Hong Kong Housing Authority

CB20170587

Consultancy for Environmental Design Studies for Public Housing Development at Chiu Shun Road, Tseung Kwan O

Air Ventilation Assessment – Expert Evaluation (AVA-EE)

May 2019

	Name	Signature
Prepared:	Sam Shao	
Checked:	Tsang Hon Wai	
Reviewed & Approved:	YT Tang	

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AECOM Asia Co. Ltd.
13/F, Grand Central Plaza, Tower 2, 138 Shatin Rural Committee Road, Shatin, NT, Hong Kong
Tel: (852) 3922 9000 Fax: (852) 3922 9797 www.aecom.com

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1 INTRODUCTION

Background

1.1 AECOM Asia Co. Ltd. has been commissioned by the Hong Kong Housing Authority (HKHA) to undertake an Air Ventilation Assessment (AVA) Study – Expert Evaluation (EE) for the potential Public Housing Development located at Chiu Shun Road, Tseung Kwan O to examine the air ventilation impact of the proposed building design qualitatively and formulate effective and practicable measures enhancing the air ventilation as part of the continuous design improvement process.

Objectives

1.2 The objective of this study is to assess the air ventilation impacts of the development proposal for incorporation into the Outline Zoning Plan (OZP). The Expert Evaluation Study has made reference to the "Housing, Planning and Lands Bureau Technical Circular No.1/06, Air Ventilation Assessment" which recommended that it is important to allow adequate air ventilation through the built environment for pedestrian comfort.

1.3 The key purposes of the Expert Evaluation are to identify the major wind breezeways, air paths good wind performance areas, locate obvious problematic areas and propose appropriate mitigation measures if necessary. Based on the findings of the Expert Evaluation, it is required to determine whether further study is required.

1.4 This Expert Evaluation Report presents the following findings:

- List the Site Wind Availability information in the Preliminary AVA - EE Report;
- Examine qualitatively the prima facie impact, merits or demerits of the housing layouts of the Housing Sites in the Developments on the pedestrian wind environment of the Assessment Area focusing on public areas frequented by pedestrians in the existing and/or planned condition, and advise whether the pedestrian wind environment of the Assessment Area and the surrounding affected areas could likely be better, similar or worsened due to the Developments;
- Identify major breezeways and air paths due to the housing layout;
- Identify the rough order of the magnitude of any possible wind problem areas in the Developments;
- Recommend any improvements that could be made in refining the housing layouts of the Housing Sites; and
- Recommend mitigation and improvement measures with due regard to the relevant statutory plans, Building (Planning) Regulations, and Urban Design Guidelines in HKPSG as well as the existing constraints. The recommended mitigation and improvement measures should be effective and practical.

2 SITE CHARACTERISTICS

Project Area and Its Surrounding Area

2.1 The Project Area is currently an unoccupied site with an area of approximately 0.42 ha. It is located at the road junction of Chiu Shun Road and Ngan O Road, Tseung Kwan O, bounded by existing natural slopes to the east and southeast, Fat Tau Chau Village, Tin Ha Wan Village and Tin Hau Temple (Hang Hau) in the northeast and a low-rise Pak Shing Kok Ventilation Building in southwest.

2.2 According to the "Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/26", the Project Area is zoned as "Residential (Group A) 7" ("R(A)7"), "Road" with a maximum plot ratio of 6.5 and 130mPD building height restriction. To the west of Chiu Shun Road are "R(A)" clusters.

2.3 To the east of the Project Area on the uphill topography including the DSD Water Tank and existing natural slopes. To the west of Chiu Shun Road and the Project Area are high-rise residential sites. The three high-rise existing residential buildings near the Project Area are Yuk Ming Court (115mPD), La Cite Noble (146mPD) and Wo Ming Court (101mPD).

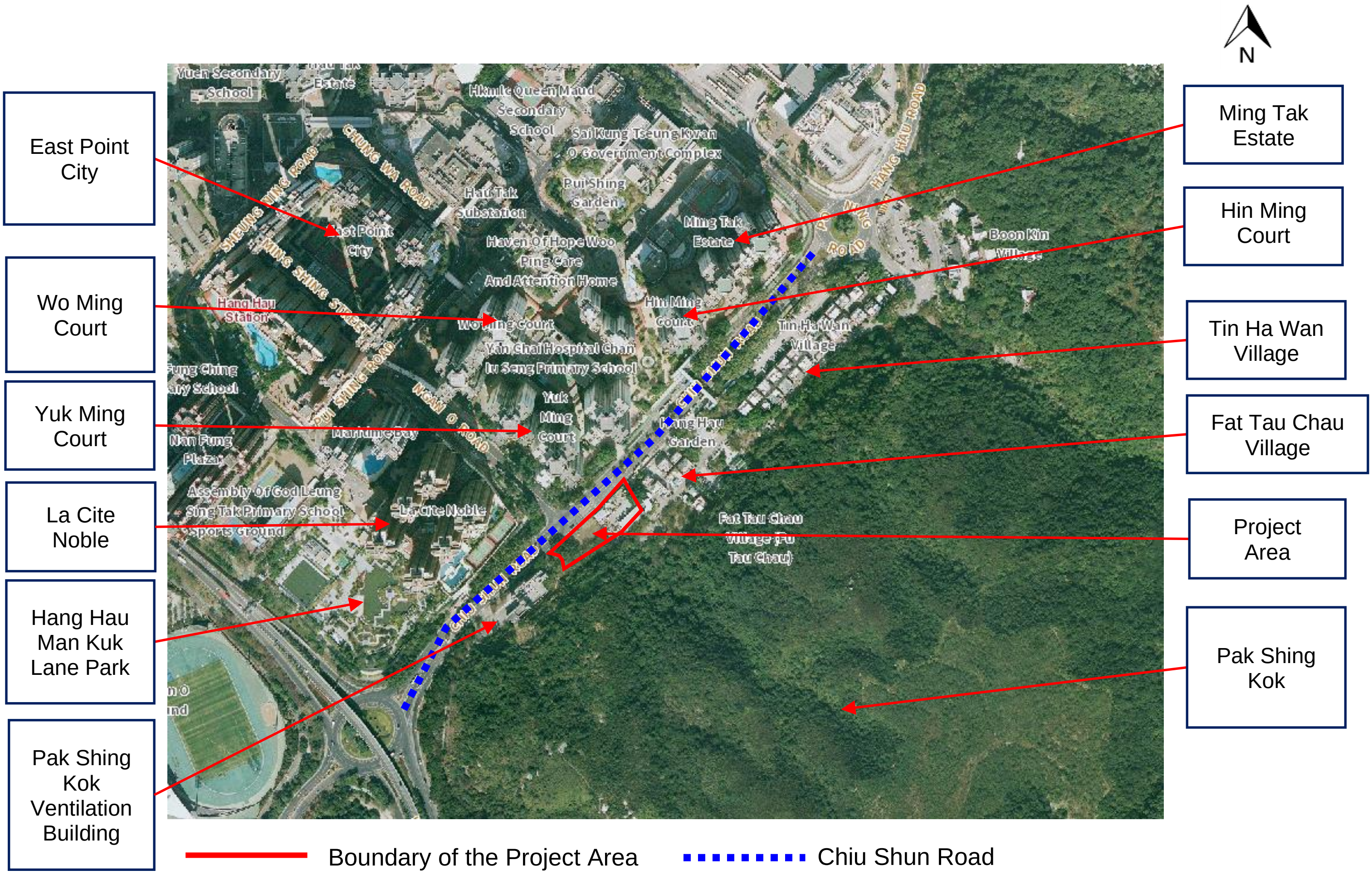


Figure 2.1 Overview of the Project Area and its Surroundings (Source: GeoInfo Map)

3 WIND ENVIRONMENT

3.1 Natural wind availability is crucial to the investigation of wind ventilation performance. In this section, relevant measured wind data obtained from the Hong Kong Observatory (HKO) weather station and computed wind data from the RAMS model, as well as Wind Tunnel Experimental Study at the region near the Project Area are analysed and compared in order to identify the prevailing wind directions.

