LC Paper No. PWSC47/16-17(01)

Legislative Council Public Works Subcommittee
meeting on 11 January 2017

778CL – Site formation and infrastructure works for public housing developments at Chung Nga Road and Area 9, Tai Po

Supplementary Information

PURPOSE

At the Legislative Council Public Works Subcommittee meeting on 11 January 2017 when the captioned project was considered (PWSC(2016-17)38 refers), Members requested the following supplementary information -

(a) the technical reports regarding the traffic impact assessment and baseline impact assessment of air quality conducted for the proposed public housing developments at Tai Po Area 9 and Chung Nga Road; and

(b) supplementary information on the provision of a wet market in the proposed public housing developments at Tai Po Area 9 and Chung Nga Road.

GOVERNMENT RESPONSES

2. The required information is set out below -

(a) generally, the Transport Department will request developers or the related government departments to submit relevant traffic impact assessment for developments where necessary. Besides the additional traffic arising from the related developments, the traffic impact assessment will take into account the traffic flow arising from other planned developments in the vicinity and the traffic growth in the area in order to make a comprehensive assessment for

the affected area and propose recommendations for traffic improvement.

Regarding this project, the Civil Engineering and Development Department employed a consultant to carry out an assessment on the traffic impact arising from the proposed public housing developments at Tai Po Area 9 and Chung Nga Road in the vicinity (near Chung Nga Road and Chuen On Road). The traffic impact assessment indicated that the maximum volume to capacity ratio of Chung Nga Road and Chuen On Road would only be 0.58 during peak hours after population intake of the proposed developments.

According to the traffic impact assessment report on roads in the vicinity of the proposed public housing developments at Tai Po Area 9 and Chung Nga Road, the hourly traffic flow after population intake during morning peak hours from the junction of Chung Nga Road / Ting Kok Road / Nam Wan Road to Nam Wan Road, leading to Tai Po town centre is approximately 1 000 vehicles. This is less than half of the design capacity of the road section of Nam Wan Road between Ting Kok Road and On Po Road. Since the traffic will be further distributed to different roads after entering Nam Wan Road, the traffic impact on Tai Po town centre is considered to be minimal.

Three recommendations relating to traffic were made in the traffic impact assessment for the proposed public housing developments at Tai Po Area 9 and Chung Nga Road. They were -

(i) construction of a new carriageway connecting Tai Po Area 9 site and Chuen On Road;

(ii) improvement works at the two junctions of Chung Nga Road and Chuen On Road (South and North); and

(iii) proposed improvement works at the junction of Chuen On Road and the carriageway connecting with Tai Po Area 9.

The above recommendations relating to traffic have already been included as part of the project which is now being upgraded to Category A.

According to the recommendations in the traffic impact assessment for the proposed public housing developments at Tai Po Area 9 and Chung Nga Road, with the proposed improvement works at the two junctions of Chung Nga Road and Chuen On Road (North and South) and at the road junction of Chuen On Road and the carriageway connecting with Tai Po Area 9, it would be sufficient to cope with the additional traffic flow. No adverse impact would be caused to the traffic in the vicinity.

The capacities of the related junctions are set out below -

Junctions	Proposed Improvement Works	Junction Capacity[1]			
		Before improvement		After improvement	
		AM	PM	AM	PM
Chuen On Road and the new carriageway connecting with Tai Po Area 9	Widening of the junction between Chuen On Road and the new carriageway connecting with Tai Po Area 9 site (near Tai Po Hospital).	1.31	0.71	0.64	0.45
Chung Nga Road and Chuen On Road (South)	Widening of Chung Nga Road southbound for the provision of an additional lane at Chung Nga Road southbound.	-16%	5%	16%	35%
Chung Nga Road and Chuen On Road (North)	Widening of the existing junction between Chung Nga Road and Chuen On Road, signalising of the junction and rearranging of pedestrian crossings.	0.91	0.61	16%	>50%

Generally, the Environmental Protection Department (EPD), having reviewed the situation in the vicinity of a development project, will

[1] The reserve capacity of signal-controlled junctions is indicated by percentage, a positive figure indicates that the junction could accommodate more traffic. As regards priority junctions (controlled by "Stop" or "Give Way" traffic signs and/or the associated road markings), the degree of saturation of traffic is indicated by design flow/capacity ratio and represented by decimal, a ratio above 1 indicates the presence of traffic queues.

request developers or the related government departments to submit relevant assessments where necessary.

In 2009, the Hong Kong Housing Authority (HA) conducted a preliminary qualitative review (without computer modelling) for impact of the chimney emissions on the location of the proposed public housing development at Tai Po Area 9 (the development at Chung Nga Road had yet proposed at the time). The review pointed out that the proposed public housing development at Tai Po Area 9 was located within the buffer zone of chimneys at Tai Po Hospital. Therefore, the chimney emissions at Tai Po Hospital might restrict the proposed housing development.

In view of the above preliminary review result, HA conducted a more detailed quantitative assessment (through computer modelling) on air quality for the proposed housing developments at Tai Po Area 9 and Chung Nga Road in 2013. The assessment results indicated that all relevant parameters in the Air Quality Objectives were met, and there would be no adverse impact on the proposed housing developments at Tai Po Area 9 and Chung Nga Road due to the chimney emissions at Tai Po Hospital.

The related technical reports (English version only) are at the Annex; and

(b) when planning shopping facilities for new housing estates, HA will, based on the circumstances in individual developments, consider a number of factors such as the scale of the proposed housing developments, population in the area, demographic mix, community needs and availability of shopping facilities nearby (including the number of wet markets and fresh food retail outlets) before determining the provision of suitable shopping facilities for the new estates. Consideration will also be given to the operational and financial viability and suitability of concerned facilities.

As mentioned by the Government representatives at the meeting of the Legislative Council Public Works Subcommittee on 11 January 2017, there were altogether eight wet markets in Tai Po

District with over-supply of varied degrees in individual markets. From the operational and financial return perspectives, it was believed that the prospect of setting up another traditional wet market at Tai Po Area 9 was not optimistic and also such provision might not exactly meet the shopping needs of residents.

There are still a few years before the scheduled completion of the public rental housing developments at Tai Po Area 9 in 2023. HA will make adjustment to the provision of shopping facilities at Tai Po Area 9, taking into account the above factors and the views of various parties. The adjustment will include providing fresh food retail outlets in the form of street shops with an area approximately equivalent to 30 to 40 traditional wet market stalls in order to better meet the shopping needs of the future residents at Tai Po Area 9 and at the same time enhance the operational and financial viability of these facilities. To this end, we will allow for flexibility in the design and construction of the project.

Transport and Housing Bureau
January 2017

附錄

Appendix

Civil Engineering and Development Department

Agreement No. CE 67/2014 (CE) Site Formation and Infrastructural Works at [redacted] Chung Nga Road and Area 9, Tai Po – Investigation, Design and Construction

Final Traffic Impact Assessment Report (Chung Nga Road & Area 9, Tai Po) (Rev.1)

REP-013-02

Final (Rev.1) | May 2016

Job number244005

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ARUP

Document Verification

ARUP

Job title	Agreement No. CE 67/2014 (CE) Site Formation and Infrastructural Works at [redacted] Chung Nga Road and Area 9, Tai Po – Investigation, Design and Construction		**Job number** 244005
Document title	Final Traffic Impact Assessment Report (Chung Nga Road & Area 9, Tai Po) (Rev.1)		**File reference**
Document ref	REP-013-02		

Revision	**Date**				
Draft 1	22/12/15	**Filename**	REP-013-00		
		Description	Draft Traffic Impact Assessment Report (Chung Nga Road & Area 9, Tai Po)		
			Prepared by	Checked by	Approved by
		Name	[redacted]	[redacted]	[redacted]
		Signature			
Final	22/12/15	**Filename**	REP-013-01		
		Description	Final Traffic Impact Assessment Report (Chung Nga Road & Area 9, Tai Po)		
			Prepared by	Checked by	Approved by
		Name	[redacted]	[redacted]	[redacted]
		Signature			
Final (Rev.1)	6/5/2016	**Filename**	REP-013-02		
		Description	Final Traffic Impact Assessment Report (Chung Nga Road & Area 9, Tai Po) (Rev.1)		
			Prepared by	Checked by	Approved by
		Name	[redacted]	[redacted]	[redacted]
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

Issue Document Verification with Document ✓

Contents

1 Introduction

1.1 General

1.1.1. Ove Arup and Partners Hong Kong Limited (Arup) was commissioned by the Civil Engineering Office of the Civil Engineering and Development Department (CEDD) of the Hong Kong Special Administrative Region (HKSAR) Government on 9 June 2015 to provide consultancy services for the investigation, design and construction supervision of Site Formation and Infrastructural Works at [redacted] Chung Nga Road and Area 9, Tai Po.

1.2 Project Background

1.2.1. In the 2013 Policy Address announced in mid-January 2013, the Chief Executive set out that the top priority of the current-term Government is to tackle the housing problem. Government will increase and expedite the supply of subsidized housing in short to medium term. In order to meet this policy objective, Planning Department (PlanD) has identified batches of potential public housing sites. The sites at [redacted] Chung Nga Road East (CNRE), Chung Nga Road West (CNRW) and Area 9 (TP9) of Tai Po with a total area of about 9.6 ha are among these potential sites.

1.2.2. [redacted]

1.2.3. As stated in the Government Policy, it aims to maintain the average waiting time of around three years for general Waiting List applicants. Timely provision of formed land and essential infrastructures is required to support the housing developments which their tentative population intakes are scheduled as follows:

(a) CNRE - Late 2020

(b) TP9 - Late 2022

(c) CNRW - Mid 2025

[redacted]

1.2.4. The Projects [redacted] "Site Formation and Infrastructure Works for Development at Chung Nga Road and Area 9, Tai Po" (CNR&TP9 Project) are proposed to form platforms for the housing development and related uses in the sites and to carry out necessary infrastructural works for the proposed development.

1.2.5. In order to expedite the achievement of the tight population intake programme for the CNR&TP9 Project, the works for the site formation, natural terrain hazard mitigation measures, road works and other infrastructural works within TP9 and CNRW shall be entrusted to Hong Kong Housing Authority (HKHA) subject to the approval of the Financial Services and the Treasury Bureau (FSTB). The infrastructural works outside TP9 and CNRW shall be carried out under the CNR&TP9 Project.

1.2.6. This Traffic Impact Assessment (TIA) report to be prepared for the CNR&TP9 Project only. [redacted]

1.3 Objective of the Report

1.3.1. The main objective of this TIA Report is to review the traffic impact assessment report which carried out by HD (hereinafter refer as HDTIA), including considering the comments made by concerned department such as TD and verify the findings and recommendations therein and recommend necessary traffic improvement works outside the CNRE, TP9 and CNRW sites.

1.3.2. The report contains the following:

(a) To carry out traffic survey to update the traffic figures;

(b) To update the planning assumption and associated traffic forecast;

(c) To carry out a series of assessment based on the updated traffic figures, forecast model, traffic aids and method of control (MOC) to review the validity of the findings and recommendation of the HDTIA and recommend necessary traffic improvement works;

(d) To review the adequacy of the traffic facilities and propose mitigation/ improvement measures where necessary; and

(e) To review the capacity of the existing road network and determine any adverse traffic impact caused by the Project during operation stages, propose temporary traffic management and recommend solution/ necessary improvement measure, where necessary, at the problem area identified.

2 Review on Existing Traffic Condition

2.1 Existing Traffic Conditions

2.1.1 The proposed Area of Influence (AOI) as shown in **Figure 2.1** has been sent to TD and agreed by TD on 3 August 2015.

2.1.2 In order to review the baseline result, comprehensive traffic survey has been conducted on 7 July, 2015 during 0700 to 0900 hours and 1700 to 1900 hours within the AOI. **Figure 2.1** illustrates the AOI and the location of assessed junctions.

2.1.3 To obtain the most updated traffic information, manual traffic count has been conducted on the following junctions and links within the AOI.

Table 2.1 Assessed Existing Junctions and Links

No.	Junction	Type
J1	Chung Nga Road / Access Road to Pinehill Village	Priority
J2	Chung Nga Road / Chuen On Road (North)	Priority
J3	Chuen On Road / Access Road to Tai Po Hospital	Priority
J4	Chung Nga Road / Chuen On Road (South)	Signal
J5	Ting Kok Road / Chung Nga Road / Nam Wan Road	Signal
J6	Ting Kok Road / Chung Nga Road	Priority
J7	Chung Nga Road / Ting Lai Road	Priority
J8	Chung Nga Road with its Pedestrian Crossing	Signal
J11	Chuen On Road / Access Road to Tai Po Hospital	Priority
J12	Chuen On Road / Access Road to Nethersole Hospital	Priority

2.1.4 The survey results revealed that the morning and evening peak hours were during 0800 to 0900 and 1730 to 1830 hours respectively.

2.1.5 As the survey day was close to summer holiday, an adjustment factor of +3%, reference to the historical Annual Traffic Census (ATC) data in year 2011, 2012 and 2013, was adopted to project the traffic figure. The relevant ATC data is attached in **Appendix A** for reference. The adjusted traffic flow during abovementioned peak hours is shown in **Figure 2.2**.

2.1.6 Junction capacity analyses were therefore carried out at the key junctions based on the peak hour surveyed flows. The results are presented in **Table 2.2**.

Table 2.2 Existing Junction Performance

Junction [1]		Type	Performance [2]	
			AM	PM
J1	Chung Nga Road / Access Road to Pinehill Village	Priority	0.05	0.03
J2	Chung Nga Road / Chuen On Road (North)	Priority	0.28	0.20
J3	Chuen On Road / Access Road to Tai Po Hospital	Priority	0.03	0.03
J4	Chung Nga Road / Chuen On Road (South)	Signal	>50%	>50%
J5	Ting Kok Road / Chung Nga Road / Nam Wan Road	Signal	>50%	>50%
J6	Ting Kok Road / Chung Nga Road	Priority	0.34	0.25
J7	Chung Nga Road / Ting Lai Road	Priority	0.27	0.24
J8	Chung Nga Road Pedestrian Crossing	Signal	>50%	>50%
J11	Chuen On Road / Access Road to Tai Po Hospital	Priority	0.06	0.15
J12	Chuen On Road / Access Road to Nethersole Hospital	Priority	0.48	0.41

Notes:

1. Please refer to **Figure 2.1** for the location of the assessed junctions.
2. A signal-controlled junction with a Reserved Capacity (RC) of 15% implies that it is operating at desirable capacity. For priority junctions and roundabouts, the performance indicator is the Design Flow to Capacity (DFC) ratio. A DFC ratio less than 0.85 indicates that the junction is operating with desirable capacity.

2.1.7 Results of the analysis indicate that all junctions in the study area are currently operating satisfactorily with ample capacity during both morning and evening peaks.

2.2 Existing Pedestrian Facilities Conditions

2.2.1 Pedestrian count has been carried out along the footpath on both sides of Chung Nga Road to reveal the existing footpath environment. Based on the survey result, the morning and evening peak hours were identified from 0745 to 0845 and 1700 to 1800 hours respectively.

Level of Service (LOS)

2.2.2 'Level of Service' (LOS) analysis of the existing pedestrian facilities was carried out based on the definitions presented in the Highways Capacity Manual 2000. This follows the approach currently being recommended by Transport Department. In general, LOS C and D are typical values and LOS A and B would provide a very good LOS. At a LOS of A, pedestrians basically move in desired paths without altering their movements in response to other pedestrians. Walking speeds are freely selected and conflicts between pedestrians are unlikely. At a LOS of B, pedestrians would continue to freely select their own walking

speed, can bypass slower pedestrians, and avoid crossing conflicts with others. At a LOS of C, pedestrians are restricted in selecting walking speed and in bypassing other pedestrians. A LOS of D would represent a further deterioration of the pedestrian movements but would still provide reasonable fluid flow. At a LOS of E or lower, it was determined that mitigation measures or improvement schemes should be considered to achieve a LOS of C or better. For the purposes of this pedestrian impact assessment, a LOS of C or above would be considered acceptable while a LOS of D would be marginally acceptable. **Table 2.3** shows the various LOS 'quantified' in terms of pedestrian flow rates.

Table 2.3 Level of Service (LOS) for Walkway

LOS	Flow rate (ped/min/m)	Description
A	<= 16	Pedestrians move in desired paths. Walking speeds are freely selected and conflicts between pedestrians are unlikely.
B	16 - 23	Sufficient space is provided for pedestrians to freely select walking speeds, to bypass other pedestrians and to avoid crossing conflicts with others. Pedestrians become aware of other pedestrians.
C	23 - 33	Sufficient space is available to select normal walking speeds and to bypass other pedestrians in unidirectional stream. Minor conflicts will occur in reverse direction or crossing movements.
D	33 - 49	Freedom to select individual walking speeds and bypass other pedestrians is restricted. Probability of conflicts is high in crossing or reverse-flow movements. LOS provides reasonable fluid flow, however, friction and interactions between pedestrians are likely to occur.
E	49 - 75	All pedestrians would have normal walking speeds restricted. Space is insufficient to pass over slower pedestrians. Cross and reverse movements are possible only with extreme difficulties. Design volumes approach the limit of walking capacity.
F	> 75	Walking speeds are severely restricted. Forward progress is made by shuffling. Cross and reverse movements are virtually impossible. Space is more characteristic of queued pedestrians than of moving pedestrian streams.

2.2.3 Based on the result of pedestrian count surveys, LOS assessment has been carried out and the result is shown in **Table 2.4**.

Table 2.4 Existing (2015) Pedestrian Facilities Assessment Results

Footpath	Clear Width (m)	Effective Width (m)	Two-way Pedestrian Flow (ped/ hour)		Level of Service	
			AM Peak	PM Peak	AM Peak	PM Peak
Footpath adjacent to Chung Nga Road EB in between of Access Road to Pinehill and Chuen On Road	2.5	1.5	45	40	A	A
Footpath adjacent to Chung Nga Road WB in between of Access Road to Pinehill and Chuen On Road	3	2	65	100	A	A
Footpath adjacent to Chung Nga Road EB south of Chuen On Road	4	3	35	25	A	A
Footpath adjacent to Chung Nga Road WB south of Chuen On Road	3	2	80	95	A	A

As shown in the **Table 2.4**, the footpaths in the vicinity of the proposed housing sites are operating satisfactorily.

2.3 Existing Public Transport Services

2.3.1 The inventory of existing public transport service has been reviewed. **Figure 2.3** show the location of public transport facilities. A summary of the existing franchised bus and GMB services is listed in **Table 2.5 – 2.8** below.

Table 2.5 Public Transport Interchange (PTI) at Tai Po Hospital

Route No.	Original	Destination	Peak Headway (min.)
Franchised Bus Service			
71K	Tai Wo B/T	Tai Po Market Railway Station B/T	10
GMB Service			
20A	Tai Po Nethersole Hospital	Tai Po Market Railway Station B/T	8
20X	Tai Po Nethersole Hospital	Tai Po Market Railway Station B/T	10
502	Tai Po Nethersole Hospital	Ching Ho Estate PTI	12

Table 2.6 Bus / GMB Layby at Chung Nga Road near Heng Wing House of Fu Heng Estate

Route No.	Original	Destination	Peak Headway (min.)
Franchised Bus Service			
71K	Tai Wo B/T	Tai Po Market Railway Station B/T	10

GMB Service			
502	Tai Po Nethersole Hospital	Ching Ho Estate PTI	12

Table 2.7 Public Transport Interchange (PTI) at Fu Heng Estate

Route No.	Original	Destination	Peak Headway (min.)
Franchised Bus Service			
71A	Fu Heng B/T	Tai Po Market Railway Station B/T	5
71B	Fu Heng B/T	Tai Po Central B/T	7
71K	Tai Wo B/T	Tai Po Market Railway Station B/T	10
271	Fu Heng B/T	Tsim Sha Tsui (Canton Road)	5
272P	Fu Heng B/T	Cheung Sha Wan	mon-sat 07:15 only
307A	Tai Po Tau B/T	Wing Kut Street	Mon-Fri 07:10,07:20, 07:30 & 07:40 Sat: 07:20 & 07:40 only
N271	Fu Heng B/T	Hung Hom Railway Station B/T	13

Table 2.8 Bus / GMB Layby at Ting Kok Road

Route No.	Original	Destination	Peak Headway (min.)
Franchised Bus Service			
72A	Fu Heng B/T	Tai Po Industrial Estate B/T	20
73	Fu Heng B/T	Tai Po Industrial Estate B/T	15
75K	Tai Wo B/T	Tai Po Market Railway Station B/T	8
265S	Fu Heng B/T	Tai Po Industrial Estate B/T	Mon-Sat 06:40 & 07;15 only
274P	Fu Heng B/T	Tai Po Industrial Estate B/T	mon-sat: 07:20, 07:40 & 07:55 only

2.3.2 The PTIs at Tai Po Hospital, Fu Heng Estate and bus/ GMB layby at Chung Nga Road are the closest public transport facilities to the proposed housing sites.

2.3.3 During the site visit and survey, it was observed that majority of residents make use of public transport services to MTR Tai Po Market Station. Survey was undertaken to review the occupancy of existing public transport. Franchised bus route 71K, 71A, 71B & 271 and GMB routes 20A, 20X & 502 were surveyed on a typical weekday in July 2015 during 0730-0930 and 1730-1930.

3 The Proposed Housing Development

3.1 Development Schedule

3.1.1 The development comprises of 3 sites, namely Chung Nga Road East (CNRE), Chung Nga Road West (CNRW) and Area 9, Tai Po (TP9). Basic development parameters and schedule are appended in **Table 3.1**.

Table 3.1 Summary of Development Schedule

Development Parameters	CNRE	TP9	CNRW
Area (ha)	7.77ha (approx.)		1.72 (approx.)
Housing Type	Public Rental Housing (PRH)		
Estimated No. of Flats	550	6,370	960
Estimated Population	1,260	16,392	2,938
Education Facilities	Nil	1 Primary School, 2 Kindergartens	1 Primary School
Commencement of site formation and piling	Aug 2017		Aug 2019
Target Population Intake data	Dec 2020	Dec 2022	May 2025

Source: Updated development parameter received in October 2015

3.1.2 For assessment purpose, an additional 10% increase is allowed to the estimated no. of flats and estimated populations. The adjusted flat number will be incorporated into the traffic forecast and assessments. Thus, for any possible change in proposed flat number at later stage of the study, the assessment results of this study will be kept valid with any change within the range of allowance. **Table 3.2** tabulates the proposed development scale adopted.

Table 3.2 Summary of Development Parameters Adopted for the Study

	CNRE	TP9	CNRW	Total
Adopted in this study				
No. of flats	605	7,007	1,056	8,668
	(Actual no. 550)	(Actual no. 6,370)	(Actual no. 960)	(Actual no. 7,880)

3.1.3 For the proposed development trip generation and attraction, trip rates were made reference to Transport Department's Transport Planning and Design Manual (TPDM) Volume 1 Chapter 3 - Transport Considerations in Town Plans. The trip rates for the proposed development and associated induced traffic are shown in **Table 3.3 and Table 3.4** respectively.

Table 3.3 Vehicular Trip Generation Rates (pcu/hr)

Development	AM Peak		PM Peak	
	Generation	Attraction	Generation	Attraction
Subsidised Housing (pcu/hr/flat)	0.0539	0.0439	0.0278	0.0339
Commercial / Retail (pcu/hr/100m2 GFA)	0.3307	0.3342	0.3839	0.4504
Primary School (pcu/hr/class operating)	1.3462	1.3846	0.6154	0.6154
Kindergarten (pcu/hr/ kindergarten)*	10	10	10	10

Source: 'Traffic Rates for Residential Developments at 95% Confidence Level', Transport Planning and Design Manual (TPDM), Volume 1

(*)For kindergarten in the sites, a nominal traffic of 10 pcu/hr each way is assumed, since they are expected to induce minimal trips on the road network.

Table 3.4 Estimated Vehicular Trips for the Housing Site (pcu/hr)

Component	AM		PM	
	Generation	Attraction	Generation	Attraction
Chung Nga Road West (CNRW)				
PRH 1056 flats (960 +10% allowance)	57	46	29	36
1 Primary school (30-classroom)	40	42	18	18
non-domestic (4,500 sqm GFA)	15	15	17	20
CNRW sub total	112	103	64	74
Chung Nga Road East (CNRE)				
PRH 605 flats (550 +10% allowance)	33	27	17	21
Tai Po Area 9 (TP9)				
PRH 7007 flats (6370 +10% allowance)	378	308	195	238
1 Primary school (36-classroom)	48	50	22	22
2 Kindergartens	20	20	20	20
Retail (5,690 sqm GFA)	19	19	22	26
TP9 sub total	465	397	259	305
All sites total	610	527	340	399

3.1.4 The total trips of the 3 sites would be around 1,137 and 739 pcu/hr two-way during the AM and PM peak periods respectively and to be distributed on future design scenarios. The public transport provision is not included in above table and it will be illustrated in **Section 5**.

4 Future Traffic Conditions And Impact Assessment

4.1 Assessment Scenarios

4.1.1 To evaluate the associated traffic impact likely to be induced by the proposed housing development during the Design Years of 2025 and 2030 i.e. the completion year and 5 years after completions, two scenarios were analysed and compared. The first scenario is the Reference Scenario (without the development). The second scenario is the Design Scenario (with the development).

4.1.2 Four assessment scenarios were assessed for the design years, namely:

- 2025 Reference Case
- 2025 Design Case (2025 Reference Case Traffic Flow + generated/attracted traffic related to the proposed development)
- 2030 Reference Case
- 2030 Design Case (2030 Reference Case Traffic Flow + generated/attracted traffic related to the proposed development)

4.2 Forecasting Methodology

Vehicular Traffic Forecast

4.2.1 In house traffic model was developed by using the latest 2008 NTE1 Saturn based Base District Traffic Model (BDTM) covering mainly Sheung Shui, Fanling, Tai Po, Sha Tin, Ma On Shan and Sai Kung areas, with refinements and updates on the available road network and development assumptions, and the model was refined and validated against their observed data to reflect the traffic condition of Year 2015 taking into account of the latest changes in the AOI. The committed / planned developments were included in the trip matrix.

4.2.2 The most updated enhanced 2011-based TPEDM has been taken into consideration of the model matrix updated.

4.2.3 The latest planning information in the Planning Department website (http://www2.ozp.tpb.gov.hk/gos/default.aspx?) was reviewed that there were no new planned / committed developments from year 2014 to the date of this Report completed, therefore, no additional matrix change is required.

4.2.4 Additional traffic from the proposed development were added on the corresponding matrix zone to from the design year traffic in the assessment scenario described in section **4.1**.

4.2.5 The traffic forecast for 2025 reference flow, 2025 design flow, 2030 reference flow and 2030 design flow are shown in **Figure 4.1** to **4.4** respectively.

Pedestrian Forecast

4.2.6 **Table 4.1** shows the population and employment figures in years 2011, 2016, 2021, 2026 & 2031 for the surrounding Planning Vision and Strategy (PVS) zones. **Table 4.2** summarises the estimated growth rate between 2011 and 2031 based on the TPEDM.

Table 4.1 2011-Based Population and Employment Planning Data (TPEDM)

[redacted]

Table 4.2 Estimated Growth Rate from 2011-Based TPEDM

[redacted]

4.2.7 The average annual growth rate in terms of population and employment planning data extracted from TPEDM is [redacted]

4.2.8 Hence, as a conservative approach, an annual growth rate of 1% p.a. is applied onto the existing peak pedestrian flows for projection of 2025 and 2030 pedestrian forecast.

4.3 Junction Capacity Assessment

4.3.1 Junction capacity assessment was undertaken based on the methodology presented in the TPDM. The results for year 2025 and 2030 reference and design cases are shown in **Table 4.3** and **Table 4.4**.

Table 4.3 Summary of Junction Performance – Year 2025

Junction [1]		Type	Junction Performance			
			Reference Case [2]		Design Case [2]	
			AM	PM	AM	PM
J1	Chung Nga Road / Access Road to Pinehill Village	Priority/ Signal	0.06	0.04	26%[3]	>50%[3]
J2	Chung Nga Road / Chuen On Road (North)	Priority	0.32	0.25	0.88	0.60
J3	Chuen On Road / Access Road to Tai Po Hospital	Priority	0.03	0.03	1.30	0.71
J4	Chung Nga Road / Chuen On Road (South)	Signal	>50%	>50%	-14%	9%
J5	Ting Kok Road / Chung Nga Road / Nam Wan Road	Signal	>50%	>50%	15%	42%
J6	Ting Kok Road / Chung Nga Road	Priority	0.41	0.28	0.41	0.28
J7	Chung Nga Road / Ting Lai Road	Priority	0.27	0.26	0.36	0.31
J8	Chung Nga Road Pedestrian Crossing	Signal	>50%	>50%	26%[3]	>50%[3]
J11	Chuen On Road / Access Road to Tai Po Hospital	Priority	0.08	0.16	0.09	0.18
J12	Chuen On Road / Access Road to Nethersole Hospital	Priority	0.53	0.41	0.60	0.46

Notes:
1. Please refer to **Figure 2.1** for the location of the assessed junctions.
2. A signal-controlled junction with a Reserved Capacity (RC) of 15% implies that it is operating at desirable capacity. For priority junctions and roundabouts, the performance indicator is the Design Flow to Capacity (DFC) ratio. A DFC ratio less than 0.85 indicates that the junction is operating with desirable capacity.
3. The junction improvement was proposed for ensuring the pedestrian safety and smooth manoeuvring of long vehicles in future design scenarios.

Table 4.4 Summary of Junction Performance – Year 2030

Junction [1]		Type	Junction Performance			
			Reference Case [2]		Design Case [2]	
			AM	PM	AM	PM
J1	Chung Nga Road / Access Road to Pinehill Village	Priority/ Signal	0.06	0.04	22%[3]	44%[3]
J2	Chung Nga Road / Chuen On Road (North)	Priority	0.34	0.26	0.91	0.61
J3	Chuen On Road / Access Road to Tai Po Hospital	Priority	0.03	0.03	1.31	0.71
J4	Chung Nga Road / Chuen On Road (South)	Signal	>50%	>50%	-16%	5%
J5	Ting Kok Road / Chung Nga Road / Nam Wan Road	Signal	49%	>50%	11%	36%
J6	Ting Kok Road / Chung Nga Road	Priority	0.44	0.30	0.44	0.30
J7	Chung Nga Road / Ting Lai Road	Priority	0.29	0.27	0.38	0.33
J8	Chung Nga Road Pedestrian Crossing	Signal	>50%	>50%	22%[3]	44%[3]
J11	Chuen On Road / Access Road to Tai Po Hospital	Priority	0.08	0.17	0.10	0.19
J12	Chuen On Road / Access Road to Nethersole Hospital	Priority	0.56	0.44	0.64	0.48

Notes: 1. Please refer to **Figure 2.1** for the location of the assessed junctions.

2. A signal-controlled junction with a Reserved Capacity (RC) of 15% implies that it is operating at desirable capacity. For priority junctions and roundabouts, the performance indicator is the Design Flow to Capacity (DFC) ratio. A DFC ratio less than 0.85 indicates that the junction is operating with desirable capacity.
3. The junction improvement was proposed for ensuring the pedestrian safety and smooth manoeuvring of long vehicles in future design scenarios.

4.3.2 The assessment revealed the assessed junctions will be operating with ample capacity in year 2025 and 2030, except Junction J2, J3, J4 and J5. The improvement measures for J2, J3, J4 and J5 have been proposed in below **Para. 4.5**.

4.4 Preliminary Junction Improvement Schemes

Preliminary junction improvement scheme are therefore recommended as follows.

J1 – Chung Nga Road / Access Road to PineHill and J8 Chung Nga Road Pedestrian Crossing

4.4.1 Although the junction will be operating at a desirable capacity as shown in Tables 4.3 and 4.4 in the design years, junction improvement was proposed to enhance the pedestrian safety and smooth manoeuvring of long vehicles. Under the improvement scheme, another signalized

pedestrian crossing will be setup to across the access road to Pine Hill. Therefore, Junction J1 and J8 will be combined into one signalized junction. The junction configuration is shown in **Figure 4.5**.

J2 - Chung Nga Road / Chuen On Road (North)

4.4.2 In view of the substantial upsurge of right-turning traffic induced by the proposed housing sites from Chung Nga Road to Chuen On Road as well as the consideration of pedestrian safety, it is proposed to upgrade junction J2 into a signalized controlled junction with widening from existing one lane to two lanes at Chung Nga Road northbound and Chuen On Road westbound.

4.4.3 Straight pedestrian crossings across Chuen On Road and Chung Nga Road will be provided in a dedicated pedestrian stage in the proposed method-of-control (MOC). The MOC is shown in below **Diagram 4.1** and the junction assessment result is shown in **Table 4.5**. **Figure 4.5** shows the proposed junction improvement scheme.

Diagram 4.1 Proposed MOC for junction improvement of J2

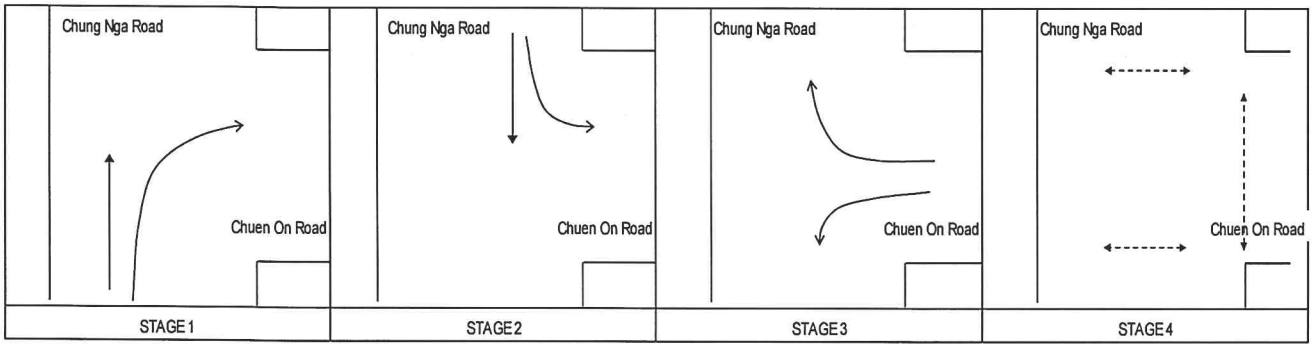


Table 4.5 Junction improvement J2 – junction performance at year 2030

Junction (1)		Type	Junction Performance Design Case(2)			
			Without improvement		With improvement	
			AM	PM	AM	PM
J2	Chung Nga Road / Chuen On Road (North)	Priority converted to signalized	0.91	0.61	16%	>50%

Notes: 1. Please refer to **Figure 2.1** for the location of the assessed junctions.

2. A signal-controlled junction with a Reserved Capacity (RC) of 15% implies that it is operating at desirable capacity. For priority junctions and roundabouts, the performance indicator is the Design Flow to Capacity (DFC) ratio. A DFC ratio less than 0.85 indicates that the junction is operating with desirable capacity.

4.4.4 As shown, junction J2 will be operating with ample capacity after the junction improvement.

J3 - Chuen On Road / Access Road to Tai Po Hospital

4.4.5 Junction J3 will be served as the sole access of TP9 and CNRE sites. In view of the anticipated over-capacity condition, an improvement is proposed to widen the minor arm, i.e. the proposed new access road, to have separated left turn and right turn traffic lanes. **Figure 4.5** shows the proposed improvement scheme.

Table 4.6 Junction improvement J3 – junction performance at year 2030

Junction [1]		Type	Junction Performance Design Case[2]			
			Without improvement		With improvement	
			AM	PM	AM	PM
J3	Chuen On Road / Access Road to Tai Po Hospital	Priority	1.31	0.71	0.64	0.45

Notes: 1. Please refer to **Figure 2.1** for the location of the assessed junctions.

2. A signal-controlled junction with a Reserved Capacity (RC) of 15% implies that it is operating at desirable capacity. For priority junctions and roundabouts, the performance indicator is the Design Flow to Capacity (DFC) ratio. A DFC ratio less than 0.85 indicates that the junction is operating with desirable capacity.

4.4.6 As shown, junction J3 will be operating within capacity after the junction improvement.

J4 - Chung Nga Road / Chuen On Road (South)

4.4.7 To cope with the anticipated over-capacity condition, an additional straight-ahead lane is proposed by local widening at Chung Nga Road Southbound at upstream of the junction.

4.4.8 Further to enhance the junction performance, right-turn from Chuen On Road Westbound will be demolished. In term of existing and future predicted low volume of right-turn traffic, i.e. around 25 pcu/hr during AM peak in year 2030, it is anticipated to have insignificant traffic impact which motorist can be diverted to Junction J2 without delay.

4.4.9 The junction performance will be improved by reducing the existing 4 stages MOC to 3 stages. The proposed MOC is shown in below

Diagram 4.2 and the junction assessment result is shown in **Table 4.7.** **Figure 4.6** shows the proposed improvement scheme.

Diagram 4.2 Proposed MOC for junction improvement of J4

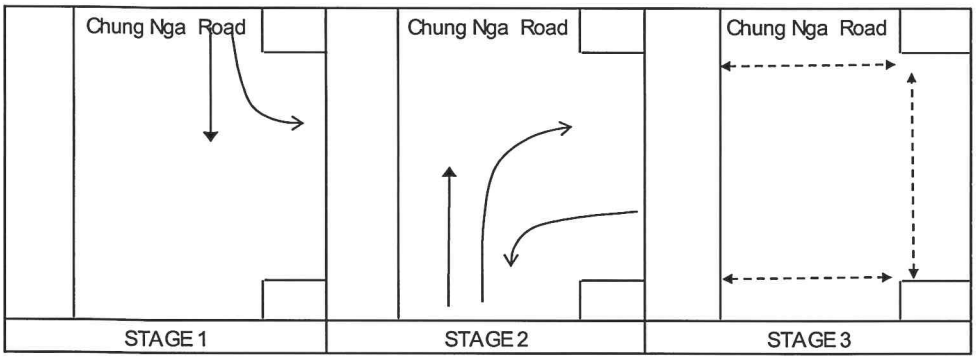


Table 4.7 Junction improvement J4 – junction performance at year 2030

Junction [1]		Type	Junction Performance Design Case[2]			
			Without improvement		With improvement	
			AM	PM	AM	PM
J4	Chung Nga Road / Chuen On Road (South)	Signalized	-16%	5%	16%	35%

Notes: 1. Please refer to **Figure 2.1** for the location of the assessed junctions.

2. A signal-controlled junction with a Reserved Capacity (RC) of 15% implies that it is operating at desirable capacity. For priority junctions and roundabouts, the performance indicator is the Design Flow to Capacity (DFC) ratio. A DFC ratio less than 0.85 indicates that the junction is operating with desirable capacity.

4.4.10 As shown, junction J4 will be operating within capacity after the junction improvement.

J5 - Ting Kok Road / Chung Nga Road / Nam Wan Road

4.4.11 The cycle time of the captioned junction is proposed to be prolonged to 128s. The junction assessment after the modification of cycle time is shown in **Table 4.8** below

Table 4.8 Junction improvement J5 – junction performance at year 2030

Junction [1]		Type	Junction Performance Design Case[2]			
			Without improvement		With improvement	
			AM	PM	AM	PM
J5	Ting Kok Road / Chung Nga Road / Nam Wan Road	Signalized	11%	36%	15%	41%

4.4.12 As shown, junction J5 will be operating within capacity after the junction improvement.

5 Provision of Public Transport and Pedestrian Assessment

5.1 Pedestrian Forecasts

5.1.1 The adopted pedestrian generation rates are shown in **Table 5.1**. The trip rates were applied to the proposed number of flats to derive the resident trips. The estimated pedestrian trips are tabulated in **Table 5.2**.

Table 5.2 Adopted Pedestrian Generation Rates

	AM peak		PM Peak	
	Generation	Attraction	Generation	Attraction
PRH (person/hr/ flat)(1)	0.571	0.101	0.213	0.436
Primary School (person/hr/classroom) (1)	4.733	17.533	1.467	0.333
Kindergarten (ped/hr/classroom)(2)	12.02	30.31	2.75	1.00

Source: (1) The trip rate obtain from the survey is less than the one shown in HDTIA, for conservative approach, the trip rate in HDTIA is adopted to ensure conservative assessment result.
(2) Arup's in-house pedestrian survey

Table 5.2 Estimated Pedestrian Trips (persons/hr)

Proposed Development	AM peak		PM Peak	
	Generation	Attraction	Generation	Attraction
Chung Nga Road (CNRE + CNRW)				
PRH 1,661 flats (1,510 Flats +10% allowance)	948	168	354	724
Primary School (30 classes)	142	526	44	10
Tai Po Area 9				
PRH 7,007 flats (6370 Flats +10% allowance)	4,001	708	1,492	3,055
Primary School (36 classes)	170	631	53	12
2 Kindergartens (assume 8 classroom)	192	485	44	16
Total	5,454	2,518	1,987	3,817

5.1.2 The AM peak will be critical period with some 5,454 pedestrian trips to be generated from the proposed development. There are no significant attractions/ destinations within walking distance. For the purpose of estimating the additional public transport requirements, it is assumed as a conservative approach that 95% of pedestrians generated by the sites will take road-based transport, i.e. 5,181 ped/hr generated in AM peak, while the remaining 5% would be internal trips within the proposed development sites. According to Travel Characteristics Survey 2011 issued by Transport Department, the total distribution of taxi and private vehicle is 18%, based on this distribution we assume the remaining 82% will take public transport ,i.e. 4,248 ped/hr generated in AM peak.

5.1.3 Thus, passengers demand for AM and PM peak in design years will be 4,248 and 2,974 respectively.

5.2 Public Transport Capacity Assessment

5.2.1 A PTT is proposed at TP9 in order to serve the above passengers demand generated from the development, mainly TP9 site. The additional public transport provided by the proposed PTT is assumed at a provision of 2 nos. of bus bays and 1 no. of GMB bay in accordance with the layout designed by HD as shown in **Appendix D**.

5.2.2 There will also be laybys proposed along both Chung Nga Road eastbound and westbound just outside of the future CNRW site as shown in **Figure 4.5 as** potential kerb side activities are anticipated from the proposed school site and GIC facilities in the future. For assessment purpose, a conservative approach is adopted to assume all passengers will go to the PTT in TP9 is made for the worst case scenarios.

5.2.3 In view thereof, the proposed public transport service headways are recommended based on the demand forecast. The proposed public transport service in the PTT is summarized in **Table 5.3**.

Table 5.3 Proposed Public Transport Service in TP9 PTT

Provision	Type	Proposed peak average headway (mins)		Capacity (ppl/veh)	Estimated handling Capacity (ppl/hr)	
		AM	PM		AM	PM
Franchised Bus Route 1	Double-decker bus	5	8	130	1,560	975
Franchised Bus Route 2	Double-decker bus	6	8	130	1,300	975
Franchised Bus Route 3	Double-decker bus	6	8	130	1,300	975
GMB Route 1	GMB	6	8	16	160	120
				Total	**4,320**	**3,045**

Remark:
It is assumed to have 2 nos. of bus laybys and 1 no. of GMB lay-by in accordance with the layout designed by HD

5.2.4 The results indicated that the proposed public transport arrangement would have adequate capacity to accommodate the additional demand from/to the proposed housing sites.

5.2.5 The actual operation details such as destinations and operating headways of public transport routes will be subject to TD's considerations with reference to the plans of the housing sites.

5.3 Pedestrian Assessment

5.3.1 Assumptions are adopted which 80% of total pedestrian flow generated by the CNRE and CNRW sites using the footpath adjacent to Chung Nga Road EB and 20% at Chung Nga Road WB. The LOS of the nearby footpaths are therefore assessed.

5.3.2 It is anticipated most of the pedestrian from TP9 site will take public transport at the proposed PTT. As a conservative approach for assessment purpose, it is assumed 30% of total pedestrian flow generated by TP9 site will use the footpaths along the new public road to Chung Nga Road. Based on the above-mentioned distribution of the site-induced pedestrian flows, Level-of-service (LOS) of the concerned footpaths were assessed. The summary of LOS at the concerned footpaths is summarized in **Table 5.4** below.

Table 5.4 Walkway Assessment in design year 2030

Footpath	Clear Width (m)	Effective Width (m)	Two-way Pedestrian Flow (ped/ hour)		Level of Service	
			AM Peak	PM Peak	AM Peak	PM Peak
Footpath adjacent to Chung Nga Road EB in between of Access Road to Pinehill and Chuen On Road	2.5	1.5	1,475	946	B	A
Footpath adjacent to Chung Nga Road WB in between of Access Road to Pinehill and Chuen On Road	3	2	422	326	A	A
Footpath adjacent to Chung Nga Road EB south of Chuen On Road	3	2	2,947	2,053	C	B
Footpath adjacent to Chung Nga Road WB south of Chuen On Road	3	2	808	602	A	A
Footpath along new public road to Tai Po Area 9	2.75	1.75	1,856	1,402	B	A

5.3.3 The footpaths in the vicinity of the proposed housing sites are operating satisfactorily in Year 2030.

6 Construction Traffic Impact

6.1 Overview

6.1.1 The volume of construction traffic is based on the preliminary estimate on the excavation and construction material. Quantities for the various construction tasks have been identified to calculate the number of trips that can be expected for the duration of the Project.

6.2 Construction Programme

6.2.1 Considering the construction period for the underground utilities and junction improvements outside the CNRE, CNRW and TP9 sites is from June 2017 to July 2019, the assumed period of export of excavated materials will be between Sep 2017 and April 2019. Thus, year 2019 will be considered as the peak construction year in view of the increasing background traffic.

6.2.2 Meanwhile, the construction period for the site formation and building works in CNRE, CNRW and TP9 sites, will be from August 2017 to May 2025. The accumulative traffic impact to be reviewed below.

6.3 Construction Material Trip Generation

6.3.1 To determine the total traffic movements for the construction stage of the project, the cumulative effect of concurrent activities has been derived and the busiest period during the entire construction period identified. The peak construction traffic activity is expected to have some 105 trips per day.

6.3.2 A summary of trips generated and attracted by the construction listed in **Table 6.1**

Table 6.1 Estimated construction traffic generation & attraction

Work Site	Estimate of Peak Construction Traffic (pcu/hour each way)
Proposed works outside the housing site boundary (this assignment)	10 trips/ day ~ 1 trips/ hr
TP9, CNRE and CNRW housing sites	95 trips/ day ~12 trips/hr

Notes: 1. Assuming 8 working hours a day.

6.3.3 In view of the insignificant number of trucks, i.e. 13 trips per hour, it is anticipated negligible traffic impact will be induced when considering the overall traffic situation in year 2025 reference case will be in good condition within the AOI.

7 Temporary Traffic Management

7.1 Overview

7.1.1 Temporary Traffic Management (TTM) scheme have been designed for below construction works under the captioned contract:

- Construction of a sewer, watermain and drainage pipe along Chung Nga Road from CNR&TP9 housing site to Ting Kok Road;
- Junction improvement works for J1, J2, J3 & J4;

7.1.2 As all of the detail TTM schemes will be submitted by the contractor with mature design. Schematic TTM schemes attached are providing preliminary design for this contract.

7.1.3 In view of the close proximity with the exiting Tai Po Hospital in which the emergency services is required to be all the time maintained and should be no influent by the proposed TTM.

7.1.4 The detail TTM designed by the contractor is required to be tabled and approved by all TMLG member, in particular FSD to ensure the insignificant to the road users, especially for the emergency traffic.

7.2 TTM for Underground Utilities construction

7.2.1 Schematic TTM scheme for drainage, watermains and sewer construction are demonstrated in **Figure 7.1, 7.4 and 7.6** respectively.

7.2.2 Throughout the overall construction, it was anticipated majority of TTM schemes would not impose significant traffic impact in the area. Whereas there are several concerned TTM arrangement in which assessment is required to justify the feasibility in traffic engineering view point.

7.2.3 Junction assessment have been carried out for below concerned TTM arrangement and the corresponding assessment result and recommendation have been summarized in **Table 7.1** below:

Table 7.1 Summary of junction assessment for concerned TTM schemes

Situation	TTM Drawings	Junction Assessment		Recommendation
		AM	PM	
One lane Two way (3 phases traffic light control)	**Figure 7.2 & 7.3**	>30%	>30%	TTM to be implemented for 24 hrs

Lane closure in the j/o of Chung Nga Rd / Ting Kok Rd	**Figure 7.5**	>30%	>30%	TTM to be implemented for 24 hrs
Lane closure in the j/o of Chung Nga Rd / Chuen On Rd	**Figure 7.7**	>30%	>30%	TTM to be implemented for 24 hrs

7.2.4 Based on the above result, it was identified the proposed TTM scheme with recommended time frame will not impose significant impact on the in vicinity road network. Nevertheless, the contractor shall submit the junction calculation with the updated traffic data together with the proposed TTM scheme to the TMLG members around 3 months in advance of the actual works commencement.

7.3 TTM for Junction Improvement Works

7.3.1 Schematic TTM scheme for junction improvement works are demonstrated in **Figure 7.8-7.10** respectively.

7.3.2 As there is no lane reduction during the improvement works, it is anticipated the impact would be insignificant, and therefore the proposed TTM should be implemented for 24hrs.

7.3.3 Similar to TTM for UU construction, all detailed TTM should be designed by contractor with the latest traffic information and approved by all TMLG members before works commencement.

8 Summary And Conclusion

8.1.1 Arup was commissioned by the Civil Engineering Office of the CEDD of the HKSAR Government on 9 June 2015 to provide consultancy services for the investigation, design and construction supervision of Site Formation and Infrastructural Works at [redacted] Chung Nga Road and Area 9, Tai Po.

8.1.2 The development comprises of 3 sites, namely CNRE, CNRW and TP9.

8.1.3 This TIA report to be prepared for the CNR&TP9 Project only. [redacted]

8.1.4 The main objective of this TIA Report is for reviewing the traffic impact assessment report which carried out by HD in which the latest development parameters is incorporated., including considering the comment made by concerned department such as TD and verify the findings and recommendations therein and recommend necessary traffic improvement works outside the CNRE, TP9 and CNRW sites.

8.1.5 Comprehensive traffic survey has been conducted on 7 July, 2015 during 0700 to 0900 hours and 1700 to 1900 hours within the AOI. The survey results revealed that the morning and evening peak hours were during 0800 to 0900 and 1730 to 1830 hours respectively.

8.1.6 Results of the analysis indicate that all junctions in the study area are currently operating satisfactorily with spare capacity during both morning and evening peaks.

