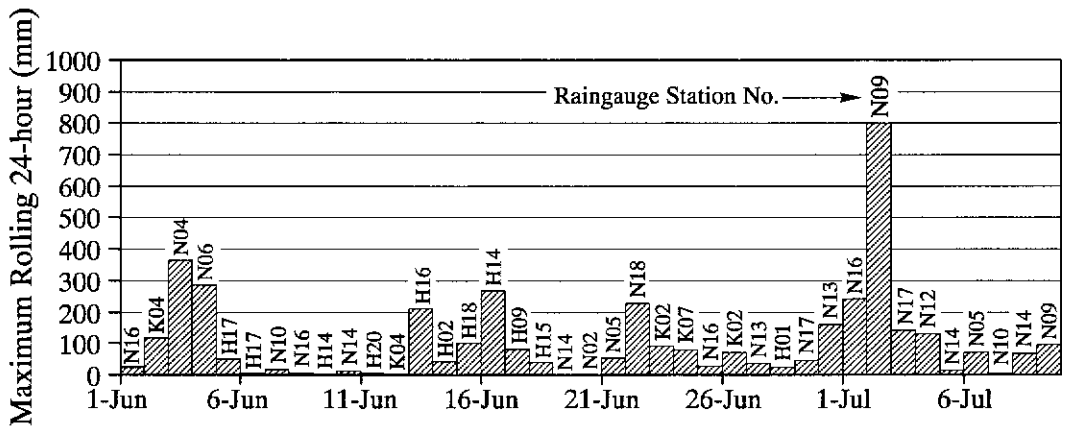


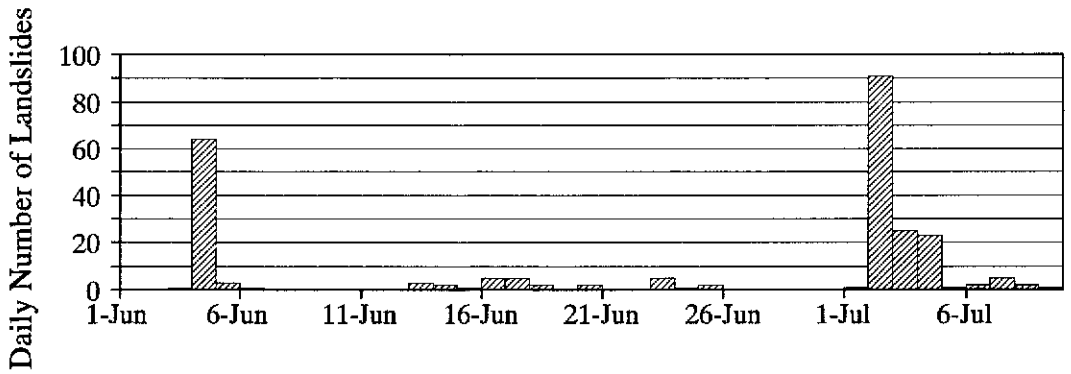
Figure 1 - Locations of GEO, HKO and DSD Automatic Raingauges



(a) Daily Rainfall Intensities Recorded at HKO

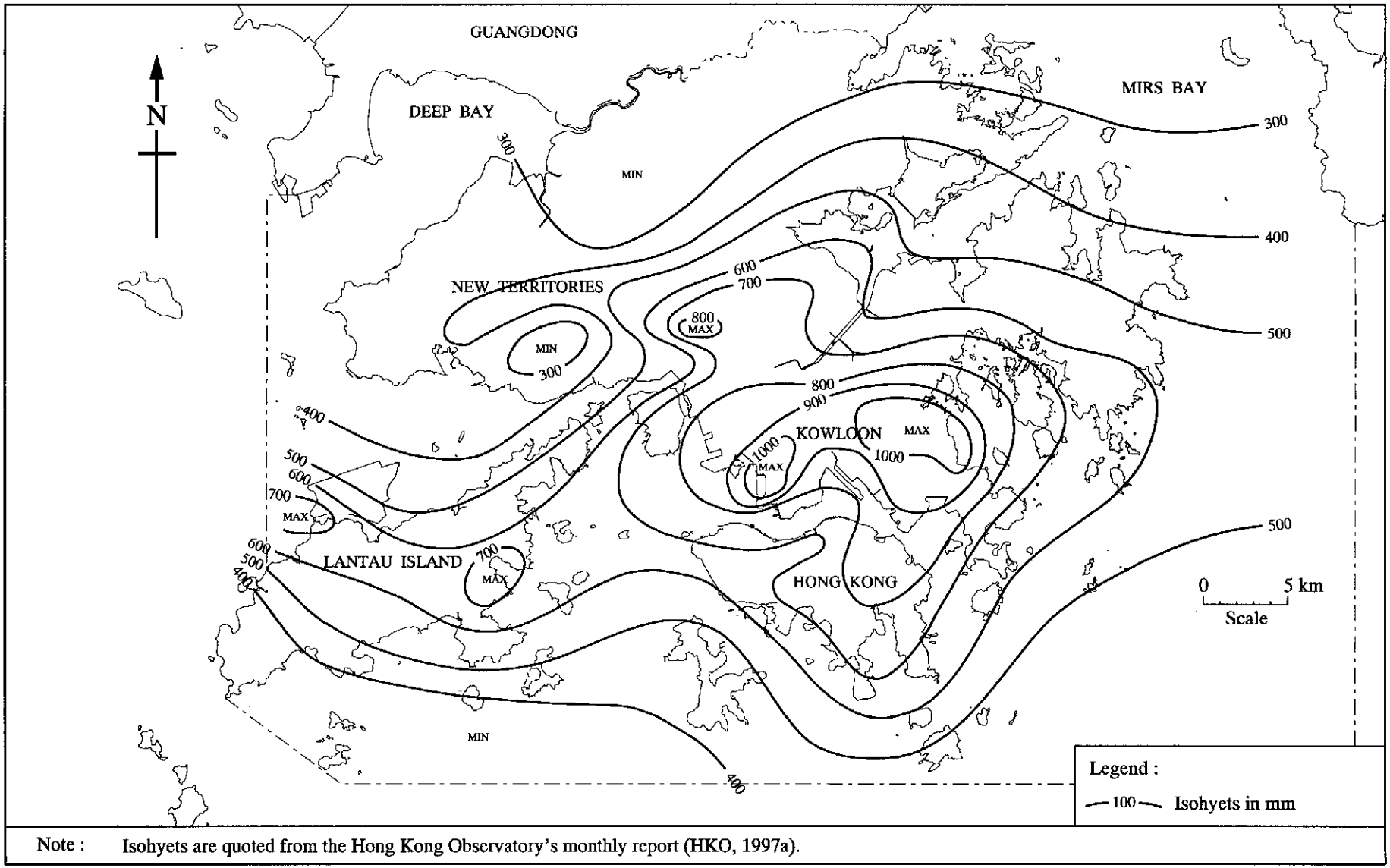


(b) Maximum 24-hour Rainfall Intensities Recorded at GEO Raingauge Stations



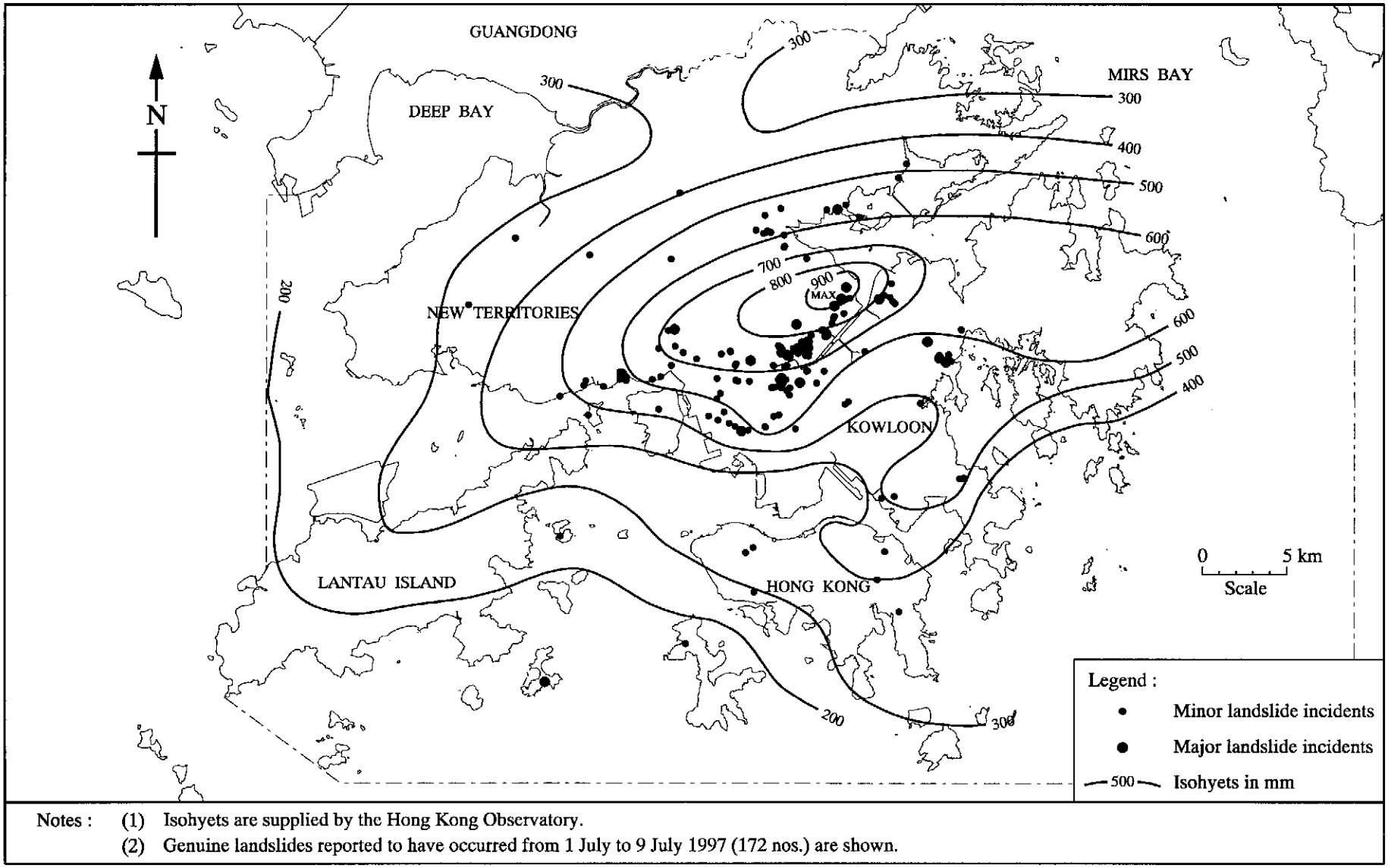
(c) Daily Number of Landslides Reported to GEO

Figure 2 - Daily Rainfall Records at the HKO, Maximum 24-hour Rainfall Records at GEO Raingauge Stations and Landslides Reported to GEO from 1 June to 9 July 1997



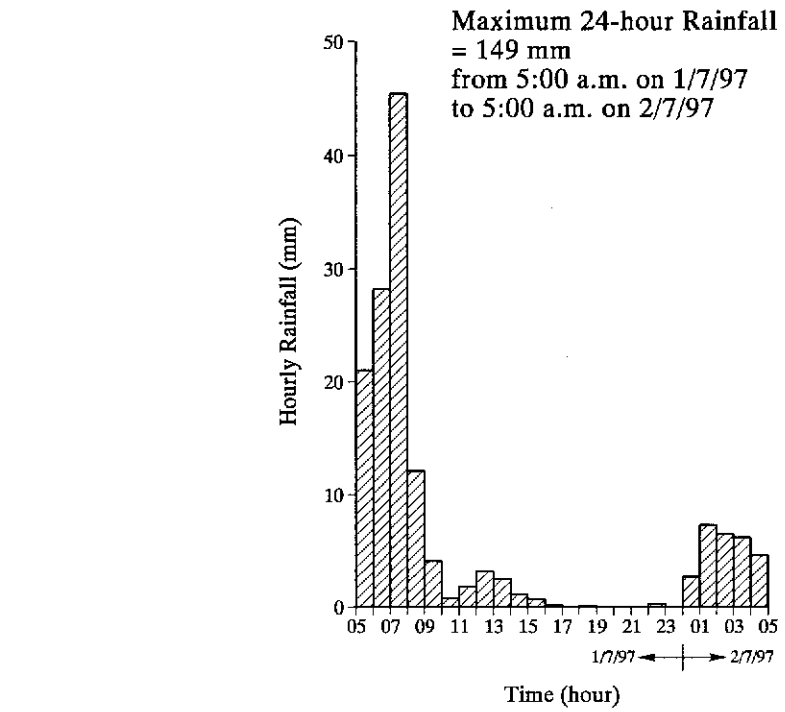
Note : Isohyets are quoted from the Hong Kong Observatory's monthly report (HKO, 1997a).

Figure 3 - Total Monthly Rainfall Distribution for June 1997

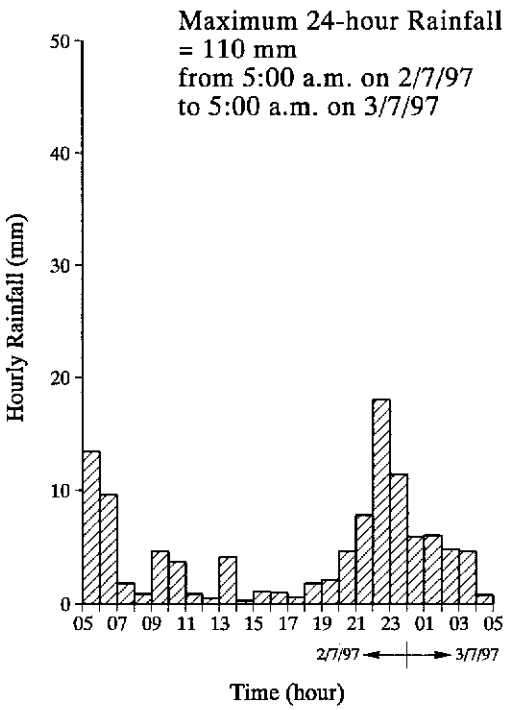


Notes : (1) Isohyets are supplied by the Hong Kong Observatory.
(2) Genuine landslides reported to have occurred from 1 July to 9 July 1997 (172 nos.) are shown.

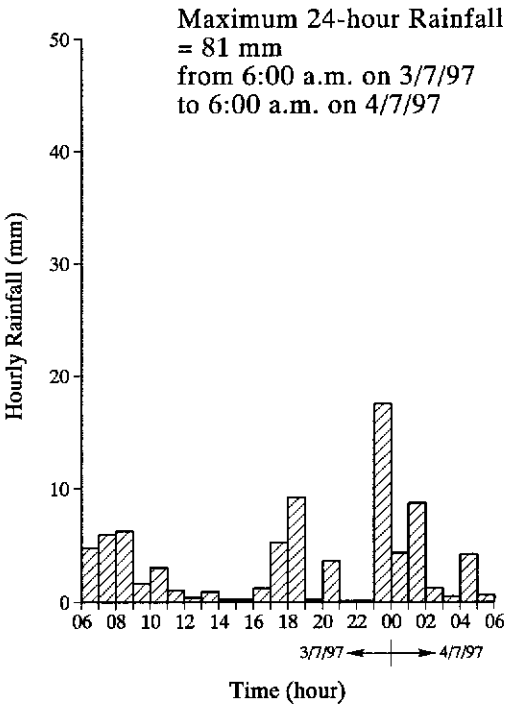
Figure 4 - Total Rainfall Distribution from 1 to 4 July 1997 and Locations of Landslides



(a) Between 1 and 2 July 1997

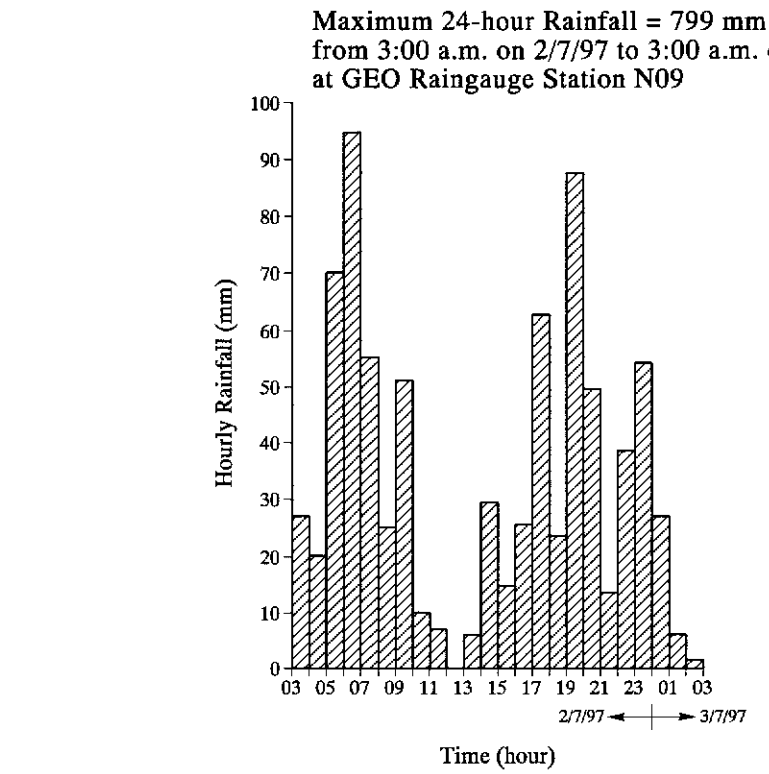


(b) Between 2 and 3 July 1997

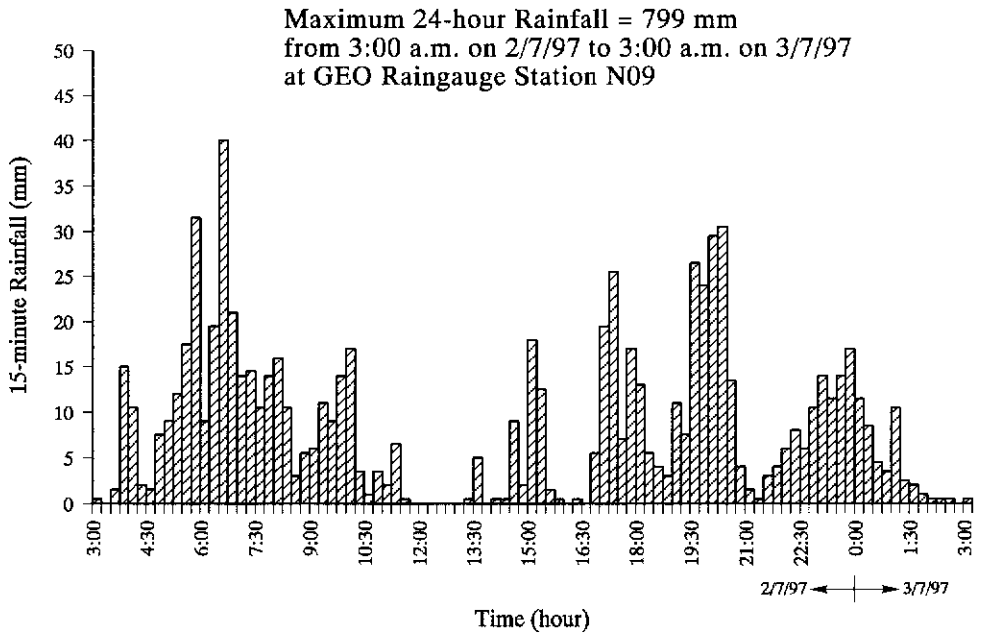


(c) Between 3 and 4 July 1997

Figure 5 - Hourly Rainfall Intensities at the HKO from 1 July to 4 July 1997



(a) Hourly Rainfall Intensities between 2 and 3 July 1997



(b) 15-minute Rainfall Intensities between 2 and 3 July 1997

Figure 6 - Hourly and 15-minute Rainfall Intensities at the Most Intense Rainfall Location at the Chinese University in the 1-4 July Rainstorm

