FACTUAL REPORT ON HONG KONG RAINFALL AND LANDSLIDES IN 2009

GEO REPORT No. 294

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

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PREFACE

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

The Geotechnical Engineering Office also produces documents specifically for publication in print. These include guidance documents and results of comprehensive reviews. They can also be downloaded from the above website.

The publications and the printed GEO Reports may be obtained from the Government's Information Services Department. Information on how to purchase these documents is given on the second last page of this report.

H.N. Wong
Head, Geotechnical Engineering Office
January 2014

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FOREWORD

This report presents a summary of the factual information on rainfall and landslides in Hong Kong throughout 2009. Details of the landslides were obtained from records of landslide incidents reported to the Geotechnical Engineering Office (GEO) of the Civil Engineering and Development Department (CEDD). Supplementary information was collected from the Agriculture, Fisheries and Conservation Department, Architectural Services Department, Drainage Services Department, Fire Services Department, Highways Department, Housing Department, Lands Department, Water Supplies Department and the GEO's landslide investigation consultants. The Hong Kong Observatory provided weather and rainfall information. The Standards and Testing Division of the GEO carried out a review of the available rainfall records as well as rainfall analyses, and prepared Section 2 of this report. All contributions are gratefully acknowledged.

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ABSTRACT

This report presents a summary of the factual information on rainfall and landslides in Hong Kong throughout 2009. Rainfall information was obtained from the Hong Kong Observatory (HKO) to supplement the information available in the Geotechnical Engineering Office (GEO). Details of the landslides were obtained from records of landslide incidents reported to the GEO. Supplementary information was provided by the Agriculture, Fisheries and Conservation Department, Architectural Services Department, Drainage Services Department, Fire Services Department, Highways Department, Housing Department, Lands Department, Water Supplies Department, and the GEO's landslide investigation consultants, namely Fugro Scott Wilson Joint Venture and AECOM Asia Company Limited.

Rainfall recorded in 2009 at the HKO's Principal Raingauge at Tsim Sha Tsui amounted to 2,182.3 mm, which was about 8% below the mean rainfall of 2,382.7 mm recorded between 1971 and 2000. Two Red Rainstorm Warnings were issued on 4 June and 17 July 2009; and 20 Amber Rainstorm Warnings were issued between 5 March and 30 September 2009.

Two Landslip Warnings were issued on 19 July and 15 September 2009. A total of 102 incidents that occurred in 2009 were reported to the Government. Of these, 101 were classified as genuine landslides and two of them were designated as major failures (i.e. with a failure volume of 50 m^3 or more, or where a fatality has occurred).

Ten landslides in 2009 resulted in notable consequences. Of these ten landslides, one led to temporary evacuation of a squatter dwelling. Two landslides resulted in temporary closure of roads and another seven resulted in temporary closure of pedestrian pavements, footpaths or access paths. In addition, four other landslides affected catchwaters, but none of them had any significant direct or indirect impact on the areas downhill of the catchwaters. No injury or fatality was reported as a result of the 2009 landslides.

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1. INTRODUCTION

This report summaries the factual information on rainfall and landslides that occurred in Hong Kong throughout 2009. Rainfall information was obtained from the Hong Kong Observatory (HKO) to supplement the information available in the Geotechnical Engineering Office (GEO). Details of the landslides were obtained from records of landslide incidents reported to the GEO. Supplementary information was provided by the Agriculture, Fisheries and Conservation Department (AFCD), Architectural Services Department (Arch SD), Drainage Services Department (DSD), Fire Services Department (FSD), Highways Department (HyD), Housing Department (HD), Lands Department (Lands D), Water Supplies Department (WSD), and the GEO's landslide investigation consultants, namely Fugro Scott Wilson Joint Venture (FSWJV) and AECOM Asia Company Limited (AECOM), under Agreements Nos. CE 40/2007 (GE) and CE 41/2007 (GE) respectively.

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

2. RAINFALL

2.1 The Raingauge System

The GEO, in collaboration with the HKO, operates an automatic raingauge system that transmits rainfall data through either telephone lines or the General Packet Radio Service (GPRS) of the mobile network, viz. a wireless transmission technology, to the GEO and the HKO at 5-minute intervals. The system comprises 86 GEO raingauges and 24 HKO raingauges. The raingauges are of the tipping-bucket type, tipping for every 0.5 mm of rainfall. The locations of the automatic raingauges are shown in Figure 1.

2.2 Rainfall Records

The rainfall data from the raingauge system are checked, verified and stored by the GEO in a database, from which they can be extracted for analysis. This report presents a selection of rainfall parameters for the whole year of 2009, as well as individual months and individual rainstorms.

The weather in 2009, as described by the HKO (2010), is excerpted as follows:

> "According to the World Meteorological Organization, the year 2009 would likely rank among the top ten hottest years globally on record. In Hong Kong, the weather was also exceptionally warm in 2009 with an annual mean temperature of 23.5 degrees,

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> ranking the ninth highest on record……. The year 2009 was also drier than usual. The annual rainfall of 2,182.3 millimetres was about eight percent below normal."
>
> "It was also wetter than usual in September. The total rainfall of 486.3 millimetres in the month was about 69 percent above the normal."

The following are excerpts from the HKO's Monthly Weather Summary describing the weather condition when the most intense rainstorms occurred in the wet season (i.e. between April and September 2009). Further details on the monthly weather are available on the HKO Website (http://www.hko.gov.hk/wxinfo/pastwx/mws.htm).

> "Affected by an area of low pressure near Hainan, local weather became more unsettled with occasional heavy downpour and squally thunderstorms from 23 to 25 May. The rain eased off gradually with some bright periods on 26 May."
>
> "Tropical Storm Nangka entered the South China Sea on the evening of 24 June and edged towards the coast of eastern Guangdong in the next two days. Nangka made landfall over the vicinity of Daya Bay and weakened into an area of low pressure inland Guangdong in the morning of 27 June. Locally, it was mainly cloudy with showers on 25 and 26 June. Affected by the remnants of Nangka, the weather was cloudy with heavy rain and a few squally thunderstorms on 27 and 28 June."
>
> "With Molave moving closer to the coast of Guangdong, local winds strengthened gradually with squally showers in the evening of 18 July. Molave made landfall in the vicinity of Mirs Peninsula in the early hours of 19 July. Gale force winds with maximum gusts up to 148 kilometres per hour and heavy rain with squalls affected the territory during the period."
>
> "A tropical depression over the western North Pacific entered the northern part of the South China Sea on 13 September. It intensified into a tropical storm that evening and was named Koppu……. Koppu made landfall over the western coast of Guangdong in the morning of 15 September and weakened into a tropical storm in the afternoon. The rainbands associated with Koppu brought heavy squally showers to the territory on that day. With Koppu moving further inland and dissipating, the showers eased off gradually on 16 September."

The rainfall recorded at the HKO in the first quarter of 2009 is 121.8 mm (18% below normal). The total rainfall recorded in the second and third quarter are 695.7 mm (23.2% below the normal rainfall) and 1,209.8 mm (9.3% above the normal rainfall) respectively. For the last quarter of 2009, the total rainfall is 155 mm (30% below normal). The annual rainfall for 2009 is 2,182.3 mm, which is 8.4% below the mean rainfall (2,382.7 mm)

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recorded between 1971 and 2000. The cumulative rainfall for 2009 is compared with the highest, lowest and mean rainfall in Figure 2.

Figures 3a, 3b, 3c and 3d show the monthly rainfall distribution in 2009.

Figure 4 shows the annual rainfall distribution in 2009, together with the locations of the reported landslides.

2.3 Rainstorms in 2009

Table 1 tabulated the rainfall parameters for 17 rainstorms in 2009, during which the daily rainfall exceeded 50 mm at any of the HKO and the GEO raingauges. The parameters include the maximum 24-hour, 4-hour and 1-hour rolling rainfalls (based on 5-minute rainfall data). Table 1 also includes the 4-day and 15-day antecedent rainfalls at the HKO's Principal Raingauge. Similar data for selected major rainstorms in previous years are included in Table 1 for comparison. Other rainfall parameters for the above 17 rainstorms are also shown in Table A1 of Appendix A.

Figures 5 to 21 show the isohyets of the maximum rolling 24-hour rainfall during the above 17 rainstorms, together with the locations of reported landslides with reliable timing of occurrence that can be attributed to the rainstorm event, and the locations and values of maximum rolling rainfall for durations ranging from five minutes to 48 hours.

None of the rainstorms in 2009 resulted in more than 10 reported landslides.

2.4 Warnings Issued by the Hong Kong Observatory

Table 2 summarises the details of the Thunderstorm, Flood, Landslip, Tropical Cyclone and Rainstorm Warnings issued by the HKO in 2009. Two Red Rainstorm Warnings were issued on 4 June and 17 July 2009, and 20 Amber Rainstorm Warnings were issued between 5 March and 30 September 2009. Two Landslip Warnings were issued on 19 July and 15 September 2009.

3. LANDSLIDES

3.1 Landslides in 2009

Landslide incidents reported to the GEO and other Government Departments in 2009 are summarised in Table 3.

A total of 102 landslide incidents were reported in 2009 to various Government Departments. These include 66 incidents reported to the GEO. Another 36 incidents were reported to other Government Departments (i.e. AFCD, Arch SD, DSD, FSD, HyD, HD, Lands D or WSD). Of these 102 reported incidents, 101 were genuine landslides (see details in Appendix B). The other reported incident was non-landslide event with no geotechnical concern.

Of the 101 landslides, two (2%) were major landslides (see Table B1 in Appendix B), 81 (80.2%) were minor landslides, and 18 (17.8%) were very minor landslides with negligible consequences (see Section 1).

Selected notable landslides are presented in Section 4 and illustrated in Plates 1 to 4. For those landslide incidents inspected by the GEO, the information on the landslides was recorded in Incident Reports prepared by the GEO (as well as in Landslip Cards for major landslides). For those landslide incidents attended to by other Government Departments responsible for slope maintenance, landslide incident reports were prepared by the respective Departments. The above information, together with the scanned images of the Incident Reports and Landslip Cards prepared by the GEO and other Government Departments, have been uploaded onto the Slope Information System (SIS). Further details of these slope failures can be found in the relevant files of the three District Divisions and the Landslip Preventive Measures Division 1 of the GEO.

Wherever possible, the dates and times of the landslides were assessed by geotechnical professionals. Of the 101 landslides, the timing of occurrence was determined to within one day for 39 incidents based on the reported date of failure given in the incident reports. For the remaining landslide incidents, the timing of occurrence could not be ascertained due to lack of information or that the incidents were not reported to the GEO or other Government Departments until several days or even weeks after occurrence.

3.2 Consequence of Landslides

The consequence of landslides in terms of the types of facilities affected (e.g. buildings, roads, registered squatter dwellings, catchwaters, construction sites, etc.) in different regions is summarised in Table 4. For those landslides affecting catchwaters and construction sites, none of them resulted in any significant direct or indirect consequences. In regard to the landslides with significant consequences (e.g. casualties, evacuation of buildings or squatter dwellings, temporary closure of roads, etc.), they are classified with respect to the type of slope failure, as shown in Table 5. The distribution of different facility groups affected by major landslides is presented in Table 6. Further descriptions of some selected notable landslides of 2009 are given in Section 4 below.

3.3 Types of Slope Failures

Landslides reported to the GEO and other Government Departments have been classified into five types of slope failures, i.e. fill slopes, cut slopes, retaining walls, natural hillside and registered disturbed terrain. The breakdown of different types of slope failures is shown in Table 7.

3.4 Landslide Volume Distribution

Tables 8 and 9 show the distribution of failure volumes for all the reported landslides. A total of 73 landslides (72.3%) involved less than 5 m^3 of material. There were two major (with a failure volume of 50 m^3 or more) landslides along Lin Ma Hang Road, one in

Zone 259 and the other in Zone 234 (Table B1), that resulted in temporary closure of the road.

4. NOTABLE LANDSLIDES

4.1 General

Of the 101 genuine landslides reported to the Government in 2009, four incidents are described in more detail below. These four incidents have been selected on the basis of their consequences or scale of failure.

4.2 Landslide on Slope No. 6SW-D/C439 at Tai Lam Correctional Institution, Tuen Mun (Incident No. 2009/04/0866)

At about 7 a.m. on 25 April 2009, a landslide occurred on a vegetated, soil-nailed cut slope (No. 6SW-D/C439) at Tai Lam Correctional Institution, Tuen Mun (Plate 1). The incident involved a shallow washout failure, with an estimated volume of 10 m^3. The landslide scar measured about 6 m long, 4 m wide and 0.5 m deep, exposing some soil nail heads. The landslide debris was deposited on an access road at the slope toe. No casualties were reported as a result of the incident.

4.3 Signs of Distress on Slopes Nos. 11SE-C/C70 and 11SE-C/C89 below 133 Tai Hang Road (Incident No. 2009/05/0867)

A section of Tai Hang Road above two slopes (Nos. 11SE-C/C70 and C89) subsided around 11 p.m. on 29 April 2009, revealing two large cavities (Plate 2). One of the cavities measured about 5 m long, 3 m wide and 3 m deep. Another measured about 2.7 m long, 1.5 m wide and 3 m deep (Plate 2). The affected section of Tai Hang Road was subsequently closed for about 19 hours until 6 p.m. on 30 April 2009 upon completion of the urgent repair works. No casualties were reported as a result of the incident.

During a follow-up inspection on 30 April 2009, signs of distress in the form of surface cracks up to about 200 mm deep and 10 m long were observed along the crest of the 12 m high slope No. 11SE-C/C70. In addition, about 2 m^3 of soil deposit and heavy but clear seepages were noted from the terraced ground in front of a disused building of the Wesley Hostel, about 50 m downslope of Tai Hang Road (Plate 2).

4.4 Natural Terrain Landslide at Zone 259, Lin Ma Hang Road, Sha Tau Kok (Incident No. 2009/08/0897)

The landslide occurred on 6 August 2009, involving a 3 m high mass concrete wall (No. 3NE-A/R10) and the hillside below Lin Ma Hang Road, within the restricted area Zone 259 (Plate 3). The landslide measured about 16 m wide, 11 m long and up to 5 m deep. The failure volume was about 125 m^3, with a runout distance of about 20 m. The landslide severely undermined a section of Lin Ma Hang Road, resulting in collapse of the affected road section. No casualties were reported as a result of the incident.

4.5 Signs of Distress on Slope No. 11NW-B/C582 below Shek Kip Mei No. 2 Fresh Water Service Reservoir, Pak Tin Estate (Incident No. WSD/2009/2/2/K)

Cracking on the shotcrete cover of slope No. 11NW-B/C582 was reported in February 2009 (Plate 4). The slope is a 42 m high soil cut atop a 30 m high rock slope (No. 11NW-B/C97), below Shek Kip Mei No. 2 fresh water service reservoir and overlooking Pak Wan Street and Pak Tin Estate some 30 m and 70 m away respectively. Subsequent removal of the shotcrete cover revealed two tension cracks about 8 m apart in the middle portion of slope No. 11NW-B/C582. One of the tension cracks measured about 4 m long, up to 50 mm deep. Another measured about 5 m long, 400 mm to 500 mm deep. The incident did not have any impact on the facilities nearby.

5. CONCLUSIONS

Rainfall recorded at the HKO's Principal Raingauge at Tsim Sha Tsui amounted to 2,182.3 mm in 2009, which was 8.4% below the mean value of 2,382.7 mm between 1971 and 2000. In 2009, two Landslip Warnings were issued on 19 July and 15 September 2009. Two Red Rainstorm Warnings were issued on 4 June and 17 July 2009, and 20 Amber Rainstorm Warnings were issued between 5 March and 30 September 2009. Of the 101 genuine landslides, two were major failures, 81 were minor failures and 18 were very minor failures with negligible consequences.

Ten landslides in 2009 resulted in notable consequences. Of these ten landslides, one led to temporary evacuation of a squatter dwelling. Two landslides resulted in temporary closure of roads and another seven resulted in temporary closure of pedestrian pavements, footpaths or access paths. No injury or fatality was reported as a result of the 2009 landslides.

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Table 1 - Rainfall and Landslides in 2009 as Compared with Selected Previous Major Rainstorms (Sheet 1 of 2)

Date of Rainstorm Event [1]	Maximum Rainfall (mm) [2]								Number of Landslides Reported to GEO [4]
	Hong Kong Observatory (HKO)					GEO Raingauges [3]			
	24-hr	4-hr	1-hr	Antecedent		24-hr	4-hr	1-hr	
				4-day	15-day				
12-17 September 2009	211.0	85.9	51.0	49.8	52.7	250.5 (K03)	124.5 (N36)	57.5 (N27)	9
19-20 July 2009	136.1	75.1	29.4	17.7	144.1	221.0 (N21)	169.5 (N21)	77.0 (N35)	1
20-28 May 2009	98.9	52.5	30.6	0.6	0.6	231.5 (N25)	150.5 (N25)	94.5 (N38)	4
4-7 August 2009	95.4	72.5	44.1	30.1	141.6	200.0 (N45)	97.5 (K02)	71.0 (N14)	4
10-15 August 2009	71.2	43.1	34.9	8.3	236.5	126.5 (N19)	95.0 (N12)	77.5 (N26)	2
28 September - 1 October 2009	71.0	62.6	37.1	53.0	313.4	125.0 (N51)	102.5 (H12)	63.5 (H26)	2
19-29 June 2009	66.1	20.2	13.6	23.4	169.0	146.0 (N20)	123.5 (H29)	97.5 (N18)	2
4-7 July 2009	63.8	31.2	19.8	0.6	162.9	140.5 (H26)	72.0 (K05)	70.0 (K05)	3
15-17 November 2009	53.9	25.6	9.2	5.4	5.4	124.0 (H09)	71.0 (N16)	25.0 (N16)	0
27-31 July 2009	53.5	30.0	11.6	42.6	193.6	124.5 (H08)	89.5 (H08)	68.0 (H08)	2
8-17 June 2009	49.2	37.1	26.5	36.8	214.6	137.0 (H21)	130.5 (H21)	65.0 (H06)	3
3-5 June 2009	46.9	35.5	24.1	0.0	244.6	99.5 (H26)	80.5 (N36)	73.5 (N36)	3
5-7 March 2009	45.6	30.5	13.5	1.2	1.8	101.0 (N31)	54.0 (N26)	41.0 (N26)	1
25-26 April 2009	43.0	36.3	29.4	1.7	52.5	112.0 (N37)	79.0 (N23)	66.5 (N38)	1
16-20 April 2009	38.6	29.9	11.1	9.3	18.0	94.5 (N48)	54.0 (N20)	49.0 (N28)	0
9-10 September 2009	37.1	37.1	20.0	0.0	2.9	76.0 (K04)	76.0 (K04)	70.0 (K04)	1
24-28 March 2009	34.4	27.0	24.0	0.1	0.5	75.0 (N28)	73.0 (N28)	73.0 (N28)	2

Notes:
(1) Rainstorms are arranged in order of the rolling 24-hour rainfall at the Hong Kong Observatory in Tsim Sha Tsui.
(2) The maximum rainfalls are calculated using 5-minute rainfall as the basic unit, except those recorded at the HKO, for which the rolling rainfall is calculated using one-clock hour rainfall as the basic unit.
(3) The maximum rainfalls are selected from the 86 GEO Raingauges for the rainstorms. The GEO Raingauge reference number is shown in brackets.
(4) Reported nos. of landslides refer to those genuine landslides that can be attributed to the rainstorm events.

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Table 1 - Rainfall and Landslides in 2009 as Compared with Selected Previous Major Rainstorms (Sheet 2 of 2)

Date of Rainstorm Event	Maximum Rainfall (mm) [1]								Number of Landslides Reported to GEO [2]
	Hong Kong Observatory (HKO)					GEO Raingauges [3]			
	24-hr	4-hr	1-hr	Antecedent		24-hr	4-hr	1-hr	
				4-day	15-day				
Selected Major Rainstorms in Previous Years (for comparison only)									
20-21 May 1989	387.8	119.3	37.3	27.9	41.7	566.0 (N14)	194.5 (N14)	61.5 (N14)	378
7-9 May 1992	324.7	195.0	109.9	4.2	9.1	386.5 (H10)	243.0 (H10)	144.5 (H19)	314
15-16 June 1993	155.1	122.3	54.1	155.8	296.1	285.0 (N13)	191.5 (N13)	111.0 (H13)	123
4-5 November 1993	106.6	27.8	9.4	0	0	745.0 (N17)	285.0 (N17)	114.0 (N17)	394
21-25 July 1994	310.2	141.9	70.4	18.7	310.1	956.0 (N14)	365.0 (N14)	211.5 (N14)	208
3-11 August 1994	74.1	44.9	27.1	8.1	759.1	381.0 (N14)	187.5 (N14)	103.5 (N14)	46
11-15 August 1995	325.7	109.1	43.8	5.1	436.9	468.0 (H08)	223.5 (H14)	106.0 (N14)	110
3-5 June 1997	150.2	83.7	46.4	0.9	33.6	367.5 (N04)	262.5 (N04)	128.5 (N04)	81
1-4 July 1997	148.8	106.7	45.4	33.5	362.7	800.0 (N09)	249.5 (N09)	125.0 (N01)	150
8-9 June 1998	428.4	152.4	71.7	86.6	246.8	562.0 (N15)	218.5 (N15)	98.0 (N09)	96
22-26 August 1999	313.1	127.4	50.7	6.8	170.3	565.0 (N14)	230.5 (N10)	120.5 (N10)	269
16-21 August 2005	416.4	122.9	39.1	110.7	214.1	570.0 (N01)	173.5 (N18)	82.0 (N25)	229
6-9 June 2008	417.6	246.3	145.5	99.9	242.5	622.5 (N19)	384.0 (N19)	153.5 (N21)	363

Notes:
(1) The maximum rainfalls are calculated using 5-minute rainfall as the basic unit, except those recorded at the HKO, for which the rolling rainfall is calculated using one-clock hour rainfall as the basic unit.
(2) Reported nos. of landslides refer to those genuine landslides that can be attributed to the rainstorm events.
(3) The maximum rainfalls are selected from all the available GEO Raingauges for the rainstorms. The GEO Raingauge reference number is shown in brackets.

