Factual Report on Hong Kong Rainfall and Landslides in 2011

GEO Report No. 310

J.C.W. Leung, H.W.K. Lam & S.M. Ting

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.

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H.N. Wong
Head, Geotechnical Engineering Office
May 2015

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Foreword

This report presents a summary of the factual information on rainfall and landslides in Hong Kong throughout 2011. 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, Highways Department, Housing Department, Lands Department, Water Supplies Department, and including that by 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.

Alex C.O. Li
Atg. Chief Geotechnical Engineer/LPM Division 1

Abstract

This report presents a summary of the factual information on rainfall and landslides in Hong Kong throughout 2011. 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 collected from the Agriculture, Fisheries and Conservation Department, Architectural Services Department, Drainage Services Department, Highways Department, Housing Department, Lands Department, Water Supplies Department, and including that by the GEO's landslide investigation consultants, namely Fugro Scott Wilson Joint Venture and AECOM Asia Company Limited.

Rainfall recorded in 2011 at the HKO's Principal Raingauge at Tsim Sha Tsui amounted to 1,476.7 mm, significantly lower than the mean rainfall of 2,382.7 mm recorded between 1971 and 2000. No Black Rainstorm Warning was issued in 2011; two Red Rainstorm Warnings were issued on 22 May 2011 and 14 Amber Rainstorm Warnings between 17 April and 19 September 2011.

No Landslip Warning was issued in 2011. A total of 83 incidents were reported to the Government in 2011. Of these, 77 were classified as genuine landslides and one of them was designated as major failure (i.e. with a failure volume of 50 m^3 or more, or where a fatality has occurred).

There were seven landslides in 2011 with notable consequences. Of these landslides, one resulted in damage to an external wall within a bus terminus, five led to temporary closure of roads, and another one with landslide debris inundating a residential area. Other landslides in 2011 affected open car parks, footpaths or minor access roads and cemeteries, without any significant direct or indirect consequence. No injury or fatality was reported as a result of the 2011 landslides.

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1 Introduction

This report summarises the factual information on rainfall and reported landslides in Hong Kong throughout 2011. 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 collected from the Agriculture, Fisheries and Conservation Department (AFCD), Architectural Services Department (ArchSD), Drainage Services Department (DSD), Highways Department (HyD), Housing Department (HD), Lands Department (LandsD), Water Supplies Department (WSD), and including that by the GEO's landslide investigation consultants, namely AECOM Asia Company Limited (AECOM) and Fugro Scott Wilson Joint Venture (FSWJV), under Agreement Nos. CE 09/2009 (GE) and CE 10/2009 (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, or 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 ≥ 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. ≤ 5 m^3 for failures involving soil, or ≤ 0.1 m^3 for rockfalls/boulder falls) and does not give rise to any significant public nuisance or notable consequences (e.g. casualty, evacuation of buildings or squatter dwellings, road closure, 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 88 GEO raingauges and 22 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 2.1.

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 2011, as well as individual months and individual rainstorms.

The weather in 2011, as described by the HKO (2012), is excerpted as follows:

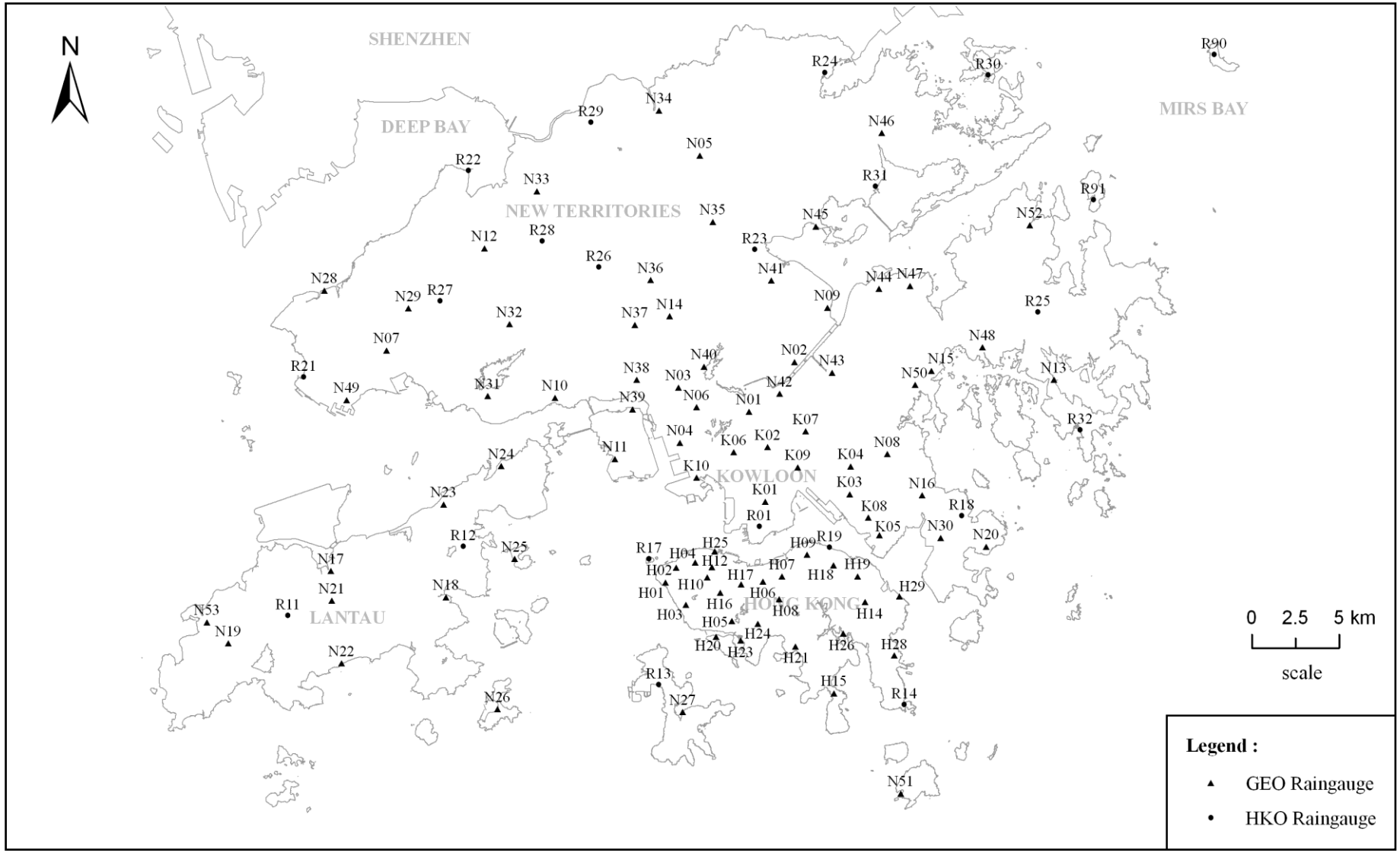


Figure 2.1 Locations of GEO and HKO Automatic Raingauge

> "The year 2011 was also an exceptionally dry year. With well below normal rainfall in the first nine months, the annual rainfall of 1,476.7 millimetres was about 38 per cent below normal, the lowest since 1963."
>
> "During 2011, there were only two red rainstorm warnings issued by the Hong Kong Observatory, about one half of the average number of red rainstorm warnings in a year since operation of the Rainstorm Warning System in 1992. There was no black rainstorm warning issued in the year."
>
> "In Hong Kong, five tropical cyclones necessitated the issuance of local tropical cyclone warning signals, slightly less than the long term average of about six in a year. Typhoon Nesat, which affected Hong Kong in September, necessitated the issuance of the No. 8 Gale or Storm Signal."

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 2011). Further details on the monthly weather are available on the HKO Website (http://www.hko.gov.hk/wxinfo/pastwx/mws.htm).

> "With the return of the trough of low pressure, showers and thunderstorms developed over Hong Kong in the afternoon and evening on 21 May. Rain became heavy with squally thunderstorms in the morning of 22 May as the trough became very active along the coast. Meanwhile, another trough of low pressure over inland Guangdong edged southwards to cross the coast that evening, bringing another episode of heavy rain and squally thunderstorms to the territory. Totally, more than 100 millimetres of rainfall were recorded over most of Hong Kong with more than 200 millimetres over parts of the New Territories on 22 May. There were still a few squally thunderstorms in the morning of 23 May."
>
> "Under the influence of a convective disturbance, local weather deteriorated again with occasional heavy rain and a few squally thunderstorms on 16 and 17 June. Over 200 millimetres of rainfall were recorded over parts of the urban area and Sha Tin on these two days."
>
> "….an active trough of low pressure brought occasional heavy rain and squally thunderstorms to the territory on 28 and 29 June. More than 120 millimetres of rainfall were recorded over the western part of Hong Kong Island on 28 June and more than 100 millimetres over Yuen Long, Sha Tin and the northeastern part of the New Territories on 29 June."

> "A trough of low pressure lingered along the coast of southern China for most of the time in the ensuing eight days and continued to bring unsettled weather with occasional rain and thunderstorms to the territory. The rain was particularly heavy on 16 July where more than 70 millimetres of rainfall was recorded on Hong Kong Island in the small hours."
>
> "A trough of low pressure developed near the South China coast and brought thundery showers to the territory for the next two days. As the trough of low pressure became more active, there were occasional heavy rain and squally thunderstorms over the territory on 10 August. With the weakening of the trough of low pressure on 11 August, the rain eased off and there were sunny periods during the day."

The rainfall recorded at the HKO in the first quarter of 2011 is 49.6 mm (66.6% below the normal rainfall). The total rainfalls recorded in the second and third quarter are 658.3 mm (27.3% below normal) and 507.5 mm (54.1% below normal) respectively. For the last quarter of 2011, the total rainfall is 261.3 mm (17.9% above normal). The annual rainfall for 2011 is 1,476.7 mm, about 38 percent lower than the annual normal of 2,382.7 mm recorded between 1971 and 2000. The cumulative rainfall for 2011 is compared with the highest, lowest and mean rainfall in Figure 2.2.

Figure 2.3 shows the monthly rainfall distribution in 2011.

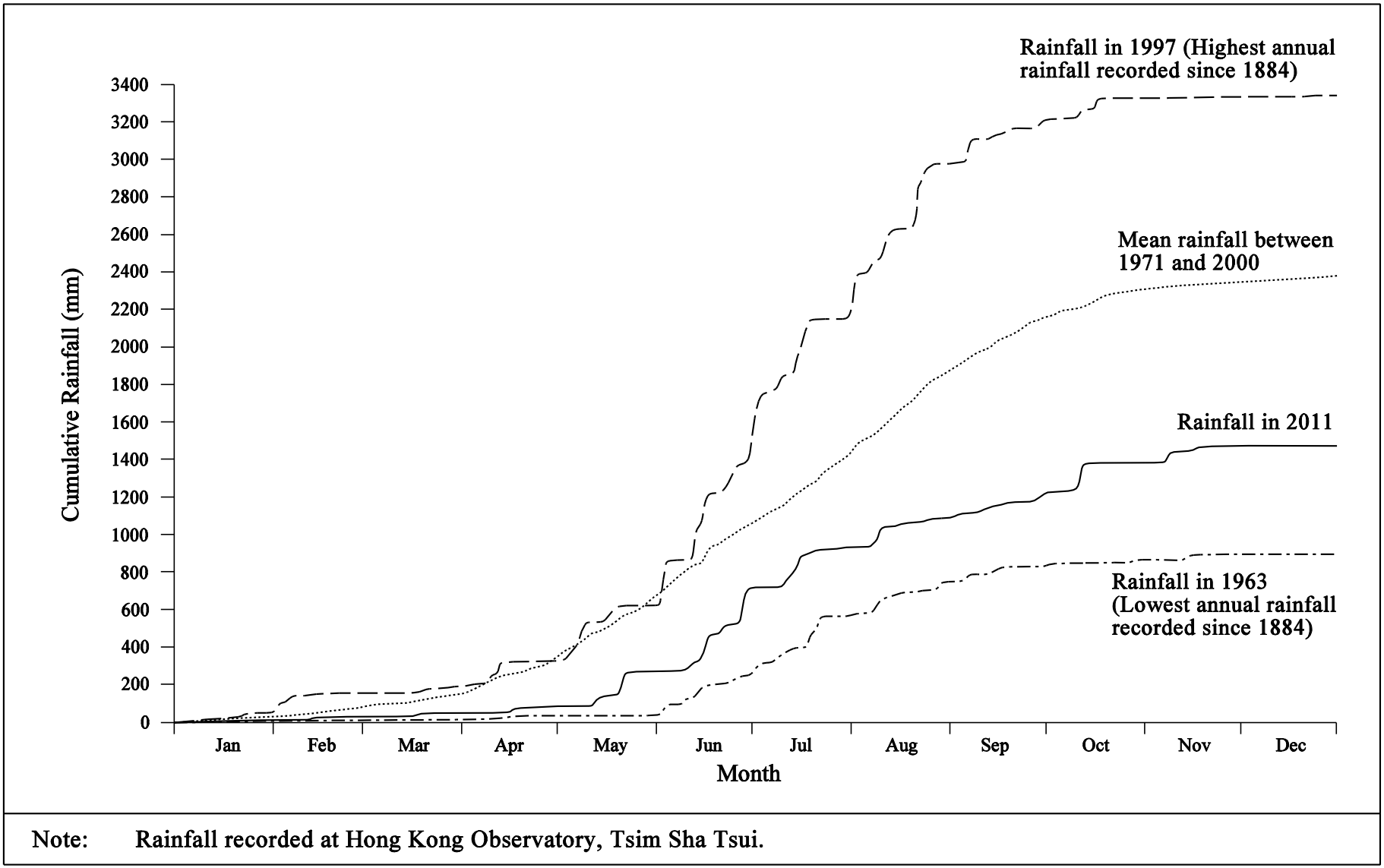
Figure 2.4 shows the annual rainfall distribution in 2011, together with the locations of the reported landslides.

2.3 Rainstorms in 2011

Table 2.1 tabulates the rainfall parameters for 19 rainstorms in 2011, 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 2.1 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 2.1 for comparison. Other rainfall parameters for the above 19 rainstorms are also shown in Table A1 of Appendix A.

Figures A1 to A19 of Appendix A show the isohyets of the maximum rolling 24-hour rainfall during the above 19 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.

Each of the rainstorms in 2011 resulted in less than 10 reported landslides.



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

Figure 2.2 Cumulative Rainfall for 2011 at the Hong Kong Observatory and its Recorded Highest, Mean and Lowest Cumulative Rainfalls

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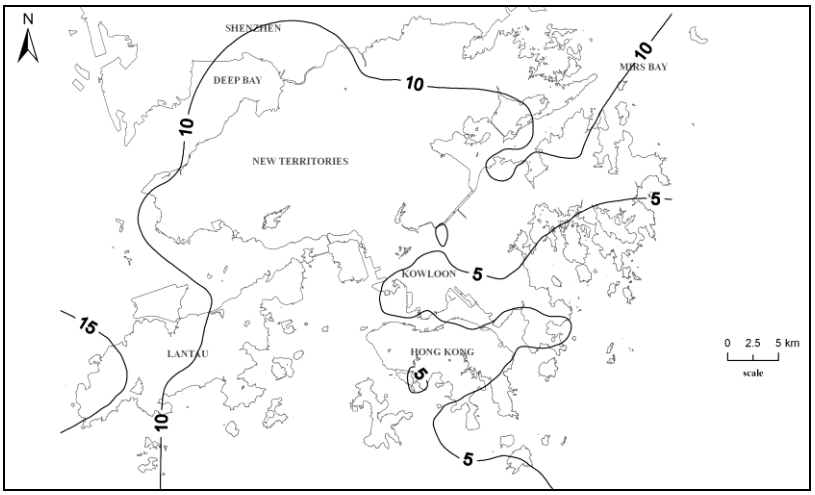
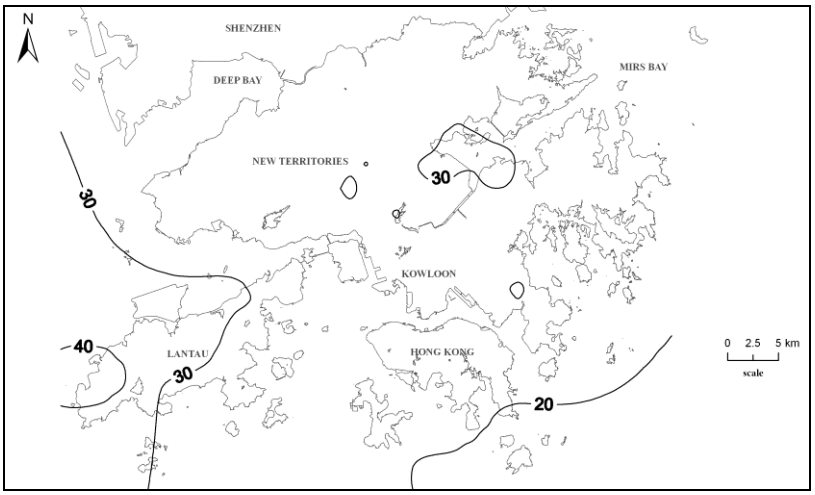
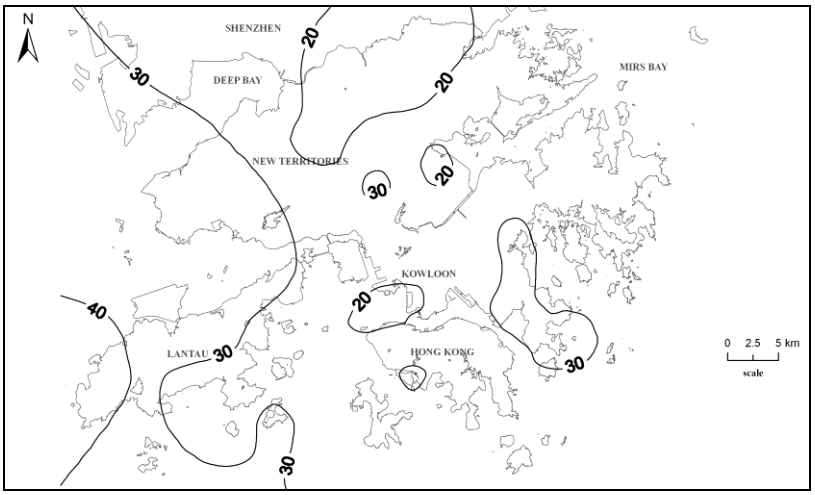


January 2011



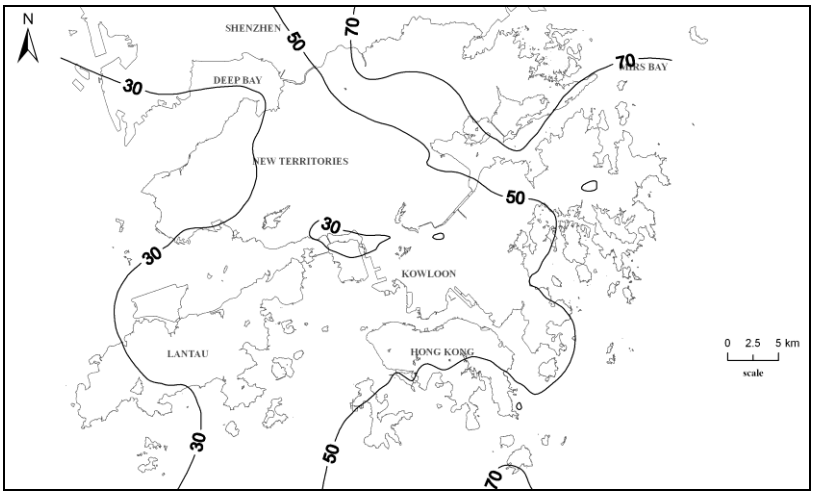
February 2011



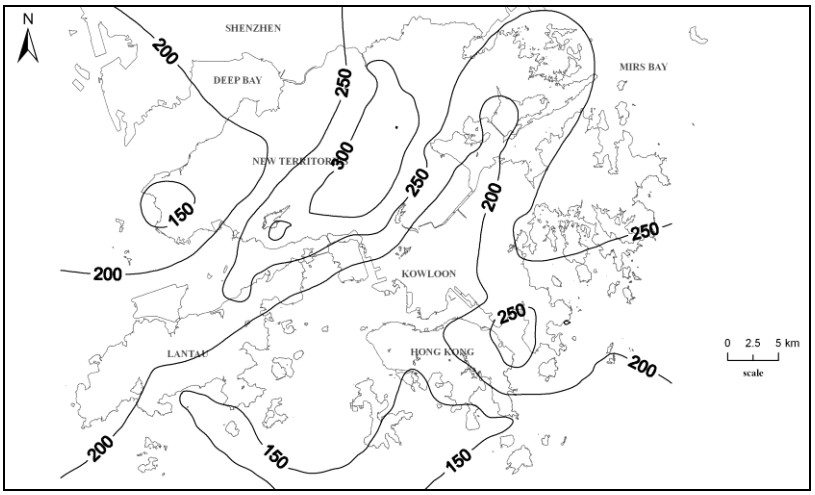
March 2011

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

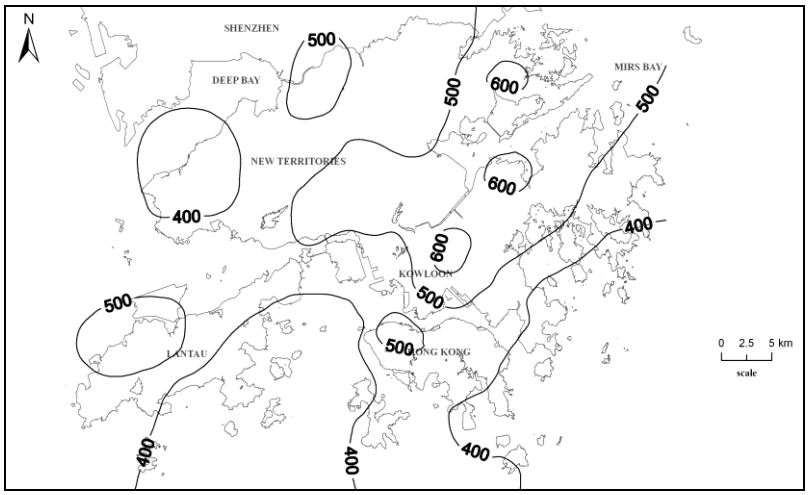
Figure 2.3 Monthly Rainfall Distribution in 2011 (Sheet 1 of 4)