8.1.7 Pedestrian count has been carried out along Chung Nga Road both bound to reveal the existing footpath environment. Based on the survey result, the morning and evening peak hours were identified from 0745 to 0845 and 1700 to 1800hours respectively. The footpaths in the vicinity of the proposed housing sites are operating satisfactorily.

8.1.8 The inventory of existing public transport service has been investigated. To evaluate the associated traffic impact likely to be induced by the proposed housing sites during the Design Years of 2025 and 2030, i.e. the completion year and 5 years after completion, four scenarios were analysed and compared. The first and third scenarios are the Reference Scenarios (without the development). The second and forth scenarios are the Design Scenario (with the development).

8.1.9 The assessed junctions will be operating with ample capacity in year 2025 and 2030 except junction J2, J3, J4 and J5.

8.1.10 Preliminary junction improvement schemes for junction J2, J3, J4 and J5 were proposed.

8.1.11 Junction improvement scheme for Junction J1 was proposed for enhancing the pedestrian environment and smooth manoeuvring of long vehicles.

8.1.12 The proposed public transport service to/from the proposed PTT in TP9 site would have adequate capacity to accommodate the additional

demand from/to the proposed housing sites. The actual operation details such as destinations and operating headways of public transport routes will be subject to TD's considerations with reference to the plans of the housing sites.

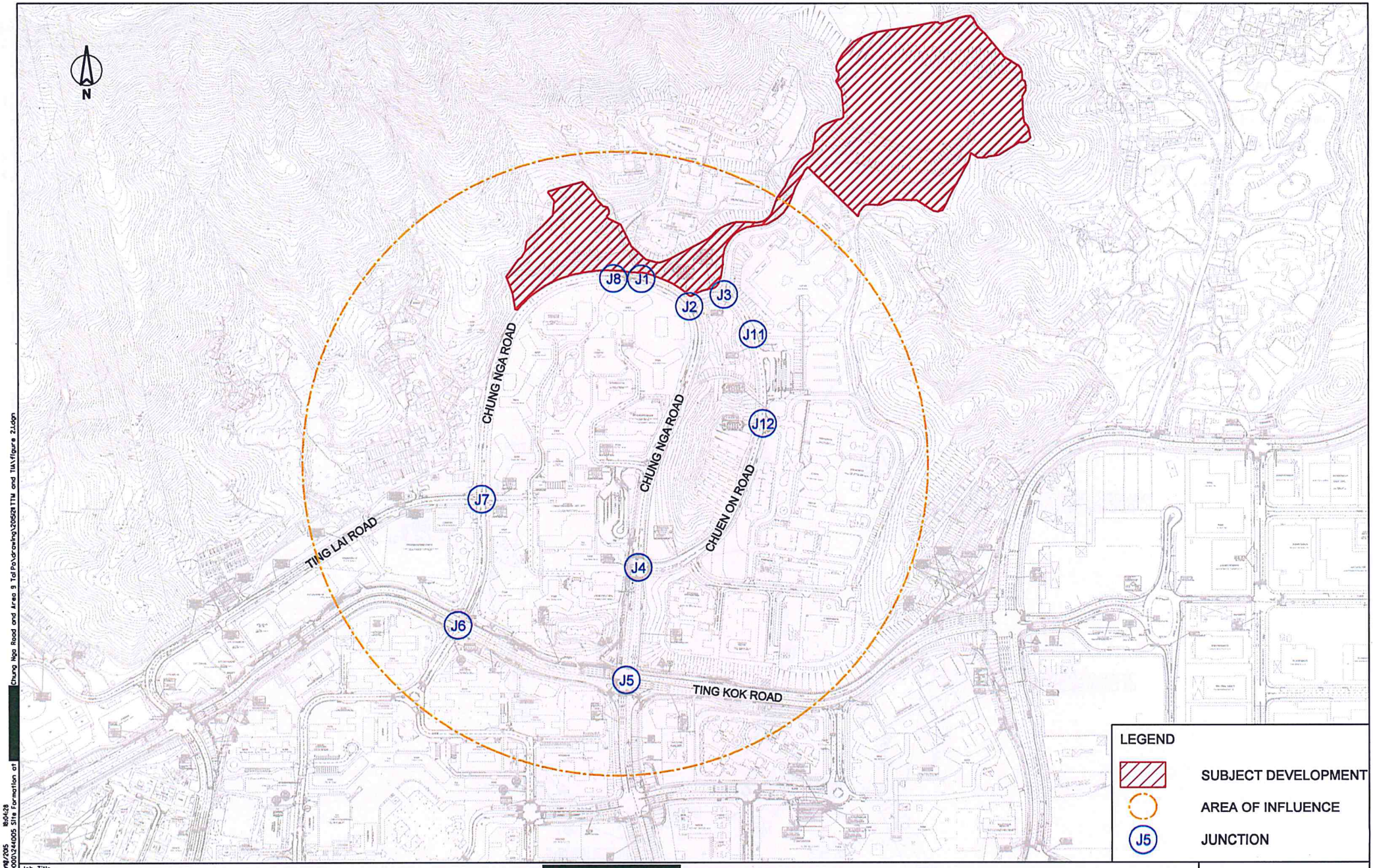
8.1.13 The footpaths in the vicinity of the proposed housing sites are operating satisfactorily in Year 2030.

8.1.14 Schematic TTM with recommended working hours are designed for the proposed underground utilities works and junction improvement works.

8.1.15 In view of the insignificant number of trucks, it is anticipated negligible construction traffic impact will be induced.

8.1.16 Junction assessment for the proposed TTM schemes has been conducted and no significant impact was observed

Figures



Job Title

AGREEMENT NO. CE67/2014(CE) - SITE FORMATION AND INFRASTRUCTURAL WORKS AT [redacted] CHUNG NGA ROAD AND AREA 9, TAI PO - INVESTIGATION, DESIGN AND CONSTRUCTION

FIGURE 2.1

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Drawn	Job No.
LW	244005

Drawing Title

LOCATION PLAN & AREA OF INFLUENCE (AOI)

ARUP

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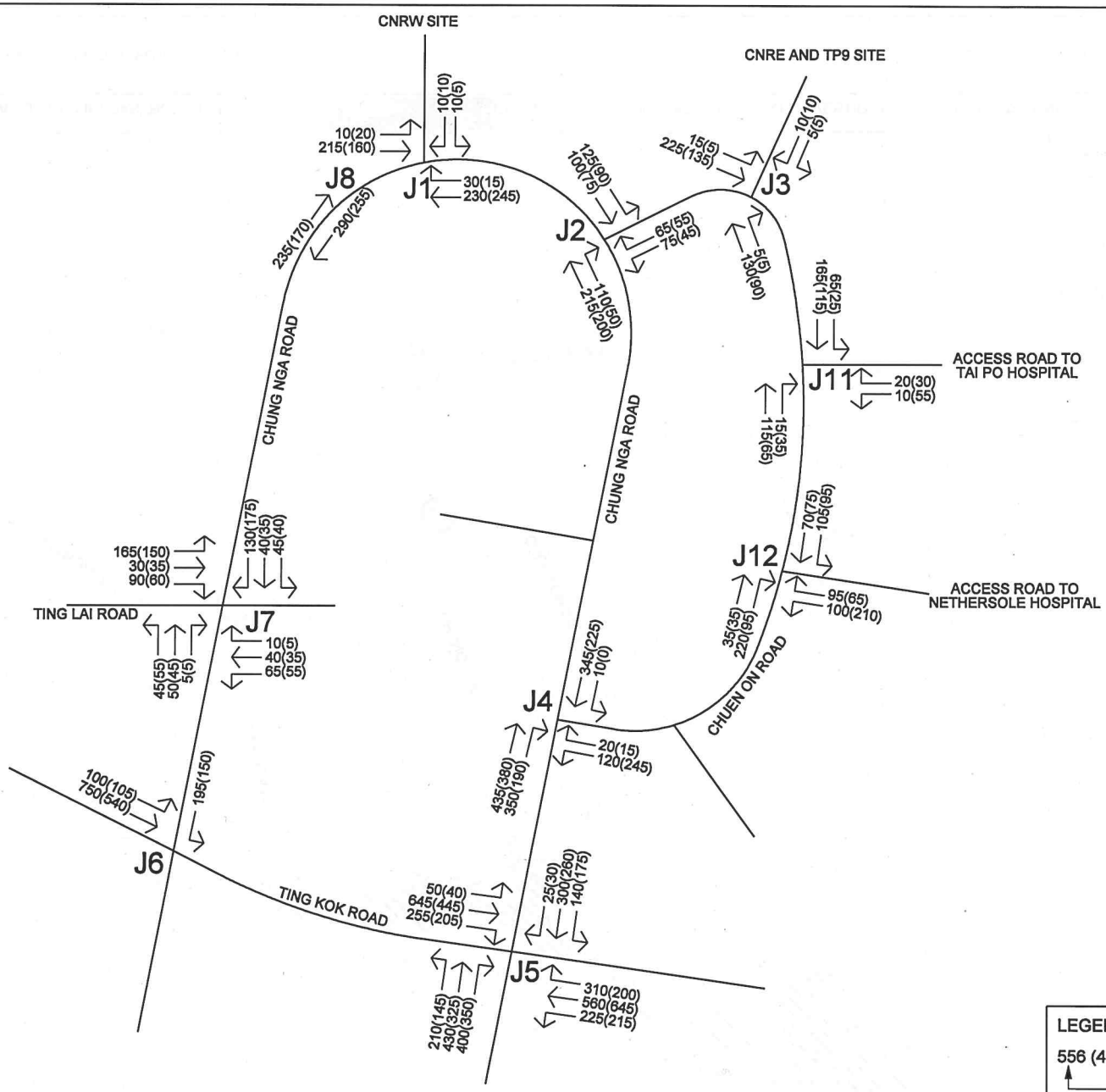

LEGEND

556 (454) ← PM PEAK (PCU/HR)

AM PEAK (PCU/HR)

Job Title

AGREEMENT NO. CE67/2014(CE) - SITE FORMATION AND INFRASTRUCTURAL WORKS AT [redacted] CHUNG NGA ROAD AND AREA 9, TAI PO - INVESTIGATION, DESIGN AND CONSTRUCTION

FIGURE 2.2

Date	Scale
JUL 15	N.T.S.
Drawn	Job No.
LW	244005

Drawing Title

EXISTING TRAFFIC FLOWS (YEAR 2015)

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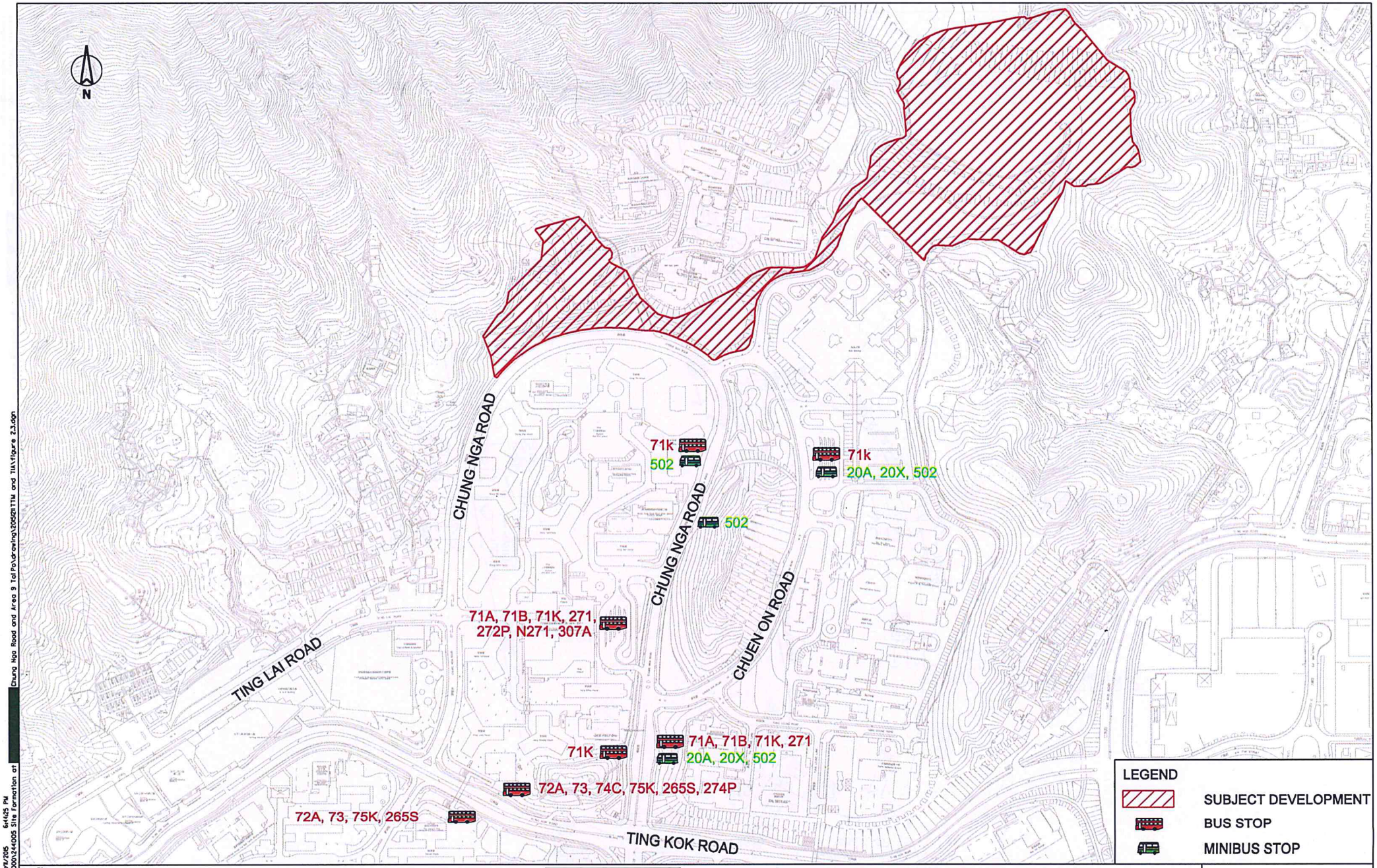

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Job Title
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FIGURE 2.3

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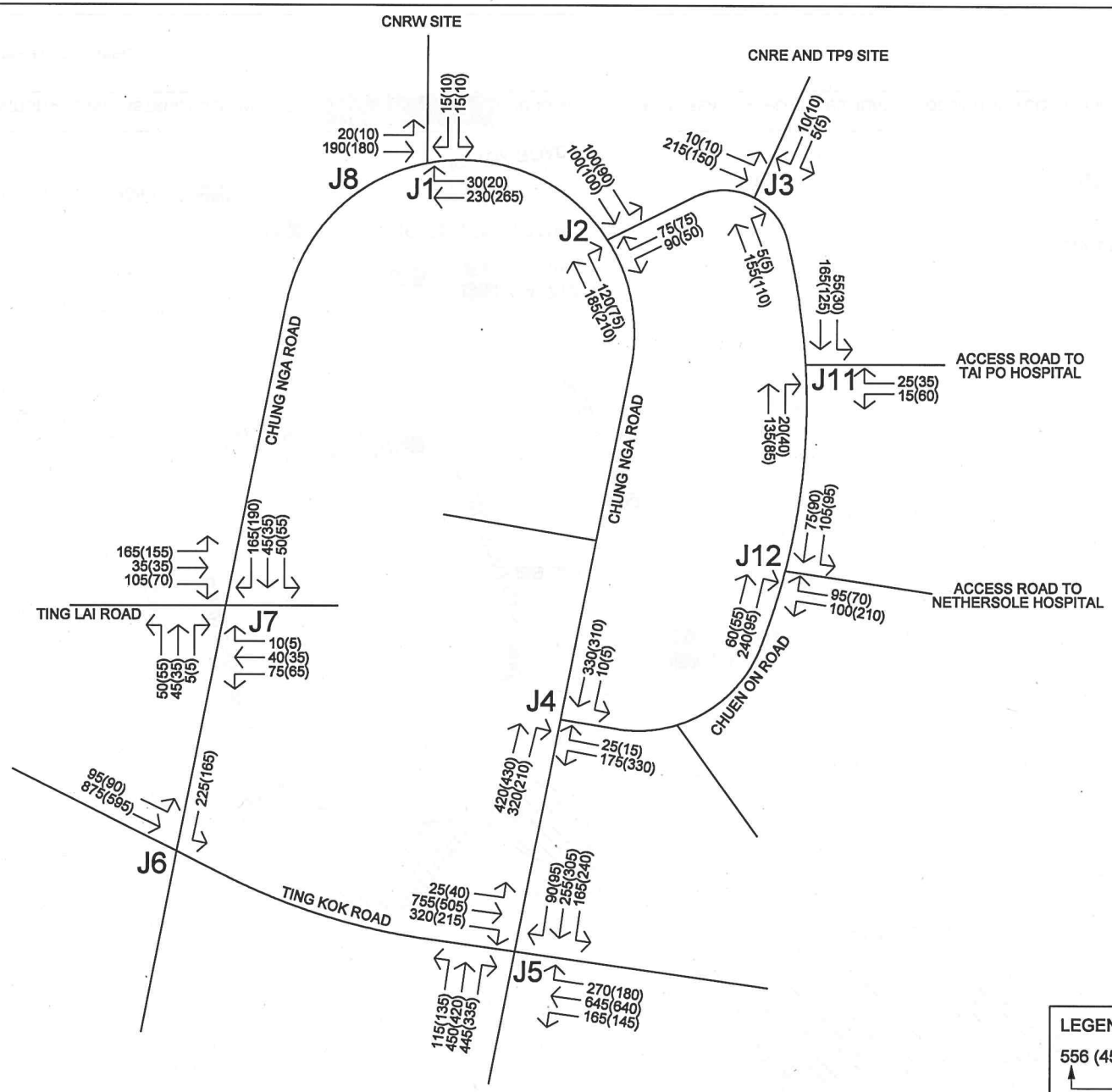
Drawing Title
EXISTING PUBLIC TRANSPORT

ARUP



LEGEND

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↑ AM PEAK (PCU/HR)

Job Title

AGREEMENT NO. CE67/2014(CE) - SITE FORMATION AND INFRASTRUCTURAL WORKS AT [redacted] CHUNG NGA ROAD AND AREA 9, TAI PO - INVESTIGATION, DESIGN AND CONSTRUCTION

FIGURE 4.1

Date	Scale
JUL 15	N.T.S.
Drawn	Job No.
LW	244005

Drawing Title

YEAR 2025 REFERENCE TRAFFIC FLOWS

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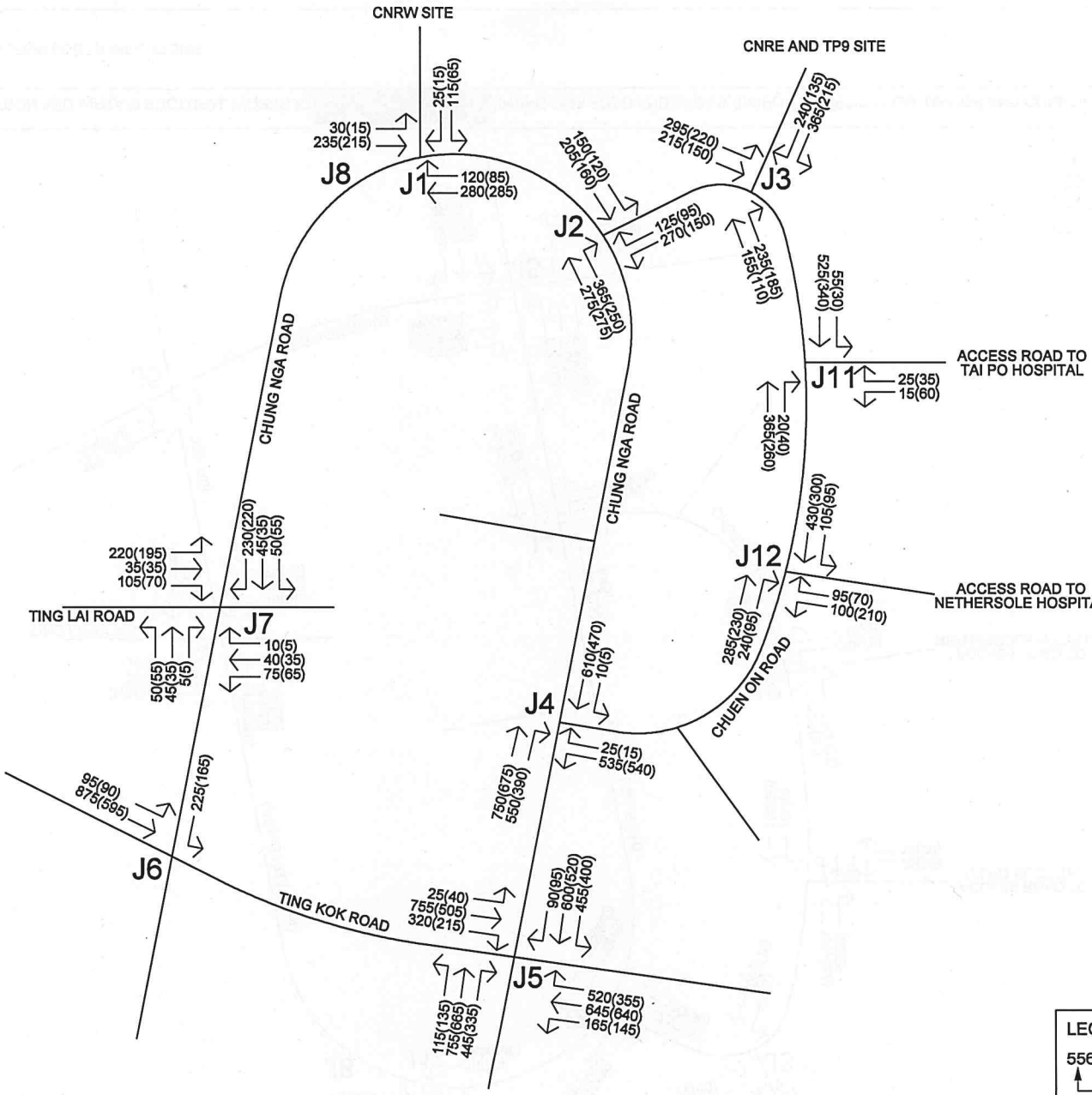

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FIGURE 4.2

Date	Scale
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Drawn	Job No.
LW	244005

Drawing Title
YEAR 2025 DESIGN TRAFFIC FLOWS

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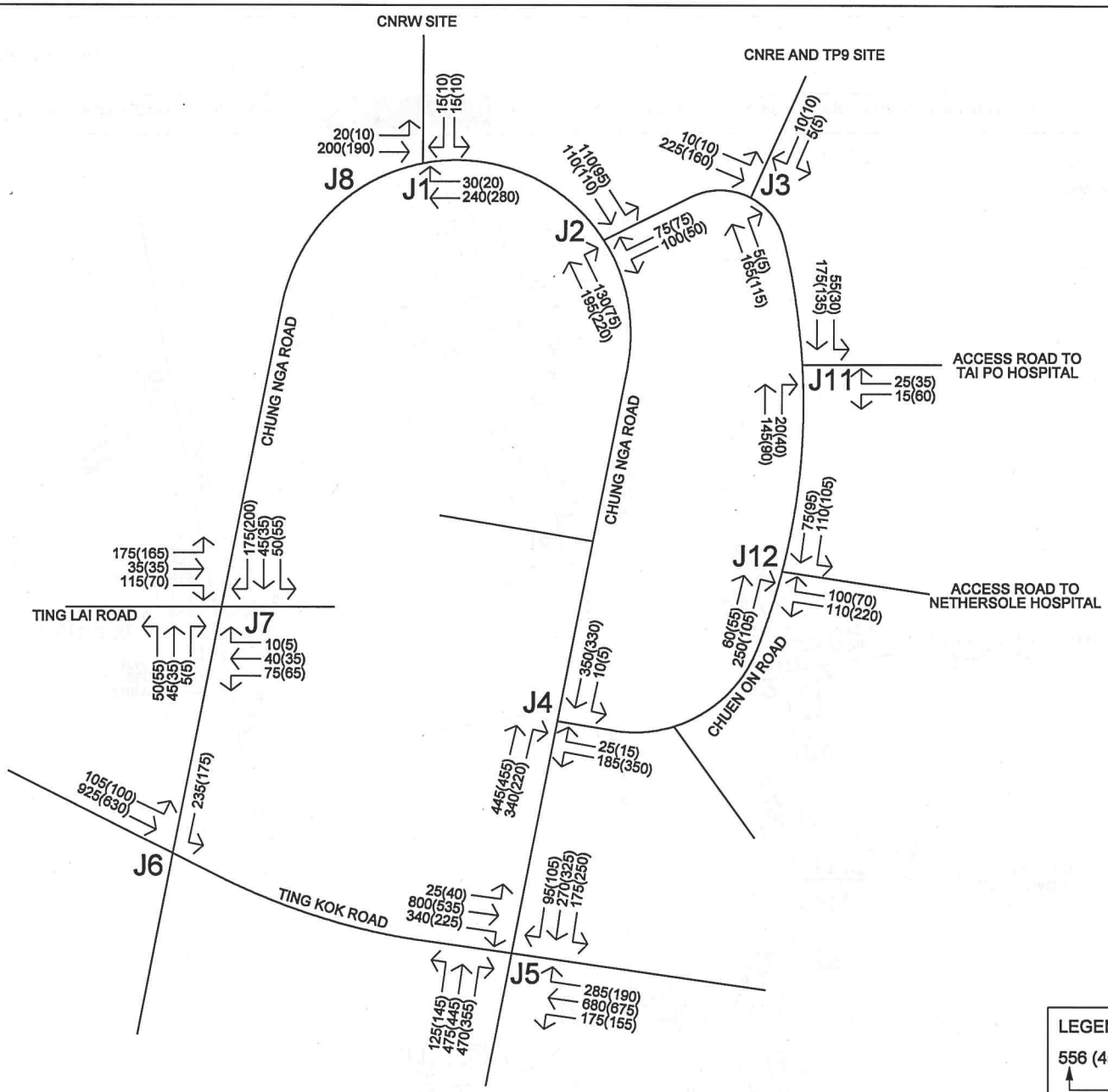

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AM PEAK (PCU/HR)

Job Title

AGREEMENT NO. CE67/2014(CE) - SITE FORMATION AND INFRASTRUCTURAL WORKS AT [redacted] CHUNG NGA ROAD AND AREA 9, TAI PO - INVESTIGATION, DESIGN AND CONSTRUCTION

FIGURE 4.3

Date	Scale
JUL 15	N.T.S.
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Drawing Title

YEAR 2030 REFERENCE TRAFFIC FLOWS

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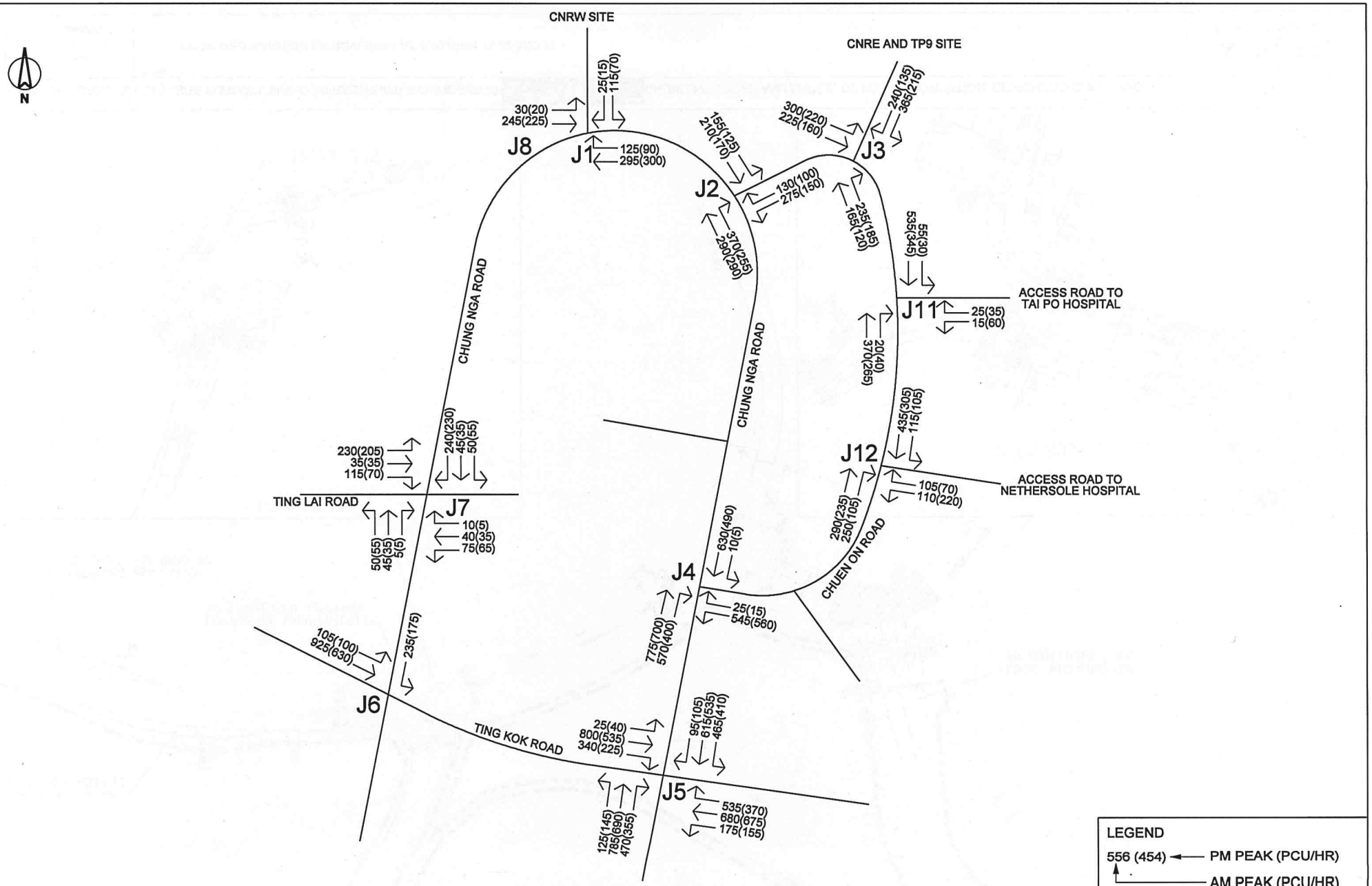

Job Title

AGREEMENT NO. CE67/2014(CE) - SITE FORMATION AND INFRASTRUCTURAL WORKS AT [redacted] CHUNG NGA ROAD AND AREA 9, TAI PO - INVESTIGATION, DESIGN AND CONSTRUCTION

FIGURE 4.4

Date	Scale
JUL 15	N.T.S.
Drawn	Job No.
LW	244005

Drawing Title

YEAR 2030 DESIGN TRAFFIC FLOWS

ARUP

PRINTED BY: ying-tung.ma@arup.com 6:48:0 PM
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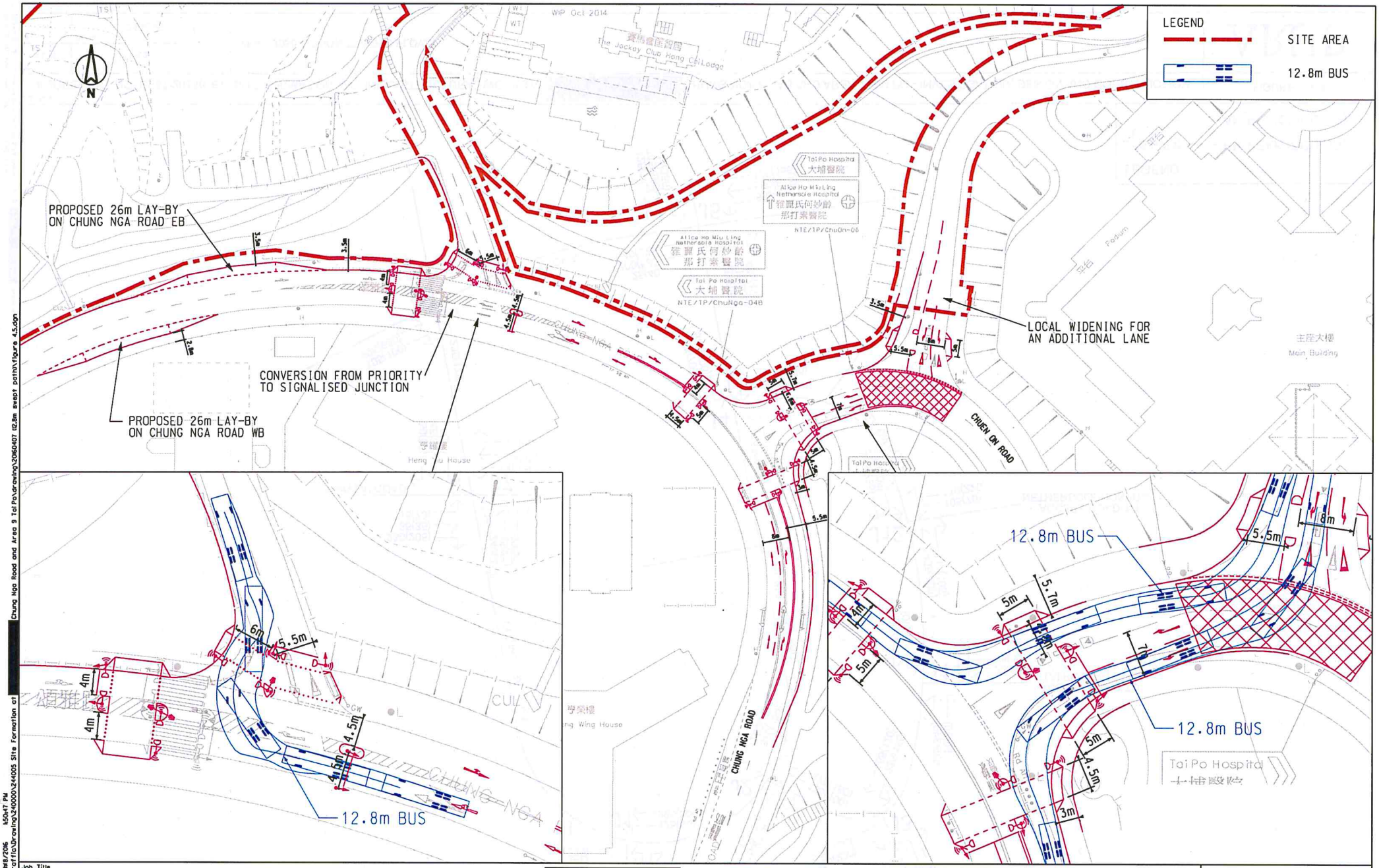


Job Title

AGREEMENT NO. CE67/2014(CE) - SITE FORMATION AND INFRASTRUCTURAL WORKS AT [redacted] CHUNG NGA ROAD AND AREA 9, TAI PO - INVESTIGATION, DESIGN AND CONSTRUCTION

FIGURE 4.5

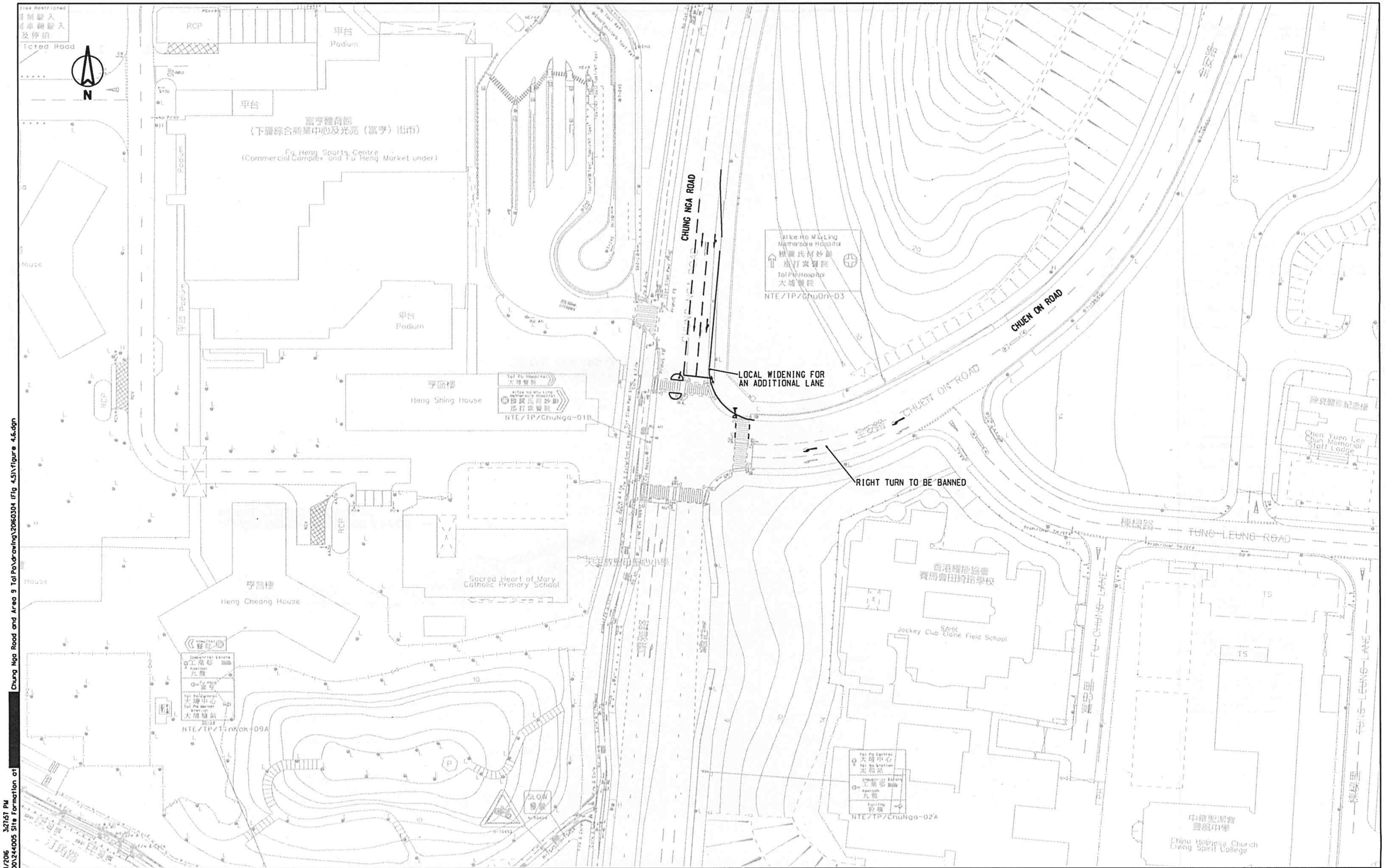
Date	Scale
JUL 15	1:5000
Drawn	Job No.
LW	244005

Drawing Title

PROPOSED JUNCTION IMPROVEMENT AT JUNCTION J1, J2 AND J3

ARUP

PRINTED BY: wing-tungkam1206 M50x17 PM
FILENAME: \\Arupnt65\Traffic\Drawing\244000\244005 Site Formation of [redacted] Chung Nga Road and Area 9 Tai Po\drawing\20150407 12.8m swept path\Figure 4.5.dgn



Job Title			
AGREEMENT NO. CE67/2014(CE) - SITE FORMATION AND INFRASTRUCTURAL WORKS AT [redacted] CHUNG NGA ROAD AND AREA 9, TAI PO - INVESTIGATION, DESIGN AND CONSTRUCTION			FIGURE 4.6
Date: JUL 15	Scale: 1:5000	Drawing Title: PROPOSED JUNCTION IMPROVEMENT AT J4 - CHUNG NGA ROAD / CHUEN ON ROAD	ARUP
Drawn: LW	Job No.: 244005		

PRINTED BY: wing-tung.lai 3/4/2016 3:21:57 PM
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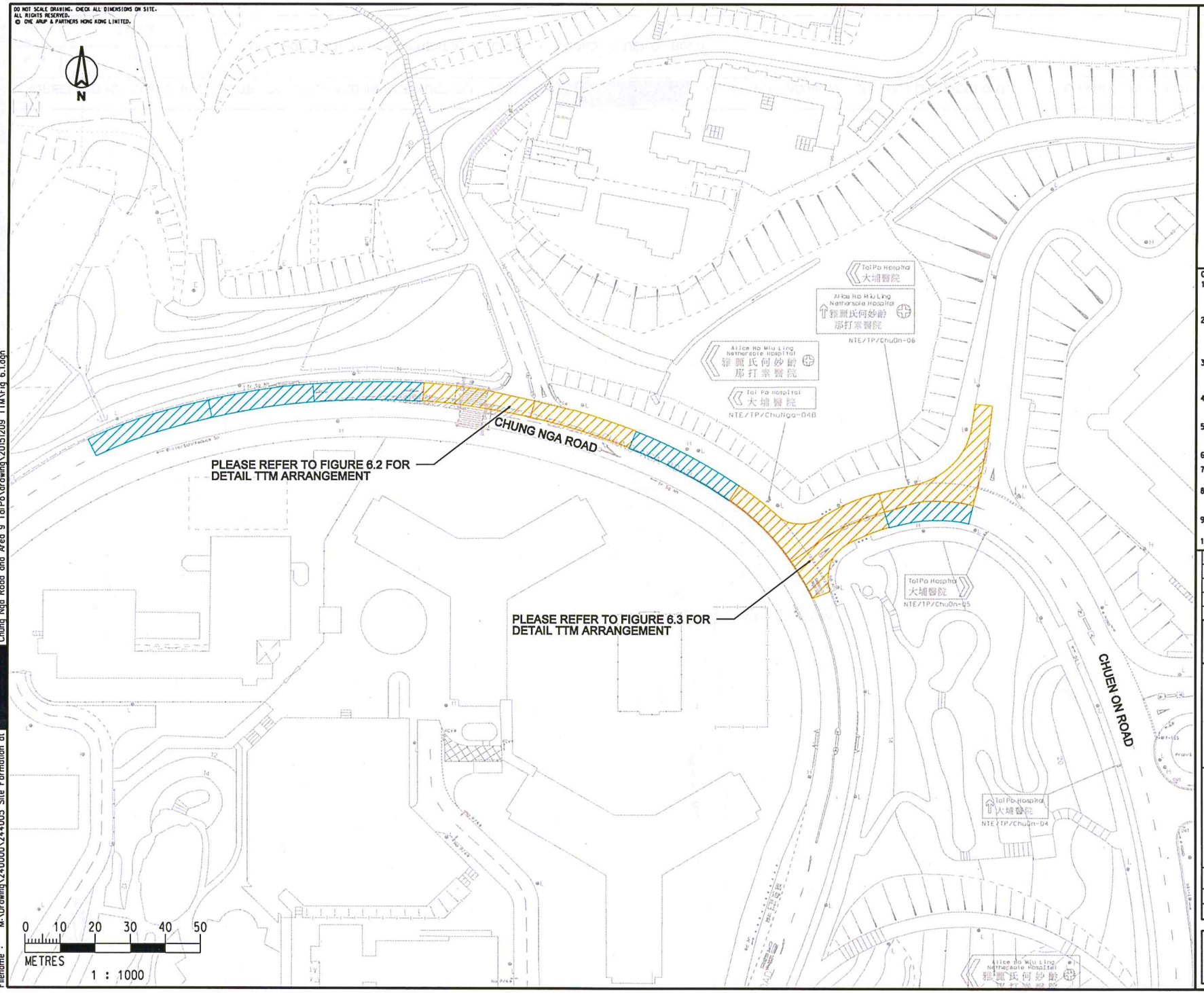


LEGEND:

- ONE LANE TWO WAY TTM (2-PHASE MOC)
- ONE LANE TWO WAY TTM (3-PHASE MOC)

GENERAL NOTES:

1. ALL TRAFFIC DIVERSION WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CODE OF PRACTICE FOR THE LIGHTING SIGNING AND GUARDING OF ROAD WORKS' BY HIGHWAYS DEPARTMENT.
2. TRAFFIC CONES SHALL BE PLACED AT NOT MORE THAN 9 METRES APART EXCEPT AT LEAD-IN AND END TAPERS WHERE A SPACING OF 2 METRES AND 1 METRE SHALL BE PROVIDED. 1000 MM HEIGHT OF CONES TO BE USED.
3. FLASHING LANTERNS WITH SPACING OF 18 METRES SHALL BE PLACED BUT LEAD-IN AND END TAPERS WHERE A SPACING OF 8 METRES AND 1 METRE SHALL BE PROVIDED.
4. PUBLICITY BOARD TO BE PROVIDED AND DETAILS SHOULD REFER TO HYD STANDARD DRAWINGS NO. 6144B, 6145B, 6146B AND 6147B.
5. ALL VEHICLES ENTERING/EXITING THE SITE AT NORTH LANTAU HIGHWAY SHALL BE ESCORTED BY A SHADOW VEHICLES.
6. NO STOPPING OF SHADOW VEHICLE ON THE ROAD.
7. ACCESS TO BE CLOSED BY WATER-FILLED BARRIERS DURING NON WORKING HOUR.
8. TRAFFIC CONTROLLER TO PROVIDE ADEQUATE ASSISTANCE FOR SITE WORKERS AND MOTORIST AT INGRESS AND EGRESS WHERE APPLICABLE.
9. NO REVERSING MOVEMENT ACCESSING IN/OUT TO THE SITE.
10. NO QUEUING OUTSIDE THE SITE ACCESS.

Rev	Description	By	Date

Consultant

ARUP

Contract No. and Title:

Agreement No. CE 67/2014(CE)

Site Formation and Infrastructural Works at [redacted] Chung Nga Road and Area 9, Tai Po - Investigation, Design and Construction

Drawing title

SCHEMATIC TTM
FOR DRAINAGE CONSTRUCTION

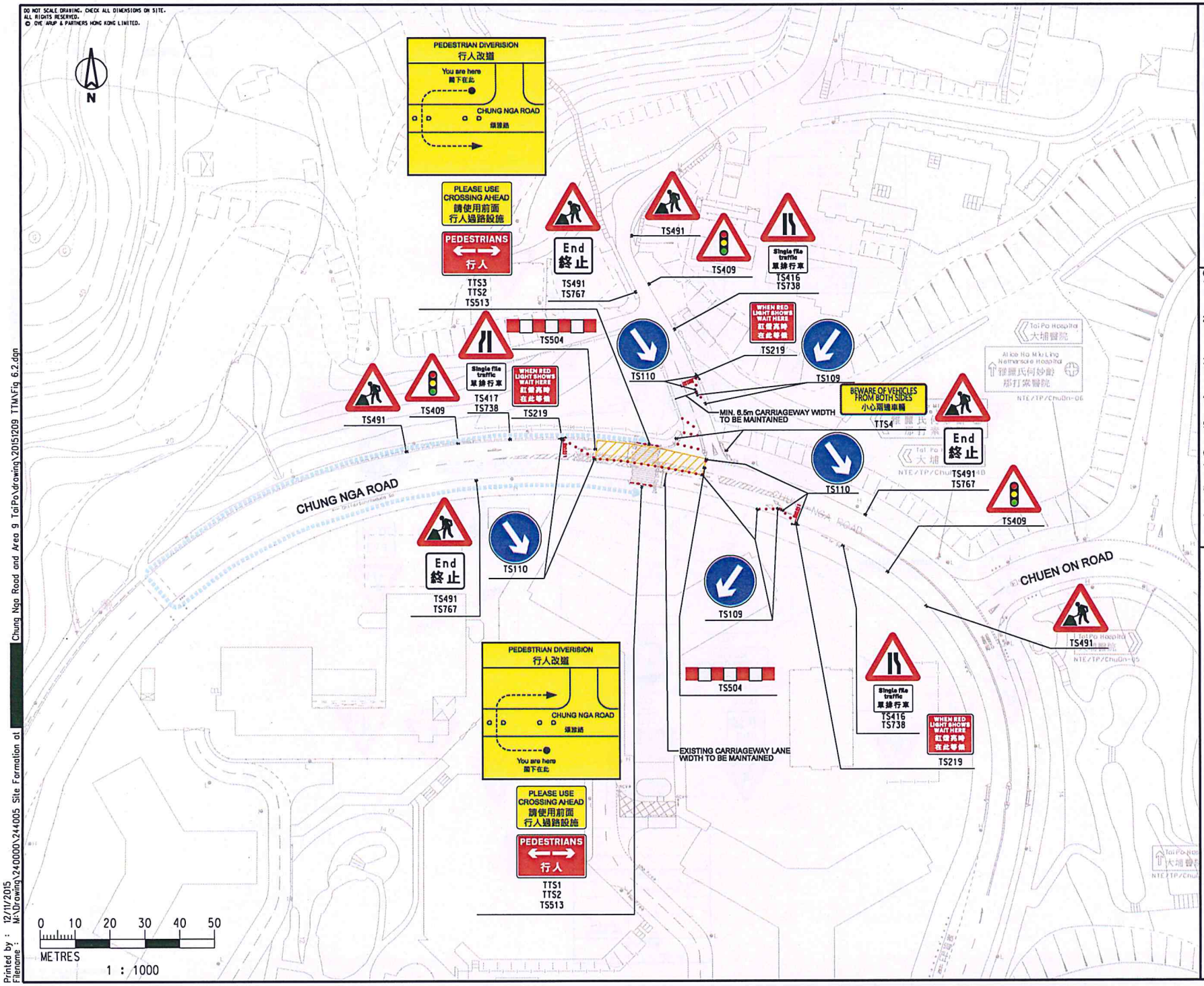
Drawing no.	Rev.
FIGURE 7.1	-

Drawn	Date	Checked	Approved
WTL	12/15	HTTS	HTTS

Scale: 1:1000 @A3 | Status: PRELIMINARY

CEDD 土木工程拓展署 Civil Engineering and Development Department

Printed by : 12/11/2015
Filename : M:\Drawing\240000\244005 Site Formation at [redacted] Chung Nga Road and Area 9 TaiPo\drawing\20151209 TTM\Fig 6.1.dgn



LEGEND:

- WORKS AREA
- TRAFFIC SIGN
- TRAFFIC CONES
- PEDESTRIAN ROUTE

GENERAL NOTES:

1. ALL TRAFFIC DIVERSION WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CODE OF PRACTICE FOR THE LIGHTING SIGNING AND GUARDING OF ROAD WORKS BY HIGHWAYS DEPARTMENT.
2. TRAFFIC CONES SHALL BE PLACED AT NOT MORE THAN 9 METRES APART EXCEPT AT LEAD-IN AND END TAPERS WHERE A SPACING OF 2 METRES AND 1 METRE SHALL BE PROVIDED. 1000 MM HEIGHT OF CONES TO BE USED.
3. FLASHING LANTERNS WITH SPACING OF 18 METRES SHALL BE PLACED BUT LEAD-IN AND END TAPERS WHERE A SPACING OF 8 METRES AND 1 METRE SHALL BE PROVIDED.
4. PUBLICITY BOARD TO BE PROVIDED AND DETAILS SHOULD REFER TO HYD STANDARD DRAWINGS NO. 6144B, 6145B, 6146B AND 6147B.
5. ALL VEHICLES ENTERING/EXITING THE SITE AT NORTH LANTAU HIGHWAY SHALL BE ESCORTED BY A SHADOW VEHICLES.
6. NO STOPPING OF SHADOW VEHICLE ON THE ROAD.
7. ACCESS TO BE CLOSED BY WATER-FILLED BARRIERS DURING NON WORKING HOUR.
8. TRAFFIC CONTROLLER TO PROVIDE ADEQUATE ASSISTANCE FOR SITE WORKERS AND MOTORIST AT INGRESS AND EGRESS WHERE APPLICABLE.
9. NO REVERSING MOVEMENT ACCESSING IN/OUT TO THE SITE.
10. NO QUEUING OUTSIDE THE SITE ACCESS.