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Table 2 - Warnings Issued by the Hong Kong Observatory in 2009

Month	Monthly Total Rainfall (mm)	Dates on which Warnings [1] were in Effect				
		Thunderstorm [2]	Flooding	Landslip [3]	Tropical Cyclone [4]	Rainstorm
January	0.0	-	-	-	-	-
February	1.1	-	-	-	-	-
March	120.7	5, 6, 7 , 24, 25, 27, 29	-	-	-	5 (2 x Amber), 24 (Amber)
April	108.7	13, 16, 25	-	-	-	16 (Amber), 25 (Amber)
May	245.2	19, 20, 21, 23, 24, 25, 26, 27	-	-	-	21 (Amber), 23 (Amber), 24 (Amber)
June	341.8	3, 4, 8, 9, 10, 11, 12, 13, 14, 15, 16, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30	4	-	20-21 (1, LINFA), 26-27 (1-3, NANGKA)	4 (2 x Amber, Red), 11 (Amber), 12 (Amber)
July	389.4	3, 4, 5, 6, 15, 16, 18, 19, 20, 25, 26, 27, 28, 29, 30	19	19 (03:00 - 12:35)	10-12 (1-3, SOUDELOR), 17-19 (1-9, MOLAVE)	6 (Amber), 19 (Amber, Red)
August	334.1	3, 5, 6, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24, 25, 26, 27, 29, 30, 31	11	-	3-5 (1-8, GONI)	5 (Amber), 11 (Amber)
September	486.3	1, 2, 4, 9, 11, 12, 13, 14, 15, 16, 19, 20, 21, 28, 30	15	15 (18:00) - 16 (00:30)	10-11 (1-3, MUJIGAE) 13-15 (1-8, KOPPU) 27-28 (1, KETSANA)	13 (Amber), 15 (2 x Amber), 30 (Amber)
October	44.4	-	-	-	-	-
November	60.4	-	-	-	-	-
December	50.2	-	-	-	-	-
Total	2,182.3	126 Warnings	4 Warnings	2 Warnings	8 Warnings	22 Warnings (20 x Amber & 2 x Red)

Notes:
(1) Warnings and signals were based on the information from the HKO.
(2) More than one Thunderstorm Warning may have been issued within a day but have only been shown once for clarity.
(3) Landslip Warning was issued after consultation between the GEO and the HKO.
(4) Tropical Cyclone Warning signal no. hoisted is shown in the bracket followed by the name of the tropical cyclone.

Table 3 - Breakdown of Landslides Reported to Government Departments in 2009

Department	Reported Number of Landslides	Genuine Landslides
Agriculture, Fisheries and Conservation Department	2 (0)	2 (0)
Architectural Services Department	10 (3)	10 (3)
Drainage Services Department	0 (0)	0 (0)
Fire Services Department	0 (0)	0 (0)
Geotechnical Engineering Office, Civil Engineering and Development Department	66[(3)]	65[(1)]
Highways Department	22 (18)	22 (18)
Housing Department	0 (0)	0 (0)
Lands Department	5 (1)	5 (1)
Water Supplies Department	19 (0)	19 (0)
Total	124 (22)[(2)]	123 (22)[(2)]

Legend:

10 (3) Ten incidents were reported to the Government Department concerned, three of which were also reported to the GEO spearately by other parties (i.e. duplicate cases)

Notes:

(1) A total of 66 landslide incidents that occurred in 2009 (discounting duplicated cases) were reported to the GEO. Sixty five reported incidents were classified as genuine landslide.

(2) The number of reported landslide incidents in 2009 (discounting duplicate cases) is 102 [124 - 22]. The number of genuine landslides is **101** [123 - 22].

(3) There were 81 incidents recorded in the Integrated Landslide Information System (ILIS) for the year 2009 (GEO, 2010). Of the 81 incidents, 16 occurred in 2008 but were reported to the GEO in early 2009. Another incident occurred in 2009 but was reported to the GEO in early 2010. In summary, the number of incidents reported to the GEO in 2009 is 66 (i.e. 81 – 16 + 1).

Table 4 - Breakdown of Landslides Affecting Different Facilities

Affected Facility	Hong Kong Island	Kowloon	New Territories and Outlying Islands	All
Buildings	0 (0)	0 (0)	4 (0)	4 (0)
Registered Squatter Dwellings	0 (0)	0 (0)	10 (0)	10 (0)
Roads	7 (0)	1 (0)	3 (0)	11 (0)
Transportation Facilities (e.g. railways, tramways, etc.)	0 (0)	0 (0)	0 (0)	0 (0)
Pedestrian Pavements/Footways	1 (0)	0 (0)	2 (0)	3 (0)
Minor Footpaths/Access Paths	9 (0)	3 (0)	19 (2)	31 (2)
Construction Sites	0 (0)	1 (0)	0 (0)	1 (0)
Open Areas	3 (0)	1 (0)	11 (0)	15 (0)
Catchwaters	1 (0)	0 (0)	3 (0)	4 (0)
Others (e.g. carparks, parks, playgrounds, gardens, backyards, etc.)	9 (0)	1 (0)	7 (0)	17 (0)
Nil consequence	1 (0)	1 (0)	4 (0)	6 (0)
Total	31 (0)	8 (0)	63 (2)	102 (2)

Legend:

19 (2) Nineteen landslides of which two were major failures (i.e. failure volume ≥ 50 m^3)

Notes:
(1) A given landslide may affect more than one key type of facility.
(2) Incidents that were not genuine landslides have been excluded.
(3) Nil consequence refers to incidents where the landslide debris came to rest on areas with no proper access for the public (e.g. natural hillside, slope berm, disused quarry surrounded by fence, etc.).

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Table 5 - Landslide Consequences Related to Type of Slope Failure

Type of Slope Failure		Number of Squatter Dwellings [1] Evacuated		Number of Floors, Houses or Flats Evacuated or Partially Closed	Number of Closure			Deaths	Injuries
		Permanent	Temporary		Roads	Pedestrian Pavements	Footpaths, Alleyways or Private Access Paths		
Fill Slopes		0	0	0	1	0	0	0	0
Cut Slopes	Soil	0	1(1)	0	1	1	3	0	0
	Soil/Rock	0	0	0	0	0	1	0	0
	Rock	0	0	0	0	0	0	0	0
Retaining Walls		0	0	0	0	0	1	0	0
Natural Hillside		0	0	0	0	0	1	0	0
Registered Disturbed Terrain		0	0	0	0	0	0	0	0
Total		0	1(1)[2]	0	2	1	6	0	0

Legend:

1(1) Number of squatter dwellings evacuated, with the number of tolerated squatter structures evacuated shown in brackets

Notes:

(1) A squatter dwelling is defined as a place of residence that contains one or more tolerated squatter structures, i.e. structures built for domestic purposes or non-domestic purposes and registered in 1982 Housing Department's Squatter Structure Survey (GEO, 2010).

(2) A minor rockfall incident (No. 2009/06/0882) behind Block A, Yen Lok Building in Chai Wan resulted in the evacuation of occupants in an unauthorised structure.

Table 6 - Distribution of Facility Groups Affected by Major Landslides

Type of Major Landslide	Facility Group Affected by Major Landslides (Group No.)						
	1a	1b	2a	2b	3	4	5
All Major Landslides	0	0	0	0	0	0	2
Major Landslides on Man-made Slopes	0	0	0	0	0	0	1
Major Landslides on Registered Disturbed Terrain	0	0	0	0	0	0	0
Major Landslides on Natural Hillside	0	0	0	0	0	0	1

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

Table 7 - Breakdown of Landslides by Type of Slope Failure

Type of Failure		Number	Percentage (%)
Fill Slopes		8 (0)	7.9
Cut Slopes	Soil	35 (1)	34.6
	Soil/Rock	22 (0)	21.8
	Rock	4 (0)	4.0
Retaining Walls		7 (0)	6.9
Natural Hillside		24 (1)	23.8
Registered Disturbed Terrain		1 (0)	1.0
Total		101 (2)	100

Legend:

35 (1) Thirty five landslides, one of which was major failure

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

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Table 8 - Landslide Volume Distribution with Respect to Geographical Locations

Volume of Failure (m^3)	Hong Kong Island	Kowloon	New Territories and Outlying Islands	All
< 5	29	5	39	73 (72.3%)
≥ 5 to < 10	0	0	10	10 (9.9%)
≥ 10 to < 20	1	1	7	9 (8.9%)
≥ 20 to < 50	1	1	5	7 (6.9%)
≥ 50 to < 200	0	0	2	2 (2%)
≥ 200 to < 500	0	0	0	0 (0%)
≥ 500 to < 1000	0	0	0	0 (0%)
≥ 1000	0	0	0	0 (0%)
Total	31	7	63	101 (100%)

Legend:

10 (9.9%) Ten landslides, which amount to 9.9% of the total 101 genuine landslides reported to the Government

Note: Two landslides involved a failure volume ≥ 50 m^3.

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

Volume of Failure (m^3)	Fill Slope	Cut Slope			Retaining Wall	Natural Hillsides	Registered Disturbed Terrain	Total
		Soil	Soil/Rock	Rock				
< 5	4	25	20	4	6	13	1	73 (72.3%)
≥ 5 to < 10	3	3	1	0	0	3	0	10 (9.9%)
≥ 10 to < 20	1	3	1	0	1	3	0	9 (8.9%)
≥ 20 to < 50	0	3	0	0	0	4	0	7 (6.9%)
≥ 50 to < 200	0	1	0	0	0	1	0	2 (2%)
≥ 200 to < 500	0	0	0	0	0	0	0	0 (0%)
≥ 500 to < 1000	0	0	0	0	0	0	0	0 (0%)
≥ 1000	0	0	0	0	0	0	0	0 (0%)
Total	8	35	22	4	7	24	1	101 (100%)

Legend:

10 (9.9%) Ten landslides, which amount to 9.9% of the total 101 genuine landslides reported to the Government

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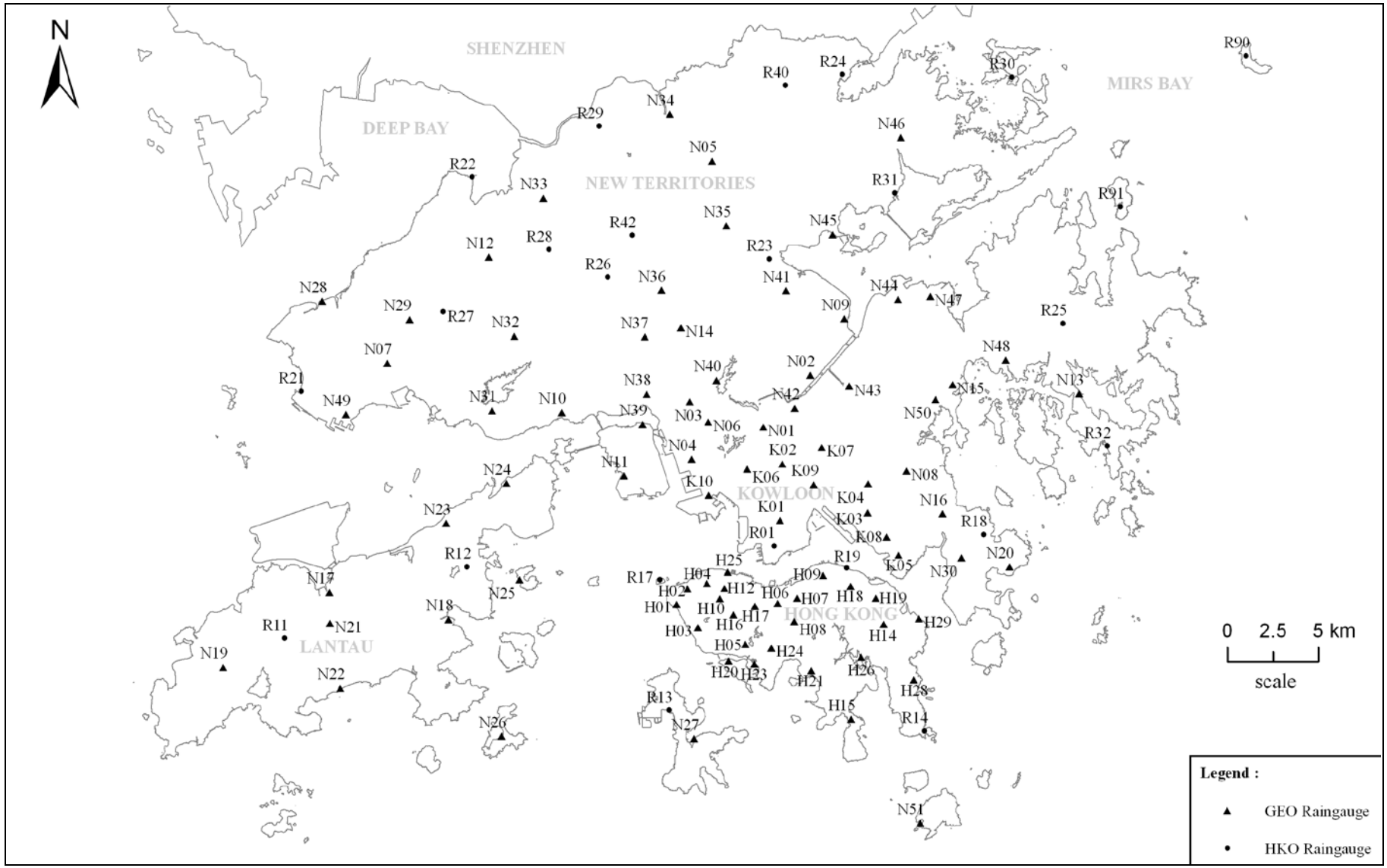
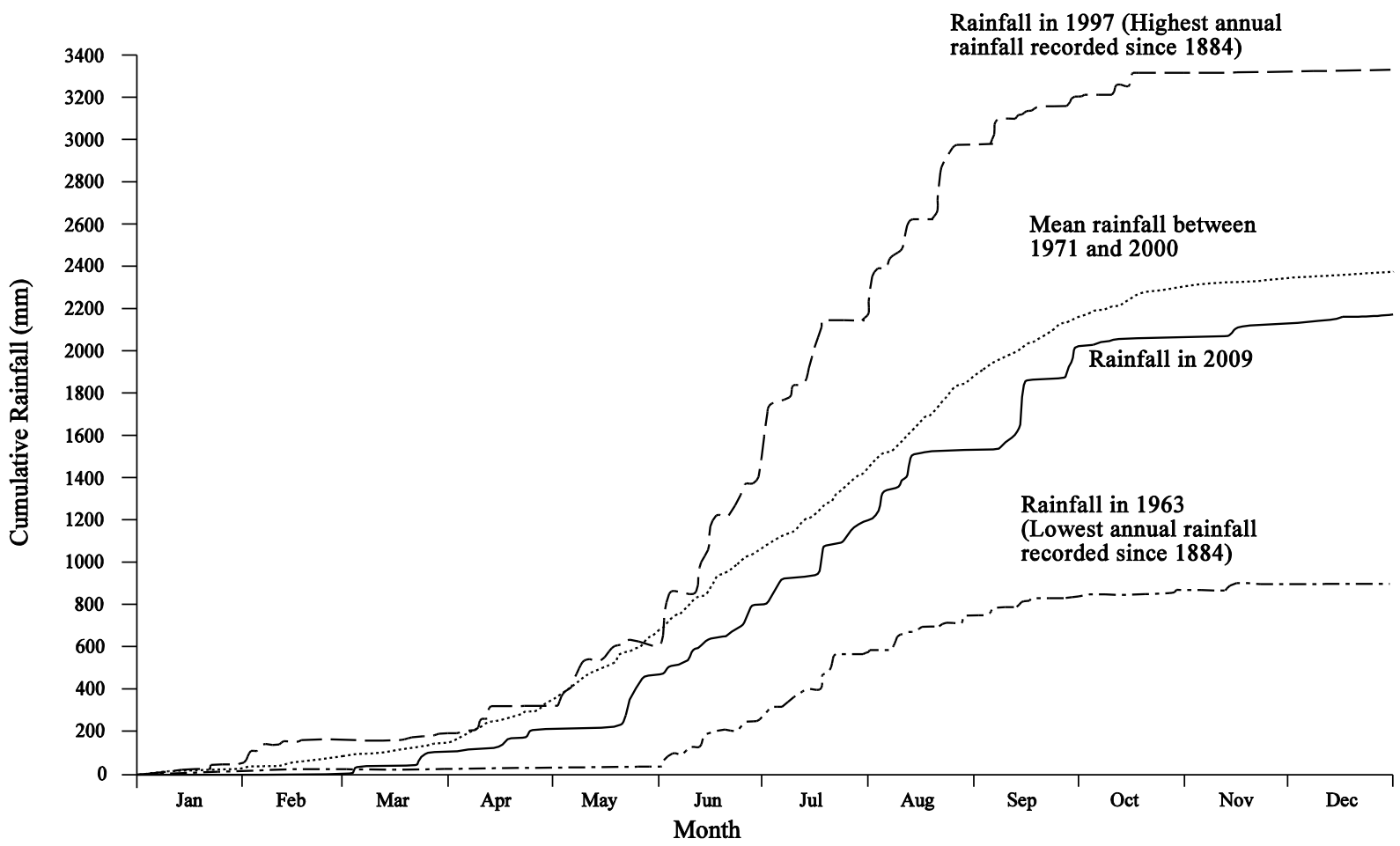


Figure 1 - Locations of GEO and HKO Automatic Raingauges



Note: Rainfall recorded at Hong Kong Observatory, Tsim Sha Tsui.

Figure 2 - Cumulative Rainfall for 2009 at the Hong Kong Observatory and its Recorded Highest, Mean and Lowest Cumulative Rainfalls

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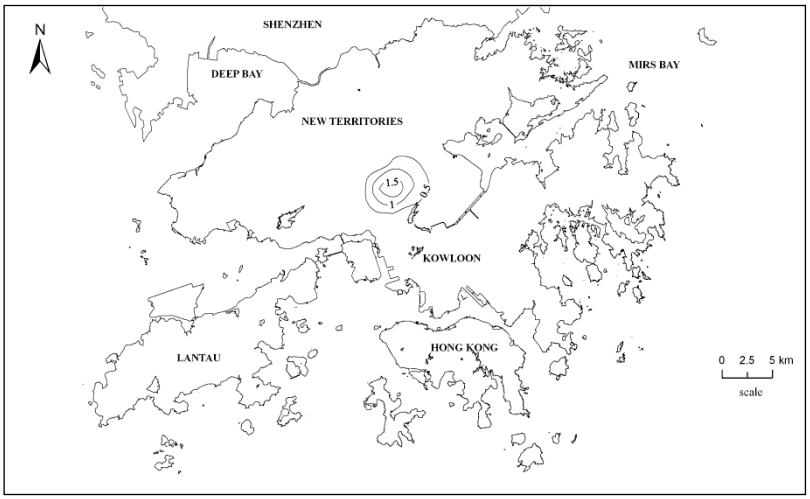
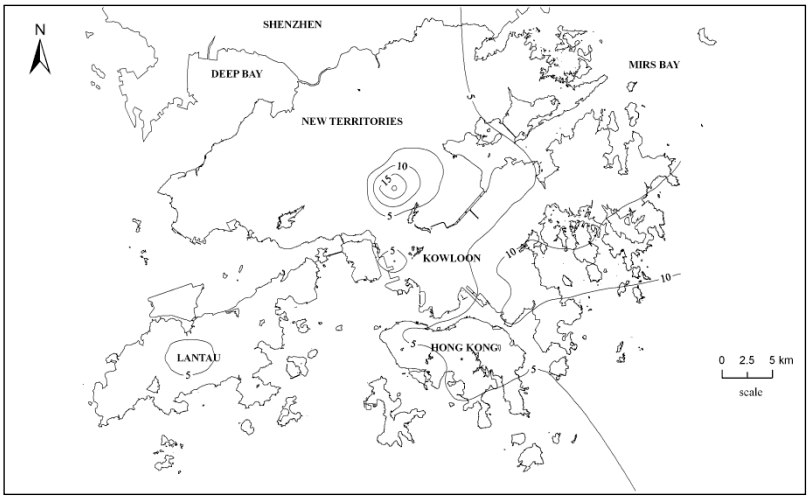
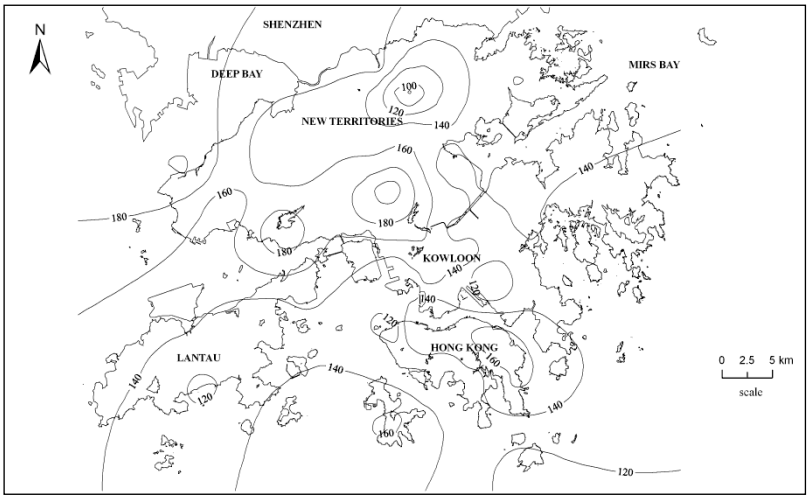


January 2009



February 2009



March 2009

Note: Isohyets are based on the GEO and HKO raingauges.