April 2011



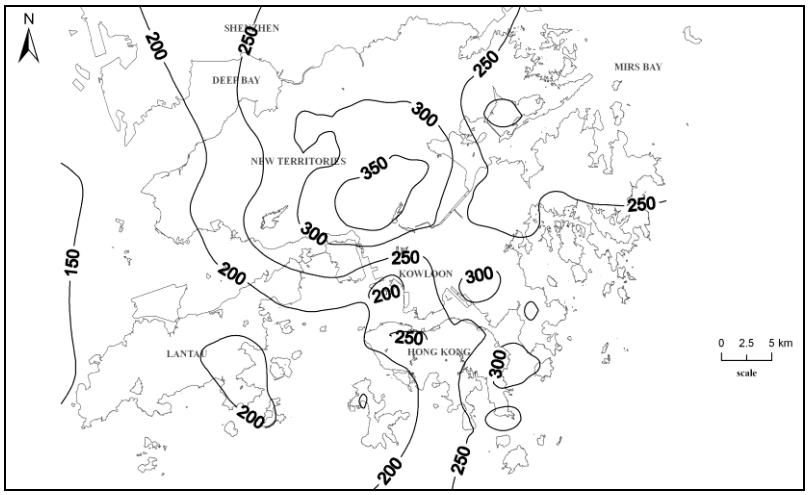
May 2011



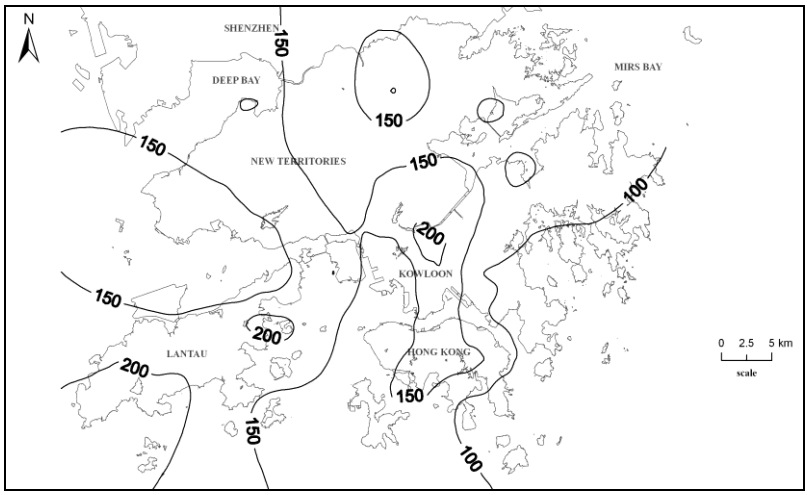
June 2011

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

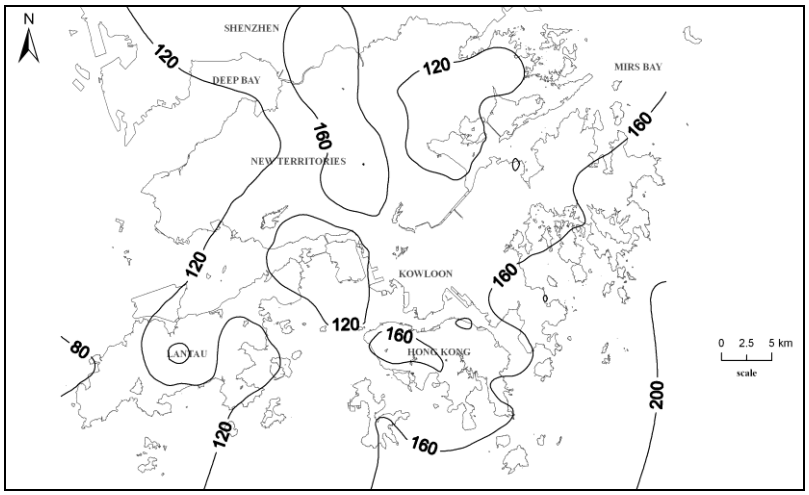
Figure 2.3 Monthly Rainfall Distribution in 2011 (Sheet 2 of 4)



July 2011



August 2011



September 2011

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

Figure 2.3 Monthly Rainfall Distribution in 2011 (Sheet 3 of 4)

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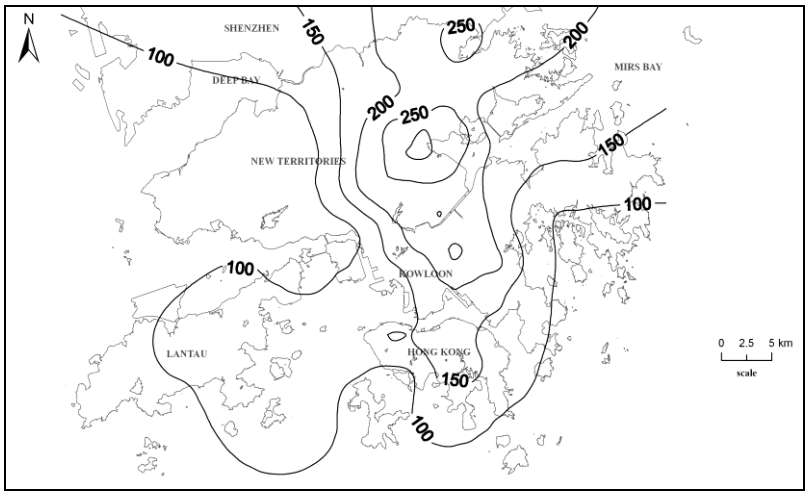
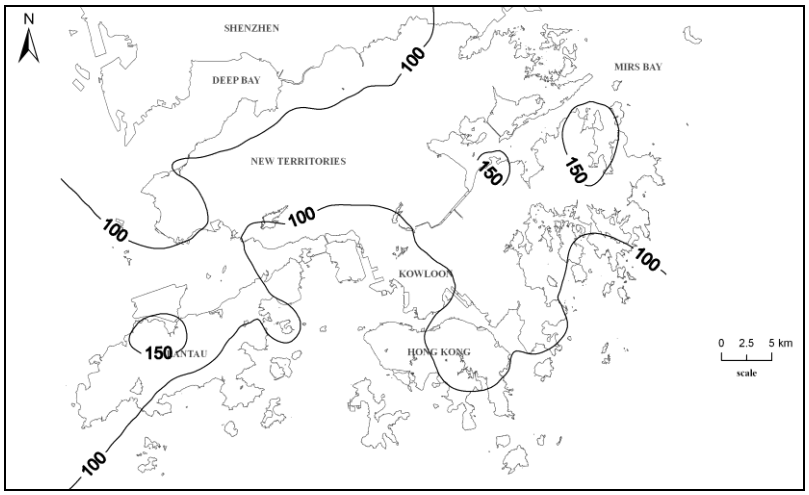
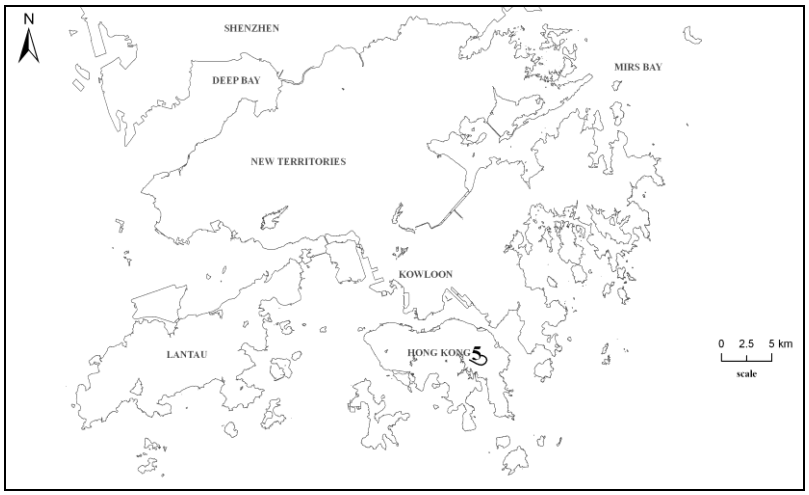


October 2011



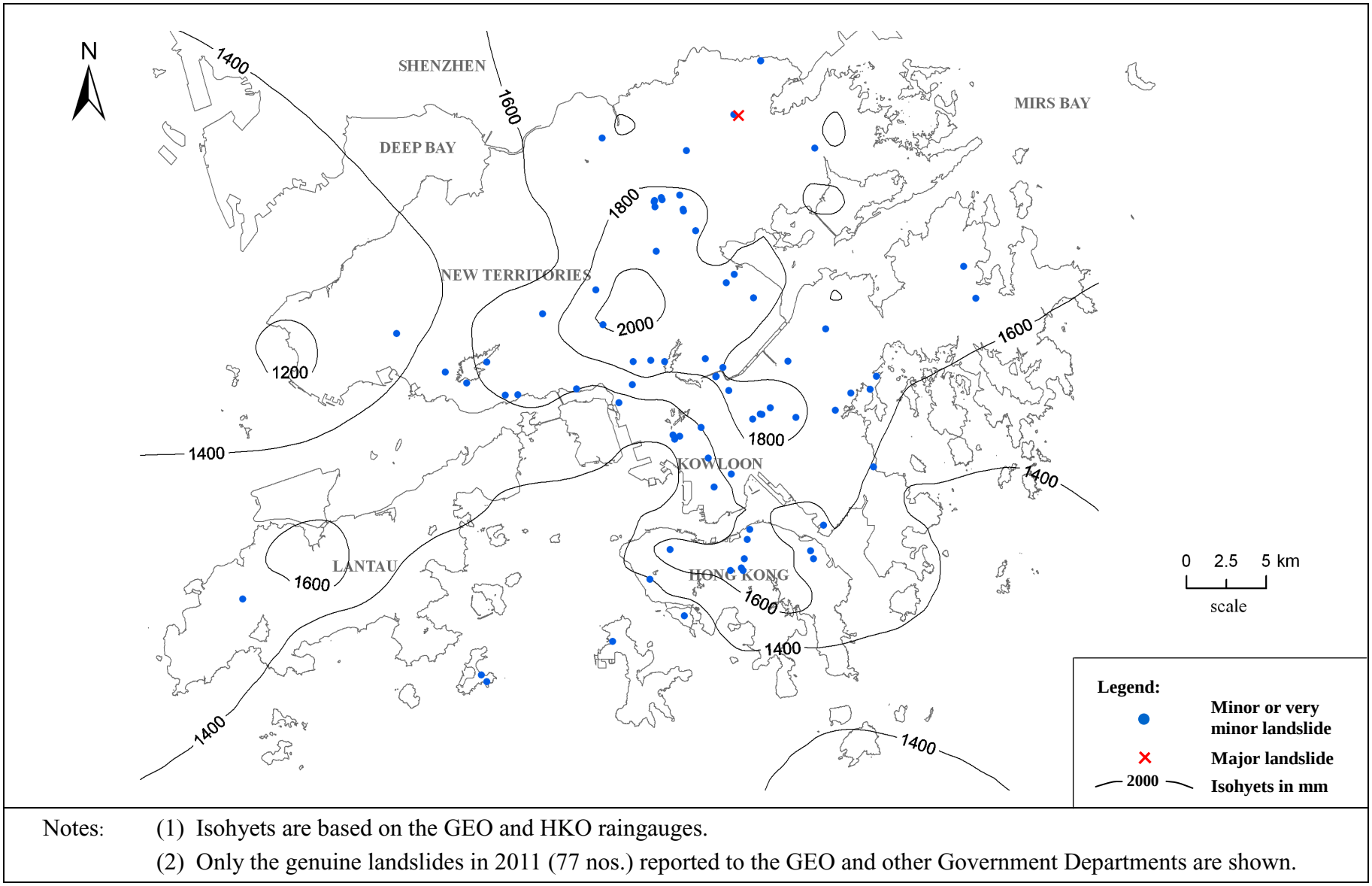
November 2011



December 2011

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

Figure 2.3 Monthly Rainfall Distribution in 2011 (Sheet 4 of 4)



Notes: (1) Isohyets are based on the GEO and HKO raingauges.

(2) Only the genuine landslides in 2011 (77 nos.) reported to the GEO and other Government Departments are shown.

Figure 2.4 Annual Rainfall Distribution and Locations of Reported Landslides in 2011

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Table 2.1 Rainfall and Landslides in 2011 and Selected Previous Major Rainstorms (Sheet 1 of 3)

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				
17-18 April 2011	26.7	24.7	14	0	0	67.5 (N34)	51.5 (N51)	49 (N51)	0
13-16 May 2011	37.5	31.3	12.6	0.2	7.7	91.5 (H28)	73.5 (H28)	52.5 (N36)	0
21-23 May 2011	77.9	47.6	23.1	0.3	58.9	236.5 (N31)	183 (N35)	116.5 (N35)	7
11-13 June 2011	39.5	23.1	9.9	2.8	2.8	164.5 (N17)	119 (N17)	88.5 (N38)	3
16-18 June 2011	113.7	47.2	29.7	39.1	53.5	205(N42)	114.5 (K02)	69 (N42)	4
22-24 June 2011	44.5	18.4	9	9.5	205.2	101 (N36)	69 (N19)	49.5 (N17)	1
28 June – 1 July 2011	109.1	57.5	36.2	0.6	204.4	166.5 (N46)	101 (N46)	65.5 (H25)	1
11-13 July 2011	33.2	27.3	27.3	0	199.6	69 (N45)	43 (H21)	41.5 (K03)	1
15-17 July 2011	88.6	62.3	14.1	78.3	94.8	153 (N03)	102.5 (N18)	63 (N31)	1
19-21 July 2011	19.5	8.3	7.3	99.9	178.2	114 (N38)	74.5 (N38)	65.5 (N39)	0
29-30 July 2011	12.4	9.7	8.5	0	137.3	89.5 (N35)	46.5 (N35)	45 (N35)	0
8-11 August 2011	78.2	51.8	29.2	0	12.4	132 (N21)	98 (H08)	74 (H24)	1
25-26 August 2011	13.7	13.7	13.6	5.3	106	92 (N32)	92 (N32)	71.5 (N32)	0
3-4 September 2011	22.8	19.7	7.6	0.6	28.7	69 (H16)	64 (H16)	39 (N13)	0
15-16 September 2011	11.9	10.9	5.4	26.4	54.2	65.5 (N51)	65.5 (N51)	46 (N51)	0
19-20 September 2011	16.1	16.1	8.9	12.6	43.6	64 (N05)	64 (N05)	57 (N34)	1
29 September – 1 October 2011	33.3	14	13.1	6.9	38.6	91 (N37)	55.5 (N23)	42.5 (N23)	0
10-15 October 2011	108.9	53.7	17.2	0.1	58.2	174 (N45)	104.5 (N45)	80.5 (45)	5
8-10 November 2011	52.8	27.6	10.2	0	2.1	116 (N17)	43.5 (N44)	18.5 (N35, N53)	1

Table 2.1 Rainfall and Landslides in 2011 and Selected Previous Major Rainstorms (Sheet 2 of 3)

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				

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 88 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.

Table 2.1 Rainfall and Landslides in 2011 and Selected Previous Major Rainstorms (Sheet 3 of 3)

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 2.2 Warnings Issued by the Hong Kong Observatory in 2011

Month	Monthly Total Rainfall (mm)	Dates on which Warnings [1] were in Effect				
		Thunderstorm [2]	Flooding	Landslip [3]	Tropical Cyclone [4]	Rainstorm
January	5.4	-	-	-	-	-
February	23.7	-	-	-	-	-
March	20.5	-	-	-	-	-
April	36	17	-	-	-	17 (Amber)
May	186.7	3, 12, 13, 14, 16, 21, 22	13, 22	-	-	13 (Amber), 22 (3 x Amber, 2 x Red)
June	435.6	6, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 26, 28, 29, 30	-	-	10 (1, SARIKA), 20-23 (1-3, HAIMA)	11 (Amber), 12 (Amber), 16 (Amber), 17 (Amber), 28 (Amber), 29 (Amber)
July	226.8	1, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 22, 28, 29	-	-	28-29 (1-3, NOCK-TEN)	16 (Amber)
August	157.6	8, 9, 10, 11, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31	25	-	-	10 (Amber)
September	123.1	2, 4, 6, 9, 10, 11, 15, 18, 19, 30	-	-	27-30 (1-8, NESAT)	19 (Amber)
October	172.4	14	-	-	2-3 (1-3, NALGAE)	-
November	86.1	-	-	-	-	-
December	2.8	-	-	-	-	-
Total	1,476.7	65 Warnings	3 Warnings	0 Warnings	5 Warnings	16 Warnings (14 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.

2.4 Warnings Issued by the Hong Kong Observatory

Table 2.2 summarises the details of the Thunderstorm, Flooding, Landslip, Tropical Cyclone and Rainstorm Warnings issued by the HKO in 2011. No Black Rainstorm Warning was issued in 2011. Two Red Rainstorm Warnings and 14 Amber Rainstorm Warnings were issued on 22 May 2011 and between 17 April and 19 September 2011 respectively. No Landslip Warning was issued in 2011.

3 Landslides

3.1 Landslides in 2011

Landslide incidents reported to the GEO and other Government Departments in 2011 are summarised in Table 3.1.

Table 3.1 Breakdown of Landslides Reported to Government Departments in 2011

Department	Reported Number of Landslides	Genuine Landslides
Agriculture, Fisheries and Conservation Department	1 (0)	1 (0)
Architectural Services Department	12 (2)	12 (2)
Drainage Services Department	0 (0)	0 (0)
Geotechnical Engineering Office, Civil Engineering and Development Department	58(1)	53(1)
Highways Department	18 (12)	18 (12)
Housing Department	0 (0)	0 (0)
Lands Department	4 (1)	3 (1)
Water Supplies Department	6 (1)	6 (1)
Total	99 (16)(2)	93 (16)(2)

Legend:

6(1) Six incidents were reported to the Government Department concerned, one of which was also reported to the GEO separately by other parties (i.e. duplicate cases)

Notes:

(1) A total of 58 landslide incidents (discounting duplicated cases) were reported to the GEO in 2011, of which 53 incidents were classified as genuine landslides.

(2) The number of reported landslide incidents in 2011 (discounting duplicate cases) is 83 [99-16]. The number of genuine landslides is 77 [93-16].

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A total of 83 landslide incidents that occurred in 2011 were reported to various Government Departments. These include 58 incidents reported to the GEO. Another 25 incidents were reported to other Government Departments (i.e. AFCD, ArchSD, HyD, LandsD and WSD). Of these 83 reported incidents, 77 were genuine landslides (see details in Appendix B). The other reported incidents were non-landslide events such as flooding.

Of the 77 genuine landslides, one (2%) was major landslide (see Table B1 in Appendix B), 38 (49%) were minor landslides, and 38 (49%) were very minor landslides with negligible consequences (see Section 1).

Selected notable landslides are presented in Section 4 and illustrated in Figures 4.1 to 4.3. For those landslide incidents inspected by the GEO, the information on the landslides was recorded in incident reports prepared by the GEO. 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 is available in 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 77 landslides, the timing of occurrence was determined to within one day for 34 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 3.2. 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 3.3. The facility group affected by the major landslide is presented in Table 3.4. Further descriptions of some selected notable landslides of 2011 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 major 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 3.5.