Wind Direction Analysis based on HKO Weather Stations' Data

3.2 There are a total of 46 weather stations (See Figure 3.1) operated by Hong Kong Observatory (HKO) which provide reliable data on the wind environment in Hong Kong. The wind information and weather data from these stations provide reference to aid a general understanding of the surface wind environment.

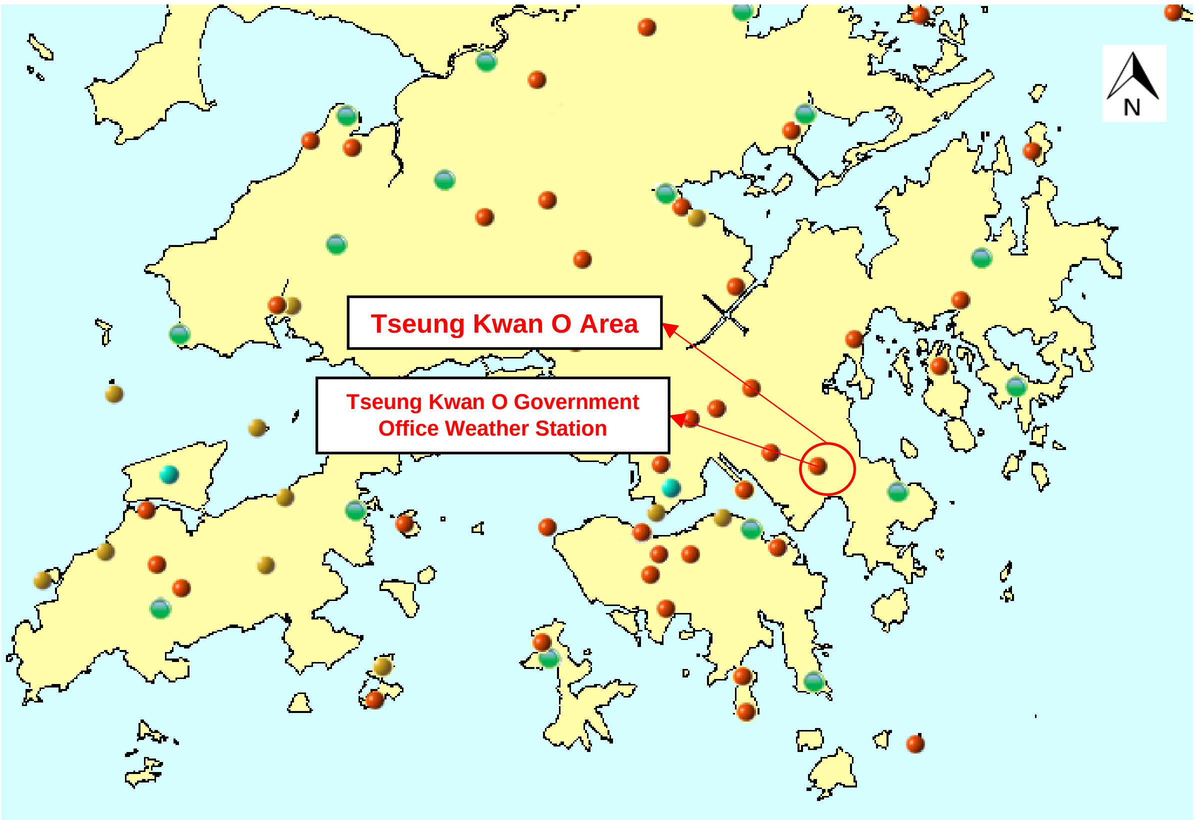


Figure 3.1 Locations of HKO Weather Stations in Hong Kong

3.3 The Tseung Kwan O Government Office Weather Station is the nearest station from the Study Area. However, this weather station has a height of 52mPD. The wind data obtained from this station will be affected by local topography and building morphology. Nevertheless, the wind data from this automatic weather station is presented as reference. Figure 3.2 shows the annual wind rose from the Tseung Kwan O Government Office Weather Station and it is observed that the annual prevailing wind is from the NE directions.

3.4 Wind data from June to August are able to reflect the wind environment during summer seasons and are used to identify the prevailing summer wind directions. According to the average monthly wind roses (averaged from 1992 to 2017) of the summer months at Tseung Kwan O Government Office Weather Station in Figure 3.3, SW wind is considered the most dominant summer wind in the Tseung Kwan O area.

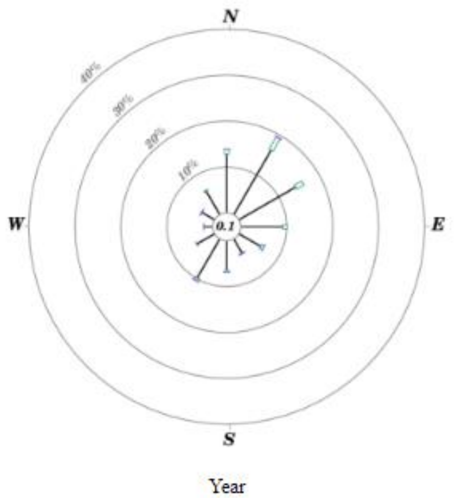


Figure 3.2 Annual Wind Rose of Tseung Kwan O Government Office Weather Station (1992-2017)