Figure 3a - Monthly Rainfall Distribution in 2009

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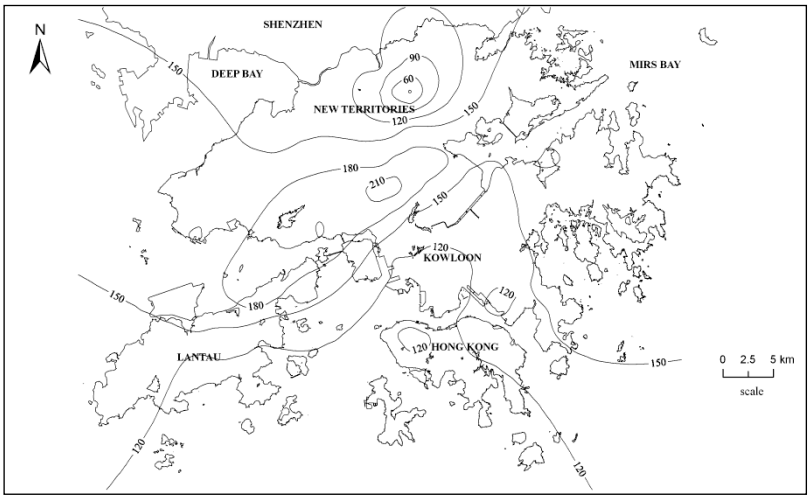
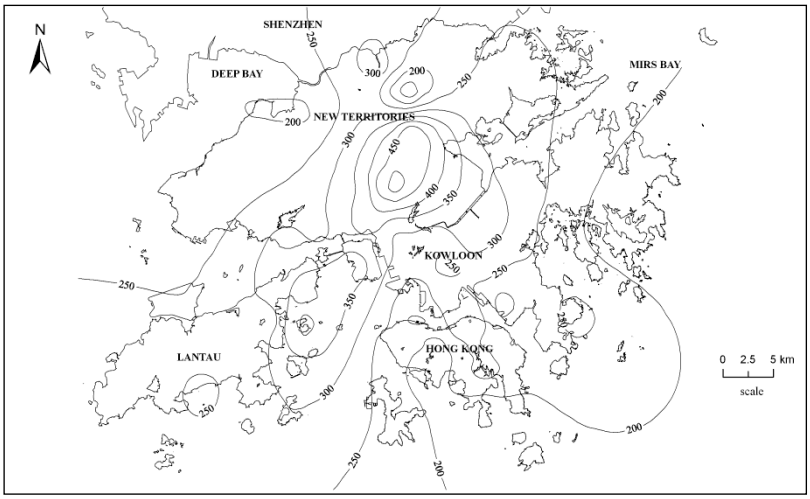
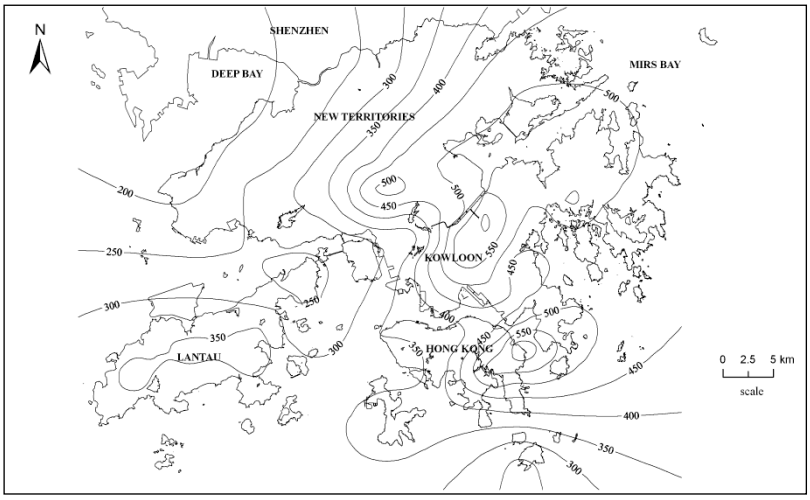


April 2009



May 2009



June 2009

Note: Isohyets are based on the GEO and HKO raingauges.

Figure 3b - Monthly Rainfall Distribution in 2009

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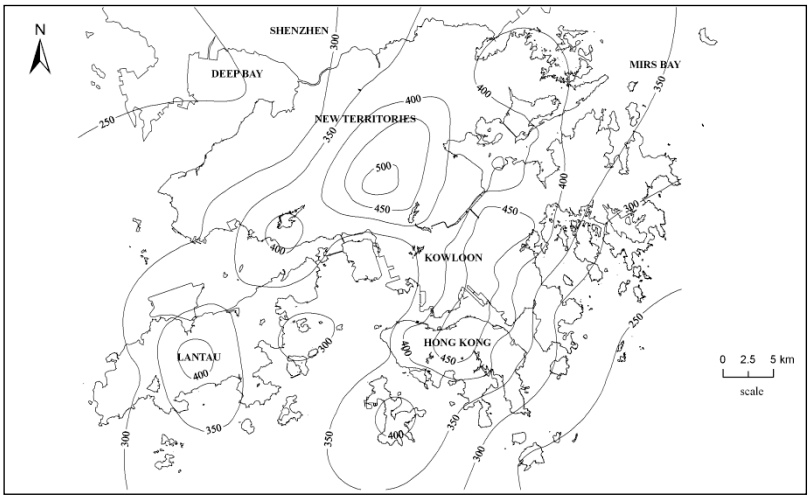
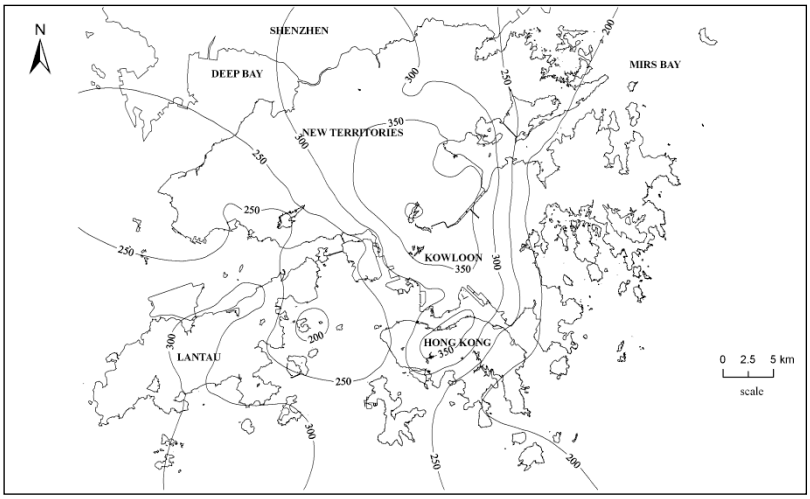
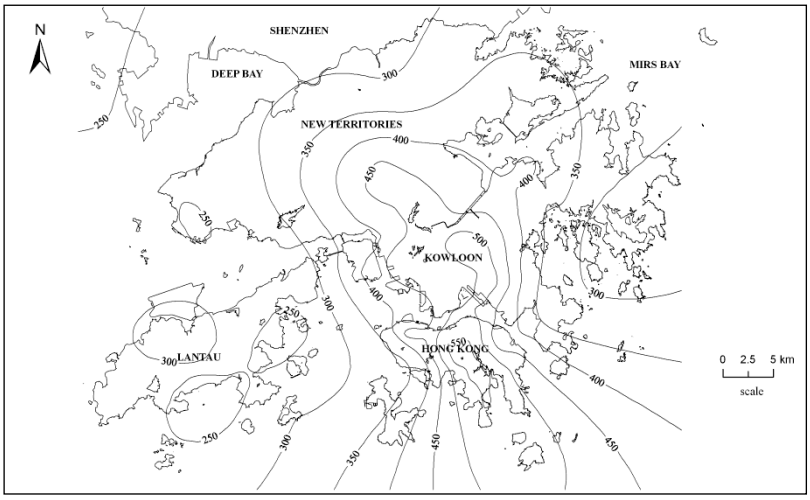


July 2009



August 2009



September 2009

Note: Isohyets are based on the GEO and HKO raingauges.

Figure 3c - Monthly Rainfall Distribution in 2009

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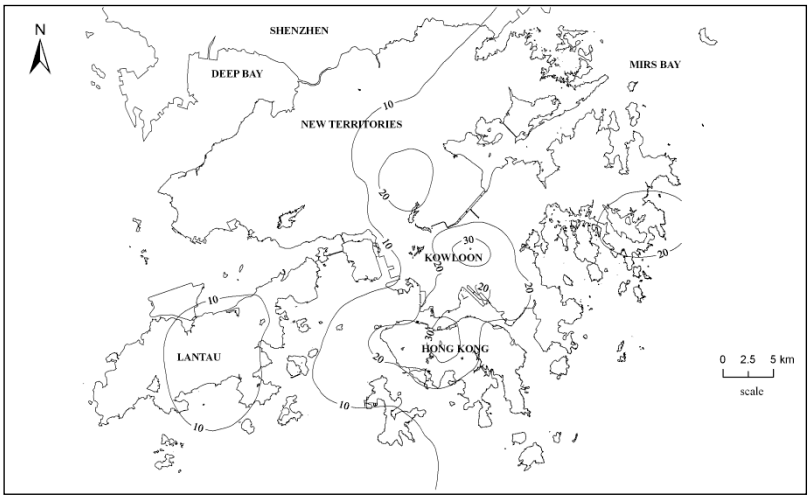
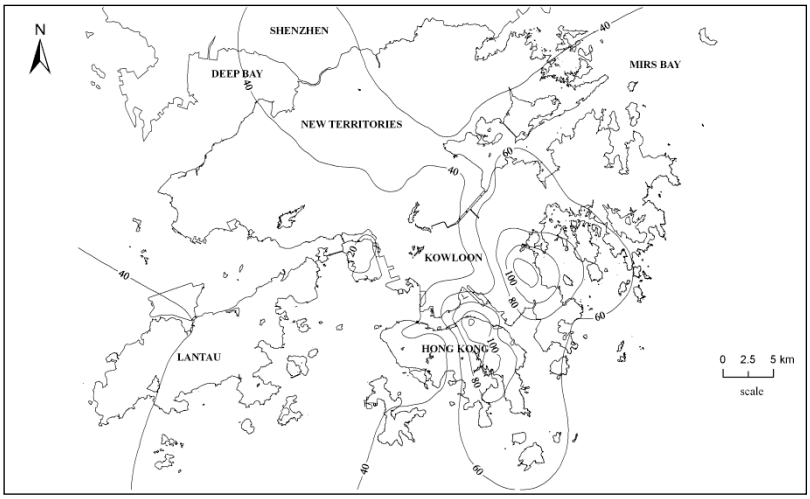
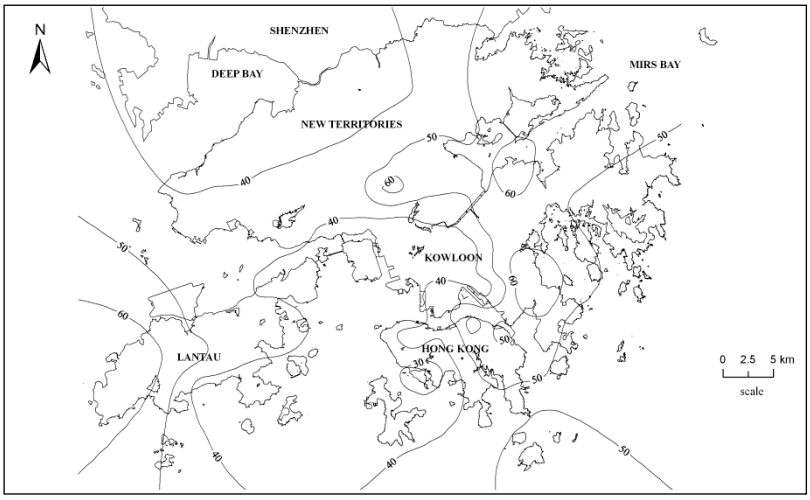


October 2009



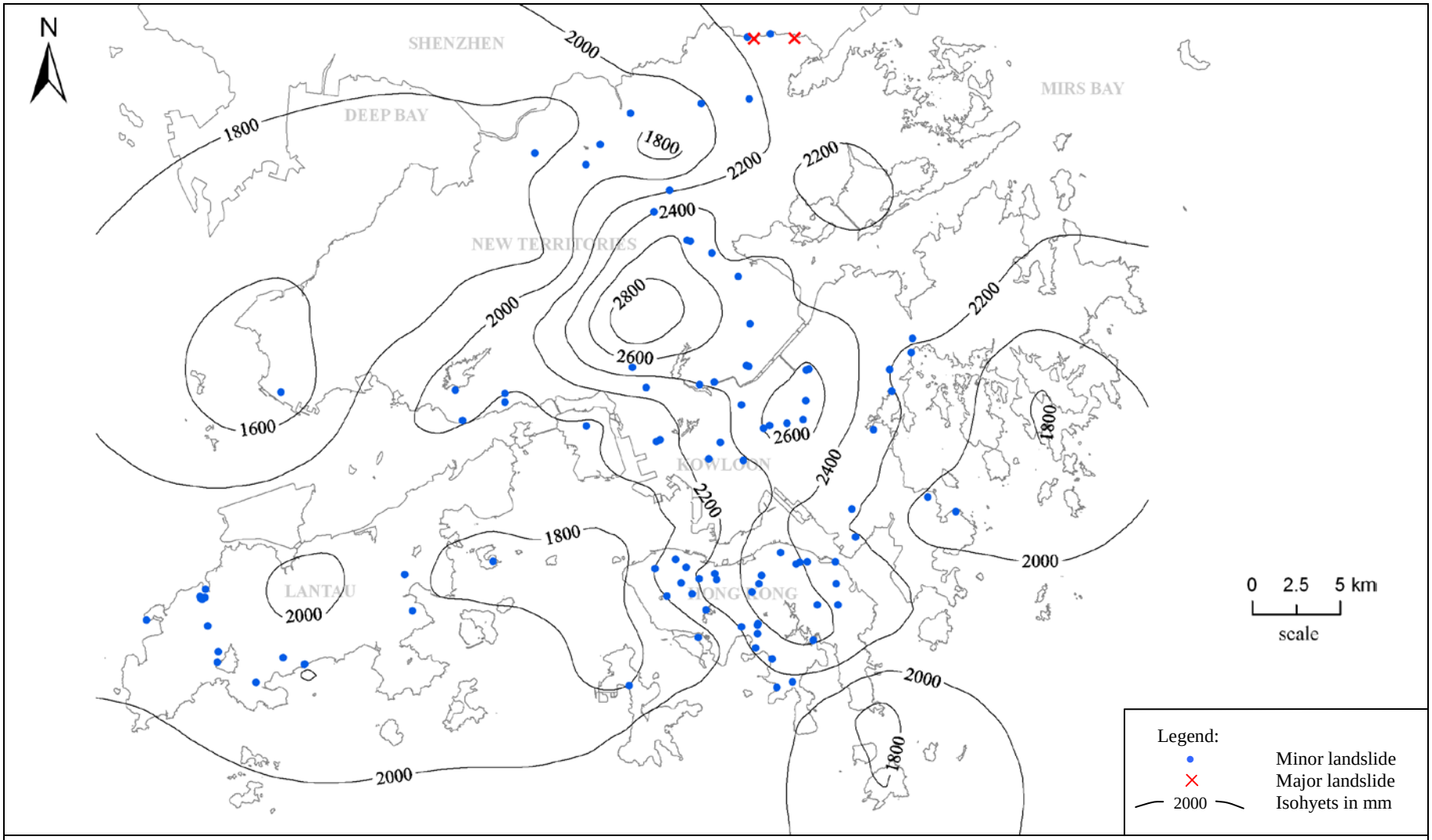
November 2009



December 2009

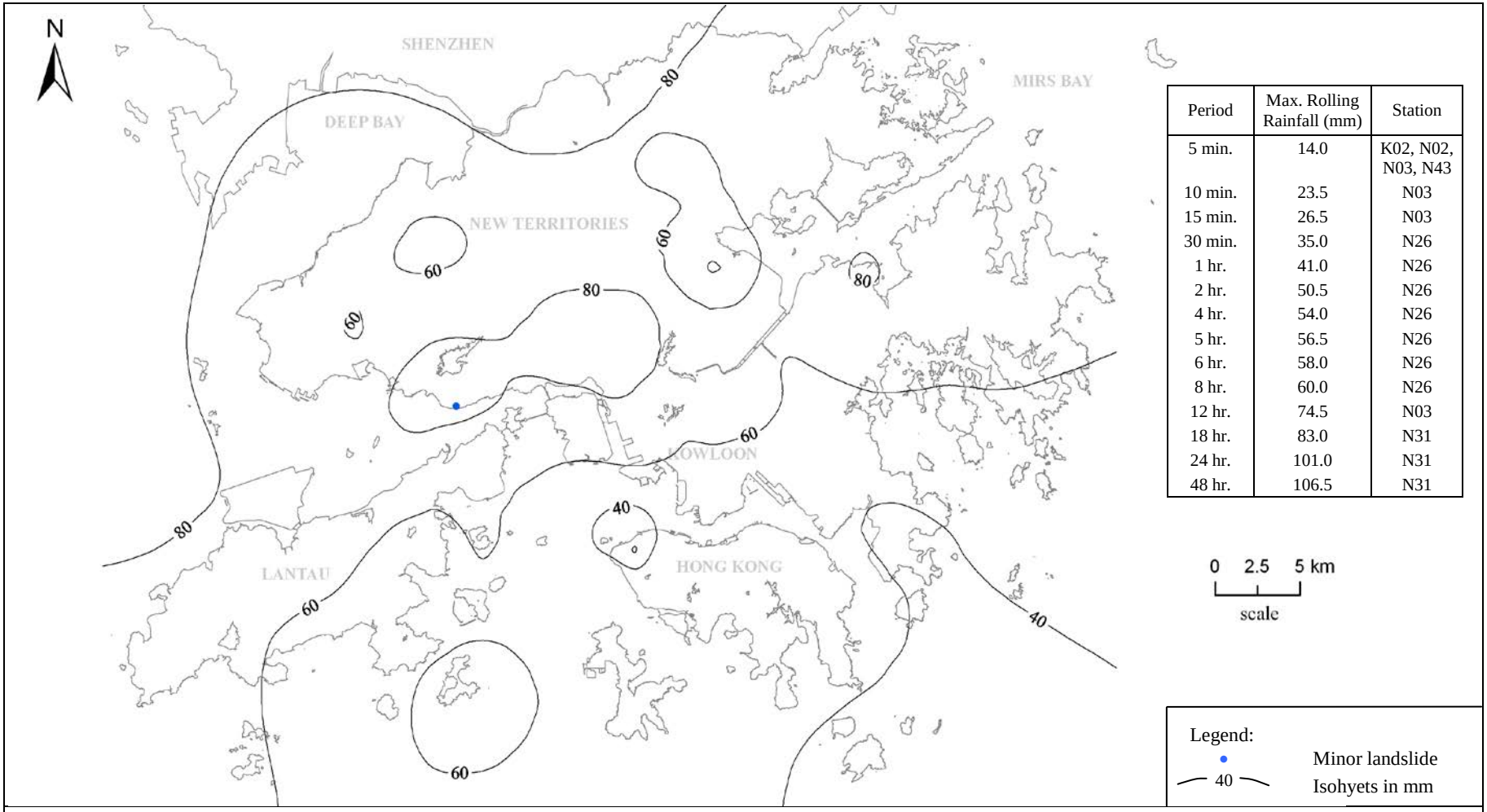
Note: Isohyets are based on the GEO and HKO raingauges.

Figure 3d - Monthly Rainfall Distribution in 2009



Notes: (1) Isohyets are based on the GEO and HKO raingauges.
(2) Only the genuine landslides in 2009 (101 nos.) reported to the GEO and other Government Departments are shown.

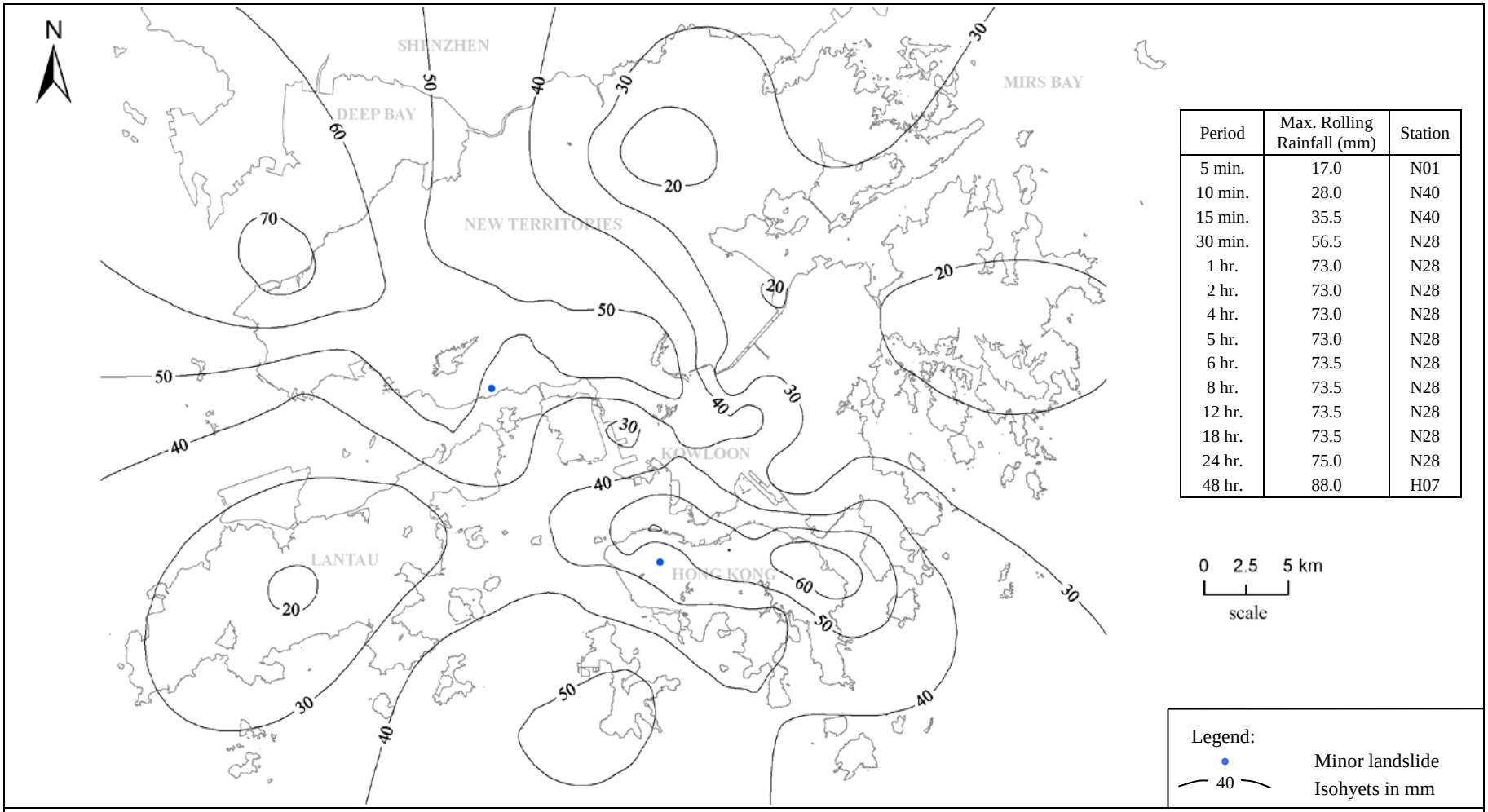
Figure 4 - Annual Rainfall Distribution and Locations of Reported Landslides in 2009



Period	Max. Rolling Rainfall (mm)	Station
5 min.	14.0	K02, N02, N03, N43
10 min.	23.5	N03
15 min.	26.5	N03
30 min.	35.0	N26
1 hr.	41.0	N26
2 hr.	50.5	N26
4 hr.	54.0	N26
5 hr.	56.5	N26
6 hr.	58.0	N26
8 hr.	60.0	N26
12 hr.	74.5	N03
18 hr.	83.0	N31
24 hr.	101.0	N31
48 hr.	106.5	N31

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) A genuine landslide reported to have occurred within the period between 5 March and 7 March 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