Table 3.2 Breakdown of Landslides by Type of Affected Facility

Type of Affected Facility	Hong Kong Island	Kowloon	New Territories and Outlying Islands	All
Buildings (including village houses)	3 (0)	1 (0)	5 (0)	9 (0)
Registered Squatter Dwellings	0 (0)	0 (0)	4 (0)	4 (0)
Roads	2 (0)	0 (0)	6 (0)	8 (0)
Transportation Facilities (e.g. railways, tramways, etc.)	0 (0)	0 (0)	0 (0)	0 (0)
Pedestrian Pavements/Footways	0 (0)	0 (0)	6 (0)	6 (0)
Minor Footpaths/Access Paths/ Access Roads	3 (0)	2 (0)	13 (0)	18 (0)
Construction Sites	0 (0)	0 (0)	0 (0)	0 (0)
Open Areas	1 (0)	2 (0)	5 (0)	8 (0)
Catchwaters	0 (0)	0 (0)	0 (0)	0 (0)
Others (e.g. carparks, parks, playgrounds, gardens, backyards, etc.)	2 (0)	2 (0)	16 (1)	20 (1)
Nil	0 (0)	2 (0)	2 (0)	4 (0)
Total	11 (0)	9 (0)	57 (1)	77 (1)

Legend:

16 (1) Sixteen landslides of which one was major failure (i.e. failure volume $\geq 50\ m^3$)

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

Table 3.3 Breakdown of Landslide Consequences by 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 reported to GEO
		Permanent	Temporary		Roads	Pedestrian Pavements	Footpaths, Alleyways or Private Access Paths		
Fill Slopes		0	0	0	1	1	2	0	0
Cut Slopes	Soil	0	0	0	0	0	1	0	0
	Soil/Rock	0	0	0	1	0	1	0	0
	Rock	0	0	0	1	0	0	0	0
Retaining Walls		0	0	0	0	0	1	0	0
Natural Hillside		0	0	0	2	0	1	0	0
Registered Disturbed Terrain		0	0	0	0	0	0	0	0
Total		0	0	0	5	1	6	0	0

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) The above table has not included a landslide incident, which resulted in damage to an external wall within a bus terminus (see Appendix B3 for details).

Table 3.4 Breakdown of Facility Groups Affected by Major Landslides

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

Note: Facility groups are classified in accordance with the GEO Technical Note No. 15 (GEO, 2007).

Table 3.5 Breakdown of Landslides by Type of Slope Failure

Type of Slope Failure		Number	Percentage (%)
Fill Slopes		7 (0)	9.1
Cut Slopes	Soil	32 (1)	41.5
	Soil/Rock	12 (0)	15.6
	Rock	4 (0)	5.2
Retaining Walls		8 (0)	10.4
Natural Hillsides		13 (0)	16.9
Registered Disturbed Terrain		1 (0)	1.3
Total		77 (1)	100.0

Legend:

32 (1) Thirty-two 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 that were not genuine landslides have been excluded.

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3.4 Landslide Volume Distribution

Tables 3.6 and 3.7 show the distribution of failure volumes for all the reported landslides. A total of 53 landslides (68.8%) involved less than 5 m^3 of material. There was one major landslide (with a failure volume of 50 m^3 or more).

Table 3.6 Landslide Volume Distribution with Respect to Geographical Locations

Volume of Failure (m^3)	Hong Kong Island	Kowloon	New Territories and Outlying Islands	All
< 5	10	5	38	53 (68.8%)
≥ 5 to < 10	0	1	7	8 (10.4%)
≥ 10 to < 20	0	2	3	5 (6.5%)
≥ 20 to < 50	1	1	8	10 (13%)
≥ 50 to < 200	0	0	1	1 (1.3%)
≥ 200 to < 500	0	0	0	0 (0%)
≥ 500 to < 1000	0	0	0	0 (0%)
≥ 1000	0	0	0	0 (0%)
Total	11	9	57	77 (100%)

Legend:

5 (6.5%) Five landslides, which amount to 6.5% of the total 77 genuine landslides reported to the Government

Table 3.7 Landslide Volume Distribution with Respect to Type of Slope Failure

Volume of Failure (m^3)	Fill Slopes	Cut Slopes			Retaining Walls	Natural Hillsides	Registered Disturbed Terrain	Total
		Soil	Soil/ Rock	Rock				
< 5	2	24	10	3	4	10	0	53 (68.8%)
≥ 5 to < 10	1	2	0	1	2	1	1	8 (10.4%)
≥ 10 to < 20	2	1	1	0	0	1	0	5 (6.5%)
≥ 20 to < 50	2	4	1	0	2	1	0	10 (13%)
≥ 50 to < 200	0	1	0	0	0	0	0	1 (1.3%)
≥ 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	7	32	12	4	8	13	1	77 (100%)

Legend**:**

5 (6.5%) Five landslides, which amount to 6.5% of the total 77 genuine landslides reported to the Government

4 Notable Landslides

4.1 General

Of the 77 genuine landslides reported to the Government in 2011, two incidents are described in more detail below. These two incidents have been selected on the basis of their consequences or scale of failure.

4.2 The 16 June 2011 Landslide on Natural Hillside beneath Stubbs Road, Happy Valley (Incident No. 2011/06/1110)

At about 9:10 a.m. on 16 June 2011 when Amber Rainstorm Warning was in effect, a 30 m^3 landslide occurred at the natural hillside beneath Stubbs Road, below a retaining wall (slope No. 11SW-D/R148). The source area was about 4 m wide, 6 m long, and 0.5 m deep. The landslide debris and muddy water travelled down the hillside and along the surface drainage channels near the slope toe to Village Terrace below. Landslide debris inundated the open area between Houses No. 9 and No. 11 in Village Terrace. No injury or casualty was reported.

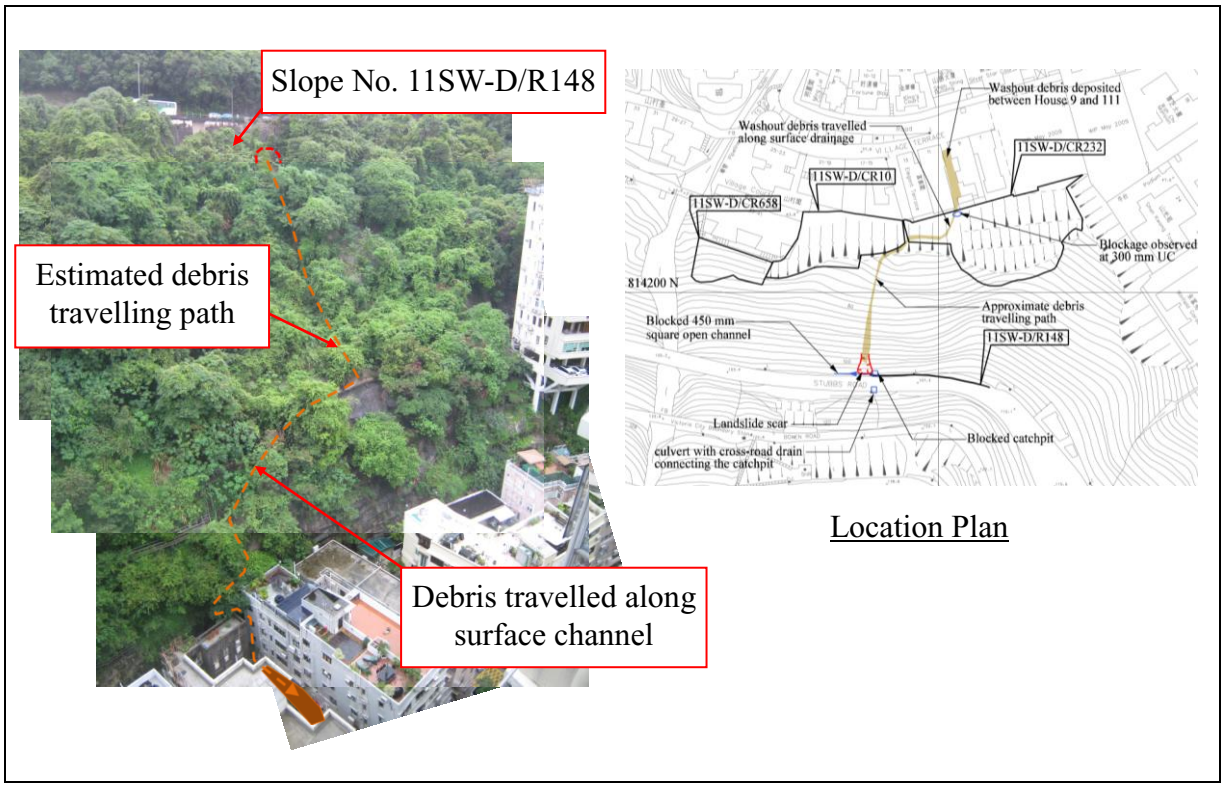

Figure 4.1 General View of the 16 June 2011 Landslide on Natural Hillside Beneath Stubbs Road, Happy Valley (Incident No. 2011/06/1110)

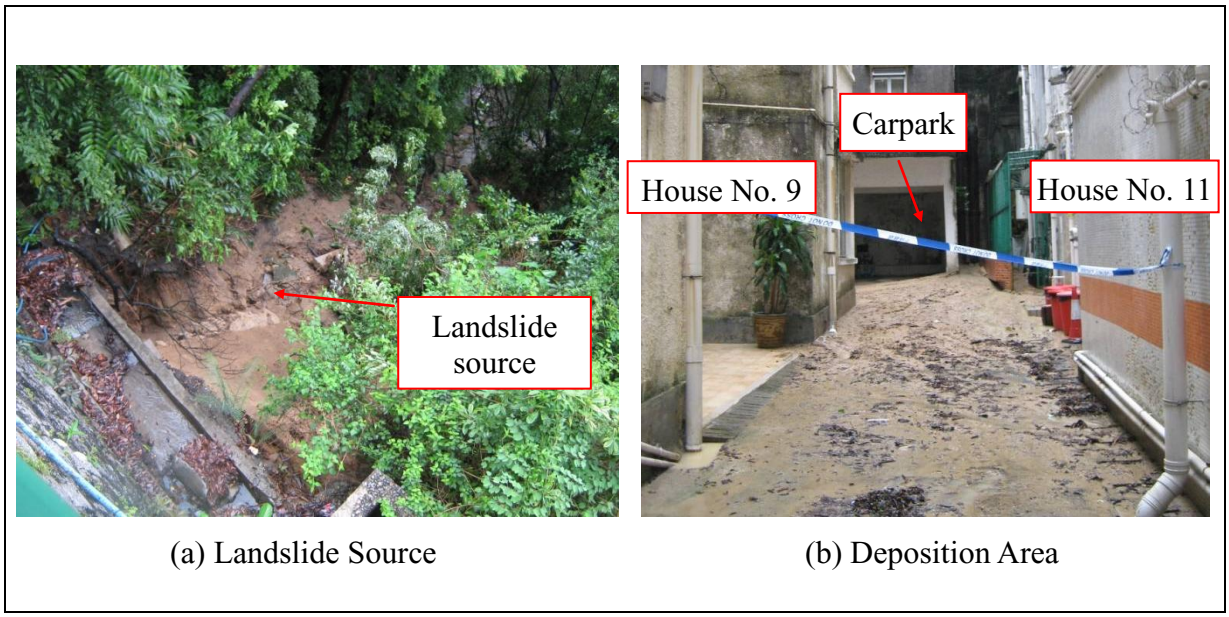

Figure 4.2 Views of the 16 June 2011 Landslide on Natural Hillside Beneath Stubbs Road, Happy Valley (Incident No. 2011/06/1110)

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4.3 The October 2011 Landslide on Slope No. 3NW-D/C41 behind a Construction Depot near Loi Tung Village, Sha Tau Kok (Incident No. 2011/10/1138)

On 18 October 2011, a 150 m^3 landslide was reported to have occurred at slope No. 3NW-D/C41 behind a construction depot, near Loi Tung Village, Sha Tau Kok. The exact time and date of the failure were unknown. The landslide mainly occurred at the middle portion of the slope. The landslide debris partly deposited on the lower slope portion and partly on an open area at the slope toe. Debris of the landslide came to rest against the fencing of a construction depot. Signs of cultivation were observed at the area immediately below the landslide scar. No injury or casualty was reported.

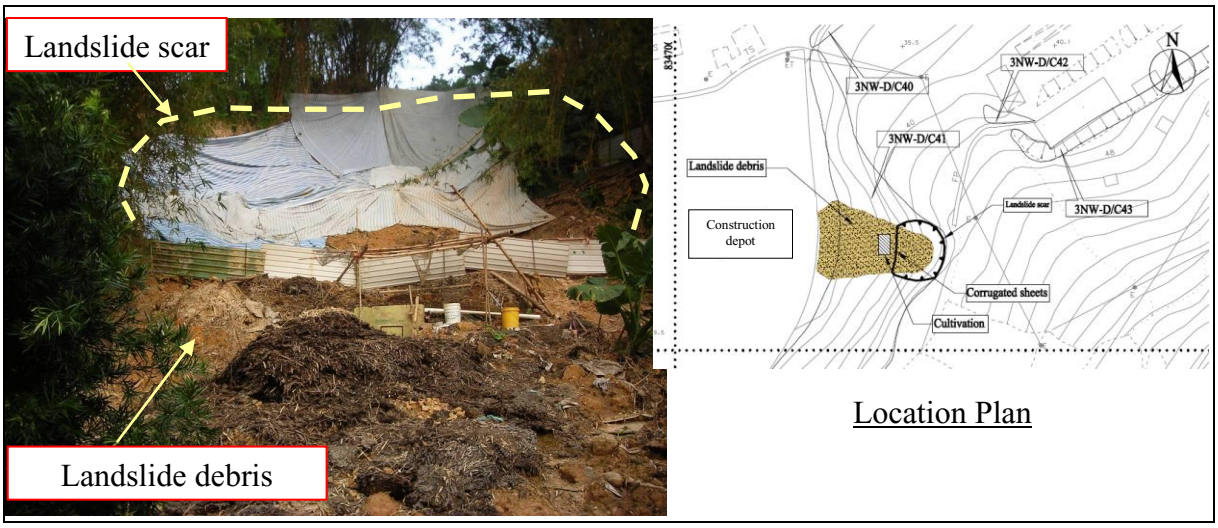

Figure 4.3 General View of the October 2011 Landslide on Slope No. 3NW-D/C41 behind a Construction Depot near Loi Tung Village, Sha Tau Kok (Incident No. 2011/10/1138)

5 Conclusion

Rainfall recorded at the HKO's Principal Raingauge at Tsim Sha Tsui amounted to 1,476.7 mm in 2011, significantly lower than the mean value of 2,382.7 mm between 1971 and 2000. In 2011, no Landslip Warning or Black Rainstorm Warning was issued. Two Red Rainstorm Warnings were issued on 22 May 2011 and 14 Amber Rainstorm Warnings between 17 April and 19 September 2011. Of the 77 genuine landslides, one was a major failure, 38 were minor failures and 38 were very minor failures with negligible consequences.

There were seven landslides in 2011 with notable consequences. Of these landslides, one resulted in damage to an external wall within a bus terminus, five led to temporary closure of roads, and another one with landslide debris inundating a residential area. Other landslides in 2011 affected open car parks, footpaths or minor access roads and cemeteries, without any significant direct or indirect consequence. No injury or fatality was reported as a result of the 2011 landslides.

6 References

GEO (2007). *GEO Technical Guidance Note No. 15 (TGN 15) – Guidelines for Classification of Consequence-to-Life Category for Slope Features.* Geotechnical Engineering Office, Hong Kong, 14 p.

GEO (2010). *GEO Circular No. 3 – Non Development Clearance (Slope Safety) of Squatters.* Geotechnical Engineering Office, Hong Kong, 20 p.

HKO (2012). *Monthly Weather Summary December 2011.* Hong Kong Observatory, Hong Kong, 26 p.

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Appendix A

Some Selected Rainfall Parameters for the 19 Rainstorms with Daily Rainfall Exceeding 50 mm

List of Tables

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Table A1 Some Selected Rainfall Parameters for the 19 Rainstorms with Daily Rainfall Exceeding 50 mm in 2011 (Sheet 1 of 3)

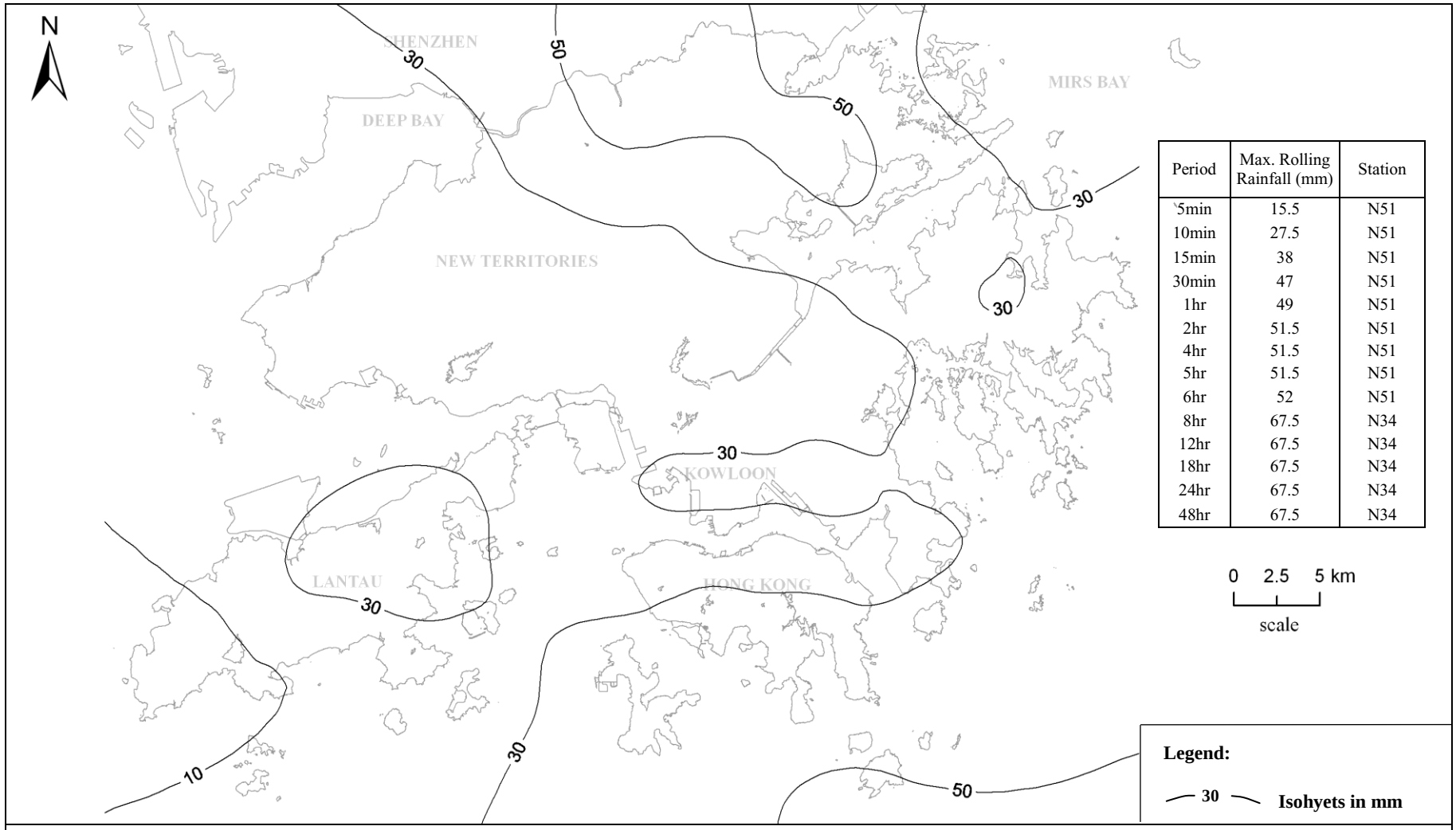
Rainstorm		5-min		10-min		15-min		30-min	
		Max. rainfall (mm)	Raingauge Station	Max. rainfall (mm)	Raingauge Station	Max. rainfall (mm)	Raingauge Station	Max. rainfall (mm)	Raingauge Station
1	17-18 April 2011	15.5	N51	27.5	N51	38	N51	47	N51
2	13-16 May 2011	14	H18	24.5	H18	33	H18	46	H18
3	21-23 May 2011	13.5	N03, N23, N36	27	N23	38	N23	69	N35
4	11-13 June 2011	15.5	H04	26.5	N03	37.5	N03	66	N38
5	16-18 June 2011	13	N51	23	N51	29.5	N51	42.5	N42
6	22-24 June 2011	9.5	N24	16.5	N17	23.5	N17	31	H17
7	28 June – 1 July 2011	14	N26	24	N09	29	N26	40.5	N10, N37
8	11-13 July 2011	13	K04	20	K04	24.5	N45	33.5	K09
9	15-17 July 2011	11	H12	17	K03	24	K03	38.5	H09, K03
10	19-21 July 2011	10	N25	18.5	N25	23.5	N38	40.5	N38
11	29-30 July 2011	11.5	H23	19	H02, N35	28.5	H23	40.5	N35
12	08-11 August 2011	14.5	N22	24	N22	33	H08	55	H08
13	25-26 August 2011	15.5	N32	28	N32	37.5	N32	56.5	N32
14	03-04 September 2011	11.5	N13	21	N36	26	N36	35	N50
15	15-16 September 2011	7.5	N51	14.5	N51	17	N51	24	N51
16	19-20 September 2011	21	H28	25	H28	30.5	N44	45	N05
17	29 September – 01 October 2011	13.5	K04	18.5	N02, N37	27.5	N37	32	N31
18	10-15 October 2011	13.5	N22	18	N26, N45	26	N26	48.5	N45
19	08-10 November 2011	4.5	N30, N35	7	N21	9.5	N10, N44	16	N10