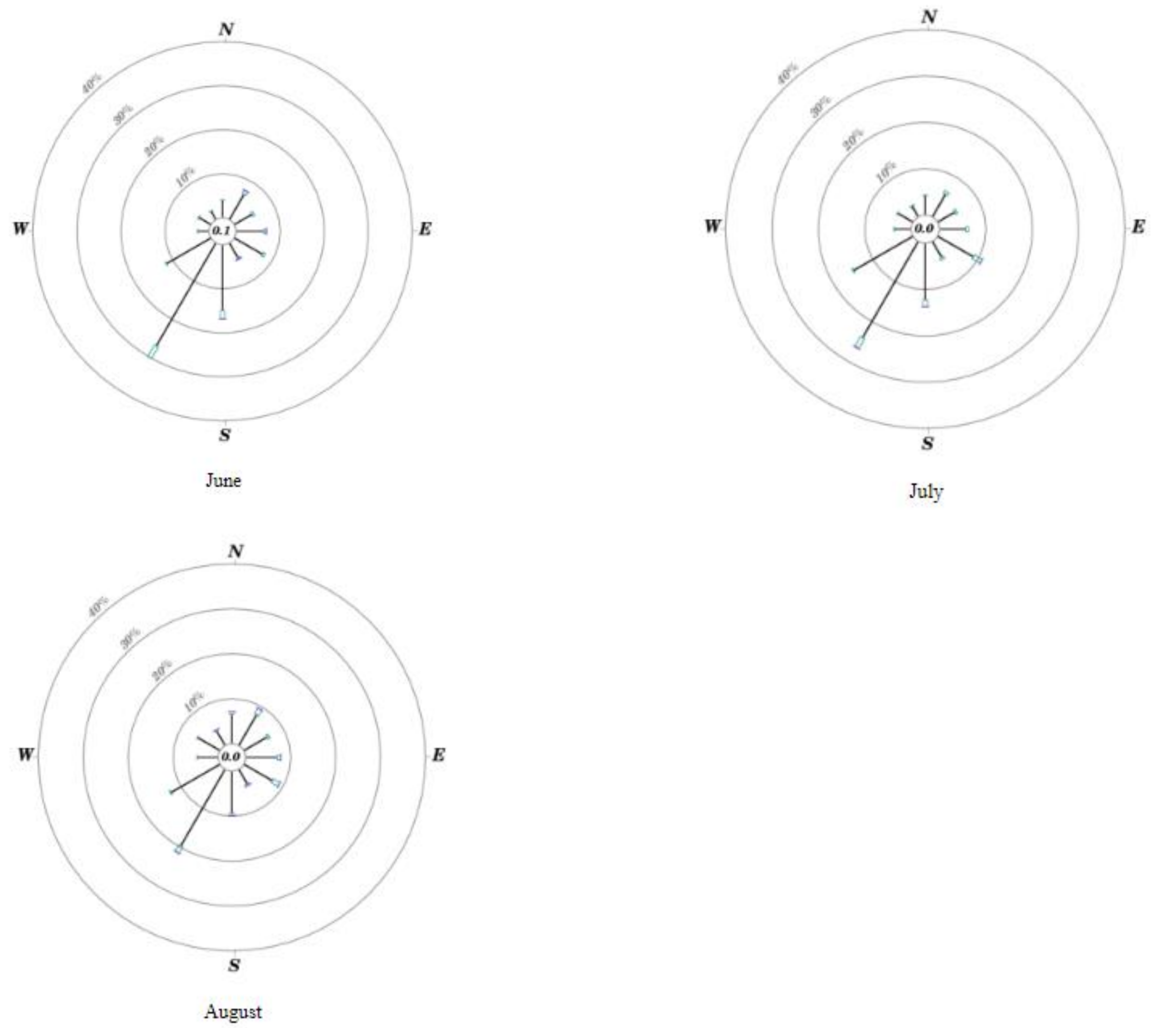
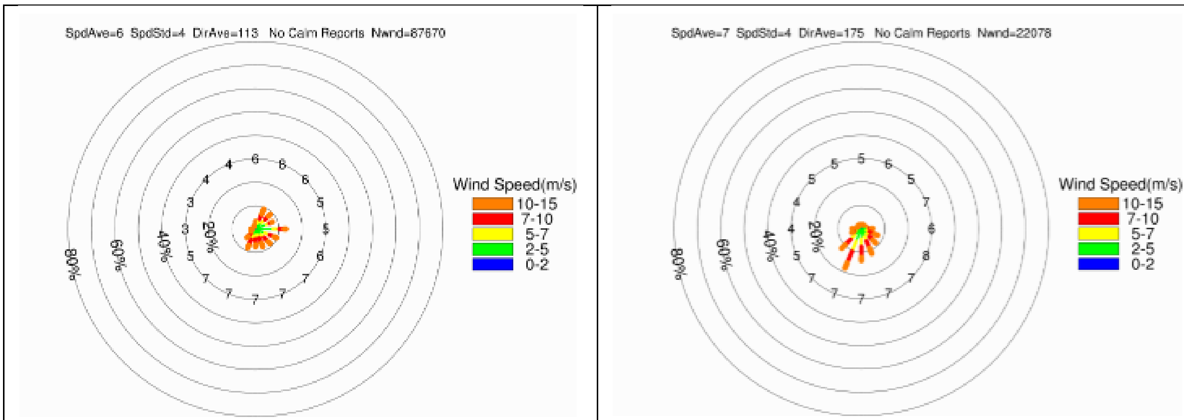


Figure 3.3 Wind Rose (June to August) of Tseung Kwan O Government Office Weather (1992-2017)

Wind Direction Analysis based on PlanD RAMS wind data

3.5 The Hong Kong Planning Department also released a set of Site Wind Availability, the annual and summer wind roses based on these wind data at location near the Project Area are presented in Figure 3.4 below.

3.6 By referring to the wind roses obtained from PlanD RAMS wind data from Grid (099, 041), the annual prevailing winds at the Project Area, Chiu Shun Road, Tseung Kwan O are mainly comprised by N, NNE, NE, E and SW winds. While summer winds are comprised by SSW, SW, S and SE winds.



Annual Wind at Chiu Shun Road | Summer Wind at Chiu Shun Road

Figure 3.4 Annual and Summer Wind Roses based on PlanD RAMS wind data (500mPD level)

Wind Direction Analysis based on Experimental Site Wind Availability Data

3.7 A study of wind availability and characteristics for the study area in Tseung Kwan O was conducted by the CLP Wind/Wave Tunnel Facility (WWTF) at the Hong Kong University of Science and Technology, as part of the "Urban Climate Map and Standards for Wind Environment – Feasibility Study".

3.8 The study area is located in Po Lam as shown in Figure 3.5. The resulting annual prevailing winds are mainly from N, ENE and E while summer prevailing winds are from E, S and SW.