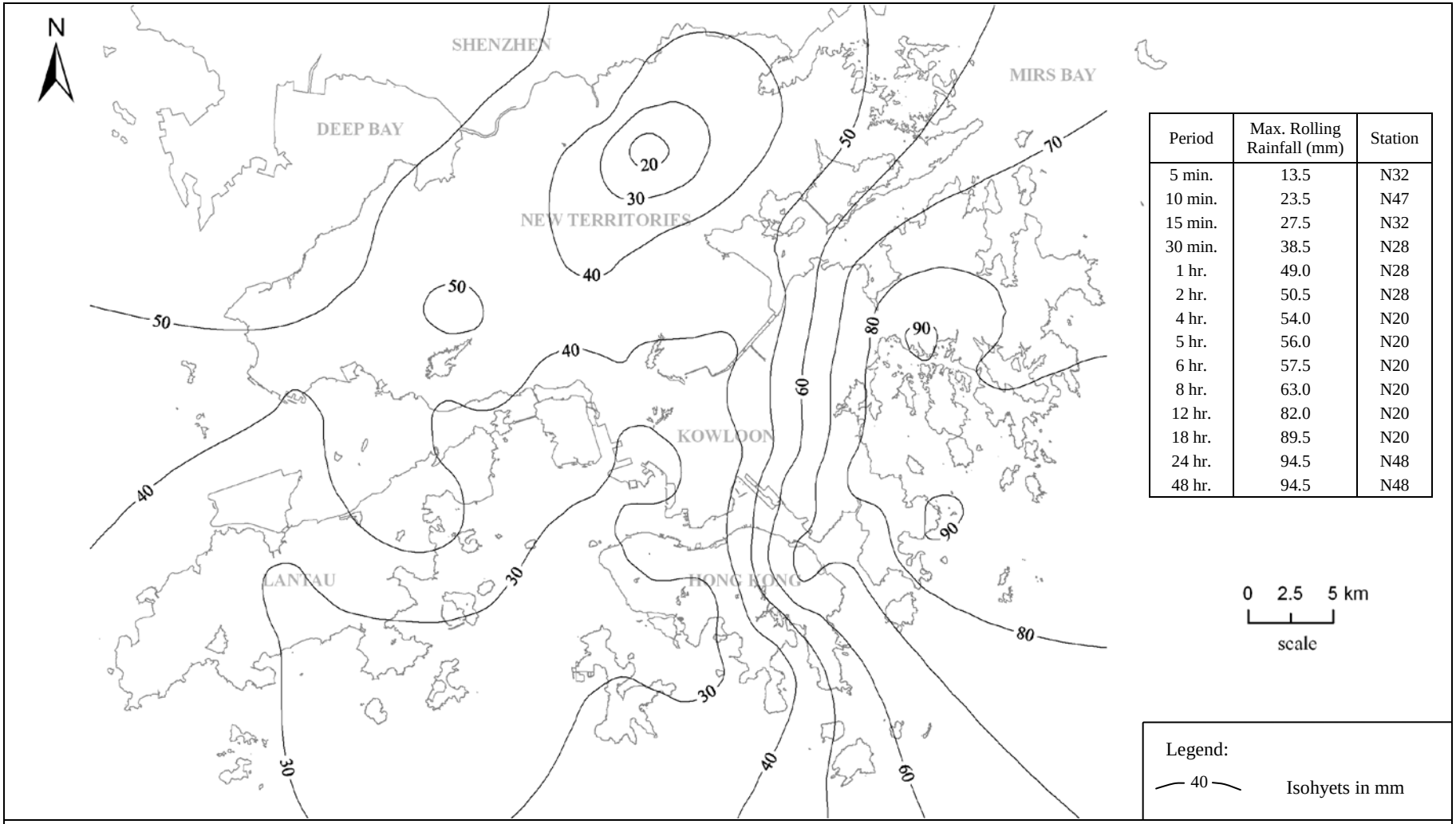
Figure 5 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 5 March (00:00) and 7 March (24:00) 2009 and Locations of Landslides



Period	Max. Rolling Rainfall (mm)	Station
5 min.	17.0	N01
10 min.	28.0	N40
15 min.	35.5	N40
30 min.	56.5	N28
1 hr.	73.0	N28
2 hr.	73.0	N28
4 hr.	73.0	N28
5 hr.	73.0	N28
6 hr.	73.5	N28
8 hr.	73.5	N28
12 hr.	73.5	N28
18 hr.	73.5	N28
24 hr.	75.0	N28
48 hr.	88.0	H07

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) Two genuine landslides reported to have occurred within the period between 24 March and 28 March 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

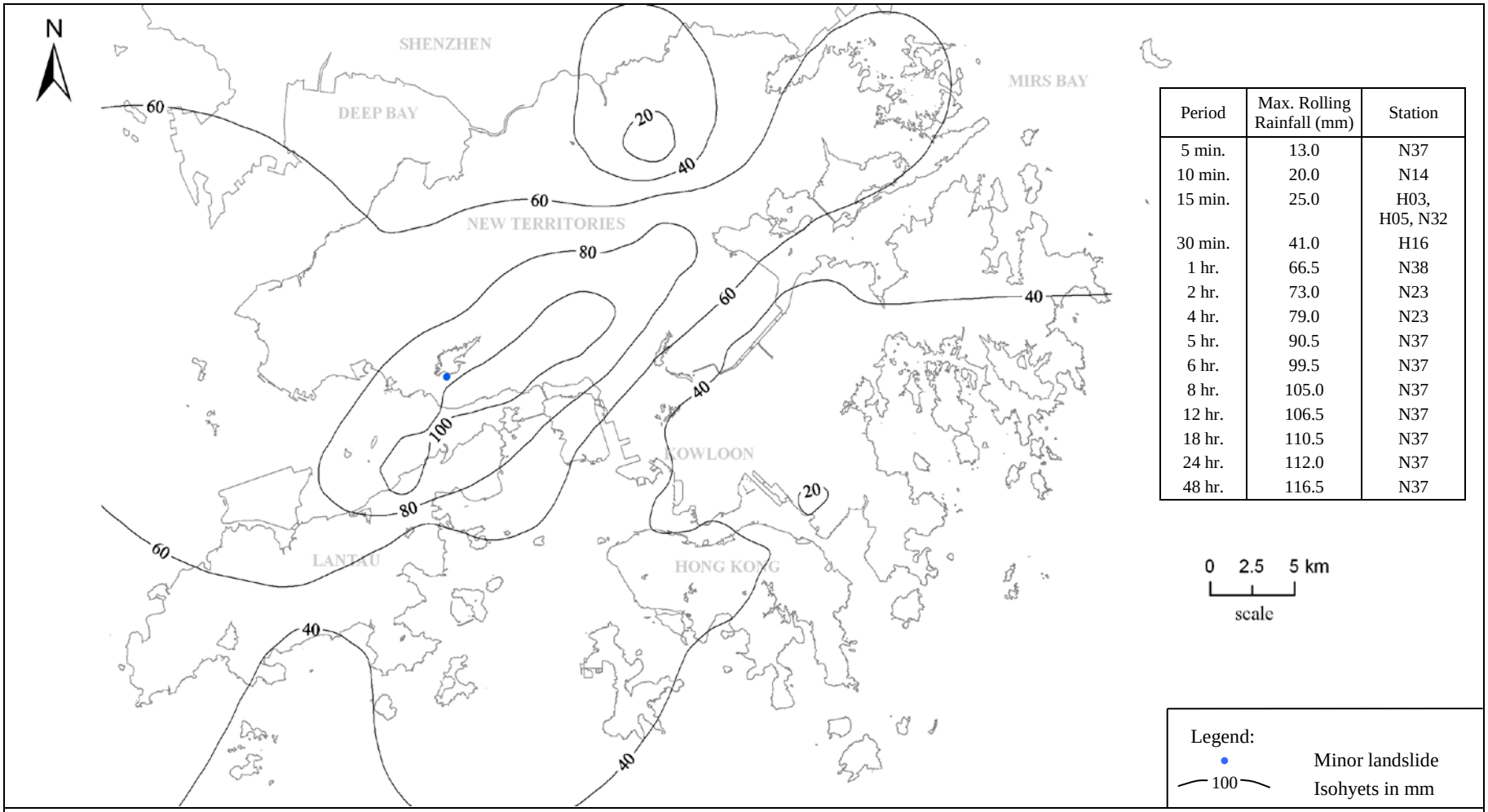
Figure 6 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 24 March (00:00) and 28 March (24:00) 2009 and Locations of Landslides



Period	Max. Rolling Rainfall (mm)	Station
5 min.	13.5	N32
10 min.	23.5	N47
15 min.	27.5	N32
30 min.	38.5	N28
1 hr.	49.0	N28
2 hr.	50.5	N28
4 hr.	54.0	N20
5 hr.	56.0	N20
6 hr.	57.5	N20
8 hr.	63.0	N20
12 hr.	82.0	N20
18 hr.	89.5	N20
24 hr.	94.5	N48
48 hr.	94.5	N48

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) No genuine landslide was reported to have occurred within the period between 16 April and 20 April 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure 7 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 16 April (00:00) and 20 April (24:00) 2009



Period	Max. Rolling Rainfall (mm)	Station
5 min.	13.0	N37
10 min.	20.0	N14
15 min.	25.0	H03, H05, N32
30 min.	41.0	H16
1 hr.	66.5	N38
2 hr.	73.0	N23
4 hr.	79.0	N23
5 hr.	90.5	N37
6 hr.	99.5	N37
8 hr.	105.0	N37
12 hr.	106.5	N37
18 hr.	110.5	N37
24 hr.	112.0	N37
48 hr.	116.5	N37

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) A genuine landslide reported to have occurred within the period between 25 April and 26 April 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure 8 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 25 April (00:00) and 26 April (24:00) 2009 and Locations of Landslides

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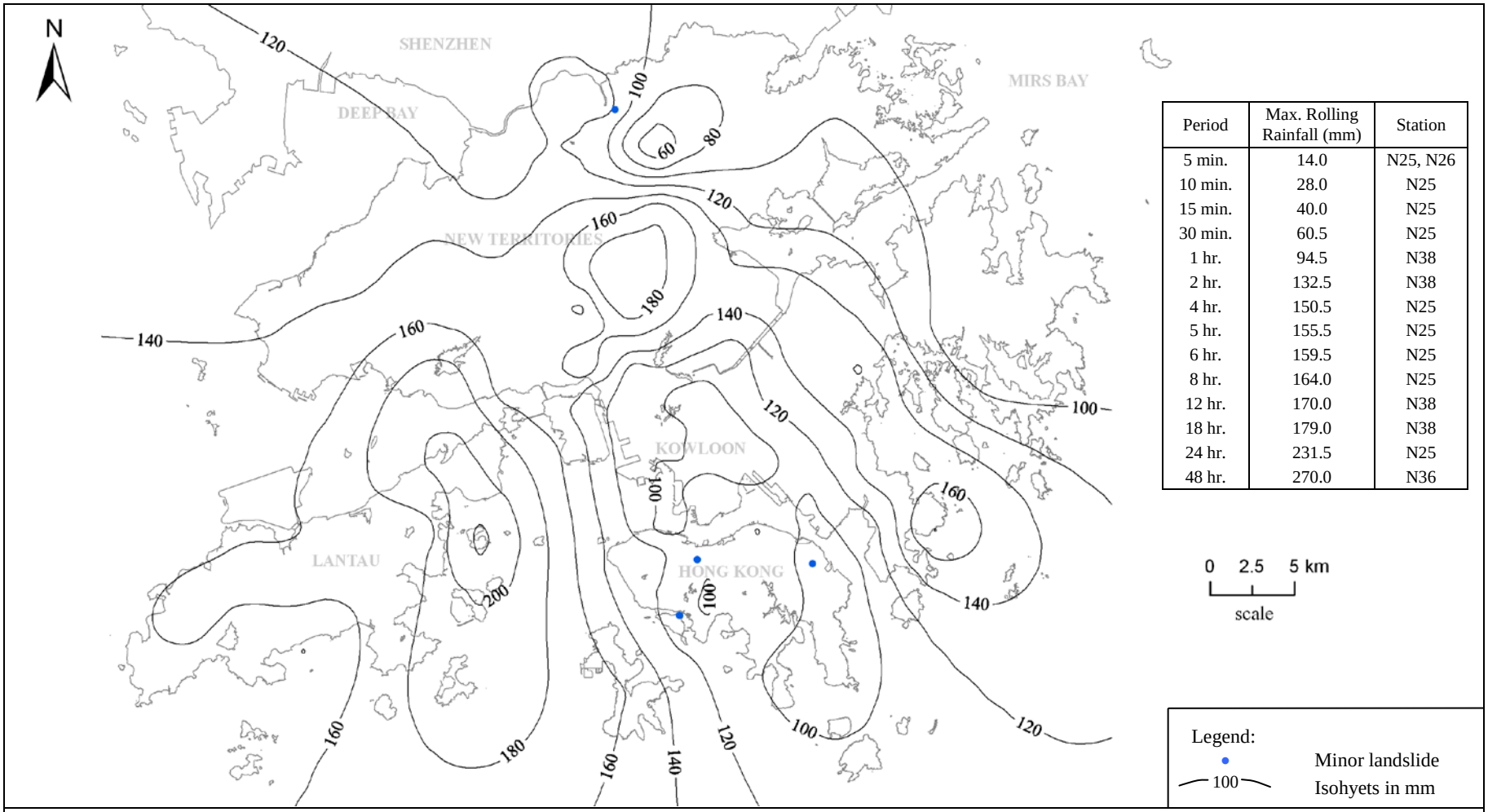

Period	Max. Rolling Rainfall (mm)	Station
5 min.	14.0	N25, N26
10 min.	28.0	N25
15 min.	40.0	N25
30 min.	60.5	N25
1 hr.	94.5	N38
2 hr.	132.5	N38
4 hr.	150.5	N25
5 hr.	155.5	N25
6 hr.	159.5	N25
8 hr.	164.0	N25
12 hr.	170.0	N38
18 hr.	179.0	N38
24 hr.	231.5	N25
48 hr.	270.0	N36

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) Four genuine landslides reported to have occurred within the period between 20 May and 28 May 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure 9 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 20 May (00:00) and 28 May (24:00) 2009 and Locations of Landslides

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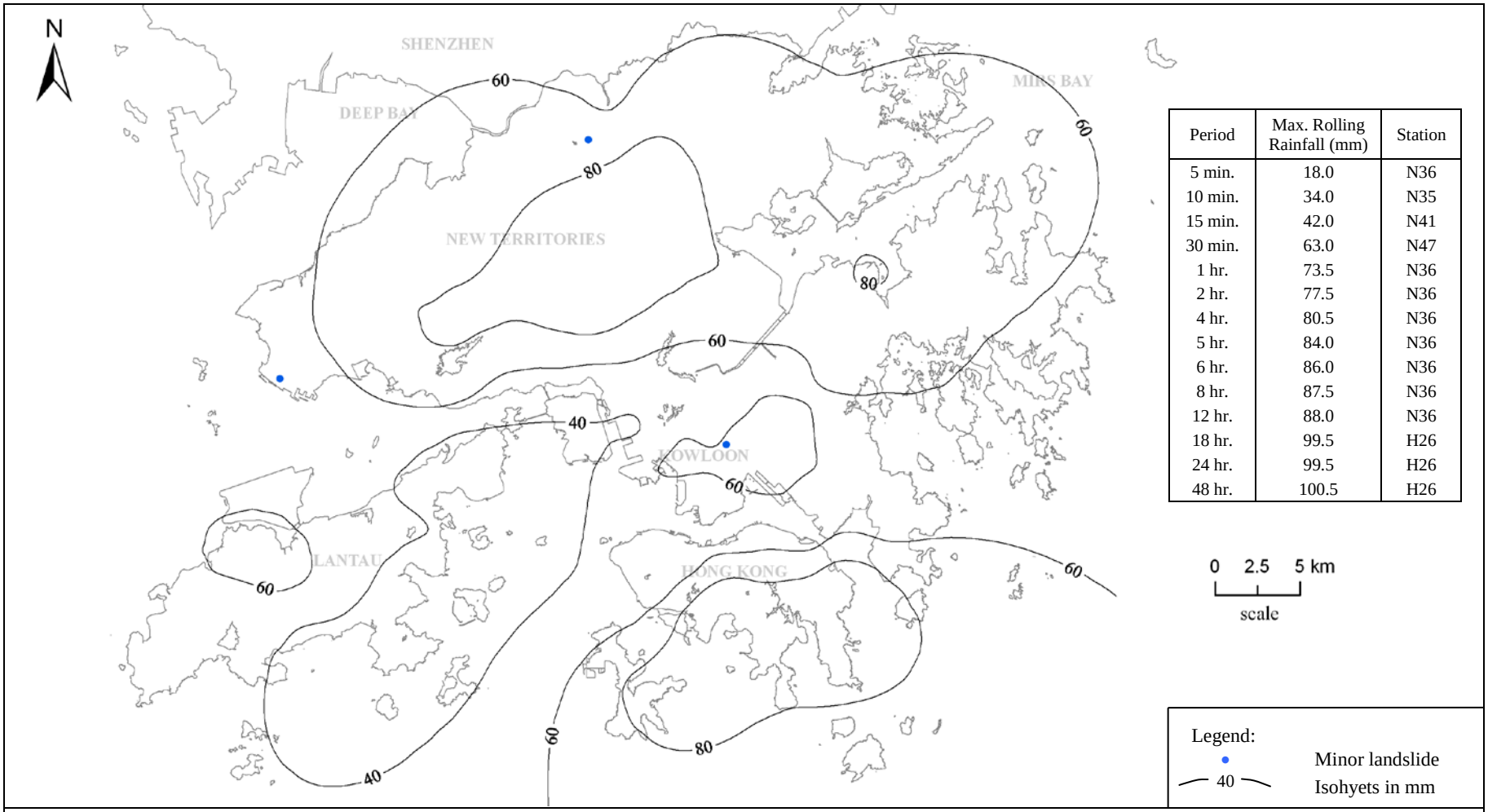

Period	Max. Rolling Rainfall (mm)	Station
5 min.	18.0	N36
10 min.	34.0	N35
15 min.	42.0	N41
30 min.	63.0	N47
1 hr.	73.5	N36
2 hr.	77.5	N36
4 hr.	80.5	N36
5 hr.	84.0	N36
6 hr.	86.0	N36
8 hr.	87.5	N36
12 hr.	88.0	N36
18 hr.	99.5	H26
24 hr.	99.5	H26
48 hr.	100.5	H26

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) Three genuine landslides reported to have occurred within the period between 3 June and 5 June 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure 10 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 3 June (00:00) and 5 June (24:00) 2009 and Locations of Landslides

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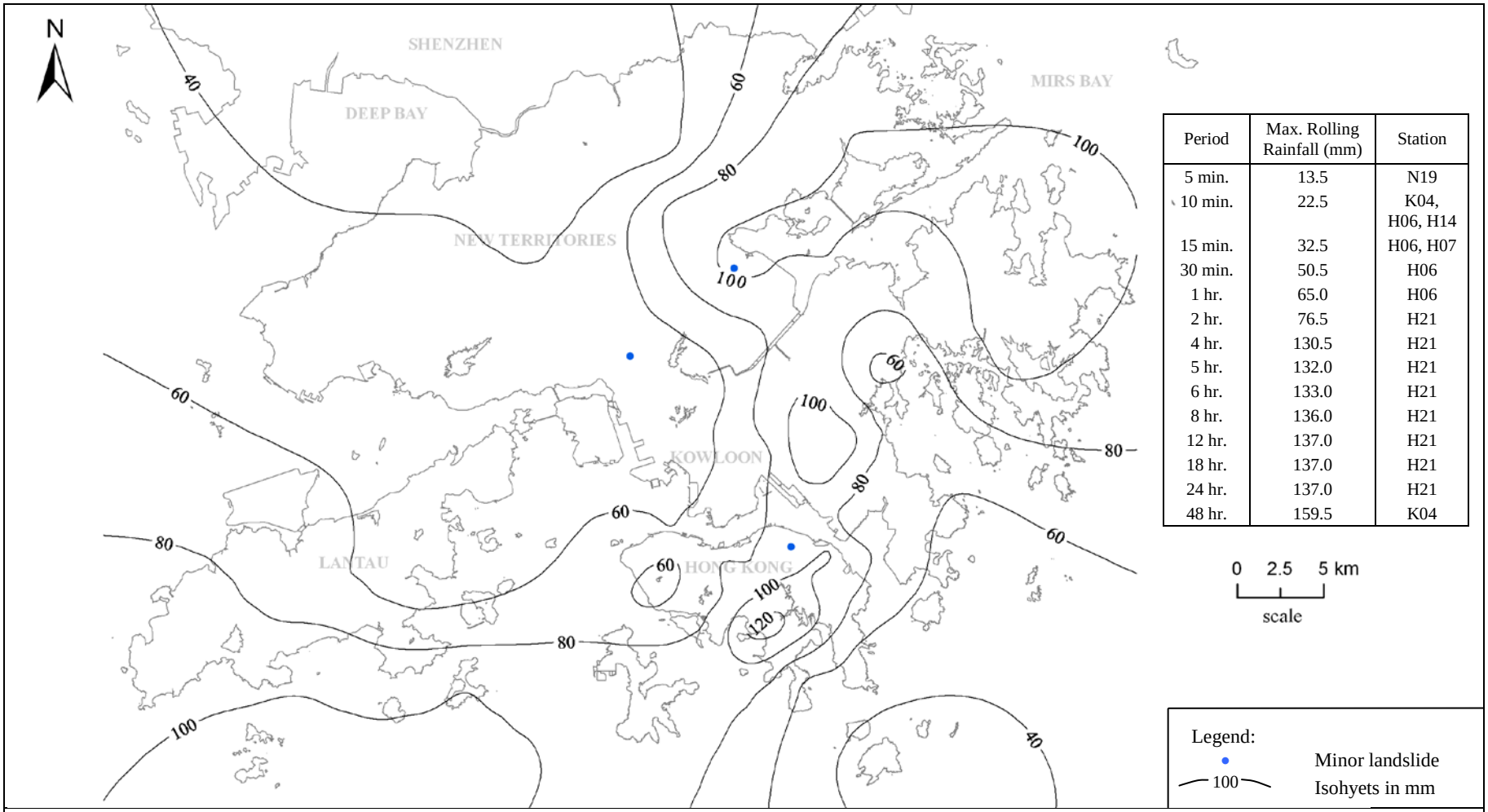

Period	Max. Rolling Rainfall (mm)	Station
5 min.	13.5	N19
10 min.	22.5	K04, H06, H14
15 min.	32.5	H06, H07
30 min.	50.5	H06
1 hr.	65.0	H06
2 hr.	76.5	H21
4 hr.	130.5	H21
5 hr.	132.0	H21
6 hr.	133.0	H21
8 hr.	136.0	H21
12 hr.	137.0	H21
18 hr.	137.0	H21
24 hr.	137.0	H21
48 hr.	159.5	K04