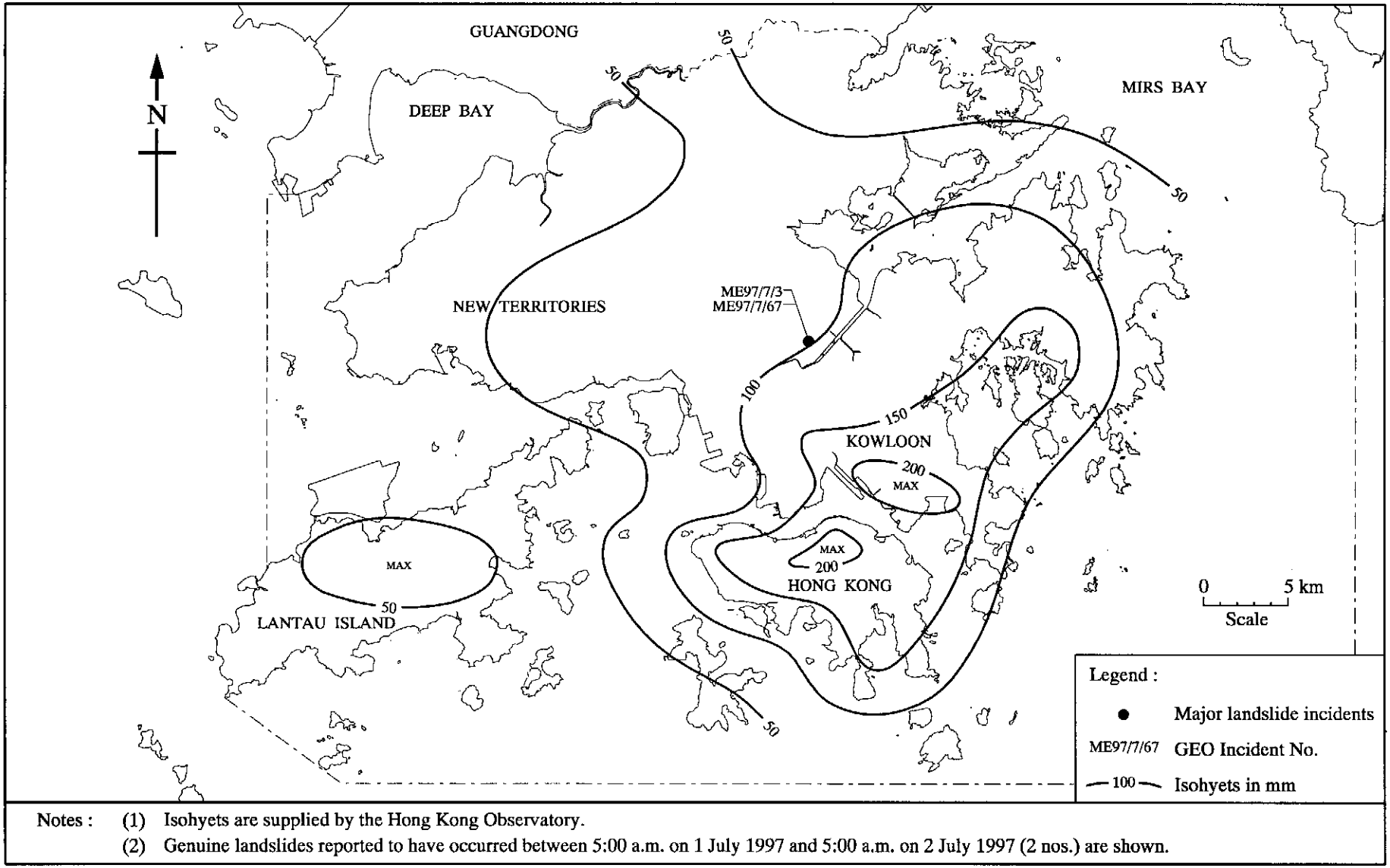
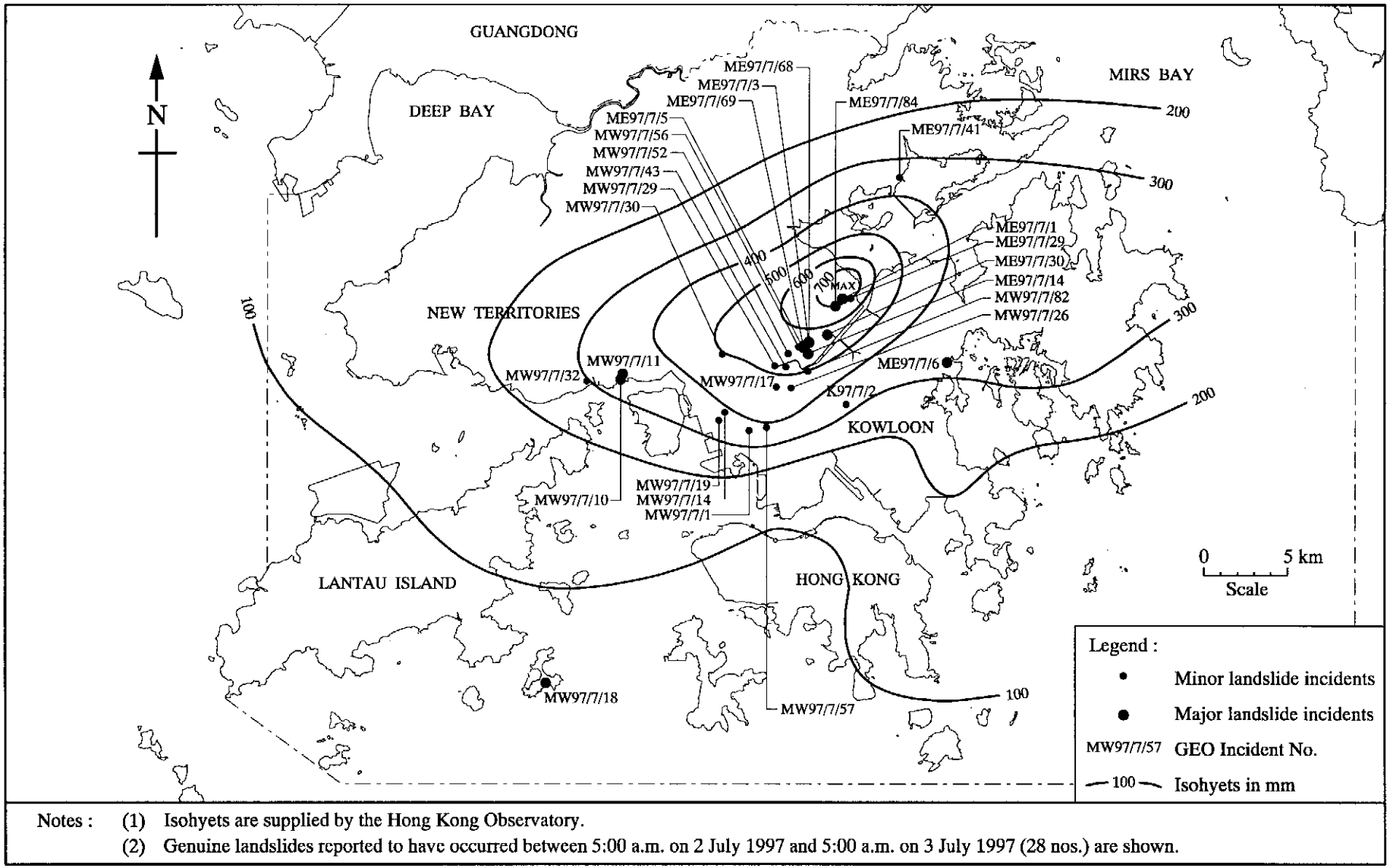
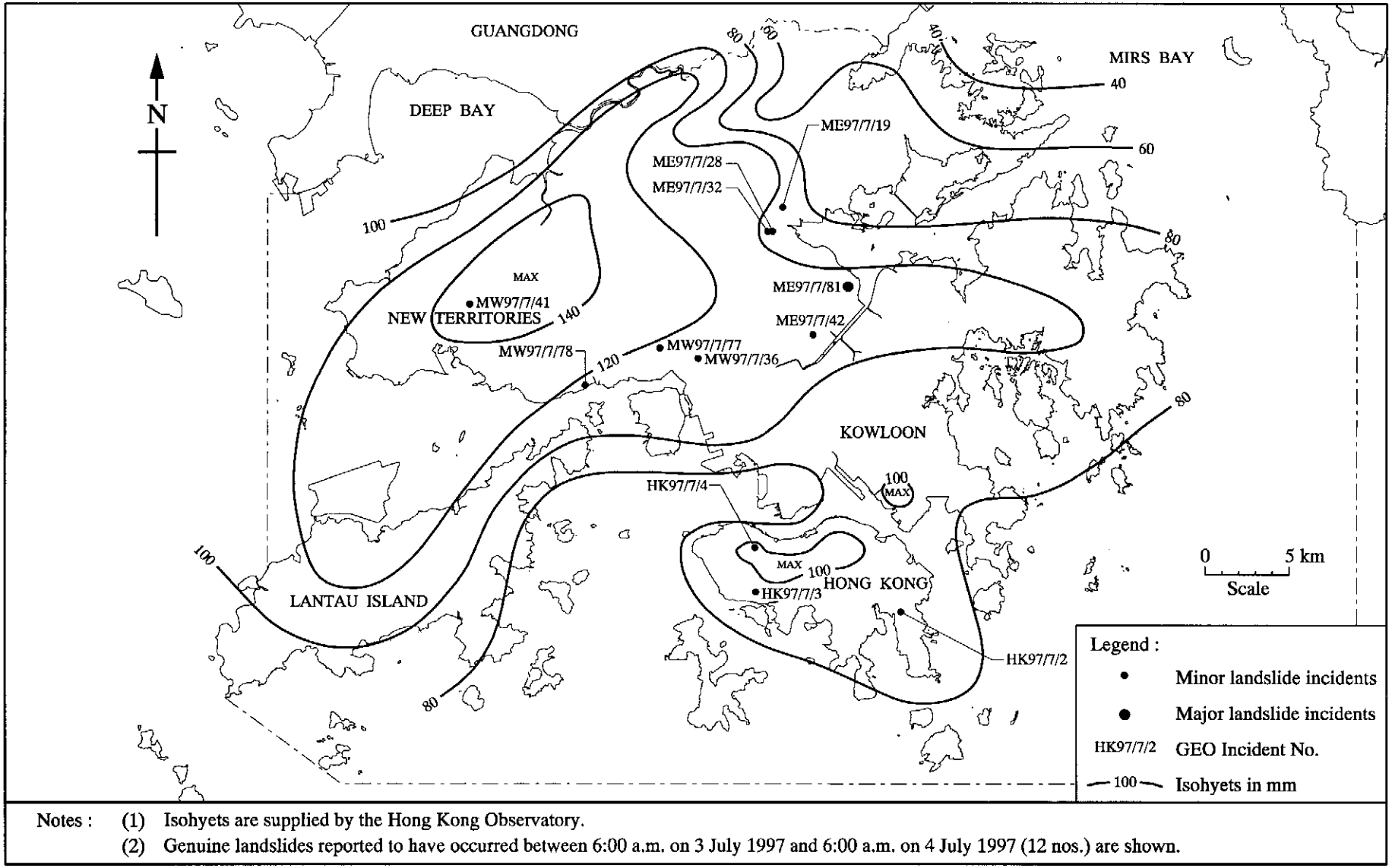


Figure 7 - 24-hour Rainfall Distribution from 5:00 a.m. on 1 July 1997 to 5:00 a.m. on 2 July 1997 and Locations of Landslides



Notes : (1) Isohyets are supplied by the Hong Kong Observatory.
(2) Genuine landslides reported to have occurred between 5:00 a.m. on 2 July 1997 and 5:00 a.m. on 3 July 1997 (28 nos.) are shown.

Figure 8 - 24-hour Rainfall Distribution from 5:00 a.m. on 2 July 1997 to 5:00 a.m. on 3 July 1997 and Locations of Landslides



Notes : (1) Isohyets are supplied by the Hong Kong Observatory.
(2) Genuine landslides reported to have occurred between 6:00 a.m. on 3 July 1997 and 6:00 a.m. on 4 July 1997 (12 nos.) are shown.

Figure 9 - 24-hour Rainfall Distribution from 6:00 a.m. on 3 July 1997 to 6:00 a.m. on 4 July 1997 and Locations of Landslides

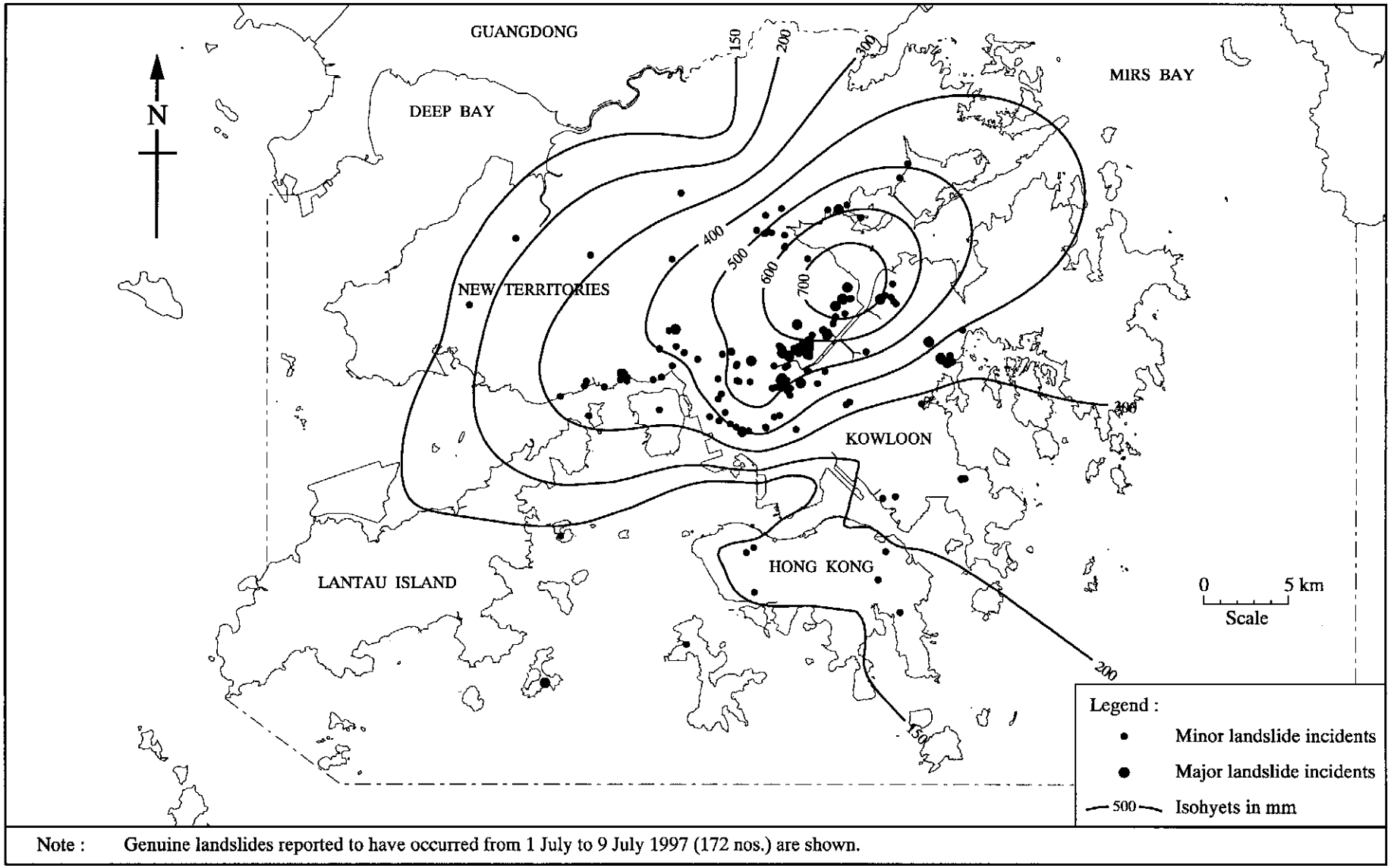


Figure 10 - Maximum 24-hour Rainfall Distribution in the Rainstorm of 1 to 4 July 1997 and Locations of Landslides

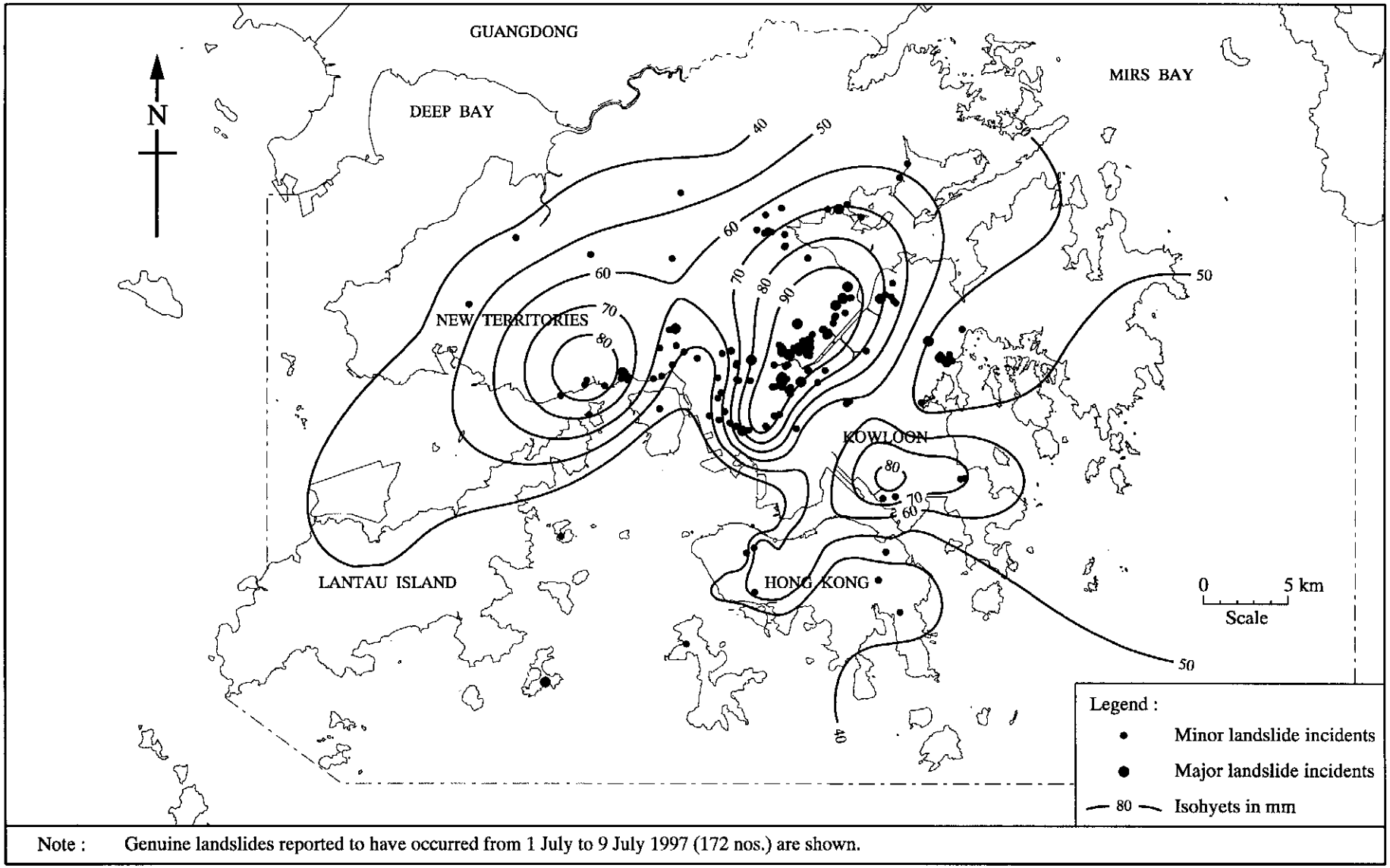


Figure 11 - Maximum Hourly Rainfall Distribution in the Rainstorm of 1 to 4 July 1997 and Locations of Landslides

LIST OF PLATES

Negative No. PS 885/4 Taken on : 4-7-97

Description : Major landslide of a cut slope resulting in total blockage of Lai Ping Road.