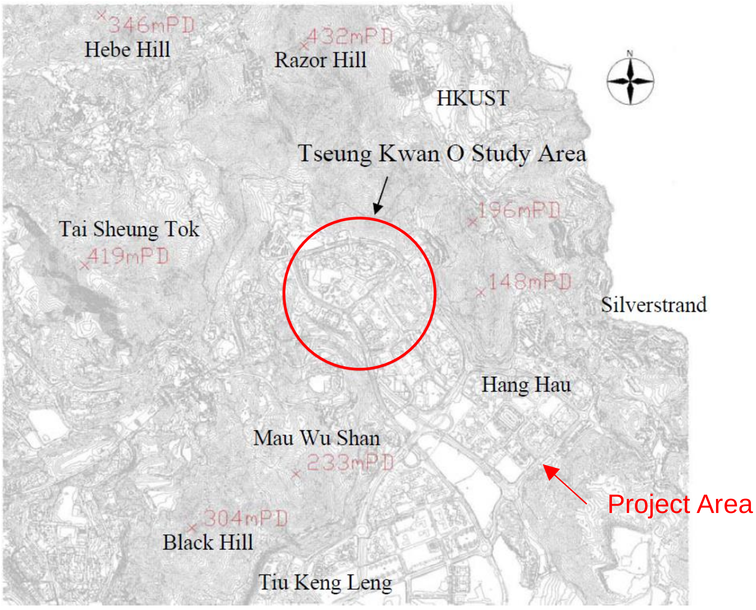


Figure 3.5 Location of the Tseung Kwan O Study Area by Wind Tunnel

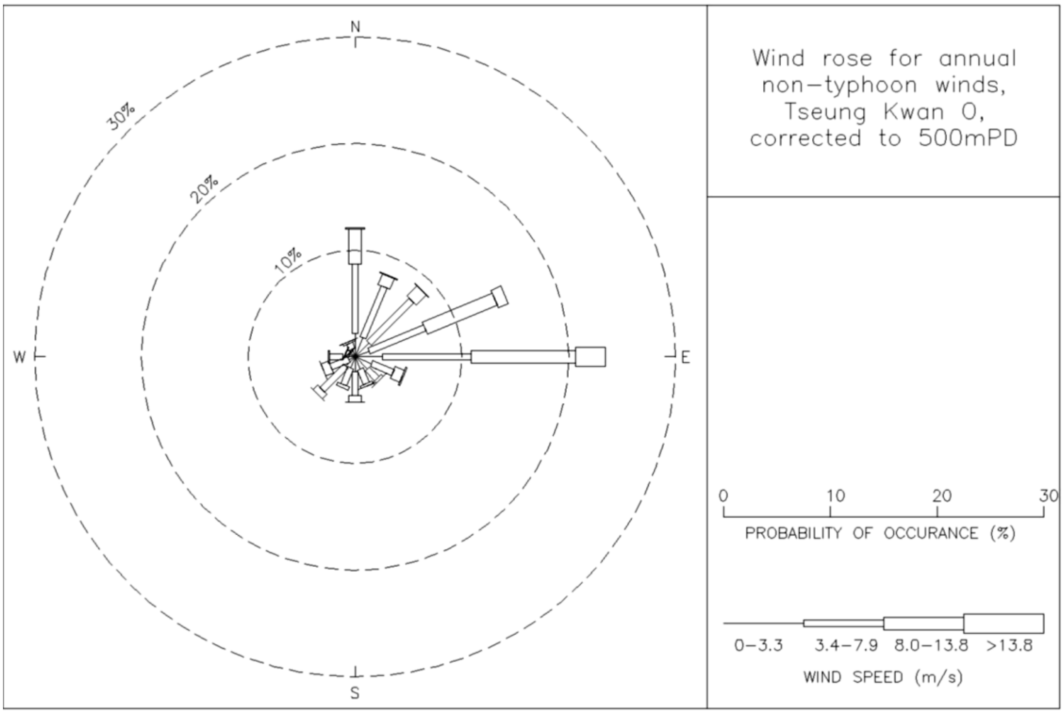


Figure 3.6 Annual Wind Rose for Tseung Kwan O area from Wind Tunnel Data (500 mPD)

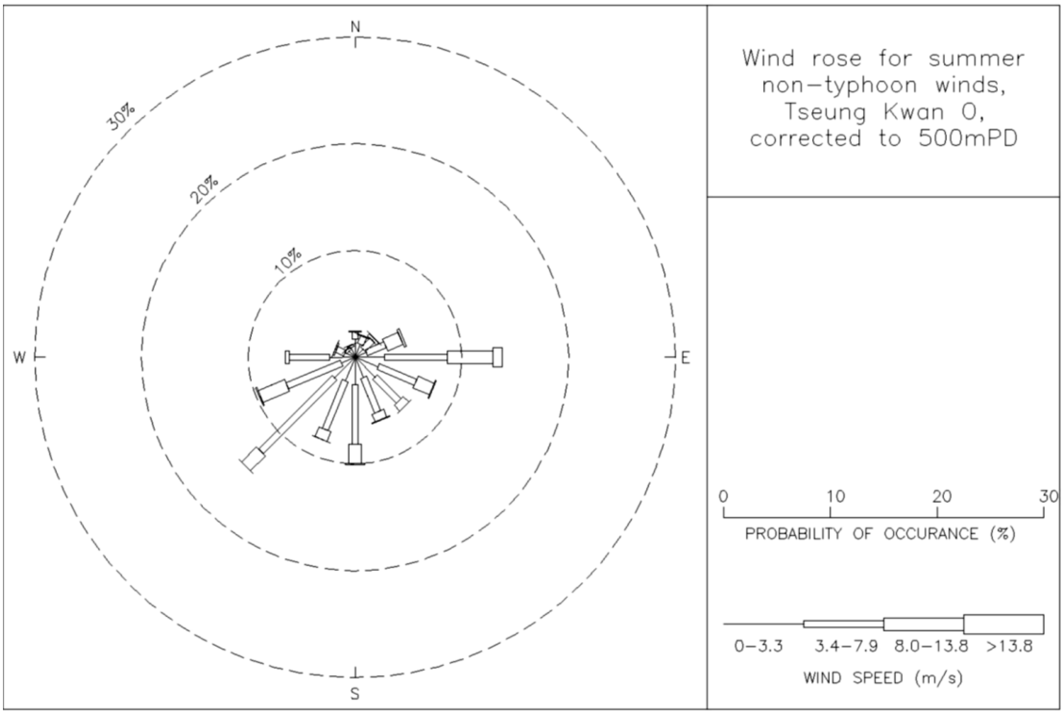


Figure 3.7 Summer Wind Rose for Tseung Kwan O area from Wind Tunnel Data (500 mPD)

Summary and Identification of Prevailing Wind Directions

3.9 By reviewing the wind data from HKO Tseung Kwan O Government Office Weather Station, PlanD RAMS wind data and Wind Tunnel Experiment, it can be concluded that the annual prevailing winds at Chiu Shun Road, Tseung Kwan O mainly come from NNE, ENE and E directions, while summer prevailing winds are E, S, SSW and SW winds.

3.10 It is noticed that the annual prevailing winds at the Project Area is coming from northerly to north-easterly quadrant (i.e. NNE, NE, ENE and E), meanwhile, the summer winds at this Project Area is coming from easterly as well as south-westerly (S, SW, SSW).

3.11 Table 3.1 summarized the annual and summer prevailing winds from difference sources, while Figure 3.8 is an illustration diagram showing the prevailing wind directions towards the Project Area during the annual and summer seasons.