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) Three genuine landslides reported to have occurred within the period between 8 June and 17 June 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure 11 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 8 June (00:00) and 17 June (24:00) 2009 and Locations of Landslides

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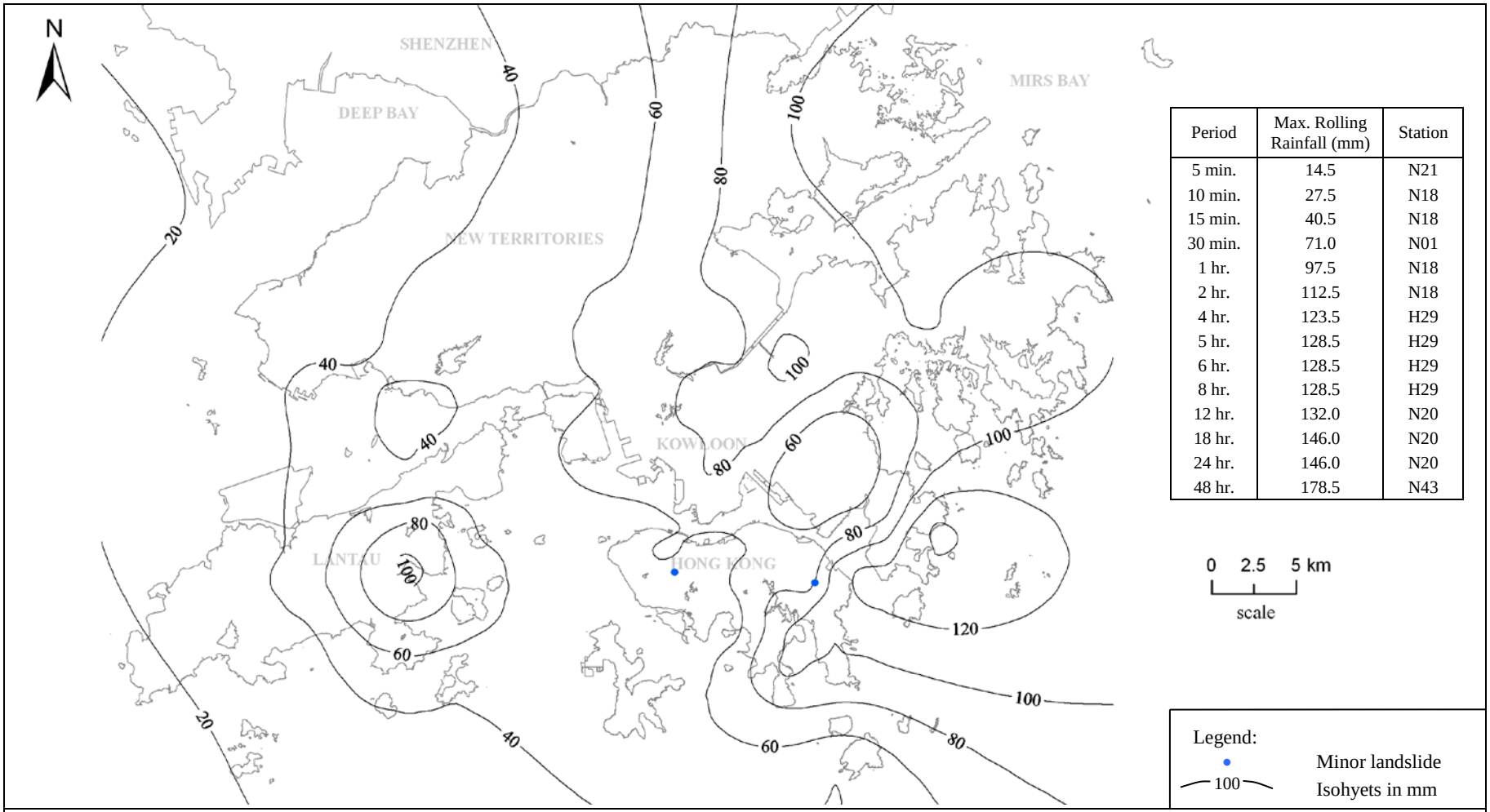
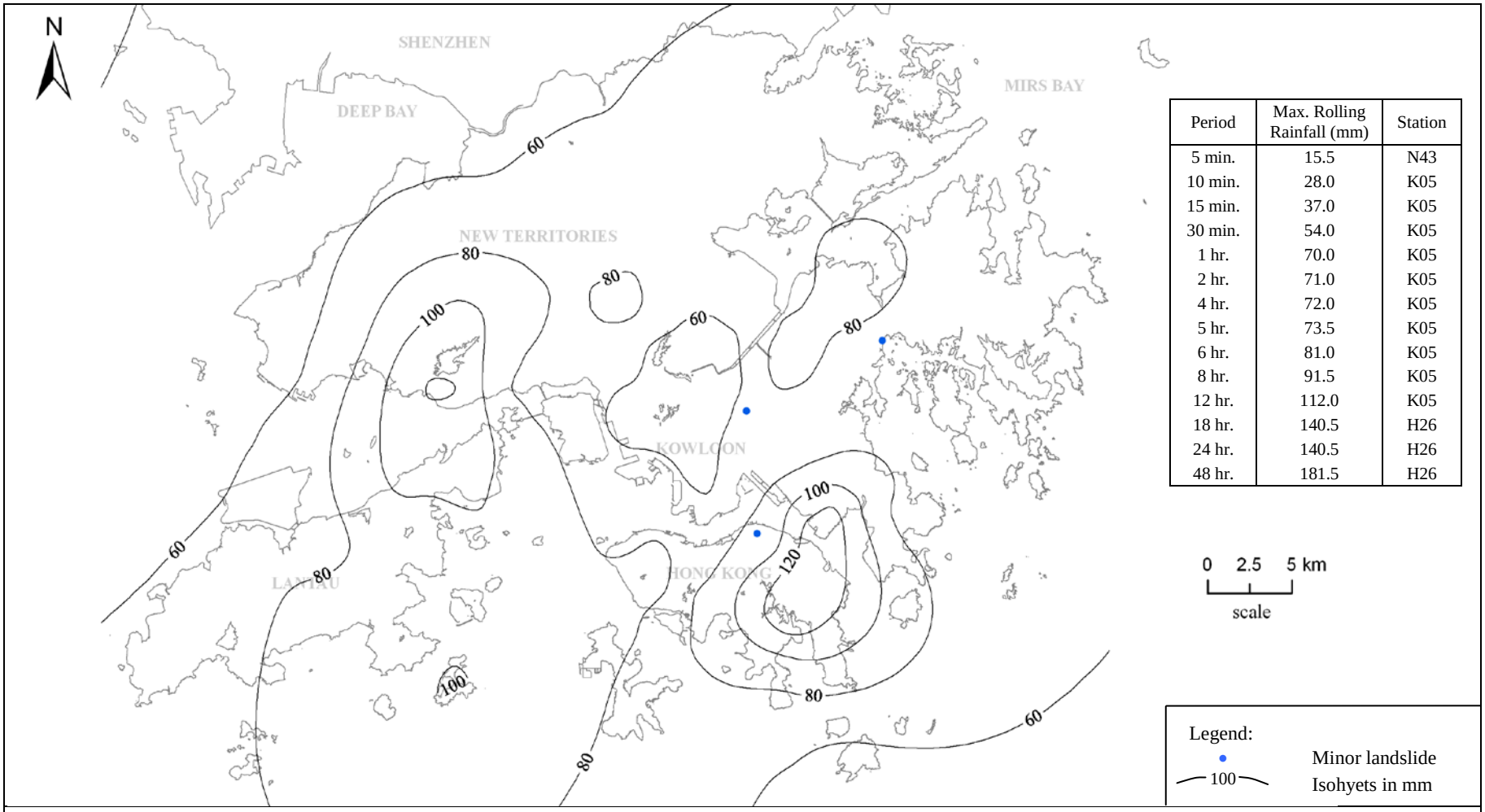


Period	Max. Rolling Rainfall (mm)	Station
5 min.	14.5	N21
10 min.	27.5	N18
15 min.	40.5	N18
30 min.	71.0	N01
1 hr.	97.5	N18
2 hr.	112.5	N18
4 hr.	123.5	H29
5 hr.	128.5	H29
6 hr.	128.5	H29
8 hr.	128.5	H29
12 hr.	132.0	N20
18 hr.	146.0	N20
24 hr.	146.0	N20
48 hr.	178.5	N43

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) Two genuine landslides reported to have occurred within the period between 19 June and 29 June 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

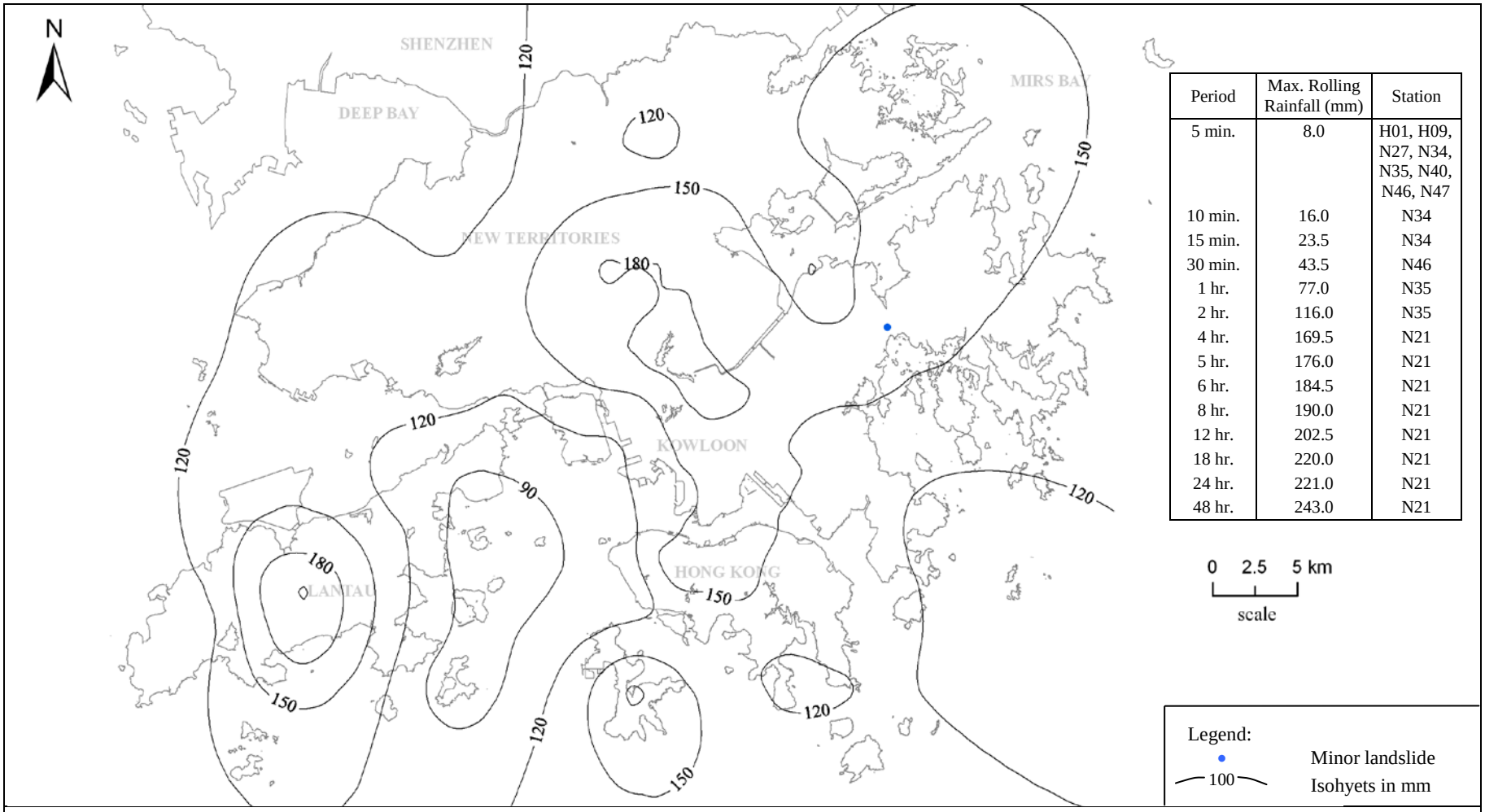
Figure 12 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 19 June (00:00) and 29 June (24:00) 2009 and Locations of Landslides



Period	Max. Rolling Rainfall (mm)	Station
5 min.	15.5	N43
10 min.	28.0	K05
15 min.	37.0	K05
30 min.	54.0	K05
1 hr.	70.0	K05
2 hr.	71.0	K05
4 hr.	72.0	K05
5 hr.	73.5	K05
6 hr.	81.0	K05
8 hr.	91.5	K05
12 hr.	112.0	K05
18 hr.	140.5	H26
24 hr.	140.5	H26
48 hr.	181.5	H26

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) Three genuine landslides reported to have occurred within the period between 4 July and 7 July 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

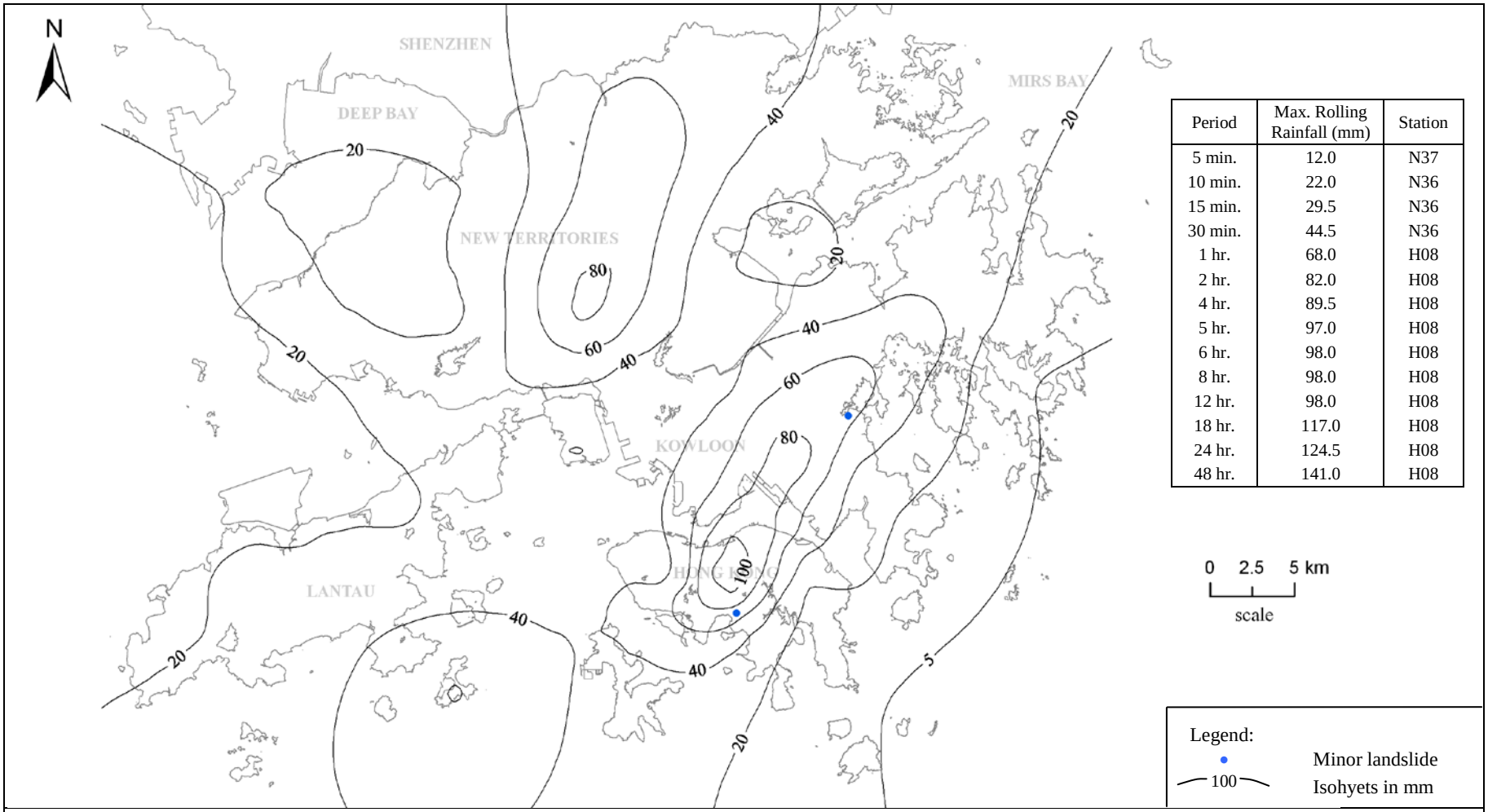
Figure 13 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 4 July (00:00) and 7 July (24:00) 2009 and Locations of Landslides



Period	Max. Rolling Rainfall (mm)	Station
5 min.	8.0	H01, H09, N27, N34, N35, N40, N46, N47
10 min.	16.0	N34
15 min.	23.5	N34
30 min.	43.5	N46
1 hr.	77.0	N35
2 hr.	116.0	N35
4 hr.	169.5	N21
5 hr.	176.0	N21
6 hr.	184.5	N21
8 hr.	190.0	N21
12 hr.	202.5	N21
18 hr.	220.0	N21
24 hr.	221.0	N21
48 hr.	243.0	N21

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) A genuine landslide reported to have occurred within the period between 19 July and 20 July 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure 14 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 19 July (00:00) and 20 July (24:00) 2009 and Locations of Landslides



Period	Max. Rolling Rainfall (mm)	Station
5 min.	12.0	N37
10 min.	22.0	N36
15 min.	29.5	N36
30 min.	44.5	N36
1 hr.	68.0	H08
2 hr.	82.0	H08
4 hr.	89.5	H08
5 hr.	97.0	H08
6 hr.	98.0	H08
8 hr.	98.0	H08
12 hr.	98.0	H08
18 hr.	117.0	H08
24 hr.	124.5	H08
48 hr.	141.0	H08

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) Two genuine landslides reported to have occurred within the period between 27 July and 31 July 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure 15 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 27 July (00:00) and 31 July (24:00) 2009 and Locations of Landslides

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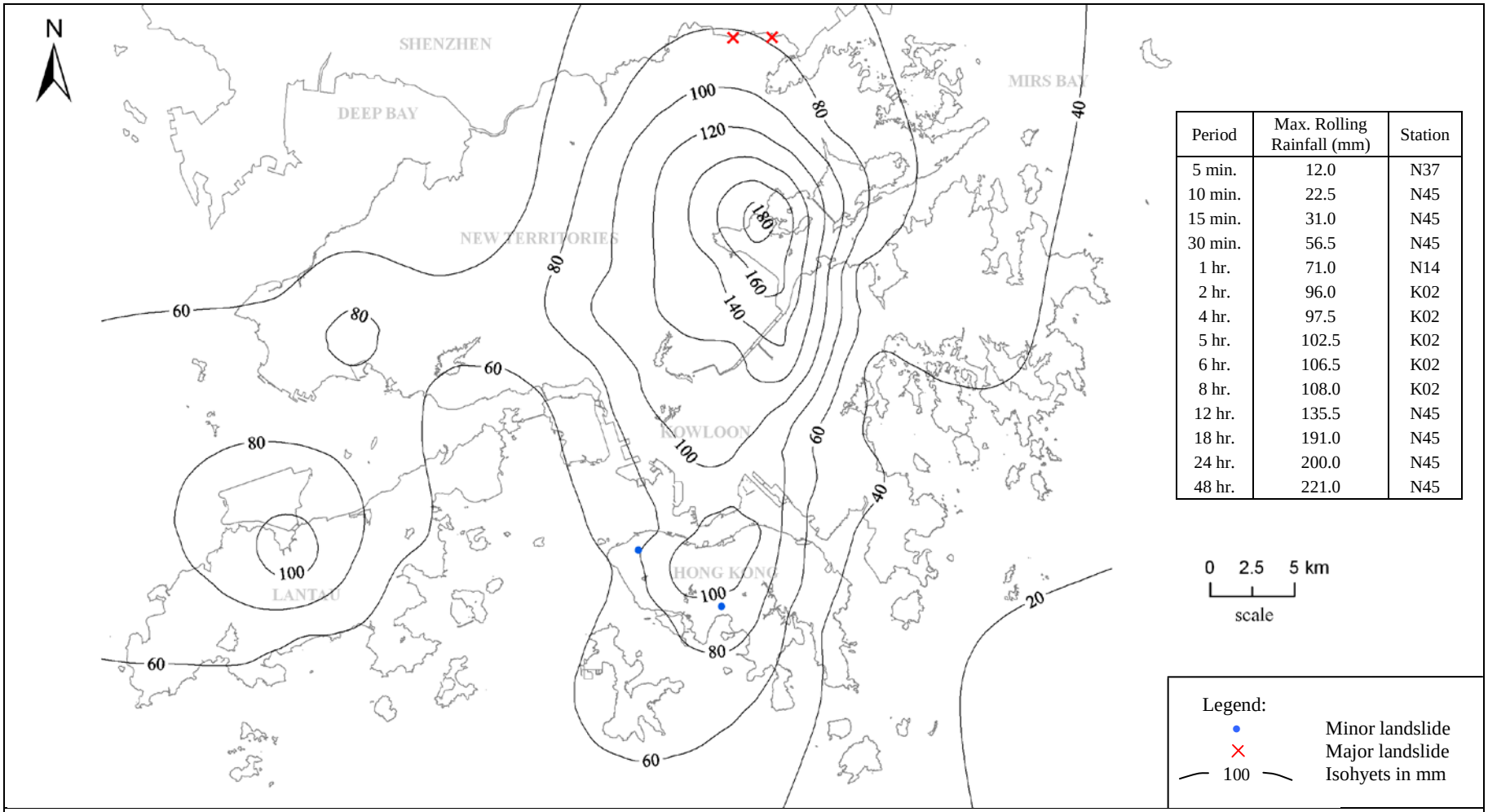
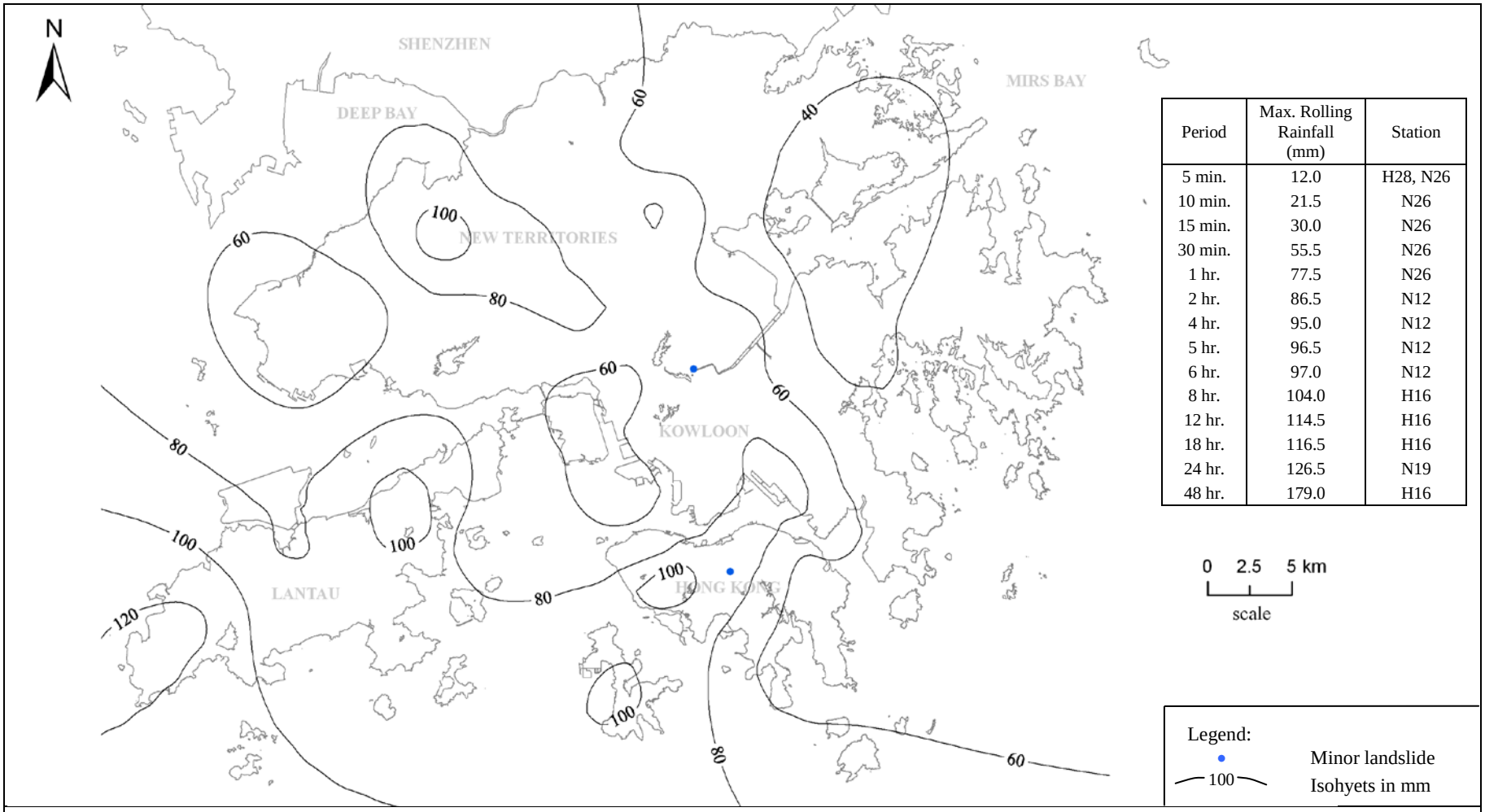