Rev	Description	By	Date

Consultant

ARUP

Contract No. and Title:

Agreement No. CE 67/2014(CE)

Site Formation and Infrastructural Works at [redacted] Chung Nga Road and Area 9, Tai Po - Investigation, Design and Construction

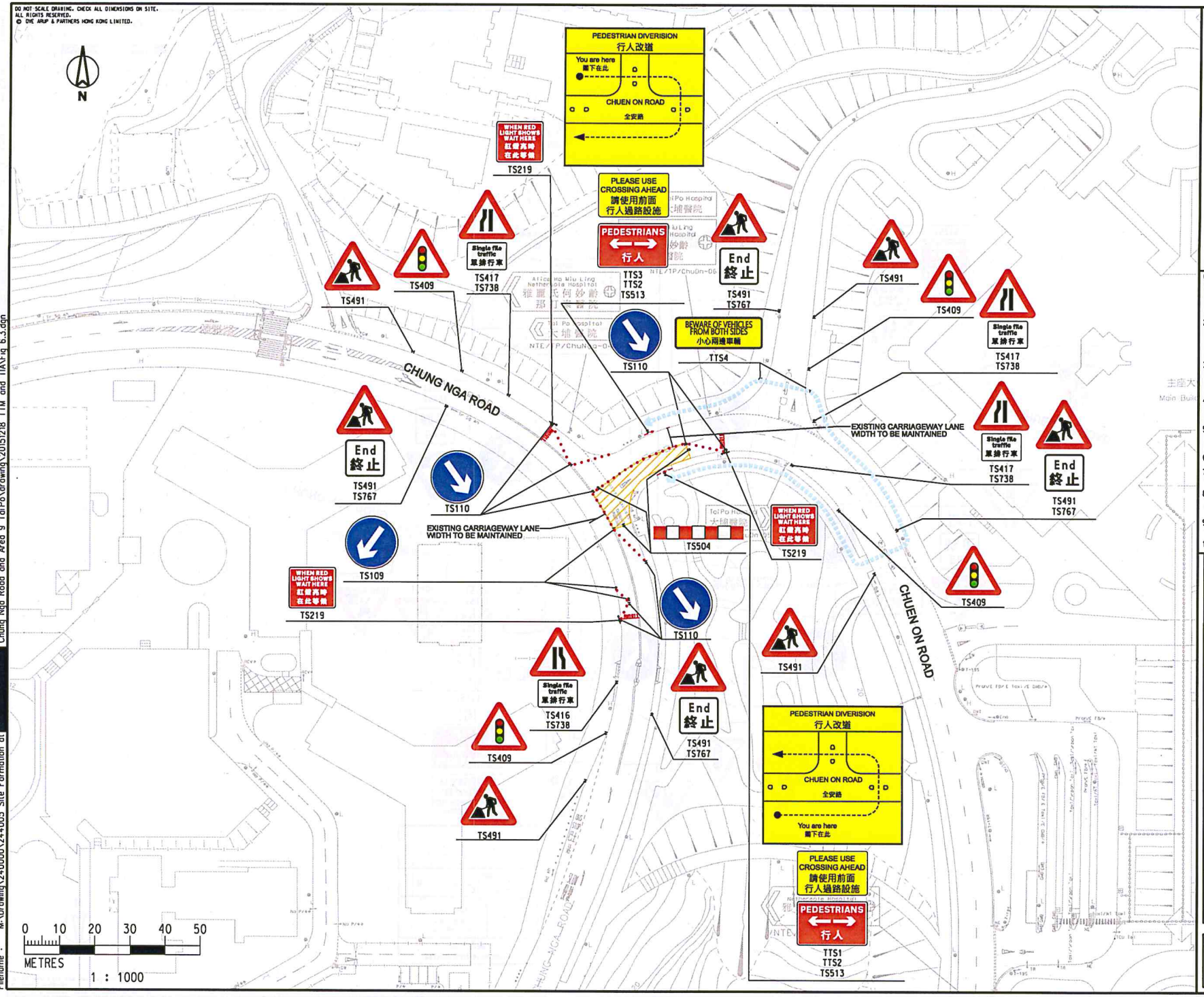
Drawing title

DETAILED TTM FOR DRAINAGE CONSTRUCTION AT CHUNG NGA ROAD WITH ONE LANE TWO WAY TTM (3-PHASES MOC)

Drawing no.		Rev.
FIGURE 7.2		-
Drawn: WTL	Date: 12/15	Checked: HTTS	Approved: HTTS
Scale: 1:1000 @A3		Status: PRELIMINARY	

土木工程拓展署
Civil Engineering and Development Department

Printed by : 12/11/2015
Filename : M:\Drawing\240000\244005 Site Formation at [redacted] Chung Nga Road and Area 9 TaiPo\drawing\20151209 TTMVFig 6.2.dgn



LEGEND:

- WORKS AREA
- TRAFFIC SIGN
- TRAFFIC CONES
- PEDESTRIAN ROUTE

GENERAL NOTES:

1. ALL TRAFFIC DIVERSION WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CODE OF PRACTICE FOR THE LIGHTING SIGNING AND GUARDING OF ROAD WORKS' BY HIGHWAYS DEPARTMENT.
2. TRAFFIC CONES SHALL BE PLACED AT NOT MORE THAN 5 METRES APART EXCEPT AT LEAD-IN AND END TAPERS WHERE A SPACING OF 2 METRES AND 1 METRE SHALL BE PROVIDED. 1000 MM HEIGHT OF CONES TO BE USED.
3. FLASHING LANTERNS WITH SPACING OF 18 METRES SHALL BE PLACED BUT LEAD-IN AND END TAPERS WHERE A SPACING OF 8 METRES AND 1 METRE SHALL BE PROVIDED.
4. PUBLICITY BOARD TO BE PROVIDED AND DETAILS SHOULD REFER TO HYD STANDARD DRAWINGS NO. 6144B, 6145B, 6146B AND 6147B.
5. ALL VEHICLES ENTERING/EXITING THE SITE AT NORTH LANTAU HIGHWAY SHALL BE ESCORTED BY A SHADOW VEHICLES.
6. NO STOPPING OF SHADOW VEHICLE ON THE ROAD.
7. ACCESS TO BE CLOSED BY WATER-FILLED BARRIERS DURING NON WORKING HOUR.
8. TRAFFIC CONTROLLER TO PROVIDE ADEQUATE ASSISTANCE FOR SITE WORKERS AND MOTORIST AT INGRESS AND EGRESS WHERE APPLICABLE.
9. NO REVERSING MOVEMENT ACCESSING IN/OUT TO THE SITE.
10. NO QUEUING OUTSIDE THE SITE ACCESS.

Rev	Description	By	Date

Consultant

ARUP

Contract No. and Title

Agreement No. CE 67/2014(CE)

Site Formation and Infrastructural Works at [redacted] Chung Nga Road and Area 9, Tai Po - Investigation, Design and Construction

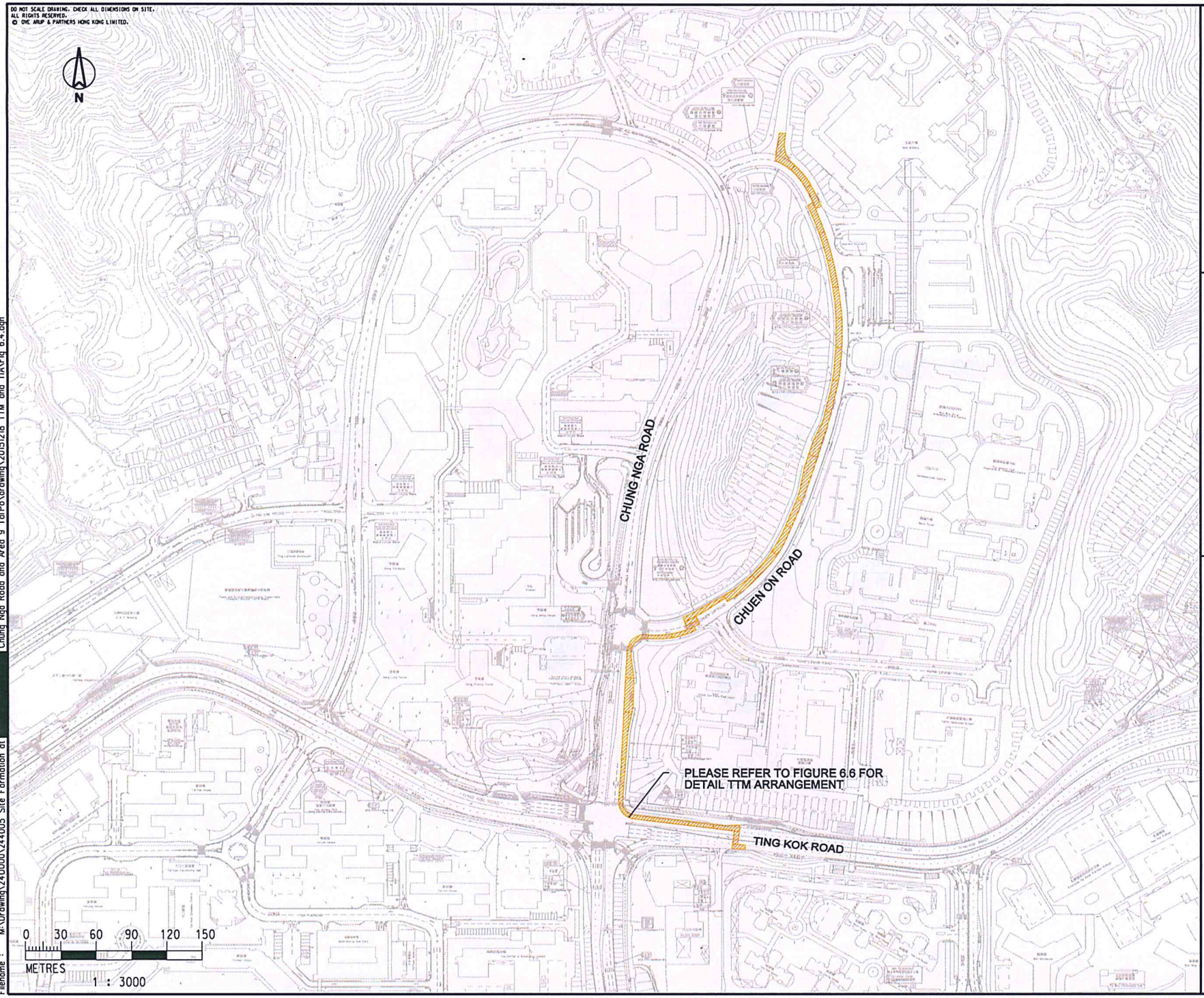
Drawing title

DETAILED TTM FOR DRAINAGE CONSTRUCTION AT CHUNG NGA ROAD WITH ONE LANE TWO WAY TTM (3-PHASES MOC)

Drawing no.			Rev.
FIGURE 7.3			-
Drawn	Date	Checked	Approved
WTL	12/15	HTTS	HTTS
Scale		Status	
1:1000 @A3		PRELIMINARY	

CEDD 土木工程拓展署 Civil Engineering and Development Department

Printed by : 12/22/2015
Filename : M:\Drawing\240000\244005 Site Formation at [redacted] Chung Nga Road and Area 9 Tai Po\drawing\20151218 TTM and TIA\Fig 6.3.dgn



LEGEND:

WORKS AREA

GENERAL NOTES:

1. ALL TRAFFIC DIVERSION WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CODE OF PRACTICE FOR THE LIGHTING SIGNING AND GUARDING OF ROAD WORKS' BY HIGHWAYS DEPARTMENT.
2. TRAFFIC CONES SHALL BE PLACED AT NOT MORE THAN 9 METRES APART EXCEPT AT LEAD-IN AND END TAPERS WHERE A SPACING OF 2 METRES AND 1 METRE SHALL BE PROVIDED. 1000 MM HEIGHT OF CONES TO BE USED.
3. FLASHING LANTERNS WITH SPACING OF 18 METRES SHALL BE PLACED BUT LEAD-IN AND END TAPERS WHERE A SPACING OF 8 METRES AND 1 METRE SHALL BE PROVIDED.
4. PUBLICITY BOARD TO BE PROVIDED AND DETAILS SHOULD REFER TO HYD STANDARD DRAWINGS NO. 6144B, 6145B, 6146B AND 6147B.
5. ALL VEHICLES ENTERING/EXITING THE SITE AT NORTH LANTAU HIGHWAY SHALL BE ESCORTED BY A SHADOW VEHICLES.
6. NO STOPPING OF SHADOW VEHICLE ON THE ROAD.
7. ACCESS TO BE CLOSED BY WATER-FILLED BARRIERS DURING NON WORKING HOUR.
8. TRAFFIC CONTROLLER TO PROVIDE ADEQUATE ASSISTANCE FOR SITE WORKERS AND MOTORIST AT INGRESS AND EGRESS WHERE APPLICABLE.
9. NO REVERSING MOVEMENT ACCESSING IN/OUT TO THE SITE.
10. NO QUEUING OUTSIDE THE SITE ACCESS.

Rev	Description	By	Date

Consultant

ARUP

Contract No. and Title:

Agreement No. CE 67/2014(CE)

Site Formation and Infrastructural Works at [redacted] Chung Nga Road and Area 9, Tai Po - Investigation, Design and Construction

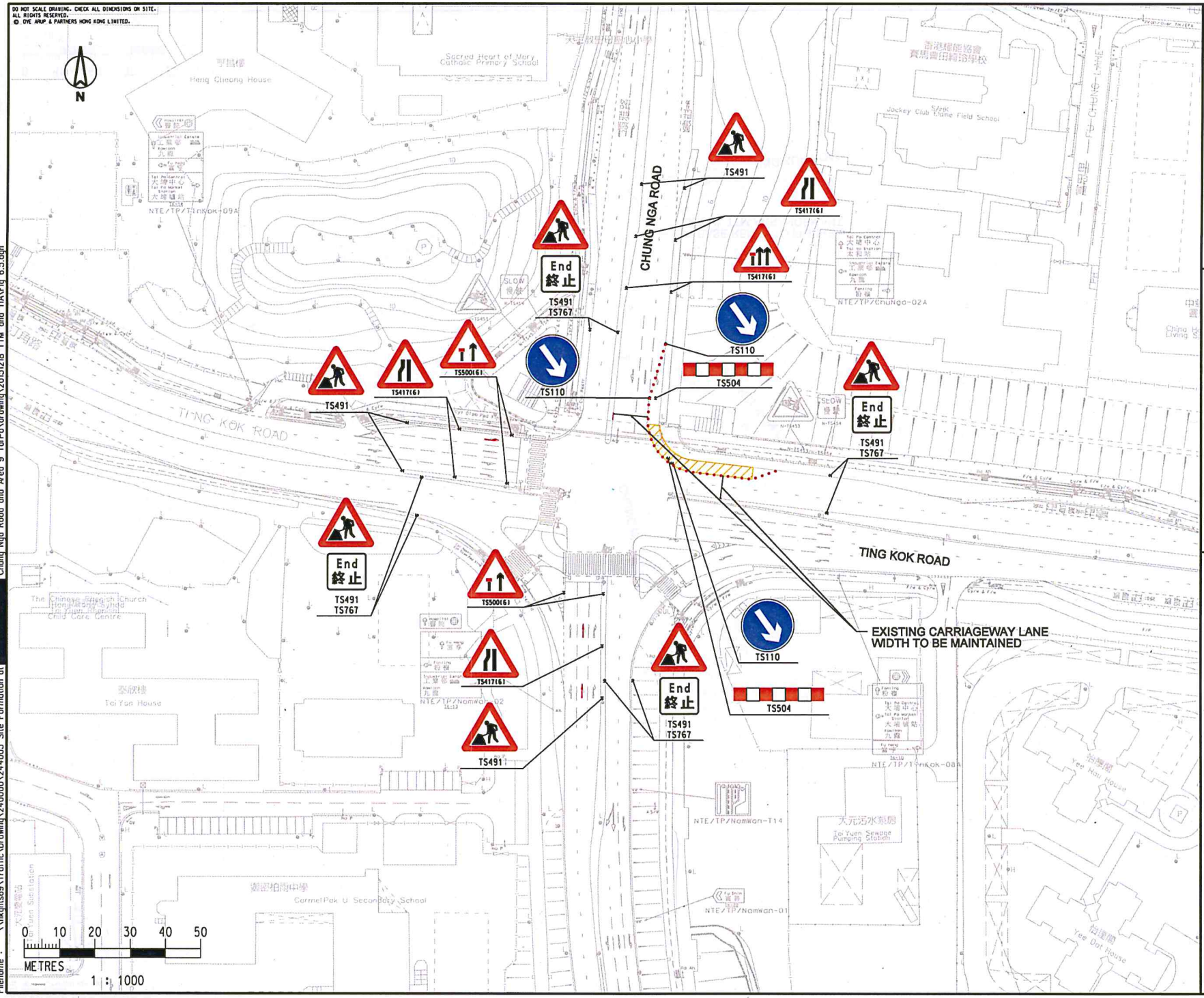
Drawing title

SCHEMATIC TTM FOR WATER MAINS CONSTRUCTION

Drawing no.	FIGURE 7.4	Rev.	-
Drawn	WTL	Date	12/15
Checked	HTTS	Approved	HTTS
Scale	1:3000 @A3	Status	PRELIMINARY

CEDD 土木工程拓展署 Civil Engineering and Development Department

Printed by : 12/21/2015
Filename : M:\Drawing\240000\244005 Site Formation at [redacted] Chung Nga Road and Area 9 Tai Po\drawing\20151218 TTM and TIA\Fig 6.4.dgn



LEGEND:

- WORKS AREA
- TRAFFIC SIGN
- TRAFFIC CONES

GENERAL NOTES:

1. ALL TRAFFIC DIVERSION WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CODE OF PRACTICE FOR THE LIGHTING SIGNING AND GUARDING OF ROAD WORKS' BY HIGHWAYS DEPARTMENT.
2. TRAFFIC CONES SHALL BE PLACED AT NOT MORE THAN 9 METRES APART EXCEPT AT LEAD-IN AND END TAPERS WHERE A SPACING OF 2 METRES AND 1 METRE SHALL BE PROVIDED. 1000 MM HEIGHT OF CONES TO BE USED.
3. FLASHING LANTERNS WITH SPACING OF 18 METRES SHALL BE PLACED BUT LEAD-IN AND END TAPERS WHERE A SPACING OF 8 METRES AND 1 METRE SHALL BE PROVIDED.
4. PUBLICITY BOARD TO BE PROVIDED AND DETAILS SHOULD REFER TO HYD STANDARD DRAWINGS NO. 6144B, 6145B, 6146B AND 6147B.
5. ALL VEHICLES ENTERING/EXITING THE SITE AT NORTH LANTAU HIGHWAY SHALL BE ESCORTED BY A SHADOW VEHICLES.
6. NO STOPPING OF SHADOW VEHICLE ON THE ROAD.
7. ACCESS TO BE CLOSED BY WATER-FILLED BARRIERS DURING NON WORKING HOUR.
8. TRAFFIC CONTROLLER TO PROVIDE ADEQUATE ASSISTANCE FOR SITE WORKERS AND MOTORIST AT INGRESS AND EGRESS WHERE APPLICABLE.
9. NO REVERSING MOVEMENT ACCESSING IN/OUT TO THE SITE.
10. NO QUEUING OUTSIDE THE SITE ACCESS.

Rev	Description	By	Date

Consultant

ARUP

Contract No. and Title:

Agreement No. CE 67/2014(CE)

Site Formation and Infrastructural Works at [redacted] Chung Nga Road and Area 9, Tai Po - Investigation, Design and Construction

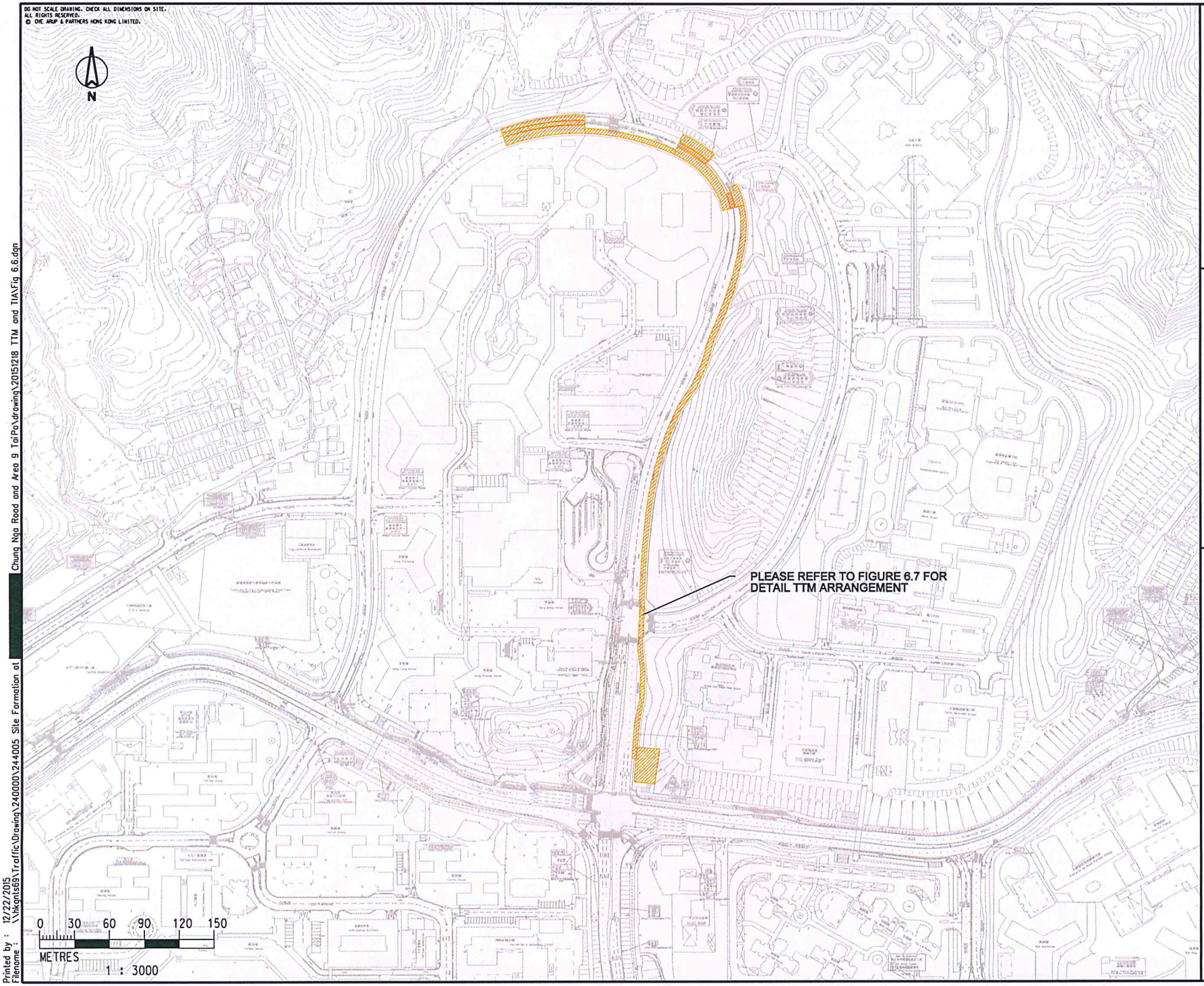
Drawing title

DETAILED TTM FOR WATER MAINS CONSTRUCTION AT CHUNG NGA ROAD

Drawing no.		Rev.
FIGURE 7.5		-
Drawn: WTL	Date: 12/15	Checked: HTTS / Approved: HTTS
Scale: 1:1000 @A3	Status: PRELIMINARY	

CEDD 土木工程拓展署 Civil Engineering and Development Department

Printed by : 12/22/2015
Filename : \\Vkgnts69\Traffic\Drawing\240000\244005 Site Formation at [redacted] Chung Nga Road and Area 9 TaiPo\drawing\20151218 TTM and TIA\Fig 6.5.dgn



LEGEND:

WORKS AREA

GENERAL NOTES:

1. ALL TRAFFIC DIVERSION WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CODE OF PRACTICE FOR THE LIGHTING SIGNING AND GUARDING OF ROAD WORKS' BY HIGHWAYS DEPARTMENT.
2. TRAFFIC CONES SHALL BE PLACED AT NOT MORE THAN 9 METRES APART EXCEPT AT LEAD-IN AND END TAPERS WHERE A SPACING OF 2 METRES AND 1 METRE SHALL BE PROVIDED. 1000 MM HEIGHT OF CONES TO BE USED.
3. FLASHING LANTERNS WITH SPACING OF 18 METRES SHALL BE PLACED BUT LEAD-IN AND END TAPERS WHERE A SPACING OF 9 METRES AND 1 METRE SHALL BE PROVIDED.
4. PUBLICITY BOARD TO BE PROVIDED AND DETAILS SHOULD REFER TO HYD STANDARD DRAWINGS NO. 6144B, 6145B, 6146B AND 6147B.
5. ALL VEHICLES ENTERING/EXITING THE SITE AT NORTH LANTAU HIGHWAY SHALL BE ESCORTED BY A SHADOW VEHICLES.
6. NO STOPPING OF SHADOW VEHICLE ON THE ROAD.
7. ACCESS TO BE CLOSED BY WATER-FILLED BARRIERS DURING NON WORKING HOUR.
8. TRAFFIC CONTROLLER TO PROVIDE ADEQUATE ASSISTANCE FOR SITE WORKERS AND MOTORIST AT INGRESS AND EGRESS WHERE APPLICABLE.
9. NO REVERSING MOVEMENT ACCESSING IN/OUT TO THE SITE.
10. NO QUEUING OUTSIDE THE SITE ACCESS.

Rev	Description	By	Date

Consultant

ARUP

Contract No. and Title:

Agreement No. CE 67/2014(CE)

Site Formation and Infrastructural Works at [redacted] Chung Nga Road and Area 9, Tai Po - Investigation, Design and Construction

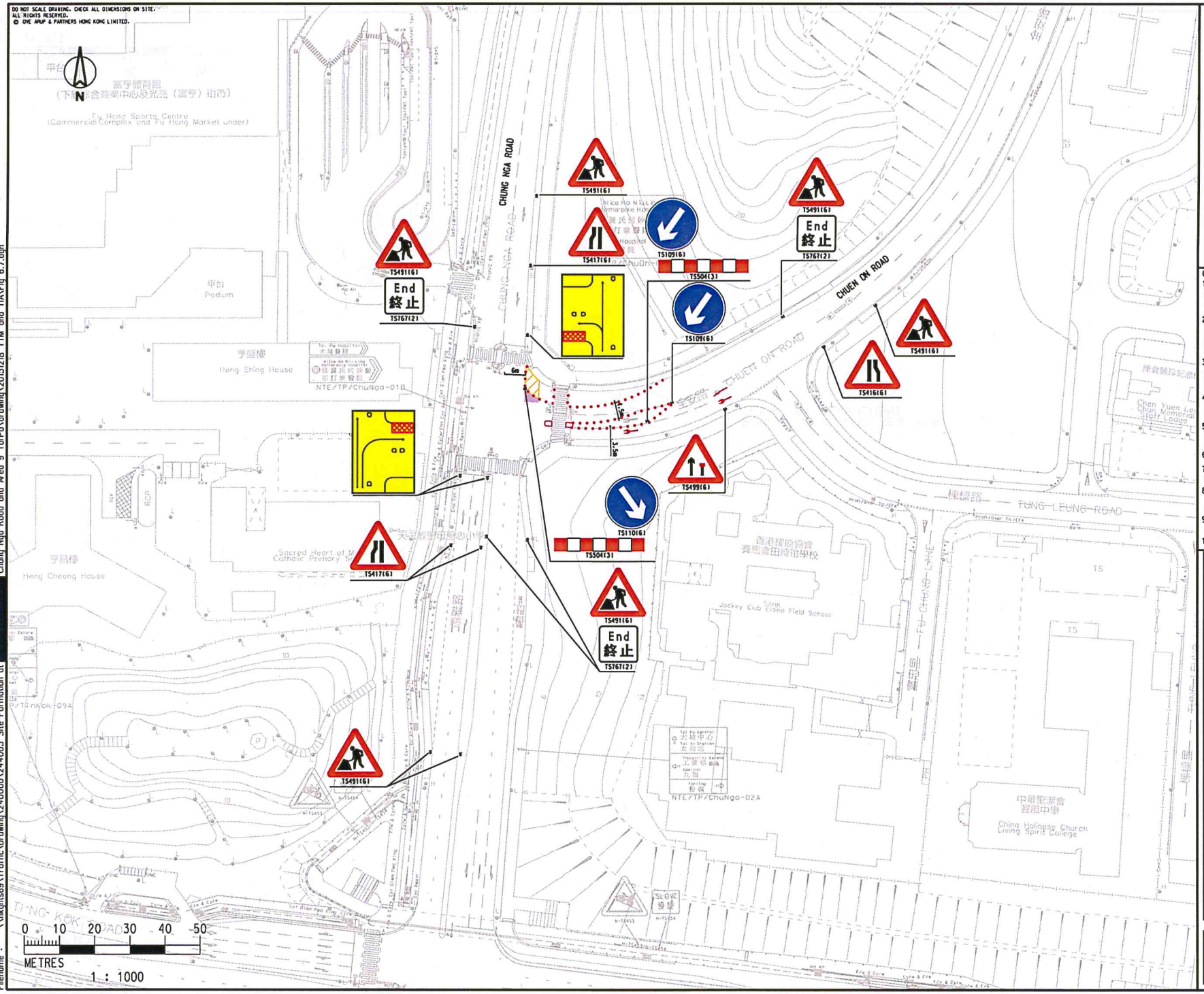
Drawing title

SCHEMATIC TTM FOR SEWERAGE WORKS CONSTRUCTION

Drawing no.			Rev.
FIGURE 7.6			-
Drawn: WTL	Date: 12/15	Checked: HTTS	Approved: HTTS
Scale: 1:3000 @A3		Status: PRELIMINARY	

CEDD 土木工程拓展署 Civil Engineering and Development Department

Printed by : 12/22/2015
Filename : \\hkqnts69\Traffic\Drawing\240000\244005 Site Formation at [redacted] Chung Nga Road and Area 9 TaiPo\drawing\20151218 TTM and TIA\Fig 6.6.dgn



LEGEND:

- WORKS AREA
- TRAFFIC SIGN
- TRAFFIC CONES
- DECKING AREA

GENERAL NOTES:

1. ALL TRAFFIC DIVERSION WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CODE OF PRACTICE FOR THE LIGHTING SIGNING AND GUARDING OF ROAD WORKS' BY HIGHWAYS DEPARTMENT.
2. TRAFFIC CONES SHALL BE PLACED AT NOT MORE THAN 9 METRES APART EXCEPT AT LEAD-IN AND END TAPERS WHERE A SPACING OF 2 METRES AND 1 METRE SHALL BE PROVIDED. 1000 MM HEIGHT OF CONES TO BE USED.
3. FLASHING LANTERNS WITH SPACING OF 18 METRES SHALL BE PLACED BUT LEAD-IN AND END TAPERS WHERE A SPACING OF 8 METRES AND 1 METRE SHALL BE PROVIDED.
4. PUBLICITY BOARD TO BE PROVIDED AND DETAILS SHOULD REFER TO HYD STANDARD DRAWINGS NO. 6144B, 6145B, 6146B AND 6147B.
5. ALL VEHICLES ENTERING/EXITING THE SITE AT NORTH LANTAU HIGHWAY SHALL BE ESCORTED BY A SHADOW VEHICLES.
6. NO STOPPING OF SHADOW VEHICLE ON THE ROAD.
7. ACCESS TO BE CLOSED BY WATER-FILLED BARRIERS DURING NON WORKING HOUR.
8. TRAFFIC CONTROLLER TO PROVIDE ADEQUATE ASSISTANCE FOR SITE WORKERS AND MOTORIST AT INGRESS AND EGRESS WHERE APPLICABLE.
9. NO REVERSING MOVEMENT ACCESSING IN/OUT TO THE SITE.
10. NO QUEUING OUTSIDE THE SITE ACCESS.

Rev	Description	By	Date

Consultant

ARUP

Contract No. and Title:

Agreement No. CE 67/2014(CE)

Site Formation and Infrastructural Works at [redacted] Chung Nga Road and Area 9, Tai Po - Investigation, Design and Construction

Drawing title

TTM FOR SEWERAGE WORKS AT CHUNG NGA ROAD

Drawing no.	Rev.
FIGURE 7.7	-

Drawn	Date	Checked	Approved
WTL	08/15	HTTS	HTTS

Scale: 1:1000 @A3

Status: PRELIMINARY

CEDD 土木工程拓展署 Civil Engineering and Development Department

Printed by : 12/22/2015
Filename : \\Hkgnts69\Traffic\Drawing\240000\244005 Site Formation at [redacted] Chung Nga Road and Area 9 TaiPo\drawing\20151218 TTM and TIA\Fig 6.7.dgn

LEGEND:

- WORKS AREA
- TRAFFIC SIGN

GENERAL NOTES:

1. ALL TRAFFIC DIVERSION WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CODE OF PRACTICE FOR THE LIGHTING SIGNING AND GUARDING OF ROAD WORKS BY HIGHWAYS DEPARTMENT.
2. TRAFFIC CONES SHALL BE PLACED AT NOT MORE THAN 9 METRES APART EXCEPT AT LEAD-IN AND END TAPERS WHERE A SPACING OF 2 METRES AND 1 METRE SHALL BE PROVIDED. 1000 MM HEIGHT OF CONES TO BE USED.
3. FLASHING LANTERNS WITH SPACING OF 18 METRES SHALL BE PLACED BUT LEAD-IN AND END TAPERS WHERE A SPACING OF 8 METRES AND 1 METRE SHALL BE PROVIDED.
4. PUBLICITY BOARD TO BE PROVIDED AND DETAILS SHOULD REFER TO HYD STANDARD DRAWINGS NO. 6144B, 6145B, 6146B AND 6147B.
5. ALL VEHICLES ENTERING/EXITING THE SITE AT NORTH LANTAU HIGHWAY SHALL BE ESCORTED BY A SHADOW VEHICLES.
6. NO STOPPING OF SHADOW VEHICLE ON THE ROAD.
7. ACCESS TO BE CLOSED BY WATER-FILLED BARRIERS DURING NON WORKING HOUR.
8. TRAFFIC CONTROLLER TO PROVIDE ADEQUATE ASSISTANCE FOR SITE WORKERS AND MOTORIST AT INGRESS AND EGRESS WHERE APPLICABLE.
9. NO REVERSING MOVEMENT ACCESSING IN/OUT TO THE SITE.
10. NO QUEUING OUTSIDE THE SITE ACCESS.

Rev	Description	By	Date

Consultant

ARUP

Contract No. and Title:

Agreement No. CE 67/2014(CE)

Site Formation and Infrastructural Works at [redacted] Chung Nga Road and Area 9, Tai Po - Investigation, Design and Construction

Drawing title

TTM FOR PROPOSED JUNCTION IMPROVEMENT AT JUNCTION J1, J2 AND J3 (STAGE 1)

Drawing no.	Rev.
FIGURE 7.8	-

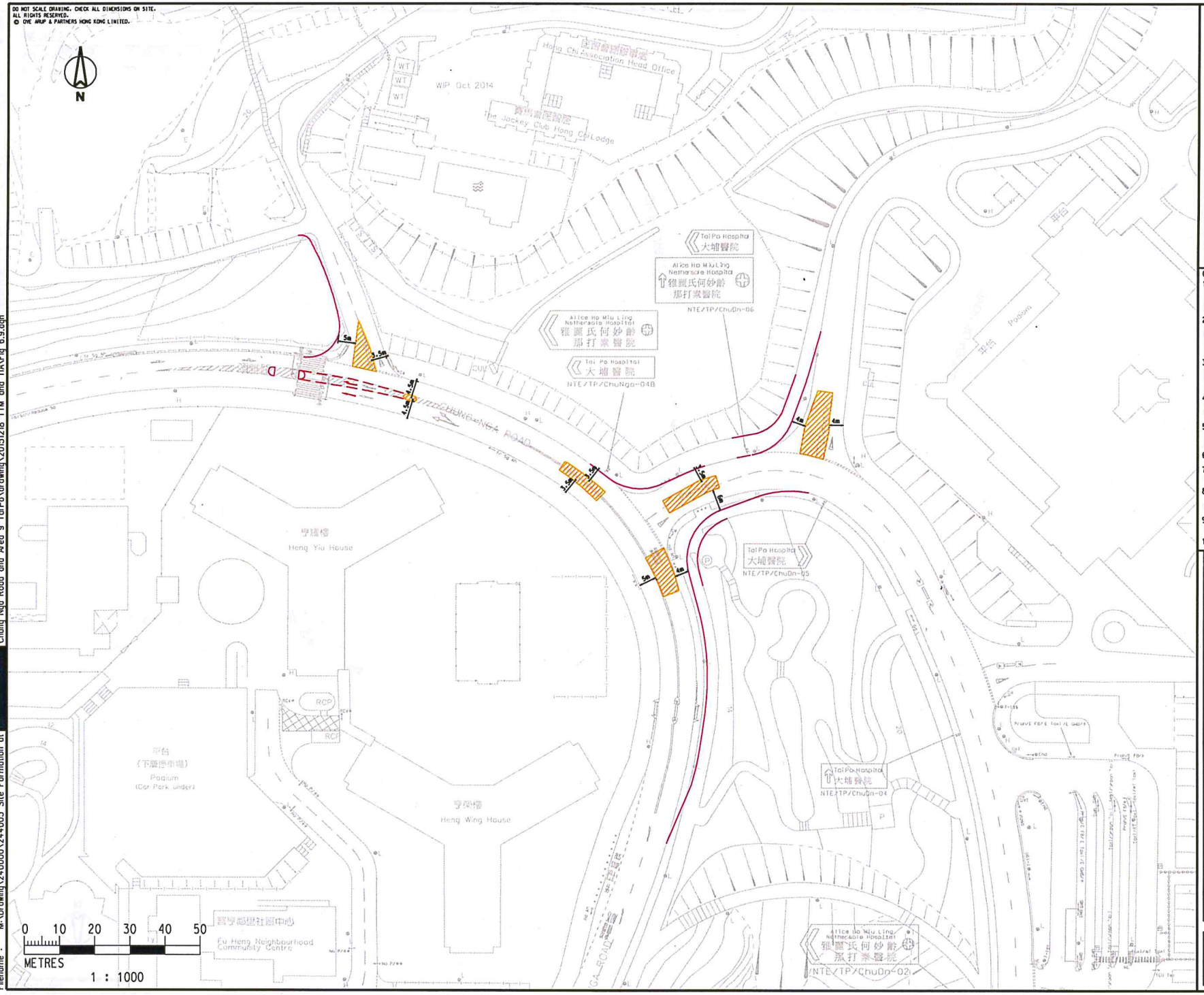
Drawn	Date	Checked	Approved
WTL	08/15	HTTS	HTTS

Scale: 1:1000 @A3

Status: PRELIMINARY

CEDD 土木工程拓展署 Civil Engineering and Development Department

Printed by : 12/22/2015
Filename : M:\Drawing\244000\244005 Site Formation at [redacted] Chung Nga Road and Area 9 Tai Po\drawing\20151218 TTM and TIAV\Fig 6.8.dgn



LEGEND:

- WORKS AREA
- TRAFFIC SIGN
- TRAFFIC CONES
- PROFILE BARRIER

GENERAL NOTES:

1. ALL TRAFFIC DIVERSION WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CODE OF PRACTICE FOR THE LIGHTING SIGNING AND GUARDING OF ROAD WORKS' BY HIGHWAYS DEPARTMENT.
2. TRAFFIC CONES SHALL BE PLACED AT NOT MORE THAN 9 METRES APART EXCEPT AT LEAD-IN AND END TAPERS WHERE A SPACING OF 2 METRES AND 1 METRE SHALL BE PROVIDED. 1000 MM HEIGHT OF CONES TO BE USED.
3. FLASHING LANTERNS WITH SPACING OF 18 METRES SHALL BE PLACED BUT LEAD-IN AND END TAPERS WHERE A SPACING OF 8 METRES AND 1 METRE SHALL BE PROVIDED.
4. PUBLICITY BOARD TO BE PROVIDED AND DETAILS SHOULD REFER TO HYD STANDARD DRAWINGS NO. 6144B, 6145B, 6146B AND 6147B.
5. ALL VEHICLES ENTERING/EXITING THE SITE AT NORTH LANTAU HIGHWAY SHALL BE ESCORTED BY A SHADOW VEHICLES.
6. NO STOPPING OF SHADOW VEHICLE ON THE ROAD.
7. ACCESS TO BE CLOSED BY WATER-FILLED BARRIERS DURING NON WORKING HOUR.
8. TRAFFIC CONTROLLER TO PROVIDE ADEQUATE ASSISTANCE FOR SITE WORKERS AND MOTORIST AT INGRESS AND EGRESS WHERE APPLICABLE.
9. NO REVERSING MOVEMENT ACCESSING IN/OUT TO THE SITE.
10. NO QUEUING OUTSIDE THE SITE ACCESS.

Rev	Description	By	Date

Consultant

ARUP

Contract No. and Title:

Agreement No. CE 67/2014(CE)

Site Formation and Infrastructural Works at [redacted] Chung Nga Road and Area 9, Tai Po - Investigation, Design and Construction

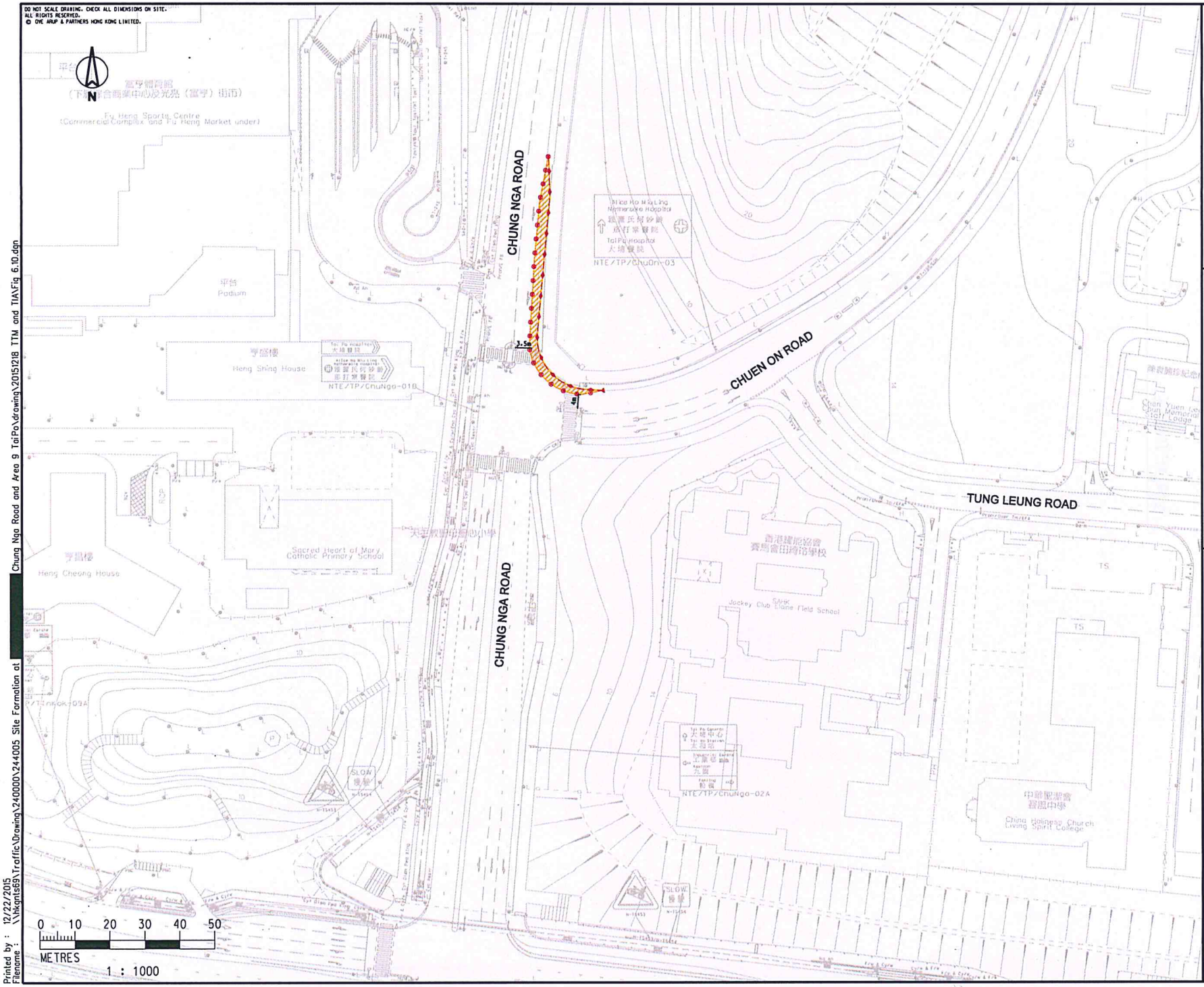
Drawing title

TTM FOR PROPOSED JUNCTION IMPROVEMENT AT JUNCTION J1, J2 AND J3 (STAGE 2)

Drawing no.			Rev.
FIGURE 7.9			-
Drawn	Date	Checked	Approved
WTL	08/15	HTTS	HTTS
Scale		Status	
1:1000 @A3		PRELIMINARY	

CEDD 土木工程拓展署 Civil Engineering and Development Department

Printed by : 12/22/2015
Filename : M:\Drawing\240000\244005 Site Formation at [redacted] Chung Nga Road and Area 9 TaiPo\drawing\20151218 TTM and TIAFig 6.9.dgn



LEGEND:

- WORKS AREA
- TRAFFIC SIGN
- TRAFFIC CONES
- PROFILE BARRIER

GENERAL NOTES:

1. ALL TRAFFIC DIVERSION WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CODE OF PRACTICE FOR THE LIGHTING SIGNING AND GUARDING OF ROAD WORKS' BY HIGHWAYS DEPARTMENT.
2. TRAFFIC CONES SHALL BE PLACED AT NOT MORE THAN 9 METRES APART EXCEPT AT LEAD-IN AND END TAPERS WHERE A SPACING OF 2 METRES AND 1 METRE SHALL BE PROVIDED. 1000 MM HEIGHT OF CONES TO BE USED.
3. FLASHING LANTERNS WITH SPACING OF 18 METRES SHALL BE PLACED BUT LEAD-IN AND END TAPERS WHERE A SPACING OF 8 METRES AND 1 METRE SHALL BE PROVIDED.
4. PUBLICITY BOARD TO BE PROVIDED AND DETAILS SHOULD REFER TO HYD STANDARD DRAWINGS NO. 6144B, 6145B, 6146B AND 6147B.
5. ALL VEHICLES ENTERING/EXITING THE SITE AT NORTH LANTAU HIGHWAY SHALL BE ESCORTED BY A SHADOW VEHICLES.
6. NO STOPPING OF SHADOW VEHICLE ON THE ROAD.
7. ACCESS TO BE CLOSED BY WATER-FILLED BARRIERS DURING NON WORKING HOUR.
8. TRAFFIC CONTROLLER TO PROVIDE ADEQUATE ASSISTANCE FOR SITE WORKERS AND MOTORIST AT INGRESS AND EGRESS WHERE APPLICABLE.
9. NO REVERSING MOVEMENT ACCESSING IN/OUT TO THE SITE.
10. NO QUEUING OUTSIDE THE SITE ACCESS.