Table 3.1 Summary of annual and summer prevailing winds from different sources

		Annual	Summer
HKO Tseung Kwan O Government Office Weather Station		NE	SW
Chiu Shun Road	RAMS wind data	NNE, ENE, E	E, S, SSW, SW
	Experimental site wind data	N, ENE, E	E, S, SW
	Prevailing winds	NNE, NE, ENE, E	E, S, SSW, SW

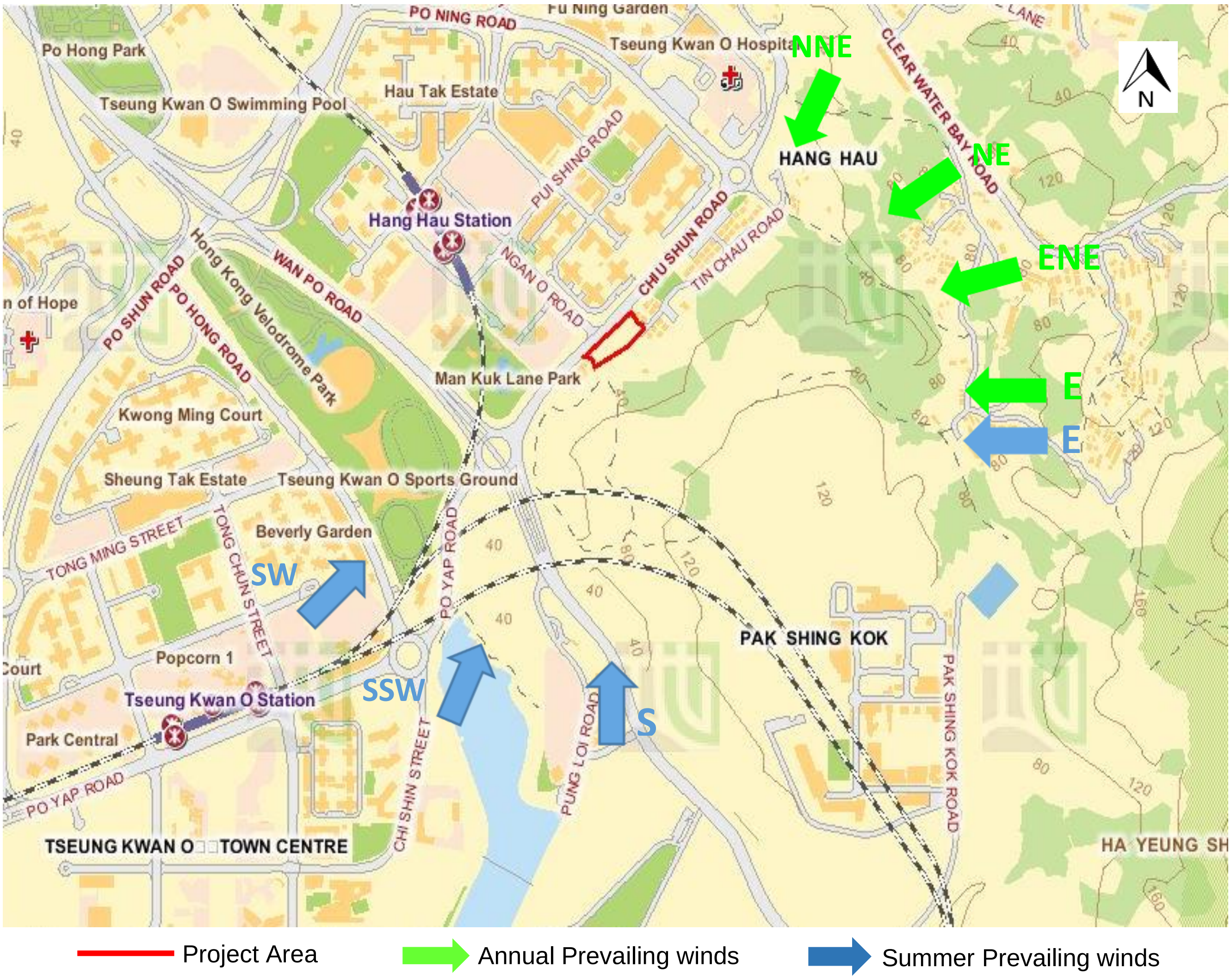


Figure 3.8 Summary of Annual and Summer Prevailing Winds towards the Project Area

4 TOPOGRAPHICAL FEATURES AND WIND FLOW

4.1 The topographical features surround the Project Area will affect the wind flows and the general wind environment of the Tseung Kwan O Area.

4.2 The flow of wind around and over hilly terrains is very complex and depends greatly on the shape of the topographies, atmospheric stability conditions and the strength of the prevailing wind etc. Figure 4.1 below illustrates typical wind flow over hills under moderate wind speed conditions. As shown in the figure, wind either flows over the hill or bends around it and creates eddy flows with opposite direction to the upper wind flow in the leeside.

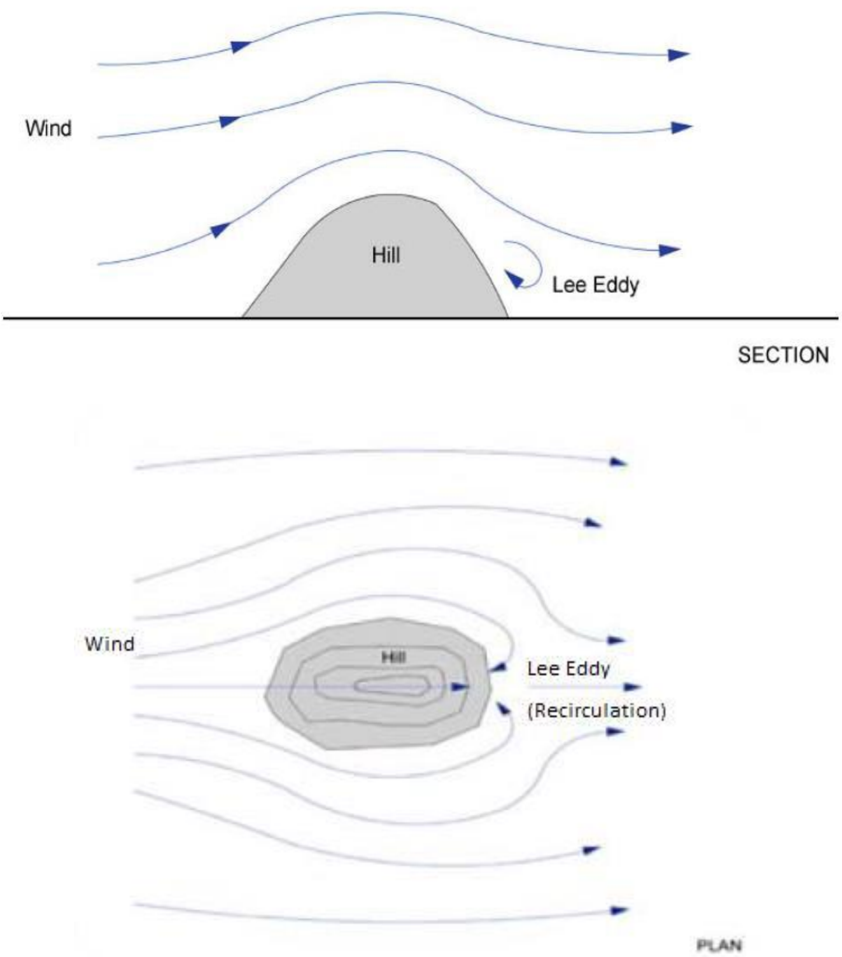


Figure 4.1 Illustration of Wind Flow over Hills under Moderate Wind

4.3 This section describes the major topographical features at the vicinity of the Project Area in Tseung Kwan O and their impacts on the wind environment of the Project Area during annual and summer seasons.

Major Topographical Features

4.4 As shown in Figure 4.2, Tseung Kwan O Area falls in a valley aligning in approximately north-south direction. There exists high-rise hilly terrain of Pak Shing Kok from the east to the south of the Project Area, while the regions west to the Project Area is fronting the existing residential buildings (i.e. La Cite Noble, Yuk Ming Court, Wo Ming Court). Meanwhile, the terrains and low-rise village type development located to the southeast quadrant of the Project Area are no more than 40mPD with the terrain height.