Table A1 Some Selected Rainfall Parameters for the 19 Rainstorms with Daily Rainfall Exceeding 50 mm in 2011 (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	17-18 April 2011	49	N51	51.5	N51	51.5	N51	51.5	N51	52	N51
2	13-16 May 2011	52.5	N36	67	H28, N36	73.5	H28	74	H28	83.5	N36
3	21-23 May 2011	116.5	N35	142	N35	183	N35	185	N35	188	N35
4	11-13 June 2011	88.5	N38	95.5	N17	119	N17	119	N17	119	N17
5	16-18 June 2011	69	N42	106.5	N42	114.5	K02	115.5	K02	115.5	K02
6	22-24 June 2011	49.5	N17	54	N17	69	N19	69	N19	69	N19
7	28 June – 1 July 2011	65.5	H25	85	H25	101	N46	117.5	N46	122.5	N46
8	11-13 July 2011	41.5	K03	43	H21	43	H21	43	H21	43	H21
9	15-17 July 2011	63	N31	78	H06	102.5	N18	105.5	N18	106	N18
10	19-21 July 2011	65.5	N39	70	N39	74.5	N38	74.5	N38	74.5	N38, N39
11	29-30 July 2011	45	N35	46	N35	46.5	N35	47	N35	47	N35
12	08-11 August 2011	74	H24	86.5	H08	98	H08	98.5	H08	101	H08
13	25-26 August 2011	71.5	N32	92	N32	92	N32	92	N32	92	N32
14	03-04 September 2011	39	N13	43.5	H16	64	H16	65.5	H16	67.5	H16
15	15-16 September 2011	46	N51	60	N51	65.5	N51	65.5	N51	65.5	N51
16	19-20 September 2011	57	N34	61.5	N05	64	N05	64	N05	64	N05
17	29 September – 01 October 2011	42.5	N23	55	N23	55.5	N23	63.5	N23	68.5	N23
18	10-15 October 2011	80.5	N45	96	N45	104.5	N45	110.5	N45	114	N45
19	08-10 November 2011	18.5	N35, N53	28	N21	43.5	N44	47.5	N17, N44	56	N17

Table A1 Some Selected Rainfall Parameters for the 19 Rainstorms with Daily Rainfall Exceeding 50 mm in 2011 (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	17-18 April 2011	67.5	N34	67.5	N34	67.5	N34	67.5	N34	67.5	N34
2	13-16 May 2011	87	N36	87	N36	87	N36	91.5	H28	104.5	H28
3	21-23 May 2011	188	N35	210.5	N31	235.5	N31	236.5	N31	263.5	N31
4	11-13 June 2011	119	N17	120	N17	164	N17	164.5	N17	171.5	N17
5	16-18 June 2011	131	K02	138	K02	158	K02	205	N42	253.5	N42
6	22-24 June 2011	69	N19	77	N44	92.5	N44	101	N36	116.5	N21
7	28 June – 1 July 2011	125	N46	144.5	H04	150.5	N46	166.5	N46	263.5	N46
8	11-13 July 2011	45.5	N12	57.5	K04	58	K04	69	N45	90.5	K03
9	15-17 July 2011	106	N18	131.5	N03	148	N03	153	N03	181.5	N40
10	19-21 July 2011	85.5	N39	85.5	N39	103.5	N38	114	N38	117	N38
11	29-30 July 2011	77	N35	78	N35	88.5	N35	89.5	N35	95	N35
12	08-11 August 2011	103.5	N21	119	N21	130.5	N21	132	N21	190	H08
13	25-26 August 2011	92	N32	92	N32	92	N32	92	N32	95	N32
14	03-04 September 2011	67.5	H16	67.5	H16	67.5	H16	69	H16	83.5	H16
15	15-16 September 2011	65.5	N51	65.5	N51	65.5	N51	65.5	N51	83.5	N51
16	19-20 September 2011	64	N05	64	N05	64	N05	64	N05	73.5	H28
17	29 September – 01 October 2011	70	N23	71.5	N23	87.5	N37	91	N37	123.5	N21
18	10-15 October 2011	116.5	N45	134	N45	169.5	N45	174	N45	210.5	N35
19	08-10 November 2011	72.5	N17	86.5	N17	106.5	N17	116	N17	133	N17



Period	Max. Rolling Rainfall (mm)	Station
5min	15.5	N51
10min	27.5	N51
15min	38	N51
30min	47	N51
1hr	49	N51
2hr	51.5	N51
4hr	51.5	N51
5hr	51.5	N51
6hr	52	N51
8hr	67.5	N34
12hr	67.5	N34
18hr	67.5	N34
24hr	67.5	N34
48hr	67.5	N34

Notes: (1) Isohyets are based on the GEO and HKO raingauges.
(2) No genuine landslide reported to have occurred within the period between 17 April and 18 April 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A1 Maximum Rolling 24-hour Rainfall Distribution for the Period between 17 April (00:00) and 18 April 2011 (24:00)

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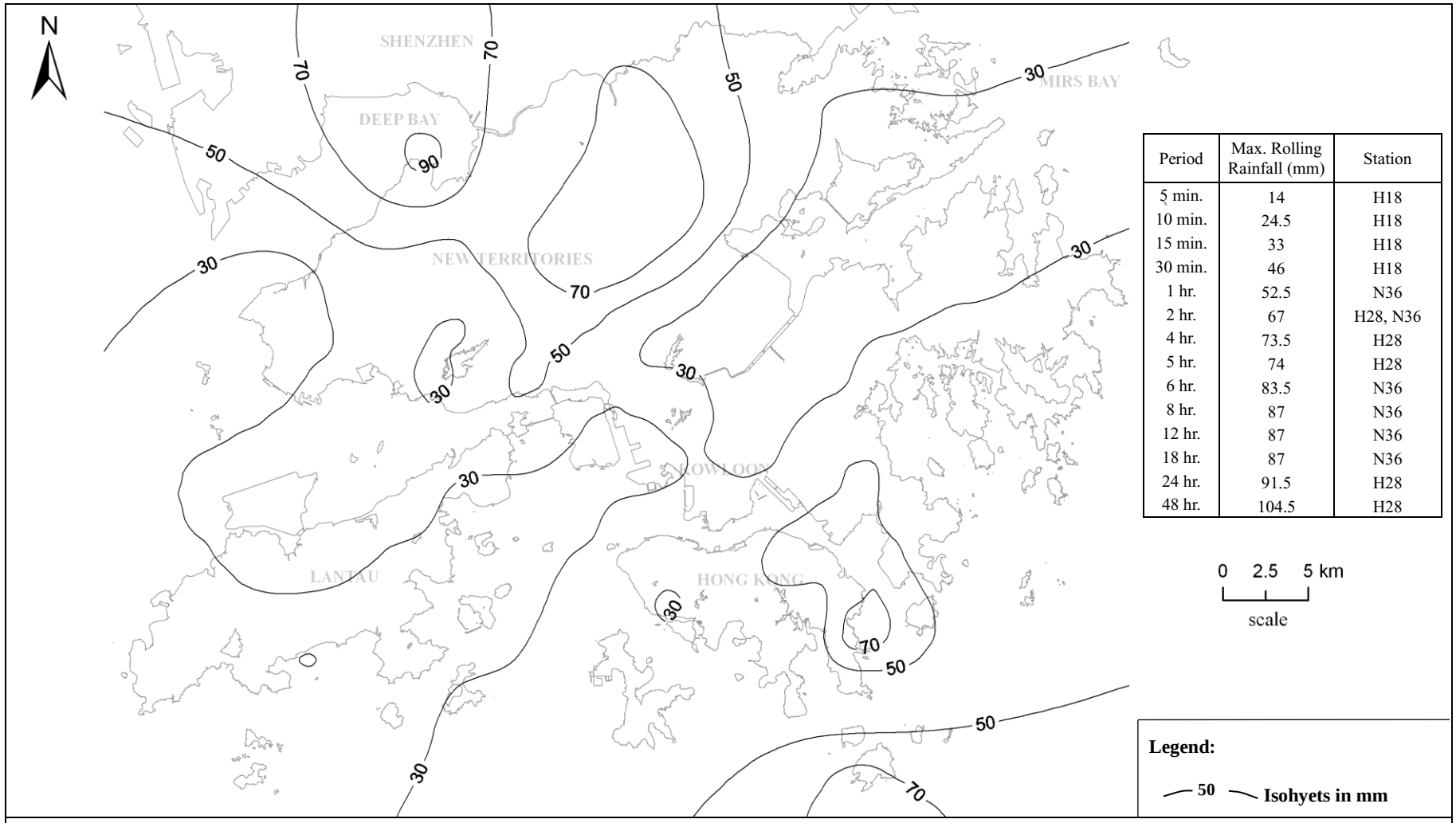

Period	Max. Rolling Rainfall (mm)	Station
5 min.	14	H18
10 min.	24.5	H18
15 min.	33	H18
30 min.	46	H18
1 hr.	52.5	N36
2 hr.	67	H28, N36
4 hr.	73.5	H28
5 hr.	74	H28
6 hr.	83.5	N36
8 hr.	87	N36
12 hr.	87	N36
18 hr.	87	N36
24 hr.	91.5	H28
48 hr.	104.5	H28

Notes: (1) Isohyets are based on the GEO and HKO raingauges.
(2) No genuine landslide was reported to have occurred within the period between 13 May and 16 May 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A2 Maximum Rolling 24-hour Rainfall Distribution for the Period between 13 May (00:00) and 16 May 2011 (24:00)

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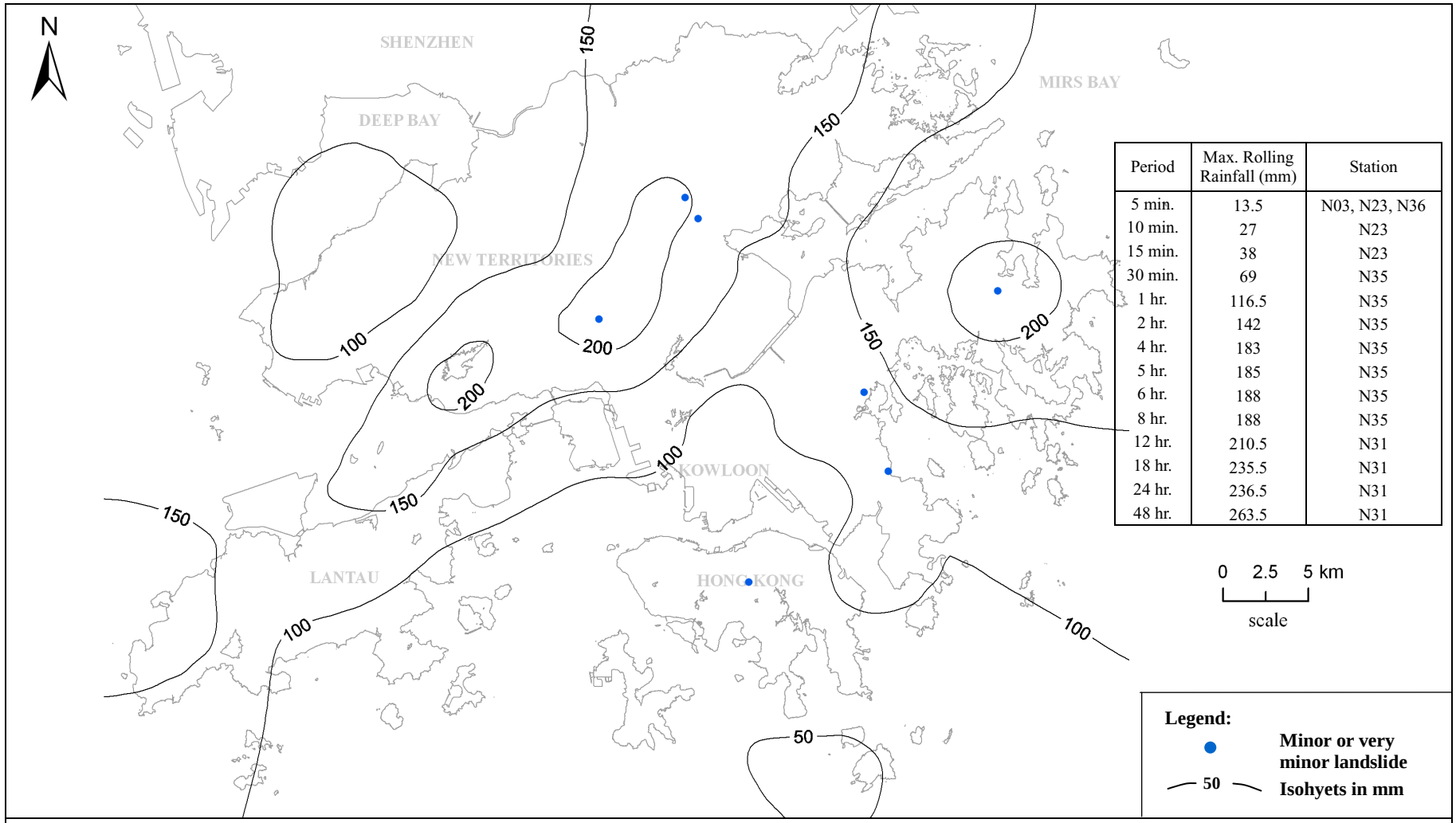
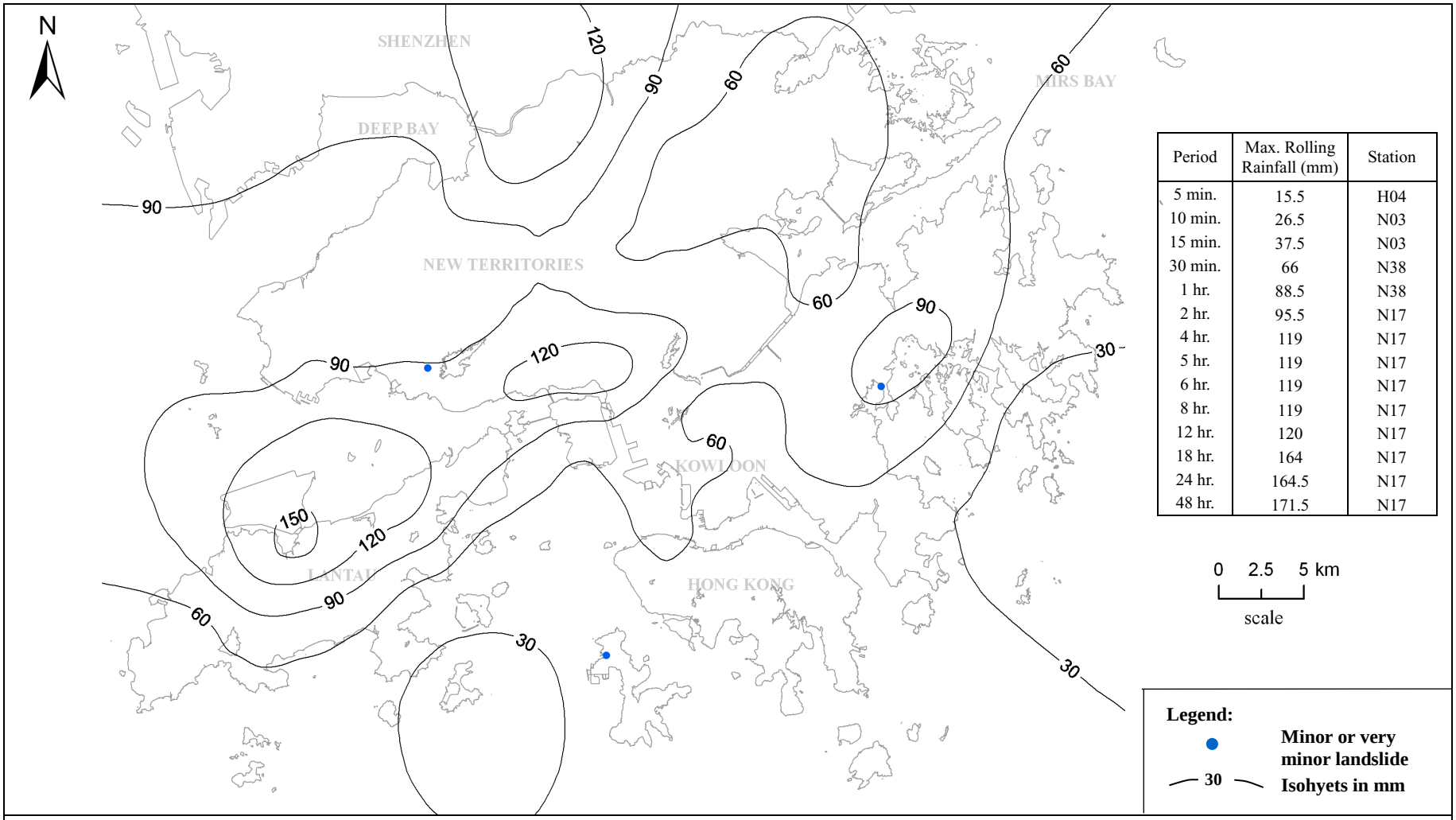


Period	Max. Rolling Rainfall (mm)	Station
5 min.	13.5	N03, N23, N36
10 min.	27	N23
15 min.	38	N23
30 min.	69	N35
1 hr.	116.5	N35
2 hr.	142	N35
4 hr.	183	N35
5 hr.	185	N35
6 hr.	188	N35
8 hr.	188	N35
12 hr.	210.5	N31
18 hr.	235.5	N31
24 hr.	236.5	N31
48 hr.	263.5	N31

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) Seven genuine landslides reported to have occurred within the period between 21 May and 23 May 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

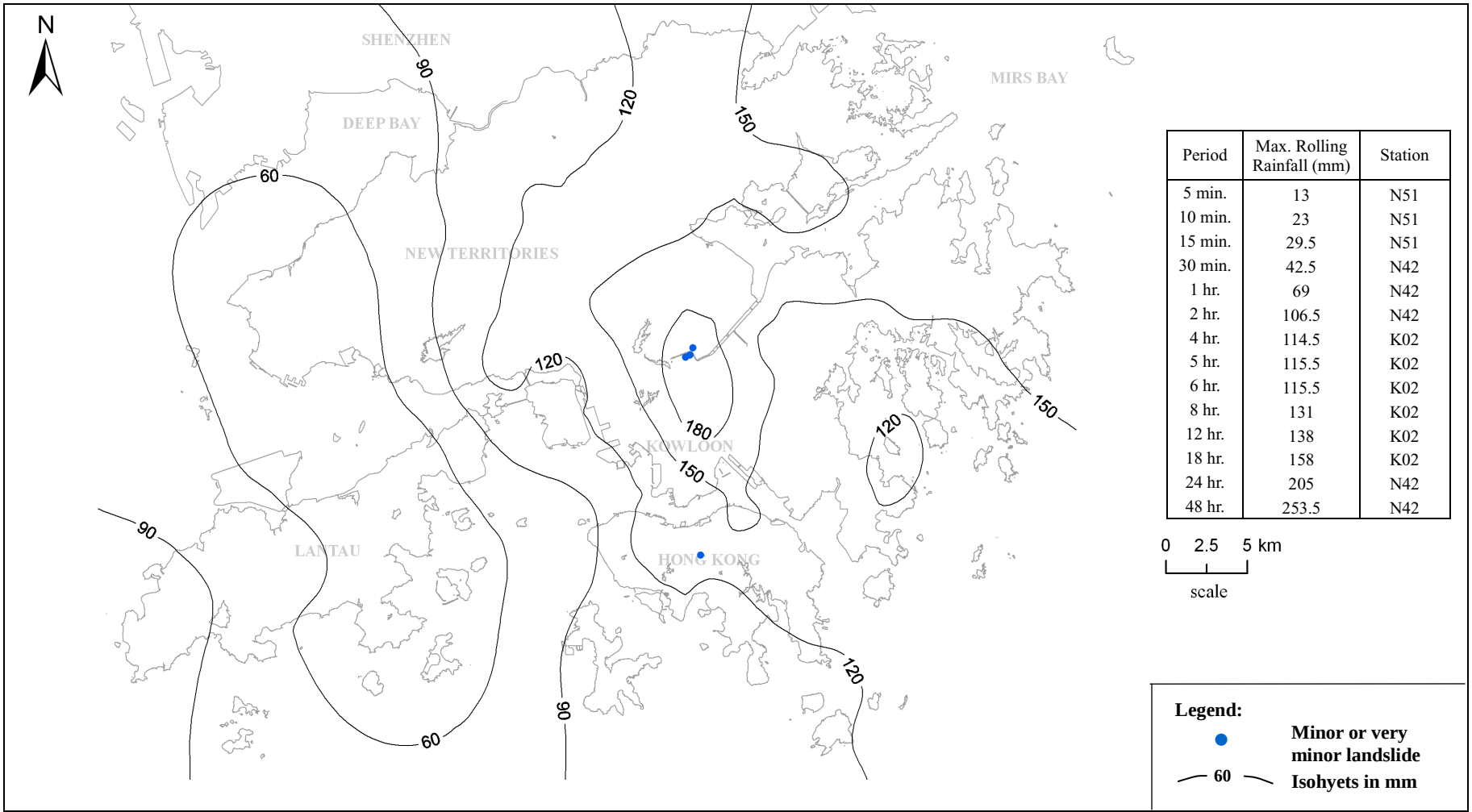
Figure A3 Maximum Rolling 24-hour Rainfall Distribution for the Period between 21 May (00:00) and 23 May 2011 (24:00) and Locations of Landslides