Rev	Description	By	Date

Consultant

ARUP

Contract No. and Title

Agreement No. CE 67/2014(CE)

Site Formation and Infrastructural Works at [redacted] Chung Nga Road and Area 9, Tai Po - Investigation, Design and Construction

Drawing title

TTM FOR PROPOSED JUNCTION IMPROVEMENT AT JUNCTION J4

Drawing no.	Rev.
FIGURE 7.10	-

Drawn	Date	Checked	Approved
WTL	08/15	HTTS	HTTS

Scale: 1:1000 @A3 Status: PRELIMINARY

CEDD 土木工程拓展署 Civil Engineering and Development Department

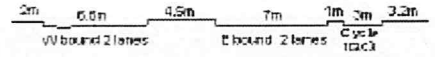
Printed by : 12/22/2015
Filename : \\hkgrts69\Traffic\Drawing\240000\244005 Site Formation at [redacted] Chung Nga Road and Area 9 TaiPo\drawing\20151218 TTM and TIA\Fig 6.10.dgn

Appendix

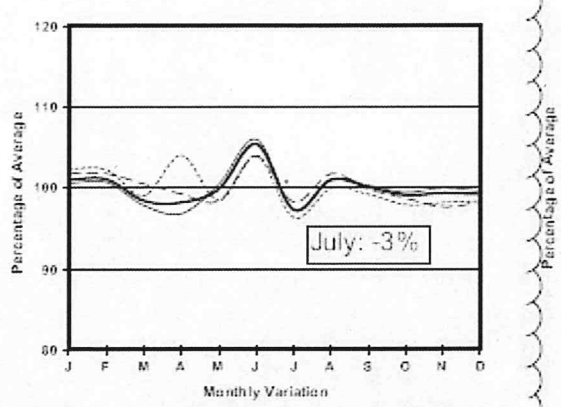
Appendix A

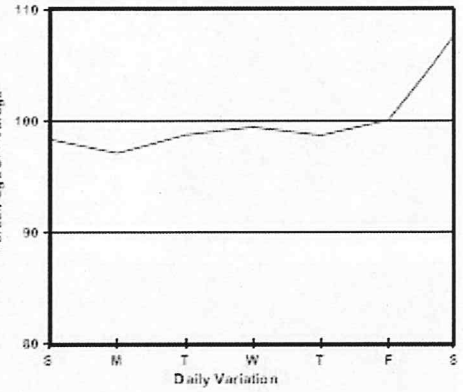
YEAR 2012 LINK KWONG FUK RD (from NAM WAN RD to WAN TAU ST)

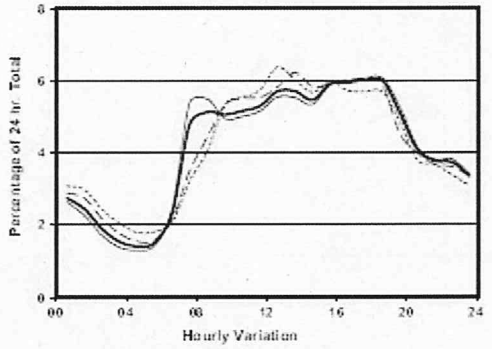
CORE STATION 5009
ROAD NETWORK MAJOR
ROAD TYPE DISTRIBUTOR

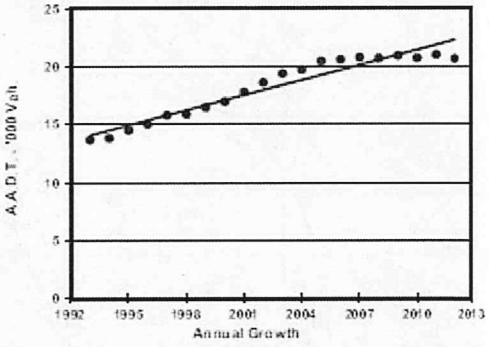


1. TRAFFIC FLOW VARIATION AND GROWTH









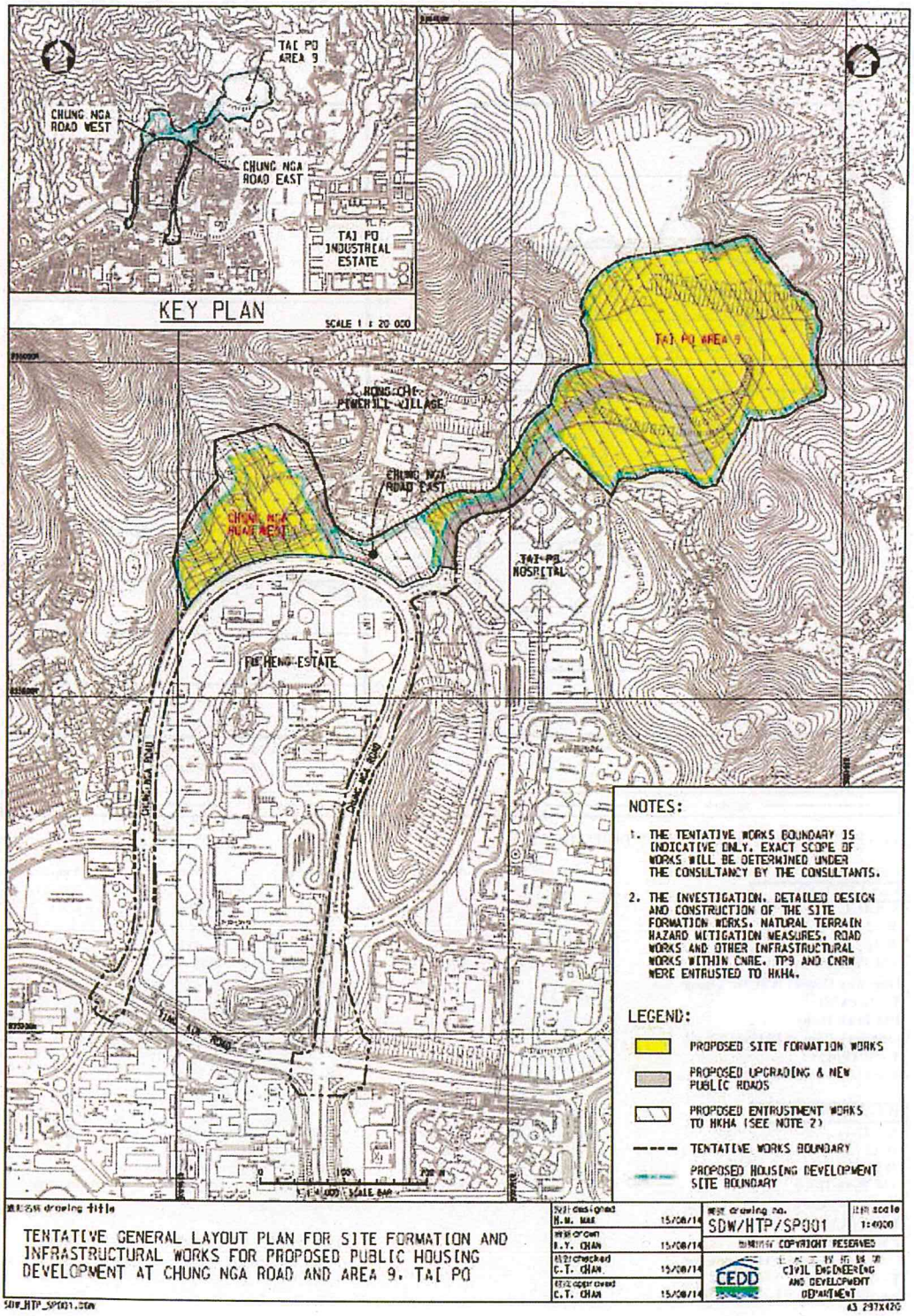
All day Mon - Fri Sat Sun

2. TRAFFIC CHARACTERISTICS (BY DIRECTION)

Parameter	All - Day	Mon - Fri	Sat	Sun
EAST BOUND				
A.A.D.T.	8280	8190	8950	8080
R 12 / 24 - %	65	65.4	64.4	63.5
R 16 / 24 - %	81.3	82	80.2	79.1
AM Peak Hour	0700-0800	0700-0800	0900-1000	0900-1000
One-way flow at AM peak hour	450	510	470	410
T - % (AM)				
PM Peak Hour	1700-1800	1700-1800	1600-1700	1700-1800
One-way flow at PM peak hour	470	470	520	450
T - % (PM)				
Prop.of commercial vehicles - 16 hr.				
WEST BOUND				
A.A.D.T.	12380	12230	13280	12280
R 12 / 24 - %	66.8	66.9	67	65.9
R 16 / 24 - %	83.7	84.4	82.8	81.7
AM Peak Hour	0800-0900	0800-0900	0900-1000	0900-1000
One-way flow at AM peak hour	620	660	720	670
T - % (AM)				
PM Peak Hour	1800-1900	1800-1900	1700-1800	1800-1900
One-way flow at PM peak hour	800	800	830	730
T - % (PM)				
Prop.of commercial vehicles - 16 hr.				

3. OTHER INFORMATION AND COMMENT

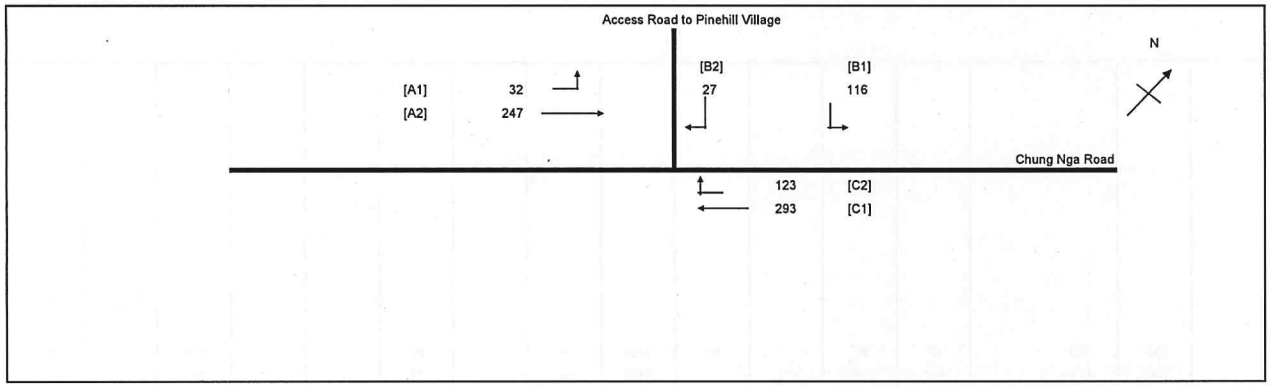
Appendix B


KEY PLAN
SCALE 1 : 20 000
TAI PO AREA 9
CHUNG NGA ROAD WEST
CHUNG NGA ROAD EAST
TAI PO INDUSTREAL ESTATE
HONG CHI PEWTER LTD. VILLAGE
PAK HENG ESTATE
NOTES:
1. THE TENTATIVE WORKS BOUNDARY IS INDICATIVE ONLY. EXACT SCOPE OF WORKS WILL BE DETERMINED UNDER THE CONSULTANCY BY THE CONSULTANTS.
2. THE INVESTIGATION, DETAILED DESIGN AND CONSTRUCTION OF THE SITE FORMATION WORKS, NATURAL TERRAIN HAZARD MITIGATION MEASURES, ROAD WORKS AND OTHER INFRASTRUCTURAL WORKS WITHIN CNRE, TP9 AND CNRN WERE ENTRUSTED TO HKH4.
LEGEND:
PROPOSED SITE FORMATION WORKS
PROPOSED UPGRADING & NEW PUBLIC ROADS
PROPOSED ENTRUSTMENT WORKS TO HKHA (SEE NOTE 2)
TENTATIVE WORKS BOUNDARY
PROPOSED HOUSING DEVELOPMENT SITE BOUNDARY
TENTATIVE GENERAL LAYOUT PLAN FOR SITE FORMATION AND INFRASTRUCTURAL WORKS FOR PROPOSED PUBLIC HOUSING DEVELOPMENT AT CHUNG NGA ROAD AND AREA 9, TAI PO
SDW/HTP/SP001
1:4000
COPYRIGHT RESERVES
CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT
A3 297X420

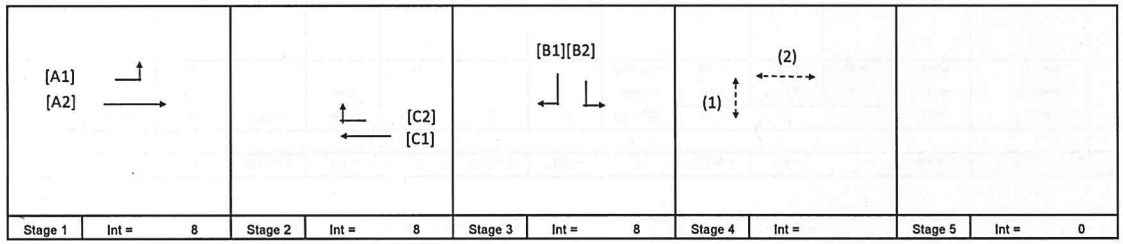
OVE ARUP & PARTNERS | TRAFFIC SIGNAL CALCULATION

PROJECT NO: 244005

J1_improvement | 2030_AM_design | DATE : 11-Dec-15 | FILENAME:



No. of stages per cycle	N =	4
No. of stage using for calculation	N =	3
Cycle time	C =	105 sec
Sum(y)	Y =	0.436
Loss time	L =	43 sec
Total Flow	=	837.64898 pcu
Co = (1.5*L+5)/(1-Y)	=	123.3 sec
Cm = L/(1-Y)	=	76.3 sec
Yult	=	0.878
R.C.ult = (Yult-Y)/Y*100%	=	101.1 %
Cp 0.9*L/(0.9-Y)	=	83.5 sec
Ymax = 1-L/C	=	0.590
R.C.(C)	=	21.8 %



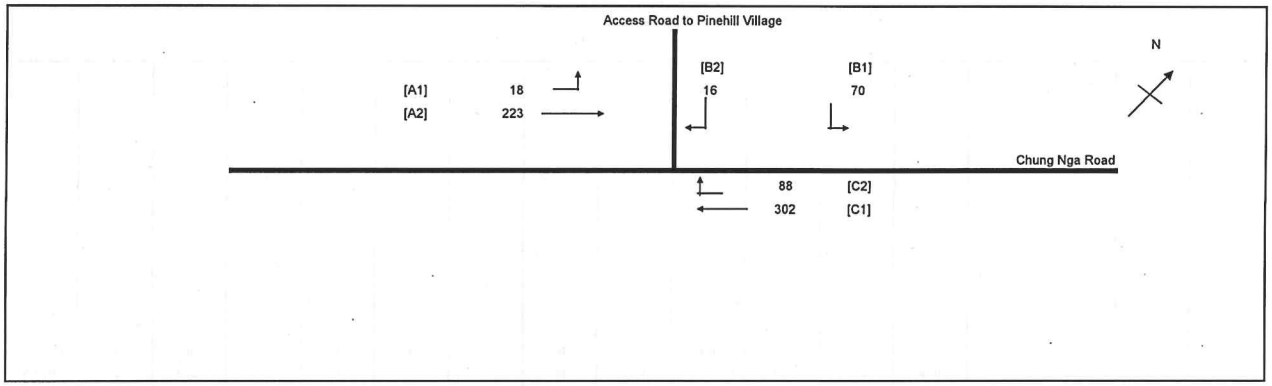
Stage 1	Int = 8	Stage 2	Int = 8	Stage 3	Int = 8	Stage 4	Int =	Stage 5	Int = 0

Pedestrian Phase	Width (m)	Green Time Required (s) SG	Delay	FG	Green Time Provided (s) SG	Delay	FG	Check

Move-ment	Stage	Lane Width m.	Phase	No. of lane	Radius m,	O	N	Straight-Ahead Sat. Flow	m Left pcu/h	m Straight pcu/h	m Right pcu/h	Total FLow pcu/h	Proportion of Turning Vehicles	Sat. Flow pcu/h	Uphill Gradient %	Short lane Effect pcu/h	Revised Sat. Flow pcu/h	y	Greater y	L sec	g (required) sec	g (input) sec	Degree of Saturation X	Queuing Length m.
																				21				
A1,A2	1	4.00		1	10		N	2015	32	247		278	0.11	1981			1981	0.141	0.141		20	30	0.485	35
C1,C2	2	4.00		1	12		N	2015		293	123	416	0.29	1943			1943	0.214	0.214		30	30	0.739	52
B1,B2	3	4.00		1	10		N	2015	116		27	143	1.00	1752			1752	0.082	0.082		12	12	0.739	22
ped	4																			22				

OVE ARUP & PARTNERS | TRAFFIC SIGNAL CALCULATION

		PROJECT NO:	244005
J1_improvement	2030_PM_design	DATE : 11-Dec-15	FILENAME:



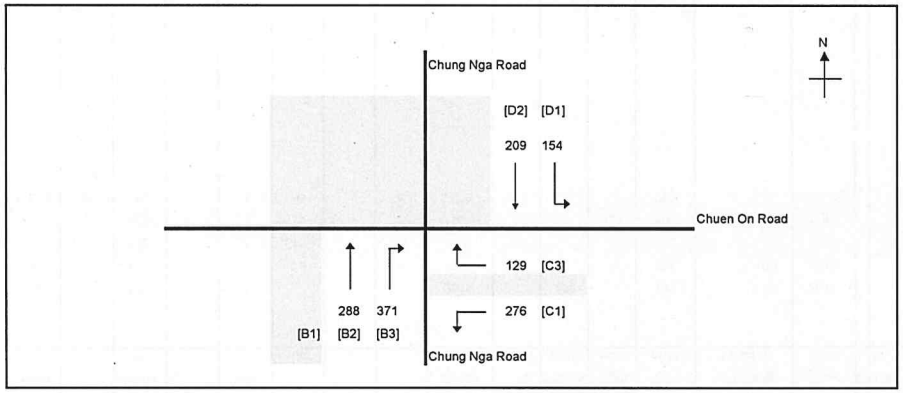
No. of stages per cycle	N =	4
No. of stage using for calculation	N =	3
Cycle time	C =	105 sec
Sum(y)	Y =	0.369
Loss time	L =	43 sec
Total Flow	=	716.22912 pcu
Co = (1.5*L+5)/(1-Y)	=	110.1 sec
Cm = L/(1-Y)	=	68.1 sec
Yult	=	0.878
R.C.ult = (Yult-Y)/Y*100%	=	138.1 %
Cp 0.9*L/(0.9-Y)	=	72.8 sec
Ymax = 1-L/C	=	0.590
R.C.(C)	=	44.2 %

Stage 1	Int = 8	Stage 2	Int = 8	Stage 3	Int = 8	Stage 4	Int =	Stage 5	Int = 0
[A1] [A2]		[C2] [C1]		[B1][B2]		(1) (2)			

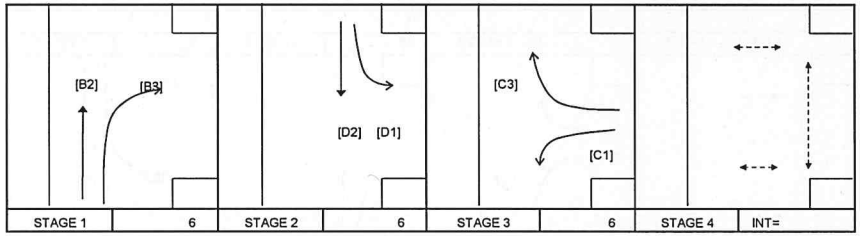
Pedestrian Phase	Width (m)	Green Time Required (s) SG	Delay	FG	Green Time Provided (s) SG	Delay	FG	Check

Move-ment	Stage	Lane Width m.	Phase	No. of lane	Radius m.	O	N	Straight-Ahead Sat. Flow	m Left pcu/h	m Straight pcu/h	m Right pcu/h	Total FLow pcu/h	Proportion of Turning Vehicles	Sat. Flow pcu/h	Uphill Gradient %	Short lane Effect pcu/h	Revised Sat. Flow pcu/h	y	Greater y	L sec	g (required) sec	g (input) sec	Degree of Saturation X	Queuing Length m.
																				21				
A1,A2	1	4.00		1	10		N	2015	18	223		241	0.07	1993			1993	0.121	0.121		20	33	0.380	29
C1,C2	2	4.00		1	12		N	2015		302	88	389	0.23	1960			1960	0.199	0.199		33	33	0.624	46
B1,B2	3	4.00		1	10		N	2015	70		16	86	1.00	1752			1752	0.049	0.049		8	8	0.624	14
ped	4																			22				

OVE ARUP & PARTNERS	TRAFFIC SIGNAL CALCULATION		
		PROJECT NO: 253xx	
J2_improvement	2030_AM_design	DATE : 11-Dec-15	FILENAME :



No. of stages per cycle		N =	4
No. of stage using for calculation		N =	3
Cycle time		C =	120 sec
Sum(y)		Y =	0.545
Loss time		L =	35.6667 sec
Total Flow		=	1425.825 pcu
Co	= (1.5*L+5)/(1-Y)	=	128.5 sec
Cm	= L/(1-Y)	=	78.3 sec
Yult		=	0.633
R.C.ult	= (Yult-Y)/Y*100%	=	16.1 %
Cp	= 0.9*L/(0.9-Y)	=	90.3 sec
Ymax	= 1-L/C	=	0.703
R.C.(C)	= (0.9*Ymax-Y)/Y*100%	=	16.1 % (Optimized)



Pedestrian Phase	Width (m)	Green Time Required (s) SG	Delay	FG	Green Time Provided (s) SG	Delay	FG	Check
1	8	5	9	7	5	9	7	OK

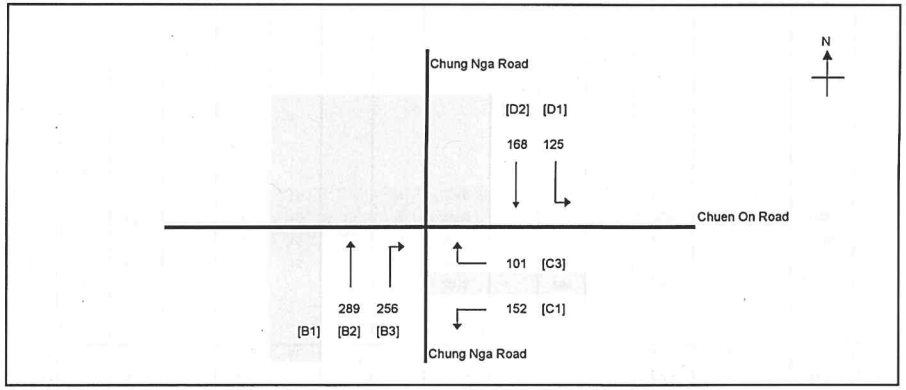
Move-ment	Stage	Lane Width m.	Phase	No. of lane	Radius m.	O	N	Straight-Ahead Sat. Flow	m Left pcu/h	m Straight pcu/h	m Right pcu/h	Total Flow pcu/h	Proportion of Turning Vehicles	Sat. Flow pcu/h	Uphill Gradien %	Short lane Effect pcu/h	Revised Sat. Flow pcu/h	y	Greater y	L sec	g (required) sec	g (input) sec	Degree of Saturation X	Queuing Length m.
																				15				
B2	1	4.00		1			N	2015		288		288	0.00	2015			2015	0.143			22	37	0.463	40
B3	1	4.00		1	15		N	2015			371	371	1.00	1832			1832	0.202	0.202		31	37	0.656	51
C1	3	3.50		1	15		N	1965	276			276	1.00	1786			1786	0.155	0.155		24	11	1.688	50
C3	3	3.50		1	15		N	1965			129	129	1.00	1786			1786	0.072			11	11	0.785	23
D1.D2	2	4.00		1	15		N	2015	154	209		363	0.42	1933			1933	0.188	0.188		29	19	1.185	61
	ped																			21				

NOTE : 'O - OPPOSING TRAFFIC N - NEAR SIDE LANE SG - STEADY GREEN FG - FLASHING GREEN PEDESTRIAN WALKING SPEED = 1.2m/s

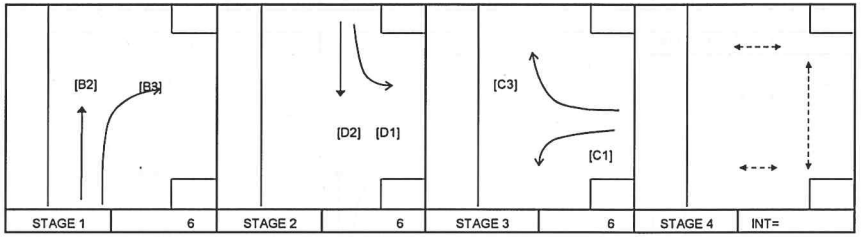
QUEUING LENGTH = AVERAGE QUEUE * 6m

N/A: UNSTABLE QUEUE LENGTH DUE TO SATURATION

OVE ARUP & PARTNERS	TRAFFIC SIGNAL CALCULATION		
		PROJECT NO: 253xx	
J2_improvement	2030_PM_design	DATE : 11-Dec-15	FILENAME :



No. of stages per cycle		N =	4
No. of stage using for calculation		N =	3
Cycle time		C =	120 sec
Sum(y)		Y =	0.377
Loss time		L =	35.6667 sec
Total Flow		=	1091.377 pcu
Co	= (1.5*L+5)/(1-Y)	=	93.9 sec
Cm	= L/(1-Y)	=	57.3 sec
Yult		=	0.633
R.C.ult	= (Yult-Y)/Y*100%	=	67.8 %
Cp	= 0.9*L/(0.9-Y)	=	61.4 sec
Ymax	= 1-L/C	=	0.703
R.C.(C)	= (0.9*Ymax-Y)/Y*100%	=	67.8 % (Optimized)



Pedestrian Phase	Width (m)	Green Time Required (s) SG	Delay	FG	Green Time Provided (s) SG	Delay	FG	Check
1	8	5	9	7	5	9	7	OK

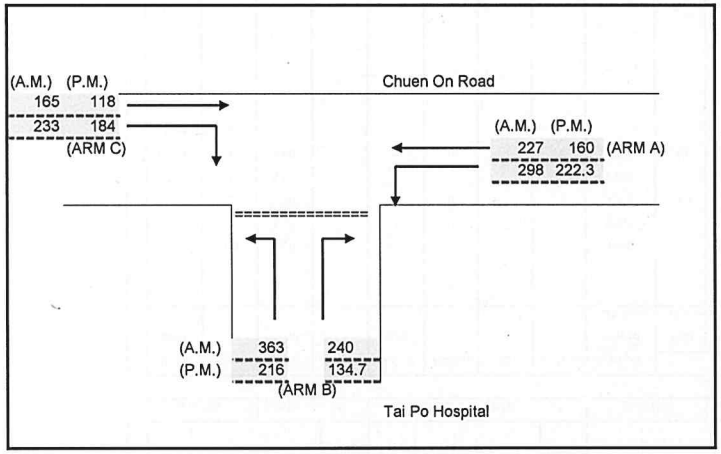
Move-ment	Stage	Lane Width m.	Phase	No. of lane	Radius m.	O	N	Straight-Ahead Sat. Flow	m Left pcu/h	m Straight pcu/h	m Right pcu/h	Total Flow pcu/h	Proportion of Turning Vehicles	Sat. Flow pcu/h	Uphill Gradien %	Short lane Effect pcu/h	Revised Sat. Flow pcu/h	y	Greater y	L sec	g (required) sec	g (input) sec	Degree of Saturation X	Queuing Length m.
																				15				
B2	1	4.00		1			N	2015		289		289	0.00	2015			2015	0.143			32	37	0.464	40
B3	1	4.00		1	15		N	2015			256	256	1.00	1832			1832	0.140	0.140		31	37	0.454	35
C1	3	3.50		1	15		N	1965	152			152	1.00	1786			1786	0.085	0.085		19	11	0.930	48
C3	3	3.50		1	15		N	1965			101	101	1.00	1786			1786	0.056			13	11	0.616	18
D1,D2	2	4.00		1	15		N	2015	125	168		293	0.43	1932			1932	0.152	0.152		34	19	0.958	92
	ped																			21				

NOTE : 'O - OPPOSING TRAFFIC N - NEAR SIDE LANE SG - STEADY GREEN FG - FLASHING GREEN PEDESTRIAN WALKING SPEED = 1.2m/s

QUEUING LENGTH = AVERAGE QUEUE * 6m

N/A: UNSTABLE QUEUE LENGTH DUE TO SATURATION

OVE ARUP & PARTNERS	PRIORITY JUNCTION CALCULATION		
		Project No. : 244005	
J3_improvement	2030_design	DATE : 11-Dec-15	FILENAME :



NOTES : (GEOMETRIC INPUT DATA)

W	=	MAJOR ROAD WIDTH
W cr	=	CENTRAL RESERVE WIDTH
W b-a	=	LANE WIDTH AVAILABLE TO VEHICLE WAITING IN STREAM b-a
W b-c	=	LANE WIDTH AVAILABLE TO VEHICLE WAITING IN STREAM b-c
W c-b	=	LANE WIDTH AVAILABLE TO VEHICLE WAITING IN STREAM c-b
Vl b-a	=	VISIBILITY TO THE LEFT FOR VEHICLES WAITING IN STREAM b-a
Vr b-a	=	VISIBILITY TO THE RIGHT FOR VEHICLES WAITING IN STREAM b-a
Vr b-c	=	VISIBILITY TO THE RIGHT FOR VEHICLES WAITING IN STREAM b-c
Vr c-b	=	VISIBILITY TO THE RIGHT FOR VEHICLES WAITING IN STREAM c-b
D	=	STREAM-SPECIFIC B-A
E	=	STREAM-SPECIFIC B-C
F	=	STREAM-SPECIFIC C-B
Y	=	(1-0.0345W)

GEOMETRIC DETAILS:

MAJOR ROAD (ARM A)

		(A.M.)	(P.M.)	
W	=	10.00		(metres)
W cr	=	0		(metres)
q a-b	=	298	222	(pcu/hr)
q a-c	=	227	160	(pcu/hr)

MAJOR ROAD (ARM C)

		(A.M.)	(P.M.)	
W c-b	=	0.00		(metres)
Vr c-b	=	60		(metres)
q c-a	=	165	118	(pcu/hr)
q c-b	=	233	184	(pcu/hr)

MINOR ROAD (ARM B)

		(A.M.)	(P.M.)	
W b-a	=	3.50		(metres)
W b-c	=	2.60		(metres)
Vl b-a	=	70		(metres)
Vr b-a	=	60		(metres)
Vr b-c	=	60		(metres)
q b-a	=	240	135	(pcu/hr)
q b-c	=	363	216	(pcu/hr)

GEOMETRIC FACTORS :

D	=	0.888
E	=	0.853
F	=	0.621
Y	=	0.655

THE CAPACITY OF MOVEMENT :

	(A.M.)	(P.M.)
Q b-a =	391	433
Q b-c =	565	585
Q c-b =	385	406
Q b-ac =	480	515.6

TOTAL FLOW (A.M.) = 1525.186069 (PCU/HR)
TOTAL FLOW (P.M.) = 1035.446646 (PCU/HR)

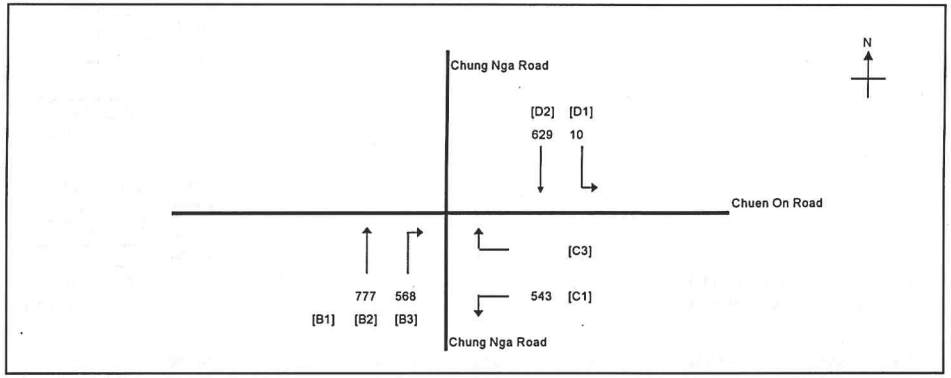
COMPARISION OF DESIGN FLOW TO CAPACITY:

		(A.M.)	(P.M.)
DFC b-a	=	0.6141	0.3110
DFC b-c	=	0.6423	0.3699
DFC c-b	=	0.6047	0.4531
DFC b-ac	=	1.2564	0.6809

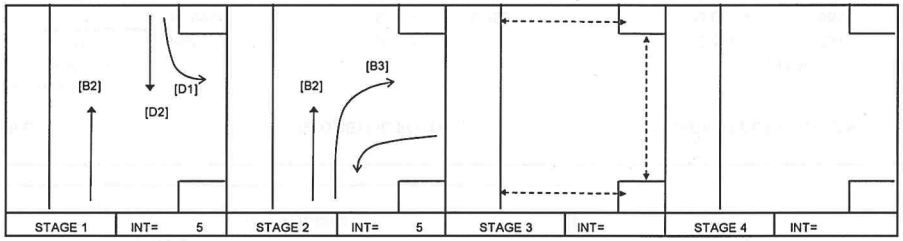
CRITICAL DFC (A.M.) = 0.64

CRITICAL DFC (P.M.) = 0.45

OVE ARUP & PARTNERS	TRAFFIC SIGNAL CALCULATION		
		PROJECT NO: 244005	
J4 - Chung Nga Road (S) / Chuen On Road	2030_AM_design_imp	DATE : 19-Apr-16	FILENAME :



No. of stages per cycle		N =	4
No. of stage using for calculation		N =	2
Cycle time		C =	75 sec
Sum(y)		Y =	0.455
Loss time		L =	31 sec
Total Flow		=	2527.193 pcu
Co	= (1.5*L+5)/(1-Y)	=	94.4 sec
Cm	= L/(1-Y)	=	56.8 sec
Yult		=	0.668
R.C.ult	= (Yult-Y)/Y*100%	=	46.9 %
Cp	= 0.9*L/(0.9-Y)	=	62.6 sec
Ymax	= 1-L/C	=	0.587
R.C.(C)	= (0.9*Ymax-Y)/Y*100%	=	16.2 % (Optimized)



Pedestrian Phase	Width (m)	Green Time Required (s) SG	Delay	FG	Green Time Provided (s) SG	Delay	FG	Check
1	8	7	11	5	7	11	5	OK

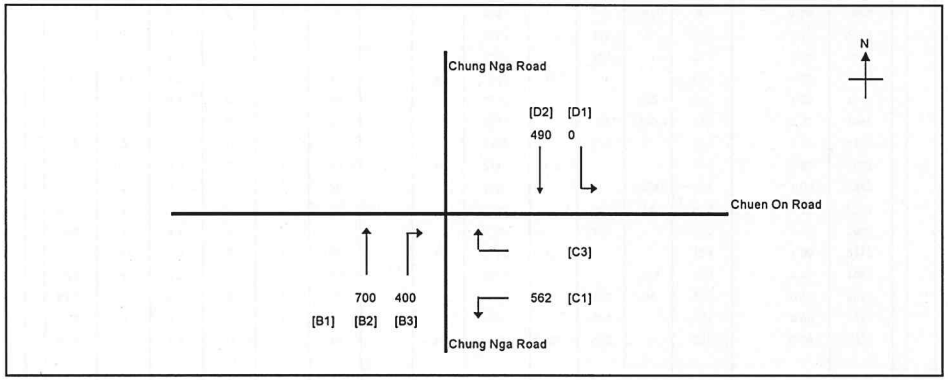
Move-ment	Stage	Lane Width m.	Phase	No. of lane	Radius m.	O	N	Straight-Ahead Sat. Flow	m Left pcu/h	m Straight pcu/h	m Right pcu/h	Total Flow pcu/h	Proportion of Turning Vehicles	Sat. Flow pcu/h	Uphill Gradien %	Short lane Effect pcu/h	Revised Sat. Flow pcu/h	y	Greater y	L sec	g (required) sec	g (input) sec	Degree of Saturation X	Queuing Length m.
																				8				
B2	1,2	3.50		1			N	1965		777		777	0.00	1965			1965	0.395			38	37	0.801	49
B3	2	3.50		1	15			2105			568	568	1.00	1914			1914	0.297	0.297		29	14	1.589	58
C1	2	3.50		2	15		N	4070	543			543	1.00	3700			3700	0.147			14	11	1.001	29
D2	1	3.50		1				2105		331		331	0.00	2105			2105	0.157	0.158		15	19	0.621	31
D1,D2	1	3.50		1	10		N	1965	10	298		309	0.03	1955			1955	0.158			15	19	0.623	29
Ped	4																			23				

NOTE : 'O - OPPOSING TRAFFIC N - NEAR SIDE LANE SG - STEADY GREEN FG - FLASHING GREEN PEDESTRIAN WALKING SPEED = 1.2m/s

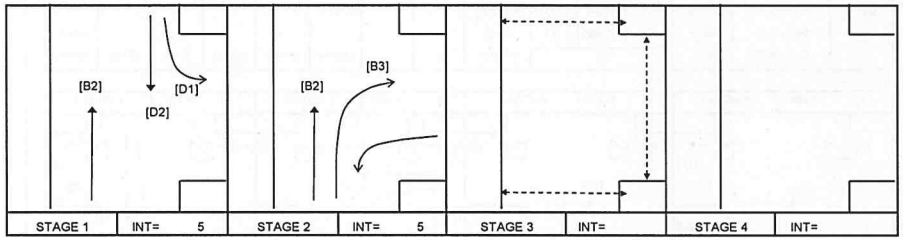
QUEUING LENGTH = AVERAGE QUEUE * 6m

N/A: UNSTABLE QUEUE LENGTH DUE TO SATURATION

OVE ARUP & PARTNERS	TRAFFIC SIGNAL CALCULATION		
		PROJECT NO: 244005	
J4 - Chung Nga Road (S) / Chuen On Road	2030_PM_design_imp	DATE : 19-Apr-16	FILENAME :



No. of stages per cycle		N =	4
No. of stage using for calculation		N =	2
Cycle time		C =	75 sec
Sum(y)		Y =	0.330
Loss time		L =	31 sec
Total Flow		=	2151.466 pcu
Co	= (1.5*L+5)/(1-Y)	=	76.8 sec
Cm	= L/(1-Y)	=	46.3 sec
Yult		=	0.668
R.C.ult	= (Yult-Y)/Y*100%	=	102.4 %
Cp	= 0.9*L/(0.9-Y)	=	48.9 sec
Ymax	= 1-L/C	=	0.587
R.C.(C)	= (0.9*Ymax-Y)/Y*100%	=	60.1 % (Optimized)



Pedestrian Phase	Width (m)	Green Time Required (s) SG	Delay	FG	Green Time Provided (s) SG	Delay	FG	Check
1	8	7	11	5	7	11	5	OK

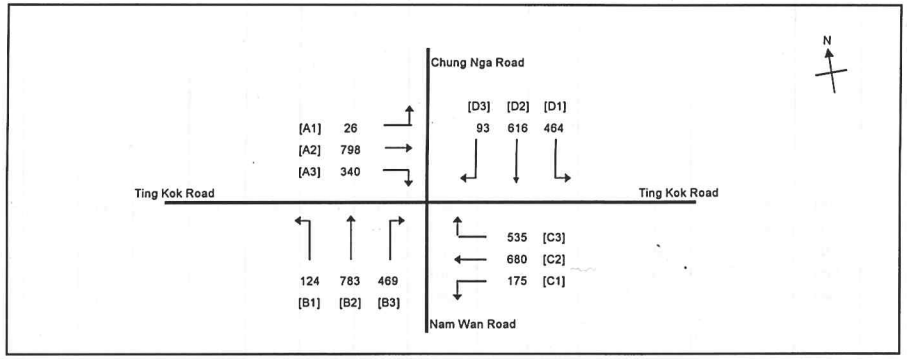
Move-ment	Stage	Lane Width m.	Phase	No. of lane	Radius m.	O	N	Straight-Ahead Sat. Flow	m Left pcu/h	m Straight pcu/h	m Right pcu/h	Total Flow pcu/h	Proportion of Turning Vehicles	Sat. Flow pcu/h	Uphill Gradien %	Short lane Effect pcu/h	Revised Sat. Flow pcu/h	y	Greater y	L sec	g (required) sec	g (input) sec	Degree of Saturation X	Queuing Length m.
																				8				
B2	1,2	3.50		1			N	1965		700		700	0.00	1965			1965	0.356			47	37	0.722	44
B3	2	3.50		1	15			2105			400	400	1.00	1914			1914	0.209	0.209		28	14	1.121	41
C1	2	3.50		2	15		N	4070	562			562	1.00	3700			3700	0.152			20	11	1.035	30
D2	1	3.50		1				2105		253		253	0.00	2105			2105	0.120	0.121		16	19	0.474	24
D1,D2	1	3.50		1	10		N	1965	0	237		237	0.00	1965			1965	0.121			16	19	0.476	22
Ped	4																			23				

NOTE : 'O - OPPOSING TRAFFIC N - NEAR SIDE LANE SG - STEADY GREEN FG - FLASHING GREEN PEDESTRIAN WALKING SPEED = 1.2m/s

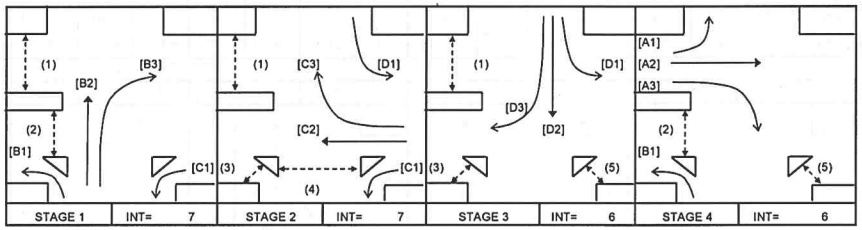
QUEUING LENGTH = AVERAGE QUEUE * 6m

N/A: UNSTABLE QUEUE LENGTH DUE TO SATURATION

OVE ARUP & PARTNERS	TRAFFIC SIGNAL CALCULATION		
		PROJECT NO: 244005	
J5 - Ting Kok Road / Nam Wan Road / Chung Nga Road	2030_AM_design_imp	DATE : 21-Apr-16	FILENAME :



No. of stages per cycle		N =	4
No. of stage using for calculation		N =	4
Cycle time		C =	128 sec
Sum(y)		Y =	0.648
Loss time		L =	22 sec
Total Flow		=	5102.946 pcu
Co	= (1.5*L+5)/(1-Y)	=	108.0 sec
Cm	= L/(1-Y)	=	62.6 sec
Yult		=	0.735
R.C.ult	= (Yult-Y)/Y*100%	=	13.4 %
Cp	= 0.9*L/(0.9-Y)	=	78.7 sec
Ymax	= 1-L/C	=	0.828
R.C.(P)	= (0.9/Xmax-1)*100%	=	15.0 % (Actual)
R.C.(C)	= (0.9*Ymax-Y)/Y*100%	=	15.0 % (Optimized)

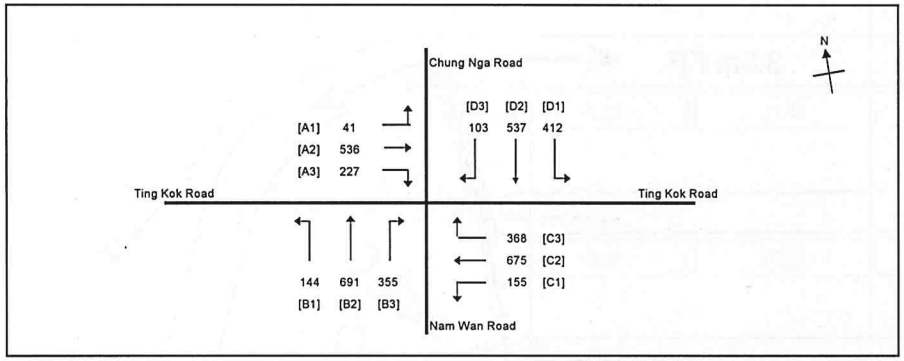


Pedestrian Phase	Width (m)	Green Time Required (s) SG	Delay	FG	Green Time Provided (s) SG	Delay	FG	Check
1	13.5	5		11	87	1	11	OK
2	10	5		8	52	8	8	OK
3	5.5	5		5	55	0	5	OK
4	11	5		9	20	1	9	OK
5	5.5	5		5	52	1	5	OK

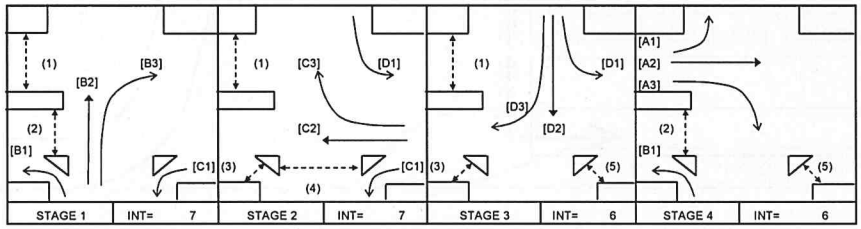
Move-ment	Stage	Lane Width m.	Phase	No. of lane	Radius m.	O	N	Straight-Ahead Sat. Flow	m Left pcu/h	m Straight pcu/h	m Right pcu/h	Total Flow pcu/h	Proportion of Turning Vehicles	Sat. Flow pcu/h	Uphill Gradien %	Short lane Effect pcu/h	Revised Sat. Flow pcu/h	y	Greater y	L sec	g (required) sec	g (input) sec	Degree of Saturation X	Queuing Length m.
																				22				
A1,A2	4	3.3	G	1	15		N	1945	26	252		278	0.09	1927			1927	0.144	0.145		24	24	0.776	48
A2	4	3.3	G	1				2085		301		301	0.00	2085			2085	0.145			24	24	0.779	52
A2,A3	4	3.3	G	1	20			2085		245	54	299	0.18	2057			2057	0.145			24	24	0.783	52
A3	4	3.3	G	1	25			2085			286	286	1.00	1967			1967	0.145			24	24	0.783	50
B1	1,4	5.5	B	1	60		N	2165	124			124	1.00	2112			2112	0.059			10	62	0.120	14
B2	1	3.4	A	1				2095		430		430	0.00	2095			2095	0.205	0.205		34	34	0.783	68
B2,B3	1	3.4	A	1	25			2095		353	70	423	0.17	2074			2074	0.204			33	34	0.779	67
B3	1	3.4	A	1	20			2095			399	399	1.00	1949			1949	0.205			33	34	0.780	63
C1	1,2	5.3	C	1	35		N	2145	175			175	1.00	2057			2057	0.085			14	63	0.173	19
C2	2	3.4	D	2				4190		625		625	0.00	4190			4190	0.149	0.150		24	24	0.779	54
C2,C3	2	3.4	D	1	25			2095		55	243	298	0.82	1997			1997	0.149			24	24	0.780	51
C3	2	3.4	D	1	20			2095			292	292	1.00	1949			1949	0.150			24	24	0.783	50
D1	2,3	3.3	E	1	15		N	1945	464			464	1.00	1768			1768	0.262			43	53	0.637	58
D2	3	3.3	F	1				2085		308		308	0.00	2085			2085	0.148	0.148		24	24	0.782	53
D2,D3	3	3.3	F	1	25			2085		308	0	308	0.00	2085			2085	0.148			24	24	0.783	53
D3	3	3.3	F	1	20			2085			93	93	1.00	1940			1940	0.048			8	24	0.253	16

NOTE : 'O - OPPOSING TRAFFIC N - NEAR SIDE LANE SG - STEADY GREEN FG - FLASHING GREEN PEDESTRIAN WALKING SPEED = 1.2m/s QUEUING LENGTH = AVERAGE QUEUE * 6m

OVE ARUP & PARTNERS	TRAFFIC SIGNAL CALCULATION		
		PROJECT NO: 244005	
J5 - Ting Kok Road / Nam Wan Road / Chung Nga Road	2030_PM_design_imp	DATE : 21-Apr-16	FILENAME :



No. of stages per cycle		N =	4	
No. of stage using for calculation		N =	4	
Cycle time		C =	128	sec
Sum(y)		Y =	0.529	
Loss time		L =	22	sec
Total Flow		=	4242.977	pcu
Co	= (1.5*L+5)/(1-Y)	=	80.7	sec
Cm	= L/(1-Y)	=	46.7	sec
Yult		=	0.735	
R.C.ult	= (Yult-Y)/Y*100%	=	39.0	%
Cp	= 0.9*L/(0.9-Y)	=	53.4	sec
Ymax	= 1-L/C	=	0.828	
R.C.(P)	= (0.9/Xmax-1)*100%	=	40.9	% (Actual)
R.C.(C)	= (0.9*Ymax-Y)/Y*100%	=	40.9	% (Optimized)

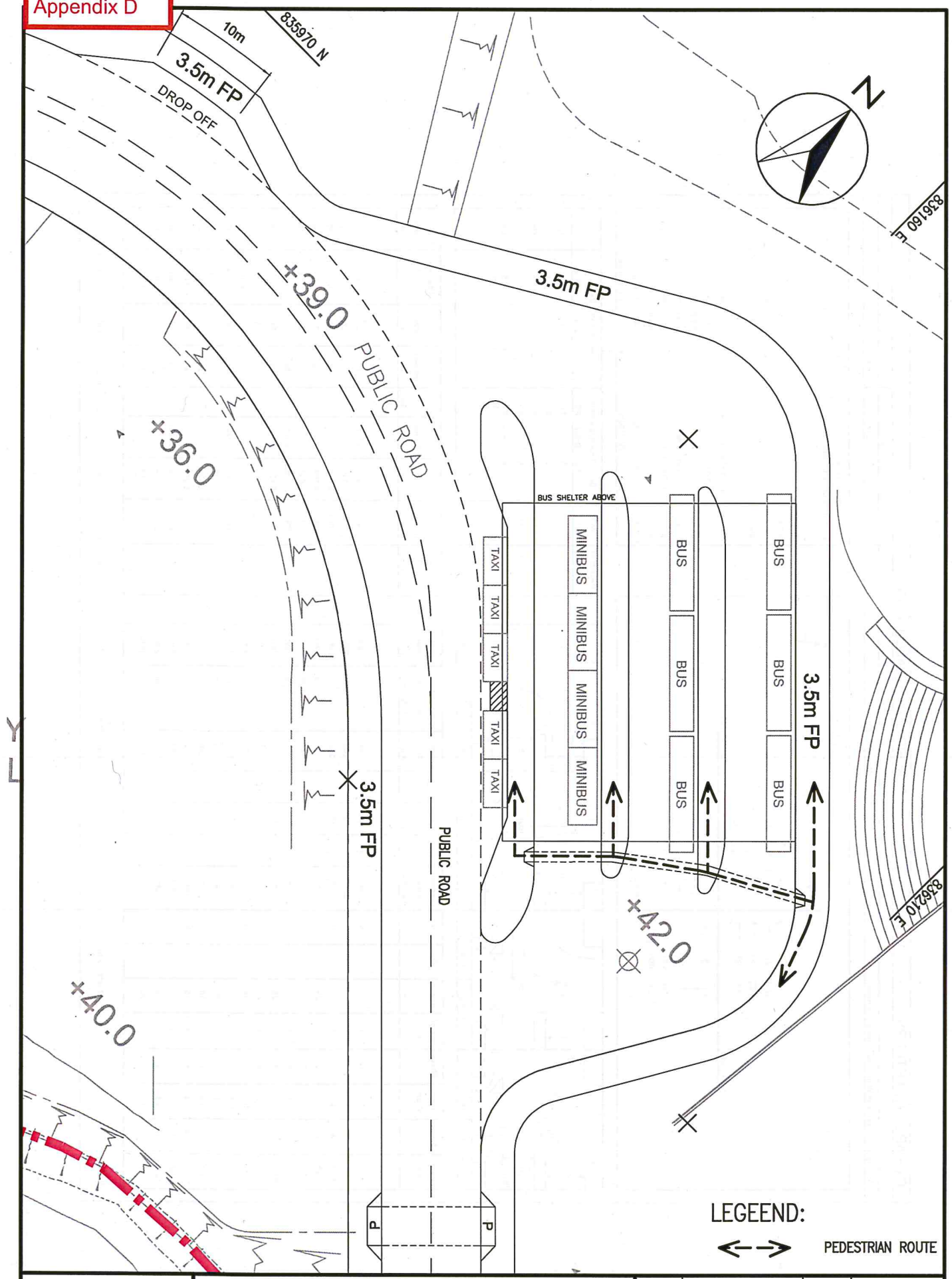


Pedestrian Phase	Width (m)	Green Time Required (s) SG	Delay	FG	Green Time Provided (s) SG	Delay	FG	Check
1	13.5	5		11	91	1	11	OK
2	10	5		8	49	8	8	OK
3	5.5	5		5	58	0	5	OK
4	11	5		9	22	1	9	OK
5	5.5	5		5	50	1	5	OK

Move-ment	Stage	Lane Width m.	Phase	No. of lane	Radius m.	O	N	Straight-Ahead Sat. Flow	m Left pcu/h	m Straight pcu/h	m Right pcu/h	Total Flow pcu/h	Proportion of Turning Vehicles	Sat. Flow pcu/h	Uphill Gradien %	Short lane Effect pcu/h	Revised Sat. Flow pcu/h	y	Greater y	L sec	g (required) sec	g (input) sec	Degree of Saturation X	Queuing Length m.
																				22				
A1,A2	4	3.3	G	1	15		N	1945	41	150		191	0.22	1904			1904	0.100	0.101		20	20	0.636	34
A2	4	3.3	G	1				2085		208		208	0.00	2085			2085	0.100			20	20	0.631	37
A2,A3	4	3.3	G	1	20			2085		178	30	208	0.14	2063			2063	0.101			20	20	0.639	37
A3	4	3.3	G	1	25			2085			197	197	1.00	1967			1967	0.100			20	20	0.633	35
B1	1,4	5.5	B	1	60		N	2165	144			144	1.00	2112			2112	0.068			14	59	0.147	16
B2	1	3.4	A	1				2095		357		357	0.00	2095			2095	0.170	0.171		34	34	0.636	56
B2,B3	1	3.4	A	1	25			2095		334	23	357	0.06	2087			2087	0.171			34	34	0.639	56
B3	1	3.4	A	1	20			2095			332	332	1.00	1949			1949	0.171			34	34	0.637	52
C1	1,2	5.3	C	1	35		N	2145	155			155	1.00	2057			2057	0.075			15	65	0.148	16
C2	2	3.4	D	2				4190		533		533	0.00	4190			4190	0.127	0.128		25	26	0.634	45
C2,C3	2	3.4	D	1	25			2095		142	118	260	0.45	2039			2039	0.127			26	26	0.635	44
C3	2	3.4	D	1	20			2095			250	250	1.00	1949			1949	0.128			26	26	0.639	43
D1	2,3	3.3	E	1	15		N	1945	412			412	1.00	1768			1768	0.233			47	56	0.537	50
D2	3	3.3	F	1				2085		268		268	0.00	2085			2085	0.129	0.129		26	26	0.637	46
D2,D3	3	3.3	F	1	25			2085		269	0	269	0.00	2085			2085	0.129			26	26	0.639	46
D3	3	3.3	F	1	20			2085			103	103	1.00	1940			1940	0.053			11	26	0.263	18

NOTE : 'O - OPPOSING TRAFFIC N - NEAR SIDE LANE SG - STEADY GREEN FG - FLASHING GREEN PEDESTRIAN WALKING SPEED = 1.2m/s QUEUING LENGTH = AVERAGE QUEUE * 6m

Appendix D



CONSULTANT: AECOM	PROPOSED PRH DEVELOPMENT AT CHUNG NGA ROAD AND TAI PO AREA 9, TAI PO PROPOSED BUS TERMINUS LAYOUT	SCALE: A4 1 : 500	DATE: JUN. 2014
		CHECK: -	DRAWN: DW
		JOB No.: 60266561	DRAWING No.: FIG 5.1 REV: H

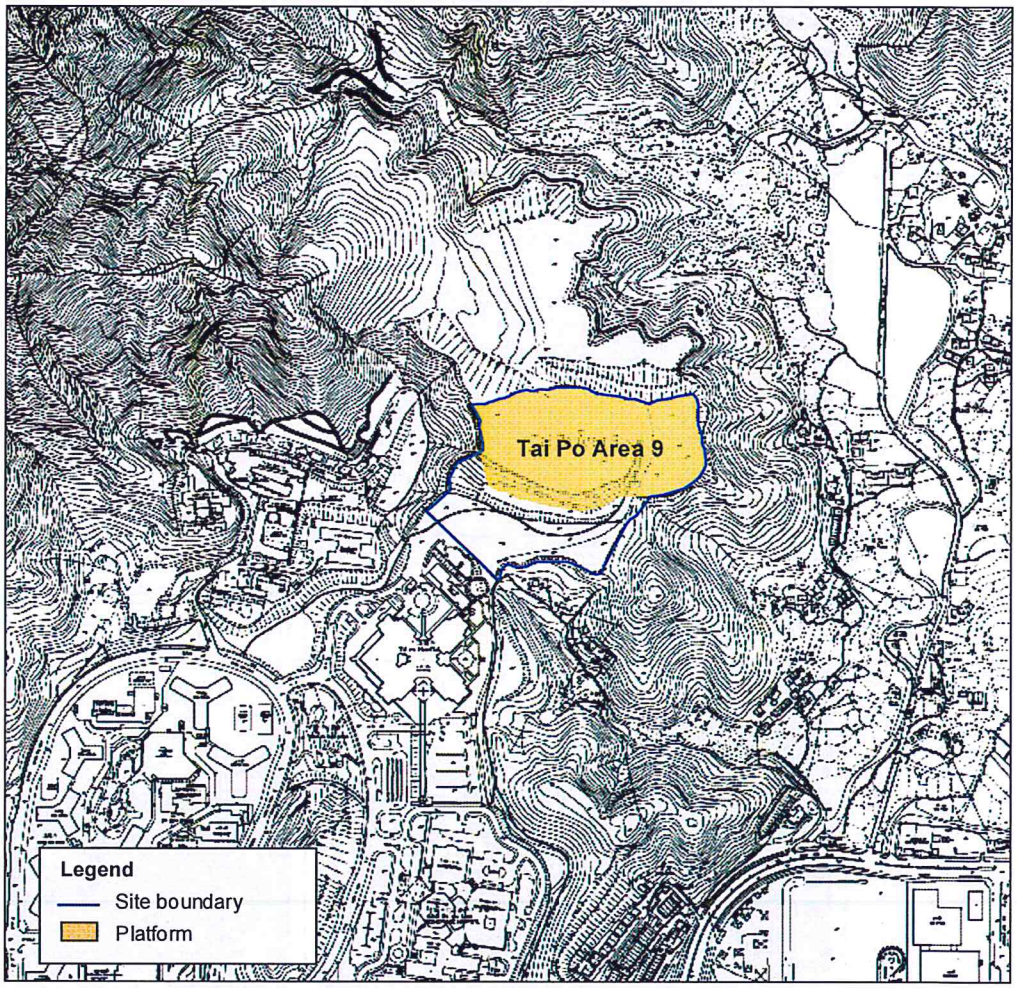
P:\PROJECTS\60266561\DRAWING\REPORT\108\108_513.DWG ZHOU, YUAN 2014/6/11

1 Introduction

Ove Arup & Partners Hong Kong Ltd (Arup) was commissioned by the Hong Kong Housing Authority (HKHA) to conduct a qualitative review study of chimney emission impact on the proposed public housing development (PHD option) in Tai Po Area 9. The study will include a chimney survey within 500m of the site and qualitative review of the potential impacts caused by the identified chimney emission on the proposed development.