Plate 1 - Lai Ping Road in Kau To Shan (Incident ME 97/7/1)

Negative No. PS 886/4 Taken on : 4-7-97

Description : An aerial view of the site of the landslide, the Kum Yam Din Building and the Annex Building buried by landslide debris.

Plate 2 - Ten Thousand Buddhas' Monastery, Sha Tin (Incident ME 97/7/3)

Negative No. I9731715 Taken on : 2-7-97

Description : A close-up of the Kum Yam Din building and the annex building buried by landslide debris.

Plate 3 - Ten Thousand Buddhas' Monastery, Sha Tin (Incident ME 97/7/3)

Negative No. PS 886/11 Taken on : 4-7-97

Description : An aerial view of the landslide on the northern slope.

Plate 4 - Tao Fung Shan Christian Cemetery, Sha Tin (Incident ME 97/7/69)

Negative No. ME 9710523 Taken on : 3-7-97

Negative No. ME 9710512 Taken on : 3-7-97

Description : The main scarp of the eastern landslide, which resulted in the permanent evacuation of four huts, temporary evacuation of one hut and closure of the cemetery.

Plates 5 & 6 - Tao Fung Shan Christian Cemetery, Sha Tin (Incident ME 97/7/5)

Negative No. PS 885/9 Taken on : 4-7-97

Description : An aerial view of a partly modified natural hillside landslide resulting in the blockage of a northbound rail track and the derailment of a train.

Plate 7 - Near Fo Tan Station of the Kowloon-Canton Railway, Sha Tin (Incident ME 97/7/30)

Plate 8 :
Negative No. ME 971091
Taken on : 3-7-97

Description : A partly modified natural hillside landslide resulting in the blockage of a northbound rail track and the derailment of a train.

Plate 9 : Negative No. ME 971093 Taken on : 3-7-97

Plates 8 & 9 - Near Fo Tan Station of the Kowloon-Canton Railway, Sha Tin (Incident ME 97/7/30)

Negative No. ME 9712024, ME 9712025 Taken on : 9-7-97

Description : A natural slope failure affecting a cycle track.

Plate 10 - Ma On Shan Road, near the Shing On Temporary Housing Area, Ma On Shan (Incident ME 97/7/51)

Negative No. PS 912/07 Taken on : 14-10-97

Description : An aerial view of a natural slope failure affecting a cycle track.

Plate 11 - Ma On Shan Road, near the Shing On Temporary Housing Area, Ma On Shan (Incident ME 97/7/51)

Negative No. PS 881/4 Taken on : 4-7-97

Description : An aerial view of a landslide resulting in complete closure of Castle Peak Road and a dump truck which was carried by the landslide debris down the slope.

Plate 12 - Castle Peak Road near Lido Beach (Incident MW 97/7/10)

Negative No. MW 971244, MW 971245 Taken on : 3-7-97

Description : A close-up of a landslide resulting in complete closure of Castle Peak Road.

Plate 13 - Castle Peak Road near Lido Beach (Incident MW 97/7/10)

Negative No. MW 971341, MW 971342 Taken on : 4-7-97

Description : A fill slope failure which damaged a squatter hut.

Plate 14 - Milestone 6½, Tai Po Road, Sha Tin Heights, Sha Tin
(Incident MW 97/7/27)

Negative No. MW 9714616, MW 9714617, MW 9714618, MW 9714619 Taken on : 9-7-97

Description : A major initial cut slope failure resulting in the landslide debris encroached onto the closed section of Ching Cheung Road.

Plate 15 - Ching Cheung Road, Cheung Sha Wan (Incident MW 97/7/70)

Negative No. PS 890/7 Taken on : 8-8-97

Description : An aerial view of urgent remedial works following initial slope failure on 7-7-97 and two subsequent failures on 17-7-97 and 3-8-97.

Plate 16 - Ching Cheung Road, Cheung Sha Wan (Incident MW 97/7/70)

Negative No. PS 883/5 Taken on : 4-7-97

Description : An aerial view of a rock cut slope failure.

Plate 17 - Shing Mun Main (Upper) Dam, Tsuen Wan

Negative No. TE 97082/8,10,12 Taken on : 7-7-97

Description : A close-up of a rock cut slope failure.

Plate 18 - Shing Mun Main (Upper) Dam, Tsuen Wan

APPENDIX A

RECORDS OF HOURLY RAINFALL FROM GEO RAINGAUGES BETWEEN 1 JULY AND 4 JULY 1997

LIST OF FIGURES

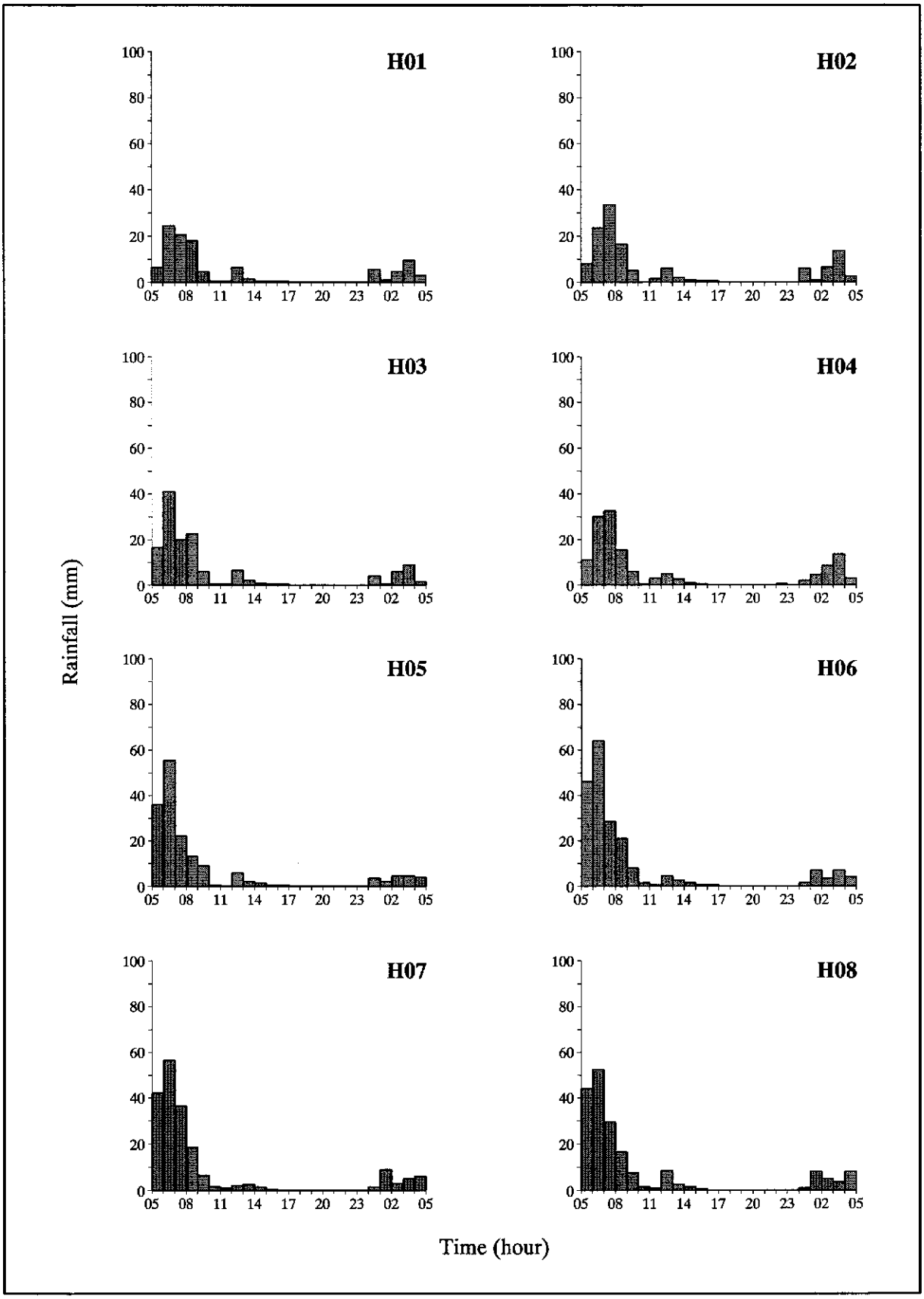


Figure A1 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 1 to 2 July, 1997 (Sheet 1 of 6)

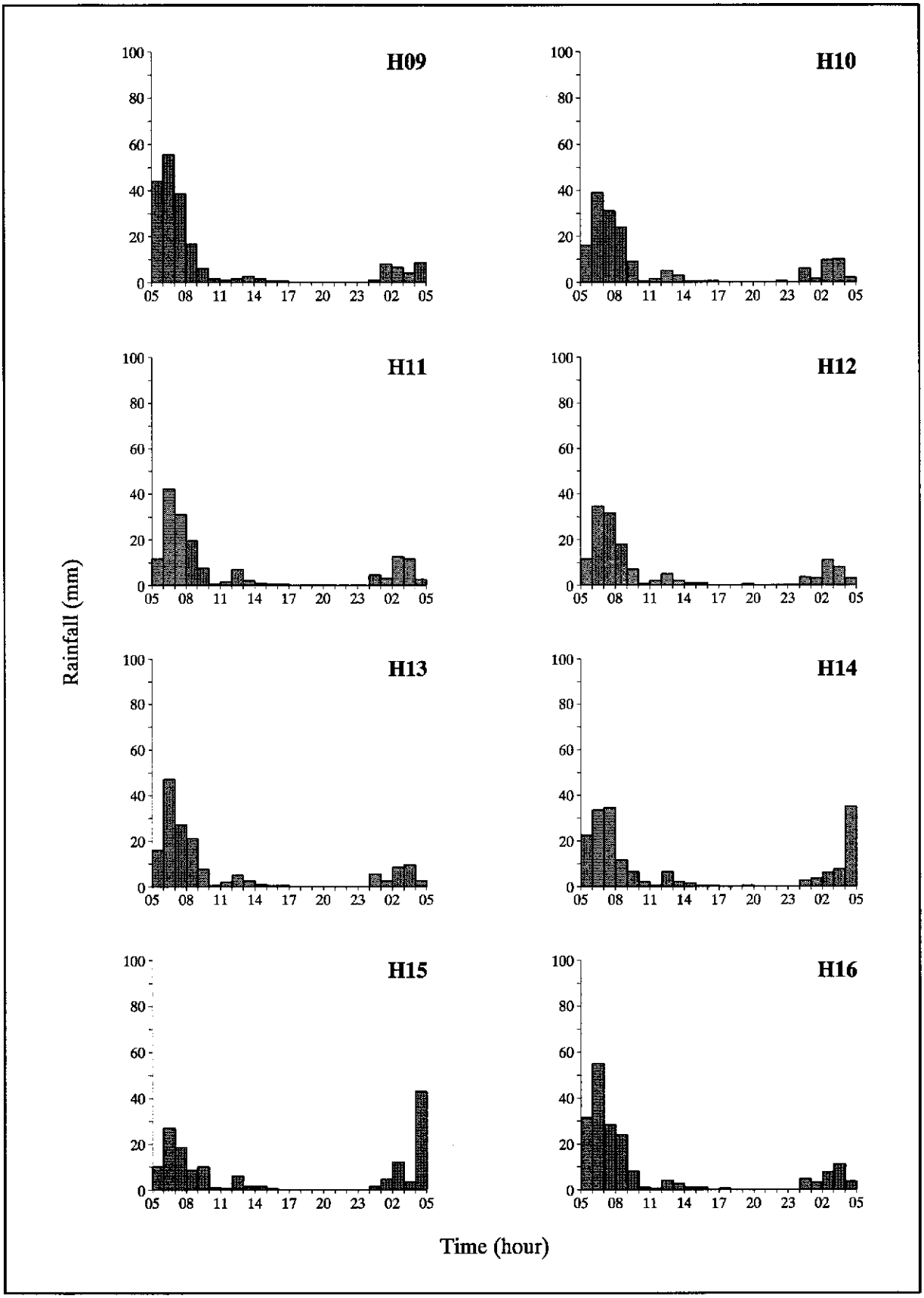


Figure A1 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 1 to 2 July, 1997 (Sheet 2 of 6)

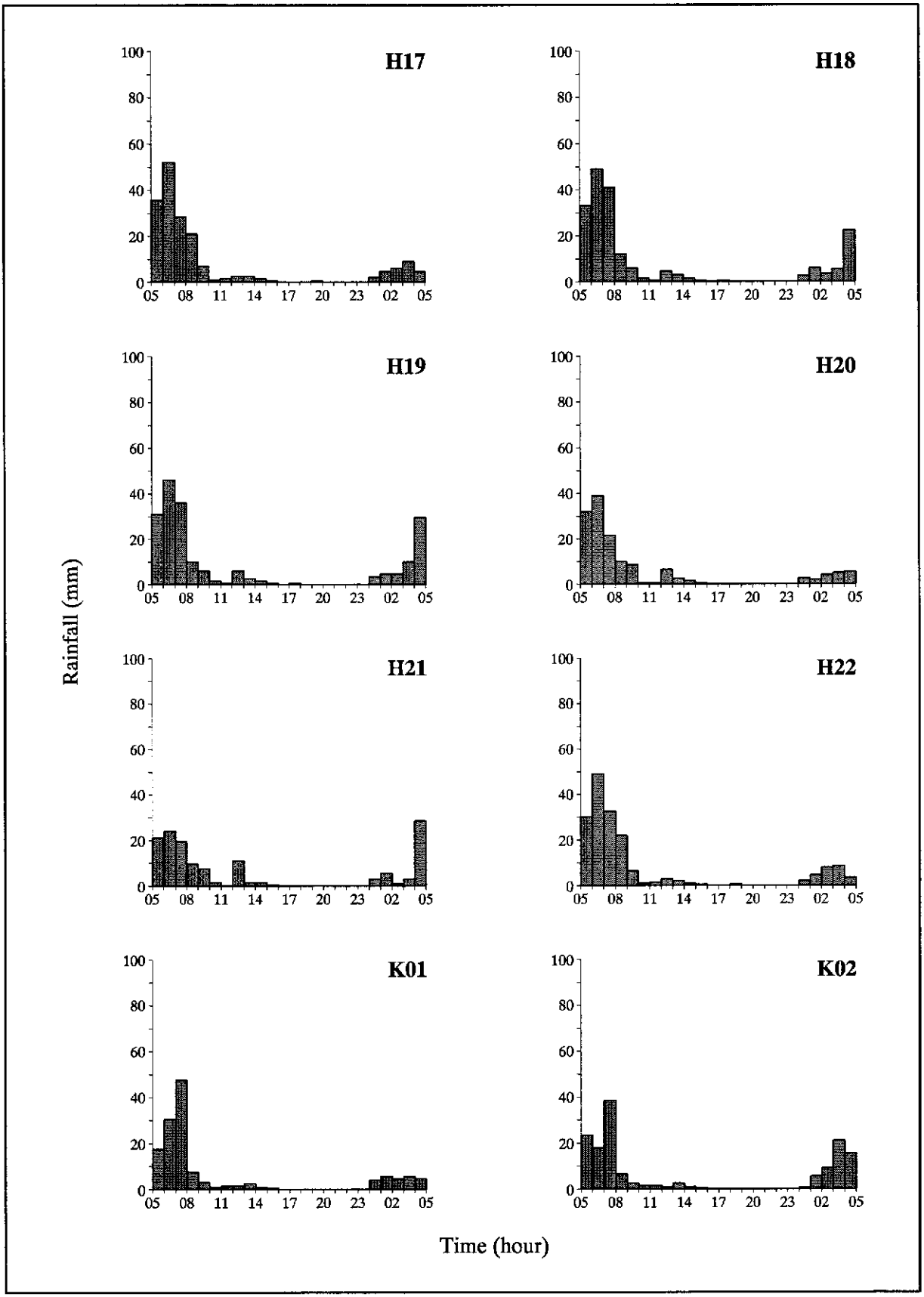


Figure A1 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 1 to 2 July, 1997 (Sheet 3 of 6)

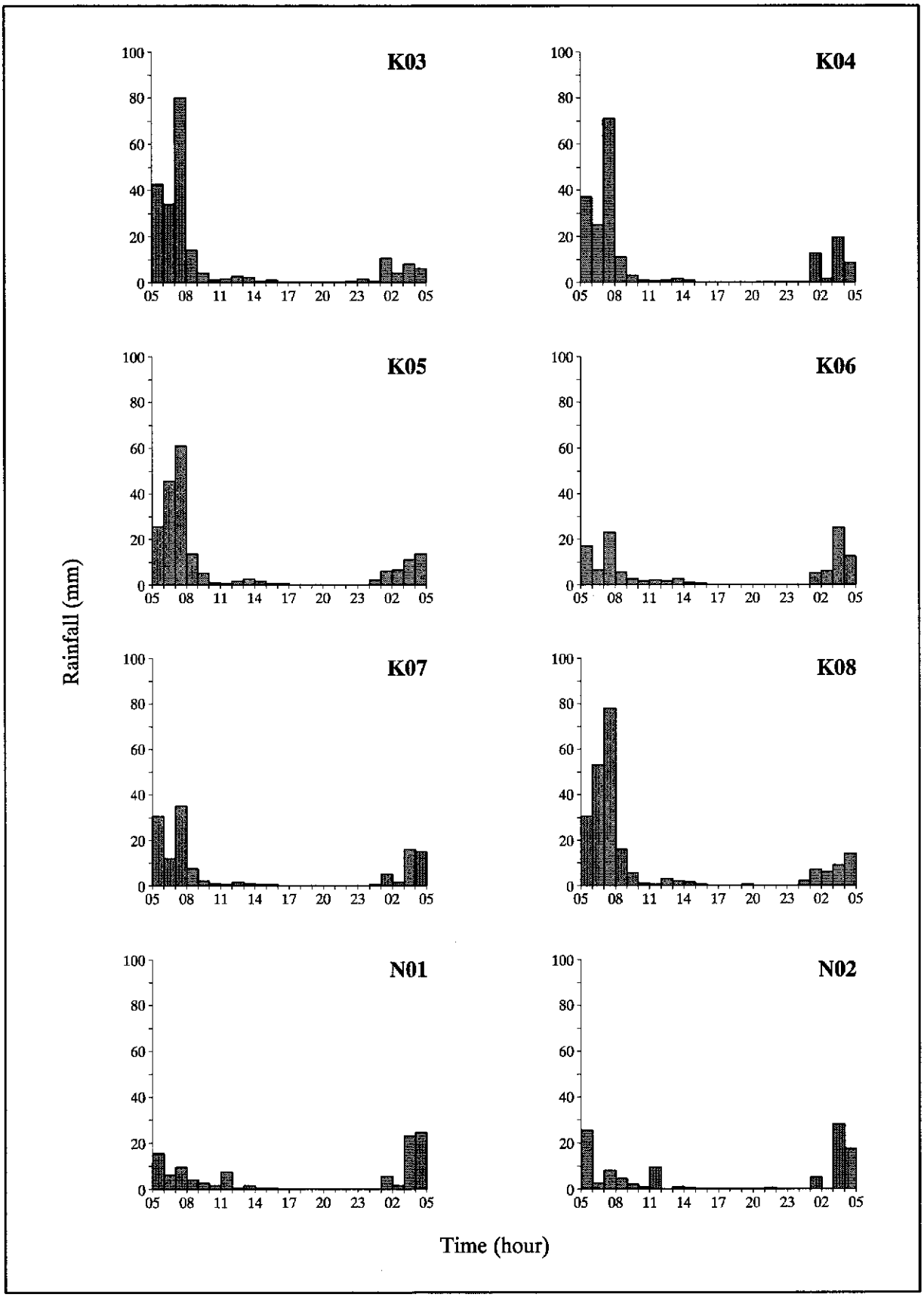


Figure A1 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 1 to 2 July, 1997 (Sheet 4 of 6)