Period	Max. Rolling Rainfall (mm)	Station
5 min.	15.5	H04
10 min.	26.5	N03
15 min.	37.5	N03
30 min.	66	N38
1 hr.	88.5	N38
2 hr.	95.5	N17
4 hr.	119	N17
5 hr.	119	N17
6 hr.	119	N17
8 hr.	119	N17
12 hr.	120	N17
18 hr.	164	N17
24 hr.	164.5	N17
48 hr.	171.5	N17

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) Three genuine landslides reported to have occurred within the period between 11 June and 13 June 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A4 Maximum Rolling 24-hour Rainfall Distribution for the Period between 11 June (00:00) and 13 June 2011 (24:00) and Locations of Landslides



Period	Max. Rolling Rainfall (mm)	Station
5 min.	13	N51
10 min.	23	N51
15 min.	29.5	N51
30 min.	42.5	N42
1 hr.	69	N42
2 hr.	106.5	N42
4 hr.	114.5	K02
5 hr.	115.5	K02
6 hr.	115.5	K02
8 hr.	131	K02
12 hr.	138	K02
18 hr.	158	K02
24 hr.	205	N42
48 hr.	253.5	N42

Notes: (1) Isohyets are based on the GEO and HKO raingauges.
(2) Four genuine landslides reported to have occurred within the period between 16 June and 18 June 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A5 Maximum Rolling 24-hour Rainfall Distribution for the Period between 16 June (00:00) and 18 June 2011 (24:00) and Locations of Landslides

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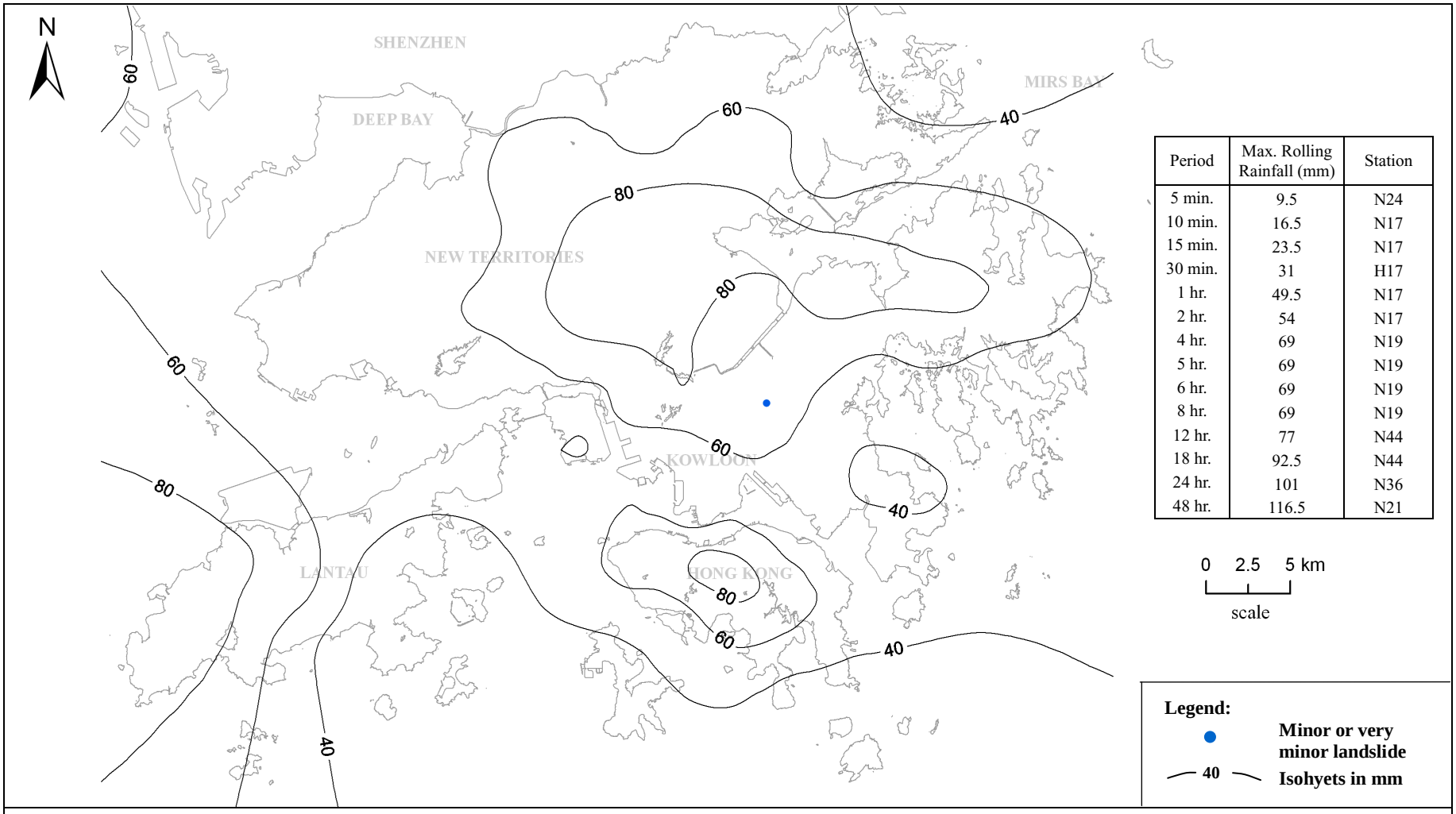
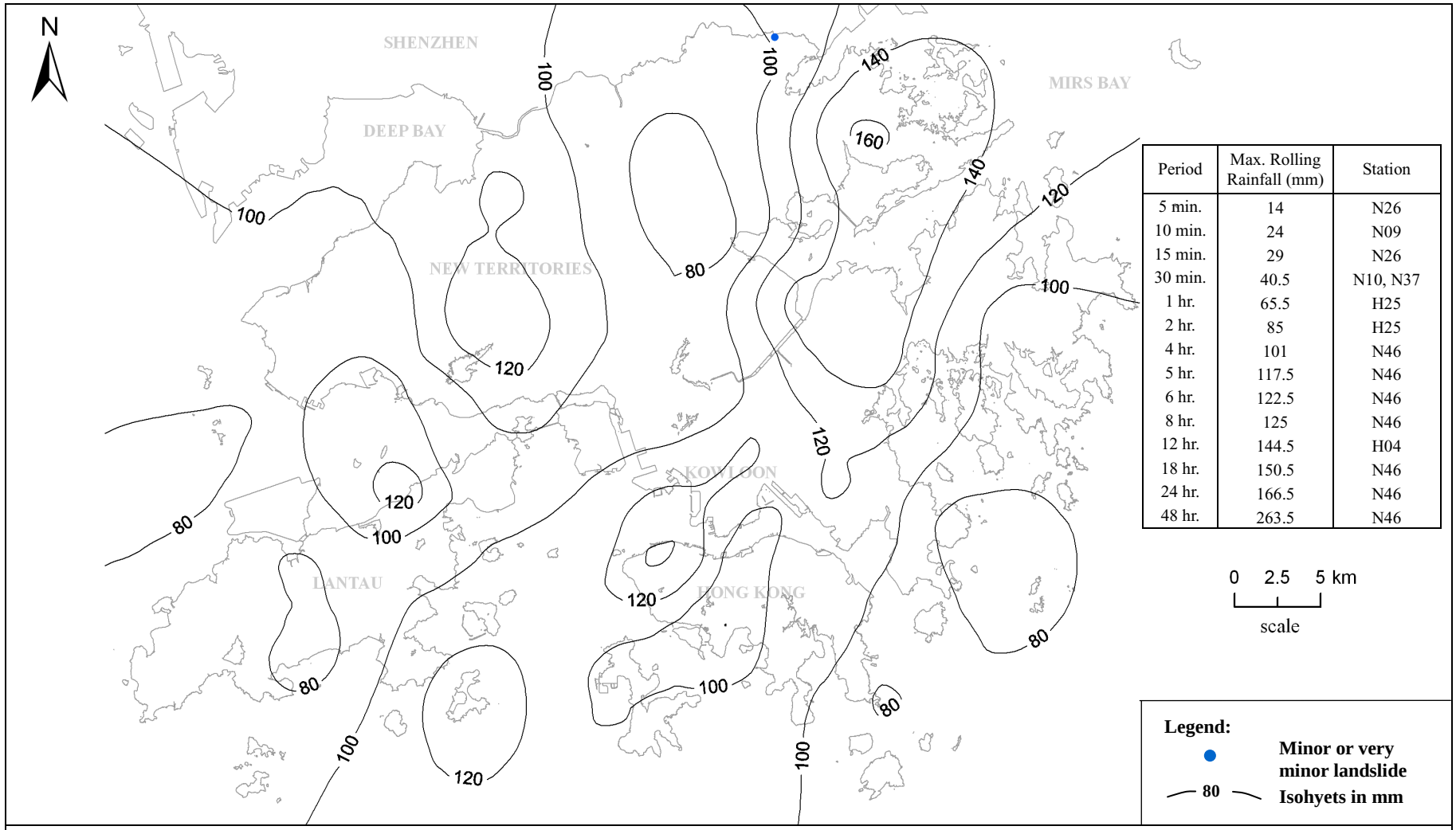


Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) A genuine landslide reported to have occurred within the period between 22 June and 24 June 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

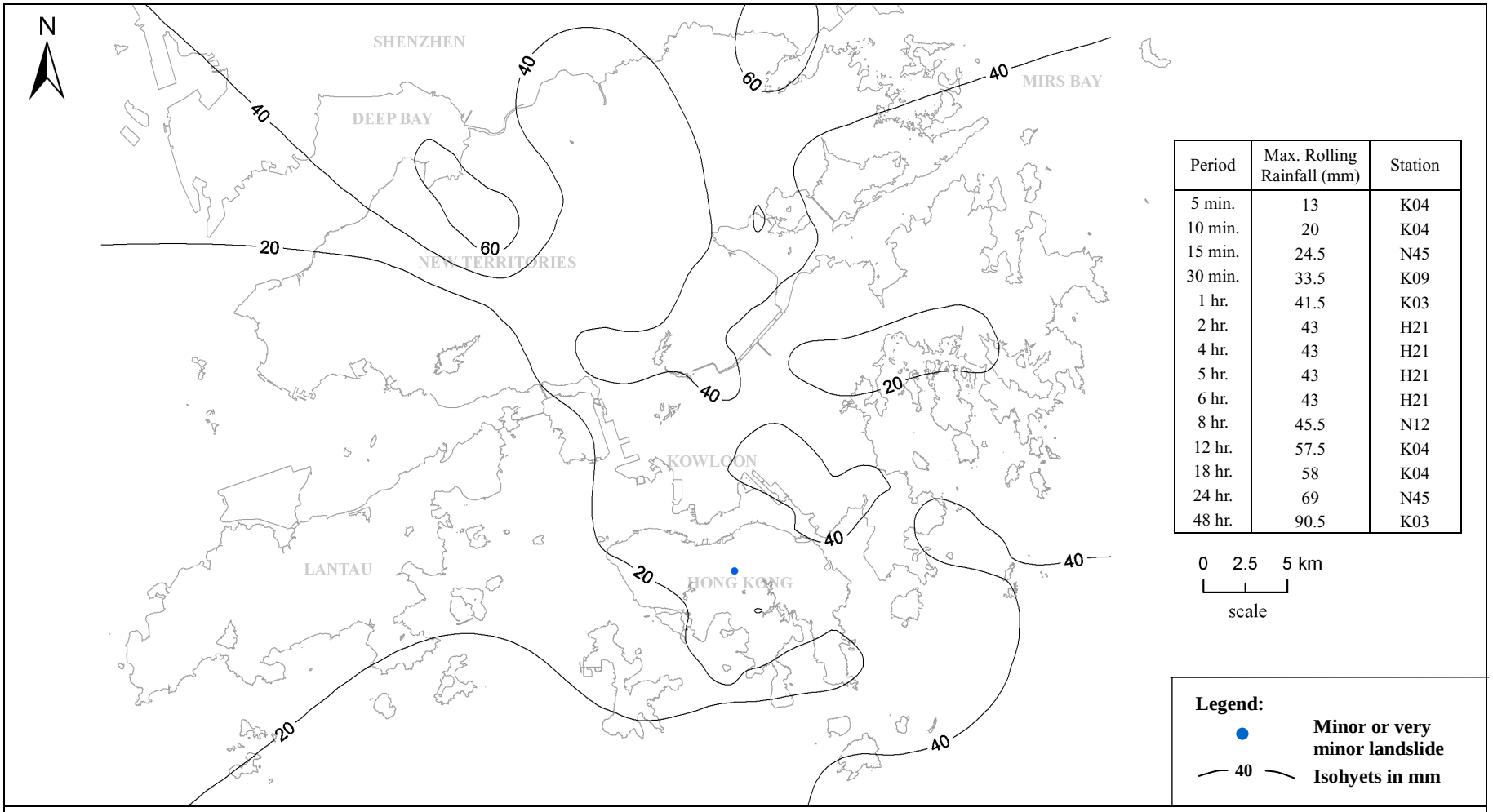
Figure A6 Maximum Rolling 24-hour Rainfall Distribution for the Period between 22 June (00:00) and 24 June 2011 (24:00) and Locations of Landslides



Period	Max. Rolling Rainfall (mm)	Station
5 min.	14	N26
10 min.	24	N09
15 min.	29	N26
30 min.	40.5	N10, N37
1 hr.	65.5	H25
2 hr.	85	H25
4 hr.	101	N46
5 hr.	117.5	N46
6 hr.	122.5	N46
8 hr.	125	N46
12 hr.	144.5	H04
18 hr.	150.5	N46
24 hr.	166.5	N46
48 hr.	263.5	N46

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) A genuine landslides reported to have occurred within the period between 28 June and 1 July 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A7 Maximum Rolling 24-hour Rainfall Distribution for the Period between 28 June (00:00) and 1 July 2011 (24:00) and Locations of Landslides



Period	Max. Rolling Rainfall (mm)	Station
5 min.	13	K04
10 min.	20	K04
15 min.	24.5	N45
30 min.	33.5	K09
1 hr.	41.5	K03
2 hr.	43	H21
4 hr.	43	H21
5 hr.	43	H21
6 hr.	43	H21
8 hr.	45.5	N12
12 hr.	57.5	K04
18 hr.	58	K04
24 hr.	69	N45
48 hr.	90.5	K03

Notes: (1) Isohyets are based on the GEO and HKO raingauges.
(2) A genuine landslide reported to have occurred within the period between 11 July and 13 July 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A8 Maximum Rolling 24-hour Rainfall Distribution for the Period between 11 July (00:00) and 13 July 2011 (24:00) and Locations of Landslides

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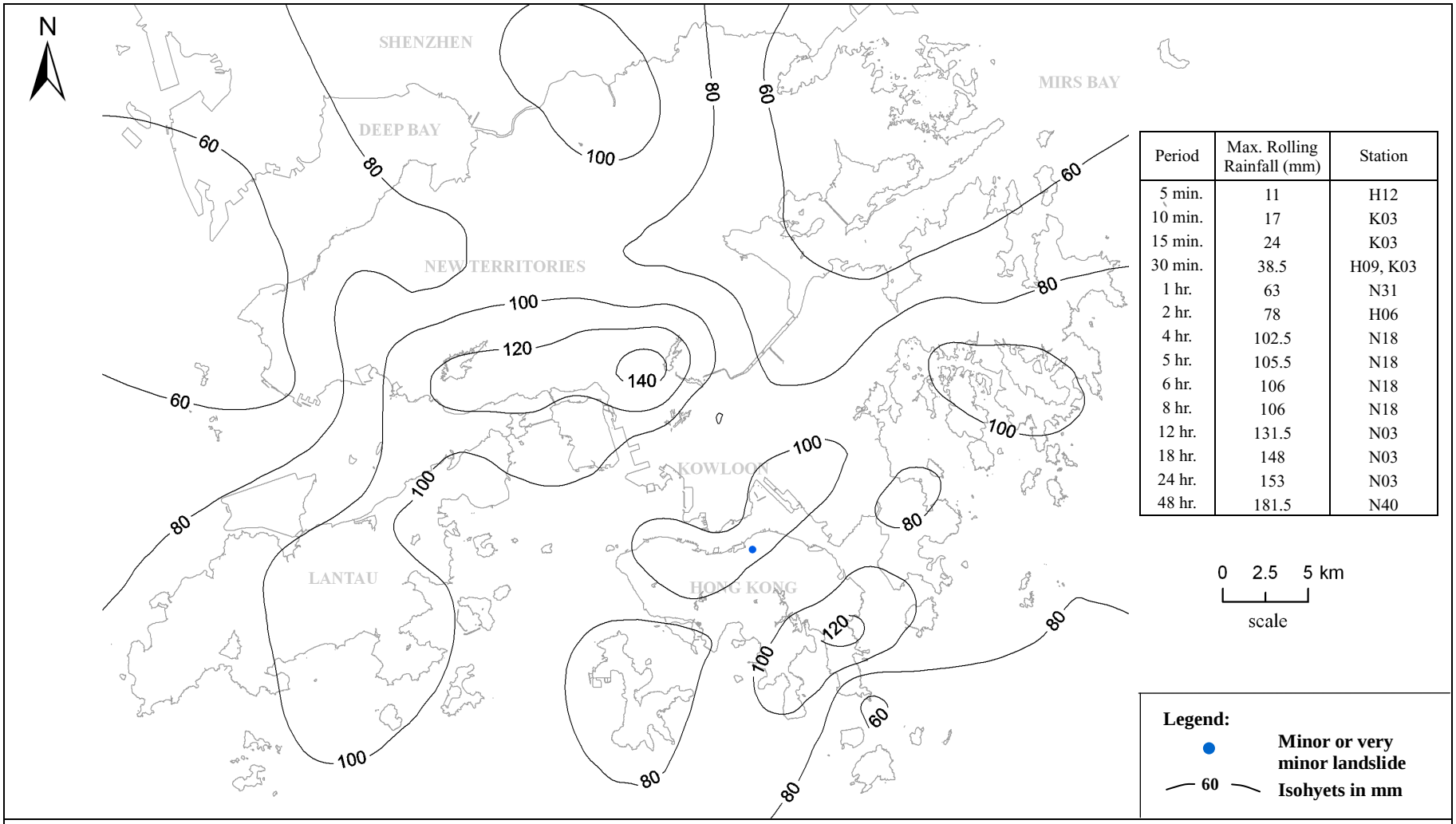

Period	Max. Rolling Rainfall (mm)	Station
5 min.	11	H12
10 min.	17	K03
15 min.	24	K03
30 min.	38.5	H09, K03
1 hr.	63	N31
2 hr.	78	H06
4 hr.	102.5	N18
5 hr.	105.5	N18
6 hr.	106	N18
8 hr.	106	N18
12 hr.	131.5	N03
18 hr.	148	N03
24 hr.	153	N03
48 hr.	181.5	N40

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) A genuine landslide reported to have occurred within the period between 15 July and 17 July 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A9 Maximum Rolling 24-hour Rainfall Distribution for the Period between 15 July (00:00) and 17 July 2011 (24:00) and Locations of Landslides