The proposed public housing development is located in Tai Po Area 9 at about 150m to the north-east of Hong Chi Association Head office, Hong Chi Pinehill School and Hong Chi Pinehill Integrated Vocational Training Centre. To the east of the site are some scattered village houses including Lau Hang, Mak Uk and Fung Yuen Lo Tsuen. Tai Po hospital and Alice Ho Miu Lai Nethersole Hospital are located at about 170m and 450m respectively to the south of the site. The northern boundary of the site is mainly hilly areas of the Cloudy Hill. **Figure 1.1** shows the location of the proposed site.

Figure 1.1 Site Location



2 Chimney Survey

The site is currently vacant and located on the uphill areas. A chimney survey was conducted within 500m of the study site on 14 February 2009. Chimney was identified on a walk-over basis where site access is allowed and practicable. Photograph records were taken at the site and the neighbouring areas within 500m of the study site. **Figures 2.1 to 2.5** indicate the existing environment of the site and its surrounds.

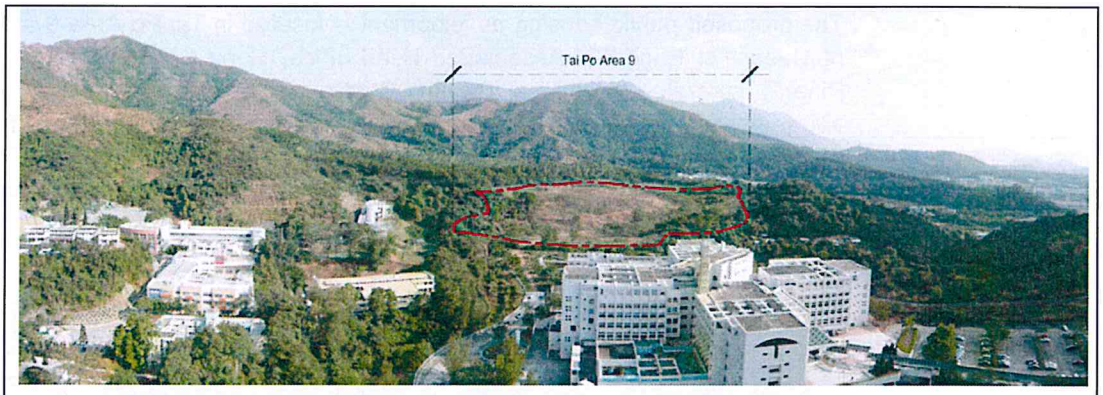


Figure 2.1: Existing site

Figure 2.2: Existing hospital located at south-west of the site

Figure 2.3: Existing training centre located at the west of the site

Figure 2.4: Lau Hang Village

Figure 2.5: Kau Shi Wai Village

Based on the survey, a total of six chimneys were found within 500m of the subject site (**Table 2.1**), including three in Tai Po Hospital and three in Alice Ho Miu Ling Nethersole Hospital. One chimney in the Lee Kam Kei factory in Fung Yuen was found at about 580m.

Two chimneys were also identified in Yu Kok Village at about 520m but they were no longer used.

Table 2.1: Summary of Chimney Survey

ID	Location	Approx Distance (m)	No.	Remarks
TP-01	Tai Po Hospital	240	1	Chimney of Hospital
TP-02	Tai Po Hospital	195	2	Chimney of Hospital
TP-03	Tai Po Hospital	170	3	Chimney of Hospital
N-01	Nethersole Hospital	450	4	Chimney of Hospital
N-02	Nethersole Hospital	475	5	Chimney of Hospital
N-03	Nethersole Hospital	455	6	Chimney of Hospital
YK-01	Yu Kok Village	520	7	Old chimney, not used during survey
YK-02	Yu Kok Village	520	8	Old chimney, not used during survey
FY-01	Fung Yuen	580	9	Chimney of Factory

Note: Distance is measured from the site platform boundary to the chimney.

The site photographs of the chimneys identified during the survey are shown in **Figures 2.6 to 2.14**. The chimney locations are illustrated in **Figure 2.15**.

Figure 2.6: TP-01 Tai Po Hospital

Figure 2.7: TP-02 Tai Po Hospital

Figure 2.8: TP-03 Tai Po Hospital

Figure 2.9: N-01 Alice Ho Miu Ling Nethersole Hospital

Figure 2.10: N-02 Alice Ho Miu Ling Nethersole Hospital

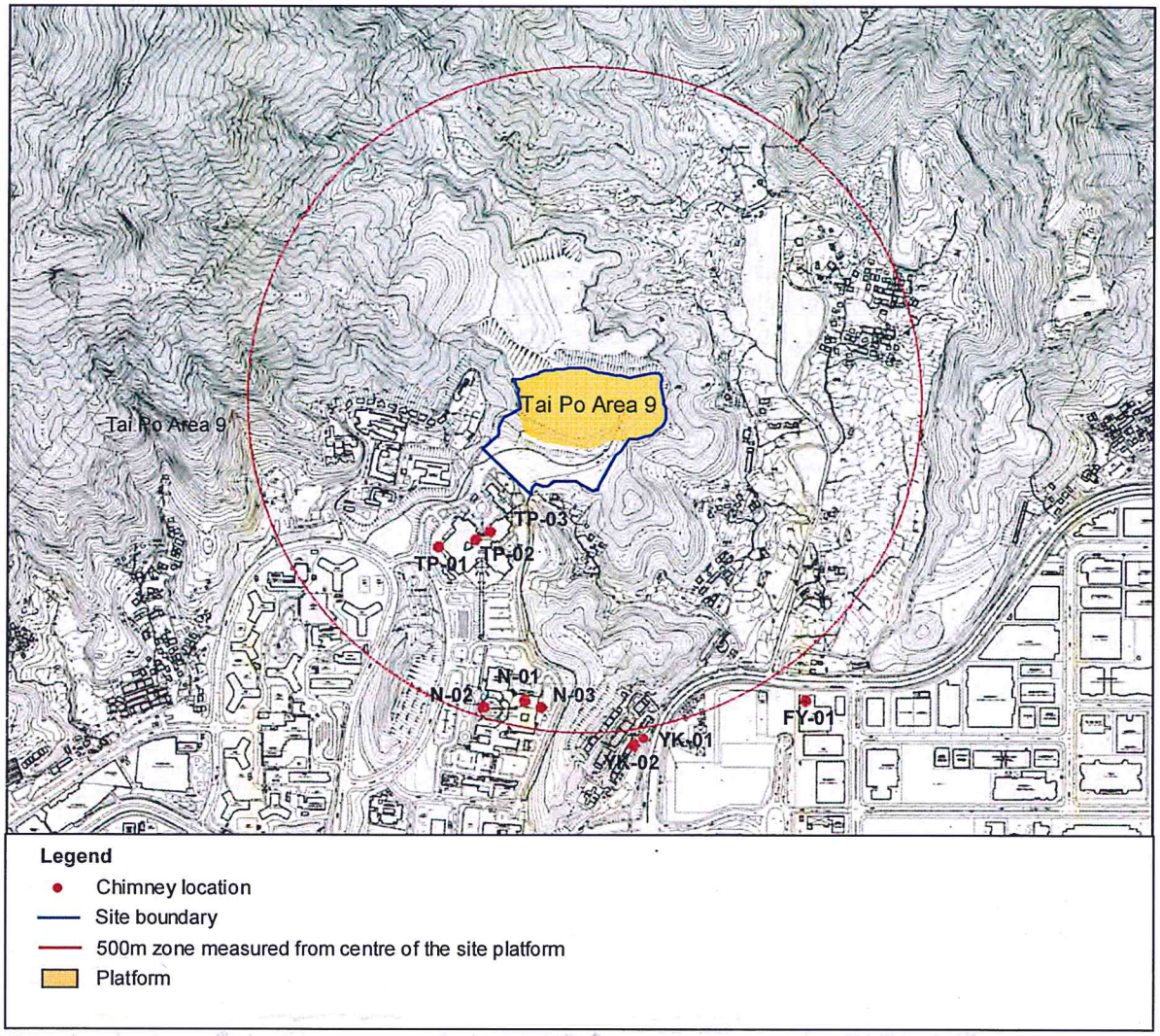
Figure 2.11: N-03 Alice Ho Miu Ling Nethersole Hospital

Figure 2.12: YK-01 Yu Kok Village

Figure 2.13: YK-02 Yu Kok Village

Figure 2.14: FY-02 Fung Yuen

Figure 2.15 Location of chimneys



There were no chimneys identified at the other areas within 500m of the site and the photograph records are given in Appendix 1.

3 Review of Chimney Emission Impact

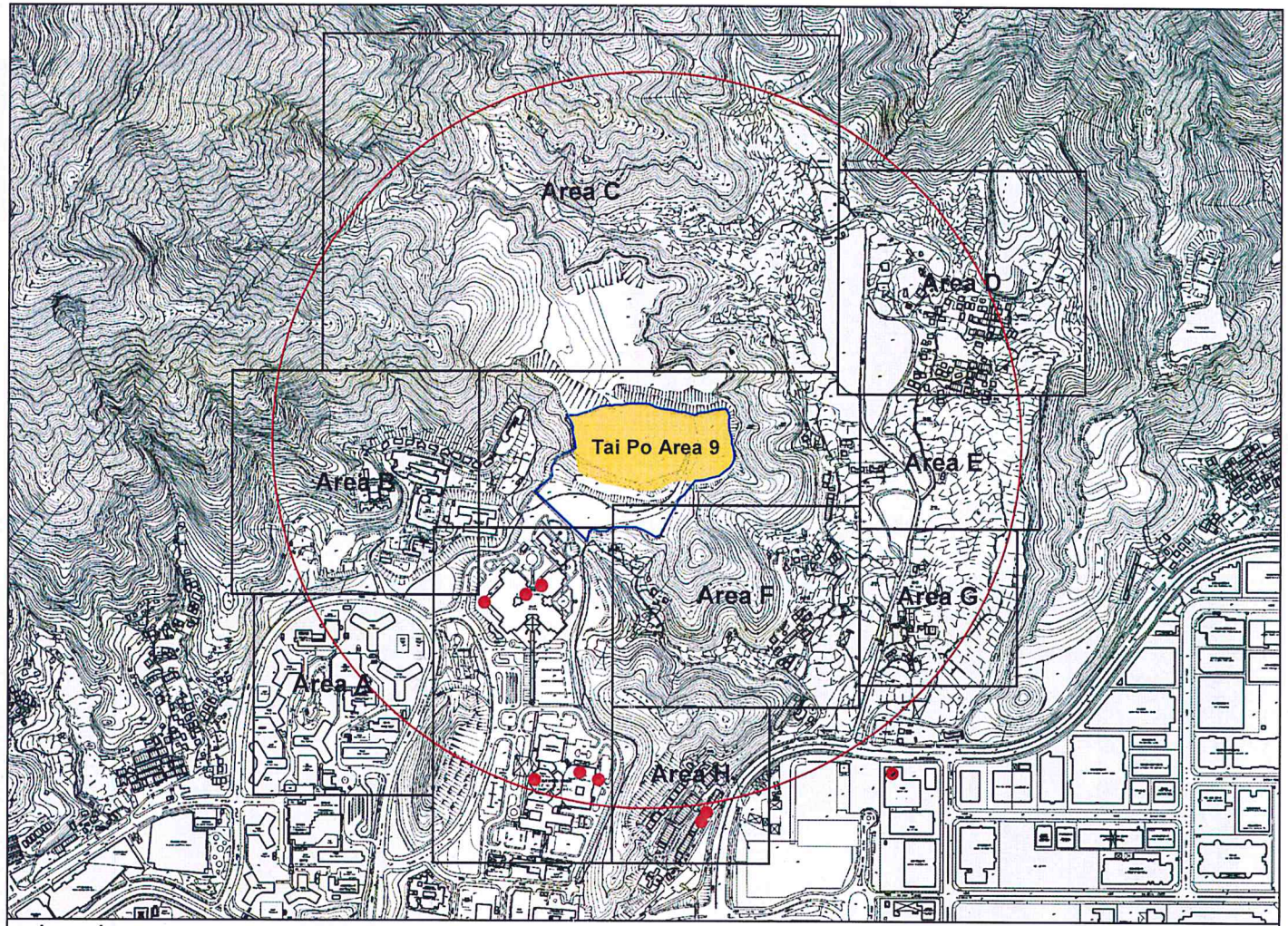
The present survey identified six chimneys within 500m of the subject site, including three chimneys in Tai Po Hospital (at 170m, 195m and 240m) and three chimneys in Alice Ho Miu Ling Nethersole Hospital (at 450m, 455m and 475m). They are operated under license and are controlled under the Air Pollution Control Ordinance.

In accordance with HKPSG, hospitals may require large boilers for providing steam and hot water and special purpose incinerators to burn pathological waste. Chimneys associated with this equipment have the potential to cause nuisance to neighbours. Although it is understood that the majority of clinical waste generated in Hong Kong is disposed of in special pre-excavated trenches at the landfills, a small amount of clinical waste consisting of human tissues and amputated organs are incinerated at the four pathological incinerators at the Tuen Mun Hospital and Yan Chai Hospital according to the internet information. Nonetheless, likelihood of operation of such kind of incineration at Tai Po and Alice Ho Miu Ling Nethersole Hospitals cannot be ruled out.

For better planning purpose, high-rise buildings and comparatively low-rise chimneys should not be located close to each other as it would cause serious air pollution due to direct impingement by the chimney plume onto the taller buildings. It is noted that EPD should be consulted if any sensitive uses are to be sited within 500m of an area with chimney emission. The HKPSG recommends a buffer distance of 200m from such chimneys.

There are a total of six chimneys found in 500m vicinity of Tai Po Area 9 and the closest one is at a separation distance of 170m only. The proposed site is located in Tai Po airshed which is topographically confined by hills and the air pollution dispersion in this area is inhibited. It is likely that EPD would have great concern on the proposed use for the public rental housing which may be potentially affected by adverse air quality impacts due to the adjacent chimney exhaust. In consideration of all these factors, potential chimney emission impact on the proposed public housing development cannot be ruled out. It is environmentally not preferable to build massive high rise public housing blocks at Tai Po Area 9.

Appendix 1


Area C
Area D
Tai Po Area 9
Area E
Area B
Area F
Area G
Area A
Area H
Legend
Chimney location
Site boundary
500m zone measured from centre of the site platform
Platform

Area A

Fu Heng Estate

Fu Heng Estate (School)

Fu Heng Estate (Community Centre)

Fu Heng Estate (Shopping Mall)

Area B

Pinehill Village (Farmland)

Pinehill Village (Farmland)

Pinehill Village (Training Center)

Pinehill Village (Hilly Areas)

Area C

Cloudy Hill

Cloudy Hill

Cloudy Hill

Cloudy Hill

Area D

Fung Yuen Lo Tsuen (Village)

Mak Uk (Village)

Mak Uk (Village)

Mak Uk (Village)

Area E

Lau Hang (Village)

Lau Hang (Village)

Lau Hang (Village)

Lau Hang (Village)

Area F

Kau Shi Wai (Village)

Kau Shi Wai (Village)

Kau Shi Wai (Village)

Kau Shi Wai (Village)

Area G

Tin Sam (Village)

Tin Sam (Village)

Tin Sam (Village)

Tin Sam (Village)

Area H

Yue Kok Tsuen (Village)

Yue Kok Tsuen (Village)

Yue Kok Tsuen (Village)

Yue Kok Tsuen (Village)

8 AIR QUALITY IMPACT ASSESSMENT

8.1 Air Quality Criteria

8.1.1 The air quality impact assessment criteria are derived from the Air Pollution Control Ordinance (APCO) (Cap. 311). The APCO provides power for controlling air pollutants from a variety of stationary and mobile sources and determining a number of Air Quality Objectives (AQOs). Currently AQOs stipulate concentrations for a range of air pollutants namely sulphur dioxide (SO_2), total suspended particulates (TSP), respirable suspended particulates (RSP), nitrogen dioxide (NO_2), carbon monoxide (CO), photochemical oxidants (as ozone), and lead (Pb). The prevailing AQOs are listed in **Table 8.1**.

Table 8.1 Hong Kong Air Quality Objectives

Pollutant	Concentration in micrograms per cubic metre [1] (Parts per million, ppm in brackets)				
	1 Hour [2]	8 Hour [3]	24 Hours [3]	3 Months [4]	1 Year [4]
Sulphur Dioxide	800 (0.3)		350 (0.13)		80 (0.03)
Total Suspended Particulates	500 [7]		260		80
Respirable Suspended Particulates [5]			180		55
Carbon Monoxide	30,000 (26.2)	10,000 (8.7)			
Nitrogen Dioxide	300 (0.16)		150 (0.08)		80 (0.04)
Photochemical Oxidants (as ozone) [6]	240				
Lead				1.5	

Notes:
[1] Measured at 298°K and 101.325 kPa.
[2] Not to be exceeded more than three times per year.
[3] Not to be exceeded more than once per year.
[4] Arithmetic mean.
[5] Respirable suspended particulates means suspended particulates in air with a nominal aerodynamic diameter of 10 micrometres or smaller.
[6] Photochemical oxidants are determined by measurement of ozone only.
[7] Not an AQO but is a criterion for evaluating air quality impacts as stated in EPD's environmental control clauses.

8.1.2 Chapter 9 of "Environment" of the Hong Kong Planning Standards and Guidelines (HKPSG) also suggests the buffer distance requirements for roads and highways.

8.2 Ambient Air Quality

8.2.1 The ambient air quality of the subject site has been determined based on the EPD's monitoring data from Year 2007 to Year 2011 at Tai Po monitoring station. **Table 8.2** summarizes the annual average concentrations of the key air pollutants due to vehicle and chimney emissions recorded at the monitoring station from 2007 to 2011.

8.2.2 Results show that in the most recent 5 years, they were all in compliance with the statutory AQOs. The background pollutant concentrations were [redacted], [redacted] and [redacted] $\mu g/m^3$ for NO_2, SO_2 and RSP, respectively.

Table 8.2 Annual Average Concentrations of Pollutants from 2007 to 2011 at EPD's Air Quality Monitoring Station (Tai Po)

Pollutant	Annual AQO ($\mu g/m^3$)	Annual Average Concentration ($\mu g/m^3$)				
		2007	2008	2009	2010	2011
RSP	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SO_2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
NO_2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

8.3 Review of Vehicular Emission Impact and Setback Requirement

8.3.1 Chung Nga Road East is bounded by Chung Nga Road to the south; Chuen On Road to the east; and the access road to Pinehill Village to the west. For Chung Nga Road West, it is bounded by Chung Nga Road to the south and the access road to Pinehill Village to the east. The location plan for the subject sites is shown in **Figure 8.1**.

8.3.2 In accordance with the traffic flow data presented in **Section 4**, the peak-hour two-way traffic flow for Chung Nga Road and Chuen On Road are 980 vehicles/hour and 530 vehicles/hour respectively as illustrated in **Figure 8.1**. Classification of Type of Road and recommended Buffer Distance in accordance HKPSG are summarised in below **Table 8.3**:

Table 8.3 Classification of Type of Road and Recommended Buffer Distance

	Type of Road	Recommended Buffer Distance (HKPSG)	Buffer Distance	
			Chung Nga Road East	Chung Nga Road West
Chung Nga Road	District Distributor	>10m	23m	10m
Chuen On Road	Local Distributor	>5m	12m	N/A
Access Road to Pinehill Village	-	-	N/A	15m

8.3.3 As shown in **Figure 8.1** and above **Table 8.2**, all residential blocks are setback from adjacent roads with adequate buffer distance in accordance with HKPSG requirement for vehicular emission.

8.3.4 Considering the moderate traffic flows for the concerned roads and adequate buffer distances are allowed for the proposed development, No adverse vehicular emission impact is anticipated.

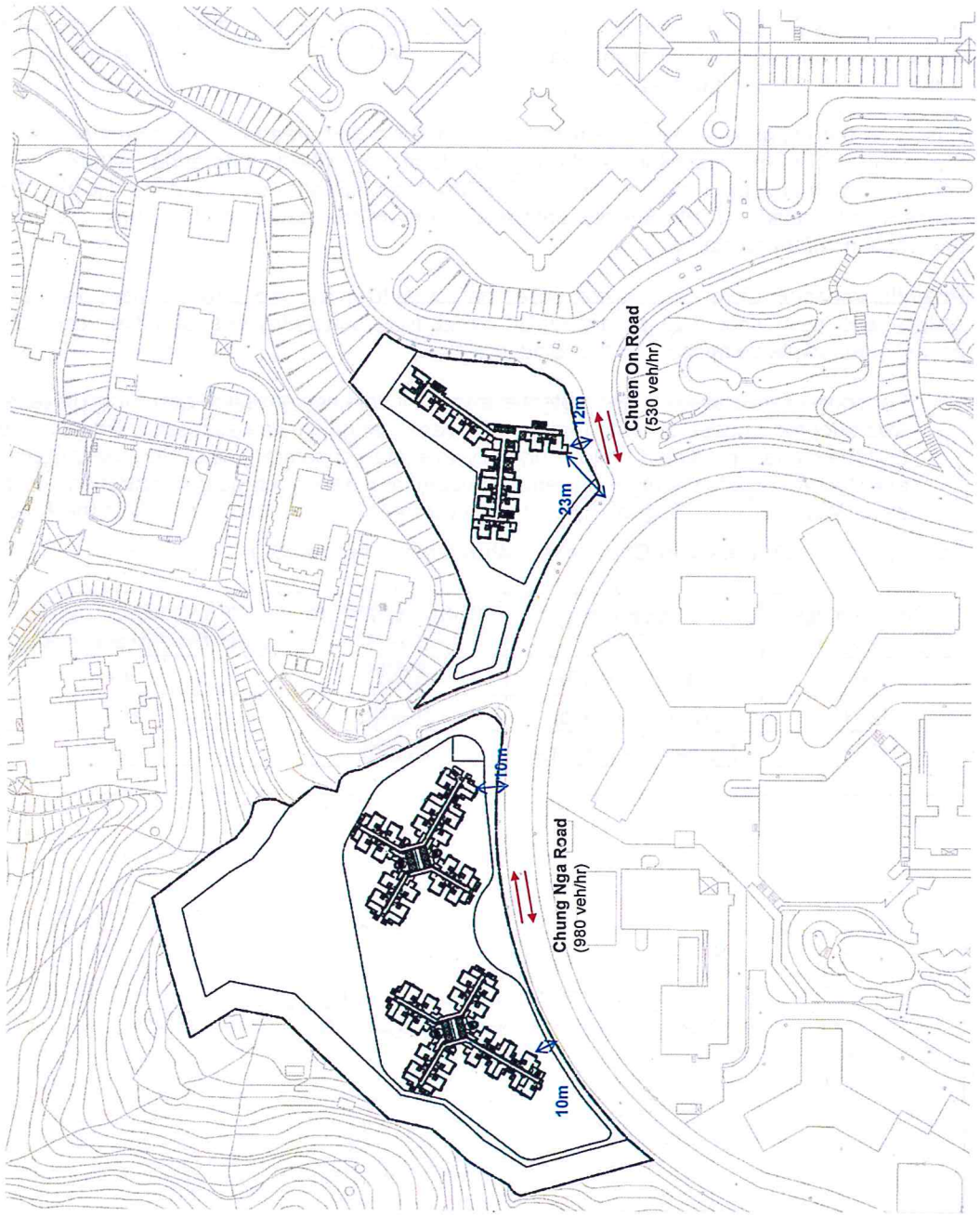


Figure 8.1 Location Plan of the Subject Site and Illustration of Two-way Traffic Flows

8.4 Review of Chimney Emission Impact

8.4.1 A quantitative review of chimney emission impact for the Eastern Site was conducted by AECOM in early 2011. Final report was submitted to EPD in May 2011. Major findings are summarised below for information:

8.4.2 Based on the chimney survey conducted within 500m study area from the potential site and the advices from Hospital Authority, a total of three operating stacks were connected with boilers, including two in Tai Po Hospital and one in Alice Ho Miu Ling Nethersole Hospital. **Table 8.4** presents a summary of the stacks, while **Figure 8.2** shows the locations of these stacks.

8.4.3 Potential impact of chimney emission based on actual towngas usage for normal operation of boilers was assessed. The predicted SO_2 and NO_2 concentrations at all representative assessment points complied with the relevant AQOs.

- For conservative assessment, potential impact of chimney emission assuming diesel fuel was adopted in case of abnormal or emergency situation was assessed. Results show that the highest predicted hourly and daily average concentrations of SO_2 were 42μg/m^3 and 20μg/m^3, while the highest predicted hourly and daily average concentrations of NO_2 were 249μg/m^3 and 78μg/m^3. The air quality impact is also found to be within the AQOs.

Table 8.4 Summary of Chimneys within 500m from the Site

Chimney ID	Location	Chimney Height (mPD)	Approximate Distance from the Potential Site (m)
H1	Tai Po Hospital	[redacted]	40
H2-H4	Tai Po Hospital	[redacted]	105
H5-H6	Nethersole Hospital	[redacted]	395

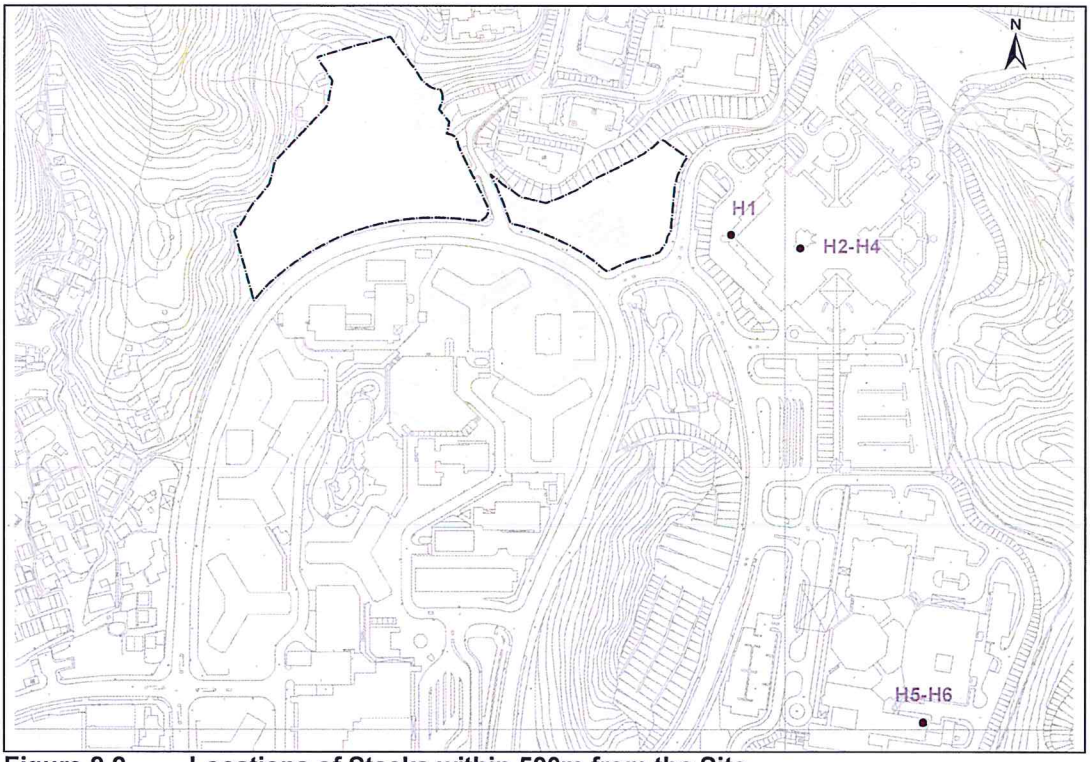


Figure 8.2 Locations of Stacks within 500m from the Site

8.4.4 Separate site inspections have been conducted recently in January 2013 to verify the information extracted from the previous chimney emission study. Based on the recent chimney survey conducted within 500m study area from the potential site, the information of operating stacks shown in **Table 8.4** and **Figure 8.2** remains unchanged and valid.

8.4.5 The operating parameters including gas exit velocity, gas exit temperature, location, height, diameter and emission rates of the stacks are based on the information extracted from the previous chimney emission study. A verification survey carried out by the Land Surveying Unit of Housing Department to record the locations and heights of the stacks are shown in **Appendix 8.2**.

8.4.6 In addition to the chimneys located within 500m study area from the potential site, the chimneys of Specified Processes within the Tai Po Industrial Estate have also been reviewed. **Table 8.5** presents a summary of the chimneys included in the assessment, while **Figure 8.3** shows the locations of them.

Table 8.5 Summary of Chimneys within Tai Po Industrial Estate

Chimney ID	Location	Chimney Height (mPD)	Approximate Distance from the Potential Site (m)
H5-H6	Nethersole Hospital	[redacted]	395
G1-G19	The Hong Kong and China Gas Co. Ltd.	[redacted]	1,060
M1-M9	Meyer Aluminium Limited	[redacted]	1,300
U1-U2	Universal (Hot-Dip) Galvanising Limited	[redacted]	980
Z1	Zama Industries Ltd.	[redacted]	1,700

8.4.7 For the chimneys of Specified Processes within the Tai Po Industrial Estate, the operating parameters are referred to the Register of Applications under Section 14(3)(a) of the Air Pollution Control Ordinance.

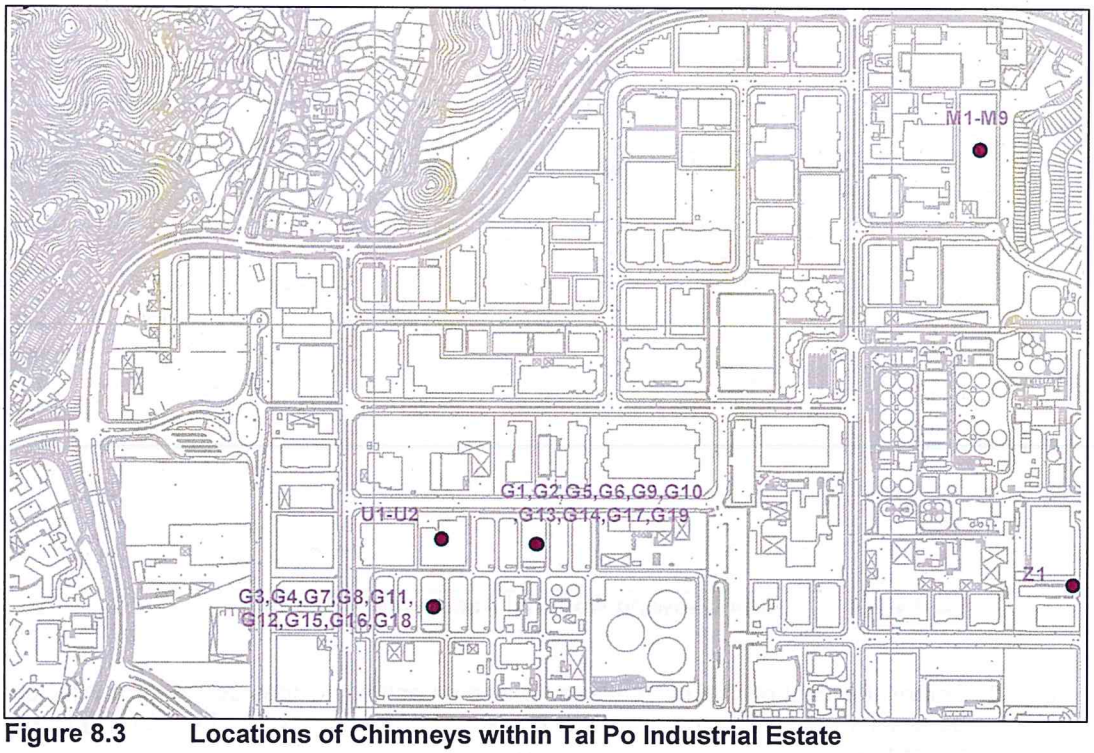


Figure 8.3 Locations of Chimneys within Tai Po Industrial Estate

Dispersion Modeling

8.4.8 Emissions (NO_2, SO_2 and RSP) from the identified chimneys have been modelled as point sources. The USEPA Industrial Source Complex Dispersion Model – Short Term Version 3 (ISCST3) model has been employed, and analysis has been conducted to establish the worst case 1-hour averaged, 24-hour averaged and annual averaged concentrations based on the latest real meteorological data recorded at Tai Mei Tuk Automatic Weather Station in Year 2011.

8.4.9 The methodology as recommended in the EPD's Guidelines on "Assessing the 'TOTAL' Air Quality Impacts" and "Estimating Height Restriction and Position of Fresh Air Intake Using Gaussian Plume Models" have been adopted. The flag-pole option has been employed in the assessment with height of terrain/platform taken into consideration.

8.4.10 The model assumes the algorithm for Rural Mode, with the stack tip downwash component. It has been assumed that 20% NO_X would be converted into NO_2 in the model. Gradual plume rise option has been employed in the assessment. As a conservative assumption, it is assumed that all sources in Tai Po Hospital and Alice Ho Miu Ling Nethersole Hospital would be operated 24-hour non-stop annually, as the worst-case scenario. No hourly emission scaling factor has been applied to the sources in the two hospitals. Calculation of emission rates from Tai Po Hospital and Alice Ho Miu Ling Nethersole Hospital is shown in **Appendix 8.3**. Summary of the emission inventory for ISC modelling is presented in **Appendix 8.4**.

Impact Assessment

8.4.11 A number of notional assessment points within the site boundary have been identified for the assessment as shown in below **Figure 8.4**.

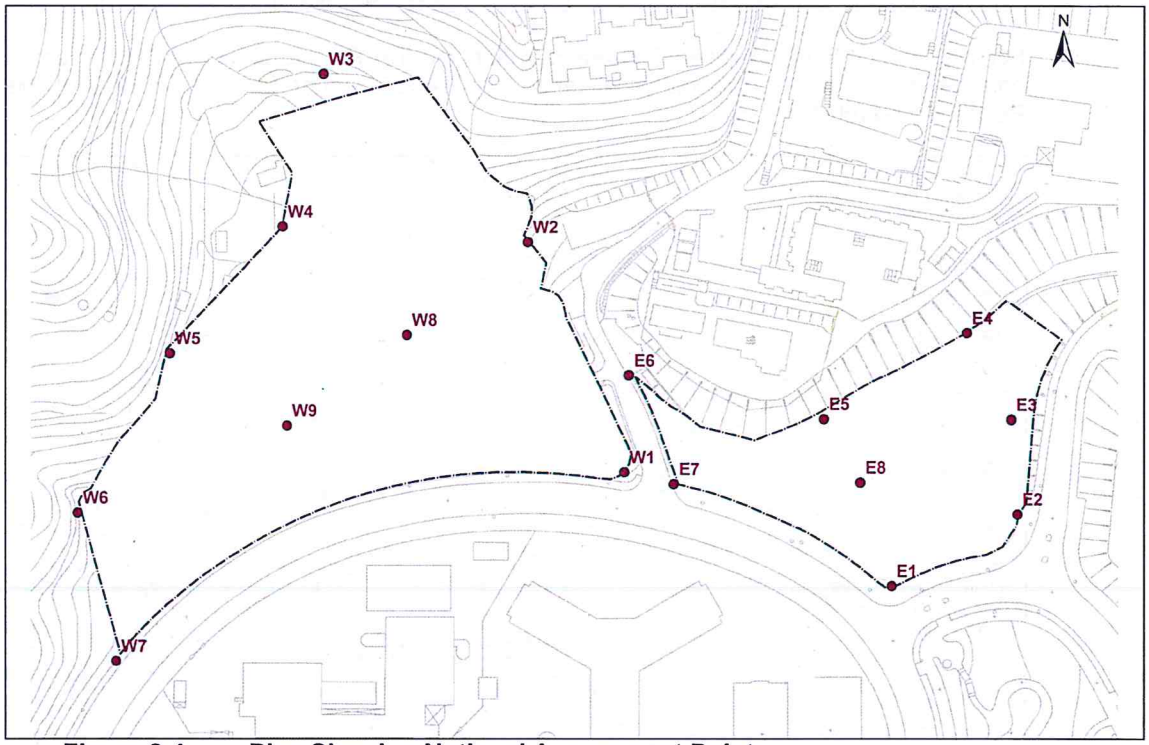


Figure 8.4 Plan Showing Notional Assessment Points

8.4.12 Potential impact of chimney emission based on actual towngas usage for normal operation of boilers is re-assessed to cover both Eastern and Western parts of the Chung Nga Road Site under this study.

8.4.13 The predicted maximum hourly and daily average concentrations of NO_2 and SO_2 at various elevations (i.e. metre above ground, mAG) of representative assessment points (E1 to E8 and W1 to W9) have been evaluated and are presented in **Appendix 8.5**.

8.4.14 In summary, the predicted SO_2, NO_2 and RSP concentrations at various assessment heights of all representative assessment points would comply with the relevant AQOs. The highest predicted hourly, daily and annual averaged concentrations of SO_2 are 328 $\mu g/m^3$, 54 $\mu g/m^3$ and 15 $\mu g/m^3$, the highest predicted hourly, daily and annual averaged concentrations of NO_2 are 117 $\mu g/m^3$, 58 $\mu g/m^3$ and 50 $\mu g/m^3$; whereas the highest predicted daily and annual averaged concentrations of RSP are 59 $\mu g/m^3$ and 49 $\mu g/m^3$ (see **Table 8.6**).

Table 8.6 Summary of Predicted Maximum 1-hour, 24-hour and Annual Average SO_2, NO_2 and RSP Concentrations

Pollutant	Maximum Average Concentration ($\mu g/m^3$)		AQO ($\mu g/m^3$)	Percentage of AQO (%)
SO_2	1-hour	328	800	41.0
	24-hour	54	350	15.4
	Annual	15	80	18.8
NO_2	1-hour	117	300	39.0
	24-hour	58	150	38.7
	Annual	50	80	62.5
RSP	24-hour	59	180	32.8
	Annual	49	55	89.1

Note: Background concentrations of SO_2, NO_2 and RSP are included.

8.4.15 The worst hit level for hourly, daily and annual averaged SO_2 and NO_2 would be at around 75mAG to 90mAG; while the worst hit level for daily and annual averaged RSP would be at around 35mAG to 45mAG. Contour plots of the predicted maximum hourly, daily and annual averaged concentrations of SO_2, NO_2 and RSP at the worst hit levels are shown in **Appendix 8.6**.

8.4.16 No exceedance would be expected at any air sensitive receiver within the potential site. There would be no constraint on the development site in terms of plume impingement at the current condition.

8.5 Conclusion

8.5.1 Considering the moderate traffic flows and the proposed development have setback from adjacent roads with adequate buffer distances in accordance with HKPSG, no adverse vehicular emission impact is anticipated.

8.5.2 Potential impacts of chimney emissions from Tai Po Hospital and Nethersole Hospital have also been assessed. The predicted SO_2, NO_2 and RSPconcentrations at various assessment heights would comply with the relevant AQOs. No adverse chimney emission impact is anticipated.

APPENDIX 8.1

Photos of the Chimneys in the Study Area

Appendix 8.1 Photos of the Chimneys in the Study Area

1) Tai Po Hospital

2) Tai Po Hospital

3) Nethersole Hospital

APPENDIX 8.2

Survey Results from HD

HOUSING DEPARTMENT
LAND SURVEYING UNIT

RESULTS OF CHECKING SURVEY

Name of Site: Tai Po Hospital & Alice Ho Miu Ling Nethersole Hospital

Job Description: Height of chimneys in mPD

Survey Job No.: 33832/PT File No.: Computation Folder No.:

Ref. Job No.: Surveyed By: [redacted] Date: 22/12/2010

Remarks: Computed By: [redacted] Date: 23/12/2010

Checked By: [redacted] Date: 3 Jan. 2011

Examined By: [redacted] Date: 3 1. 2011

Point No.	Coordinates (in metre)		Displacement (in metre)	Level (in metre)		Difference (in metre)	Remarks
	Proposed	Surveyed		Proposed	Surveyed		
B	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
A	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
C	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
F1	N	N [redacted]			[redacted]		Roof top Level
	E	E [redacted]					
F2	N	N [redacted]			[redacted]		Roof top Level
	E	E [redacted]					
F	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
J	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
I	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
E	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
D	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
G	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
H	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
A4	N	N [redacted]			[redacted]		Roof top Level
	E	E [redacted]					
A5	N	N [redacted]			[redacted]		Roof top Level
	E	E [redacted]					
D1	N	N [redacted]			[redacted]		Roof top Level
	E	E [redacted]					
D2	N	N [redacted]			[redacted]		Roof top Level
	E	E [redacted]					

Proposed coordinates and levels were attached with request form.

HOUSING DEPARTMENT
LAND SURVEYING UNIT

RESULTS OF CHECKING SURVEY

Name of Site: Tai Po Hospital & Alice Ho Miu Ling Nethersole Hospital

Job Description: Height of chimneys in mPD

Survey Job No.: 33832/PT File No.: Computation Folder No.:

Ref. Job No.: Surveyed By: [redacted] Date: 22/12/2010

Remarks: Computed By: [redacted] Date: 23/12/2010

Checked By: [redacted] Date: 3 Jan. 2011

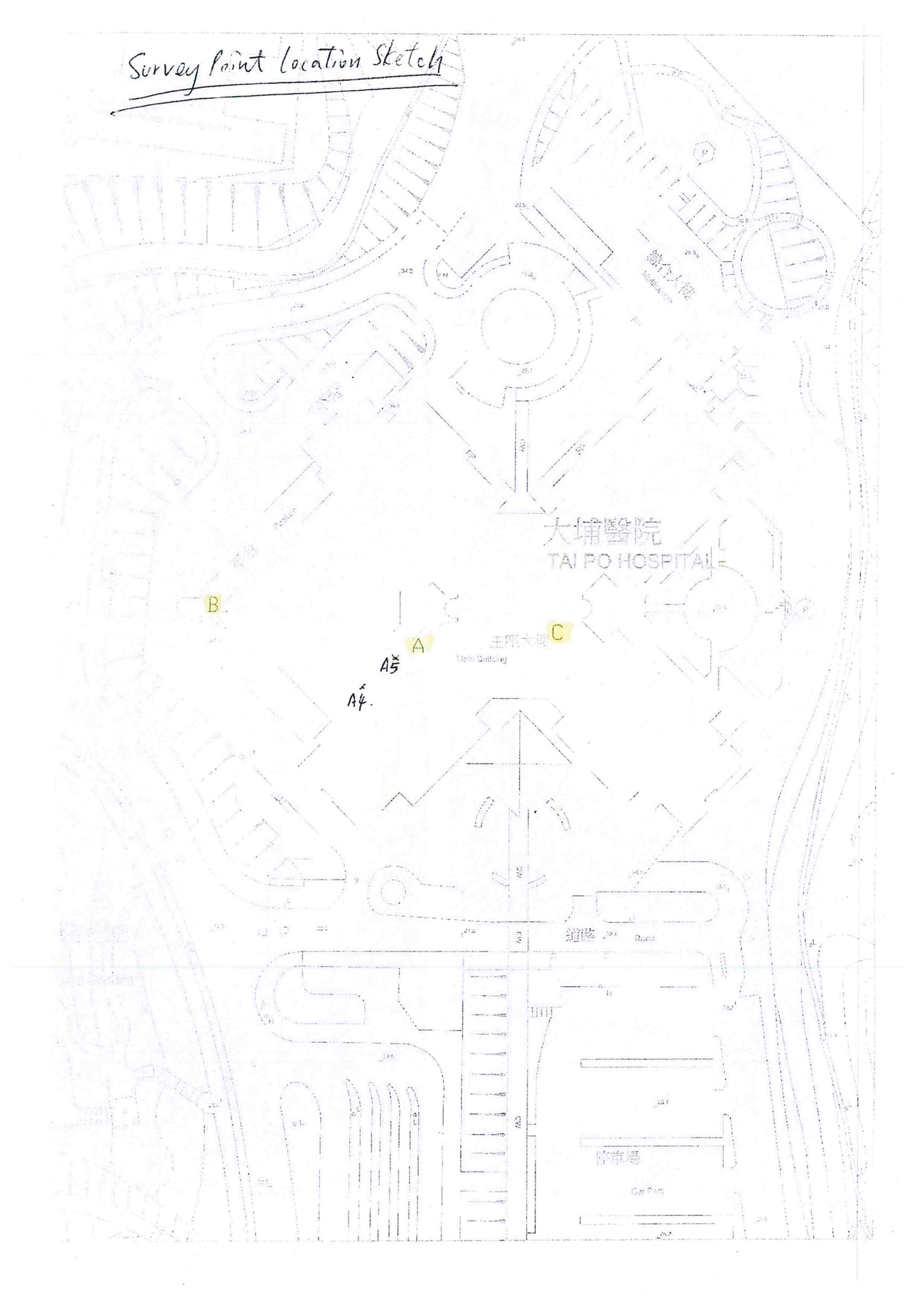
Examined By: [redacted] Date: 7.1.2011

Point No.	Coordinates (in metre)		Displacement (in metre)	Level (in metre)		Difference (in metre)	Remarks
	Proposed	Surveyed		Proposed	Surveyed		
D3	N	N [redacted]			[redacted]		Roof top Level
	E	E [redacted]					

Proposed coordinates and levels were attached with request form.