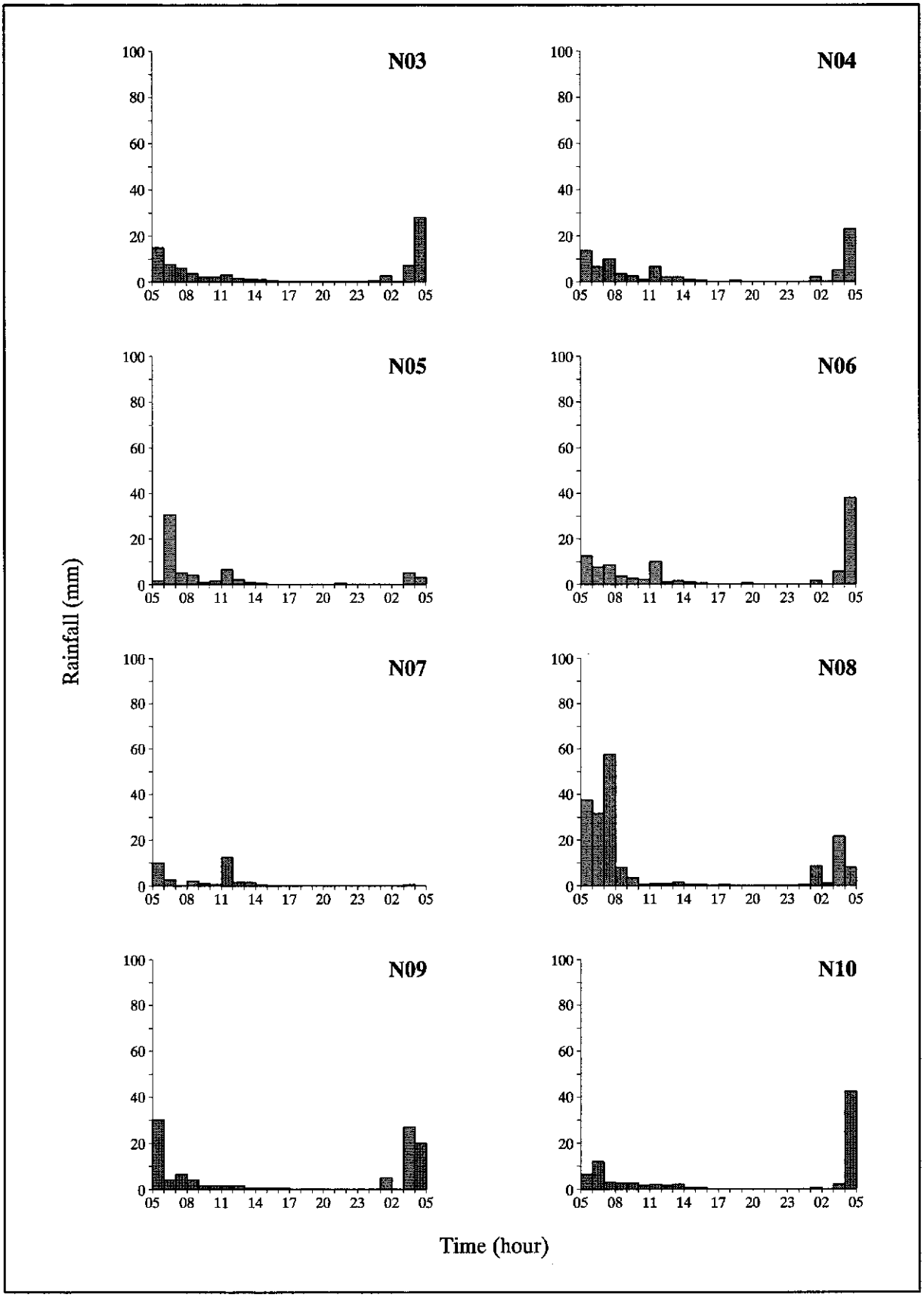


Figure A1 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 1 to 2 July, 1997 (Sheet 5 of 6)

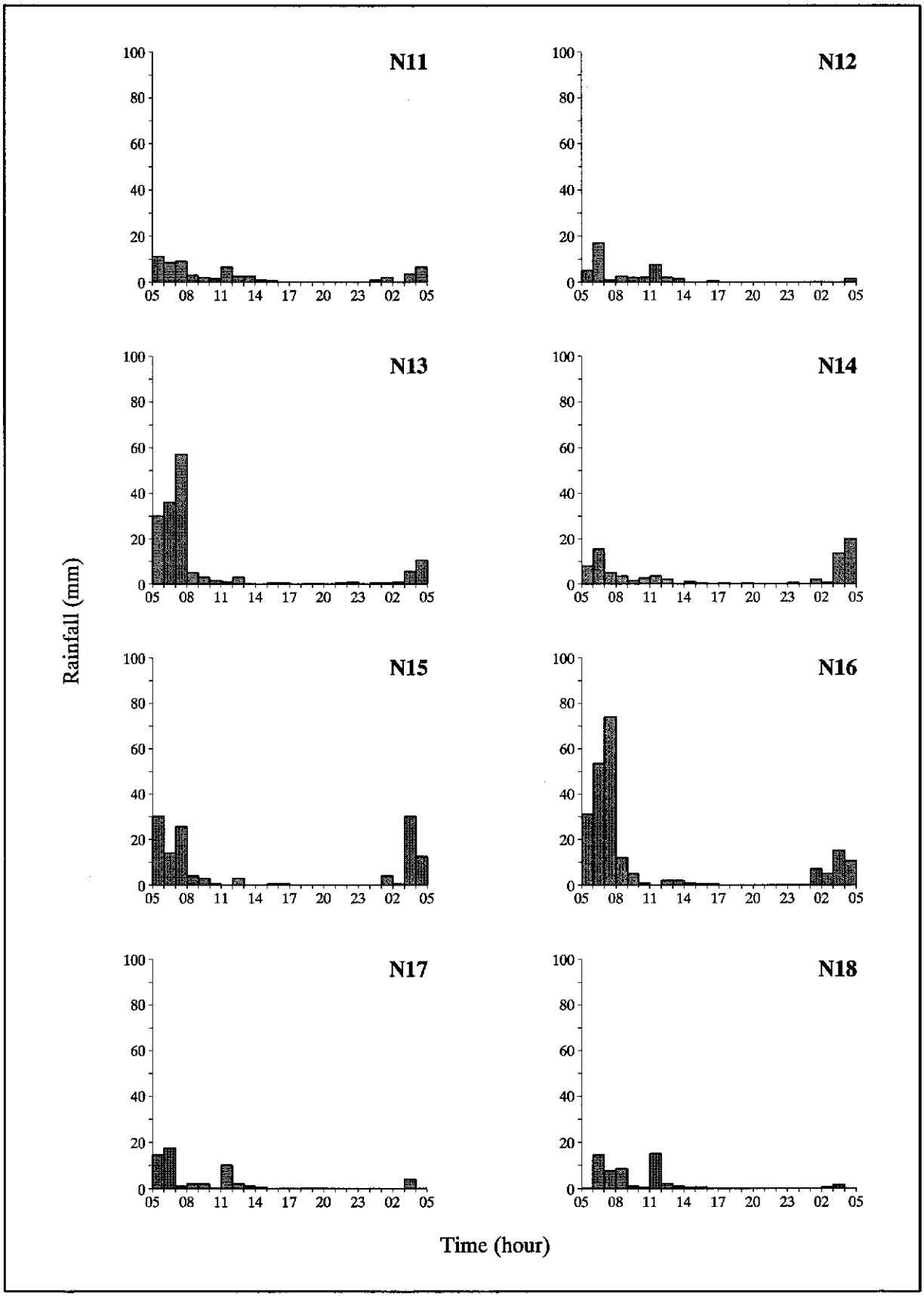


Figure A1 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 1 to 2 July, 1997 (Sheet 6 of 6)

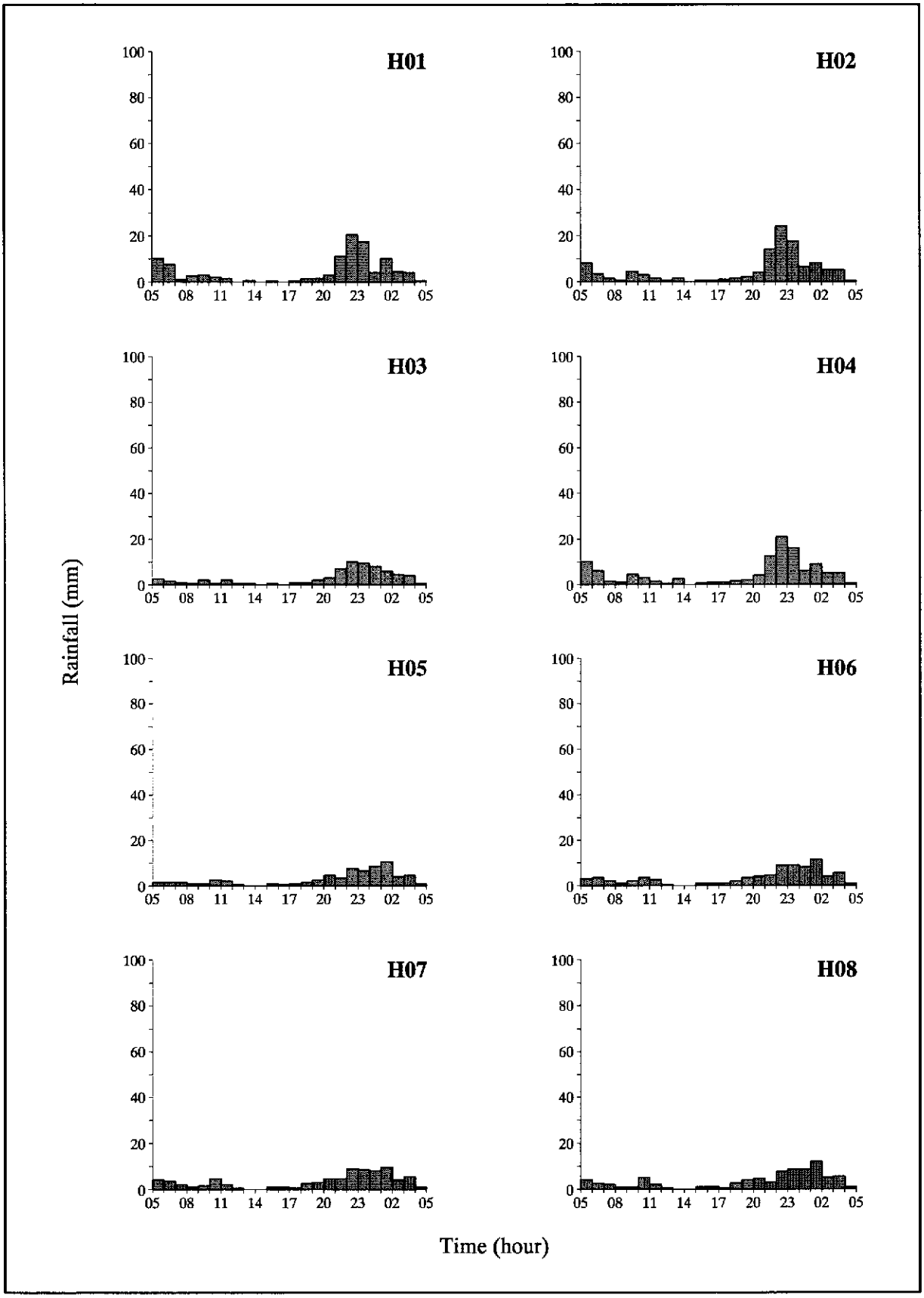


Figure A2 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 2 to 3 July, 1997 (Sheet 1 of 6)

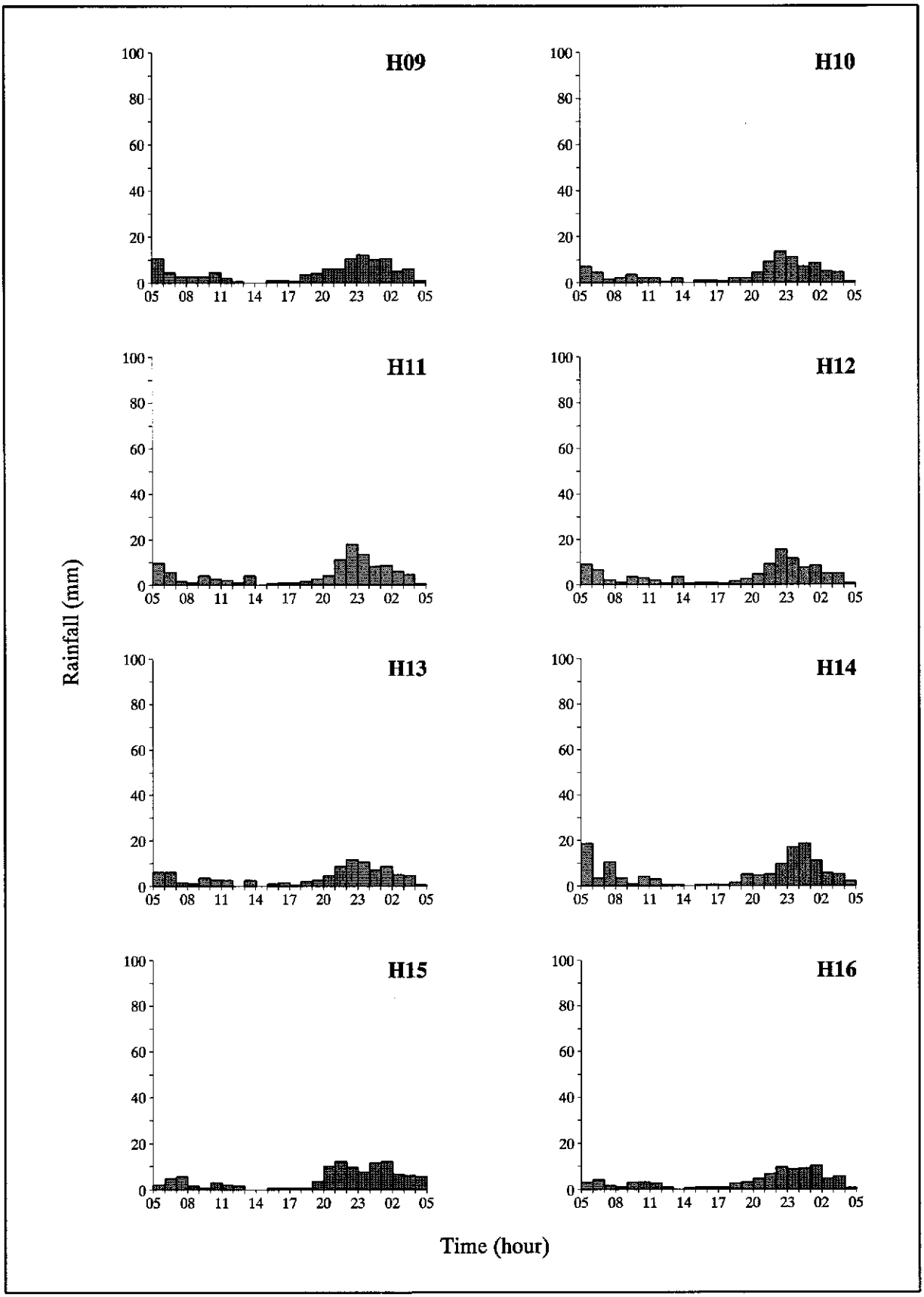


Figure A2 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 2 to 3 July, 1997 (Sheet 2 of 6)

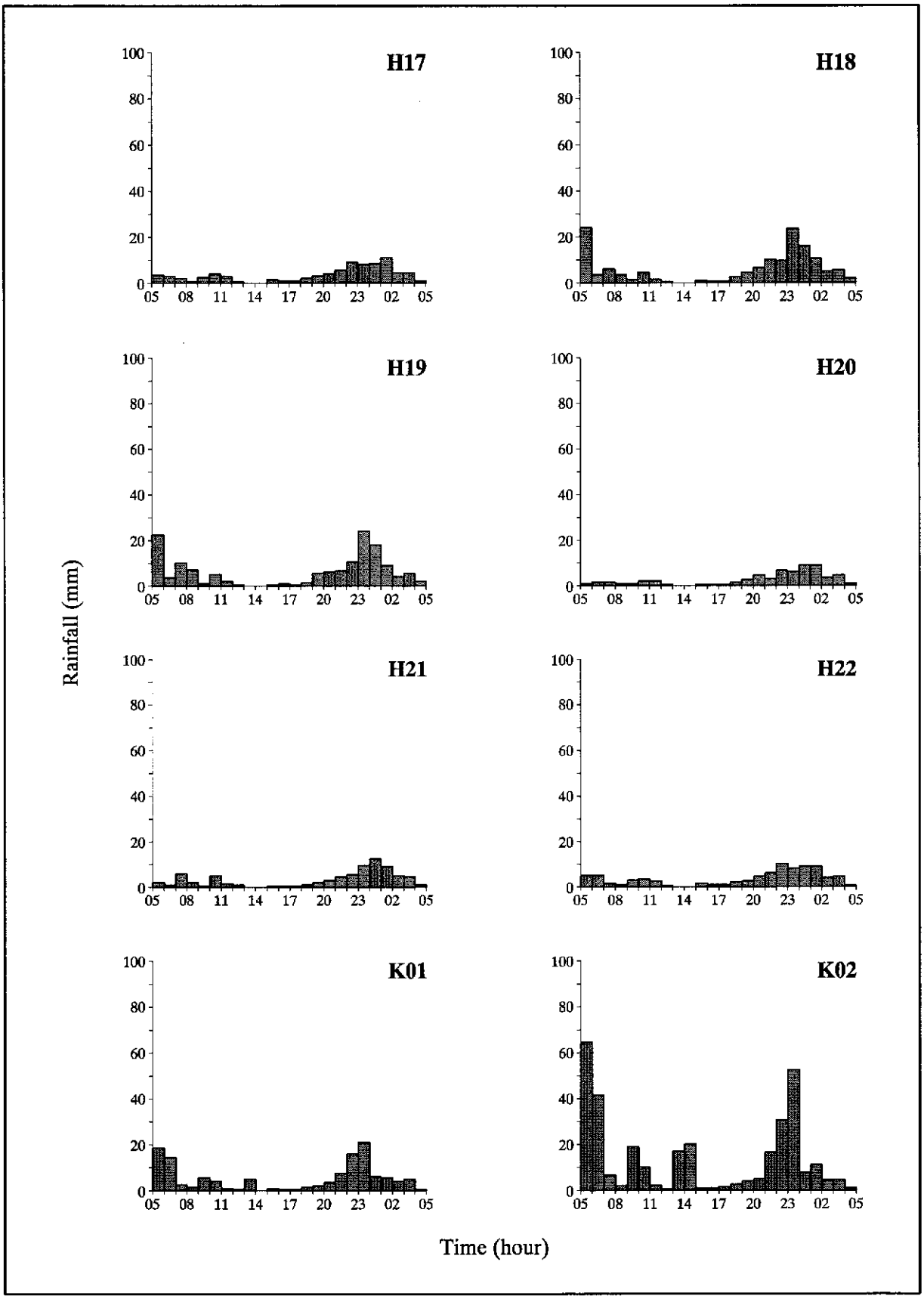


Figure A2 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 2 to 3 July, 1997 (Sheet 3 of 6)