Period	Max. Rolling Rainfall (mm)	Station
5 min.	12.0	N37
10 min.	22.5	N45
15 min.	31.0	N45
30 min.	56.5	N45
1 hr.	71.0	N14
2 hr.	96.0	K02
4 hr.	97.5	K02
5 hr.	102.5	K02
6 hr.	106.5	K02
8 hr.	108.0	K02
12 hr.	135.5	N45
18 hr.	191.0	N45
24 hr.	200.0	N45
48 hr.	221.0	N45

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) Four genuine landslides reported to have occurred within the period between 4 August and 7 August 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure 16 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 4 August (00:00) and 7 August (24:00) 2009 and Locations of Landslides



Period	Max. Rolling Rainfall (mm)	Station
5 min.	12.0	H28, N26
10 min.	21.5	N26
15 min.	30.0	N26
30 min.	55.5	N26
1 hr.	77.5	N26
2 hr.	86.5	N12
4 hr.	95.0	N12
5 hr.	96.5	N12
6 hr.	97.0	N12
8 hr.	104.0	H16
12 hr.	114.5	H16
18 hr.	116.5	H16
24 hr.	126.5	N19
48 hr.	179.0	H16

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) Two genuine landslides reported to have occurred within the period between 10 August and 15 August 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure 17 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 10 August (00:00) and 15 August (24:00) 2009 and Locations of Landslides

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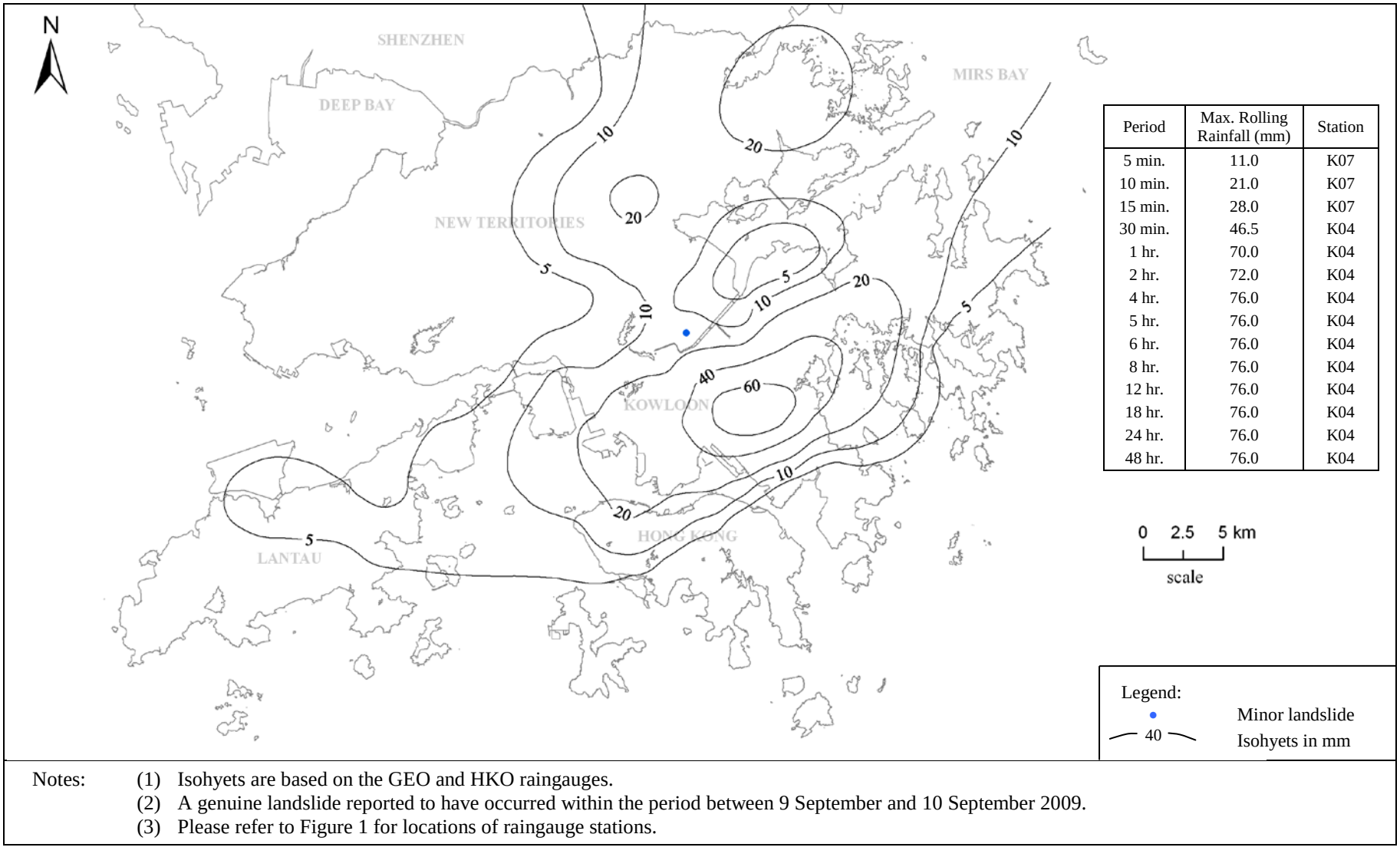

Period	Max. Rolling Rainfall (mm)	Station
5 min.	11.0	K07
10 min.	21.0	K07
15 min.	28.0	K07
30 min.	46.5	K04
1 hr.	70.0	K04
2 hr.	72.0	K04
4 hr.	76.0	K04
5 hr.	76.0	K04
6 hr.	76.0	K04
8 hr.	76.0	K04
12 hr.	76.0	K04
18 hr.	76.0	K04
24 hr.	76.0	K04
48 hr.	76.0	K04

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) A genuine landslide reported to have occurred within the period between 9 September and 10 September 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure 18 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 9 September (00:00) and 10 September (24:00) 2009 and Locations of Landslides

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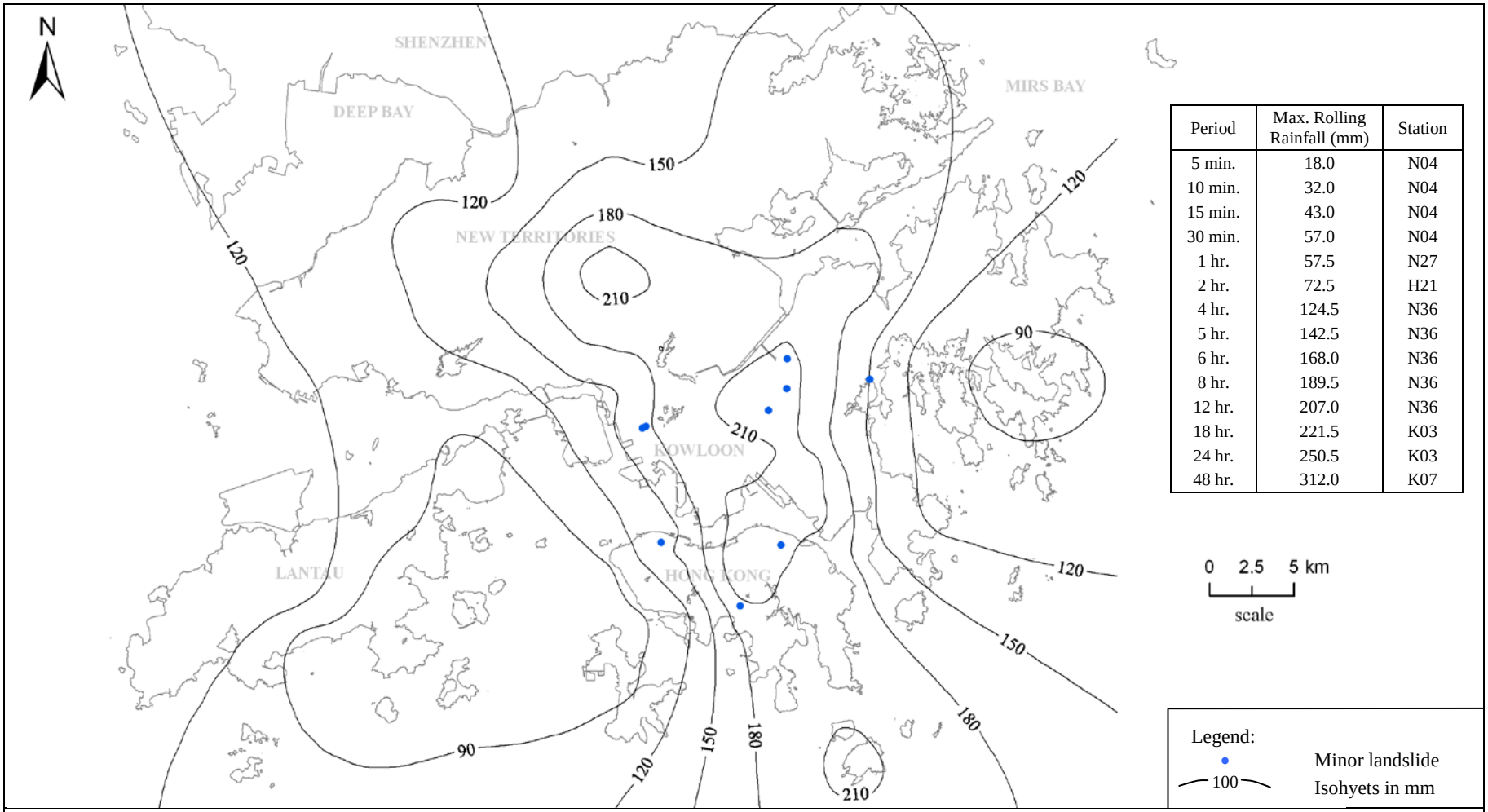

Period	Max. Rolling Rainfall (mm)	Station
5 min.	18.0	N04
10 min.	32.0	N04
15 min.	43.0	N04
30 min.	57.0	N04
1 hr.	57.5	N27
2 hr.	72.5	H21
4 hr.	124.5	N36
5 hr.	142.5	N36
6 hr.	168.0	N36
8 hr.	189.5	N36
12 hr.	207.0	N36
18 hr.	221.5	K03
24 hr.	250.5	K03
48 hr.	312.0	K07

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) Nine genuine landslides reported to have occurred within the period between 12 September and 17 September 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure 19 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 12 September (00:00) and 17 September (24:00) 2009 and Locations of Landslides

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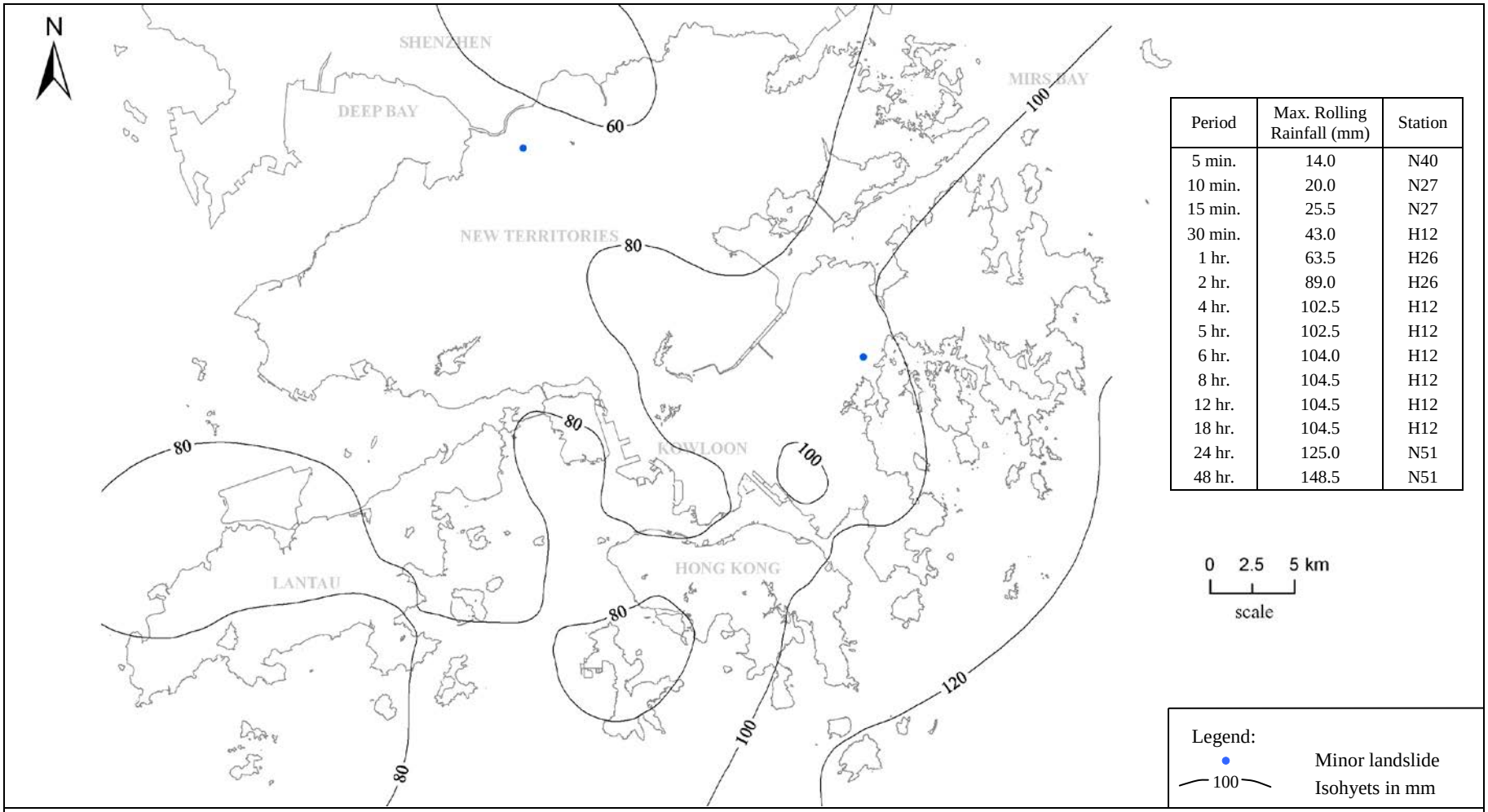

Period	Max. Rolling Rainfall (mm)	Station
5 min.	14.0	N40
10 min.	20.0	N27
15 min.	25.5	N27
30 min.	43.0	H12
1 hr.	63.5	H26
2 hr.	89.0	H26
4 hr.	102.5	H12
5 hr.	102.5	H12
6 hr.	104.0	H12
8 hr.	104.5	H12
12 hr.	104.5	H12
18 hr.	104.5	H12
24 hr.	125.0	N51
48 hr.	148.5	N51

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) Two genuine landslides reported to have occurred within the period between 28 September and 1 October 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure 20 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 28 September (00:00) and 1 October (24:00) 2009 and Locations of Landslides

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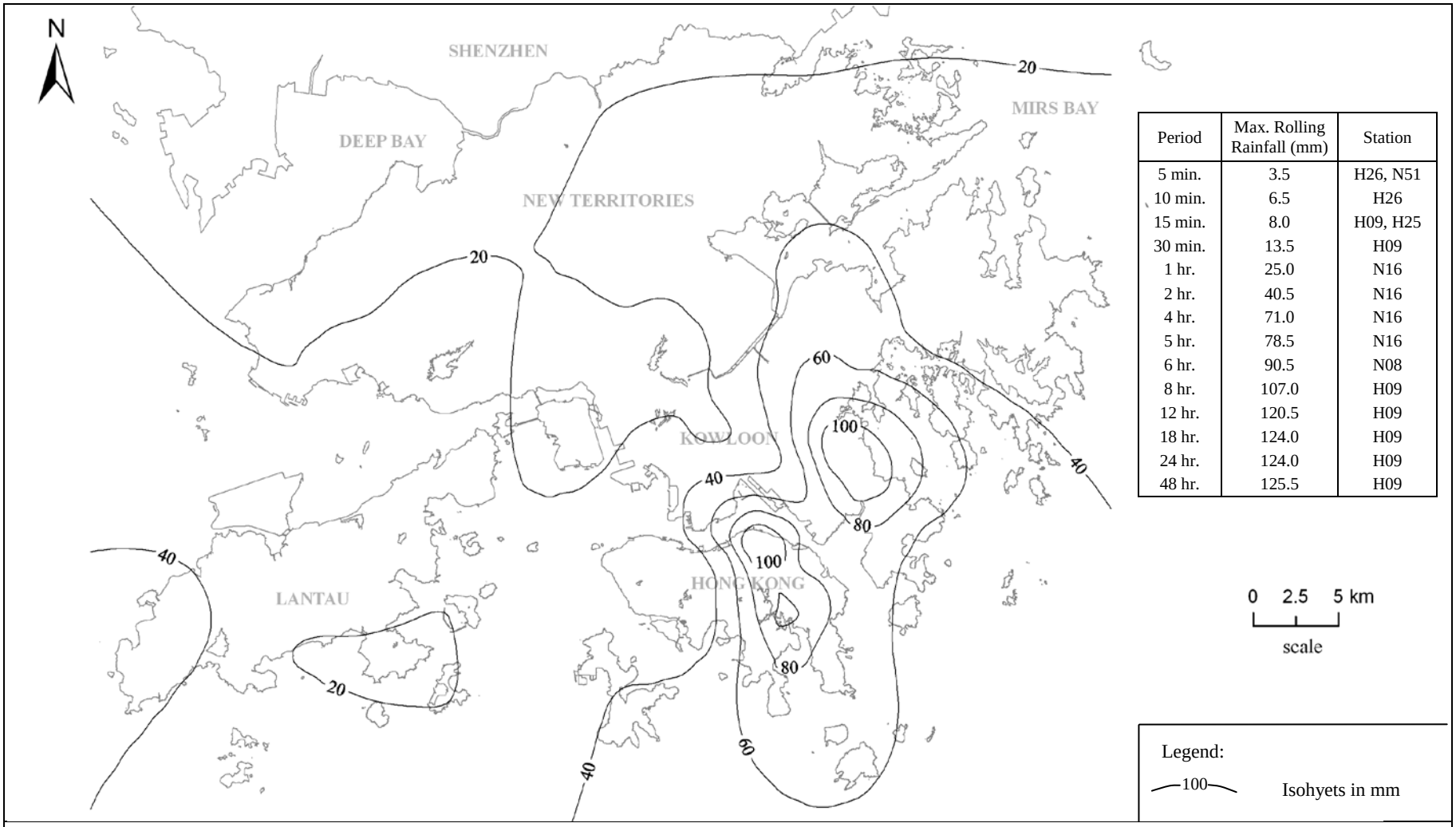

Period	Max. Rolling Rainfall (mm)	Station
5 min.	3.5	H26, N51
10 min.	6.5	H26
15 min.	8.0	H09, H25
30 min.	13.5	H09
1 hr.	25.0	N16
2 hr.	40.5	N16
4 hr.	71.0	N16
5 hr.	78.5	N16
6 hr.	90.5	N08
8 hr.	107.0	H09
12 hr.	120.5	H09
18 hr.	124.0	H09
24 hr.	124.0	H09
48 hr.	125.5	H09

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) No genuine landslide was reported to have occurred within the period between 15 November and 17 November 2009.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure 21 - Maximum Rolling 24-hour Rainfall Distribution for the Period between 15 November (00:00) and 17 November (24:00) 2009