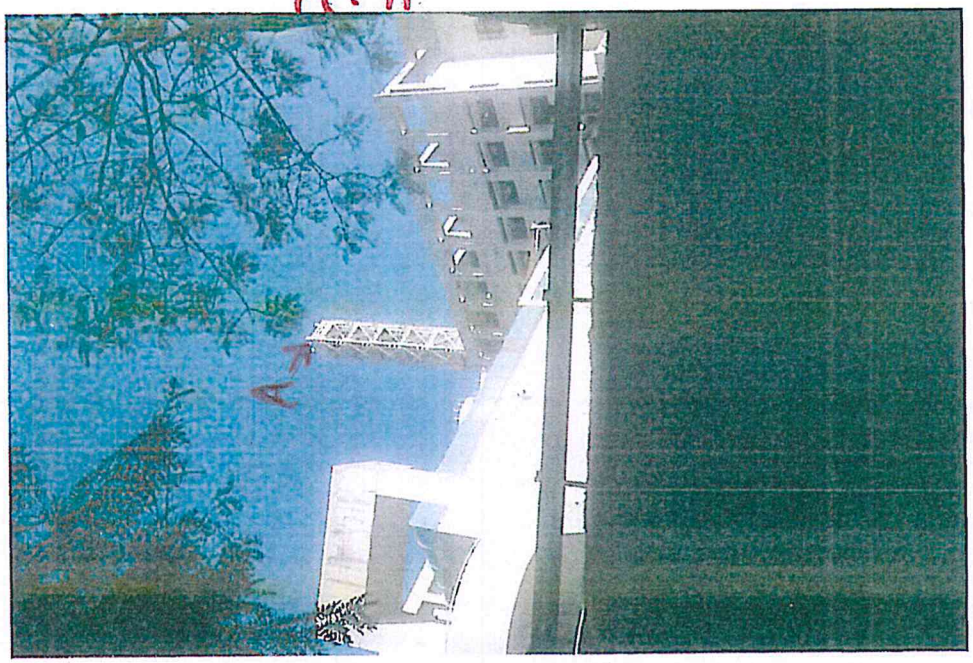
Survey point location Sketch

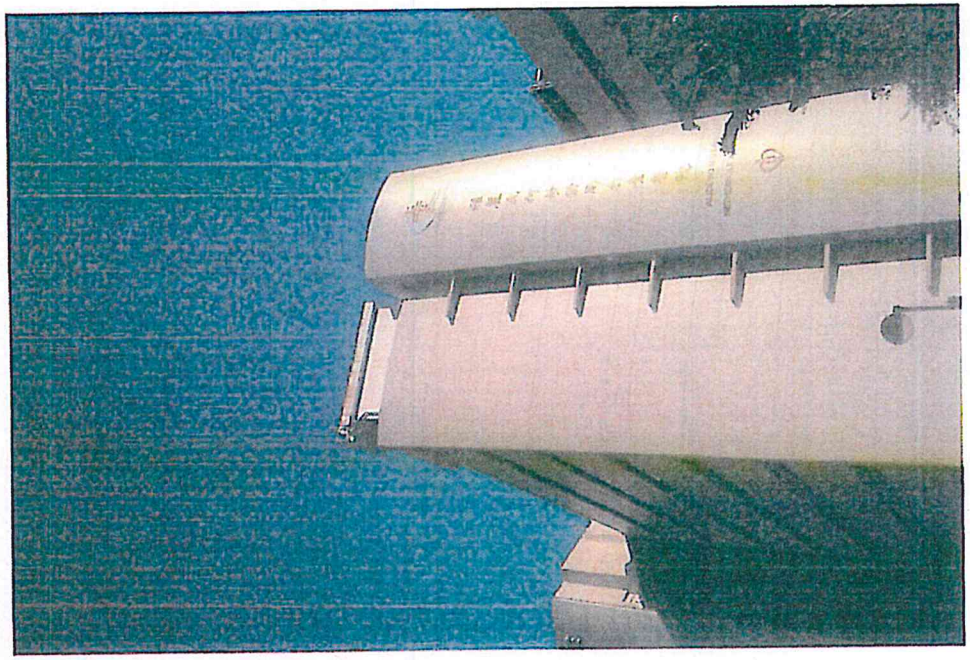
Survey Point Location Sketch



Pt. I, J

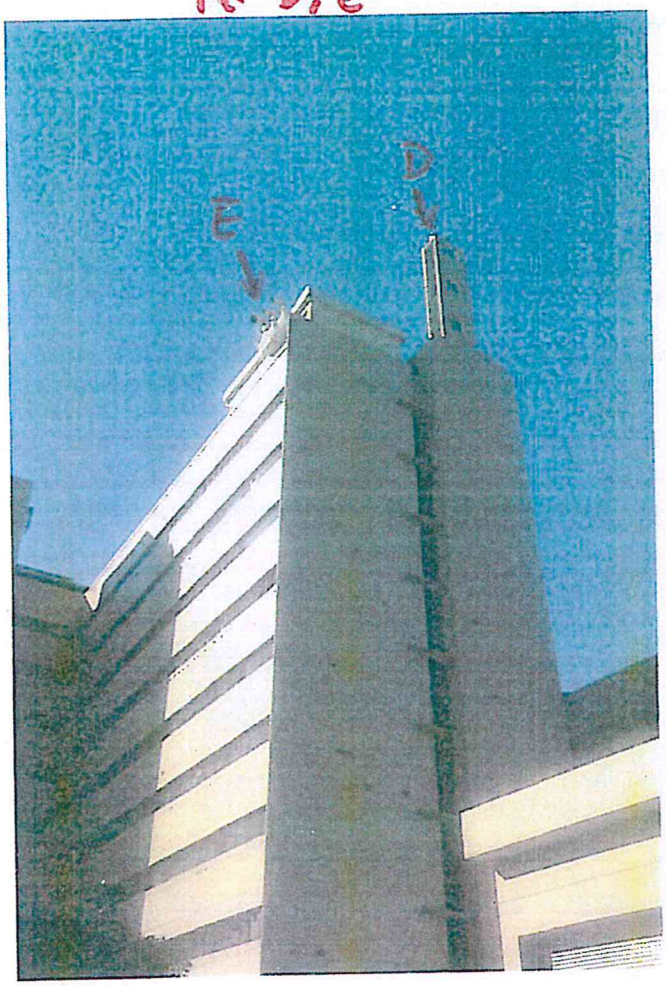
Pt. A





Pt. B

Pt. D, E



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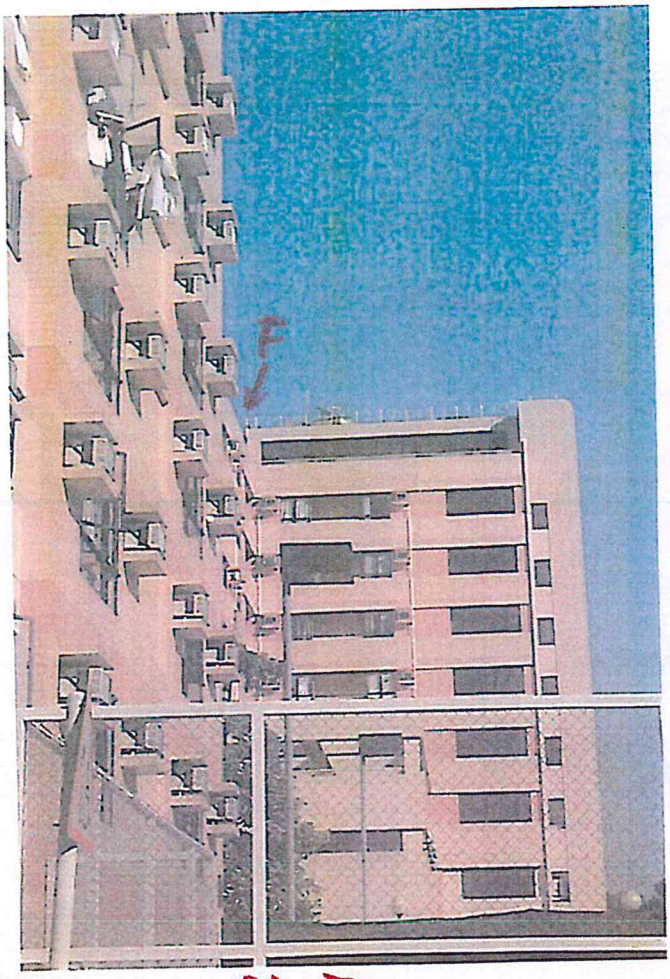
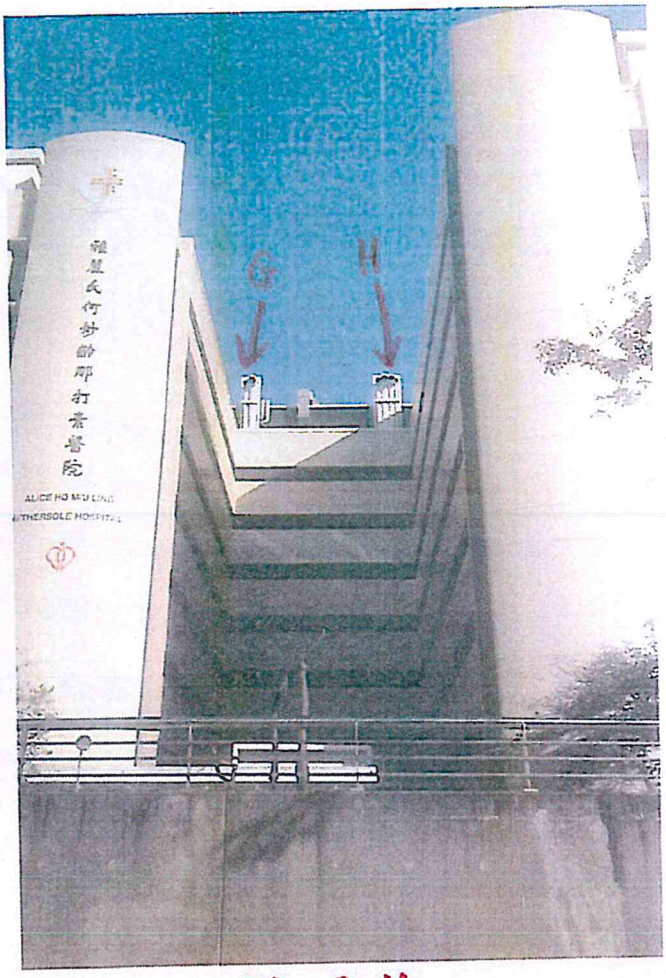
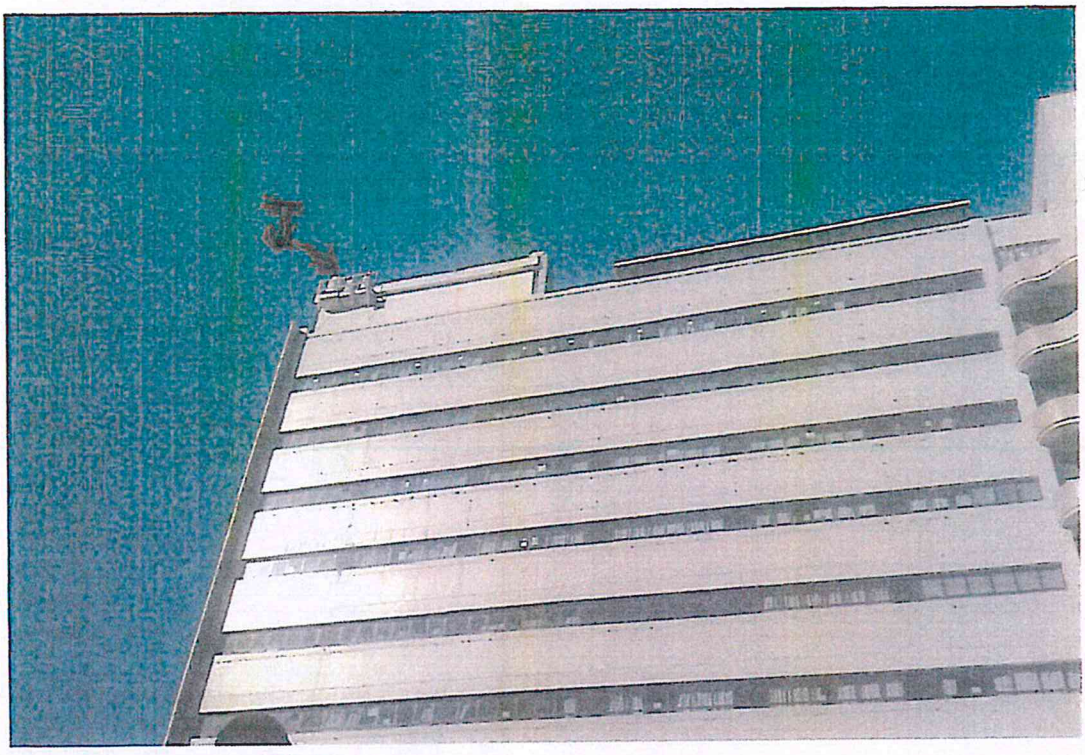


Pt. F



Pt. G, H

Pt. C



Pt. J

APPENDIX 8.3

Calculation of Chimney Emission Factors Based on Actual Towngas Usage

Appendix 8.3 Towngas Consumption for Boilers in Alice Ho Miu Ling Nethersole Hospital (2008-2010)

Month	Monthly Towngas (in Unit)	Annual Towngas (in Unit)
01/2008	[redacted]	[redacted]
02/2008	[redacted]	
03/2008	[redacted]	
04/2008	[redacted]	
05/2008	[redacted]	
06/2008	[redacted]	
07/2008	[redacted]	
08/2008	[redacted]	
09/2008	[redacted]	
10/2008	[redacted]	
11/2008	[redacted]	
12/2008	[redacted]	
01/2009	[redacted]	[redacted]
02/2009	[redacted]	
03/2009	[redacted]	
04/2009	[redacted]	
05/2009	[redacted]	
06/2009	[redacted]	
07/2009	[redacted]	
08/2009	[redacted]	
09/2009	[redacted]	
10/2009	[redacted]	
11/2009	[redacted]	
12/2009	[redacted]	
01/2010	[redacted]	[redacted]
02/2010	[redacted]	
03/2010	[redacted]	
04/2010	[redacted]	
05/2010	[redacted]	
06/2010	[redacted]	
07/2010	[redacted]	
08/2010	[redacted]	
09/2010	[redacted]	
10/2010	[redacted]	
11/2010	[redacted]	
12/2010	[redacted]	

Appendix 8.3 Towngas Consumption for Boilers in Tai Po Hospital (2008-2010)

Month	Monthly Towngas (in Unit)	Annual Towngas (in Unit)
01/2008	[redacted]	[redacted]
02/2008	[redacted]	
03/2008	[redacted]	
04/2008	[redacted]	
05/2008	[redacted]	
06/2008	[redacted]	
07/2008	[redacted]	
08/2008	[redacted]	
09/2008	[redacted]	
10/2008	[redacted]	
11/2008	[redacted]	
12/2008	[redacted]	
01/2009	[redacted]	[redacted]
02/2009	[redacted]	
03/2009	[redacted]	
04/2009	[redacted]	
05/2009	[redacted]	
06/2009	[redacted]	
07/2009	[redacted]	
08/2009	[redacted]	
09/2009	[redacted]	
10/2009	[redacted]	
11/2009	[redacted]	
12/2009	[redacted]	
01/2010	[redacted]	[redacted]
02/2010	[redacted]	
03/2010	[redacted]	
04/2010	[redacted]	
05/2010	[redacted]	
06/2010	[redacted]	
07/2010	[redacted]	
08/2010	[redacted]	
09/2010	[redacted]	
10/2010	[redacted]	
11/2010	[redacted]	
12/2010	[redacted]	

Appendix 8.3 Calculation of Chimney Emission Factors Based on Actual Towngas Usage

Estimated Emission Factor of NO_X based on AP-42 [1] = [redacted] $lb/10^6$ scf

Estimated Emission Factor of SO_2 based on AP-42 = [redacted] $lb/10^6$ scf

Estimated Emission Factor of PM based on AP-42 = [redacted] $lb/10^6$ scf

Conversion factor of NO_X to NO_2 = [redacted] [according to Ambient Ratio Method (ARM)]

Hospital	Maximum Annual Towngas Consumption for Boilers from 2008-2010 (Unit) [2]	Heat value per unit of Towngas consumed (MJ/ Unit) [3]	Total Towngas consumption (MJ)	Heating Value (MJ/m^3) [4]	Volume of Towngas Consumed (m^3)	Types of Pollutants	Emission Factors ($kg/10^6m^3$) [5]	Actual Emission Rate Using Towngas tons /year	Actual Emission Rate Using Towngas g/s
AHN	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	SO_2	[redacted]	[redacted]	[redacted]
						NO_X	[redacted]	[redacted]	[redacted]
						PM	[redacted]	[redacted]	[redacted]
TPH	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	SO_2	[redacted]	[redacted]	[redacted]
						NO_X	[redacted]	[redacted]	[redacted]
						PM	[redacted]	[redacted]	[redacted]

Note:

[1] Emission factor is based on an average natural gas higher heating value of [redacted] Btu/scf in AP-42 for small boilers (<100 MMBtu/hr Heat Input).
The emission factor in this table is converted to Towngas heating values according to AP-42 by multiplying the given emission factor (100 $lb/10^6$ scf) by the ratio of the Towngas heating value to the averge heating value used in AP-42.
To convert from MJ/m3 to Btu/scf, multiply by 25.73 (1Btu equals to 0.0011 MJ. 1standard cubic foot (scf) equals to 0.0283 cubic metres)

[2] Among the latest 3 years Towngas Consumption, the maximum Towngas Consumption of AHN is in Year 2009, while TPH is in Year 2010.

[3] Heat value of Towngas is [redacted] MJ/ Unit from Towngas Company Limited.

[4] Heating value of Town Gas is [redacted] MJ/m^3 from Towngas Company Limited.

[5] To convert from $lb/10^6$ scf to $kg/10^6m^3$, multiply by 16.

APPENDIX 8.4

Summary of Emission Inventory for ISC Modeling

Appendix 8.4 Summary of Emission Inventory for ISC Modeling

Chimney ID	X	Y	Base Elevation (mPD)	Discharge / Chimney Height (m)	Discharge Temperature (K)	Discharge Diameter (m)	Exit Velocity (m/s)	Emission Rate (g/s)			Duration of Maximum Concentration (h/d)
								NOx	SO2	RSP	
Sources in Tai Po Hospital and Nethersole Hospital											
H1											24
H2											24
H3											24
H4											24
H5											24
H6											24
Sources in Tai Po Industrial Estate											
G1											24
G2											24
G5											24
G6											24
G9											24
G10											24
G13											24
G14											24
G17											24
G19											24
G3											24
G4											24
G7											24
G8											24
G11											24
G12											24
G15											24
G16											24
G18											24
G20											Emergency Operation for Electricity Generation
G21											Emergency Operation for Electricity Generation
G22											Emergency Operation for Electricity Generation
G23											Emergency Operation for Electricity Generation
G24											Emergency Operation for Electricity Generation
G25											Emergency Operation for Electricity Generation
G26											Emergency Operation for Electricity Generation
G27											Emergency Operation for Electricity Generation
G28											Emergency Operation for Electricity Generation
G29											Emergency Operation for Electricity Generation
G30											Emergency Operation for Electricity Generation
G31											Emergency Operation for Electricity Generation
G32											Emergency Operation for Electricity Generation
M1											24
M2											24
M3											24
M4											24
M5											24
M6											24
M7											24
M8											24
M9											24
U1											24
U2											24
Z1											10

Note:
Chimney G20 to G32 are for electricity generation during emergency operation and thus not included in the modeling.

APPENDIX 8.5

Predicted SO_2, NO_2 and RSP Concentrations ($\mu g/m^3$)

Appendix 8.5a Predicted Maximum 1-hr SO2 concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
E1	835872.2	835732.4	46	46	46	46	46	46	50	79	123	169	207	222	209	175	129
E2	835914.3	835756.2	45	45	45	45	45	46	46	50	68	92	112	119	113	95	84
E3	835912.2	835787.6	43	43	43	43	43	43	44	44	44	49	54	56	58	63	66
E4	835897.4	835816.3	42	42	42	42	42	42	43	43	43	46	50	52	52	55	58
E5	835849.6	835787.8	43	43	43	43	43	43	43	43	45	50	55	57	58	63	66
E6	835784.3	835802.2	42	42	42	42	42	42	42	42	42	44	47	50	52	56	59
E7	835799.3	835766.2	44	44	44	44	44	44	44	47	59	78	93	100	95	81	77
E8	835861.8	835766.8	44	44	44	44	44	44	45	47	56	72	86	92	88	75	77
W1	835782.8	835770.1	43	43	43	43	43	44	44	46	55	71	85	91	86	74	75
W2	835750.4	835846.6	42	42	42	42	42	42	42	42	45	51	56	58	56	57	61
W3	835682.1	835902.4	43	43	43	43	43	43	45	69	103	138	165	176	167	142	108
W4	835668.4	835851.7	41	41	41	41	41	41	41	41	41	47	51	53	51	53	58
W5	835630.8	835809.5	40	40	40	40	40	40	40	40	40	43	45	48	50	54	57
W6	835600.2	835756.7	42	42	42	42	42	42	44	58	85	112	133	142	135	115	89
W7	835613.1	835707.5	44	44	44	44	44	48	75	126	190	256	308	328	311	262	198
W8	835710.0	835815.7	40	40	40	40	40	40	40	40	40	41	43	45	48	51	54
W9	835669.9	835785.6	42	42	42	42	42	42	42	42	47	54	63	67	64	63	67
sub-max-site(E):			46	46	46	46	46	46	50	79	123	169	207	222	209	175	129
sub-max-site(W):			44	44	44	44	44	48	75	126	190	256	308	328	311	262	198
Maximum			46	46	46	46	46	48	75	126	190	256	308	328	311	262	198

Appendix 8.5b Predicted Maximum Daily SO2 concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
E1	835872.2	835732.4	22	22	22	22	22	23	24	25	28	34	39	41	39	35	29
E2	835914.3	835756.2	21	21	21	21	21	22	23	24	24	24	27	28	27	25	22
E3	835912.2	835787.6	19	19	19	19	20	20	21	22	22	22	21	21	21	20	17
E4	835897.4	835816.3	19	19	19	19	19	20	20	21	21	21	20	20	19	19	18
E5	835849.6	835787.8	19	19	19	19	20	20	21	21	22	22	21	21	21	20	17
E6	835784.3	835802.2	19	19	19	19	19	20	20	20	21	21	20	20	20	19	17
E7	835799.3	835766.2	20	20	20	20	21	21	22	22	23	23	24	25	25	23	20
E8	835861.8	835766.8	20	20	20	20	21	21	22	23	23	23	24	24	24	22	20
W1	835782.8	835770.1	20	20	20	20	20	21	22	22	22	22	23	24	23	22	20
W2	835750.4	835846.6	19	19	19	19	19	20	20	20	20	20	20	19	19	18	18
W3	835682.1	835902.4	20	20	20	20	21	21	21	22	25	29	33	34	33	30	26
W4	835668.4	835851.7	19	19	19	19	19	19	19	20	20	20	19	19	18	18	18
W5	835630.8	835809.5	18	18	18	19	19	19	19	20	20	20	19	19	19	19	16
W6	835600.2	835756.7	20	20	20	21	21	21	22	22	23	27	29	30	29	27	24
W7	835613.1	835707.5	22	22	22	22	23	23	24	28	36	45	51	54	52	45	37
W8	835710.0	835815.7	18	18	18	18	19	19	19	20	20	20	19	19	19	18	17
W9	835669.9	835785.6	19	19	19	19	20	20	20	21	21	21	21	21	21	20	18
sub-max-site(E):			22	22	22	22	22	23	24	25	28	34	39	41	39	35	29
sub-max-site(W):			22	22	22	22	23	23	24	28	36	45	51	54	52	45	37
Maximum			22	22	22	22	23	23	24	28	36	45	51	54	52	45	37

Appendix 8.5c Predicted Maximum Annual SO2 concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
E1	835872.2	835732.4	13	13	13	13	13	13	14	14	14	15	15	15	14	14	14
E2	835914.3	835756.2	13	13	13	13	13	13	13	14	14	14	14	14	14	14	13
E3	835912.2	835787.6	13	13	13	13	13	13	13	13	13	14	14	13	13	13	13
E4	835897.4	835816.3	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
E5	835849.6	835787.8	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
E6	835784.3	835802.2	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
E7	835799.3	835766.2	13	13	13	13	13	13	13	13	14	14	14	14	14	13	13
E8	835861.8	835766.8	13	13	13	13	13	13	13	13	14	14	14	14	14	13	13
W1	835782.8	835770.1	13	13	13	13	13	13	13	13	13	14	14	14	13	13	13
W2	835750.4	835846.6	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
W3	835682.1	835902.4	13	13	13	13	13	13	13	13	14	14	14	14	14	13	13
W4	835668.4	835851.7	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
W5	835630.8	835809.5	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
W6	835600.2	835756.7	13	13	13	13	13	13	13	13	14	14	14	14	14	13	13
W7	835613.1	835707.5	13	13	13	13	13	13	14	14	14	15	15	15	15	14	14
W8	835710.0	835815.7	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
W9	835669.9	835785.6	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
sub-max-site(E):			13	13	13	13	13	13	14	14	14	15	15	15	14	14	14
sub-max-site(W):			13	13	13	13	13	13	14	14	14	15	15	15	15	14	14
Maximum			13	13	13	13	13	13	14	14	14	15	15	15	15	14	14

Appendix 8.5d Predicted Maximum 1-hr NO2 concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
E1	835872.2	835732.4	57	57	57	57	57	66	80	95	107	114	117	113	104	92	79
E2	835914.3	835756.2	57	57	57	57	57	73	74	87	99	109	115	115	107	94	80
E3	835912.2	835787.6	57	57	57	57	58	69	77	87	97	107	112	112	104	92	79
E4	835897.4	835816.3	57	57	57	58	58	65	79	84	91	99	104	104	97	87	75
E5	835849.6	835787.8	56	56	56	56	56	59	69	80	90	98	103	102	96	86	75
E6	835784.3	835802.2	57	57	57	57	57	64	75	87	96	102	104	102	94	84	74
E7	835799.3	835766.2	57	57	57	58	58	66	80	94	105	112	114	111	102	91	78
E8	835861.8	835766.8	56	56	57	57	57	62	73	84	93	99	101	98	91	82	72
W1	835782.8	835770.1	58	58	58	58	58	66	79	93	104	111	113	110	102	90	78
W2	835750.4	835846.6	56	56	56	56	57	59	67	75	82	87	88	86	82	75	67
W3	835682.1	835902.4	56	56	56	56	56	58	65	70	76	82	85	85	81	74	67
W4	835668.4	835851.7	57	57	57	57	57	65	76	88	98	105	106	104	96	86	76
W5	835630.8	835809.5	58	58	58	58	58	61	70	79	87	93	95	93	87	79	71
W6	835600.2	835756.7	58	58	58	58	59	59	67	76	84	91	95	95	89	81	72
W7	835613.1	835707.5	58	58	58	58	58	61	71	83	95	107	116	114	102	90	78
W8	835710.0	835815.7	57	57	57	57	58	66	78	91	101	108	110	107	99	88	77
W9	835669.9	835785.6	58	58	58	58	58	61	69	79	87	92	94	92	87	79	70
sub-max-site(E):			57	57	57	58	58	73	80	95	107	114	117	115	107	94	80
sub-max-site(W):			58	58	58	58	59	66	79	93	104	111	116	114	102	90	78
Maximum			58	58	58	58	59	73	80	95	107	114	117	115	107	94	80

Appendix 8.5e Predicted Maximum Daily NO2 concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
E1	835872.2	835732.4	50	50	50	50	50	51	53	55	56	57	58	57	56	54	53
E2	835914.3	835756.2	50	50	50	50	51	52	52	54	55	57	58	57	55	53	51
E3	835912.2	835787.6	50	50	50	50	50	51	52	53	55	56	57	56	55	53	51
E4	835897.4	835816.3	50	50	50	50	50	50	53	53	54	55	56	55	54	52	51
E5	835849.6	835787.8	50	50	50	50	50	51	51	53	54	55	56	55	54	52	51
E6	835784.3	835802.2	50	50	50	50	50	51	52	54	55	56	56	56	55	53	52
E7	835799.3	835766.2	50	50	50	50	50	51	53	55	56	57	58	57	56	54	53
E8	835861.8	835766.8	50	50	50	50	50	51	52	54	55	56	56	55	54	53	52
W1	835782.8	835770.1	50	50	50	50	50	51	53	54	56	57	58	57	56	54	52
W2	835750.4	835846.6	50	50	50	50	50	50	51	52	53	54	54	54	53	52	51
W3	835682.1	835902.4	49	49	49	50	50	50	51	52	52	53	53	53	52	51	51
W4	835668.4	835851.7	49	49	50	50	50	51	52	54	55	56	56	56	55	54	52
W5	835630.8	835809.5	49	49	49	49	50	50	51	53	54	54	55	54	54	53	52
W6	835600.2	835756.7	49	49	50	50	50	50	51	52	53	54	55	54	54	53	52
W7	835613.1	835707.5	50	50	50	50	50	50	52	53	54	56	57	57	55	54	52
W8	835710.0	835815.7	49	50	50	50	50	51	53	54	56	56	57	56	55	54	52
W9	835669.9	835785.6	49	49	49	50	50	50	51	53	54	54	54	54	54	53	51
sub-max-site(E):			50	50	50	50	51	52	53	55	56	57	58	57	56	54	53
sub-max-site(W):			50	50	50	50	50	51	53	54	56	57	58	57	56	54	52
Maximum			50	50	50	50	51	52	53	55	56	57	58	57	56	54	53

Appendix 8.5f Predicted Maximum Annual NO2 concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
E1	835872.2	835732.4	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
E2	835914.3	835756.2	49	49	49	49	49	49	49	49	49	50	49	49	49	49	49
E3	835912.2	835787.6	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
E4	835897.4	835816.3	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
E5	835849.6	835787.8	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
E6	835784.3	835802.2	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
E7	835799.3	835766.2	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
E8	835861.8	835766.8	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
W1	835782.8	835770.1	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
W2	835750.4	835846.6	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
W3	835682.1	835902.4	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
W4	835668.4	835851.7	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
W5	835630.8	835809.5	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
W6	835600.2	835756.7	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
W7	835613.1	835707.5	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
W8	835710.0	835815.7	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
W9	835669.9	835785.6	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
sub-max-site(E):			49	49	49	49	49	49	49	49	49	50	49	49	49	49	49
sub-max-site(W):			49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
Maximum			49	49	49	49	49	49	49	49	49	50	49	49	49	49	49

Appendix 8.5g Predicted Maximum Daily RSP concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
E1	835872.2	835732.4	51	51	51	51	52	53	54	53	53	52	52	51	51	50	50
E2	835914.3	835756.2	51	51	51	51	52	52	53	51	51	51	52	50	50	50	49
E3	835912.2	835787.6	50	50	50	50	50	51	52	52	51	51	51	49	49	49	49
E4	835897.4	835816.3	50	50	50	50	51	53	55	54	53	51	51	50	49	49	49
E5	835849.6	835787.8	50	50	50	50	50	50	50	50	50	50	50	49	49	49	49
E6	835784.3	835802.2	50	50	50	50	50	50	50	50	51	50	50	50	49	49	49
E7	835799.3	835766.2	51	51	51	51	51	51	52	53	53	52	52	50	50	49	49
E8	835861.8	835766.8	51	51	51	51	51	51	51	51	50	51	50	50	50	49	49
W1	835782.8	835770.1	51	51	51	51	51	51	52	53	54	53	52	51	50	49	49
W2	835750.4	835846.6	50	50	50	50	50	50	50	50	50	50	50	50	49	49	49
W3	835682.1	835902.4	50	50	50	50	51	51	51	51	51	51	51	51	50	50	49
W4	835668.4	835851.7	50	50	50	50	50	51	52	52	52	52	51	50	49	49	49
W5	835630.8	835809.5	50	50	51	51	52	54	56	58	58	57	54	52	50	49	49
W6	835600.2	835756.7	51	51	51	51	51	52	54	55	55	54	52	51	50	50	49
W7	835613.1	835707.5	52	52	52	53	53	55	55	55	54	54	53	53	52	51	51
W8	835710.0	835815.7	50	50	50	50	50	51	52	53	53	53	51	50	49	49	49
W9	835669.9	835785.6	50	50	51	51	52	54	57	58	59	57	54	52	50	49	49
sub-max-site(E):			51	51	51	51	52	53	55	54	53	52	52	51	51	50	50
sub-max-site(W):			52	52	52	53	53	55	57	58	59	57	54	53	52	51	51
Maximum			52	52	52	53	53	55	57	58	59	57	54	53	52	51	51

Appendix 8.5h Predicted Maximum Annual RSP concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
E1	835872.2	835732.4	49	49	49	49	49	49	49	49	49	49	49	49	48	48	48
E2	835914.3	835756.2	49	49	49	49	49	49	49	49	49	49	49	49	48	48	48
E3	835912.2	835787.6	49	49	49	49	49	49	49	49	49	49	49	48	48	48	48
E4	835897.4	835816.3	49	49	49	49	49	49	49	49	49	49	49	48	48	48	48
E5	835849.6	835787.8	48	48	49	49	49	49	49	49	49	49	49	48	48	48	48
E6	835784.3	835802.2	48	48	48	48	49	49	49	49	49	49	49	48	48	48	48
E7	835799.3	835766.2	49	49	49	49	49	49	49	49	49	49	49	49	48	48	48
E8	835861.8	835766.8	49	49	49	49	49	49	49	49	49	49	49	48	48	48	48
W1	835782.8	835770.1	49	49	49	49	49	49	49	49	49	49	49	49	48	48	48
W2	835750.4	835846.6	48	48	48	48	48	48	49	48	48	49	48	48	48	48	48
W3	835682.1	835902.4	48	48	48	49	49	49	49	49	49	49	48	48	48	48	48
W4	835668.4	835851.7	48	48	48	48	48	49	49	49	49	48	48	48	48	48	48
W5	835630.8	835809.5	48	48	49	49	49	49	49	49	49	49	49	48	48	48	48
W6	835600.2	835756.7	49	49	49	49	49	49	49	49	49	49	49	48	48	48	48
W7	835613.1	835707.5	49	49	49	49	49	49	49	49	49	49	49	49	48	48	48
W8	835710.0	835815.7	48	48	48	49	49	49	49	49	49	49	49	48	48	48	48
W9	835669.9	835785.6	49	49	49	49	49	49	49	49	49	49	49	48	48	48	48
sub-max-site(E):			49	49	49	49	49	49	49	49	49	49	49	49	48	48	48
sub-max-site(W):			49	49	49	49	49	49	49	49	49	49	49	49	48	48	48
Maximum			49	49	49	49	49	49	49	49	49	49	49	49	48	48	48

APPENDIX 8.6

NO_2, SO_2 and RSP Contour Plots at Worst Hit Level

Appendix 8.6 NO_2, SO_2 and RSP Contour Plots at Worst Hit Level

Figure 1 1-hr Average NO_2 Contour at Worst Hit Level (80m above ground) (in ug/m^3)

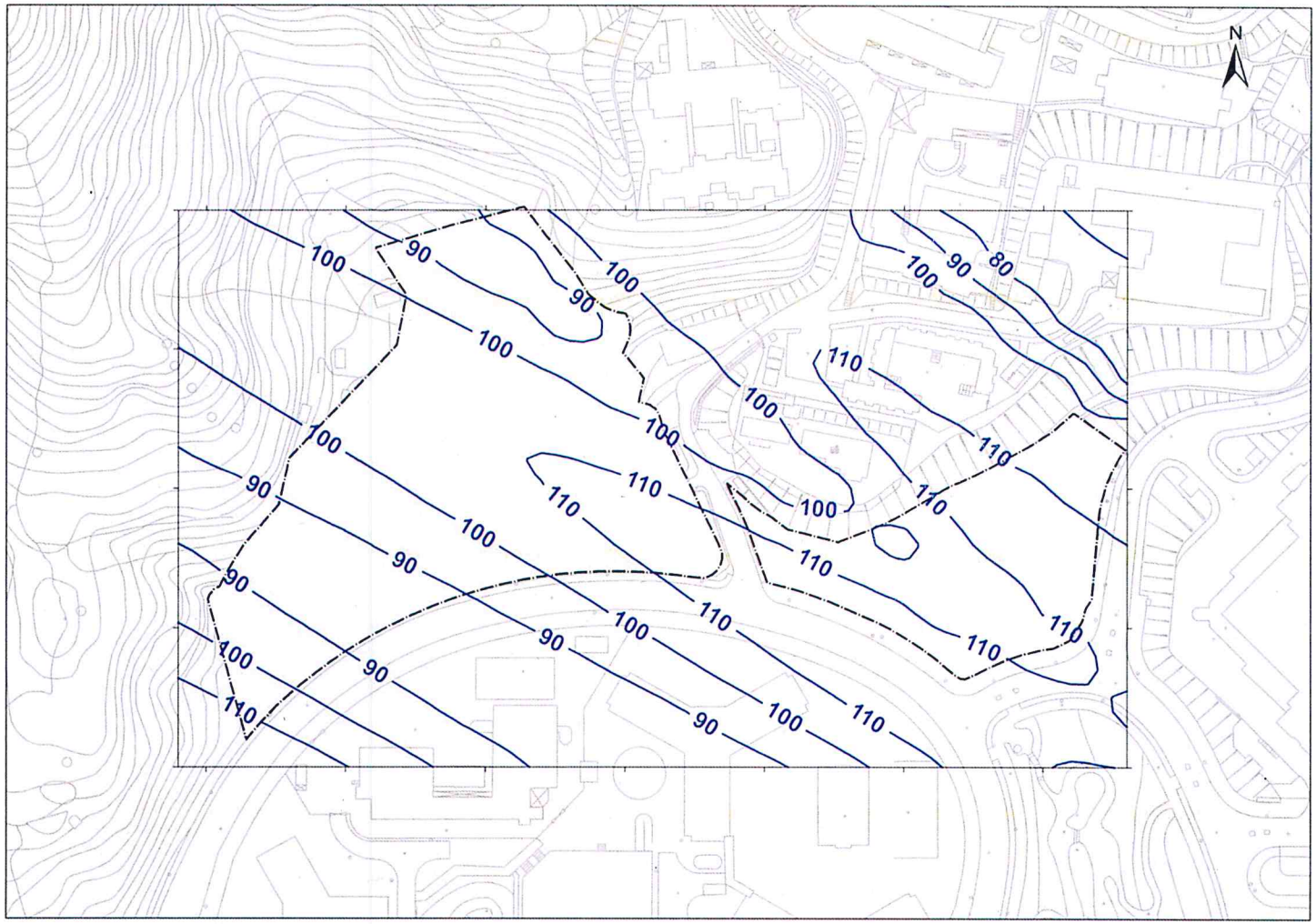


Figure 2 **24-hr Average NO_2 Contour at Worst Hit Level (80m above ground) (in ug/m^3)**

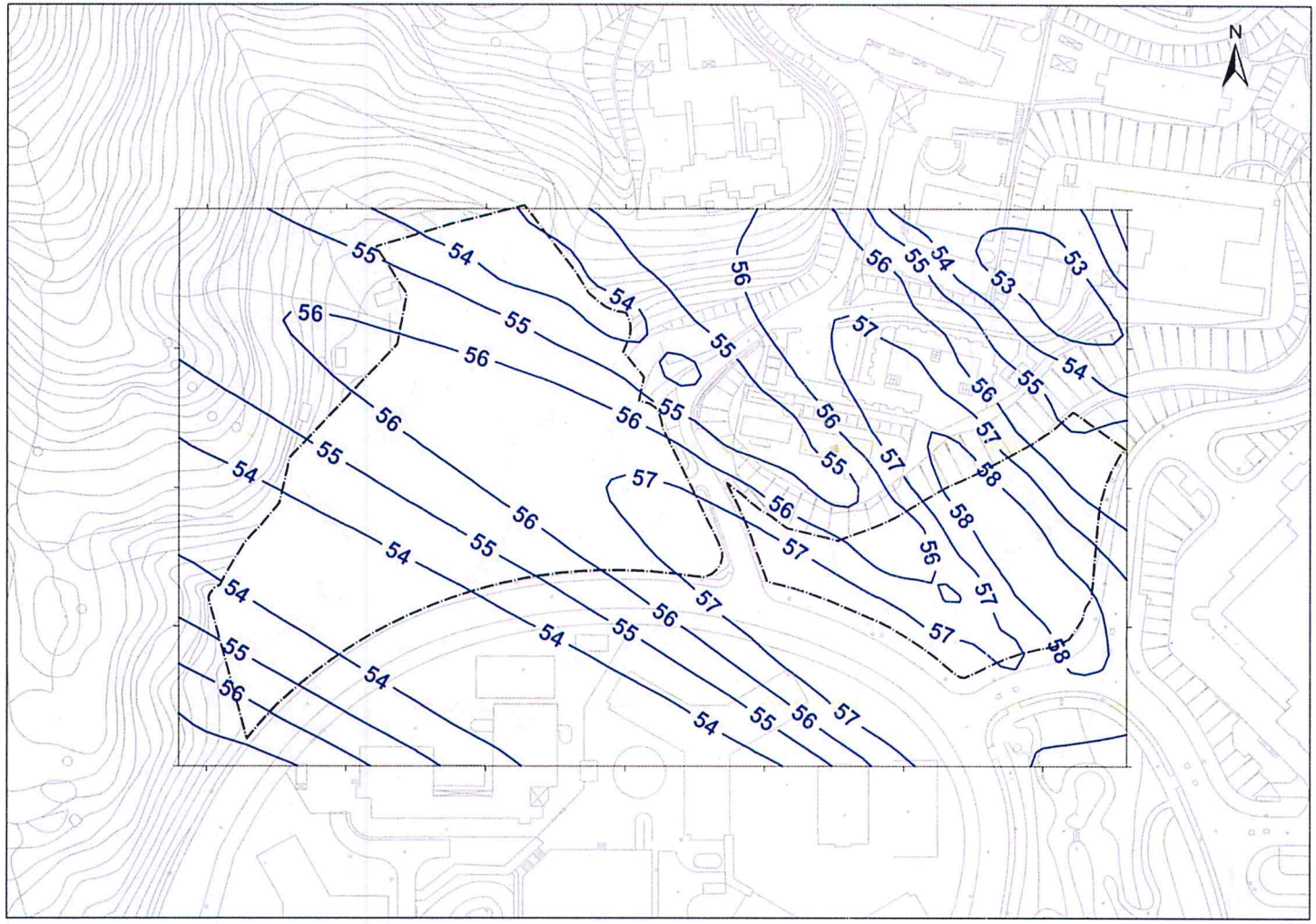


Figure 3 **Annual Average NO_2 Contour at Worst Hit Level (75m above ground) (in ug/m^3)**

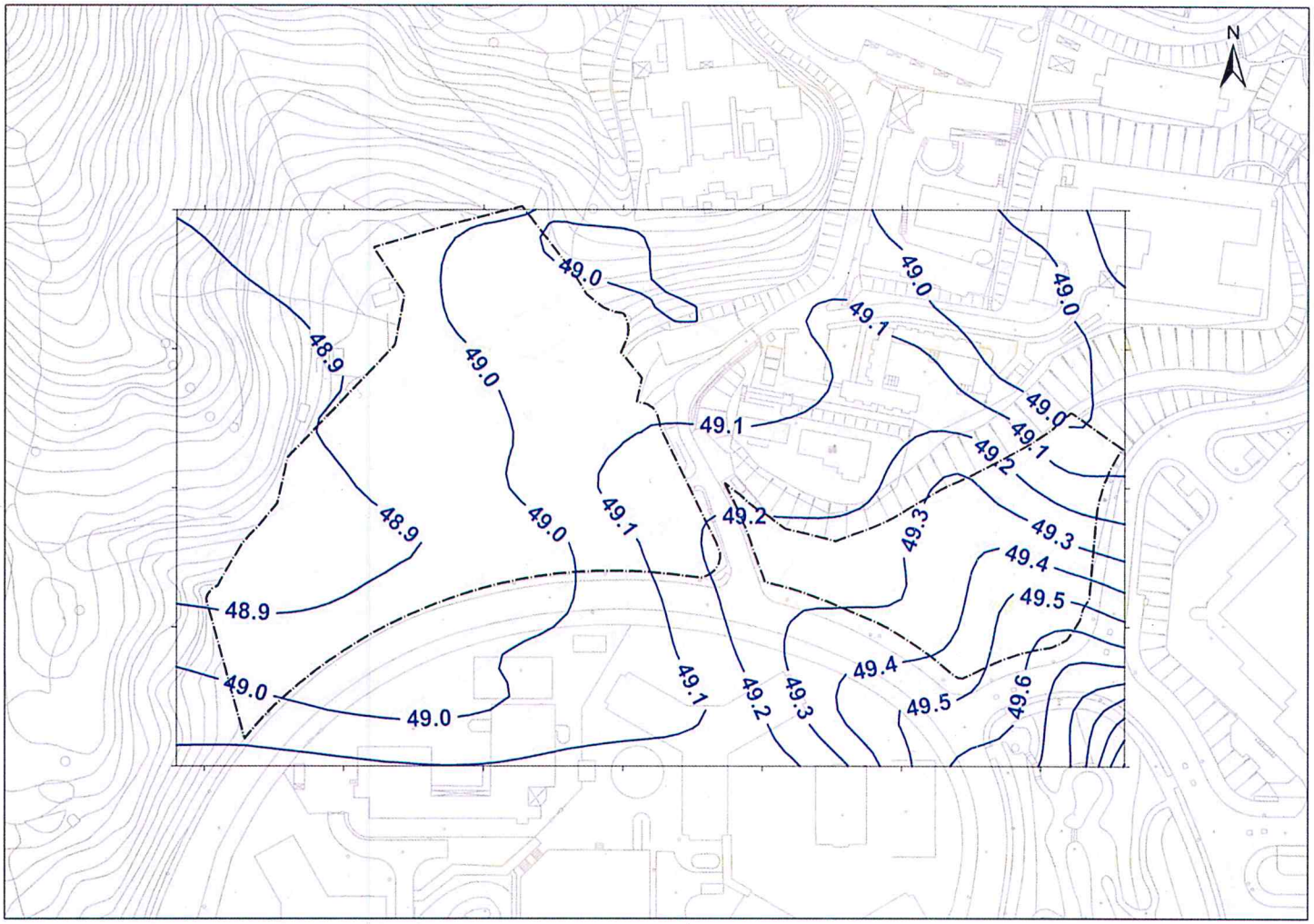


Figure 4 **1-hr Average SO_2 Contour at Worst Hit Level (90m above ground) (in ug/m^3)**