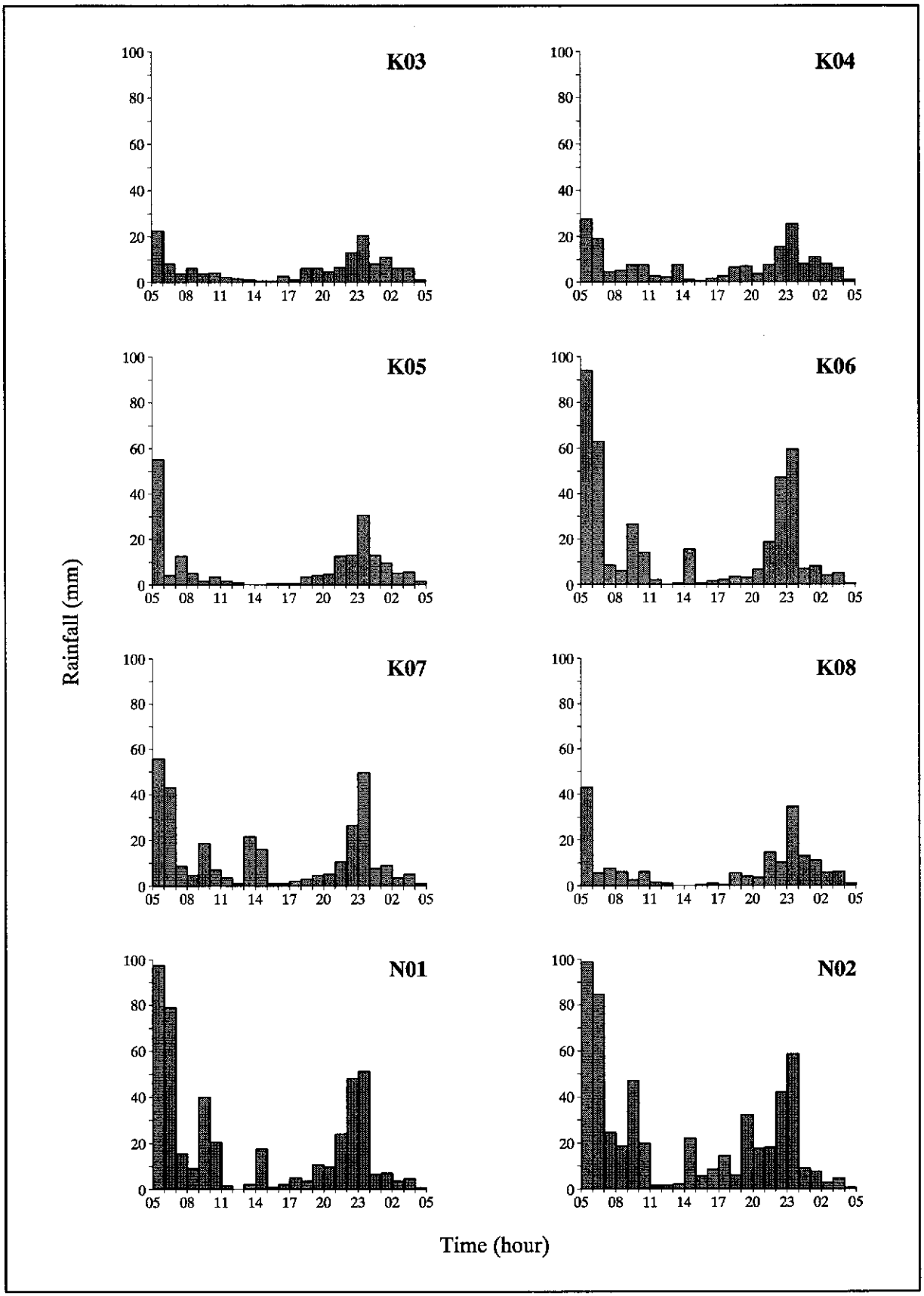


Figure A2 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 2 to 3 July, 1997 (Sheet 4 of 6)

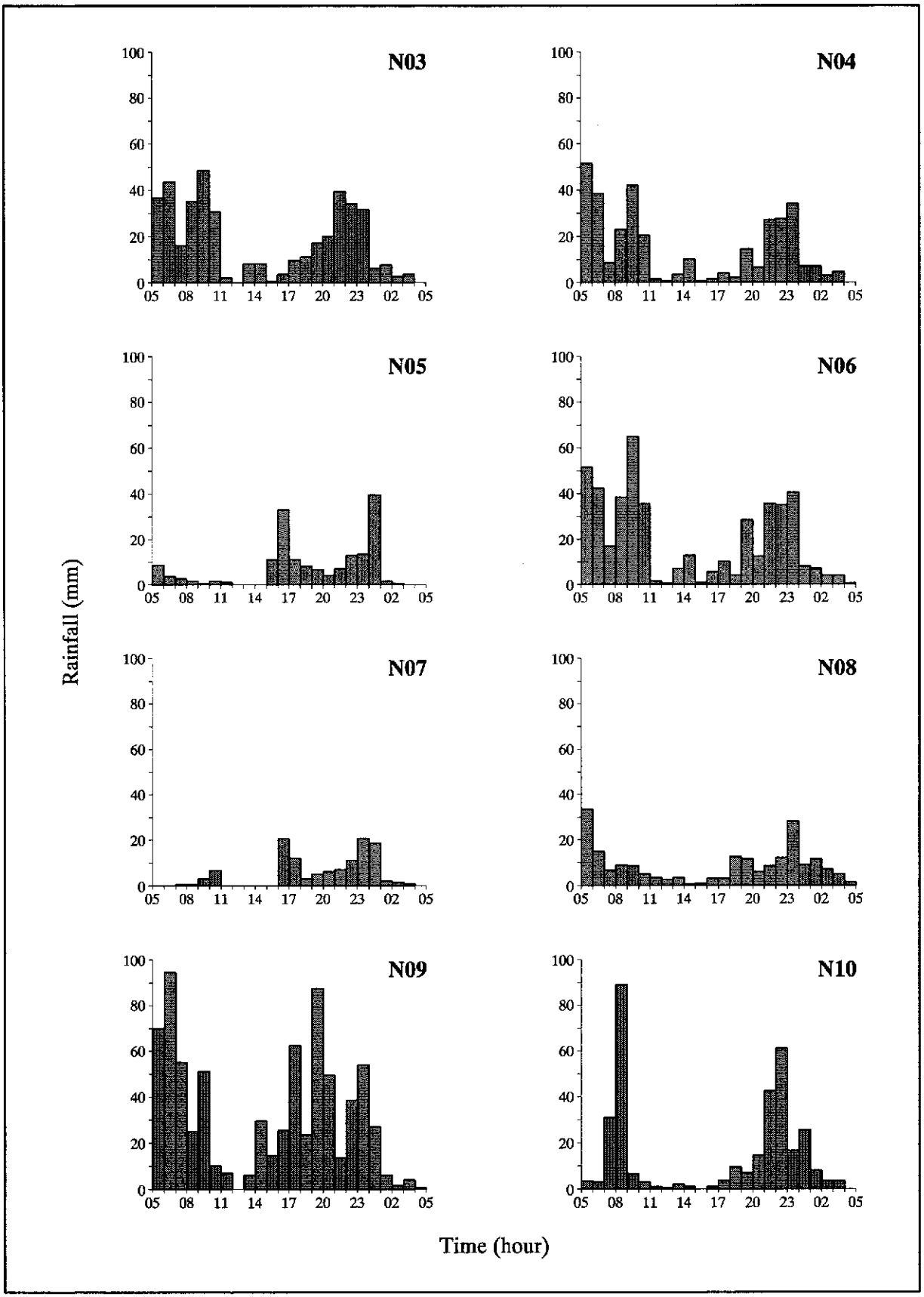


Figure A2 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 2 to 3 July, 1997 (Sheet 5 of 6)

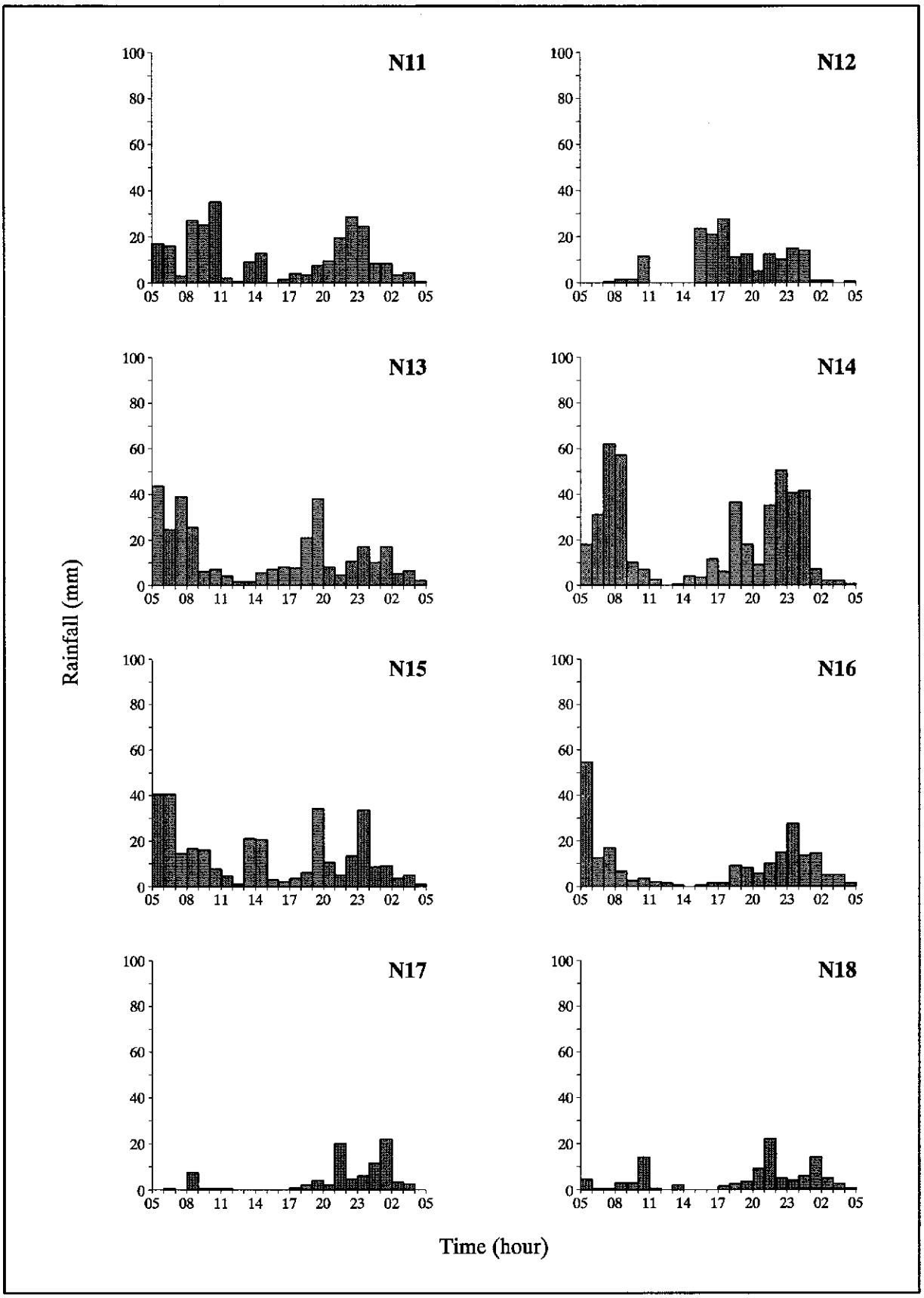


Figure A2 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 2 to 3 July, 1997 (Sheet 6 of 6)

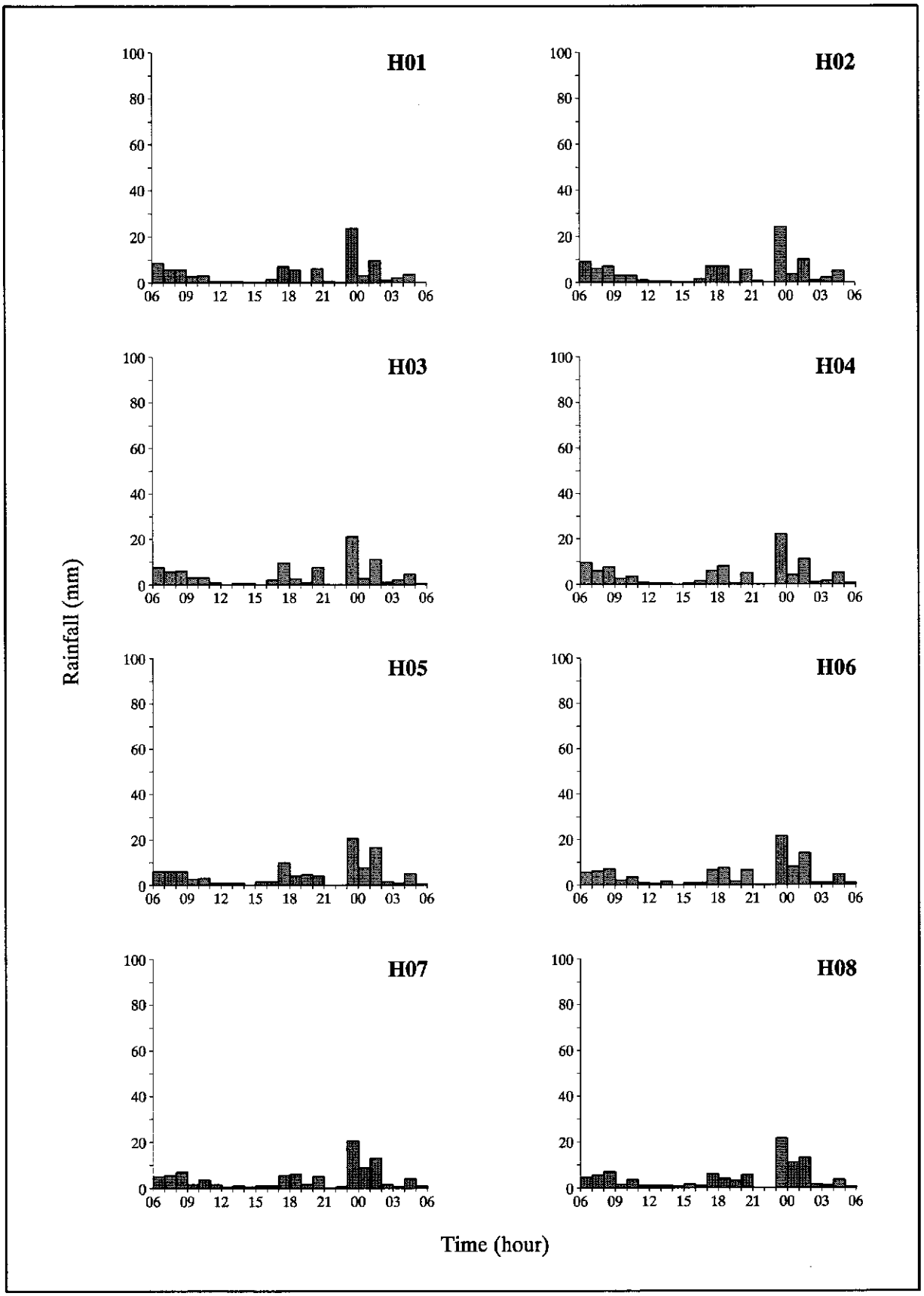


Figure A3 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 3 to 4 July, 1997 (Sheet 1 of 6)

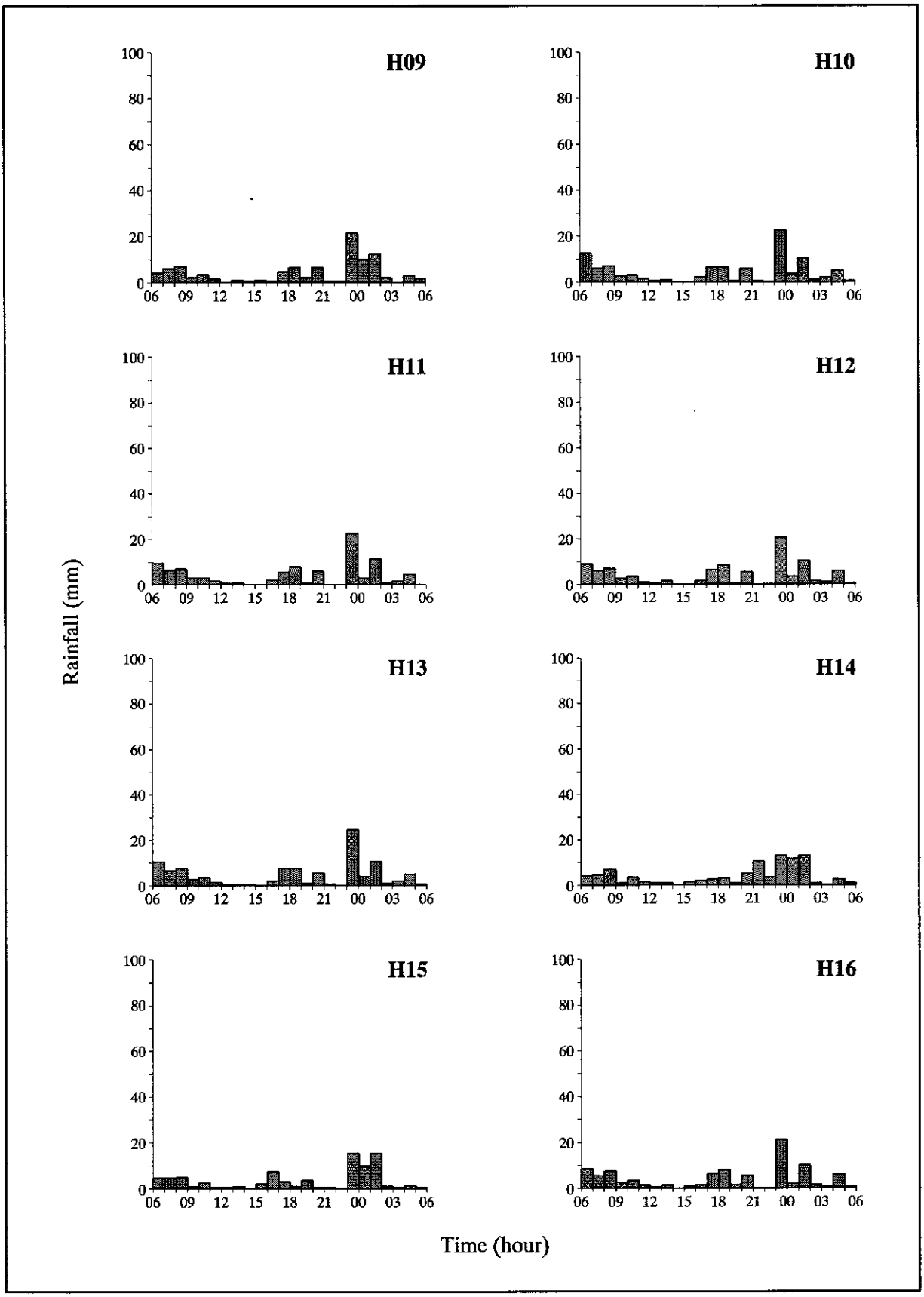


Figure A3 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 3 to 4 July, 1997 (Sheet 2 of 6)

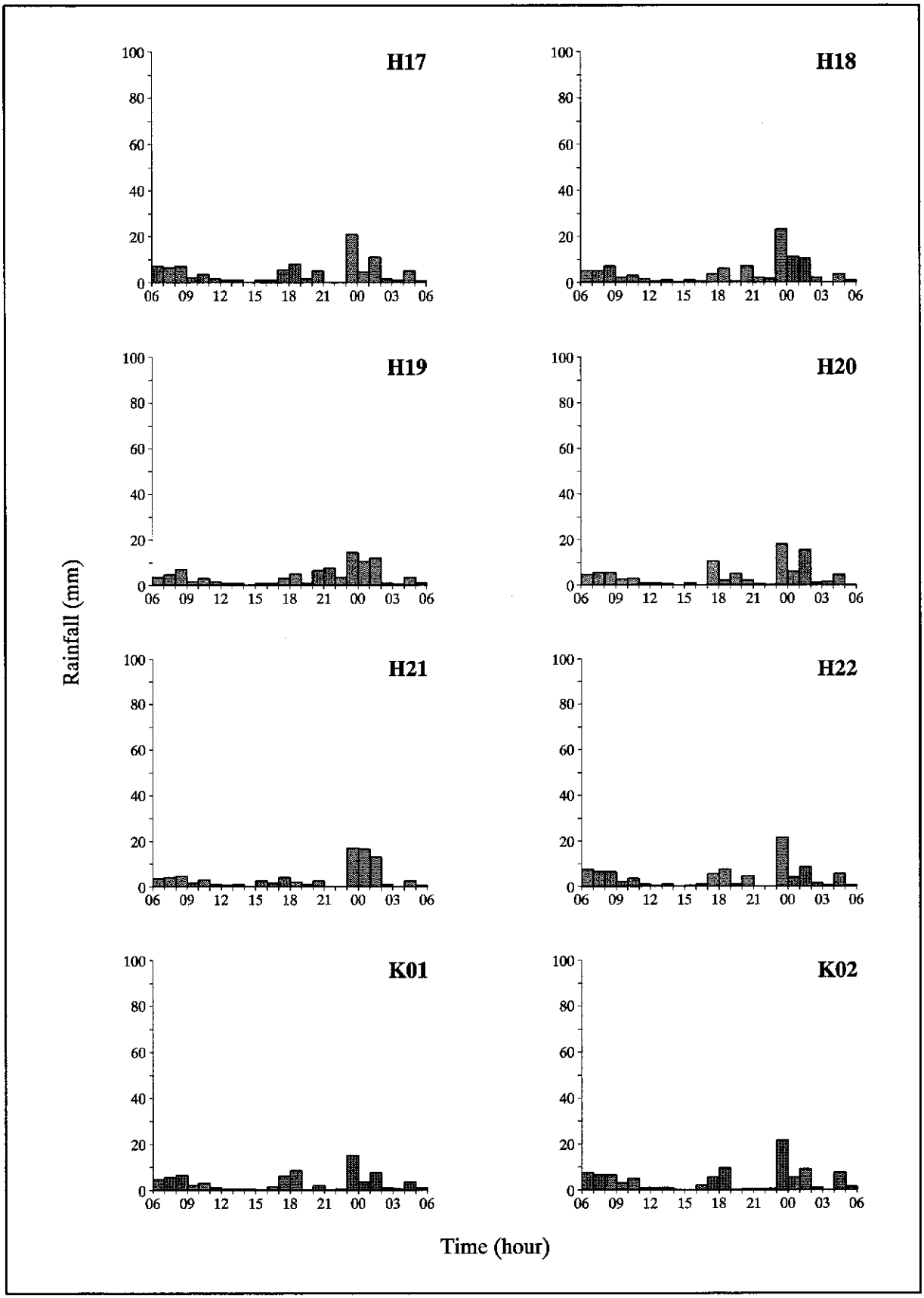


Figure A3 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 3 to 4 July, 1997 (Sheet 3 of 6)