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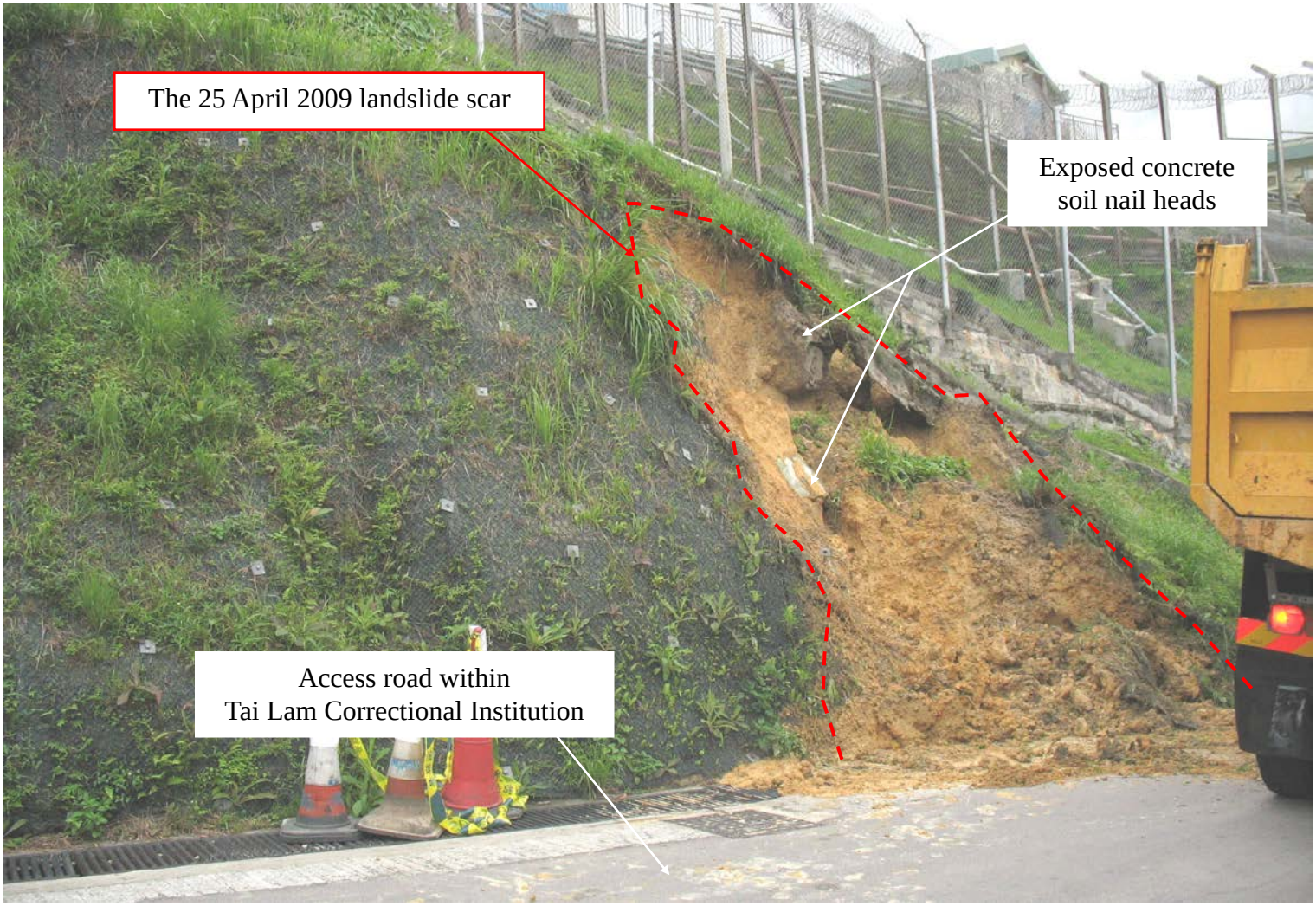

Plate 1 - The 25 April 2009 Landslide on Slope No. 6SW-D/C439 at Tai Lam Correctional Institution, Tuen Mun (Incident No. 2009/04/0866)

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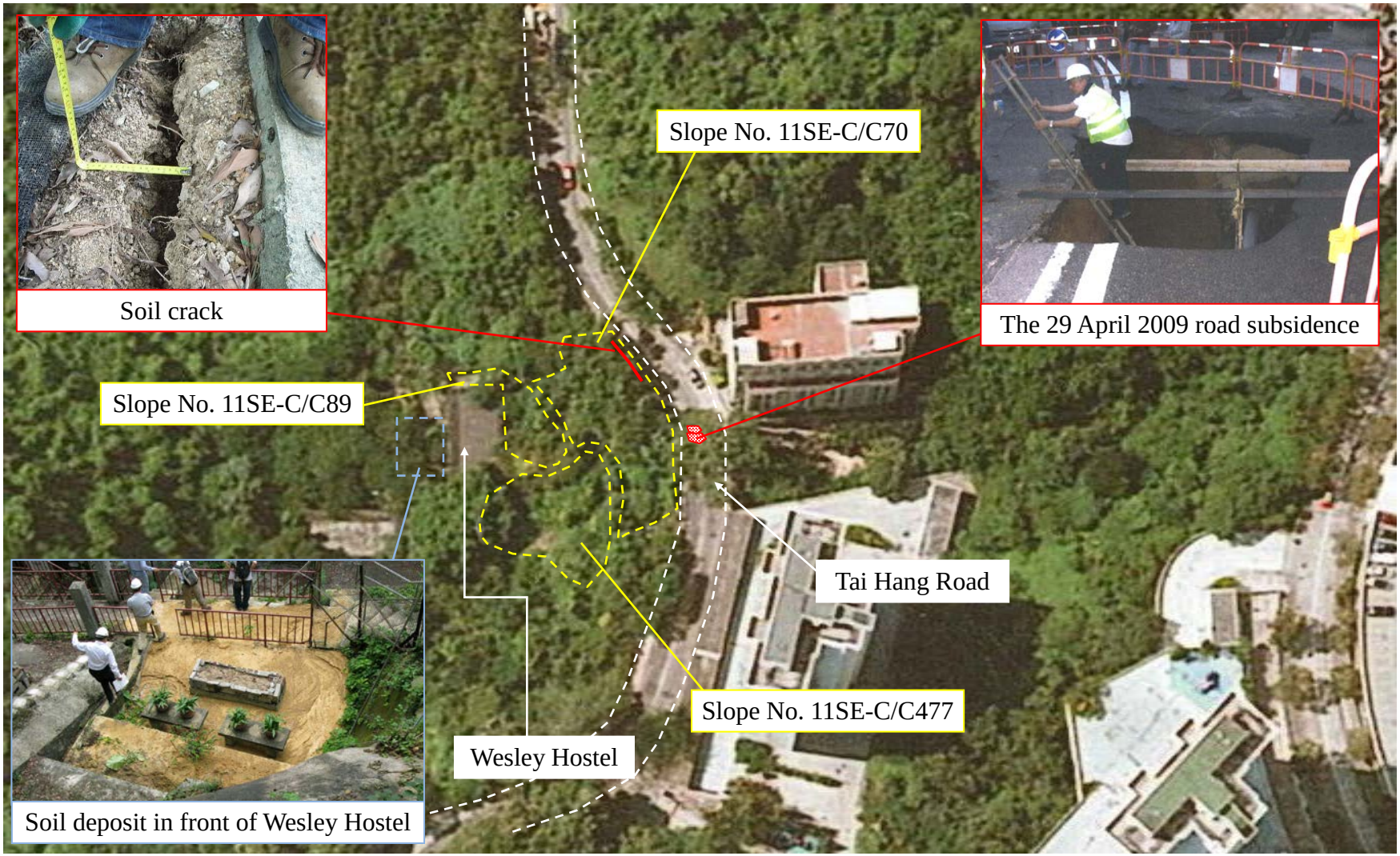

Plate 2 - Signs of Distress on Slope Nos. 11SE-C/C70 and 11SE-C/C89 below 133 Tai Hang Road (Incident No. 2009/05/0867)

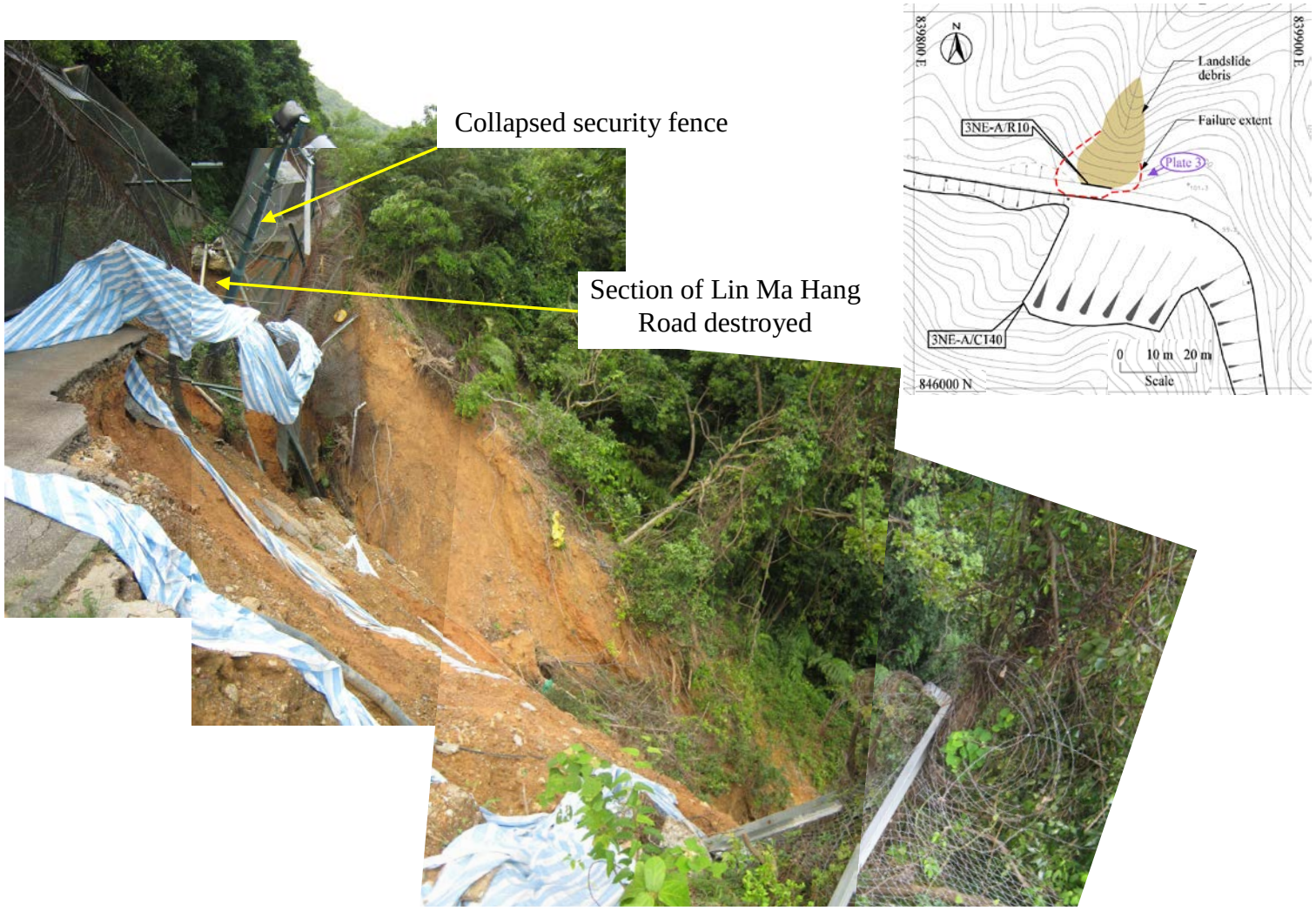

Plate 3 - Natural Terrain Landslide involving Mass Concrete Wall No. 3NE-A/R10 at Zone 259, Lin Ma Hang Road, Sha Tau Kok (Incident No. 2009/08/0897)

Plate 4 - Distress on the Shotcreted Surface of Slope No. 11NW-B/C582 below Shek Kip Mei No. 2 Fresh Water Service Reservoir, Pak Tin Estate (Incident No. WSD/2009/2/2/K)

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APPENDIX A

SOME SELECTED RAINFALL PARAMETERS FOR THE 17 RAINSTORMS WITH DAILY RAINFALL EXCEEDING 50 mm

LIST OF TABLE

Table No.		Page No.
A1	Some Selected Rainfall Parameters for the 17 Rainstorms with Daily Rainfall Exceeding 50 mm in 2009	57

Table A1 - Some Selected Rainfall Parameters for the 17 Rainstorms with Daily Rainfall Exceeding 50 mm in 2009 (Sheet 1 of 3)

Rainstorm		5-min		10-min		15-min		30-min	
		Max. Rainfall (mm)	Raingauge Station	Max. Rainfall (mm)	Raingauge Station	Max. Rainfall (mm)	Raingauge Station	Max. Rainfall (mm)	Raingauge Station
1	5-7 March 2009	14.0	K02, N02, N03, N43	23.5	N03	26.5	N03	35	N26
2	24-28 March 2009	17.0	N01	28.0	N40	35.5	N40	56.5	N28
3	16-20 April 2009	13.5	N32	23.5	N47	27.5	N32	38.5	N28
4	25-26 April 2009	13.0	N37	20.0	N14	25.0	H03, H05, N32	41.0	H16
5	20-28 May 2009	14.0	N25, N26	28.0	N25	40.0	N25	60.5	N25
6	3-5 June 2009	18.0	N36	34.0	N35	42.0	N41	63.0	N47
7	8-17 June 2009	13.5	N19	22.5	H06, H14, K04	32.5	H06, H07	50.5	H06
8	19-29 June 2009	14.5	N21	27.5	N18	40.5	N18	71.0	N01
9	4-7 July 2009	15.5	N43	28.0	K05	37.0	K05	54.0	K05
10	19-20 July 2009	8.0	H01, H09, N27, N34, N35, N40, N46, N47	16.0	N34	23.5	N34	43.5	N46
11	27-31 July 2009	12.0	N37	22.0	N36	29.5	N36	44.5	N36
12	4-7 August 2009	12.0	N37	22.5	N45	31.0	N45	56.5	N45
13	10-15 August 2009	12.0	H28, N26	21.5	N26	30.0	N26	55.5	N26
14	9-10 September 2009	11.0	K07	21.0	K07	28.0	K07	46.5	K04
15	12-17 September 2009	18.0	N04	32.0	N04	43.0	N04	57.0	N04
16	28 September - 1 October 2009	14.0	N40	20.0	N27	25.5	N27	43.0	H12
17	15-17 November 2009	3.5	H26, N51	6.5	H26	8.0	H09, H25	13.5	H29

Table A1 - Some Selected Rainfall Parameters for the 17 Rainstorms with Daily Rainfall Exceeding 50 mm in 2009 (Sheet 2 of 3)

Rainstorm		1-hr		2-hr		4-hr		5-hr		6-hr	
		Max. Rainfall (mm)	Raingauge Station	Max. Rainfall (mm)	Raingauge Station	Max. Rainfall (mm)	Raingauge Station	Max. Rainfall (mm)	Raingauge Station	Max. Rainfall (mm)	Raingauge Station
1	5-7 March 2009	41.0	N26	50.5	N26	54.0	N26	56.5	N26	58.0	N26
2	24-28 March 2009	73.0	N28	73.0	N28	73.0	N28	73.0	N28	73.5	N28
3	16-20 April 2009	49.0	N28	50.5	N28	54.0	N20	56.0	N20	57.5	N20
4	25-26 April 2009	66.5	N38	73.0	N23	79.0	N23	90.5	N37	99.5	N37
5	20-28 May 2009	94.5	N38	132.5	N38	150.5	N25	155.5	N25	159.5	N25
6	3-5 June 2009	73.5	N36	77.5	N36	80.5	N36	84.0	N36	86.0	N36
7	8-17 June 2009	65.0	H06	76.5	H21	130.5	H21	132.0	H21	133.0	H21
8	19-29 June 2009	97.5	N18	112.5	N18	123.5	H29	128.5	H29	128.5	H29
9	4-7 July 2009	70.0	K05	71.0	K05	72.0	K05	73.5	K05	81.0	K05
10	19-20 July 2009	77.0	N35	116.0	N35	169.5	N21	176.0	N21	184.5	N21
11	27-31 July 2009	68.0	H08	82.0	H08	89.5	H08	97.0	H08	98.0	H08
12	4-7 August 2009	71.0	N14	96.0	K02	97.5	K02	102.5	K02	106.5	K02
13	10-15 August 2009	77.5	N26	86.5	N12	95.0	N12	96.5	N12	97.0	N12
14	9-10 September 2009	70.0	K04	72.0	K04	76.0	K04	76.0	K04	76.0	K04
15	12-17 September 2009	57.5	N27	72.5	H21	124.5	N36	142.5	N36	168.0	N36
16	28 September - 1 October 2009	63.5	H26	89.0	H26	102.5	H12	102.5	H12	104.0	H12
17	15-17 November 2009	25.0	N16	40.5	N16	71.0	N16	78.5	N16	90.5	N08

Table A1 - Some Selected Rainfall Parameters for the 17 Rainstorms with Daily Rainfall Exceeding 50 mm in 2009 (Sheet 3 of 3)

Rainstorm		8-hr		12-hr		18-hr		24-hr		48-hr	
		Max. Rainfall (mm)	Raingauge Station	Max. Rainfall (mm)	Raingauge Station	Max. Rainfall (mm)	Raingauge Station	Max. Rainfall (mm)	Raingauge Station	Max. Rainfall (mm)	Raingauge Station
1	5-7 March 2009	60.0	N26	74.5	N03	83.0	N31	101.0	N31	106.5	N31
2	24-28 March 2009	73.5	N28	73.5	N28	73.5	N28	75.0	N28	88.0	H07
3	16-20 April 2009	63.0	N20	82.0	N20	89.5	N20	94.5	N48	94.5	N48
4	25-26 April 2009	105.0	N37	106.5	N37	110.5	N37	112.0	N37	116.5	N37
5	20-28 May 2009	164.0	N25	170.0	N38	179.0	N38	231.5	N25	270.0	N36
6	3-5 June 2009	87.5	N36	88.0	N36	99.5	H26	99.5	H26	100.5	H26
7	8-17 June 2009	136.0	H21	137.0	H21	137.0	H21	137.0	H21	159.5	K04
8	19-29 June 2009	128.5	H29	132.0	N20	146.0	N20	146.0	N20	178.5	N43
9	4-7 July 2009	91.5	K05	112.0	K05	140.5	H26	140.5	H26	181.5	H26
10	19-20 July 2009	190.0	N21	202.5	N21	220.0	N21	221.0	N21	243.0	N21
11	27-31 July 2009	98.0	H08	98.0	H08	117.0	H08	124.5	H08	141.0	H08
12	4-7 August 2009	108.0	K02	135.5	N45	191.0	N45	200.0	N45	221.0	N45
13	10-15 August 2009	104.0	H16	114.5	H16	116.5	H16	126.5	N19	179.0	H16
14	9-10 September 2009	76.0	K04	76.0	K04	76.0	K04	76.0	K04	76.0	K04
15	12-17 September 2009	189.5	N36	207.0	N36	221.5	K03	250.5	K03	312.0	K07
16	28 September - 1 October 2009	104.5	H12	104.5	H12	104.5	H12	125.0	N51	148.5	N51
17	15-17 November 2009	107.0	H09	120.5	H09	124.0	H09	124.0	H09	125.5	H09

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APPENDIX B

LIST OF LANDSLIDE INCIDENTS REPORTED TO THE GOVERNMENT

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Table B1 - List of Major Landslide Incidents

Incident No.	Location	Feature Registration No.	Failure			Facility Affected	Consequence
			Date (Time)	Feature Type	Scale (m^3)		
2009/08/0897	Zone 259, Lin Ma Hang Road, Sha Tau Kok	Natural hillside	6/8	Natural hillside	125+	Access road	Lin Ma Hang Road temporarily closed
2009/08/0898	Zone 234, Lin Ma Hang Road, Sha Tau Kok	3 m high soil cut slope(1)	6/8	Soil cut	60	Access road	Lin Ma Hang Road temporarily closed

Legend:

+ Failure volume estimated by GEO's landslide investigation consultants

(1) The feature may or may not satisfy the criteria for feature registration as stated in WBTC No. 9/2000. Further investigation is being undertaken to ascertain its eligibility for registration

Table B2 - List of Landslide Incidents in Hong Kong Island (Sheet 1 of 4)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2009/01/0844	67 Repulse Bay Road	Natural hillside	21/1	Public	20/1 (16:00)	Natural hillside	0.03 (Boulder fall)	Others (Open carpark)	-
2009/02/0849	2 Prince Terrace, Shelley Street, Central and Western District	11SW-A/R182	17/2	Public	16/2	Retaining wall (Masonry)	< 1	Others (Alleyway)	Alleyway temporarily closed
2009/03/0863	Above Feature No. 11SW-C/C825, Lugard Road, The Peak	Natural hillside	25/3	HyD	25/3 (14:30)	Natural hillside	$< 1^{+}$ (Boulder fall)	Access road	-
2009/05/0867*	Below 133 Tai Hang Road	11SE-C/C70, 11SE-C/C89	30/4	HyD	29/4 (23:00)	Fill	Signs of distress	Road	2 lanes of Tai Hang Road temporarily closed
2009/05/0868	Hong Kong Chinese Women's Club College, 2B Tai Cheong Street	11SE-A/C1	24/4	Public	23/4	Rock cut	1 (Rockfall)	Open area	-
2009/05/0869#	Queen's Road East near Monmouth Path	11SW-B/C248	4/5	Arch SD	3/5	Soil cut	2	Nil (Landslide debris deposited on slope)	-
2009/05/0871	Above Feature No. 11SW-B/CR102, 54 MacDonnell Road	Natural hillside	12/5	Public	Unknown	Natural hillside	0.1 (Boulder fall)	Others (Alleyway)	-
2009/05/0874	Ap Lei Chau Bridge Road	15NW-B/CR131	25/5	HyD	24/5 (19:00)	Soil/rock cut	0.5 (Rockfall)	Road	-

Table B2 - List of Landslide Incidents in Hong Kong Island (Sheet 2 of 4)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2009/05/0875	52 Kennedy Road	11SW-B/CR221	26/5	HKPF	25/5	Soil/rock cut	0.2 (Rockfall)	Others (Carpark)	Affected area temporarily fenced off
2009/05/0876	Near Stanley Knoll	15NE-A/C324	26/5	BD	Unknown	Rock cut	0.2 (Rockfall)	Minor footpath	-
2009/06/0880	Behind Tai Hing House, 124 Quarry Bay Street	11SE-A/C180	16/6	HKPF	14/6 (03:00)	Soil/rock cut	1 (Rockfall)	Open area	-
2009/06/0882	Block A, Yen Lok Building, 4-12 Lin Shing Road, Chai Wan	11SE-D/C14	23/6	Public	22/6 (21:00)	Soil/rock cut	0.3 (Rockfall)	Others (Unauthorised structure and water tank)	Unauthorised structure evacuated and water tank damaged
2009/06/0883	Opposite to 10 Bluff Path, Sherwood's Bluff	11SW-D/CR1591	28/6	HKPF	28/6 (00:15)	Soil/rock cut	1.7	Access road	Access road temporarily closed
2009/07/0885	Pak Fuk Road near Tin Hau Temple Road	2.5 high soil cut slope(1)	5/7	HKPF	5/7 (18:30)	Soil cut	1	Road	1 of 2 lanes of Pak Fuk Road temporarily closed
2009/07/0889	Chung Hom Kok Beach	Natural hillside	9/7	LCSD	Unknown	Natural hillside	0.3 (Boulder fall)	Others (Beach)	-
2009/07/0895	Above Feature No. 15NE-A/C13 near 37 Repulse Bay Road	Natural hillside	27/7	HyD	27/7	Natural hillside	$< 1^+$ (Boulder fall)	Road	-