4.5 Due to this terrain features, prevailing winds from the E and S will be weakened by the Pak Shing Kok before reaching the Project Area. Meanwhile, the summer wind from SSW and SW direction would be moderated by the Tseung Kwan O built-up area. On the other hand, the winds coming from S, SSW and SW along with the NNE and NE winds are anticipated to be channelled by the valley and penetrated through the Tseung Kwan O and Hang Hau area.

Under Annual Prevailing Winds

4.6 As mentioned in Section 3 above, the prevailing annual wind directions are from NNE, NE, ENE and E. Thus, the majority of the annual prevailing winds are expected to be sheltered by the Clear Water Bay, Pak Shing Kok and Hang Hau existing building area. The only exception are NNE, NE and SW winds, which could penetrated the Tseung Kwan O area by flowing through the valley, as mentioned in Para.4.5 above.

Under Summer Prevailing Winds

4.7 The prevailing summer wind directions are observed to come from the E, S, SSW and SW directions. Among the summer prevailing winds, the E and S is expected to be moderated by the terrain, while all other winds would be channelled by the terrain feature formed by Pak Shing Kok and existing high-rise residential buildings.

4.8 In addition to the influences against the prevailing annual and summer winds, the high-rise hilly terrains of Pak Shing Kok would induce katabatic (downhill) air movement at the hill slope and facilitate the air flow at the vicinity. Meanwhile, there would be sea breeze from the Junk Bay, which will likely to benefit the wind environment at the southern region of Tseung Kwan O.

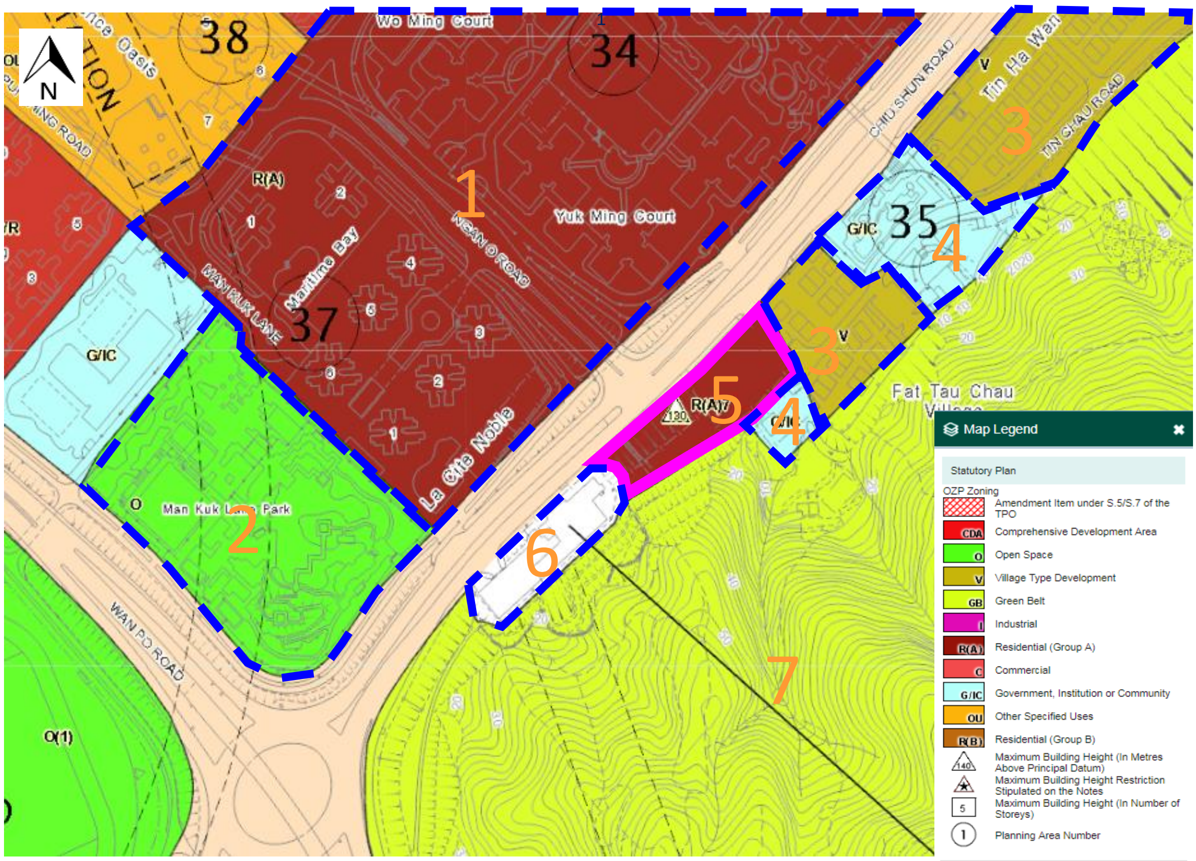
Figure 4.2 Digital Elevation Map near the Project Area

5 EXISTING LAND USE AND BUILDING MORPHOLOGY WITHIN / NEAR PROJECT AREA

5.1 Following the investigation of the effect of topographical features on the wind environment of the Project Area in Section 4 above, this section investigates the potential impact of the building morphology of Tseung Kwan O area on the air ventilation performance of the Project Area.

Existing and Potential Building Morphology near the Project Area

5.2 Figure 5.1 below shows the major existing developments at the surroundings of the Project Area in this study.



Boundary of the Project Area **Boundary of the Land use Type**

1. Yuk Ming Court (115mPD), La Cite Noble (146mPD), Yan Chai Hospital Chan Lu Seng Primary School and Wo Ming Court (101mPD)	2. Man Kok Lane Park	3. Tin Ha Wan Village and Fat Tau Chau Village
4.Hang Hau Garden, Tin Hau Temple and Drainage Services Department Water Tank	5. Chiu Shun Road Site	6. Pak Shing Kok Air Ventilation Building
7. Pak Shing Kok (120mPD)		

Figure 5.1 Existing and Proposed Developments within Project Area

Urban morphology and existing wind environment at / near Project Area

5.3 The Project Area is located at the foothill of Pak Shing Kok with the terrain height no more than 40mPD, while fronting the Ngan O Road to the northwest. To the northeast and southwest of the Project Area are low-rise spaces without wind blockage, while the regions to the west, northwest and north of Project Area are occupied by high-rise developments belongs to the Hang Hau urban area.

5.4 The most of the annual prevailing winds (north-eastern quadrant winds and south-eastern quadrant winds) along with the katabatic air movement are expected to reach and flow through the Project Area without moderation. This is mainly due to the lack of wind blockage to this directions of the Project Area.

5.5 Meanwhile, the summer prevailing winds from the south will be influenced by Pak Shing Kok before reaching the the Project Area. Moreover, the portion of summer winds from the south-western quadrants have to flow through the majority urban area of Tseung Kwan O to reach the Project Area, resulting in a weakened wind environment at the Project Area under the summer prevailing winds.

Wind Corridors near the Project Area

5.6 By understanding the prevailing winds direction, the local topography and building morphology, the major air paths near the Project Area are identified.