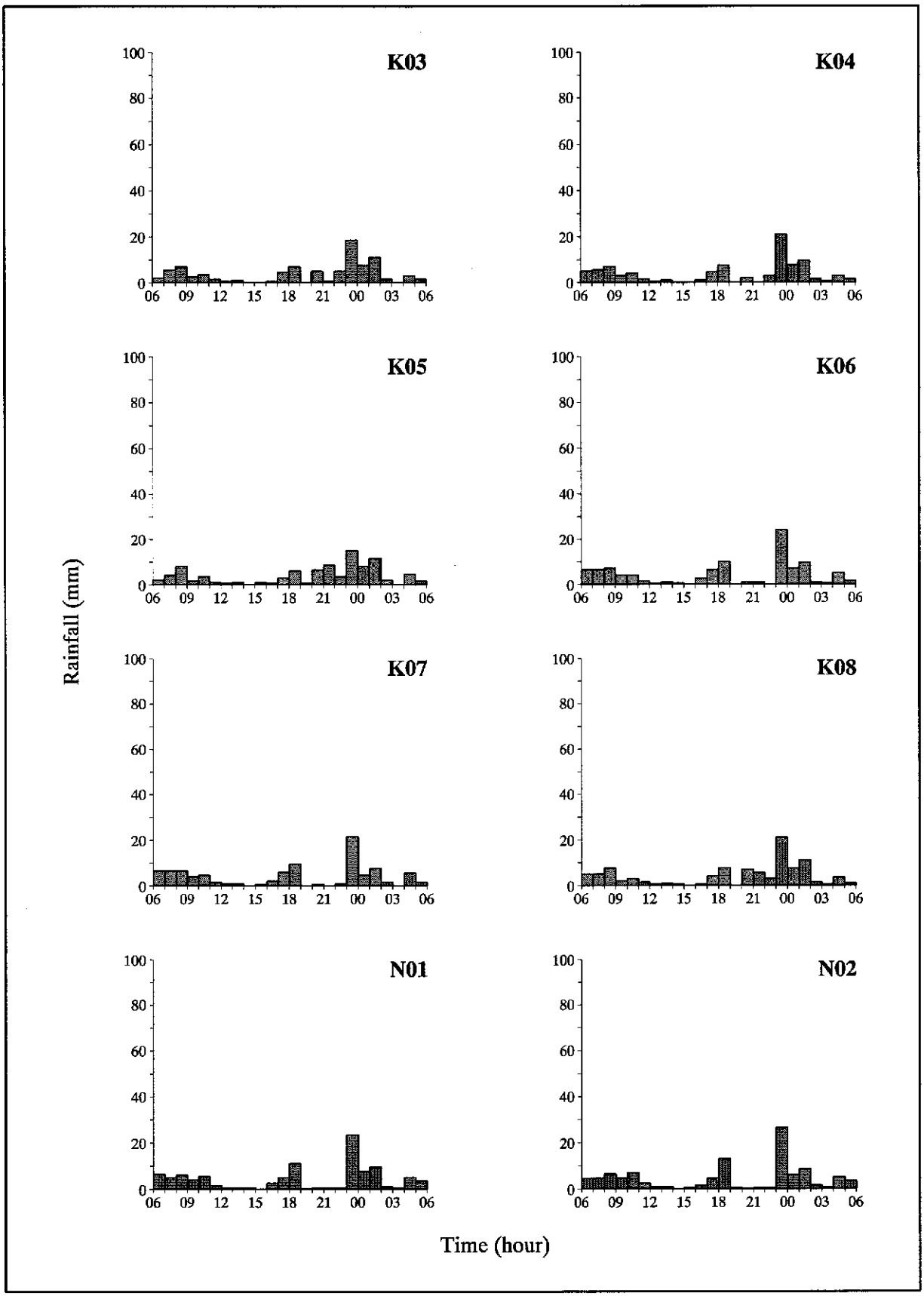


Figure A3 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 3 to 4 July, 1997 (Sheet 4 of 6)

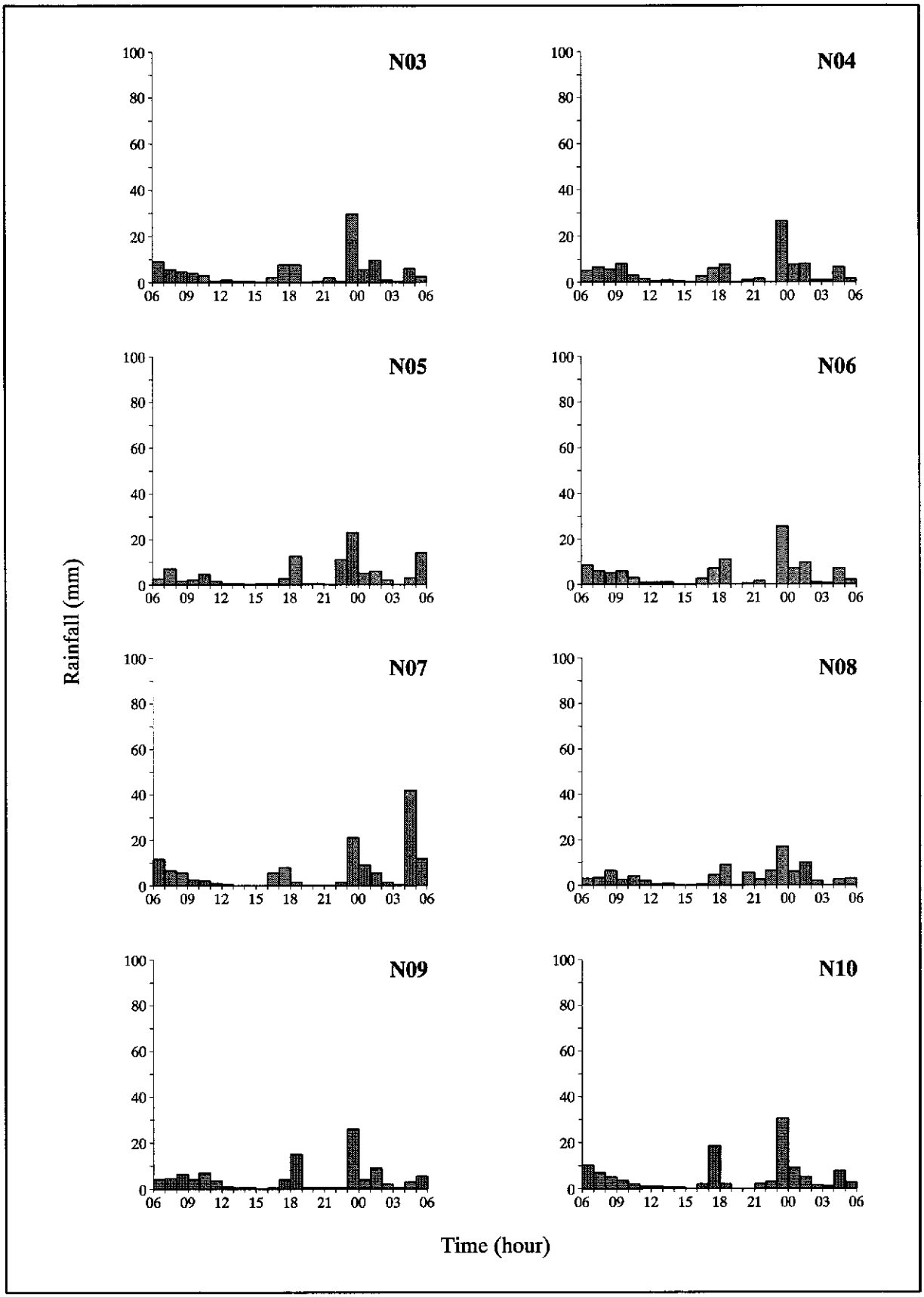


Figure A3 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 3 to 4 July, 1997 (Sheet 5 of 6)

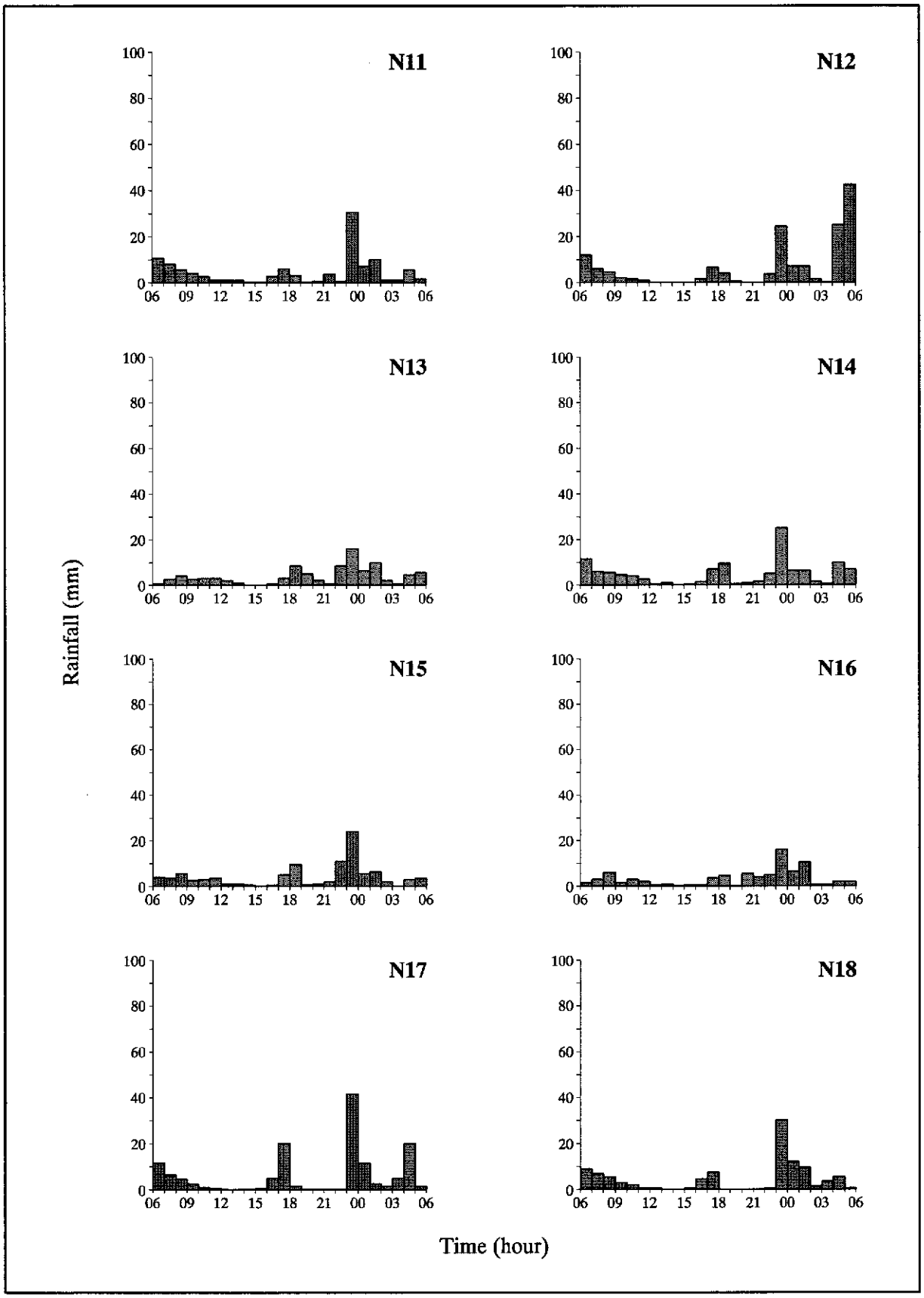


Figure A3 - Histograms of Hourly Rainfall Recorded by GEO Raingauges during 3 to 4 July, 1997 (Sheet 6 of 6)

APPENDIX B

LIST OF INCIDENTS REPORTED TO GEO

LIST OF TABLES

Table B1 - List of Major Landslides Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 1 of 5)

Incident No.	Location (Slope No.)	Failure			Facility Affected	Consequence
		Date (Time)	Type	Scale (m^3)		
ME97/7/1	Lai Ping Road, Kau To Shan, Sha Tin.	2/7 (20:00)+ (22:00-24:00)+	Soil cut slope	Major (4,000)+	Road	Totally blocked Lai Ping Road and trapped a truck driver.
ME97/7/3	Behind Kun Yam Din, Ten Thousand Buddhas' Monastery, Pai Tau, Sha Tin. (7SW-B/C116)	2/7 (6:15)*	Soil cut slope	Major (1,500)*	Building lot, access road, open area	1 person killed, 1 person injured, 1 building damaged and an annex building was buried.
ME97/7/4	Near Ten Thousand Buddhas' Monastery, Pai Tau, Sha Tin. (7SW-B/CR114)	2/7	Fill slope	Major (200)	Building lot, footpath	Whole monastery evacuated.
ME97/7/5	Tao Fung Shan Christian Cemetery, Sha Tin. (7SW-B/R50 and R51)	2/7 (6:30)*	Retaining wall	Major (400)*	Squatter area, footpath, cemetery	4 huts permanently evacuated, 1 hut temporarily evacuated. Closure of the cemetery.
ME97/7/6	Hong Tsuen Road, Sai Kung. (8SW-C/C3)	3/7 (3:00)	Soil cut slope	Major (75)	Road, pedestrian pavement	2 roads blocked.
ME97/7/9	Tai Mong Tsai Road, Sai Kung. (8SW-A/C10)	2/7	Soil cut slope	Major (50)	Road	2 roads closed.
ME97/7/14	Hut No. 366, Pai Tau, Sha Tin.	2/7 (17:00)	Soil cut slope	Major (150)	Squatter area	5 huts permanently evacuated.

Table B1 - List of Major Landslides Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 2 of 5)

Incident No.	Location (Slope No.)	Failure			Facility Affected	Consequence
		Date (Time)	Type	Scale (m^3)		
ME97/7/15	Pak Kong Water Treatment Plant, Sai Kung. (8SW-C/C175)	4/7 (8:30)	Retaining wall	Major (100)	Treatment works	
ME97/7/23	Near Lamp Post N88788, Ting Kok Road, Tai Po. (7NE-A/C8)	4/7 (am)	Soil cut slope	Major (>200)	Pedestrian pavement	
ME97/7/30	North-bound Track about 250m from Fo Tan Station, KCRC, Sha Tin.	2/7 (0:40-5:54)*	Natural slope*	Major (100)*	Railway track	Obstructed the northbound KCRC rail track.
ME97/7/51	Opposite to Shing On Temporary Housing Area, Ma On Shan Road, Ma On Shan.	2/7(am) -3/7(16:00)*	Natural slope	Major (3000)	Pedestrian pavement, bicycle truck, country park	
ME97/7/56	Wong Chuk Yeung Tsuen Path, Fo Tan. (7SW-B/C141)	Unknown	Soil cut slope	Major (50)	Road	
ME97/7/67	Behind Yuk Wong Din, Ten Thousand Buddhas' Monastery, Pai Tau, Sha Tin. (7SW-B/C113)	2/7 (4:00-5:00)	Natural slope	Major (750)	Building lot	1 house evacuated, temple damaged, whole monastery evacuated.

Table B1 - List of Major Landslides Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 3 of 5)

Incident No.	Location (Slope No.)	Failure			Facility Affected	Consequence
		Date (Time)	Type	Scale (m^3)		
ME97/7/68	Near Ten Thousand Buddhas' Monastery, Pai Tau, Sha Tin. (7SW-B/FR7 and F9)	2/7 (7:00)	Natural slope	Major (500)	Building lot	1 house evacuated, monastery structure damaged, whole monastery evacuated.
ME97/7/69	Tao Fung Shan Christian Cemetery, Sha Tin. (7SW-B/C425 and C426)	2/7 (6:30)*	Fill slope*	Major (600)*	Squatter area	Closure of the cemetery.
ME97/7/81	Chinese University of Hong Kong, Sha Tin. (7NE-C/C53)	3/7 (pm)	Soil cut slope	Major (80)	Pedestrian pavement	
ME97/7/84	22 Ma Niu Village, Kau To Shan, Sha Tin.	2/7 (6:00)	Natural slope	Major (150)	Building lot, access road	
MW97/7/7	Mei Chung Court, Sha Tin. (7SW-D/C790, C791 and C801)	2/7 (early morning)	Soil cut slope	Major (100)*	Building lot, pedestrian pavement, open area, carpark	Flood damage included severe erosion of slopes, undermining and erosion of paved areas. Pedestrian pavement closed.
MW97/7/10	Tsuen Wan Police Station, Lido Beach, Castle Peak Road, Ting Kau.	2/7 (11:45)	Natural slope	Major (750)*	Building lot, road, pedestrian pavement	8 persons injured, 4 flats evacuated, 2 roads closed, pedestrian pavement closed.