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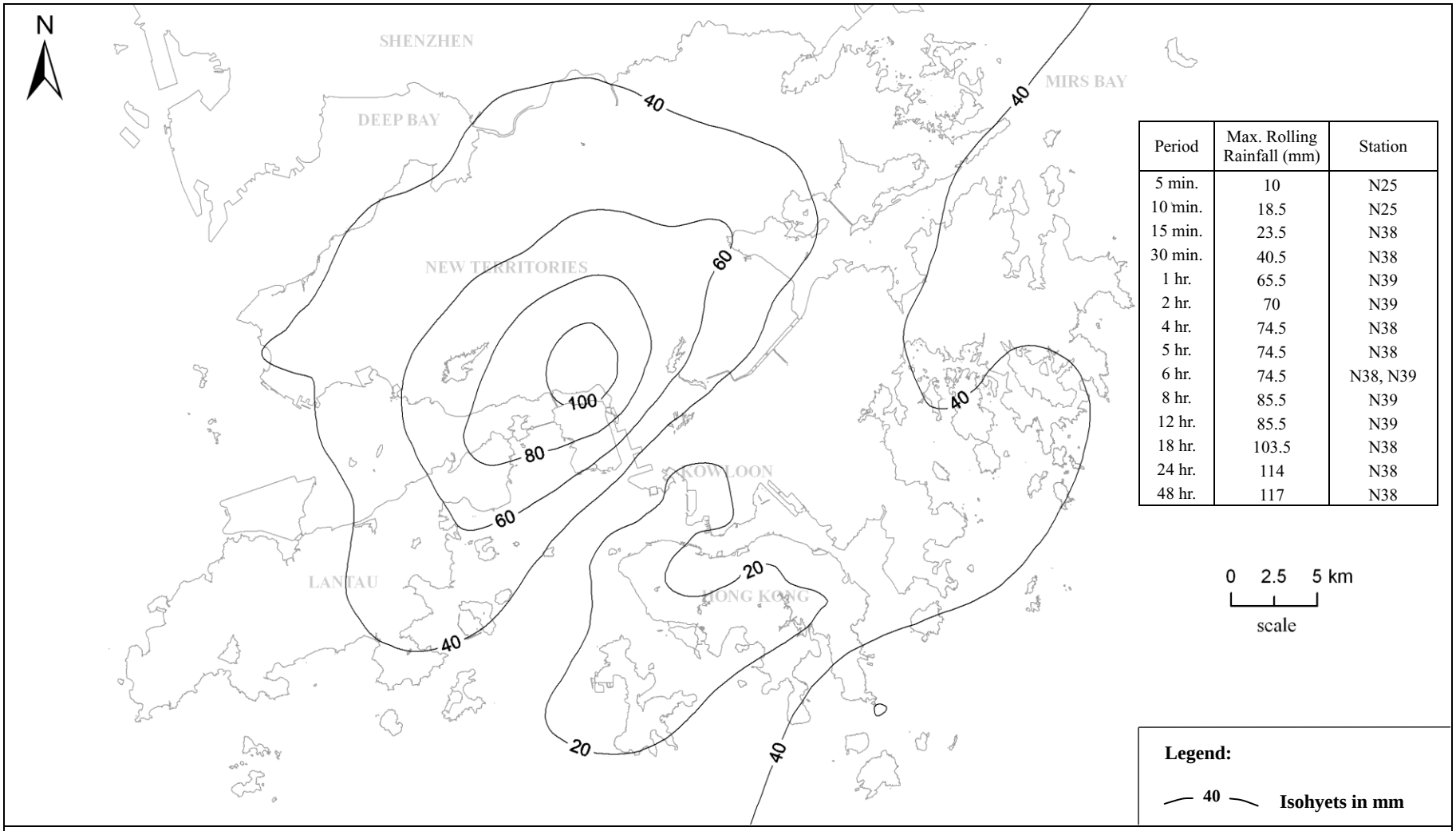

Period	Max. Rolling Rainfall (mm)	Station
5 min.	10	N25
10 min.	18.5	N25
15 min.	23.5	N38
30 min.	40.5	N38
1 hr.	65.5	N39
2 hr.	70	N39
4 hr.	74.5	N38
5 hr.	74.5	N38
6 hr.	74.5	N38, N39
8 hr.	85.5	N39
12 hr.	85.5	N39
18 hr.	103.5	N38
24 hr.	114	N38
48 hr.	117	N38

Notes: (1) Isohyets are based on the GEO and HKO raingauges.
(2) No genuine landslide reported to have occurred within the period between 19 July and 21 July 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A10 Maximum Rolling 24-hour Rainfall Distribution for the Period between 19 July (00:00) and 21 July 2011 (24:00)

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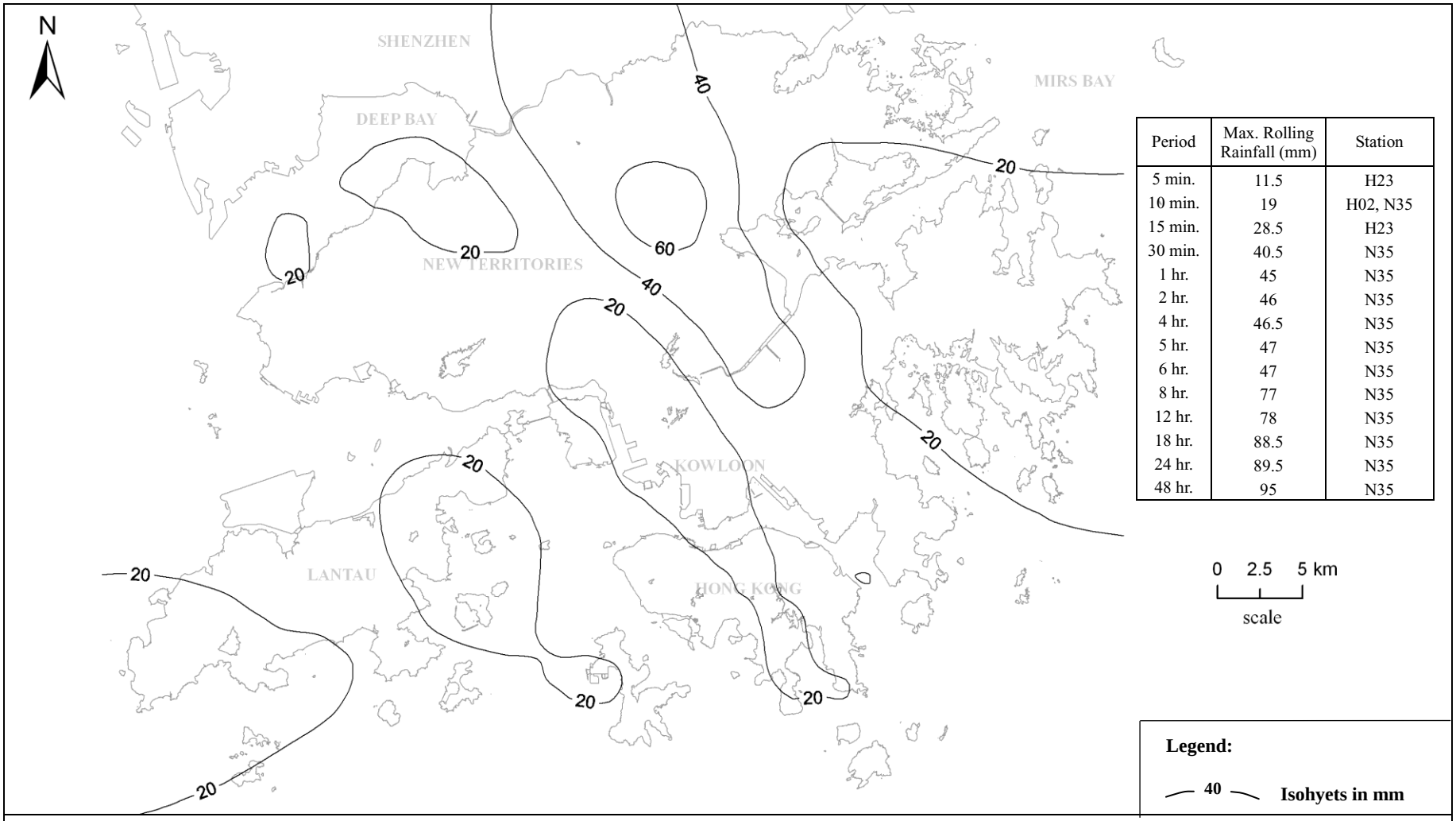

Period	Max. Rolling Rainfall (mm)	Station
5 min.	11.5	H23
10 min.	19	H02, N35
15 min.	28.5	H23
30 min.	40.5	N35
1 hr.	45	N35
2 hr.	46	N35
4 hr.	46.5	N35
5 hr.	47	N35
6 hr.	47	N35
8 hr.	77	N35
12 hr.	78	N35
18 hr.	88.5	N35
24 hr.	89.5	N35
48 hr.	95	N35

Notes: (1) Isohyets are based on the GEO and HKO raingauges.
(2) No genuine landslide reported to have occurred within the period between 29 July and 30 July 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A11 Maximum Rolling 24-hour Rainfall Distribution for the Period between 29 July (00:00) and 30 July 2011 (24:00)

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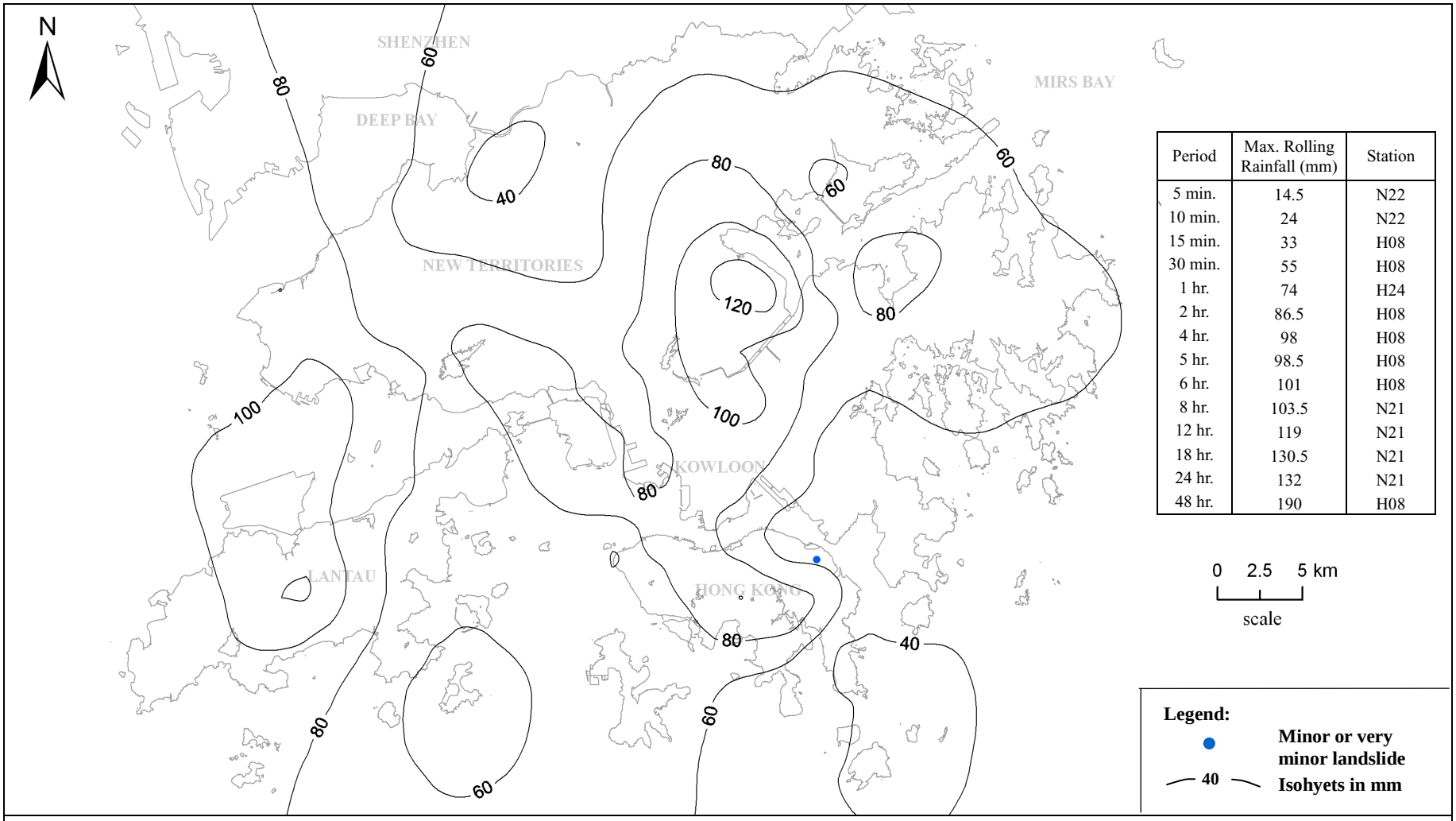

Period	Max. Rolling Rainfall (mm)	Station
5 min.	14.5	N22
10 min.	24	N22
15 min.	33	H08
30 min.	55	H08
1 hr.	74	H24
2 hr.	86.5	H08
4 hr.	98	H08
5 hr.	98.5	H08
6 hr.	101	H08
8 hr.	103.5	N21
12 hr.	119	N21
18 hr.	130.5	N21
24 hr.	132	N21
48 hr.	190	H08

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) A genuine landslide was reported to have occurred within the period between 8 August and 11 August 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A12 Maximum Rolling 24-hour Rainfall Distribution for the Period between 8 August (00:00) and 11 August 2011 (24:00) and Locations of Landslides

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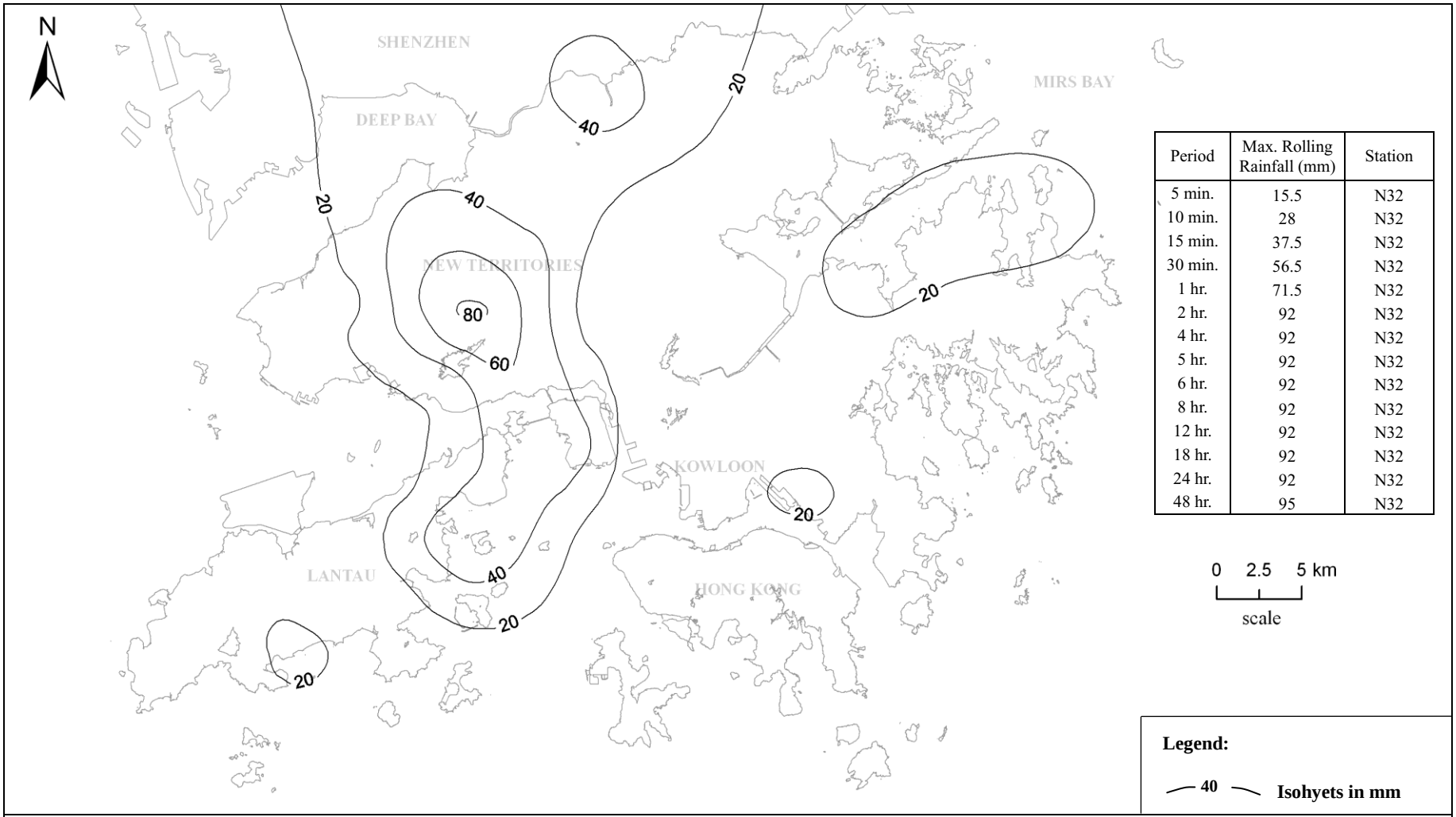

Period	Max. Rolling Rainfall (mm)	Station
5 min.	15.5	N32
10 min.	28	N32
15 min.	37.5	N32
30 min.	56.5	N32
1 hr.	71.5	N32
2 hr.	92	N32
4 hr.	92	N32
5 hr.	92	N32
6 hr.	92	N32
8 hr.	92	N32
12 hr.	92	N32
18 hr.	92	N32
24 hr.	92	N32
48 hr.	95	N32

Notes: (1) Isohyets are based on the GEO and HKO raingauges.
(2) No genuine landslide was reported to have occurred within the period between 25 August and 26 August 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A13 Maximum Rolling 24-hour Rainfall Distribution for the Period between 25 August (00:00) and 26 August 2011 (24:00)

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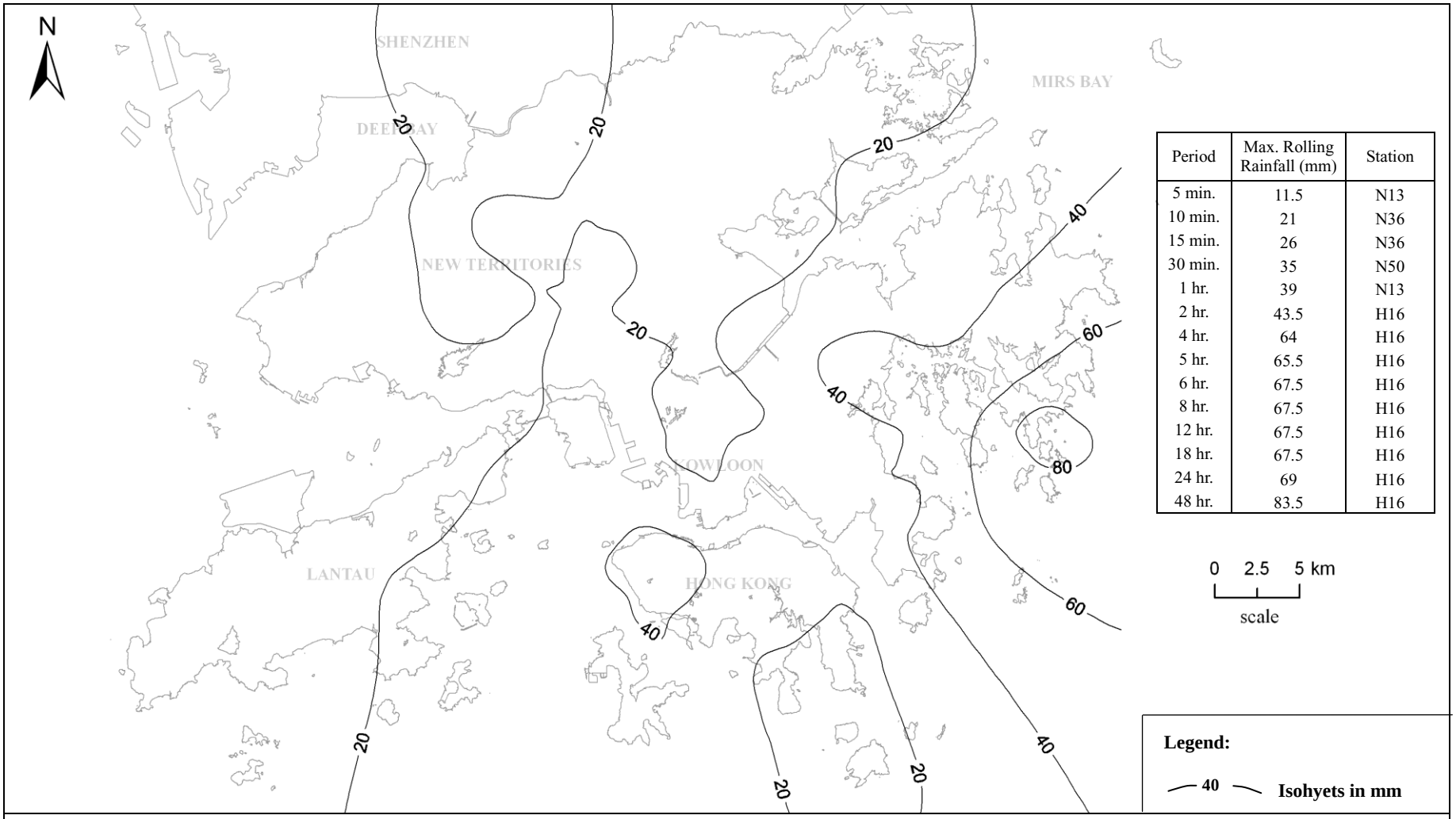