5.7 Under the annual /summer winds from E direction, Ngan O Road along with Yuk Ming Court and Sheung Ning Playground community garden which facilitate the prevailing winds from Pak Shing Kok to flow penetrate the highly dense Hang Hau urban area and reach the Tseung Kwan O Swimming Pool and MCP central. It is also noticed that there are one wind corridor aligned in roughly north-south direction near the Project Area, which is the Chiu Shun Road. The former road also elongates the air path of the building separation of Tseung Kwan O Sports Ground, and redirected the southern prevailing winds from Junk Bay into the region west to the Project Area.

6 EXPERT EVALUATION ON THE PROJECT SITES

6.1 Following the investigation of the potential impact of the existing developments on the Project Site in terms of air ventilation performance in Section 5, this section presents the influence of the proposed developments within the Project Sites on the areas of the immediate vicinity.

Recap of planning parameters and general characteristic of the Project Area

6.2 The Project Area is located at the foothill of Pak Shing Kok fronting the high-density urban area of Tseung Kwan O to the west.

6.3 The Project Area is located near the hilly terrains of Pak Shing Kok, though the ENE and E annual winds, E and S summer winds towards the Project Area are anticipated to be weakened; relatively stronger katabatic winds can be expected near the Project Area during summer seasons and enhance the air ventilation.

6.4 There are two major wind corridors in the vicinity of the Project Area, the first one being Ngan O Road which links up the Chiu Shun Road west and Ming Shing Street which facilitate the east annual / summer prevailing winds. The second air path is the Chiu Shun Road aligning in south-north direction, enhancing the southern summer winds at the area west to the Project Area.

Wind influences induced by the Proposed Development in the Project Area

6.5 The proposed development would not affect the width of Chiu Shun Road and the ventilation performance of Chiu Shun Road as a wind corridor under NNE, SSW and SW winds would not be affected by the proposed development. While some localized impacted on the immediate vicinity of the proposed development is expected under E, ENE and S winds, it is not anticipated that the proposed development, with only a single domestic tower and a relatively small and low-rise podium allowing prevailing wind to skim over, would not impose significant impact on the overall pedestrian wind environment.

6.6 The Project Area is limited due to certain site constraints and design consideration, which includes (i) residential building need a 20m setback from the curb of Chiu Shun Road to meet the air quality requirement (i.e.10m setback from carriageway); (ii) a non-domestic structure along the northeast site boundary (i.e. an important tree (Ficus Microcarpa) to be Retained); (iii) MTR Protection Zone; (iv) DSD Sewerage Tunnel Protection Zone.

6.7 Good design features in terms of air ventilation of the proposed development in Project Area is identified in Figure 6.1. The proposed domestic block has incorporated a 10m setback from carriageway to maintain the effectiveness of Chiu Shun Road as the major air path for prevailing wind. To preserve the existing Ficus Microcarpa at the northern portion, setback of the proposed podium and domestic block from Fat Tau Chau Village has been considered. This provides a buffer zone to alleviate the potential wind influencing zone from the proposed domestic block to affect Fat Tau Chau Village under summer prevailing wind. The low-rise nature at the northern portion, stepped podium deck at southern portion and permeable spaces at podium level allows prevailing wind to skim over and penetrate through, which would not impose significant impact on the overall pedestrian wind environment.

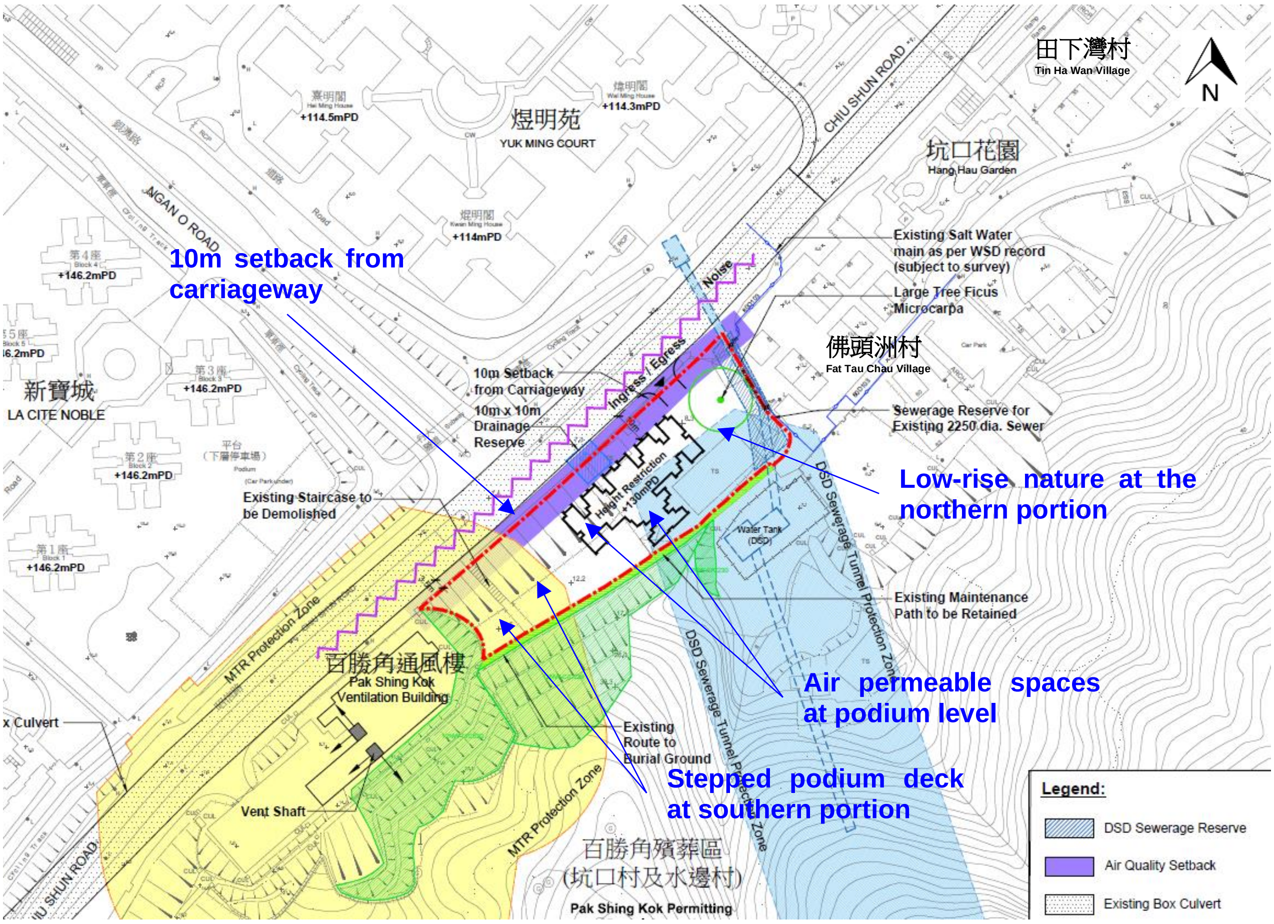


Figure 6.1 Proposed Scheme of Chiu Shun Road Site

Under Annual Prevailing Winds

6.8 It is noticed that under the annual prevailing wind from NNE and NE directions, the wind influence zone of the proposed development might possibly reach Pak Shing Kok Ventilation Building located to the southwest and slightly reduce the wind availability at leeside. However, taking the relatively short frontal length of the Project Area facing Pak Shing Kok Ventilation building (around 15m), together with the air quality setback from carriageway, the north-eastern air flow could still reach Pak Shing Kok Ventilation Building through both Chiu Shun Road and the eastern portion of the Project Area.