Table B1 - List of Major Landslides Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 4 of 5)

Incident No.	Location (Slope No.)	Failure			Facility Affected	Consequence
		Date (Time)	Type	Scale (m^3)		
MW97/7/11	Near Ting Kau Bridge, Tuen Mun Highway, Ting Kau. (6SE-C/F10)	2/7 (9:30)	Fill slope	Major (200)*	Road	2 roads closed.
MW97/7/15	Happy View House, 19 Sha Tin Height Road, Sha Tin.	2/7 (before 7:00)	Natural slope	Major (2000)	Building lot	
MW97/7/18	House Nos. 1A, 49 and 49A, Lung Tsai Tsuen Road, Lung Tsai Tsuen, Cheung Chau. (14NW-D/R206 and CR208)	2/7 (23:05)	Soil/rock cut slope	Major (70)	Building lot, footpath, building access	3 houses evacuated, footpath closed.
MW97/7/27	Milestone 6-1/2, Tai Po Road, Sha Tin Heights, Sha Tin. (7SW-D/F158)	4/7* (14:00)	Fill slope	Major (50)	Squatter area	6 huts permanently evacuated.
MW97/7/53	Hut Nos. 103-104, Area 3, Pak Tin Tsuen, Sha Tin. (7SW-B/F68 and F67)	2/7	Fill slope	Major (>50)	Squatter area	3 huts permanently evacuated.
MW97/7/70	Opposite Dragon Industrial Building, Ching Cheung Road, Kwai Chung. (11NW-A/C55)	7/7 (9:00)	Soil cut slope	Major (500)*	Road, construction site	4 roads closed.
MW97/7/76	Near Tsuen Lung, Route Twisk, Tsuen Wan. (6SE-B/C5)	4/7	Soil cut slope	Major (70)	Open area	

Table B1 - List of Major Landslides Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 5 of 5)

Incident No.	Location (Slope No.)	Failure			Facility Affected	Consequence
		Date (Time)	Type	Scale (m^3)		
No incident number was assigned	Shing Mun Main (Upper) Dam, Tsuen Wan	2/7	Rock cut slope	Major $(3,000)^+$	Country park	

Legend :

\+ Information from GEO Detailed Investigation
* Information from GEO's 1997 Landslide Investigation Consultants

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 1 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
HK97/7/1	Near 14 Kennedy Road, Mid-Levels. (11SW-B/C205)	3/7	Police	3/7 (6:00)		N/A	Road	1 road closed.	Not a landslide incident, only dislodgement of slope surface caused by rupture of watermains.
HK97/7/2	No. 4 - 14, Shek O Road, Lan Nai Wan, near Catchpit No. 41 (15NE-B/C36)	3/7	HyD/HK, Police	3/7 (9:30)	Rock slope	Minor (1)	Road	1 road closed.	
HK97/7/3	Peel Rise, Aberdeen.	3/7	HyD/HK	3/7 (10:00)	Soil/rock cut slope	Minor (3.5)	Road	1 road closed.	
HK97/7/4	Behind Block E and F, Pine Court, 5 Old Peak Road, Mid-Levels. (11SW-B/CR67 & C292)	3/7	HyD/HK	3/7 (6:00)	Soil cut slope	Minor (2)	Building lot		
HK97/7/5	Near 25 Lugard Road, The Peak.	4/7	HyD/HK	3/7	Fill slope	Minor (3)	Private or building access		
HK97/7/6	Tai Tam Road, Tai Tam. (11SE-D/C138)	4/7	HyD/HK	4/7 (10:00)	Soil cut slope	Minor (2)			
HK97/7/7	Behind Salesian English School, 16 Chai Wan Road, Shau Kee Wan.	4/7	Public	4/7 (8:00)	Boulder fall	Minor (0.1)	Open area		

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 2 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
K97/7/1	Roadside Slope at Kai Tin Road, Lam Tin. (11NE-D/C106)	1/7	Police	1/7 (am)	Soil cut slope	Minor (1)	Pedestrian pavement	Pedestrian pavement closed.	
K97/7/2	Roadside Slope at Sha Tin Pass Road, Tze Wan Shan. (11NE-A/C353)	3/7	HyD/K	2/7 (10:00)	Soil/rock cut slope	Minor (<1)	Road	1/3 road blocked.	
K97/7/3	No. 1, 3 and 5, Ede Road, Beacon Hill. (11NW-B/F299)	3/7	FSD	3/7	Fill slope	Minor (10)	Carpark		
K97/7/5	Laguna City Phase 3, Sin Fat Road, Kwun Tong.	4/7	Public	4/7	Soil/rock cut slope	Minor (40)	Open area		
ME97/7/1	Lai Ping Road, Kau To Shan, Sha Tin. (7NE-C/C95)	2/7	HyD/NT, FSD	2/7 (20:00)+ (22:00-24:00)+	Soil cut slope	Major (4,000)+	Road	Totally blocked Lai Ping Road and trapped a truck driver.	
ME97/7/2	Hut No. 65, Pai Tau Tsuen, Sha Tin. (7SW-B/C359)	2/7	Public	2/7	Retaining wall	Minor (16)	Footpath		
ME97/7/3	Behind Kun Yam Din, Ten Thousand Buddhas' Monastery, Pai Tau, Sha Tin. (7SW-B/C116)	2/7	FSD	2/7 (6:15)*	Soil cut slope	Major (1500)*	Building lot, access road, open area	1 person killed, 1 person injured, 1 building damaged and an annex building was buried.	

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 3 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
ME97/7/4	Near Ten Thousand Buddhas' Monastery, Pai Tau, Sha Tin. (7SW-B/CR114)	2/7	FSD	2/7	Fill slope	Major (200)	Building lot, footpath	Whole monastery evacuated.	
ME97/7/5	Tao Fung Shan Christian Cemetery, Sha Tin. (7SW-B/R50 and R51)	2/7	FSD	2/7 (6:30)*	Retaining wall	Major (400)*	Squatter area, footpath, cemetery	4 huts permanently evacuated, 1 hut temporarily evacuated. Closure of the cemetery.	
ME97/7/6	Hong Tsuen Road, Sai Kung. (8SW-C/C3)	3/7	Police	3/7 (3:00)	Soil cut slope	Major (75)	Road, pedestrian pavement	2 roads blocked.	
ME97/7/7	House No. 21A, Sun King Terrace, Po Lo Che, Sai Kung. (8SW-C/CR145)	2/7	Police	2/7	Soil cut slope	Minor (30)	Building lot	1 house evacuated.	Broken surface drains on the slope crest.
ME97/7/8	Luk Mei Tsuen, Sai Kung.	3/7	HyD/NT	2/7	Soil cut slope	Minor (10)	Building lot		
ME97/7/9	Tai Mong Tsai Road, Sai Kung. (8SW-A/C10)	3/7	HyD/NT	2/7	Soil cut slope	Major (50)	Road	2 roads closed.	
ME97/7/10	House No. 13, Tui Mia Hoi Tsuen, Sai Kung.	3/7	HyD/NT	2/7	Soil cut slope	Minor (1)	Open area		
ME97/7/11	House 4E, Pak Kong Au Tsuen, Sai Kung. (8SW-C/C197)	3/7	HyD/NT	2/7	Soil cut slope	Minor (10)	Open area		

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 4 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
ME97/7/12	House Nos. 20-21, Wai Sum Village, Mang Kung Uk, Sai Kung.	3/7	Police	2/7	Retaining wall	Minor (2)	Open area		
ME97/7/13	Near House No. 21, Sau Liu Ho Road, Sai Kung. (8SW-A/F67)	3/7	Public	Unknown	Fill slope	Minor (<10)	Carpark		
ME97/7/14	Hut No. 366, Pai Tau, Sha Tin.	3/7	DLO/ST	2/7 (17:00)	Soil cut slope	Major (150)	Squatter area	5 huts permanently evacuated.	
ME97/7/15	Pak Kong Water Treatment Plant, Sai Kung. (8SW-C/C175)	4/7	WSD	4/7 (8:30)	Retaining wall	Major (100)	Treatment works		
ME97/7/16	House No. 1B, Wo Tong Kong , Mang Kung Uk, Sai Kung.	4/7	HyD/NT	4/7 (am)	Natural slope	Minor (1)	Open area		
ME97/7/17	Opposite Pumping Station, Siu Wo Road, Fo Tan. (7SE-A/C2)	4/7	Police	4/7 (7:45)	Soil cut slope	Minor (44)	Road	1 road closed.	
ME97/7/18	Near Pine Villa, Yung Ping Path, Sha Tin.	4/7	GEO	4/7	Fill slope	Minor (20)	Road		
ME97/7/19	House No. 28, Nam Hang , Tai Po. (7NW-B/R16)	4/7	Police	4/7 (6:00)	Retaining wall	Minor (45.5)	Building lot		
ME97/7/20	Hut Nos. 52-53, Shan Tong Village, Tai Po. (7NW-B/C207)	4/7	HyD/NT	2/7 (am)	Soil cut slope	Minor (5)	Squatter area		

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 5 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
ME97/7/21	Hut No. 54, Shan Tong Village, Tai Po. (7NW-B/C208)	4/7	HyD/NT	Unknown	Soil cut slope	Minor (6)	Squatter area		
ME97/7/22	Near Lamp Post EB09761, Chung Pui, Bride's Pool Road, Tai Po.	4/7	HyD/NT	4/7 (am)	Soil cut slope	Minor (6)	Pedestrian pavement		
ME97/7/23	Near Lamp Post N88788, Ting Kok Road, Tai Po. (7NE-A/C8)	4/7	HyD/NT	4/7 (am)	Soil cut slope	Major (>200)	Pedestrian pavement		
ME97/7/24	Near Lamp Post EB27437, Ting Kok Road, Tai Po.	4/7	HyD/NT	Unknown	Soil cut slope	Minor (15)	Pedestrian pavement		
ME97/7/25	Tai Po Road, Tai Po Kau, Tai Po. (7NW-D/C1)	2/7	HyD/ ECC	2/7	Soil cut slope	Minor (5)	Road	1 road blocked.	
ME97/7/26	Junction of Nam Wan Road and Kwong Fuk Road, Tai Po.	5/7	HyD/NT	5/7	Natural slope	Minor (20)	Open area, carpark		
ME97/7/27	Lamp Post 6722-5, Fo Tan Road, Fo Tan. (7SE-A/C353)	5/7	HyD/NT	4/7 (16:00)	Soil cut slope	Minor (40)	Pedestrian pavement, bus stop	Pedestrian pavement closed.	
ME97/7/28	Hon Ka Road, Kam Shan, Tai Po. (7NW-B/C372)	3/7	DO/TP	3/7 (9:05)	Soil cut slope	Minor (9)	Road	1 road blocked.	

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 6 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
ME97/7/29	North-bound Track about 50m from University Station, KCRC, Sha Tin. (7NE-C/C106)	2/7	HyD/NT	2/7 (6:08)*	Soil/Rock cut slope*	Minor (30)*	Railway track	1 railway track blocked.	
ME97/7/30	North-bound Track about 250m from Fo Tan Station, KCRC, Sha Tin.	2/7	HyD/NT	2/7 (0:40-5:54)*	Natural slope*	Major (100)*	Railway track	Obstructed the northbound KCRC rail track.	
ME97/7/31	House No. 81H, Kam Shan Village, Tai Po. (7NW-B/C374)	3/7	DO/TP	3/7 (9:05)	Retaining wall	Minor (<1)	Footpath, village house		No failure, only dislodgement of rubble wall surface.
ME97/7/32	Near House No. 81D, Kam Shan Village, Tai Po.	3/7	DO/TP	3/7 (9:05)	Soil cut slope	Minor (7)	Village house	1 house evacuated.	
ME97/7/33	Kwun Ping Road, Kwun Yam Shan Tsuen, Tze Wan Shan. (7SE-C/C433)	2/7	HyD/ ECC	2/7 (before 7:00)	Soil cut slope	Minor (15)	Road	1 road blocked.	
ME97/7/34	Hut Nos. X/TPT/A124 and RTP/TPT/A571-573, Ying Pun Ha, Tai Po. (7NW-B/C136)	4/7	Police	3/7	Soil cut slope	Minor (7.2)	Squatter area	4 huts temporarily evacuated.	
ME97/7/35	No.239 Ha Wo Che, Sha Tin			2/7	Flooding damage	N/A	Squatter area	1 hut permanently evacuated.	Flooding damage. Flood damaged wall of squatter hut and also overloaded part of the structure causing collapse.

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 7 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
ME97/7/36	Behind House No. 54, Kam Shan Village, Tai Po.	8/7	DO/TP	7/7 (11:30)	Retaining wall	Minor (<1)			
ME97/7/37	Behind Hut No. RTP/KS/B/450, Kam Shan Village, Tai Po.	4/7	Public	3/7	Soil cut slope	Minor (2)	Footpath		
ME97/7/38	Luen Yick San Tsuen, Tai Po (7NE-A/C11)	3/7	GEO	3/7 (am)		Minor (1)			Washout.
ME97/7/39	House No. 50, Luen Yick San Tsuen, Tai Po.	7/7	DO/TP	7/7 (pm)	Natural slope	Minor (2)			
ME97/7/40	Behind House No. 51, Shuen Wan Lei Uk, Tai Po.	4/7	DO/TP	4/7 (pm)	Natural slope	Minor (2)	Open area		
ME97/7/41	Opposite House No. H10, Government Quarters, Tai Mei Tuk, Tai Po.	2/7	Police	2/7 (12:15)	Soil cut slope	Minor (1)			
ME97/7/42	Behind Village De Casscade, Sui Wo Road, Fo Tan. (7SW-B/C123)	3/7	DO/ST	3/7 (12:00)	Soil cut slope	Minor (15)	Carpark		
ME97/7/43	House No. 93, Pai Tau, Sha Tin. (7SW-B/C360)	4/7	Public	4/7	Soil cut slope	Minor (25)	Building lot		
ME97/7/44	House No. 125, Pai Tau, Sha Tin.	3/7	DO/ST	Unknown		Minor (1)			No failure.

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 8 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
ME97/7/45	House No. 391, Pai Tau, Sha Tin.	7/7	DO/ST	Unknown	Soil cut slope	Minor (10)	Footpath		
ME97/7/46	House No. 203, Pai Tau, Sha Tin.	7/7	DO/ST	Unknown	Natural slope	Minor (40)	Staircase		
ME97/7/47	House No.97, Pai Tau, Sha Tin. (7SW-B/CR396)	7/7	DO/ST	7/7	Soil cut slope	Minor (10)	Footpath		
ME97/7/48	Leung Man Road, Ma On Shan Village, Ma On Shan.	3/7	DO/ST	3/7 (am)	Soil cut slope	Minor (48)	Road	1 road blocked.	
ME97/7/49	Opposite House No. 13, Ha Pun Shan, Ma On Shan Village, Ma On Shan.	9/7	DO/ST	3/7 (am)	Soil cut slope	Minor (25)	Drainage channel		
ME97/7/50	Access Road to Ma On Shan Village, Ma On Shan.	9/7	DO/ST	3/7 (am)	Soil cut slope	Minor (13)	Drainage channel		
ME97/7/51	Opposite to Shing On Temporary Housing Area, Ma On Shan Road, Ma On Shan.	9/7	HyD/NT	2/7(am) - 3/7(16:00)*	Natural slope	Major (3000)	Pedestrian pavement, bicycle track, country park.		
ME97/7/54	Lot 1035, Nam Shan Village, Sai Kung.	3/7	DO/SK	2/7		Minor (<1)	Open area		Surface erosion.

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 9 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
ME97/7/55	House No. 304, Fo Tan Valley New Village, Fo Tan. (7SW-B/C324)	3/7	DO/ST	Unknown		Minor (0.5-1.0)	Building lot		No failure, only tree fallen and dislodgement of slope surface protection.
ME97/7/56	Wong Chuk Yeung Tsuen Path, Fo Tan. (7SW-B/C141)	3/7	DO/ST	Unknown	Soil cut slope	Major (50)	Road		
ME97/7/59	Ma On Shan Treatment Work Area, Ma On Shan.	9/7	Public	2/7 (am)	Soil cut slope	Minor (35)	Country park		
ME97/7/61	Belair Gardens, Sha Tin.	10/7	Police	1/7		N/A	Carpark		No failure, only tree fallen and erosion of slope surface.
ME97/7/62	5-13 Shan Mei Street, Sai Fai Factory Estate, Sha Tin		HD	2/7	Natural slope	Minor (5)	Carpark, toe drain blocked		
ME97/7/63	Slope near house no.2 Wo Liu Hang, Fo Tan (7SE-A/C116)			9/7	Soil/rock cut slope	Minor (20)	Squatter area	1 hut temporarily evacuated.	
ME97/7/64	Behind hut No. 205B1, Ho Tung Lau, Fo Tan. (7SE-A/C221)	2/7	HyD/NT	2/7	Soil cut slope	Minor (6)	Squatter area	1 hut permanently evacuated.	
ME97/7/65	Slope behind house No. 8, Wo Liu Hang, Fo Tan	2/7	HyD	2/7	Erosion/ Washout of upstream	Minor (6)	Open area, main culvert and access to village	Main culvert blocked, access to village covered by 0.5m thick debris.	Erosion/washout of upstream.

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 10 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
ME97/7/66	House No. 217, Pai Tau, Sha Tin.	10/7	GEO	2/7 (am)	Retaining wall	N/A	Squatter area, footpath, village house	1 house evacuated, footpath closed.	Signs of distress were observed, with no failure mass.
ME97/7/67	Behind Yuk Wong Din, Ten Thousand Buddhas' Monastery, Pai Tau, Sha Tin. (7SW-B/C113)	2/7	FSD	2/7 (4:00-5:00)	Natural slope	Major (750)	Building lot	1 house evacuated, temple damaged, whole monastery evacuated.	
ME97/7/68	Near Ten Thousand Buddhas' Monastery, Pai Tau, Sha Tin. (7SW-B/FR7 and F9)	2/7	FSD	2/7 (7:00)	Natural slope	Major (500)	Building lot	1 house evacuated, monastery structure damaged, whole monastery evacuated.	
ME97/7/69	Tao Fung Shan Christian Cemetery, Sha Tin. (7SW-B/C425 and C426)	2/7	Public	2/7 (6:30)*	Fill slope*	Major (600)*	Squatter area	Closure of the cemetery.	
ME97/7/70	Hut No. 210, Pai Tau, Sha Tin.	10/7	GEO	2/7 (am)	Soil cut slope	Minor (5)	Squatter area, footpath	3 huts permanently evacuated.	
ME97/7/71	Near House No. 17, Shek Kwu Lung Village, Sha Tin.	3/7	DO/ST	Unknown	Fill slope	Minor (3)	Footpath		

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 11 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
ME97/7/72	House No. 105, Sha Tin Wai, Sha Tin. (7SE-C/C195)	2/7	Public	Unknown		Minor (0.5)			No failure, only dislodgement of slope surface protection.
ME97/7/73	Near House No. 103, Shek Kwu Lung, Tai Po. (7NW-B/C346)	8/7	DO/TP	8/7 (pm)	Soil cut slope	Minor (5)	Private or building access		
ME97/7/74	Behind House No. 168, Pai Tau, Sha Tin.	9/7	HD	2/7 (am)	Soil cut slope	Minor (30)	Squatter area	3 huts permanently evacuated.	
ME97/7/76	House No. 300, Pai Tau, Sha Tin.	2/7	DLO/ST	Unknown		Minor (1)			No failure.
ME97/7/81	Chinese University of Hong Kong, Sha Tin. (7NE-C/C53)	4/7	Public	3/7 (pm)	Soil cut slope	Major (80)	Pedestrian pavement		
ME97/7/84	22 Ma Niu Village, Kau To Shan, Sha Tin.	2/7	Police	2/7 (6:00)	Natural slope	Major (150)	Building lot, access road		
ME97/7/85	Lot 54, Ma Liu Shui, Sha Tin.	4/7	Public	Unknown	Soil cut slope	Minor (3)	Open area		
ME97/7/98	Ha Wo Che, Sha Tin.	16/7	Public	2/7	Natural slope	Minor (2)			
ME97/7/99	3 Tin Cheung Terrace, Sha Tin.	16/7	Public	2/7	Fill slope	Minor (3)			
ME97/7/105	House No.161, Pau Tau Village, Sha Tin.	7/7	Public	2/7 (am)	Natural slope	Minor (10)			

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 12 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
ME97/7/106	Hut Nos.RHTL/153-154, Ho Tung Lau, Sha Tin.	24/7	DO/ST	2/7		N/A	Squatter area	2 huts permanently evacuated.	No failure, only dislodgement of slope surface protection.
ME97/7/107	House No. 6C, Lok Lo Ha, Sha Tin.	28/7	Public	2/7	Natural slope	Minor (24)	Building lot, sitting out area		
ME97/7/108	House No. 71, Lok Lo Ha, Sha Tin.	28/7	DO/ST	2/7 (am)	Retaining wall	Minor (2)	Building lot		
ME97/7/109	House No. 188, To Fung Shan, Sha Tin.	3/7	GEO	2/7 (am)	Natural slope	Minor (24)			
ME97/10/1	Between On Shan Lane and Kam Ying Court, Ma On Shan.	26/9	DO/ST	July, 1997	Natural slope	Minor (40)	Open area		
MW97/7/1	Hang Cheung Factory Building, 1 King Lam Street, Sham Shui Po. (11NW-A/C189)	2/7	HyD/K	2/7 (9:00)	Soil/rock cut slope	Minor (5)	Building lot, backyard		
MW97/7/2	Yuet Lai Court, Lai King Hill Road, Kwai Chung. (11NW-A/C17)	2/7	Public	2/7	Rock slope	Minor (1)	Road		
MW97/7/3	Mile Stone 11, Route Twisk, Tsuen Wan.	2/7	HyD/NT	2/7	Soil cut slope	Minor (40-50)	Road, pedestrian pavement	1 road closed, pedestrian pavement closed.	
MW97/7/4	Near Kwong Pan Tin, Route Twisk, Tsuen Wan.	2/7	HyD/NT	2/7	Natural slope	Minor (10)	Road	1 road blocked.	