Period	Max. Rolling Rainfall (mm)	Station
5 min.	11.5	N13
10 min.	21	N36
15 min.	26	N36
30 min.	35	N50
1 hr.	39	N13
2 hr.	43.5	H16
4 hr.	64	H16
5 hr.	65.5	H16
6 hr.	67.5	H16
8 hr.	67.5	H16
12 hr.	67.5	H16
18 hr.	67.5	H16
24 hr.	69	H16
48 hr.	83.5	H16

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) No genuine landslide reported to have occurred within the period between 3 September and 4 September 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A14 Maximum Rolling 24-hour Rainfall Distribution for the Period between 3 September (00:00) and 4 September 2011 (24:00)

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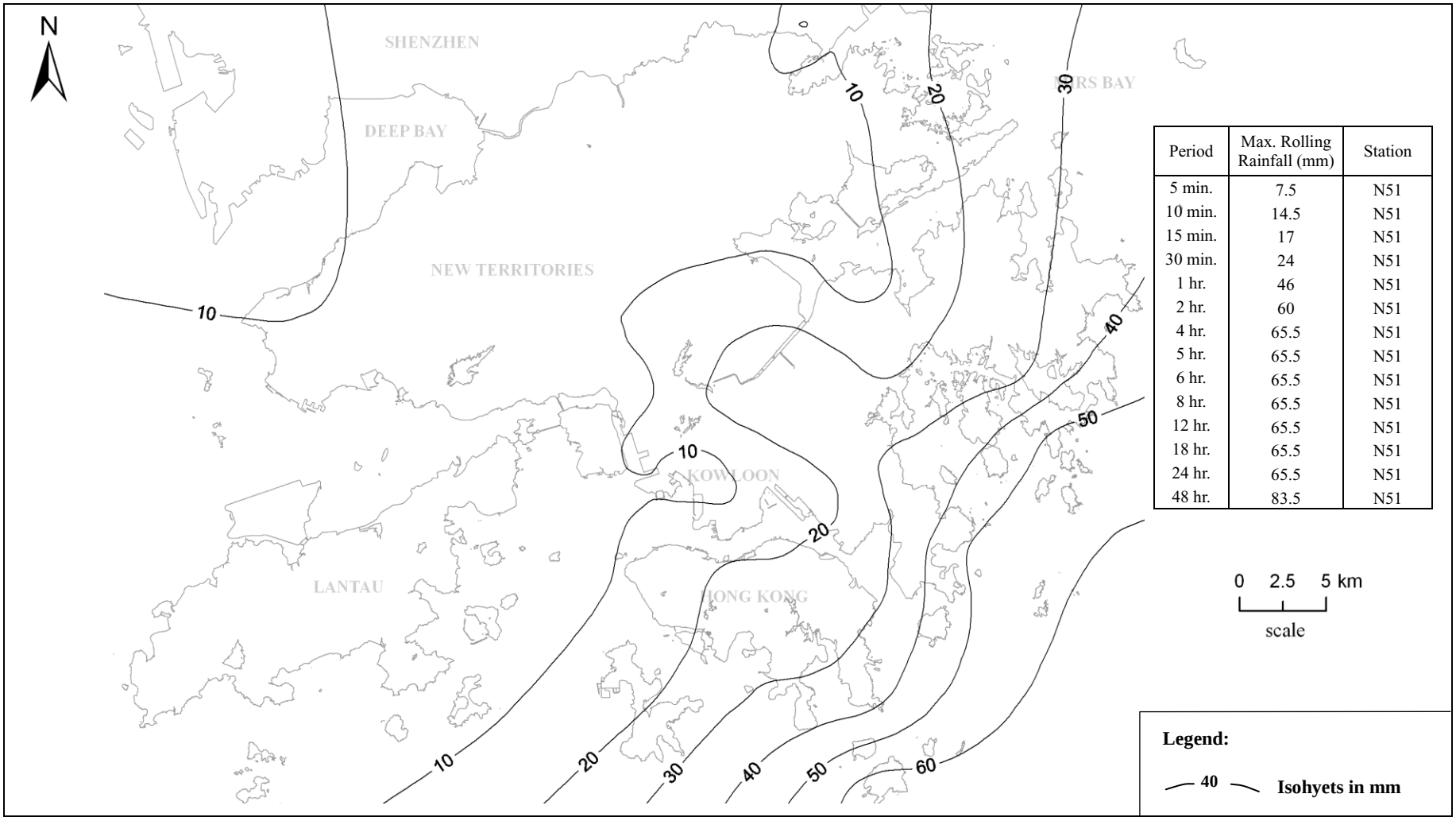

Period	Max. Rolling Rainfall (mm)	Station
5 min.	7.5	N51
10 min.	14.5	N51
15 min.	17	N51
30 min.	24	N51
1 hr.	46	N51
2 hr.	60	N51
4 hr.	65.5	N51
5 hr.	65.5	N51
6 hr.	65.5	N51
8 hr.	65.5	N51
12 hr.	65.5	N51
18 hr.	65.5	N51
24 hr.	65.5	N51
48 hr.	83.5	N51

Notes: (1) Isohyets are based on the GEO and HKO raingauges.
(2) No genuine landslide reported to have occurred within the period between 15 September and 16 September 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A15 Maximum Rolling 24-hour Rainfall Distribution for the Period between 15 September (00:00) and 16 September 2011 (24:00)

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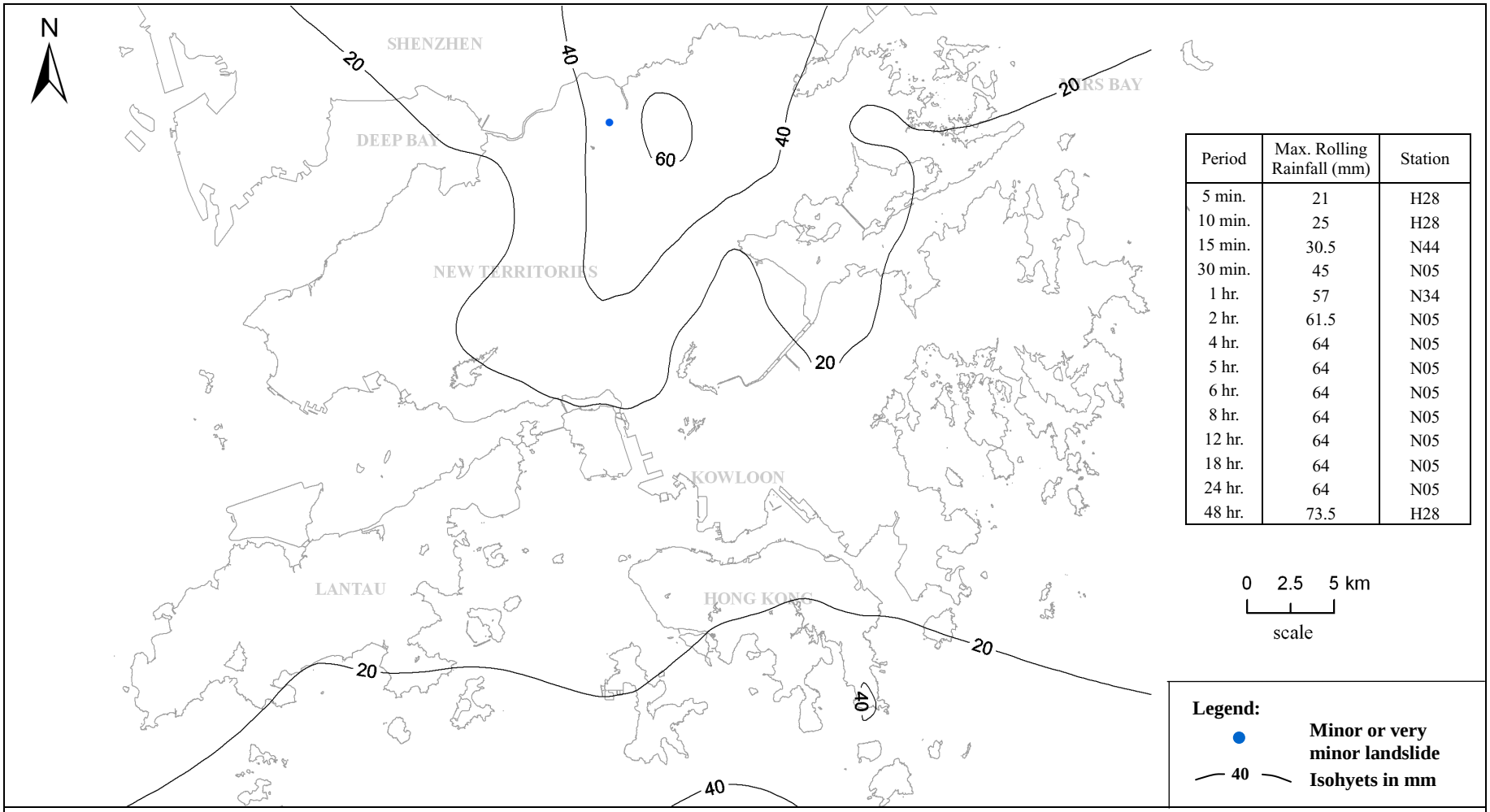

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) A genuine landslide was reported to have occurred within the period between 19 September and 20 September 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A16 Maximum Rolling 24-hour Rainfall Distribution for the Period between 19 September (00:00) and 20 September 2011 (24:00) and Locations of Landslides

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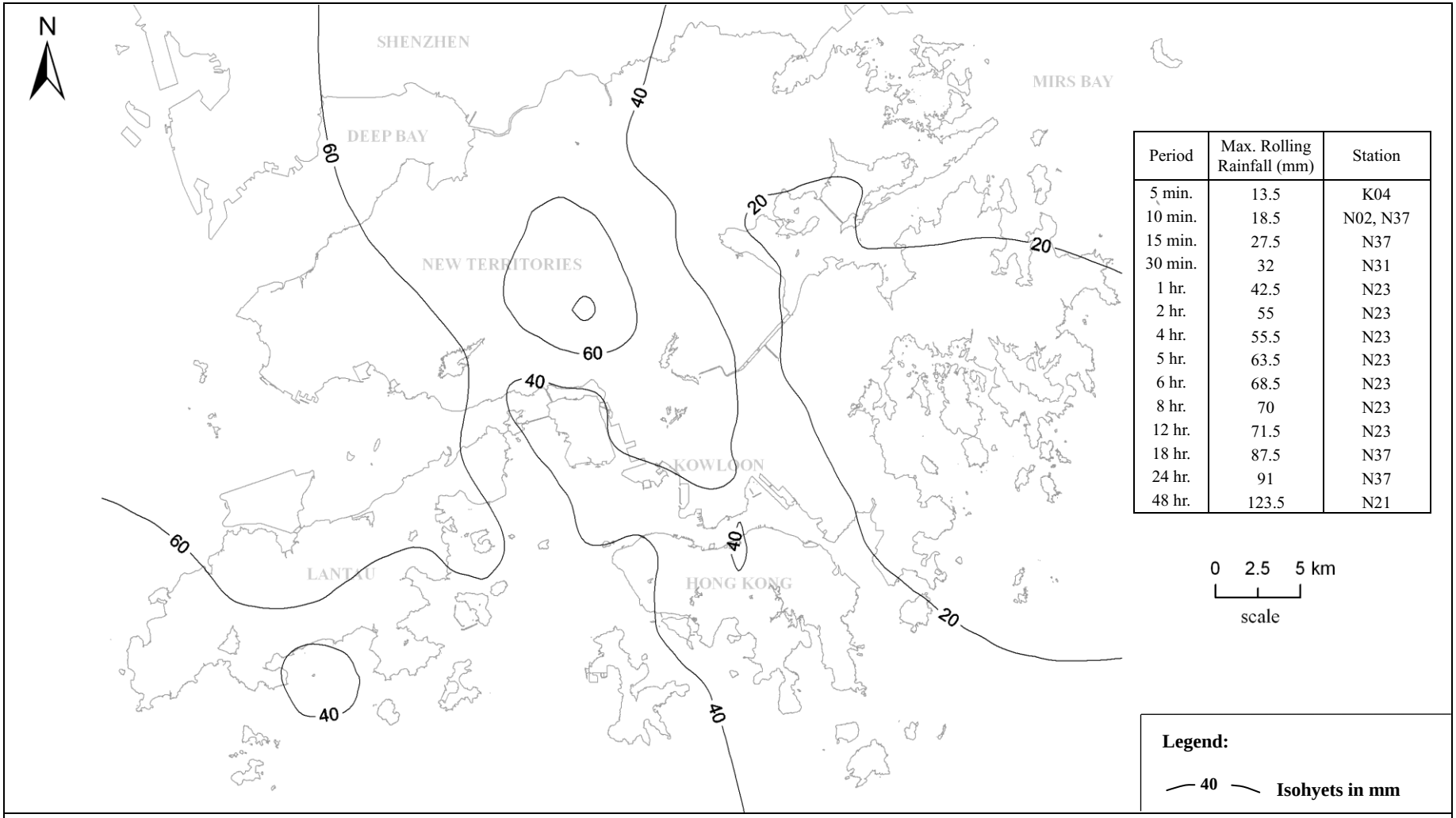

Period	Max. Rolling Rainfall (mm)	Station
5 min.	13.5	K04
10 min.	18.5	N02, N37
15 min.	27.5	N37
30 min.	32	N31
1 hr.	42.5	N23
2 hr.	55	N23
4 hr.	55.5	N23
5 hr.	63.5	N23
6 hr.	68.5	N23
8 hr.	70	N23
12 hr.	71.5	N23
18 hr.	87.5	N37
24 hr.	91	N37
48 hr.	123.5	N21

Notes: (1) Isohyets are based on the GEO and HKO raingauges.
(2) No genuine landslide reported to have occurred within the period between 29 September and 1 October 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A17 Maximum Rolling 24-hour Rainfall Distribution for the Period between 29 September (00:00) and 1 October 2011 (24:00)

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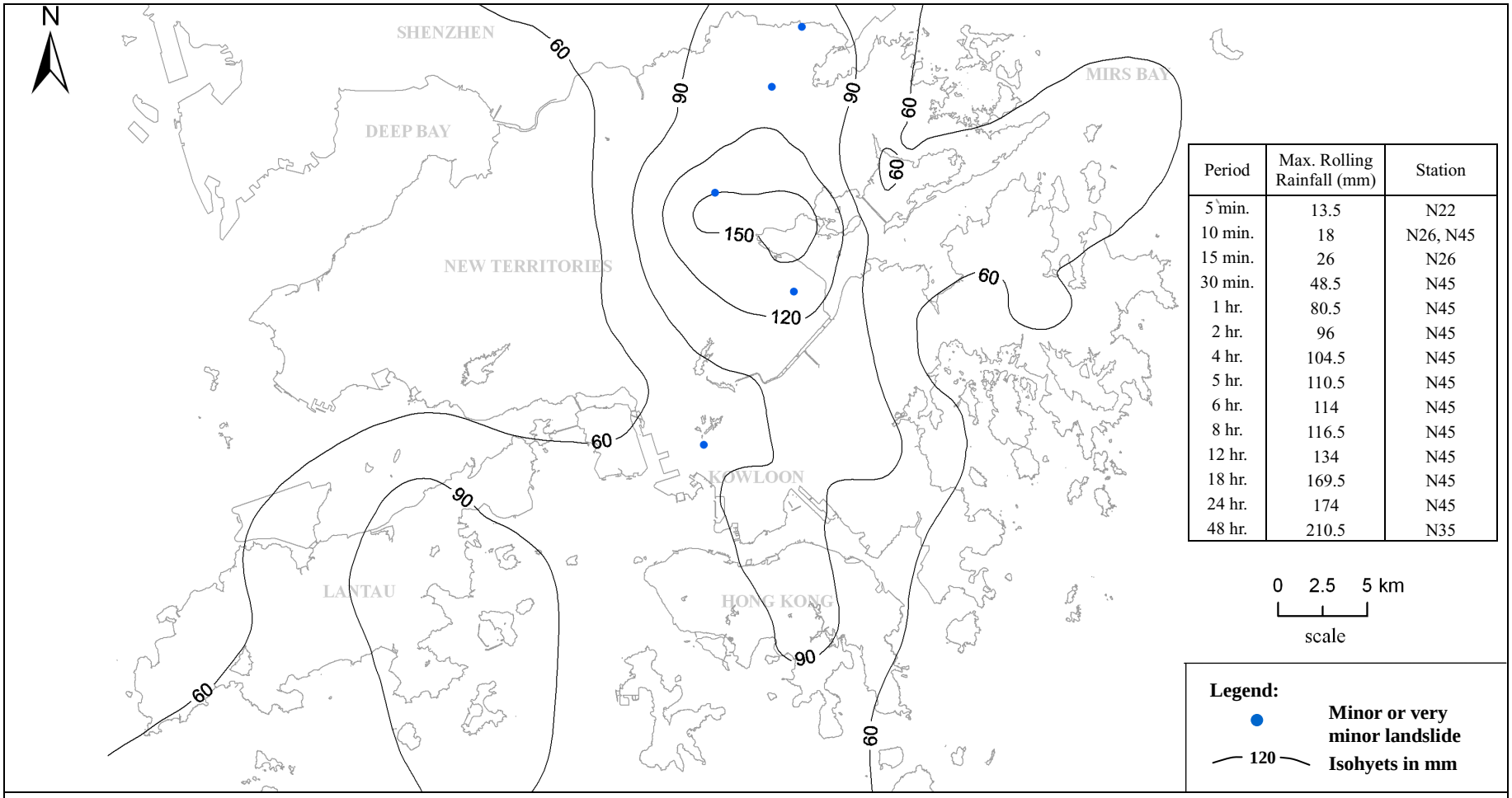

Period	Max. Rolling Rainfall (mm)	Station
5 min.	13.5	N22
10 min.	18	N26, N45
15 min.	26	N26
30 min.	48.5	N45
1 hr.	80.5	N45
2 hr.	96	N45
4 hr.	104.5	N45
5 hr.	110.5	N45
6 hr.	114	N45
8 hr.	116.5	N45
12 hr.	134	N45
18 hr.	169.5	N45
24 hr.	174	N45
48 hr.	210.5	N35

Notes: (1) Isohyets are based on the GEO and HKO raingauges.
(2) Five genuine landslides reported to have occurred within the period between 10 October and 15 October 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A18 Maximum Rolling 24-hour Rainfall Distribution for the Period between 10 October (00:00) and 15 October 2011 (24:00) and Locations of Landslides

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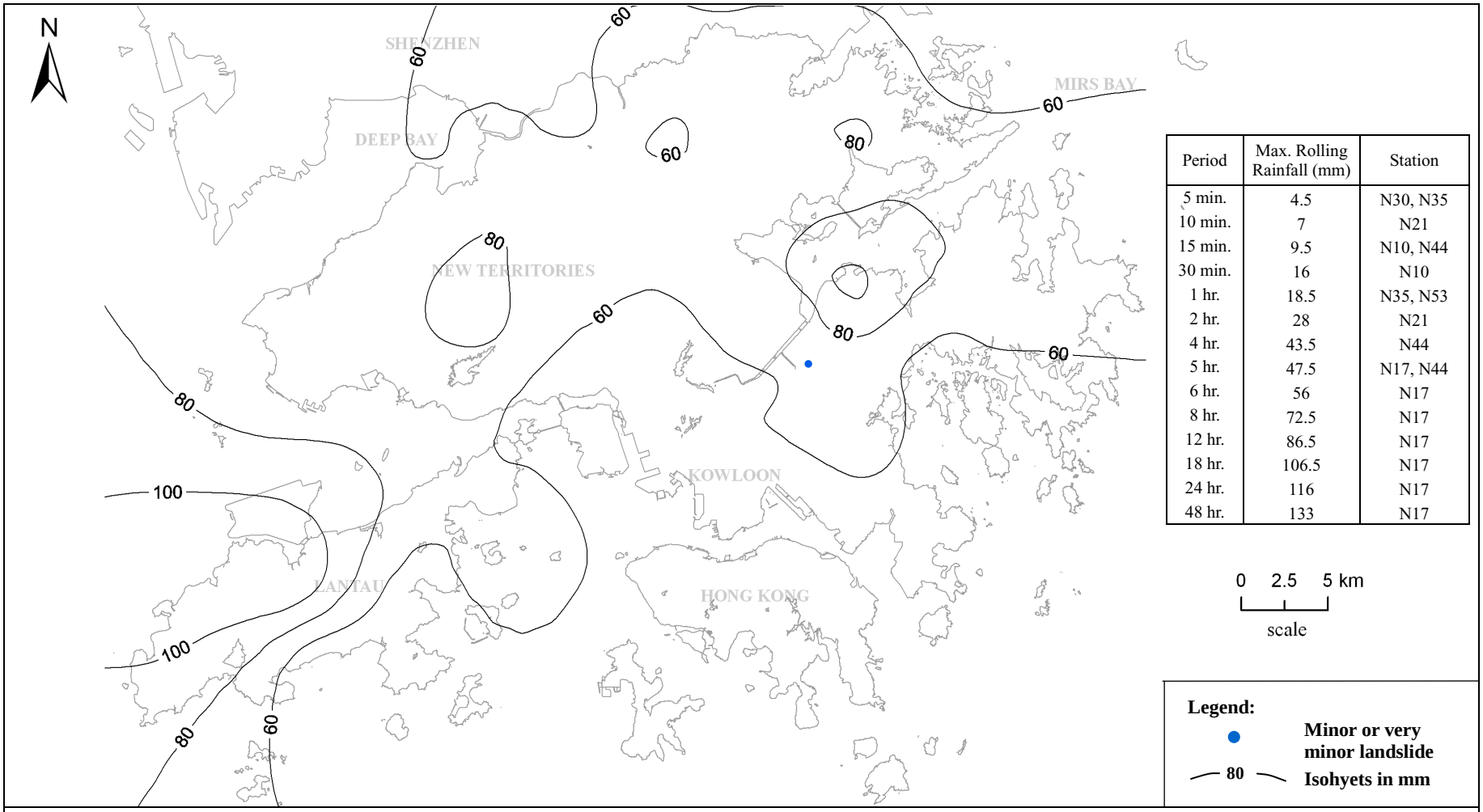

Period	Max. Rolling Rainfall (mm)	Station
5 min.	4.5	N30, N35
10 min.	7	N21
15 min.	9.5	N10, N44
30 min.	16	N10
1 hr.	18.5	N35, N53
2 hr.	28	N21
4 hr.	43.5	N44
5 hr.	47.5	N17, N44
6 hr.	56	N17
8 hr.	72.5	N17
12 hr.	86.5	N17
18 hr.	106.5	N17
24 hr.	116	N17
48 hr.	133	N17

Notes:
(1) Isohyets are based on the GEO and HKO raingauges.
(2) A genuine landslide reported to have occurred within the period between 8 November and 10 November 2011.
(3) Please refer to Figure 1 for locations of raingauge stations.