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Table B2 - List of Landslide Incidents in Hong Kong Island (Sheet 3 of 4)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2009/08/0899	Below Blocks K and L, Unicorn Gardens, 11 Shouson Hill Road	11SW-D/C2200	4/8	Public	4/8 (15:00)	Soil cut	< 1	Others (Streamcourse)	-
2009/08/0903	43 Blue Pool Road, Happy Valley	11SW-D/CR177	14/8	BD	11/8	Soil cut	3	Others (Carpark)	A section of U-channel at slope berm damaged
2009/08/0904	Near 21 South Bay Road, Repulse Bay	15NE-A/C383	24/8	Public	23/8	Soil/rock cut	< 1	Access road	-
2009/09/0913	South of 1 Hospital Road	11SW-A/CR71	16/9	Public	15/9	Soil cut	2.4	Pedestrian pavement	Pedestrian pavement temporarily closed
2009/09/0915	Below Tai Tam Road Leading to Tai Tam Tuk Village	1.5 m high soil cut slope(1)	3/9	Public	Unknown	Soil cut	< 1	Minor footpath	A section of minor footpath undermined
2009/09/0916	Above Features Nos. 11SE-C/C6 and 11SE-C/C7, near 12 Repulse Bay Road	Natural hillside	16/9	HyD	14/9	Natural hillside	0.8 (Boulder fall)	Road	-
2009/11/0923	Li Hang Court, Li Kwan Avenue, Tai Hang	11SE-A/R42	1/11	HKPF	1/11 (00:00)	Retaining wall	< 1	Road	-

Table B2 - List of Landslide Incidents in Hong Kong Island (Sheet 4 of 4)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2009/11/0924	Above Features Nos. 11SE-C/C8 and 11SE-C/C237, opposite to 12 Repulse Bay Road	Natural hillside	28/10	HKPF	28/10 (15:15)	Natural hillside	0.01 (Boulder fall)	Road	A vehicle hit by the fallen boulder
2009/11/0925	Behind Tai Ming House, Quarry Bay	11SE-A/C190	4/11	Public	15/9	Rock cut	1 (Rockfall)	Others (Alleyway)	-
AFCD/ 2009/08/0001	Lung Fu Shan Country Park	11SW-A/C1211	-	AFCD	9/8	Soil cut	10	Access road	-
ArchSD/SKW/ 2009/04/0003	Hong Kong Museum of Coastal Defence	11SE-B/FR62	-	ArchSD	23/4	Fill	< 1	Open area	-
ArchSD/SKW/ 2009/05/0002#	Lei Yue Mun Park	11SE-D/C385	-	ArchSD	27/5	Soil/rock cut	< 1	Access road	-
WSD/ 2009/2/1/HKI#	Pokfulam No. 2 Fresh Water Service Reservoir	11SW-C/C517	13/2	WSD	Unknown	Soil/rock cut	4	Access road	-
WSD/ 2009/7/1/HKI	Aberdeen West Catchwater	11SW-D/CR1911	2/7	WSD	Unknown	Soil cut	37.5	Access road	-
WSD/ 2009/9/1/HKI	Mount Parker Upper Catchwater	11SE-C/C819	9/9	WSD	Unknown	Soil cut	< 1	Catchwater	-

Legend:

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

+ Failure volume estimated by GEO's landslide investigation consultants

* Drainage works were being carried out in the adjacent area at the time when signs of distress were observed (Incident No. 2009/05/0867)

(1) These features may or may not satisfy the criteria for feature registration as stated in WBTC No. 9/2000. Further investigation is being undertaken to ascertain their eligibility for registration

Table B3 - List of Landslide Incidents in Kowloon

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2009/07/0888	Near Lamp Post AB6055, Shatin Pass Road, Wong Tai Sin	11NE-A/C497	9/7	Police	9/7	Rock cut	0.01 (Rockfall)	Road	-
2009/09/0909	Shatin Pass Road, Wong Tai Sin	11NE-A/C354	15/9	CEDD	15/9 (14:30)	Soil/rock cut	2 (Boulder fall)	Construction site, Others (Catchpit)	Site hoarding and roadside catchpit damaged
ArchSD/KC-N/ 2009/04/0002	Transit Nursery, Baptist University Road, Kowloon Tong	11NW-B/DT7	11/6	Public	4/6	Registered disturbed terrain	1	Open area	-
ArchSD/WTS/ 2009/10/0001	Police Post, Tate's Cairn	7SE-C/C566	7/10	Police	Unknown	Soil/rock cut	1 (Rockfall)	Access road	-
WSD/ 2009/2/2/K	Below Shek Kip Mei No. 2 Fresh Water Service Reservoir, Shek Kip Mei	11NW-B/C582	16/2	WSD	Unknown	Soil/rock cut	Sign of distress	Nil	-
WSD/ 2009/3/1/K	70 m East from Beacon Hill High Level Service Reservoir, Radar Station Road	11NW-B/F62	5/3	WSD	Unknown	Fill	16.8	Access road	-
WSD/ 2009/8/1/K	West of Fung Wong High Level Salt Water Service Reservoir	Natural hillside	20/8	WSD	Unknown	Natural hillside	48^{+} (Rock slope failure)	Access road	-

Legend:

$^{+}$ Failure volume estimated by GEO's landslide investigation consultants

Table B4 - List of Landslide Incidents in the New Territories (Sheet 1 of 6)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2009/02/0846#	Ho Lek Pui Village, Fo Tan, Shatin	7SW-B/C641	10/2	DLO	29/1 (09:00)	Soil/rock cut	3	Open area	-
2009/02/0850	House Nos. 53A & B, Pai Tau Village, Shatin	2.4 m high fill slope(1)	11/2	BD	9/2 (09:30)	Fill	< 1	Village house	Column of pad footing of the village house exposed
2009/03/0855	Footpath at the layby of Tuen Mun Road East Bound - Tai Lam Section, Tuen Mun	6SW-D/C783	6/3	Public	6/3 (07:45)	Soil/rock cut	2 (Rockfall)	Minor footpath (Roadside maintenance footpath)	-
2009/03/0857	Lion Rock Tunnel Road near Hung Mui Kuk Road	7SW-D/C567	6/3	HyD's Contractor	Unknown	Soil/rock cut	15	Open area	-
2009/03/0860	Tuen Mun Road near Sham Tseng Treatment Works, Tuen Mun	6SE-C/C37	24/3	HyD	24/3 (13:30)	Soil/rock cut	0.012 (Rockfall)	Road	-
2009/04/0864	House No. 78, Ki Lun Village, Sheung Shui	2SE-D/C188	6/4	Public	31/3 (10:00)	Soil cut	2.5	Open area	-
2009/04/0866	Tai Lam Correctional Institution, Tai Lam Chung, Tuen Mun	6SW-D/C439	25/4	Arch SD	25/4	Soil cut	10^+	Access road	-
2009/05/0872	Behind House No. 43, Fu Tei Au Village, Da Kou Ling	3SW-A/C47	23/5	Police	23/5 (10:00)	Soil cut	15	Squatter dwelling	1 squatter dwelling temporarily evacuated

Table B4 - List of Landslide Incidents in the New Territories (Sheet 2 of 6)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2009/06/0879	House No. 3, Section 6, Lee Wah Sun Chuen, Hang Tau Village, Sheung Shui	1.3 m high soil cut slope(1)	4/6	Police	4/6 (07:30)	Soil cut	3	Squatter dwelling	-
2009/07/0884	North of Feature No. 12NW-D/C4, Lung Ha Wan Road, Sai Kung	Natural hillside	25/6	Public	Unknown	Natural hillside	5	Road	-
2009/07/0886	Lot No. 704, Lamp Post M59606, Luna House, Tai Mong Tsai Road, Sai Kung	8SW-A/C219	5/7	Police	5/7	Soil cut	< 1	Pedestrian pavement	-
2009/07/0887	Lung Mun Road, Tuen Mun	5SE-C/C1	3/7	Public	5/6 (14:00)	Soil/rock cut	< 1 (Rockfall)	Pedestrian pavement	-
2009/07/0890	West of House No. 94B, Ng Fai Tin, Sai Kung	Natural hillside	19/3	Public	Unknown	Natural hillside	5	Open area	-
2009/07/0893	Between Distance Post W022 & W023, Wilson Trail, Junk Bay Chinese Permanent Cemetery, Tseung Kwan O	5.5 m high soil cut slope(1)	11/7	Public	Unknown	Soil cut	20	Others (Hiking trail)	-
2009/07/0894	Behind House No. 1, Nam A Village, Sai Kung	5 m high soil cut slope(1)	19/7	Police	19/7 (14:00)	Soil cut	< 1	Village house	-

Table B4 - List of Landslide Incidents in the New Territories (Sheet 3 of 6)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2009/07/0896	Behind House 18A, Nam Wai, Sai Kung	Natural hillside	29/7	Police	27/7 (00:00)	Natural hillside	0.3 (Boulder fall)	Squatter dwelling	-
2009/08/0897	Zone 259, Lin Ma Hang Road, Sha Tau Kok	Natural hillside	7/8	HyD	6/8	Natural hillside	125^{+}	Access road	Lin Ma Hang Road temporarily closed
2009/08/0898	Zone 234, Lin Ma Hang Road, Sha Tau Kok	3 m high soil cut slope(1)	7/8	HyD	6/8	Soil cut	60	Access road	Lin Ma Hang Road temporarily closed
2009/08/0902#	Near Lamp Post No. VA0489, Heung Fan Liu, Tai Wai, Sha Tin	1.7 m high masonry wall(1)	13/8	Police	13/8 (12:45)	Retaining wall (Masonry)	1	Open area	-
2009/09/0905	Ngau Kwu Ling Trail, Tai Po	3SW-C/C534	31/8	DLO	Unknown	Soil cut	8.5	Access road	Access road temporarily closed
2009/09/0906	House No. 22, Kau Wa Keng San Tsuen, Kwai Chung	11NW-A/CR778	15/9	Public	15/9 (15:00)	Soil cut	< 1	Squatter dwelling	-
2009/09/0907	Behind House No. 91, Kau Wa Keng San Tsuen, Kwai Chung	11NW-A/C805	15/9	Public	15/9 (00:15)	Soil/rock cut	< 1	Squatter dwelling	-
2009/09/0912	House No. 92A, Pai Tau Village, Shatin	2.2 m high soil cut slope(1)	10/9	DO	10/9 (09:00)	Soil cut	< 1	Squatter dwelling	-
2009/09/0914	Licence W6931, Liu To Village, Tsing Yi	10NE-B/C145	17/9	Lands D	Unknown	Soil cut	1.2	Village house	-

Table B4 - List of Landslide Incidents in the New Territories (Sheet 4 of 6)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2009/09/0917	Streamcourse side-slope opposite to House Nos. 46 & 47, Tai Lam Liu Village, Shatin	Natural hillside	16/9	Public	15/9 (09:30)	Natural hillside	1 (Boulder fall)	Others (Streamcourse)	-
2009/09/0918	Fu Yung Pit, Shatin	7SE-C/C475	18/9	Public	15/9 (09:00)	Soil cut	3	Access road	-
2009/09/0919	Mai Po Lung, San Tin, Yuen Long	2SE-A/CR38	29/9	DLO	29/9 (17:30)	Soil cut	2.4	Squatter dwelling	-
2009/09/0920#	Underneath the Abutment of Tolo Highway at Shek Kwu Lung Village, Tai Po	18 m high soil cut slope(1)	28/9	DLO	Unknown	Soil cut	1	Minor footpath	-
2009/10/0922#	Opposite to Feature No. 8SW-A/FR38, Po Lo Che Road, Sai Kung	3.1 m high retaining wall(1)	7/10	DSD	30/9	Retaining wall	< 1	Minor footpath	-
2009/12/0927	Pun Chun Yuen, Shek Kwu Lung, Tai Po	7NW-A/C52	1/12	BD	Unknown	Soil cut	1.6	Village house	-
2009/12/0930	Footpath in Shek Kwu Lung Village, Shatin	Natural hillside	8/12	DO	8/12 (15:30)	Natural hillside	3 (Boulder fall)	Minor footpath	-
2010/02/0934	South of Lot 1423 in DD 77 Ha Shan Kai Wat, Ta Kwu Ling	3NW-D/C106	4/2/2010	Lands D	Dec 2009	Soil cut	25	Squatter dwelling	-

Table B4 - List of Landslide Incidents in the New Territories (Sheet 5 of 6)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
AFCD/ 2009/06/0001	Tai Po Kau Forest Track, Tai Po Kau Nature Reserve, Tai Po	7NW-D/C127	10/6	AFCD	10/6	Soil/rock cut	1 (Boulder fall)	Access road	-
ArchSD/N/ 2009/12/0001#	Wo Hop Shek Cemetery, Fanling	3SW-C/C73	9/6	Arch SD	Unknown	Soil cut	5	Others (Cemetery)	-
HyD/NTE/ 2009/07/0014#	Zone 243, Lin Ma Hang Road, Sha Tau Kok	3NE-A/C55	24/7	HyD	13/7	Soil cut	2	Open area	-
HyD/NTE/ 2009/09/0021	Che Keng Tuk Road, Sai Kung	8SW-C/C284	16/9	HyD	15/9	Soil/rock cut	2	Access road	-
HyD/NTE/ 2009/10/0017#	Zone 230, Lin Ma Hang Road, Sha Tau Kok	3NW-B/C20	12/11	HyD	8/10	Soil/rock cut	2	Open area	-
LandsD/N/ 2009/07/0001#	To Loi Tung East Village, Sha Tau Kok Road, Sha Tau Kok	3.4 m high soil cut slope(1)	27/7	Lands D	Unknown	Soil cut	2	Minor footpath	-
LandsD/SK/ 2009/06/0001#	Footpath from Ma Yau Tong Central Landfill to Ma Yau Tong Tsuen, Tseung Kwan O	11NE-D/C911	8/7	Lands D	Unknown	Soil cut	2^+	Minor footpath	-
LandsD/TP/ 2009/02/0001	House No. 30 Pak Kiu Tsai Tsuen, Tai Po	3.4 m high soil cut slope(1)	13/3	Lands D	Unknown	Soil cut	1	Squatter dwelling	-
LandsD/TW/ 2009/06/0001#	Near to The Yuen Yuen Institute, Lo Wai, Tsuen Wan	7SW-A/C80	11/6	Lands D	11/6	Soil cut	2	Access road	-

Table B4 - List of Landslide Incidents in the New Territories (Sheet 6 of 6)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
WSD/ 2009/9/2/NTE	Near Lower Shing Mun Reservoir North Gathering Ground, Shatin	5.5 m high soil cut slope(1)	29/9	WSD	Unknown	Soil cut	5.4	Minor footpath	-
WSD/ 2009/5/1/NTW	West of Feature No. 7SW-C/F514, Tsuen Wan Water Treatment Works Staff Quarters, Sheung Kwai Chung	3.5 m high soil cut slope(1)	18/5	WSD	Unknown	Soil cut	< 1	Squatter dwelling	-
WSD/ 2009/6/1/NTW#	Sham Tseng Reservoir near Supply Tunnel, Tuen Mun	6SE-C/R13	30/6	WSD	Unknown	Retaining wall (Masonry)	1.8	Open area	-

Legend:

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

\+ Failure volume estimated by GEO's landslide investigation consultants

(1) These features may or may not satisfy the criteria for feature registration as stated in WBTC No. 9/2000. Further investigation is being undertaken to ascertain their eligibility for registration

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Table B5 - List of Landslide Incidents in Outlying Islands (Sheet 1 of 3)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2009/03/0861#	Shui Hau Village, Lantau Island	13NE-A/FR147	26/3	Lands D	Unknown	Fill	5	Others (Streamcourse)	-
2009/05/0870	Sai Tso Wan, Lantau Island	Natural hillside	11/5	DLO	Unknown	Natural hillside	30	Minor footpath	-
2009/11/0926	Tai Kwok Temple, Upper Keung Shan, Lantau Island	Natural hillside	16/11	Public	Unknown	Natural hillside	1	Minor footpath	-
2009/12/0928	Near Feature No. 15NW-C/C162, House 29, Hung Shing Ye Wan, Lamma Island	4 m high soil cut slope(1)	19/11	Public	19/8	Retaining wall (Masonry)	< 1	Others (Alleyway)	-
2009/12/0929	Old Tai O Police Station, near Shek Tsai Po Street, Tai O, Lantau Island	Natural hillside	14/12	GEO	Unknown	Natural hillside	15	Others (Beach)	-
2009/12/0931	Keung Shan Road, Lantau Island	13NW-B/F112	21/12	HyD	Unknown	Fill	8	Road	-
ArchSD/L/ 2009/01/0001	Cheung Sha Upper Beach, Lantau Island	13NE-B/FR116	-	Arch SD	23/1	Retaining wall	10	Open area	-
ArchSD/L/ 2009/01/0002	Cheung Sha Upper Beach, Lantau Island	13NE-B/F117	-	Arch SD	23/1	Fill	3	Open area	-
HyD/NTE/ 2009/12/0011	Between Lamp Posts AC1344 and AC1345, South Lantau Road	Natural hillside	03/12	HyD	02/12	Natural hillside	2 (Boulder fall)	Open area	-

Table B5 - List of Landslide Incidents in Outlying Islands (Sheet 2 of 3)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
WSD/ 2009/1/1/HKI#	Section B, Shek Pik Catchwater, Lantau Island	13NW-B/CR222	7/1	WSD	Unknown	Soil cut	4.8	Catchwater	Catchwater channel partially blocked
WSD/ 2009/1/2/HKI	Below footpath leading to 9 Tung Hang Mei Village, Mui Wo, Lantau Island	10SW-A/C162	12/1	WSD	Unknown	Soil/rock cut	5.6	Access road	-
WSD/ 2009/1/3/HKI	Section E, Shek Pik Catchwater, Lantau Island	13NE-A/F19	20/1	WSD	Unknown	Fill	9	Others (Streamcourse)	-
WSD/ 2009/5/2/HKI#	Peng Chau Service Reservoir, Peng Chau	10SE-A/C13	25/5	WSD	Unknown	Soil/rock cut	3	Access road	-
WSD/ 2009/7/4/HKI	Above Feature No. 9SW-D/CR106, Section D West, Shek Pik Catchwater, Lantau Island	Natural hillside	8/7	WSD	Unknown	Natural hillside	6	Catchwater	-
WSD/ 2009/7/5/HKI#	Above Feature No. 9SW-D/CR107, Section D West, Shek Pik Catchwater, Lantau Island	Natural hillside	8/7	WSD	Unknown	Natural hillside	3	Catchwater	-
WSD/ 2009/7/6/HKI	Southwest of Feature No. 9SW-D/CR260, Sham Wat Catchwater, Lantau Island	Natural hillside	8/7	WSD	Unknown	Natural hillside	40	Nil (Landslide debris deposited on hillside)	-

Table B5 - List of Landslide Incidents in Outlying Islands (Sheet 3 of 3)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
WSD/ 2009/7/7/HKI	About 150 m west of Feature No. 9SW-D/CR260, Sham Wat Catchwater, Lantau Island	Natural hillside	8/7	WSD	Unknown	Natural hillside	18	Nil (Landslide debris deposited on hillside)	-
WSD/ 2009/7/8/HKI	About 200 m northwest of Feature No. 9SW-D/CR260, Sham Wat Catchwater, Lantau Island	Natural hillside	8/7	WSD	Unknown	Natural hillside	12	Nil (Landslide debris deposited on hillside)	-
WSD/ 2009/7/9/HKI	About 240 m northwest of Feature No. 9SW-D/CR260, Sham Wat Catchwater, Lantau Island	Natural hillside	8/7	WSD	Unknown	Natural hillside	36	Nil (Landslide debris deposited on hillside)	-

Legend:

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

(1) The feature may or may not satisfy the criteria for feature registration as stated in WBTC No. 9/2000. Further investigation is being undertaken to ascertain its eligibility for registration

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

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

部份土力工程處的主要刊物目錄刊載於下頁。而詳盡及最新的土力工程處刊物目錄，則登載於土木工程拓展署的互聯網網頁 http://www.cedd.gov.hk 的"刊物"版面之內。刊物的摘要及更新刊物內容的工程技術指引，亦可在這個網址找到。

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

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GEOTECHNICAL MANUALS

Geotechnical Manual for Slopes, 2nd Edition (1984), 302 p. (English Version), (Reprinted, 2011).

斜坡岩土工程手冊(1998)，308頁(1984年英文版的中文譯本)。

Highway Slope Manual (2000), 114 p.

GEOGUIDES

Geoguide 1	Guide to Retaining Wall Design, 2nd Edition (1993), 258 p. (Reprinted, 2007).
Geoguide 2	Guide to Site Investigation (1987), 359 p. (Reprinted, 2000).
Geoguide 3	Guide to Rock and Soil Descriptions (1988), 186 p. (Reprinted, 2000).
Geoguide 4	Guide to Cavern Engineering (1992), 148 p. (Reprinted, 1998).
Geoguide 5	Guide to Slope Maintenance, 3rd Edition (2003), 132 p. (English Version).
岩土指南第五冊	斜坡維修指南，第三版(2003)，120頁(中文版)。
Geoguide 6	Guide to Reinforced Fill Structure and Slope Design (2002), 236 p.
Geoguide 7	Guide to Soil Nail Design and Construction (2008), 97 p.

GEOSPECS

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

GEO PUBLICATIONS

GCO Publication No. 1/90	Review of Design Methods for Excavations (1990), 187 p. (Reprinted, 2002).
GEO Publication No. 1/93	Review of Granular and Geotextile Filters (1993), 141 p.
GEO Publication No. 1/2006	Foundation Design and Construction (2006), 376 p.
GEO Publication No. 1/2007	Engineering Geological Practice in Hong Kong (2007), 278 p.
GEO Publication No. 1/2009	Prescriptive Measures for Man-Made Slopes and Retaining Walls (2009), 76 p.
GEO Publication No. 1/2011	Technical Guidelines on Landscape Treatment for Slopes (2011), 217 p.

GEOLOGICAL PUBLICATIONS

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

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

TECHNICAL GUIDANCE NOTES

TGN 1	Technical Guidance Documents

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