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 13 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
MW97/7/5	House No. 4, Tai Yuen New Village, Lamma Island.	3/7	DO/ Islands	3/7	Soil cut slope	Minor (1)	Backyard		
MW97/7/6	11 Sha Tin Heights Road, Sha Tin. (7SW-D/C123)	2/7	HyD/NT	2/7	Natural slope	Minor (5)	Road	1/2 road blocked.	
MW97/7/7	Mei Chung Court, Sha Tin. (7SW-D/C790, C791 and C801)	2/7	Public	2/7 (early morning)	Soil cut slope	Major (100)*	Building lot, pedestrian pavement, open area, carpark	Flood damage included severe erosion of slopes, undermining and erosion of paved areas. Pedestrian pavement closed.	Blockage of a natural stream channel caused stream overflow.
MW97/7/8	To Fung Shan Road, Sha Tin. (7SW-D/C294)	2/7	HyD/NT	Unknown	Rock slope	Minor (7)	Road	1 road blocked.	
MW97/7/9	Opposite Block 3, Bay View Gardens, Castle Peak Road, Tsuen Wan. (6SE-D/C24)	2/7	Police	Unknown	Fill slope	Minor (32)	Road, pedestrian pavement	2 roads closed.	
MW97/7/10	Tsuen Wan Police Station, Lido Beach, Castle Peak Road, Ting Kau.	2/7	Police	2/7 (11:45)	Natural slope	Major (750)*	Building lot, road, pedestrian pavement	8 persons injured, 4 flats evacuated, 2 roads closed, pedestrian pavement closed.	

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 14 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
MW97/7/11	Near Ting Kau Bridge, Tuen Mun Highway, Ting Kau. (6SE-C/F10)	2/7	GEO	2/7 (9:30)	Fill slope	Major (200)*	Road	2 roads closed.	Discharge of surface water onto the slope from the blocked drainage channel, which contributing the failure.
MW97/7/12	Opposite Chung Shan Terrace, Castle Peak Road, Kwai Chung. (11NW-A/C409)	2/7	Public	2/7	Rock fall	Minor (10)	Road	1 road blocked.	
MW97/7/13	House No. 5, Tai Yuen New Village, Lamma Island.	3/7	DO/ Islands	3/7		N/A	Backyard		No geotechnical concern, only tree fallen.
MW97/7/14	Behind Wah Shun Court, Wah Yuen Chuen, Kwai Chung. (11NW-A/C35)	3/7	Police	3/7 (5:00)	Soil cut slope	Minor (40)	Open area		
MW97/7/15	Happy View House, 19 Sha Tin Height Road, Sha Tin.	2/7	Public	2/7 (before 7:00)	Natural slope	Major (2000)	Building lot		
MW97/7/16	2 Sha Tin Height Road, Sha Tin. (7SW-D/C124)	2/7	HyD/NT	2/7	Retaining wall	Minor (25)	Road	1 road blocked.	
MW97/7/17	West of Sha Tin Water Treatment Work, Old Tai Po Road, Sha Tin. (7SW-D/C11)	2/7	HyD/ ECC	2/7 (9:00)	Rock fall	Minor (15)	Road	1 road blocked.	

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 15 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
MW97/7/18	House Nos. 1A, 49 and 49A, Lung Tsai Tsuen Road, Lung Tsai Tsuen, Cheung Chau. (14NW-D/R206 and CR208)	4/7	Police	2/7 (23:05)	Soil/rock cut slope	Major (70)	Building lot, footpath, private or building access	3 houses evacuated, footpath closed.	Surface water channel broken on top of the slip.
MW97/7/19	Lai King Training Centre, Wai Ta Road, Kwai Chung. (11NW-A/C171)	4/7	CSD	3/7 (2:00)	Soil cut slope	Minor (1)	Footpath		
MW97/7/20	Cheung Hang Road, Butterfly Valley.	2/7	HyD/NT	2/7	Natural slope	Minor (5)	Road		
MW97/7/21	Shek Li Hang Village, Kwai Chung. (7SW-C/C977)	3/7	DO/KT	2/7	Soil cut slope	Minor (5-10)	Squatter area, footpath	8 huts permanently evacuated.	
MW97/7/22	Shing Mun Road Village, Kwai Chung.	3/7	DO/KT	2/7	Retaining wall	Minor (1)	Squatter area		
MW97/7/23	Opposite 25 Keng Hau Road, Sha Tin Heights, Sha Tin. (7SW-D/N4)	3/7	HyD/NT	2/7	Fill slope	Minor (5)	Building lot, pedestrian pavement		
MW97/7/24	Above Ka Tin Court, Sha Tin.	2/7	HD	2/7	Natural slope	Minor (15)	Stream course	Stream course blocked.	
MW97/7/25	Below 33 Sha Tin Heights Road, Sha Tin.	2/7	HyD/NT	2/7	Natural slope	Minor (10)	Building lot		

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 16 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
MW97/7/26	Behind House No. 44, Sheung Keng Hau Village, Tai Wai. (7SW-D/C732,C417)	2/7	FSD	2/7 (6:45)	Soil cut slope	Minor (1)	Footpath, private or building access	Footpath closed.	
MW97/7/27	Milestone 6-1/2, Tai Po Road, Sha Tin Heights, Sha Tin. (7SW-D/F158)	4/7	HD	4/7* (14:00)	Fill slope	Major (50)	Squatter area	6 huts permanently evacuated.	
MW97/7/28	Pak Shek, Sha Tin.	4/7	HD	Unknown	Soil cut slope	Minor (10)	Squatter area	5 huts permanently evacuated.	
MW97/7/29	Area 5, Pak Tin, Sha Tin.	4/7	HD	2/7 (6:15)	Soil cut slope	Minor (5)	Squatter area, staircase	4 huts permanently evacuated.	
MW97/7/30	Wu Oi Christian Centre, Lai Muk Shu Youth Halfway House, Wo Yi Hap Village, Tsuen Wan.	3/7	BD	2/7 (9:00)	Soil cut slope	Minor (6)	Building lot	1 house evacuated.	
MW97/7/31	Near Nam Fung Factory, On Yuk Road, Tsuen Wan.	2/7	GEO	2/7	Soil cut slope	Minor (40)	Pedestrian pavement	Pedestrian pavement closed.	
MW97/7/32	Hut No. RTW/1B/108, Pai Miu Kok Upper Village, Tsuen Wan.	3/7	GEO	2/7 (17:00)	Soil cut slope	Minor (0.5)	Squatter area		Broken part of the drainage system on top of slope.
MW97/7/33	Beacon Hill Road, Beacon Hill.	2/7	HyD/NT	2/7	Soil cut slope	Minor (8)	Road	1 road blocked.	

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 17 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
MW97/7/34	Beacon Hill Road, Beacon Hill. (11NW-B/C512)	2/7	HyD/NT	2/7	Soil cut slope	Minor (<5)	Road	1/2 road blocked.	
MW97/7/35	Hut No. 23, Fu Tei Chung Tsuen, Tuen Mun.	4/7	DO/TM	4/7 (11:35)		Minor (15)		2 huts temporarily evacuated.	No failure, only land subsidence.
MW97/7/36	Near Chuk Lam Sim Yuen, Tai Wo Tsuen, Fa Yung Shan, Tsuen Wan.	4/7	HyD/NT	3/7 (9:00)	Soil cut slope	Minor (45)	Footpath		
MW97/7/37	Hut Nos 35-40, Hon Man Village, Tsuen Wan.	2/7	Police	2/7 (am)		N/A	Squatter area	15 huts temporarily evacuated.	No geotechnical concern, only failure of squatter hut roof.
MW97/7/38	Behind 11-19 Wing Yip Street, Kwai Chung.	3/7	GEO	3/7	Soil cut slope	Minor (20)	Building lot		
MW97/7/39	Tai Lin Pai Road, Kwai Chung. (7SW-C/C230)	4/7	GEO	4/7	Soil cut slope	Minor (25)	Pedestrian pavement		
MW97/7/40	Po Tong Ha Village, Tuen Mun.	2/7	FSD	2/7 (15:00)		Minor (1)	Squatter area	1 hut temporarily evacuated.	Not a landslide, exposure of concrete pipe.
MW97/7/41	Near House No. 76, Fu Tei Sheung Tsuen, Tuen Mun.	4/7	Police	4/7 (4:00)	Natural slope	Minor (12)			
MW97/7/42	26 Ma Wan Rear Street, Ma Wan .	7/7	Police	Unknown	Soil cut slope	Minor (3)	Building lot		

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 18 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
MW97/7/43	Hut Nos. 33A-E, Forth Street, Area 8, Heung Fan Liu, Sha Tin.	2/7	HD	2/7 (6:30)	Fill slope	Minor (4)	Squatter area, footpath	4 huts permanently evacuated, footpath blocked.	
MW97/7/44	Hut Nos. 3 and 4, Forth Street, Heung Fan Liu, Sha Tin. (7SW-D/C368)	7/7	HD	2/7	Soil cut slope	Minor (15)	Squatter area	7 huts permanently evacuated.	
MW97/7/45	63 To Fung Shan Road, Sha Tin. (7SW-B/C211)	2/7	DO/ST	2/7	Soil cut slope	Minor (5)	Squatter area	10 huts permanently evacuated.	
MW97/7/47	Behind House No.58, Wo Yi Hop Village, Tsuen Wan.	4/7	DO/TW	Unknown	Soil cut slope	Minor (5)	Building lot	1 flat evacuated.	
MW97/7/48	Below House No. 19A1, Area 4, Pik Tin, Sha Tin.	2/7		Unknown		Minor (~ 0.5)			Chunam damaged.
MW97/7/49	Liu To, Tsing Yi.	8/7	DO/KT	4/7	Soil cut slope	Minor (10)	Footpath		
MW97/7/50	Golden Hill Road, Sha Tin.	7/7	HyD/NT	2/7	Natural slope	Minor (30)	Country park		
MW97/7/51	Lamp Post No. EA5458-9, Tao Fung Shan Road, Sha Tin.	4/7		4/7	Natural slope	Minor (20)			
MW97/7/52	Christian Centre, Pak Tin Tsuen, Tai Wai, Sha Tin. (7SW-B/C492 and C792)	2/7	Police	2/7 (16:11)	Soil cut slope	Minor (5)	Building lot, access road	Access road closed.	

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 19 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
MW97/7/53	Hut Nos. 103-104, Area 3, Pak Tin Tsuen, Sha Tin. (7SW-B/F68 and F67)	2/7	FSD	2/7	Fill slope	Major (>50)	Squatter area	3 huts permanently evacuated.	
MW97/7/54	Hut No. 584, Area 5, Pak Tin Tsuen, Sha Tin.	3/7	DO/ST	2/7	Soil cut slope	Minor (3)	Squatter area	1 hut permanently evacuated.	
MW97/7/55	King Tan Court, Hung Mui Kuk Road, Sha Tin. (7SW-D/C235)	5/7	Public	5/7 (20:50)		Major (>50)			No failure, only erosion of slope surface caused by broken sewer.
MW97/7/56	Yan Oi Village, To Fung Shan Road, Tai Wai. (7SW-B/C23)	2/7	Police	2/7 (14:03)	Soil cut slope	Minor (10)	Road		
MW97/7/57	Junction of Tai Po Road and Lung Cheung Road.	7/7	HyD/K	2/7 (12:00)	Natural slope	Minor (<30)	Open area		
MW97/7/58	Junction of Tai Po Road and Lung Cheung Road.	9/7	HyD/K	Before 3/7	Natural slope	Minor (10-20)	Open area		
MW97/7/59	Shek Tong Tsuen, Au Tau, Yuen Long.	6/7	Public	6/7 (morning)	Soil cut slope	Minor (6)	Building lot		
MW97/7/60	Electric Substation, Tong Yam Street, Tai Hang Tung.	4/7	Public	Unknown		Minor (<10)			No failure, only erosion of hillside.
MW97/7/61	Wong Chuk Yuen Sheung Tsuen, Kam Tin, Yuen Long. (6NE-D/C200)	5/7	Public	4/7 (8:00)	Soil cut slope	Minor (8)	Footpath		

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 20 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
MW97/7/62	House No. 85, Wo Yi Hop Village, Kwai Chung.	8/7	Police	8/7 (17:45)	Natural slope	Minor (3)	Squatter area	1 hut temporarily evacuated.	
MW97/7/63	Hut No. 46, Yau Oi Tsuen, Sha Tin.	3/7	DO/ST	2/7	Soil cut slope	Minor (5)	Squatter area		
MW97/7/64	Near Water Supplies Department Pumping Station, Yau Oi Tsuen, Sha Tin.	9/7	DO/ST	Unknown	Natural slope	Minor (3)	Footpath		
MW97/7/65	Below Sha Tin North Service Reservoir, Yau Oi Tsuen, Sha Tin.	9/7	DO/ST	Unknown	Soil cut slope	Minor (10)	Footpath		
MW97/7/66	Shing Mun Tunnel Road, Tai Wai. (7SW-D/C292)	7/7	HyD/NT	2/7	Soil cut slope	Minor (10)	Road		
MW97/7/67	Hut No. 14B, Yau Oi Tsuen, Sha Tin.	9/7	HD	2/7 (am)		N/A	Squatter area		No geotechnical concern, only flooding.
MW97/7/68	Hut No. RTW/TE/322, Shek Lei Hang Village, Kwai Chung.	9/7	DO/KT	2/7	Natural slope	Minor (5)	Squatter area	1 hut permanently evacuated.	
MW97/7/69	Hut No. RTW/TA/77, Sheung Yat Chuen, Kwai Chung.	9/7	DO/KT	7/7 (5:30)	Soil cut slope	Minor (45)	Squatter area	1 hut permanently evacuated.	

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 21 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
MW97/7/70	Opposite Dragon Industrial Building, Ching Cheung Road, Kwai Chung. (11NW-A/C55)	9/7	HyD/NT	7/7 (9:00)	Soil cut slope	Major (500)*	Road, construction site	4 roads closed.	
MW97/7/71	Castle Peak Road, Sham Tseng.	9/7	HyD/NT	4/7	Natural slope	Minor (2)	Road		
MW97/7/72	Castle Peak Road, Tsing Lung Tau.	9/7	HyD/NT	4/7	Soil/rock cut slope	Minor (2)	Road		
MW97/7/73	Ta Shek Wu Kiu Tau, Fan Kam Road, Pat Heung, Yuen Long.	9/7	DO/YL	6/7 (13:00)	Soil/rock cut slope	Minor (6)	Road		
MW97/7/75	Near Tso Kung Tam Recreation Camp, Route Twisk, Tsuen Wan.	9/7	HyD/NT	4/7	Soil cut slope	Minor (2)	Pedestrian pavement		
MW97/7/76	Near Tsuen Lung, Route Twisk, Tsuen Wan. (6SE-B/C5)	9/7	HyD/NT	4/7	Soil cut slope	Major (70)	Open area		
MW97/7/77	Ha Fa Shan, Tsuen Wan.	8/7	DO/TW	3/7 (18:00)	Soil cut slope	Minor (3)	Footpath		
MW97/7/78	Pai Min Kok Village, Sham Tseng.	3/7	DO/TW	4/7 (2:00)	Retaining wall	Minor (15)	Footpath		
MW97/7/80	Hut No. 26, Lok Hop Tsuen. Sha Tin.	10/7	HD	2/7	Soil cut slope	Minor (5)	Squatter area	1 hut permanently evacuated.	

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 22 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
MW97/7/81	Hut No. 23, Lok Hop Tsuen, Sha Tin.	2/7	Police	2/7	Soil cut slope	Minor (2)	Squatter area	1 hut permanently evacuated.	
MW97/7/82	Hut No. 4, Area 2, Sha Tin Tau Sun Tsuen, Sha Tin.	2/7	Public	2/7 (8:00)	Soil cut slope	Minor (2)	Open area		
MW97/7/83	Hut No. 2A1, Area 2, Sha Tin Tau Sun Tsuen, Sha Tin.	9/7	Public	2/7	Soil cut slope	Minor (2)	Open area		
MW97/7/84	Behind House No. 5, Tsok Pok Hang Sun Tsuen, Sha Tin.	4/7	Public	Unknown	Soil cut slope	Minor (2)	Open area		
MW97/7/86	House No. 118A, Pak Yin Tsuen, Sha Tin. (7SW-B/C513)	14/7	HD	2/7	Soil cut slope	Minor (3)	Open area		
MW97/7/87	Hut No.120, Dak Tin Tsuen, Sha Tin. (7SW-B/C545)	2/7	FSD	2/7	Soil cut slope	Minor (5)	Squatter area, open area		
MW97/7/88	Hut No. 41B, Area 6, Sha Tin Tau New Village, Sha Tin.	14/7	BD	2/7	Soil cut slope	Minor (5)	Squatter area	3 huts permanently evacuated.	
MW97/7/91	Lot 424, DD399, Ting Kau. (6SE-C/C477)	2/7	Police	2/7	Soil cut slope	Minor (8)	Building lot		
MW97/7/92	House No. 29, Hin Tin Tsuen, Sha Tin.	2/7	Public	2/7	Soil cut slope	Minor (<0.5)	Building lot		

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 23 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
MW97/7/94	House No.18A, Wai Tsai San Tsuen, Peng Chau.	7/7	DO/ Islands	2/7	Soil cut slope	Minor (1.5)	Building lot		
MW97/7/96	Yung Yuen Road, Ping Shan, Yuen Long.	11/7	DO/YL	2/7	Soil cut slope	Minor (2)	Passing bay		
MW97/7/98	Fuk Lok Tuen, Pak Tin, Sha Tin. (7SW-B/CR527)	10/7	DO/ST	2/7	Soil cut slope	Minor (10)	Footpath		
MW97/7/99	Upper Fuk Lok Tsuen, Sha Tin.	18/7	DO/ST	2/7	Soil cut slope	Minor (6)	Footpath		
MW97/7/109	Adjacent China Light and Power Substation, Wo Tong Tsui Road, Kwai Chung. (7SW-C/CR103)	12/7	Public	3/7	Soil cut slope	Minor (15)	Open area		
MW97/8/4	Hut No. 8A, Area 2, Sha Tin Tau Village, Sha Tin.	5/8	HD	2/7	Soil cut slope	Minor (0.5)	Squatter area		Surface erosion.
MW97/8/5	Above Chik Wan Road, Tai Wai. (7SW-D/C247)	4/8	Public	2/7	Soil cut slope	Minor (5)	Plantation area		
MW97/8/7	Below Sitting-out Area, Tai Po Road, Tai Wai. (7SW-D/F161)	4/8	Public	2/7	Fill slope	Minor (8)	Plantation area		
MW97/8/8	House No. 41, Ting Kau Village, Ting Kau.	31/7	DO/TW	3/7	Retaining wall	Minor (1)	Open area		

Table B2 - List of Incidents Reported to GEO during the Period from 1 July to 9 July 1997 (Sheet 24 of 24)

Incident No.	Location (Slope No.)	Call		Failure			Facility Affected	Consequence	Remarks
		Date	From	Date (Time)	Type	Scale (m^3)			
MW97/8/9	Near Ting Kau Bridge, Ting Kau. (6SE-C/C382)	4/8	Public	3/7	Soil cut slope	Minor (3)	Access road		
MW97/8/21	Yau Oi Tsuen, To Fung Shan Road, Sha Tin.	13/8	Public	3/7	Soil cut slope	Minor (3)	Road		
MW97/8/28	Lot 259, DD354, Castle Peak Road, Ting Kau. (6SE-D/C289)	29/8	HyD/NT	2/7	Soil cut slope	Minor (5)	Access road		
MW97/8/29	Pak Tin Tsuen, Sha Tin.	2/7		2/7	Soil cut slope	Minor (10)	Stream course		
No incident number was assigned	Shing Mun Main (Upper) Dam, Tsuen Wan			2/7	Rock cut slope	Major $(3,000)^+$	Country park		

Legend :

\+ Information from GEO Detailed Investigation
* Information from GEO's 1997 Landslide Investigation Consultants

LIST OF DRAWINGS

Drawing No.	
GCSP 8/18	Location Map of Reported Incidents during the Period from 1 July to 9 July 1997