Figure A19 Maximum Rolling 24-hour Rainfall Distribution for the Period between 8 November (00:00) and 10 November 2011 (24:00) and Locations of Landslides

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Appendix B

List of Landslide Incidents Reported to the Government

List of Tables

Table B1 List of Major Landslide Incidents

Incident No.	Location	Feature Registration No.	Failure			Facility Affected	Consequence
			Date (Time)	Feature Type	Scale (m^3)		
2011/10/1138	Behind STT 887, near Loi Tung Village, Sha Tau Kok	3NW-D/C41	Unknown	Soil cut	150	Others (Construction depot)	-

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

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2011/01/1089	Behind Block 26, Baguio Villa, Victoria Road, Pok Fu Lam	Natural hillside	18/1	Police	18/1 (20:30)	Natural hillside	0.02 (Boulder fall)	Open area	-
2011/05/1102	No. 14 Wilson Road, Jardines Lookout	11SE-C/C123	24/5	Public	24/5 (09:00)	Soil/rock cut	0.5 (Rockfall)	Buildings	-
2011/06/1110	Beneath Stubbs Road, near Village Terrace	Natural hillside	16/6	Public	16/6 (09:10)	Natural hillside	30	Buildings	Landslide debris inundating a residential area and blocking an alleyway
2011/07/1121	Near No. 156 Tai Hang Road, Tai Hang	Natural hillside	11/7	HyD	11/7	Natural hillside	3 (Boulder fall)	Road	1 lane of Tai Hang Road temporarily closed
2011/07/1123	No. 46 Tin Hau Temple Road, North Point	11SE-A/C10	17/7	Police	16/7 (20:00)	Soil/rock cut	1	Buildings	-
2011/08/1125	Lei Yue Mun Park and Holiday Village, Chai Wan Road	11SE-B/CR130	10/8	Arch SD	10/8 (01:00)	Soil/rock cut	0.6	Others (Playground)	-

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

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2011/09/1126	Bus Terminal at Lei Tung Estate, Ap Lei Chau	15NW-B/C92	1/9	Public	1/9 (12:30)	Soil/rock cut	0.001 (Rockfall)	Minor footpath	Minor footpath temporoarily closed
2011/09/1128	Behind Block C of North Point Centre Nos. 278-288 King's Road, North Point	11SE-A/CR160	22/9	Public	Unknown	Soil/rock cut	0.2 (Rockfall)	Others	-
2011/11/1141	Lugard Road near lamp post 14613, The Peak	Natural hillside	14/11	Public	14/11	Natural hillside	0.06 (Boulder fall)	Access road	-
2011/12/1145	No. 113 Tai Hang Road (Hillside above slope no. 11SE-C/C448)	Natural hillside	28/12	Police	28/12 (08:21)	Natural hillside	0.03 (Boulder fall)	Road	1 lane of Tai Hang Road temporarily closed
2011/08/1019AD[#] (ArchSD/SKW/ 2011/08/0001)	Lei Yue Mun Park, Shau Kei Wan	11SE-D/C715	5/8	Arch SD	2/8	Soil/rock cut	0.5	Access road	-

Note: The bracket denotes the landslide number adopted by the Government Department concerned, other than the GEO.

Table B3 List of Landslide Incidents in Kowloon (Sheet 1 of 2)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2011/03/1092	North of Tang King Po School, Homantin	< 1.5 m high retaining wall	2/3	BD	Unknown	Retaining wall (Masonry)	Signs of distress	Open area	-
2011/03/1095	Wing Cheung Factory Building, No. 121 King Lam Street	11NW-A/C188	19/3	BD	19/3 (08:00)	Rock Cut	0.1 (Rockfall)	Others (Alleyway)	-
2011/04/1097	Within King's Park, below No. 73 King's Park Hill	11NW-D/F153	4/4	FSD	4/4 (08:00)	Fill	15^+	Minor footpath	Minor footpath temporarily closed
2011/04/1098	Behind bus terminus, adjacent to Tsz Oi Court, Tsz Wan Shan	Natural hillside	23/4	FSD	23/4 (18:00)	Natural Hillside	0.4 (Boulder fall)	Building	Damage to an external wall within a bus terminus
2011/07/1124	Sam Ka Tsuen, Lei Yue Mun	11SE-B/DT18	13/7	LandsD	5/7	Disturbed terrain	5	Open area	-
2011/10/1130	Behind United Christian College, Tai Hang Tung	11NW-B/C37	7/10	Public	Unknown	Soil/rock cut	0.3	Nil	-
2011/10/1137	St. Raphael's Catholic Cemetery, Cheung Sha Wan	2.5 m high retaining wall	17/10	Public	12/10	Retaining wall	20^+	Others (Cemetery)	-

Table B3 List of Landslide Incidents in Kowloon (Sheet 2 of 2)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
2011/11/1139	Behind Caritas Medical Centre, Cheung Sha Wan	11NW-B/FR402	3/11	Others	3/11 (16:00)	Fill	10	Nil	-
2011/11/1024HY (HyD/K/2011/ 12/0013)	Shatin Pass Road, between lamp pole Nos. AF0649 & AF0650	11NE-A/C281	22/12	HyD	19/12 (08:30)	Rock cut	1 (Rockfall)	Minor footpath	-

Legend:

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

Note: The bracket denotes the landslide number adopted by the Government Department concerned, other than the GEO.

Table B4 List of Landslide Incidents in the New Territories (Sheet 1 of 9)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2011/01/1088	Tui Min Hoi, Sai Kung	8SW-C/C62	10/1	GEO	Unknown	Soil cut	20	Village house	-
2011/02/1090	Kak Tin Street, Tai Wai (near lamp post N1200)	Natural hillside	15/2	Police	15/2 (17:48)	Natural hillside	0.06^{+} (Boulder fall)	Pedestrian pavement	-
2011/02/1091	Behind a house at Pak Tin, Sha Tin	7SW-B/C558	16/2	Public	15/2	Soil/rock cut	0.4	Squatter dwelling	-
2011/03/1096	15m East of No. 12 of Pak Tin Kong, Lam Kam Road, Tai Po	7NW-A/C265	14/3	Public	14/3 (10:30)	Soil cut	10	Others (River)	-
2011/05/1099	Tsuen Wan Chinese Permanent Cemetery, next to Sunley Centre, the 10th Terrace of Section 1	< 3 m high retaining wall	22/5	FSD	Unknown	Retaining wall	40	Others (Cemetery)	-
2011/05/1100	Near No. 68 Tai Wo Village (Lot 1570 in D.D. 9), Tai Po	< 3 m high retaining wall	24/5	DLO	22/5 (18:00)	Retaining wall (Masonry)	5	Village house	-
2011/05/1101	House Nos. 8-9, Pak Tam Au Village, Sai Kung North	8NW-D/CR76	24/5	Public	24/5 (09:00)	Soil cut	3	Village house	-

Table B4 List of Landslide Incidents in the New Territories (Sheet 2 of 9)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2011/05/1103	Sheung Kok Shan Road	3 m-4 m high soil cut slope	25/5	FEHD	Unknown	Soil cut	2	Road	-
2011/06/1104	Southeast of Lot 60 in DD35, Tsung Tsai Yuen, Tai Po	Natural hillside	20/5	DSD	20/5 (09:15)	Natural hillside	2	Squatter dwelling	-
2011/06/1105	Casa Bella, Silverstrand Beach Road, Tseung Kwan O	12NW-C/C175	23/5	Public	23/5 (16:00)	Soil cut	0.2	Pedestrian pavement	-
2011/06/1107	Near No. 80 Nam Wah Po, Tai Po	3SW-D/CR28	27/5	LandsD	27/5 (15:16)	Soil cut	3	Others (Open car park)	-
2011/06/1108	Behind house No. 12A, Chuk Hang Tsuen, Tai Po	2 m high soil cut slope(1)	9/6	ICC	22/5 (09:00)	Soil cut	1	Squatter dwelling	-
2011/06/1109	Che Keng Tuk, Sai Kung	8SW-C/CR116	15/6	ICC	15/6	Soil cut	1.5	Others (Open car park)	-
2011/06/1111	Mei Tin Road, Tai Wai	7SW-D/CR126	17/6	Public	17/6 (12:00)	Soil cut	3.5	Pedestrian pavement	-
2011/06/1112	Mei Tin Road, Tai Wai	7SW-D/CR126	17/6	HyD	17/6	Soil cut	4.5	Open area	-

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Table B4 List of Landslide Incidents in the New Territories (Sheet 3 of 9)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2011/06/1113	Mei Tin Road, Tai Wai	7SW-D/F550	17/6	HyD	17/6	Fill	20	Pedestrian pavement	-
2011/06/1114	Bride's Pool Road, Bride's Pool	3SE-B/C131	19/6	Police	Unknown	Rock cut	8^+ (Rockfall)	Road	1 lane of Bride's Pool Road temporarily closed
2011/06/1115	Behind Village Office of Pai Min Kok Village, Sham Tseng	2 m high soil cut slope	20/6	Public	Unknown	Soil cut	1	Others (Alleyway)	-
2011/06/1116	House No. 61A, Kwun Yam Shan Tsuen, Sha Tin	< 3 m high soil cut slope	22/6	Public	22/6 (16:00)	Soil cut	1	Village house	-
2011/06/1117	Behind No. 9A (license no. S10504) Mang Kung Wo Village, Sai Kung	2.3 m high soil cut slope	8/6	DLO	22/5 (09:00)	Soil cut	3	Others (Alleyway)	-
2011/06/1119	Access Road to Beacon Hill Radar Station	11NW-B/C521	23/6	DLO	28/5 (09:30)	Soil cut	3	Pedestrian pavement	-
2011/07/1120	Zone 248 of Lin Ma Hang Road, Sha Tau Kok (near lamp post 92)	3NE-A/C103	1/7	FSD	1/7 (12:35)	Soil/rock cut	29	Road	Lin Ma Hang Road temporarily closed

Table B4 List of Landslide Incidents in the New Territories (Sheet 4 of 9)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2011/07/1122	Natural slope at approx. 30m north-east of Feature No. 6SW-D/C108, Tai Lam Chung	Natural hillside	8/7	DLO	15/6 (14:00)	Natural hillside	6	Access road	-
2011/09/1127	Near Lamppost No. N3463, Ho Sheung Heung Road	1.6 m high retaining wall	19/9	FSD	19/9 (18:00)	Retaining wall	8	Minor footpath	Minor footpath temporarily closed
2011/10/1132	Nos. 45A and 45B Tai Wo Tsuen, Tai Po	3SW-D/C191	12/10	FSD	12/10 (19:20)	Soil cut	4.5	Minor footpath	Minor footpath temporarily closed
2011/10/1133	West of Nos. 3-4 Tai Po Mei Village, Tai Po	< 3 m high soil cut slope	13/10	Public	13/10 (10:20)	Soil cut	2	Minor footpath	-
2011/10/1134	Nature slope opposite to feature 3NE-A/C103, zone 248 of Lin Ma Hang Road, Sha Tau Kok	Natural hillside	14/10	HyD	13/10 (09:00)	Natural hillside	10	Road	-
2011/10/1135	North of lot no. 184 in D.D. 38, Sha Tau Kok	2.7 m high soil cut slope	13/10	Public	13/10 (15:50)	Soil cut	2	Others (Open car park)	-
2011/10/1136	Pat Heung Tai Ling - Lot1489 DD114	< 5 m high fill slope	19/10	FSD	19/10 (11:00)	Fill	8	Minor footpath	Minor footpath temporarily closed

Table B4 List of Landslide Incidents in the New Territories (Sheet 5 of 9)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2011/10/1138	Behind STT 887, adjacent to Loi Tung Village, Sha Tau Kok	3NW-D/C41	18/10	Public	Unknown	Soil cut	150	Others (Construction depot)	-
2011/11/1140	Behind Houses Nos. 179 & 180A, Tseng Tau Sheung Tsuen, Tuen Mun	6SW-A/C359	3/11	Public	10/8	Soil cut	3	Squatter dwelling	-
2011/12/1142	30m north of Block 3, Sunny Villa, Nos. 218-240 Castle Peak Road, Tsuen Wan	6SE-D/C38	29/11	DLO	Unknown	Soil cut	6	Others (Slope berm)	-
2012/01/1147	Behind House No. 100 (Lot no. 1762A in D.D. 244) Ho Chung Village, Sai Kung	2 m high retaining wall	31/12	Public	31/12 (10:50)	Retaining wall (Masonry)	3	Others (Garden)	-
2011/02/1001WS (WSD/2011/2/1/ NTW)	Unregistered slope near Shing Mun Catchwater near SM 076, Tsuen Wan	< 5 m high fill slope	23/2	WSD	Unknown	Fill	1	Access road	-
2011/05/1006HY (HyD/NTW/2011/ 05/0002)	Tai Mo Shan Road, Tsuen Wan	6SE-B/C49	6/7	HyD	22/5	Soil cut	3.6	Road	-

Table B4 List of Landslide Incidents in the New Territories (Sheet 6 of 9)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2011/05/1008WS (WSD/2011/5/1/ NTW)	Adjoining WSD access road NT 41 near spot level 171.5 of Shing Mun catchpit, (Phase 1) Tsuen Wan	7SW-A/FR 51	17/5	WSD	Unknown	Fill	0.4	Pedestrian pavement	Pedestrian pavement temporarily closed
2011/05/1009WS (WSD/2011/5/2/ NTE)	Outside WSD Intake 'UD', Sai Kung	8NW-B/C48	26/5	WSD	Unknown	Soil/rock cut	12	Access road	-
2011/06/1014WS (WSD/2011/6/2/ NTW)	Adjoining WSD access road NT31, 190m northwest of weir on access road to Tai Lam Chung Catchwater, near Shek Kong	6NE-C/C202	24/6	WSD	Unknown	Soil/rock cut	0.6 (Rockfall)	Access road	-
2011/04/1002AD (ArchSD/TM/ 2011/04/0002)	Tai Lam Correctional Institution	6SW-D/C435	29/4	Arch SD	27/4 (16:00)	Soil cut	1	Others (Planter)	-
2011/05/1003AD (ArchSD/F/2011/ 05/0001)	Wo Hop Shek Cemetery, Fanling	3SW-C/C343	16/5	Arch SD	Unknown	Soil cut	8	Others (Cemetery)	-

Table B4 List of Landslide Incidents in the New Territories (Sheet 7 of 9)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2011/05/1004AD (ArchSD/F/2011/05/0002)	Wo Hop Shek Cemetery, Fanling	3SW-C/C116	2/6	Arch SD	27/5	Soil cut	30	Others (Cemetery)	-
2011/05/1005AD (ArchSD/F/2011/05/0003)	Wo Hop Shek Cemetery, Fanling	3SW-C/C326	27/5	Arch SD	Unknown	Soil cut	2	Others (Cemetery)	-
2011/06/1010AD (ArchSD/F/2011/06/0001)	Wo Hop Shek Cemetery, Fanling	3SW-C/C702	23/6	Arch SD	Unknown	Soil cut	3	Others (Cemetery)	-
2011/06/1011AD (ArchSD/F/2011/06/0002)	Queen's Hill Camp, Fanling	3SW-B/C127	30/6	Arch SD	Unknown	Soil cut	30	Open area	-
2011/07/1016AF (AFCD/2011/07/0001)	Tai Po Kau Track - Tai Po Kau Nature Reserve	Natural hillside	4/7	AFCD	4/7	Natural hillside	0.5	Access road	-

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Table B4 List of Landslide Incidents in the New Territories (Sheet 8 of 9)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2011/07/1018WS (WSD/2011/7/1/ NTW)	Abutting WSD access road NT31 near Spot Level 126.8, Tai Lam Country Park, Tai Lam	6SW-B/C46	6/7	WSD	Unknown	Soil/rock cut	3.2	Access road	-
2011/07/1017HY (HyD/K/2011/07/ 0007)	Shatin Pass Road, between lamp posts AF0645 and AF0646	11NE-A/C284	3/8	HyD	27/7 (11:00-12:00)	Rock cut	3 (Rockfall)	Nil (Rock debris retained by rock mesh)	-
2011/08/1020HY (HyD/NTE/2011/ 08/0011)	Location 4 (near squatter no. STL/1/13-14) & Location 11 (near 7SE-B/C142), Ma On Shan Tsuen Road	< 3 m high soil cut slope	10/10	HyD	15/8	Soil cut	2	Access road	-
2011/05/1007LD (LandsD/2011/ TW&KT/05/001)	Tsing Lung Tau, Tsuen Wan	6SE-C/C558	19/5	LandsD	Unknown	Soil cut	3^+	Open area	-
2011/11/1022AD (ArchSD/F/2011/ 11/0001)	Wo Hop Shek Cemetery, Fanling	3SW-C/C80	15/11	Arch SD	Unknown	Soil cut	30	Others (Cemetery)	-

Table B4 List of Landslide Incidents in the New Territories (Sheet 9 of 9)

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2011/12/1025AD (ArchSD/TW/2011/12/0001)	Kwok Shui Road Park, Tsuen Wan	7SW-C/F503	14/12	Arch SD	Unknown	Fill	20	Road	1 lane of Kok Shui Road temporarily closed
2011/11/1023HY (HyD/NTE/2011/11/0014)	Fei Ngo Shan Road	11NE-A/C517	4/1/12	HyD	15/11	Soil cut	1	Access road	-
2011/11/1024HY (HyD/NTE/2011/11/0016)	Behind House No. 6A, Shek Kwu Lung Village, Shatin	Natural hillside	3/1/12	HyD	9/11	Natural Hillside	0.5^{+}	Nil (Undermined boulder)	-

Legend:

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

Note: The bracket denotes the landslide number adopted by the Government Department concerned, other than the GEO.

Table B5 List of Landslide Incidents in Outlying Islands

Incident No.	Location	Feature Registration No.	Reported		Failure			Facility Affected	Consequence
			Date	From	Date (Time)	Feature Type	Scale (m^3)		
2011/06/1118	Behind 29B Yung Shue Wan Street, Lamma Island	Natural hillside	15/6	Public	12/6 (12:00)	Natural hillside	0.08 (Boulder fall)	Village house	-
2011/12/1143	Tai Kok Tsz, Luk Wu, Lantau	9SW-D/FR107	8/12	Public	Unknown	Retaining Wall	2	Open area	-
2011/06/1012LD (LandsD/2011/IS/06/001)	Hong Kong Christian Service Bradbury Retreat Centre, Cheung Chau	14NW-D/CR284	7/6	Lands D	Unknown	Retaining Wall	2.5	Open area	-
2011/07/1015AD (ArchSD/IS/2011/07/0001)	Don Bosco Road Playground, Cheung Chau	14NW-D/C198	11/7	Arch SD	6/7	Soil Cut	1	Access road	-

Note: The bracket denotes the landslide number adopted by the Government Department concerned, other than the GEO.

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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.
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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.

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