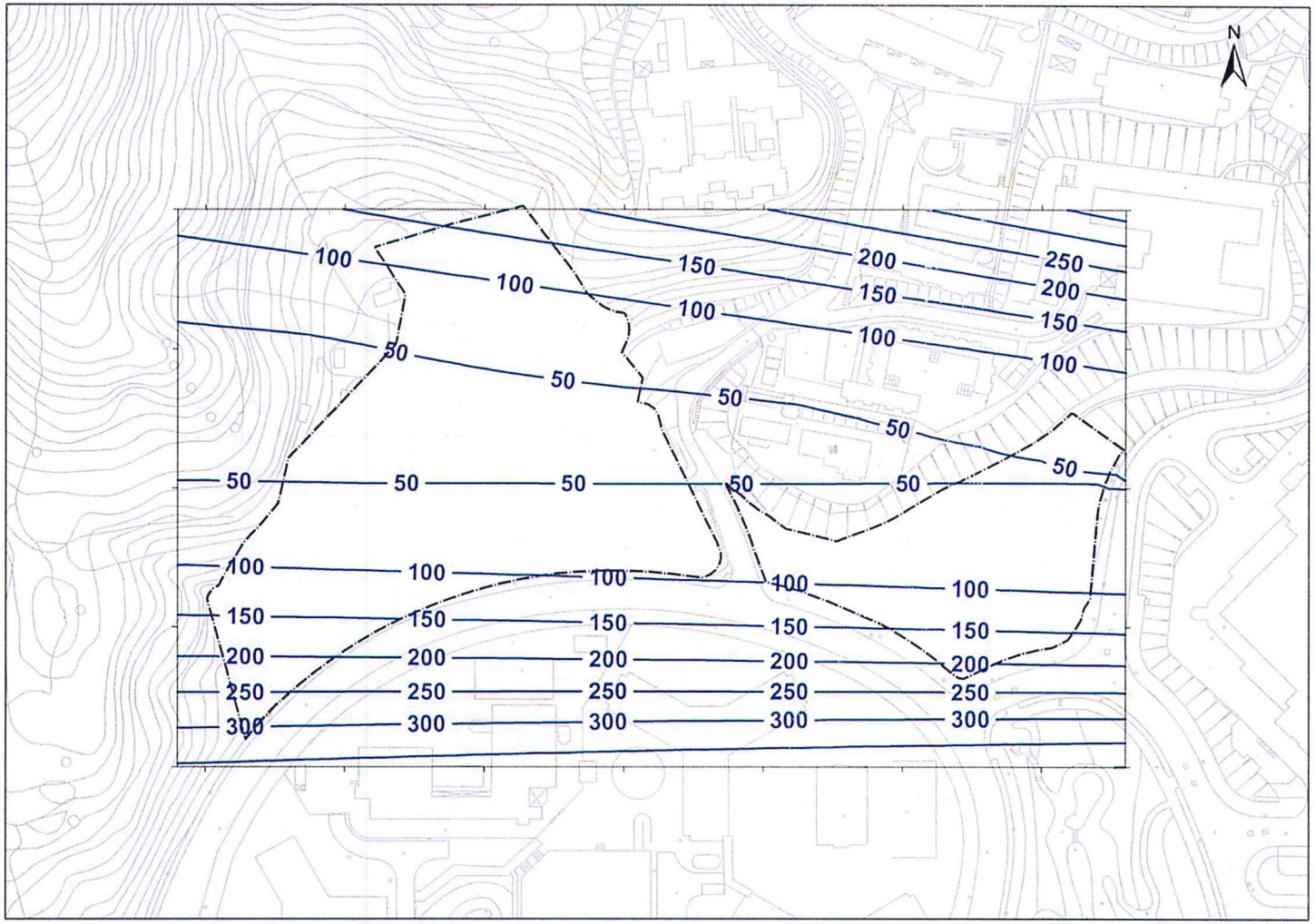


Figure 5 **24-hr Average SO_2 Contour at Worst Hit Level (90m above ground) (in ug/m^3)**

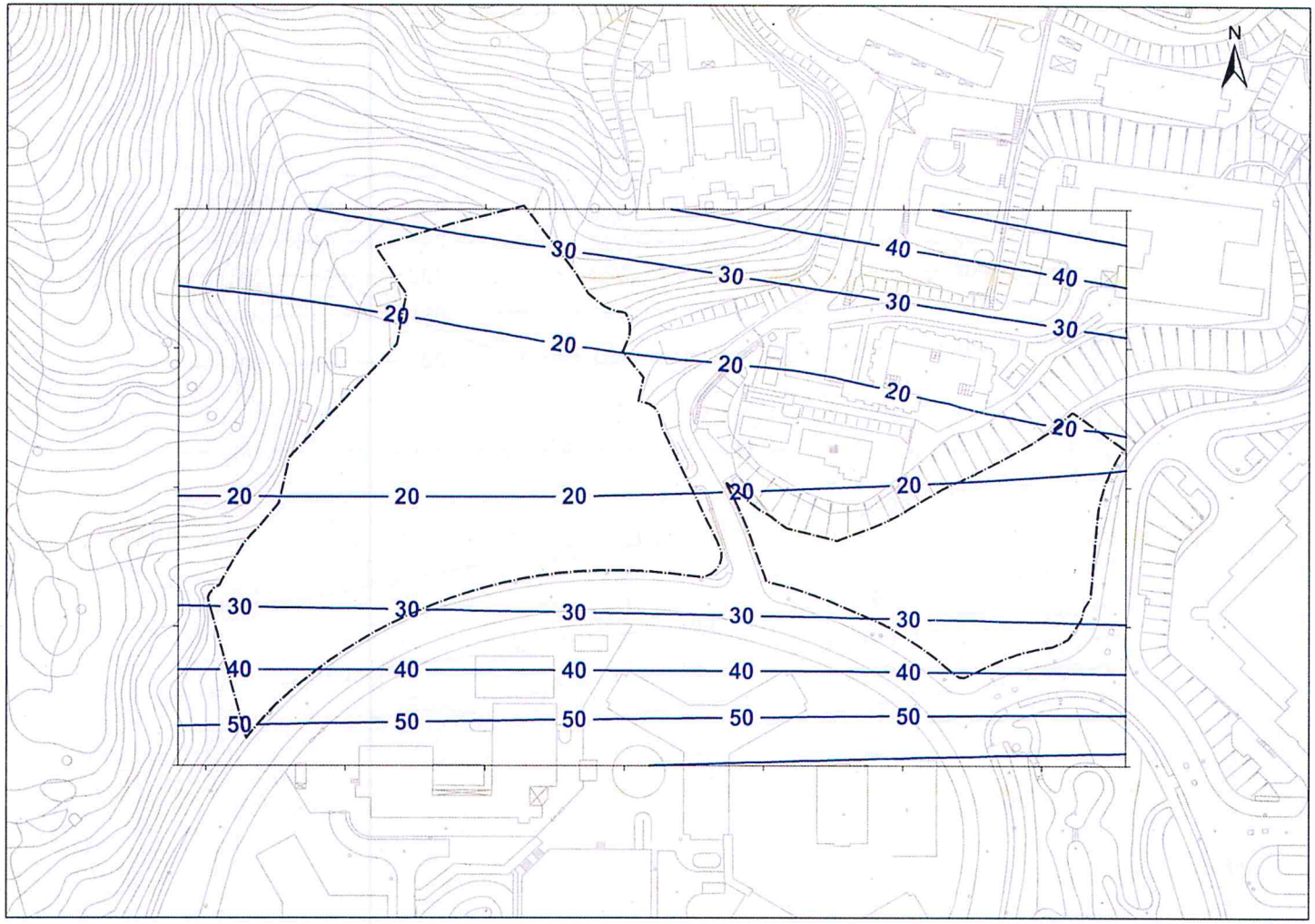


Figure 6 **Annual Average SO_2 Contour at Worst Hit Level (85m above ground) (in ug/m^3)**

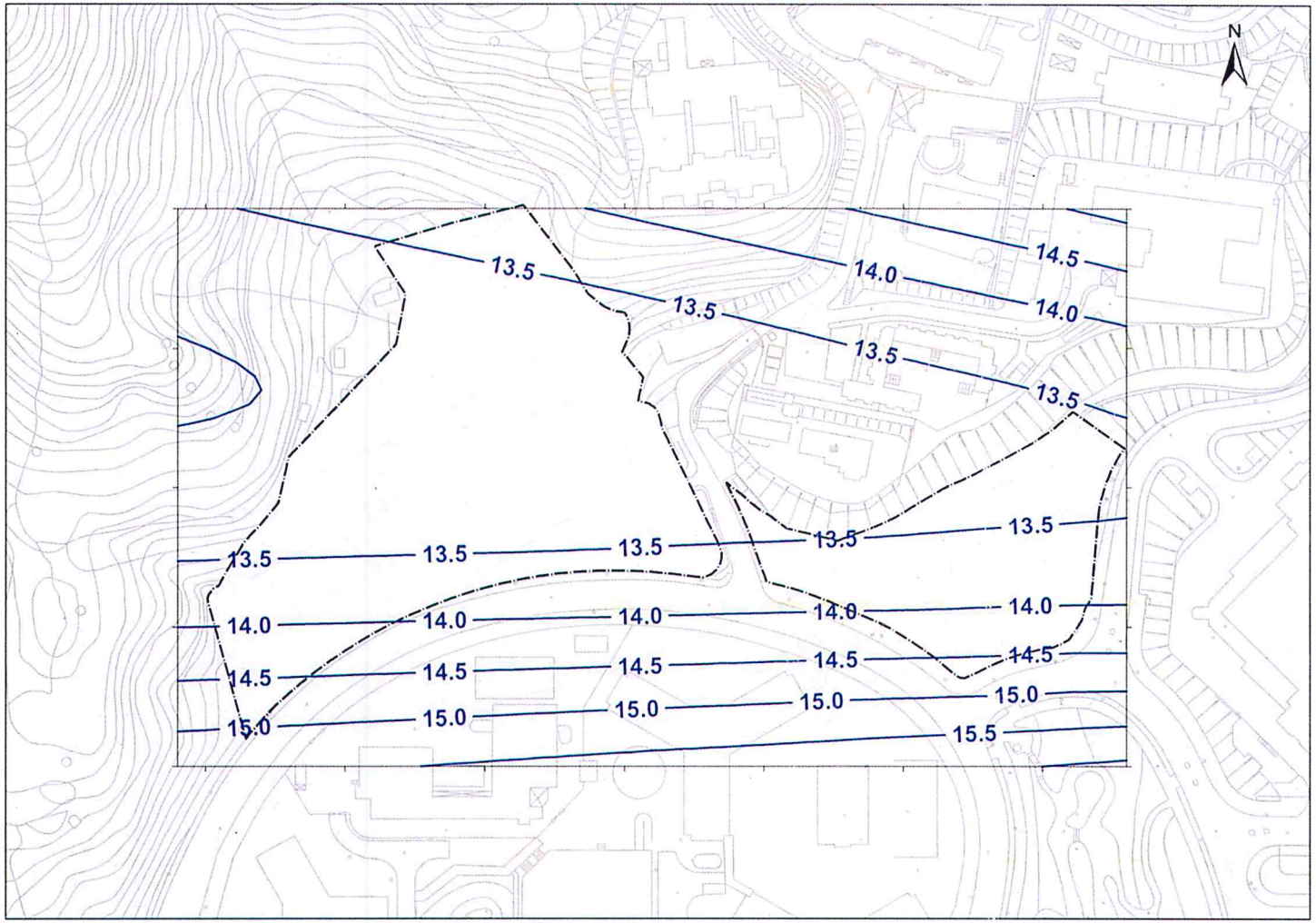


Figure 7 **24-hr Average RSP Contour at Worst Hit Level (45m above ground) (in ug/m^3)**

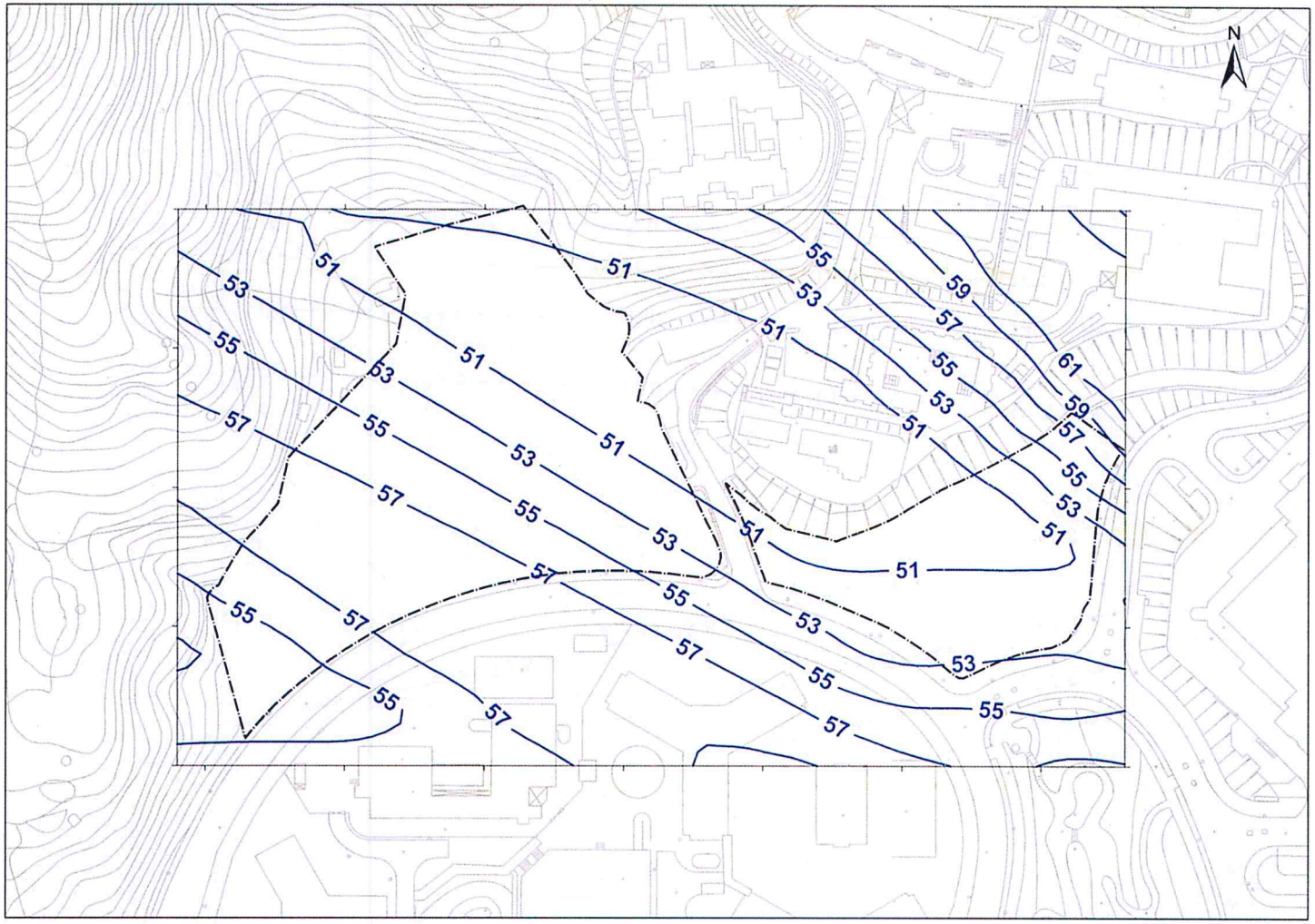
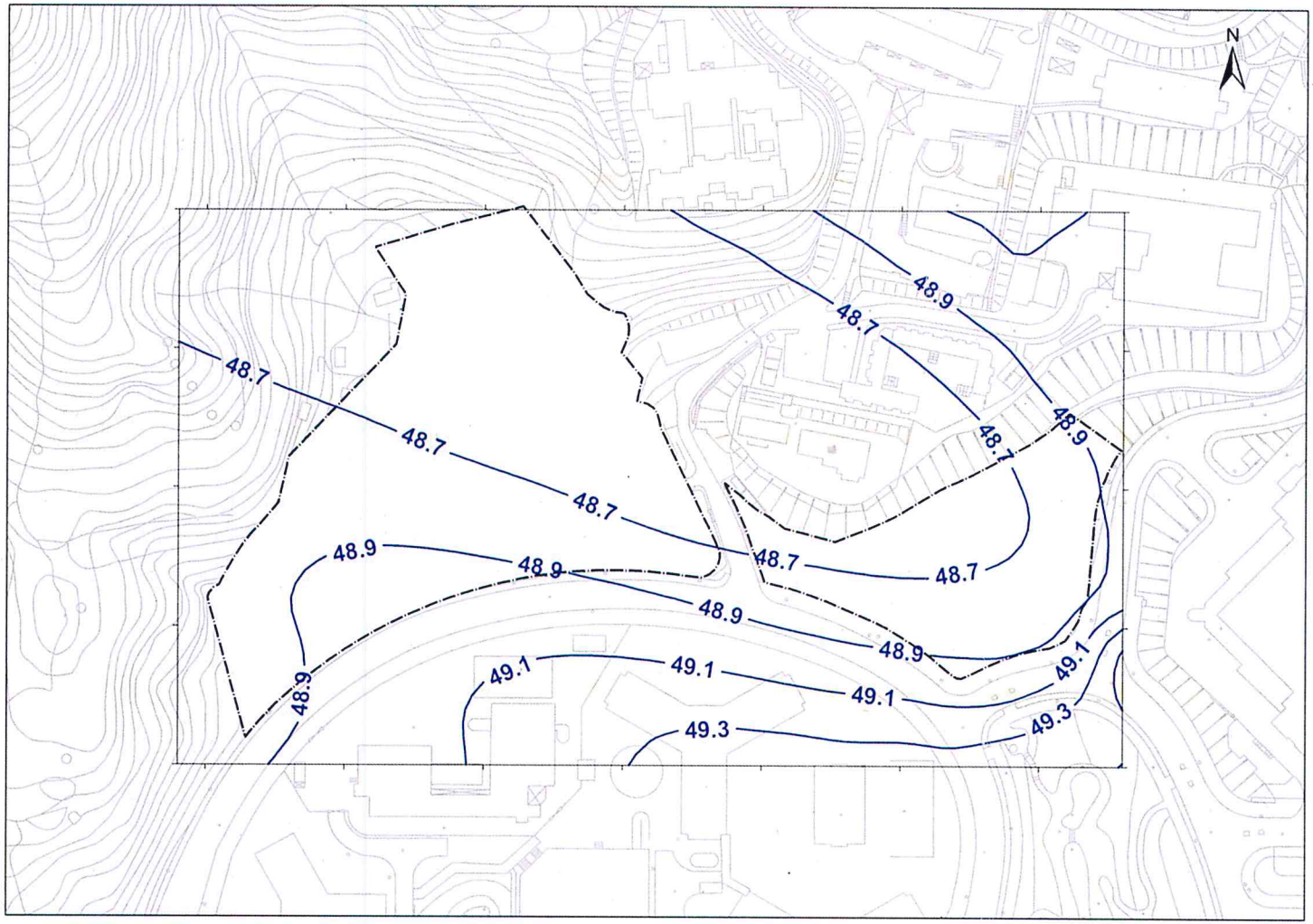


Figure 8 **Annual Average RSP Contour at Worst Hit Level (35m above ground) (in ug/m^3)**



8 AIR QUALITY IMPACT ASSESSMENT

8.1 Air Quality Criteria

8.1.1 The air quality impact assessment criteria are derived from the Air Pollution Control Ordinance (APCO) (Cap. 311). The APCO provides power for controlling air pollutants from a variety of stationary and mobile sources and determining a number of Air Quality Objectives (AQOs). Currently AQOs stipulate concentrations for a range of air pollutants namely sulphur dioxide (SO_2), total suspended particulates (TSP), respirable suspended particulates (RSP), nitrogen dioxide (NO_2), carbon monoxide (CO), photochemical oxidants (as ozone), and lead (Pb). The prevailing AQOs are listed in **Table 8.1**.

Table 8.1 Hong Kong Air Quality Objectives

Pollutant	Concentration in micrograms per cubic metre [1] (Parts per million, ppm in brackets)				
	1 Hour [2]	8 Hour [3]	24 Hours [3]	3 Months [4]	1 Year [4]
Sulphur Dioxide	800 (0.3)		350 (0.13)		80 (0.03)
Total Suspended Particulates	500 [7]		260		80
Respirable Suspended Particulates [5]			180		55
Carbon Monoxide	30,000 (26.2)	10,000 (8.7)			
Nitrogen Dioxide	300 (0.16)		150 (0.08)		80 (0.04)
Photochemical Oxidants (as ozone) [6]	240				
Lead				1.5	

Notes:
[1] Measured at 298°K and 101.325 kPa.
[2] Not to be exceeded more than three times per year.
[3] Not to be exceeded more than once per year.
[4] Arithmetic mean.
[5] Respirable suspended particulates means suspended particulates in air with a nominal aerodynamic diameter of 10 micrometres or smaller.
[6] Photochemical oxidants are determined by measurement of ozone only.
[7] Not an AQO but is a criterion for evaluating air quality impacts as stated in EPD's environmental control clauses.

8.1.2 Chapter 9 of "Environment" of the Hong Kong Planning Standards and Guidelines (HKPSG) also suggests the buffer distance requirements for roads and highways.

8.2 Ambient Air Quality

8.2.1 The ambient air quality of the subject site has been determined based on the EPD's monitoring data from Year 2008 to Year 2012 at Tai Po monitoring station. **Table 8.2** summarizes the annual average concentrations of the key air pollutants due to vehicle and chimney emissions recorded at the monitoring station from 2008 to 2012.

8.2.2 Results show that in the most recent 5 years, they were all in compliance with the statutory AQOs. The background pollutant concentrations were [redacted] and [redacted] $\mu g/m^3$ for NO_2, SO_2 and RSP, respectively.

Table 8.2 Annual Average Concentrations of Pollutants from 2008 to 2012 at EPD's Air Quality Monitoring Station (Tai Po)

Pollutant	Annual AQO ($\mu g/m^3$)	Annual Average Concentration ($\mu g/m^3$)				
		2008	2009	2010	2011	2012
RSP	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SO_2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
NO_2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

8.3 Review of Vehicular Emission Impact and Setback Requirement

8.3.1 The potential development site is located at about 150m to the north-east of Hong Chi Association which is including Head Office, School and Integrated Vocational Training Centre. To the east of the site are some scattered village houses including Lau Hang, Mak Uk and Fung Yuen Lo Tsuen. Tai Po Hospital and Alice Ho Miu Ling Nethersole Hospital are located at about 170m and 450m respectively to the south of the site. The northern boundary of the site is mainly hilly areas of the Cloudy Hill. The subject site will be connected with a new access road leading to Chung On Road The location plan for the subject sites is shown in **Figure 8.1**.

8.3.2 In accordance with the traffic flow data presented in **Section 4**, the peak-hour two-way traffic flow for Chung Nga Road and Chuen On Road are 1,040 vehicles/hour and 660 vehicles/hour respectively as illustrated in **Figure 8.1**. Classification of Type of Road and recommended Buffer Distance in accordance HKPSG are summarised in below **Table 8.3**.

Table 8.3 Classification of Type of Road and Recommended Buffer Distance

	Type of Road	Recommended Buffer Distance (HKPSG)	Buffer Distance
Chung Nga Road	District Distributor	>10m	~280m
Chuen On Road	Local Distributor	>5m	~220m
Access Road to the subject site	Local Distributor	>5m	~7m

8.3.3 As shown in **Figure 8.1** and above **Table 8.2**, all residential blocks are setback from adjacent roads with adequate buffer distance in accordance with HKPSG requirement for vehicular emission.

8.3.4 Considering the moderate traffic flows for the concerned roads and adequate buffer distances are allowed for the proposed development, no adverse vehicular emission impact is anticipated.

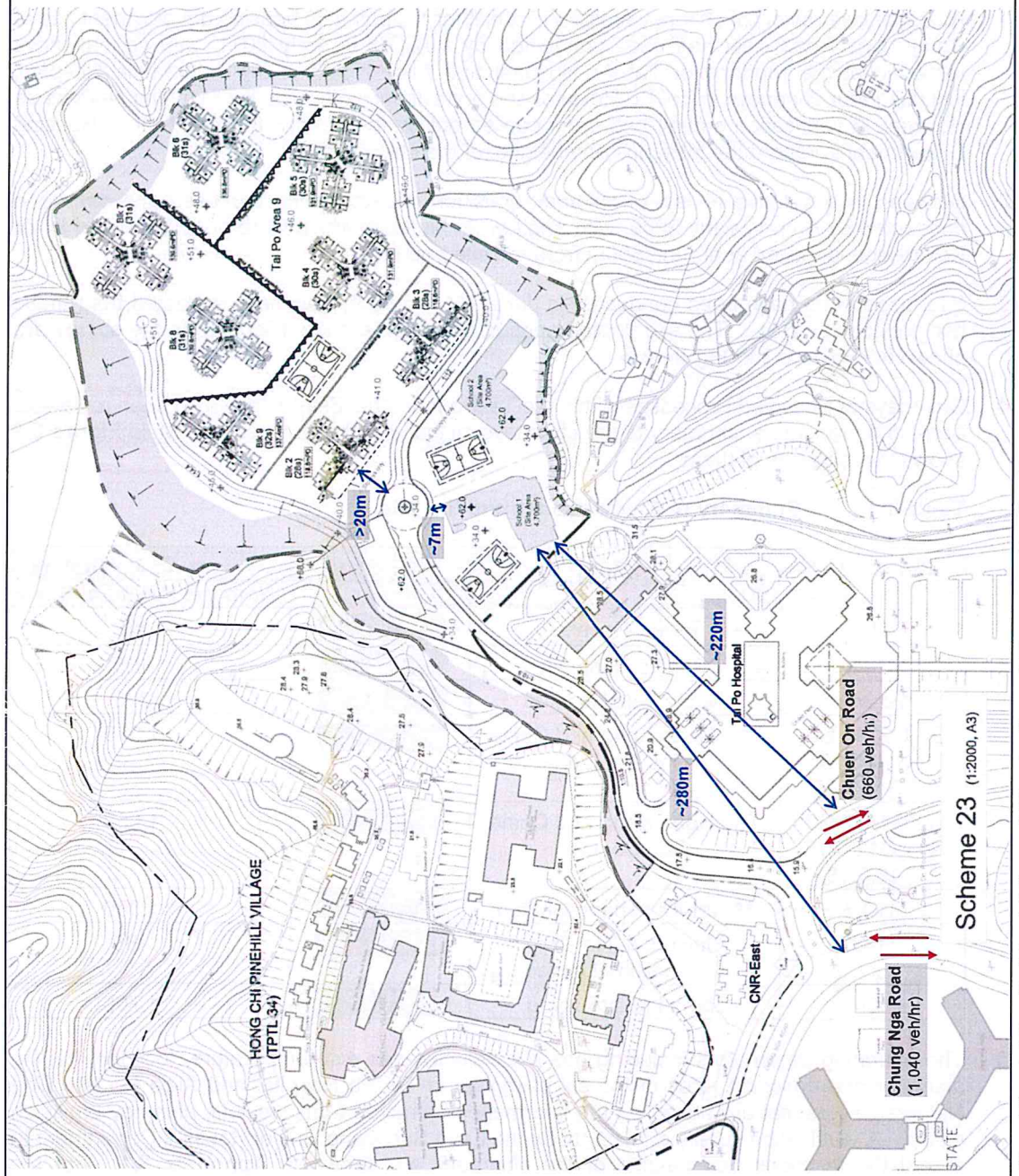


Figure 8.1 Location Plan of the Subject Site and Illustration of Two-way Traffic Flows

8.4 Review of Chimney Emission Impact

8.4.1 A quantitative review of chimney emission impact for the potential housing development site at Chugn Nga Road East has been conducted by AECOM in early 2011, with six chimneys identified at the rooftops of Tai Po Hospital and Alice Ho Miu Ling Nethersole Hospital, including four chimneys in Tai Po Hospital and two chimneys in Alice Ho Miu Ling Nethersole Hospital. A verification survey had been carried out by the Land Surveying Unit of Housing Department to record the locations and heights of the chimneys.

8.4.2 Between, a qualitative review of chimney emission impact for the proposed site has been conducted by Arup in early 2009, with another 2 chimneys which were no longer used in Yu Kok Village identified at around 500m from the site boundary.

8.4.3 Site inspections have been conducted in June 2013 to verify chimneys extracted from these two previous studies. The site photographs of the chimneys identified during the survey are shown in **Figure 8.3** to **Figure 8.6**.

8.4.4 Chimneys of Specified Processes within the Tai Po Industrial Estate have also been reviewed. **Table 8.4** presents a summary of the chimneys included in the assessment, while **Figure 8.2** shows the locations of them.

Table 8.4 Summary of Chimneys around the Site

Chimney ID	Location	Chimney Height (mPD)	Approximate Distance from the Potential Site (m)
H1	Tai Po Hospital	[redacted]	40
H2-H4	Tai Po Hospital	[redacted]	105
H5-H6	Nethersole Hospital	[redacted]	395
G1,G2,G5,G6, G9,G10,G13,G 14,G17,G19	The Hong Kong and China Gas Co. Ltd.	[redacted]	1,070
G3,G4,G7,G8, G11,G12,G15, G16,G18	The Hong Kong and China Gas Co. Ltd.	[redacted]	1,050
M1-M9	Meyer Aluminium Limited	[redacted]	1,300
U1-U2	Universal (Hot-Dip) Galvanising Limited	[redacted]	980
Z1	Zama Industries Ltd.	[redacted]	1,700

8.4.5 The operating parameters including gas exit velocity, gas exit temperature, location, height, diameter and emission rates of the six chimneys in Tai Po Hospital and Alice Ho Miu Ling Nethersole Hospital are based on the information extracted from previous chimney emission study. A verification survey carried out by the Land Surveying Unit of Housing Department to record the locations and heights of the chimneys are shown in **Appendix 8.1**. For the chimneys of Specified Processes within the Tai Po Industrial Estate, the operating parameters are referred to the Register of Applications under Section 14(3)(a) of the Air Pollution Control Ordinance.

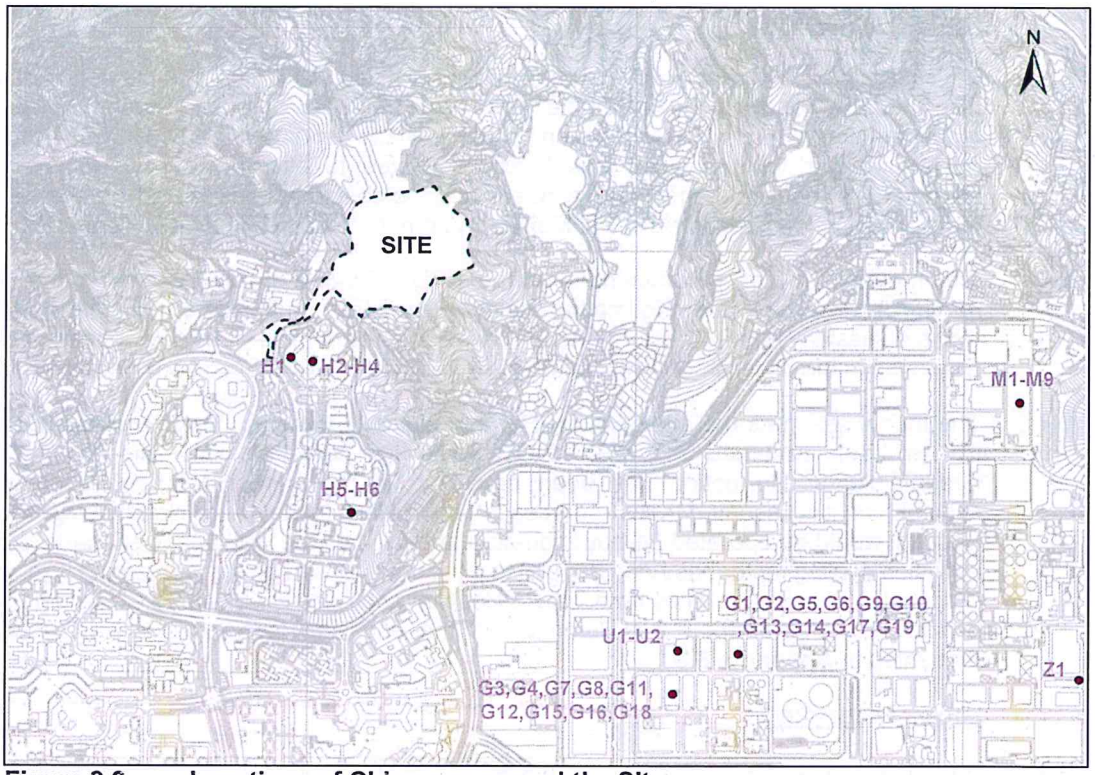


Figure 8.2 Locations of Chimneys around the Site

Figure 8.3 Tai Po Hospital

Figure 8.4 Tai Po Hospital

Figure 8.5 Nethersole Hospital

Figure 8.6 Yu Kok Village (old chimney, not used during survey)

Dispersion Modeling

8.4.6 Emissions (NO_2, SO_2 and RSP) from chimneys identified within 500m of the potential site and also those in Tai Po Industrial Estate have been modelled as point sources. The USEPA Industrial Source Complex Dispersion Model – Short Term Version 3 (ISCST3) model has been employed, and analysis has been conducted to establish the worst case 1-hour averaged, 24-hour averaged and annual averaged concentrations based on the latest real meteorological data recorded at Tai Mei Tuk Automatic Weather Station in Year 2011.

8.4.7 The methodology as recommended in the EPD's Guidelines on "Assessing the 'TOTAL' Air Quality Impacts" and "Estimating Height Restriction and Position of Fresh Air Intake Using Gaussian Plume Models" have been adopted. The flag-pole option has been employed in the assessment with height of terrain/platform taken into consideration.

8.4.8 The model assumes the algorithm for Rural Mode, with the stack tip downwash component. It has been assumed that 20% NO_X would be converted into NO_2 in the model. Gradual plume rise option has been employed in the assessment. As a conservative assumption, it is assumed that all sources in Tai Po Hospital and Alice Ho Miu Ling Nethersole Hospital would be operated 24-hour non-stop annually, as the worst-case scenario. No hourly emission scaling factor has been applied to all sources based on the operation hours per day. Calculation of emission rates from Tai Po Hospital and Alice Ho Miu Ling Nethersole Hospital is shown in **Appendix 8.2**. Summary of the emission inventory for ISC modelling is presented in **Appendix 8.3**.

Impact Assessment

8.4.9 A number of notional assessment points within the site boundary have been identified for the assessment as shown in below **Figure 8.7**.

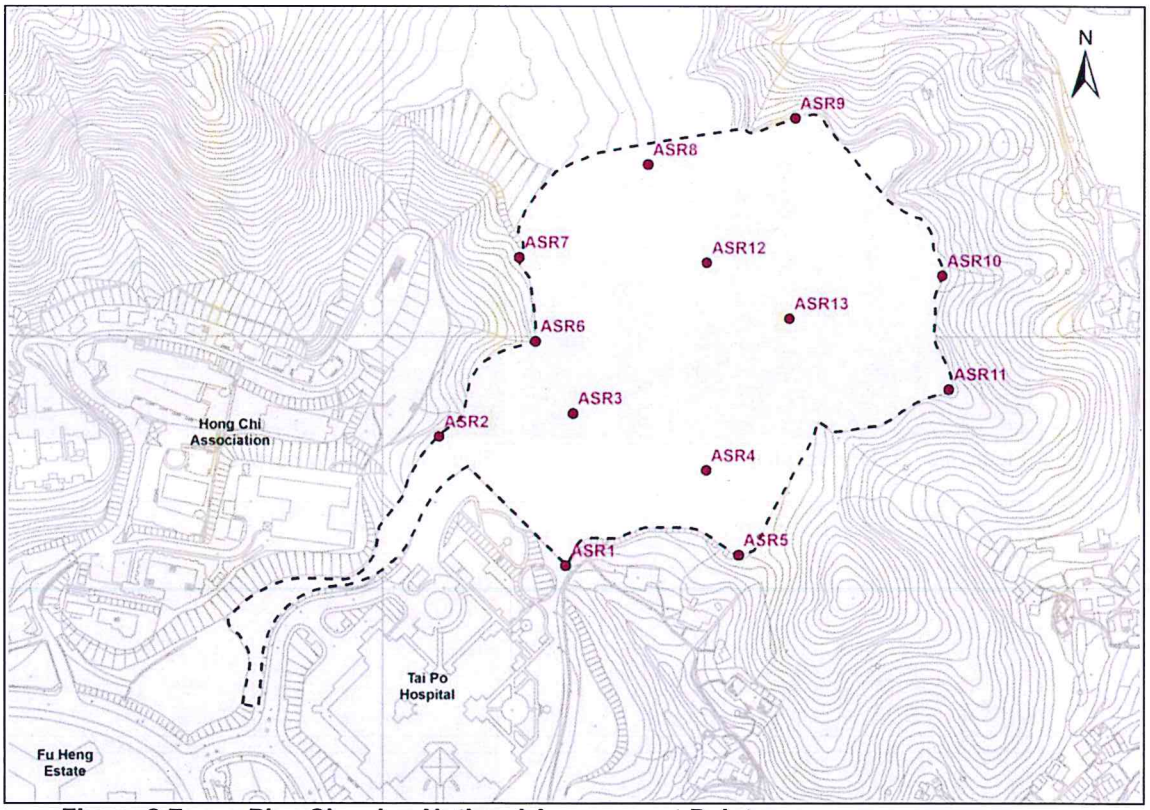


Figure 8.7 Plan Showing Notional Assessment Points

8.4.10 Potential impact of chimney emission based on actual towngas usage for normal operation of boilers is assessed for the potential site under this study.

8.4.11 The predicted maximum hourly and daily average concentrations of NO_2, SO_2 and RSP at the various elevations (i.e. metre above ground, mAG) of representative assessment points (ASR1 to ASR13) have been evaluated and are presented in **Appendix 8.4**.

8.4.12 In summary, the predicted SO_2, NO_2 and RSP concentrations at various assessment heights of all representative assessment points would comply with the relevant AQOs. The highest predicted hourly, daily and annual averaged concentrations of SO_2 are 667μg/m^3, 93μg/m^3 and 15μg/m^3, the highest predicted hourly, daily and annual averaged concentrations of NO_2 are 123 μg/m^3, 69 μg/m^3 and 49 μg/m^3; whereas the highest predicted daily and annual averaged concentrations of RSP are 76 μg/m^3 and 48 μg/m^3 (see **Table 8.5**).

Table 8.5 Summary of Predicted Maximum 1-hour, 24-hour and Annual Average SO_2, NO_2 and RSP Concentrations

Pollutant	Maximum Average Concentration (μg/m^3)		AQO (μg/m^3)	Percentage of AQO (%)
SO_2	1-hour	667	800	83.4
	24-hour	93	350	26.6
	Annual	15	80	18.8
NO_2	1-hour	123	300	41.0
	24-hour	69	150	46.0
	Annual	49	80	61.3
RSP	1-hour	N.A.	N.A.	N.A.
	24-hour	76	180	42.2
	Annual	48	55	87.3

Note: Background concentrations of SO_2, NO_2 and RSP are included.

8.4.13 The worst hit level for hourly, daily and annual averaged SO_2 and NO_2 would be at around 90mPD to 105mPD; while the worst hit level for daily and annual averaged RSP would be at around 65mPD to 70mPD. Contour plots of the predicted maximum hourly, daily and annual averaged concentrations of SO_2, NO_2 and RSP at the worst hit levels are shown in **Appendix 8.5**.

8.4.14 No exceedance would be expected at any air sensitive receiver within the potential site. There would be no constraint on the development site in terms of plume impingement at the current condition.

8.5 Conclusion

8.5.1 Considering the moderate traffic flows and the proposed development have setback from adjacent roads with adequate buffer distances in accordance with HKPSG, no adverse vehicular emission impact is anticipated.

8.5.2 Potential impacts of chimney emissions from Tai Po Hospital and Nethersole Hospital have also been assessed. The predicted SO_2, NO_2 and RSP concentrations at various assessment heights would comply with the relevant AQOs. No adverse chimney emission impact is anticipated.

APPENDIX 8.1

Survey Results from HD

HOUSING DEPARTMENT
LAND SURVEYING UNIT

RESULTS OF CHECKING SURVEY

Name of Site: Tai Po Hospital & Alice Ho Miu Ling Nethersole Hospital

Job Description: Height of chimneys in mPD

Survey Job No.: 33832/PT File No.: Computation Folder No.:

Ref. Job No.: Surveyed By: [redacted] Date: 22/12/2010

Remarks: Computed By: [redacted] Date: 23/12/2010

Checked By: [redacted] Date: 3 Jan. 2011

Examined By: [redacted] Date: 3 1. 2011

Point No.	Coordinates (in metre)		Displacement (in metre)	Level (in metre)		Difference (in metre)	Remarks
	Proposed	Surveyed		Proposed	Surveyed		
B	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
A	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
C	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
F1	N	N [redacted]			[redacted]		Roof top Level
	E	E [redacted]					
F2	N	N [redacted]			[redacted]		Roof top Level
	E	E [redacted]					
F	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
J	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
I	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
E	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
D	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
G	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
H	N	N [redacted]			[redacted]		Top of Chimmy
	E	E [redacted]					
A4	N	N [redacted]			[redacted]		Roof top Level
	E	E [redacted]					
A5	N	N [redacted]			[redacted]		Roof top Level
	E	E [redacted]					
D1	N	N [redacted]			[redacted]		Roof top Level
	E	E [redacted]					
D2	N	N [redacted]			[redacted]		Roof top Level
	E	E [redacted]					

Proposed coordinates and levels were attached with request form.

HOUSING DEPARTMENT
LAND SURVEYING UNIT

RESULTS OF CHECKING SURVEY

Name of Site: Tai Po Hospital & Alice Ho Miu Ling Nethersole Hospital

Job Description: Height of chimneys in mPD

Survey Job No.: 33832/PT File No.: Computation Folder No.:

Ref. Job No.: Surveyed By: [redacted] Date: 22/12/2010

Remarks: Computed By: [redacted] Date: 23/12/2010

Checked By: [redacted] Date: 3 Jan. 2011

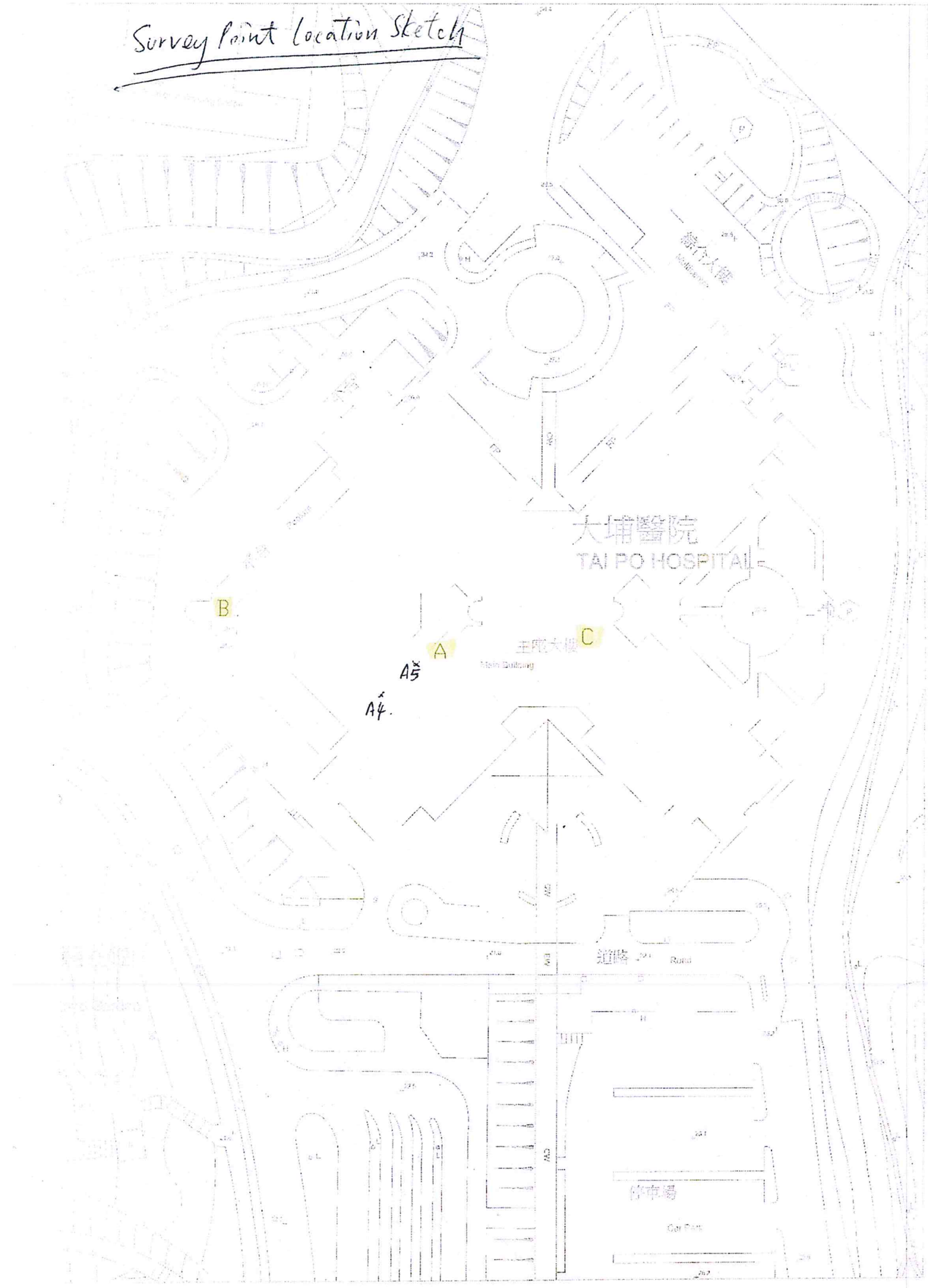
Examined By: [redacted] Date: 7.1.2011

Point No.	Coordinates (in metre)		Displacement (in metre)	Level (in metre)		Difference (in metre)	Remarks
	Proposed	Surveyed		Proposed	Surveyed		
D3	N	N [redacted]			[redacted]		Roof top Level
	E	E [redacted]					

Proposed coordinates and levels were attached with request form.

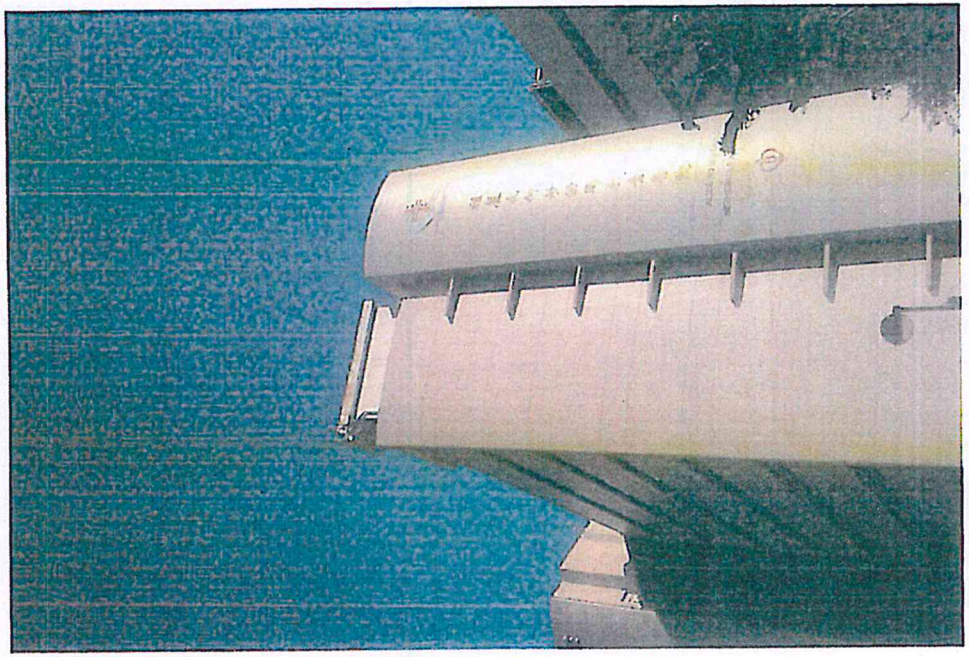
Survey point location Sketch

Survey Point Location Sketch



Pt. I, J

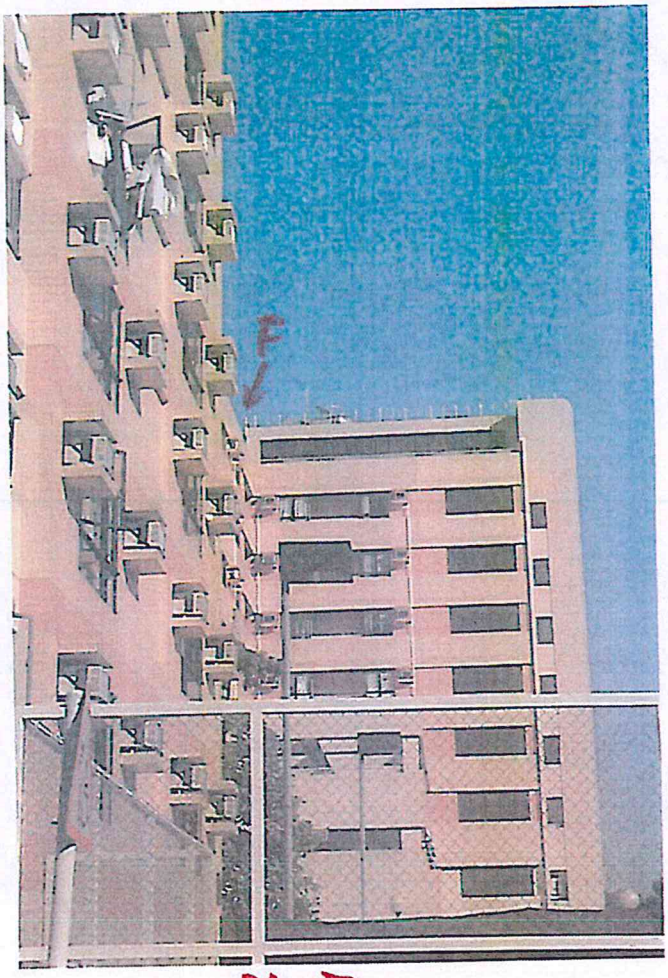
Pt. A



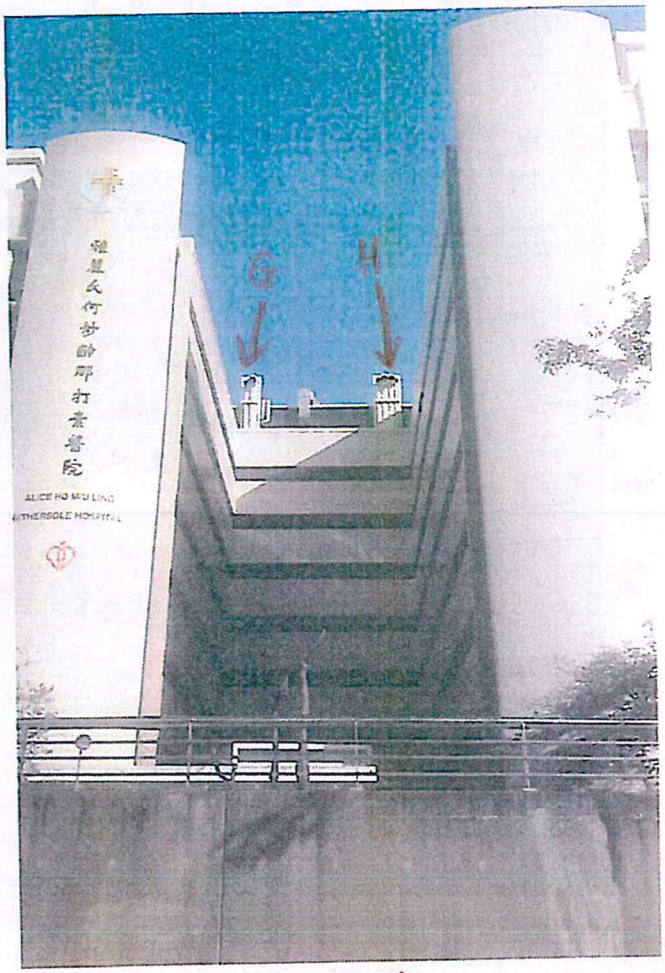
Pt. B

Pt. D, E

Pt. D, E

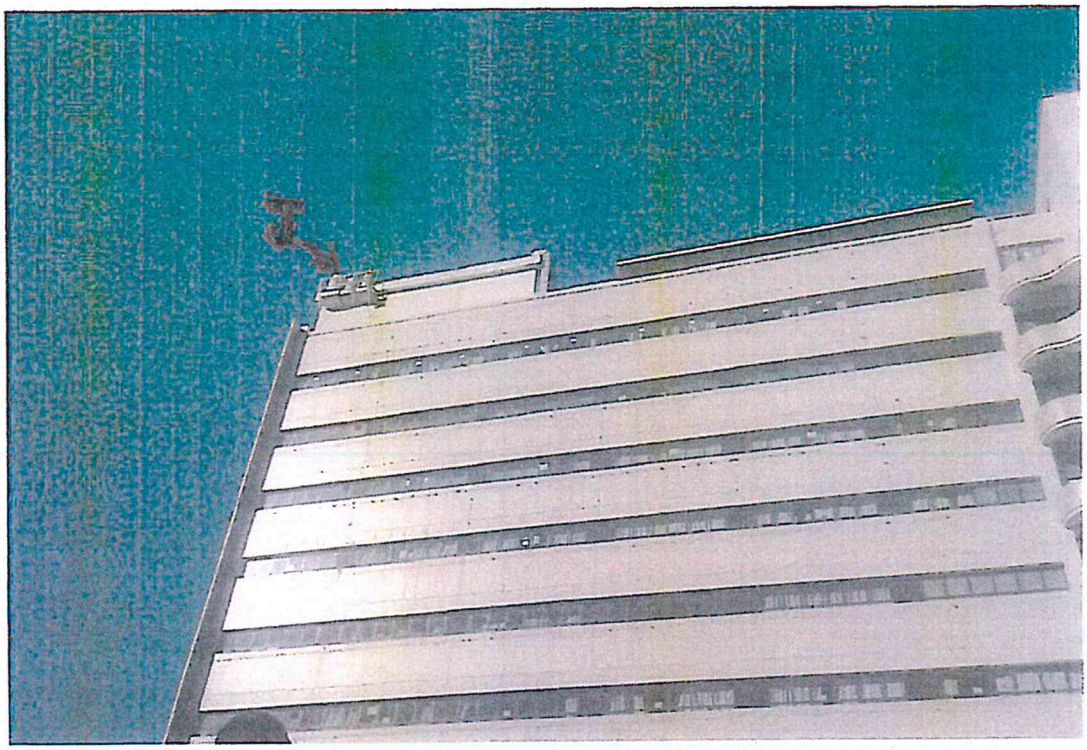


Pt. F



Pt. G, H

Pt. C



Pt. J

APPENDIX 8.2

Calculation of Chimney Emission Factors Based on Actual Towngas Usage

Appendix 8.2 Towngas Consumption for Boilers in Alice Ho Miu Ling Nethersole Hospital (2008-2010)

Month	Monthly Towngas (in Unit)	Annual Towngas (in Unit)
01/2008	[redacted]	[redacted]
02/2008	[redacted]	
03/2008	[redacted]	
04/2008	[redacted]	
05/2008	[redacted]	
06/2008	[redacted]	
07/2008	[redacted]	
08/2008	[redacted]	
09/2008	[redacted]	
10/2008	[redacted]	
11/2008	[redacted]	
12/2008	[redacted]	
01/2009	[redacted]	[redacted]
02/2009	[redacted]	
03/2009	[redacted]	
04/2009	[redacted]	
05/2009	[redacted]	
06/2009	[redacted]	
07/2009	[redacted]	
08/2009	[redacted]	
09/2009	[redacted]	
10/2009	[redacted]	
11/2009	[redacted]	
12/2009	[redacted]	
01/2010	[redacted]	[redacted]
02/2010	[redacted]	
03/2010	[redacted]	
04/2010	[redacted]	
05/2010	[redacted]	
06/2010	[redacted]	
07/2010	[redacted]	
08/2010	[redacted]	
09/2010	[redacted]	
10/2010	[redacted]	
11/2010	[redacted]	
12/2010	[redacted]	

Appendix 8.2 Towngas Consumption for Boilers in Tai Po Hospital (2008-2010)

Month	Monthly Towngas (in Unit)	Annual Towngas (in Unit)
01/2008	[redacted]	[redacted]
02/2008	[redacted]	
03/2008	[redacted]	
04/2008	[redacted]	
05/2008	[redacted]	
06/2008	[redacted]	
07/2008	[redacted]	
08/2008	[redacted]	
09/2008	[redacted]	
10/2008	[redacted]	
11/2008	[redacted]	
12/2008	[redacted]	
01/2009	[redacted]	[redacted]
02/2009	[redacted]	
03/2009	[redacted]	
04/2009	[redacted]	
05/2009	[redacted]	
06/2009	[redacted]	
07/2009	[redacted]	
08/2009	[redacted]	
09/2009	[redacted]	
10/2009	[redacted]	
11/2009	[redacted]	
12/2009	[redacted]	
01/2010	[redacted]	[redacted]
02/2010	[redacted]	
03/2010	[redacted]	
04/2010	[redacted]	
05/2010	[redacted]	
06/2010	[redacted]	
07/2010	[redacted]	
08/2010	[redacted]	
09/2010	[redacted]	
10/2010	[redacted]	
11/2010	[redacted]	
12/2010	[redacted]	

Appendix 8.2 Calculation of Chimney Emission Factors Based on Actual Towngas Usage

Estimated Emission Factor of NO_X based on AP-42 [1] = [redacted] lb/10^6 scf

Estimated Emission Factor of SO_2 based on AP-42 = [redacted] lb/10^6 scf

Estimated Emission Factor of PM based on AP-42 = [redacted] lb/10^6 scf

Conversion factor of NO_X to NO_2 = [redacted] [according to Ambient Ratio Method (ARM)]

Hospital	Maximum Annual Towngas Consumption for Boilers from 2008-2010 (Unit) [2]	Heat value per unit of Towngas consumed (MJ/ Unit) [3]	Total Towngas consumption (MJ)	Heating Value (MJ/m^3) [4]	Volume of Towngas Consumed (m^3)	Types of Pollutants	Emission Factors ($kg/10^6m^3$) [5]	Actual Emission Rate Using Towngas tons /year	Actual Emission Rate Using Towngas g/s
AHN	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	SO_2	[redacted]	[redacted]	[redacted]
						NO_X	[redacted]	[redacted]	[redacted]
						PM	[redacted]	[redacted]	[redacted]
TPH	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	SO_2	[redacted]	[redacted]	[redacted]
						NO_X	[redacted]	[redacted]	[redacted]
						PM	[redacted]	[redacted]	[redacted]

Note:

[1] Emission factor is based on an average natural gas higher heating value of [redacted] Btu/scf in AP-42 for small boilers (<100 MMBtu/hr Heat Input).
The emission factor in this table is converted to Towngas heating values according to AP-42 by multiplying the given emission factor (100 lb/10^6 scf) by the ratio of the Towngas heating value to the averge heating value used in AP-42.
To convert from MJ/m3 to Btu/scf, multiply by 25.73 (1Btu equals to 0.0011 MJ. 1standard cubic foot (scf) equals to 0.0283 cubic metres)

[2] Among the latest 3 years Towngas Consumption, the maximum Towngas Consumption of AHN is in Year 2009, while TPH is in Year 2010.

[3] Heat value of Towngas is [redacted] MJ/ Unit from Towngas Company Limited.

[4] Heating value of Town Gas is [redacted] MJ/m^3 from Towngas Company Limited.

[5] To convert from lb/10^6 scf to kg/10^6m^3, multiply by 16.

APPENDIX 8.3

Summary of Emission Inventory for ISC Modeling

Appendix 8.3 Summary of Emission Inventory for ISC Modeling

Chimney ID	X	Y	Base Elevation (mPD)	Discharge / Chimney Height (m)	Discharge Temperature (K)	Discharge Diameter (m)	Exit Velocity (m/s)	Emission Rate (g/s)			Duration of Maximum Concentration (h/d)
								NOx	SO2	RSP	
Sources in Tai Po Hospital and Nethersole Hospital											
H1											24
H2											24
H3											24
H4											24
H5											24
H6											24
Sources in Tai Po Industrial Estate											
G1											24
G2											24
G5											24
G6											24
G9											24
G10											24
G13											24
G14											24
G17											24
G19											24
G3											24
G4											24
G7											24
G8											24
G11											24
G12											24
G15											24
G16											24
G18											24
G20											Emergency Operation for Electricity Generation
G21											Emergency Operation for Electricity Generation
G22											Emergency Operation for Electricity Generation
G23											Emergency Operation for Electricity Generation
G24											Emergency Operation for Electricity Generation
G25											Emergency Operation for Electricity Generation
G26											Emergency Operation for Electricity Generation
G27											Emergency Operation for Electricity Generation
G28											Emergency Operation for Electricity Generation
G29											Emergency Operation for Electricity Generation
G30											Emergency Operation for Electricity Generation
G31											Emergency Operation for Electricity Generation
G32											Emergency Operation for Electricity Generation
M1											24
M2											24
M3											24
M4											24
M5											24
M6											24
M7											24
M8											24
M9											24
U1											24
U2											24
Z1											10

Note:
Chimney G20 to G32 are for electricity generation during emergency operation and thus not included in the modeling.

APPENDIX 8.4

Predicted SO_2, NO_2 and RSP Concentrations ($\mu g/m^3$)

Appendix 8.4a Predicted Maximum 1-hr NO2 concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
ASR1	836120.6	835849.7	63	64	68	74	81	96	109	118	123	120	109	94	79	68	68
ASR2	836037.2	835934.4	63	64	67	72	78	91	103	111	115	113	103	90	77	66	66
ASR3	836125.5	835949.6	61	61	61	61	61	63	69	78	86	89	87	80	72	68	69
ASR4	836213.5	835912.2	61	61	61	61	62	69	75	86	95	99	97	88	77	69	69
ASR5	836235.2	835856.7	61	61	61	61	61	62	67	75	82	86	84	78	69	69	69
ASR6	836100.6	835996.9	61	61	61	61	61	62	66	68	70	69	67	67	68	68	69
ASR7	836090.1	836052.2	61	61	61	61	62	69	75	79	81	79	74	68	68	68	68
ASR8	836174.7	836113.3	62	63	66	71	76	88	99	107	110	108	99	87	75	65	65
ASR9	836272.4	836143.8	62	62	62	62	62	64	75	86	96	100	98	89	77	68	68
ASR10	836369.6	836040.2	62	62	62	62	63	71	78	82	84	82	76	69	68	69	69
ASR11	836373.8	835965.5	61	61	61	61	61	62	63	64	65	65	66	67	67	68	68
ASR12	836214.0	836048.7	62	63	67	72	78	91	102	110	114	112	102	90	76	66	66
ASR13	836268.6	836012.0	61	63	66	71	77	90	101	110	114	111	102	89	75	67	68
	Maximum		**63**	**64**	**68**	**74**	**81**	**96**	**109**	**118**	**123**	**120**	**109**	**94**	**79**	**69**	**69**

Appendix 8.4b Predicted Maximum Daily NO2 concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
ASR1	836120.6	835849.7	53	53	54	55	56	58	60	61	61	60	58	55	54	54	54
ASR2	836037.2	835934.4	52	53	53	54	55	57	59	60	60	59	57	55	54	54	53
ASR3	836125.5	835949.6	53	53	53	53	53	53	53	54	54	54	54	54	54	54	54
ASR4	836213.5	835912.2	53	53	53	53	53	54	56	57	57	57	56	55	55	55	54
ASR5	836235.2	835856.7	53	53	53	53	53	53	54	54	54	54	54	54	54	54	54
ASR6	836100.6	835996.9	53	53	53	53	53	53	53	54	54	54	54	54	54	54	54
ASR7	836090.1	836052.2	53	53	53	53	53	53	54	55	55	54	54	54	54	54	54
ASR8	836174.7	836113.3	55	56	56	58	59	63	65	67	66	64	61	57	54	53	53
ASR9	836272.4	836143.8	52	52	52	53	53	54	55	55	55	54	53	52	51	51	50
ASR10	836369.6	836040.2	53	53	54	54	55	57	59	59	59	58	56	54	52	51	51
ASR11	836373.8	835965.5	52	52	52	52	53	53	54	54	54	53	53	52	51	51	51
ASR12	836214.0	836048.7	56	56	57	59	60	64	67	69	68	66	62	58	54	54	53
ASR13	836268.6	836012.0	55	56	57	58	60	63	66	67	67	65	61	57	54	53	53
	Maximum		**56**	**56**	**57**	**59**	**60**	**64**	**67**	**69**	**68**	**66**	**62**	**58**	**55**	**55**	**54**

Appendix 8.4c Predicted Maximum Annual NO2 concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
ASR1	836120.6	835849.7	49	49	49	49	49	49	49	49	49	49	49	49	49	48	48
ASR2	836037.2	835934.4	49	49	49	49	49	49	49	49	49	49	49	49	49	48	48
ASR3	836125.5	835949.6	48	49	49	49	49	49	49	49	49	49	49	49	48	48	48
ASR4	836213.5	835912.2	49	49	49	49	49	49	49	49	49	49	49	49	49	48	48
ASR5	836235.2	835856.7	49	49	49	49	49	49	49	49	49	49	49	49	48	48	48
ASR6	836100.6	835996.9	48	48	48	48	49	49	49	49	49	49	48	48	48	48	48
ASR7	836090.1	836052.2	48	48	48	48	48	49	49	49	49	49	48	48	48	48	48
ASR8	836174.7	836113.3	49	49	49	49	49	49	49	49	49	49	49	49	49	48	48
ASR9	836272.4	836143.8	48	48	48	48	48	49	49	49	49	49	49	48	48	48	48
ASR10	836369.6	836040.2	48	48	48	48	49	49	49	49	49	49	49	49	48	48	48
ASR11	836373.8	835965.5	48	48	48	49	49	49	49	49	49	49	49	48	48	48	48
ASR12	836214.0	836048.7	49	49	49	49	49	49	49	49	49	49	49	49	49	48	48
ASR13	836268.6	836012.0	49	49	49	49	49	49	49	49	49	49	49	49	49	48	48
	Maximum		**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**48**	**48**

Appendix 8.4d Predicted Maximum 1-hr SO2 concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
ASR1	836120.6	835849.7	60	60	60	61	62	95	153	214	259	273	249	197	138	99	105
ASR2	836037.2	835934.4	70	70	71	83	115	209	335	466	561	587	535	425	296	182	119
ASR3	836125.5	835949.6	70	70	70	71	98	181	293	412	500	524	476	375	259	157	120
ASR4	836213.5	835912.2	75	75	76	79	113	216	360	512	626	657	593	463	314	186	132
ASR5	836235.2	835856.7	70	70	71	72	82	157	262	374	459	482	436	340	230	137	125
ASR6	836100.6	835996.9	58	58	58	59	59	87	137	190	230	241	221	176	124	95	100
ASR7	836090.1	836052.2	45	45	45	44	44	44	45	52	57	58	58	61	62	64	68
ASR8	836174.7	836113.3	60	60	61	62	63	104	166	233	282	297	270	214	149	105	104
ASR9	836272.4	836143.8	74	74	75	80	115	220	365	520	635	667	602	470	318	189	131
ASR10	836369.6	836040.2	61	61	62	63	64	85	142	205	253	267	242	188	128	115	113
ASR11	836373.8	835965.5	55	55	55	55	55	56	69	88	108	115	105	87	90	91	95
ASR12	836214.0	836048.7	49	49	49	49	49	49	52	62	69	70	67	72	74	75	76
ASR13	836268.6	836012.0	48	48	48	48	48	48	48	54	60	61	62	65	67	69	73
	Maximum		**75**	**75**	**76**	**83**	**115**	**220**	**365**	**520**	**635**	**667**	**602**	**470**	**318**	**189**	**132**

Appendix 8.4e Predicted Maximum Daily SO2 concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
ASR1	836120.6	835849.7	28	28	28	28	28	27	30	38	43	45	42	36	28	22	21
ASR2	836037.2	835934.4	29	29	29	29	29	37	53	69	81	84	78	64	48	34	24
ASR3	836125.5	835949.6	29	29	29	29	29	34	48	63	74	77	71	58	44	31	22
ASR4	836213.5	835912.2	31	31	31	31	31	38	56	75	90	93	86	69	51	35	24
ASR5	836235.2	835856.7	31	31	31	31	31	31	44	58	69	72	66	54	40	28	23
ASR6	836100.6	835996.9	26	26	26	26	25	25	28	35	40	41	39	33	27	21	20
ASR7	836090.1	836052.2	23	23	23	23	23	22	22	20	19	18	17	17	17	17	17
ASR8	836174.7	836113.3	25	25	25	25	24	24	26	31	34	35	32	28	23	19	18
ASR9	836272.4	836143.8	27	27	27	26	26	31	42	53	62	65	60	49	36	26	20
ASR10	836369.6	836040.2	27	27	27	27	27	26	25	29	32	33	30	26	22	20	19
ASR11	836373.8	835965.5	28	28	28	28	28	27	26	24	26	27	25	22	20	20	20
ASR12	836214.0	836048.7	24	24	24	24	24	23	23	22	20	18	17	17	17	16	16
ASR13	836268.6	836012.0	25	25	25	25	25	24	24	22	21	19	18	17	18	18	18
	Maximum		**31**	**31**	**31**	**31**	**31**	**38**	**56**	**75**	**90**	**93**	**86**	**69**	**51**	**35**	**24**

Appendix 8.4f Predicted Maximum Annual SO2 concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
ASR1	836120.6	835849.7	12	12	12	12	12	13	13	13	13	13	13	12	12	11	11
ASR2	836037.2	835934.4	12	12	12	12	13	13	14	14	15	15	14	13	12	12	11
ASR3	836125.5	835949.6	12	12	12	12	13	13	14	14	15	14	14	13	12	12	11
ASR4	836213.5	835912.2	12	12	12	13	13	14	14	15	15	15	15	14	13	12	11
ASR5	836235.2	835856.7	12	12	12	13	13	13	14	14	15	14	14	13	12	12	11
ASR6	836100.6	835996.9	12	12	12	12	12	12	12	13	13	13	12	12	12	11	11
ASR7	836090.1	836052.2	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
ASR8	836174.7	836113.3	11	11	11	11	11	12	12	12	12	12	12	12	11	11	11
ASR9	836272.4	836143.8	11	11	11	11	12	12	13	14	14	14	13	13	12	11	11
ASR10	836369.6	836040.2	11	11	11	11	11	12	12	12	12	12	12	12	11	11	11
ASR11	836373.8	835965.5	12	12	12	12	12	12	12	12	12	12	12	12	11	11	11
ASR12	836214.0	836048.7	11	11	11	11	11	11	11	12	12	11	11	11	11	11	11
ASR13	836268.6	836012.0	11	11	11	11	11	12	12	12	12	12	12	11	11	11	11
	Maximum		**12**	**12**	**12**	**13**	**13**	**14**	**14**	**15**	**15**	**15**	**15**	**14**	**13**	**12**	**11**

Appendix 8.4g Predicted Maximum Daily RSP concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
ASR1	836120.6	835849.7	53	53	53	53	53	53	53	52	51	50	49	48	48	49	49
ASR2	836037.2	835934.4	58	58	59	59	60	61	60	58	56	54	52	51	49	48	48
ASR3	836125.5	835949.6	59	60	61	64	66	69	68	63	58	55	53	51	49	50	50
ASR4	836213.5	835912.2	58	59	60	61	62	64	64	61	58	55	53	51	50	49	49
ASR5	836235.2	835856.7	58	58	59	61	64	68	67	62	56	54	52	50	49	50	50
ASR6	836100.6	835996.9	57	58	59	61	63	65	65	62	57	52	49	49	49	49	49
ASR7	836090.1	836052.2	55	56	56	57	58	59	59	57	53	50	49	49	49	49	49
ASR8	836174.7	836113.3	55	56	56	56	55	55	54	52	50	49	48	48	47	48	48
ASR9	836272.4	836143.8	56	57	59	62	66	71	71	68	61	54	51	49	48	48	47
ASR10	836369.6	836040.2	56	56	57	57	57	57	57	55	52	49	49	48	47	47	47
ASR11	836373.8	835965.5	57	58	60	64	69	76	76	72	62	54	49	48	47	47	47
ASR12	836214.0	836048.7	56	56	56	56	56	55	54	52	50	48	48	48	48	48	48
ASR13	836268.6	836012.0	57	57	57	60	63	67	67	63	57	52	48	48	48	48	48
Maximum			**59**	**60**	**61**	**64**	**69**	**76**	**76**	**72**	**62**	**55**	**53**	**51**	**50**	**50**	**50**

Appendix 8.4h Predicted Maximum Annual RSP concentration (ug/m3)

ASR ID	x_co	y_co	1.5m	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m	110m	120m
ASR1	836120.6	835849.7	47	47	47	47	47	47	47	47	47	46	46	46	46	46	46
ASR2	836037.2	835934.4	47	47	47	47	47	47	47	47	47	46	46	46	46	46	46
ASR3	836125.5	835949.6	48	48	48	48	48	48	48	48	47	47	46	46	46	46	46
ASR4	836213.5	835912.2	48	48	48	48	48	48	48	47	47	47	46	46	46	46	46
ASR5	836235.2	835856.7	48	48	48	48	48	48	48	47	47	47	46	46	46	46	46
ASR6	836100.6	835996.9	47	47	47	47	47	48	47	47	47	46	46	46	46	46	46
ASR7	836090.1	836052.2	47	47	47	47	47	47	47	47	46	46	46	46	46	46	46
ASR8	836174.7	836113.3	47	47	47	47	47	47	47	47	46	46	46	46	46	46	46
ASR9	836272.4	836143.8	47	47	47	48	48	48	48	47	47	47	46	46	46	46	46
ASR10	836369.6	836040.2	47	47	47	47	47	47	47	47	46	46	46	46	46	46	46
ASR11	836373.8	835965.5	47	47	47	47	47	48	48	47	47	46	46	46	46	46	46
ASR12	836214.0	836048.7	47	47	47	47	47	47	47	46	46	46	46	46	46	46	46
ASR13	836268.6	836012.0	47	47	47	47	47	47	47	47	47	46	46	46	46	46	46
Maximum			**48**	**48**	**48**	**48**	**48**	**48**	**48**	**48**	**47**	**47**	**46**	**46**	**46**	**46**	**46**

APPENDIX 8.5

NO_2, SO_2 and RSP Contour Plots at Worst Hit Level

Appendix 8.5 NO_2, SO_2 and RSP Contour Plots at the Worst Hit Level

Figure 1 1-hr Average NO_2 Contour at the Worst Hit Level (around 90mPD) (in $\mu g/m^3$)

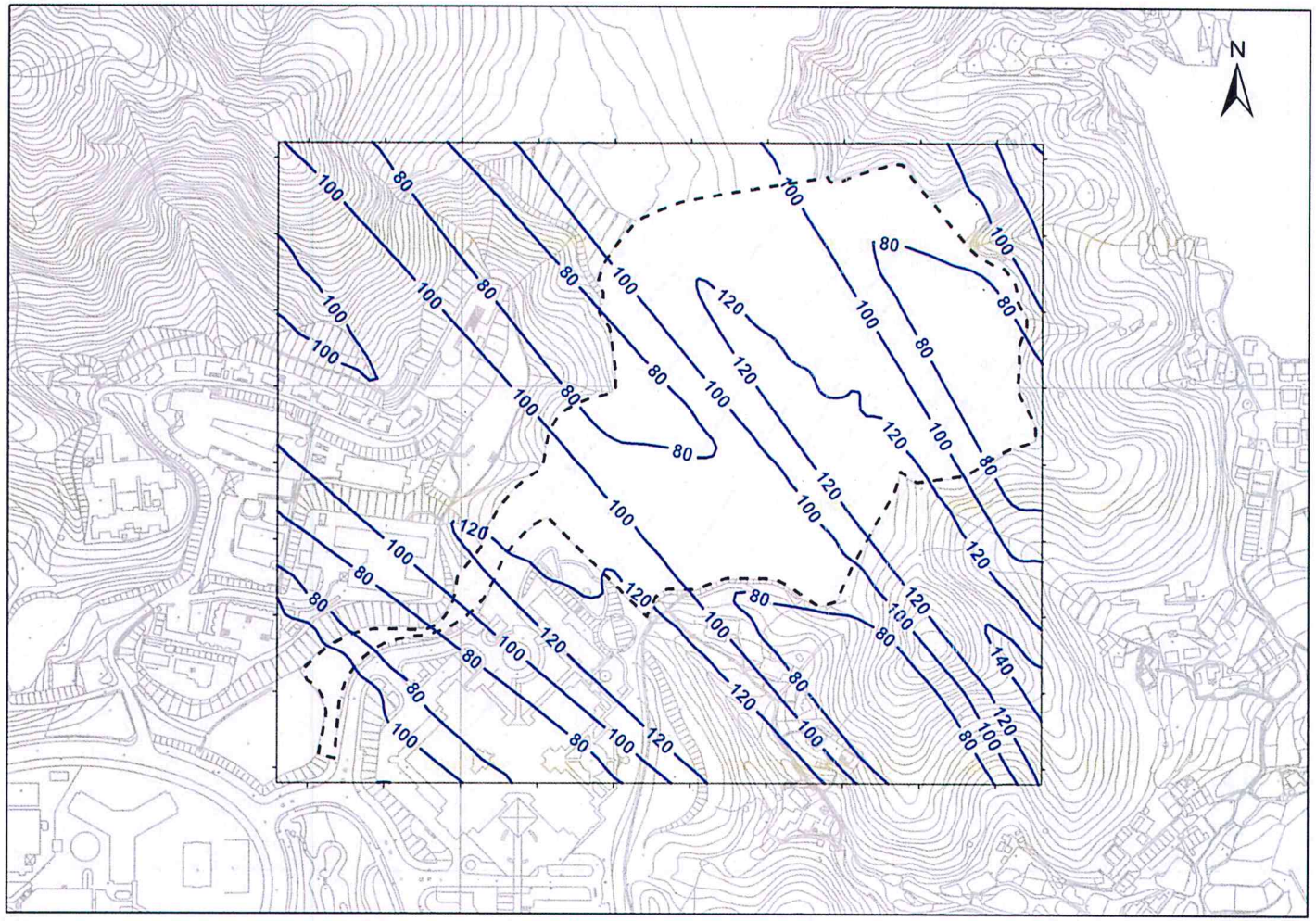


Figure 2 **24-hr Average NO_2 Contour at the Worst Hit Level (around 85mPD) (in $\mu g/m^3$)**

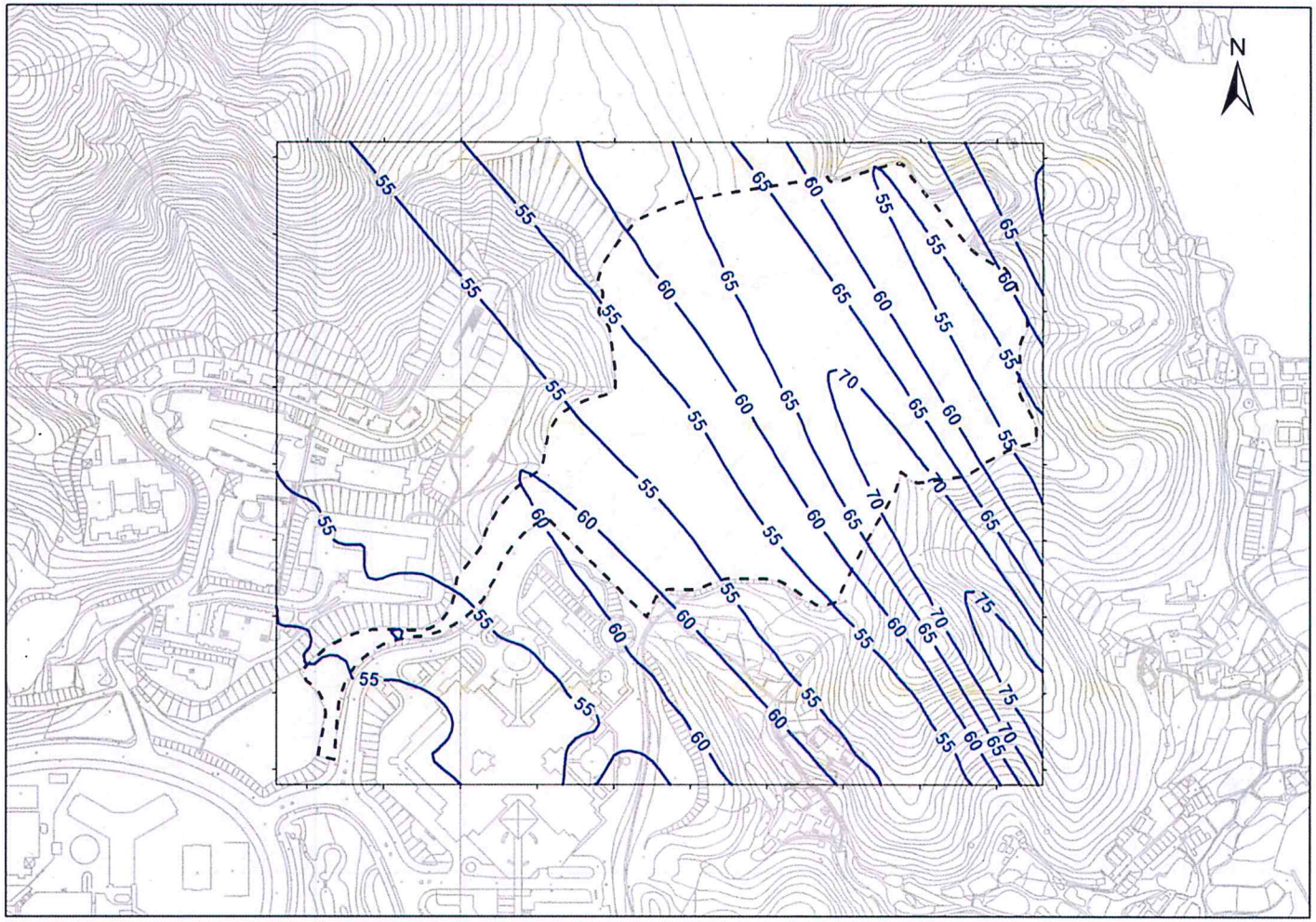


Figure 3 1-yr Average NO_2 Contour at the Worst Hit Level (around 90mPD) (in $\mu g/m^3$)

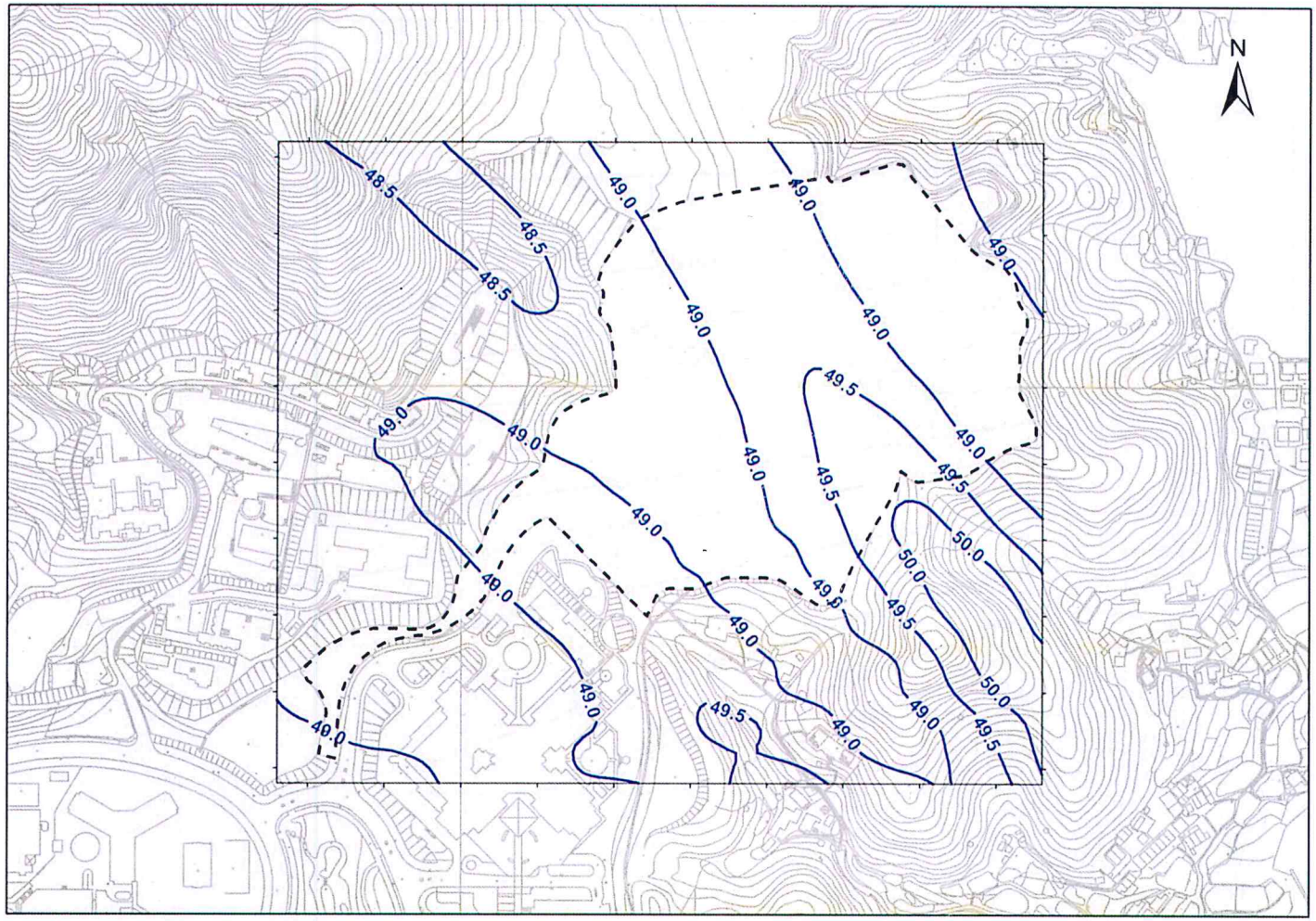


Figure 4 **1-hr Average SO_2 Contour at the Worst Hit Level (around 90mPD) (in $\mu g/m^3$)**

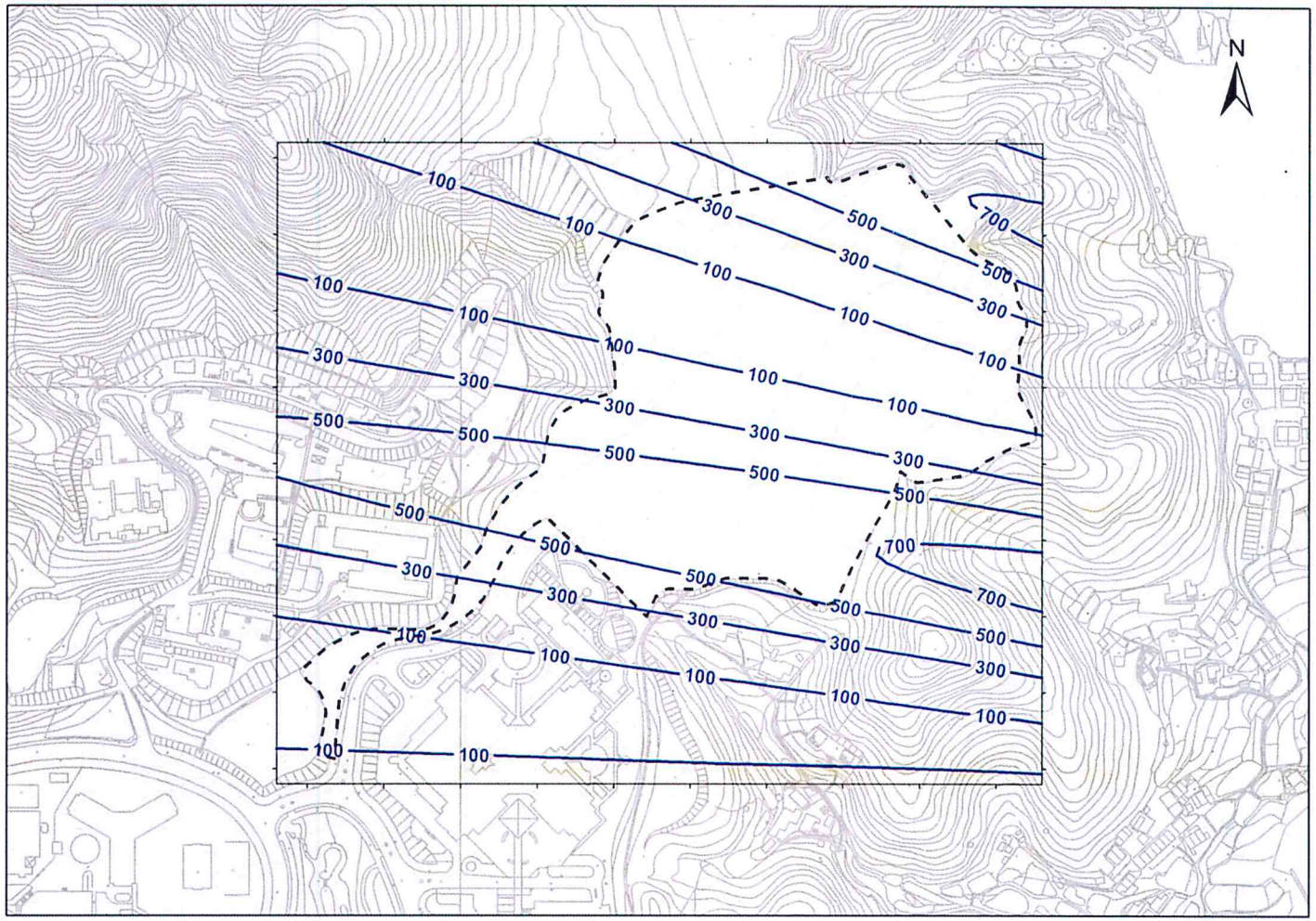


Figure 5 **24-hr Average SO_2 Contour at the Worst Hit Level (around 85mPD) (in $\mu g/m^3$)**

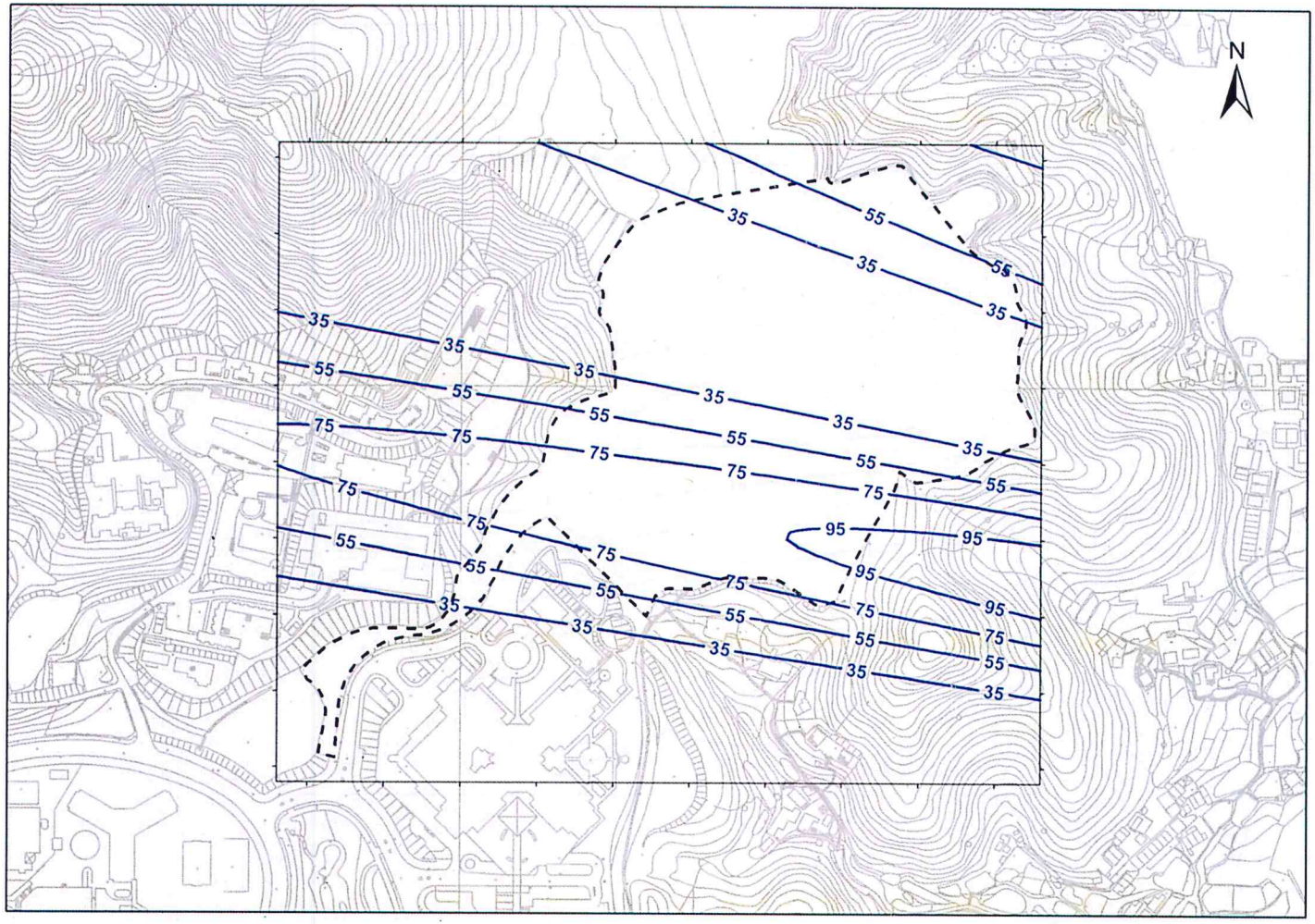


Figure 6 **1-yr Average SO_2 Contour at the Worst Hit Level (around 90mPD) (in $\mu g/m^3$)**

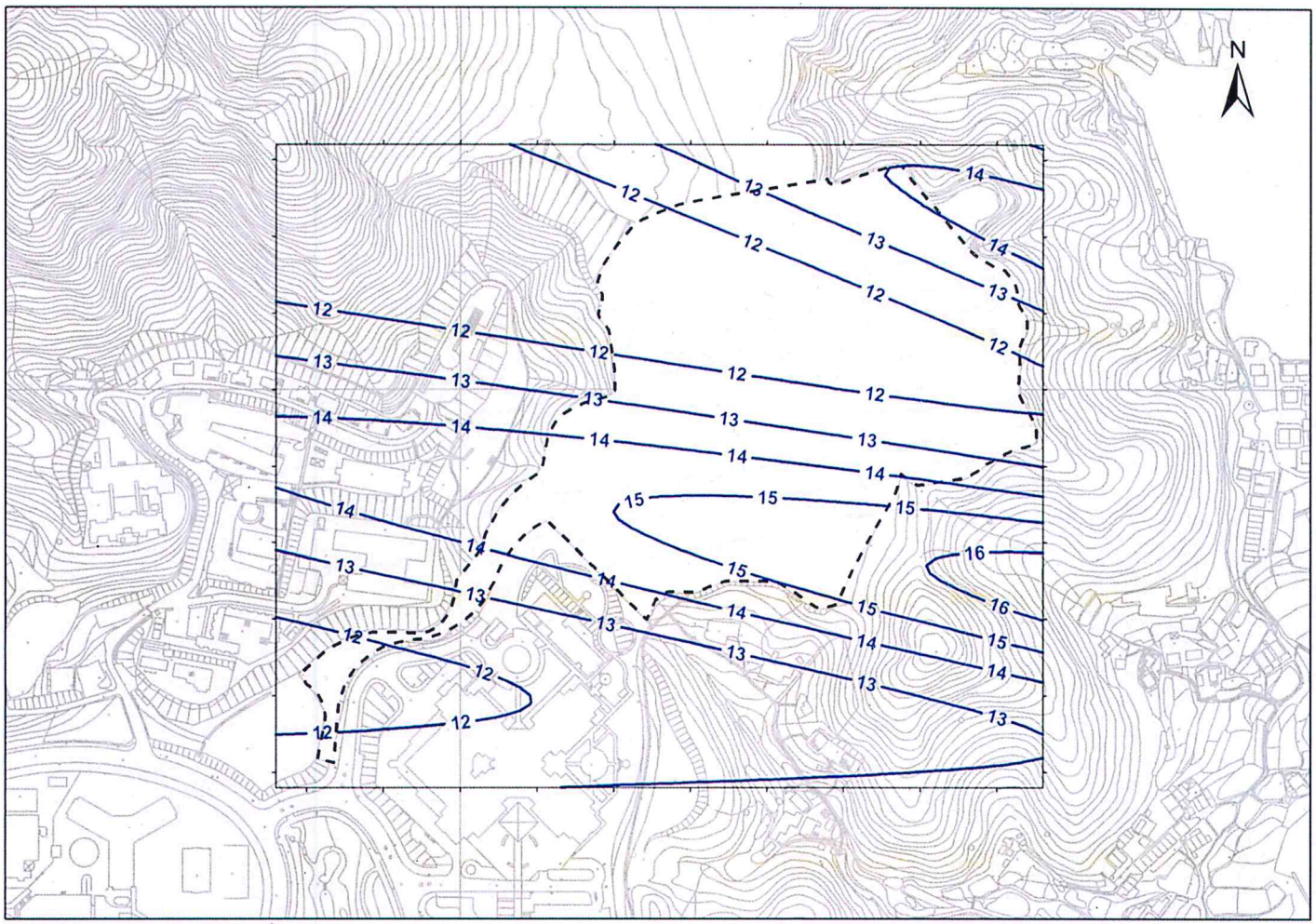


Figure 7 24-hr Average RSP Contour at the Worst Hit Level (around 85mPD) (in $\mu g/m^3$)

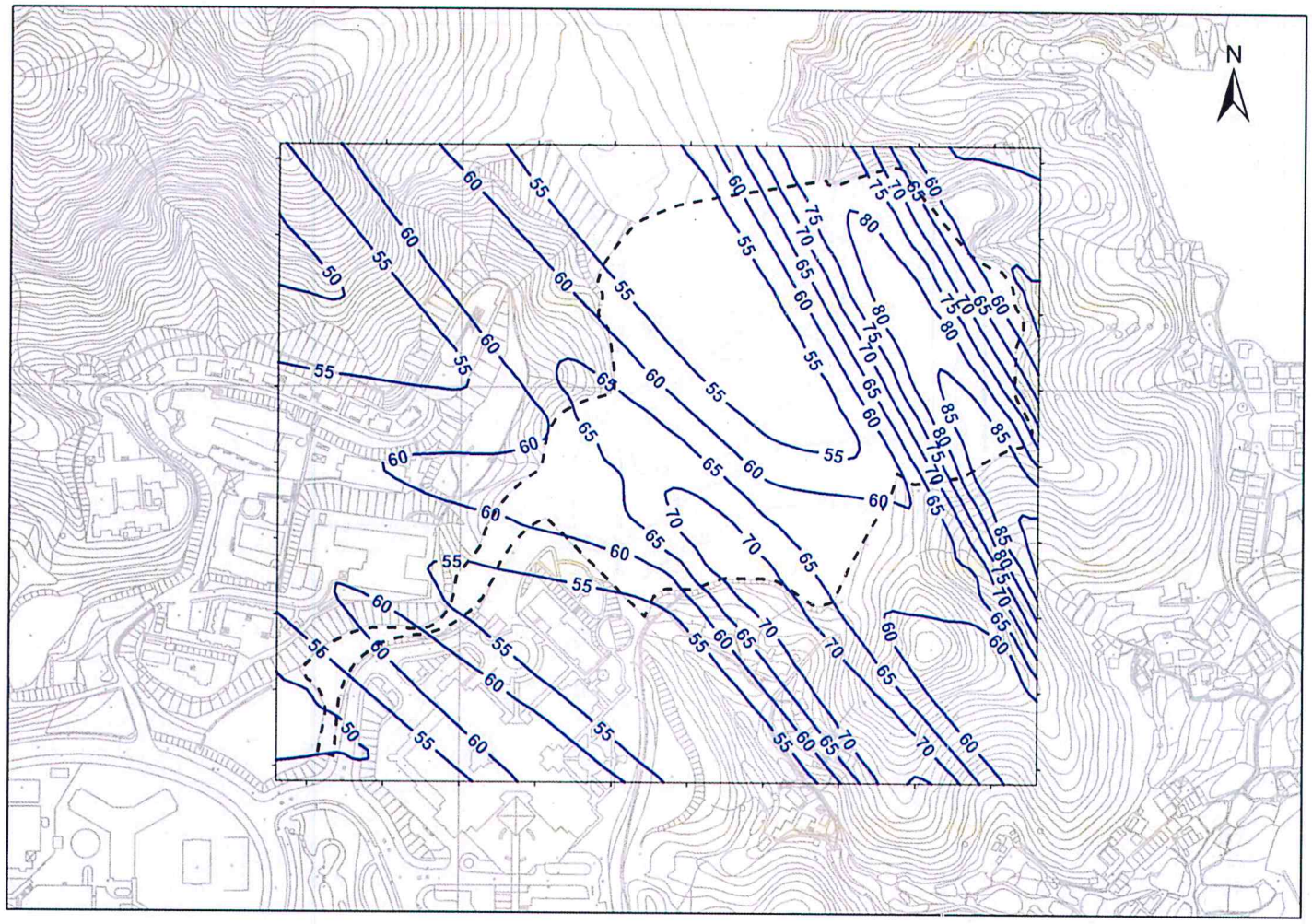


Figure 8 1-yr Average RSP Contour at the Worst Hit Level (around 90mPD) (in $\mu g/m^3$)