6.9 Owing to the long frontage of the Project Area, it is inevitable that the high-rise domestic block along with the non-domestic podium structure abuts Chiu Shun Road. The proposed development would provide wind shelter against the Yuk Ming Court and La Cite Noble under easterly winds (i.e. ENE and E). However, due to the morphology of Pak Shing Kok fronting high-rise built-up area, the incoming easterly would potentially be modulated into north-easterly wind direction before reaching the Project Area. The wind influencing would be Pak Shing Kok Ventilation Building as mentioned above.

6.10 However, the low-rise nature (+7mPD at height) located at the northern portion of the Project Area would allow penetration of easterly winds through the Project Area and reach the pedestrian level of Chiu Shun Road. Moreover, despite the fact that non-domestic podium structure is located at the southern portion of the Project Area, the stepped podium at +12.4mPD and +19.95mPD in height) would allow the incoming easterly winds to skim over and reach the high-rise buildings of La Cite Noble and Yuk Ming Court to its west freely, which results in an alleviation of the possible impact in terms of air ventilation performance at pedestrian level.

Under Summer Prevailing Winds

6.11 Under the summer prevailing winds from SSW and SW directions, the possible wind influence induced by the proposed development would reach the nearby Fat Tau Chau Village to the northeast. Due to short frontage of the Project Area (around 15m) along prevailing wind direction and the air quality setback, the south-western air flow could still reach Fat Tau Chau Village through both Chiu Shun Road and the eastern portion of the Project Area. The Chiu Shun Road adjacent to the villages are at the sideway of the Project Area and would not likely be affected.

6.12 In addition, the Project Area maintained low-rise nature at the northern and southern portion, would allow S wind to reach the lee region at Yuk Ming Court and alleviate the potential influences.

6.13 Under the summer prevailing wind from E, the wind influence is similar to wind environment under annual easterly winds as discussed in Para. 6.9 above.

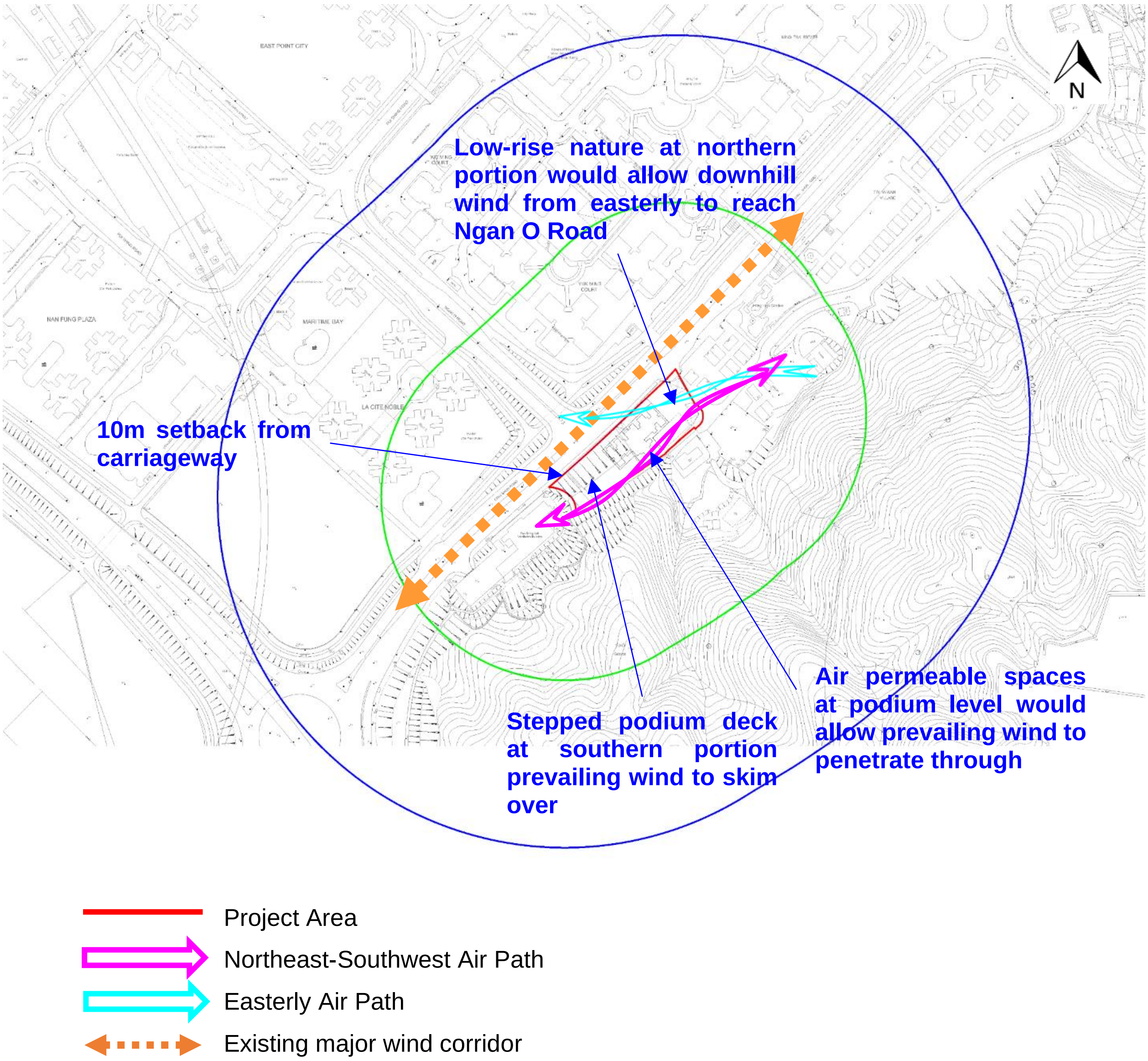


Figure 6.2 Illustration of Good Features for the Project Area (Figure not to scale)

7 SUMMARY AND CONCLUSIONS

7.1 The Project Area of this study is located at the road junction of Chiu Shun Road and Ngan O Road, Tseung Kwan O, bounded by existing natural slopes to the east and southeast, Fat Tau Chau Village, Tin Ha Wan Village and Tin Hau Temple (Hang Hau) in the northeast and a low-rise Pak Shing Kok Ventilation Building in southwest.

7.2 Based on the wind data from the HKO, RAMS model and Wind Tunnel Experiment, the annual prevailing winds at Tseung Kwan O Central area are from the NNE, NE, ENE and E directions, whereas the summer prevailing winds are winds from E, S, SSW and SW directions.

7.3 The existing developments in the vicinity of the Project Area are mostly residential varying building height and density, which will cause observable impact upon the wind environment under different prevailing winds.

7.4 There are several air paths in the vicinity of the Project Area. These air paths contribute in maintaining the air ventilation performance within the Project Area and their surrounding areas.

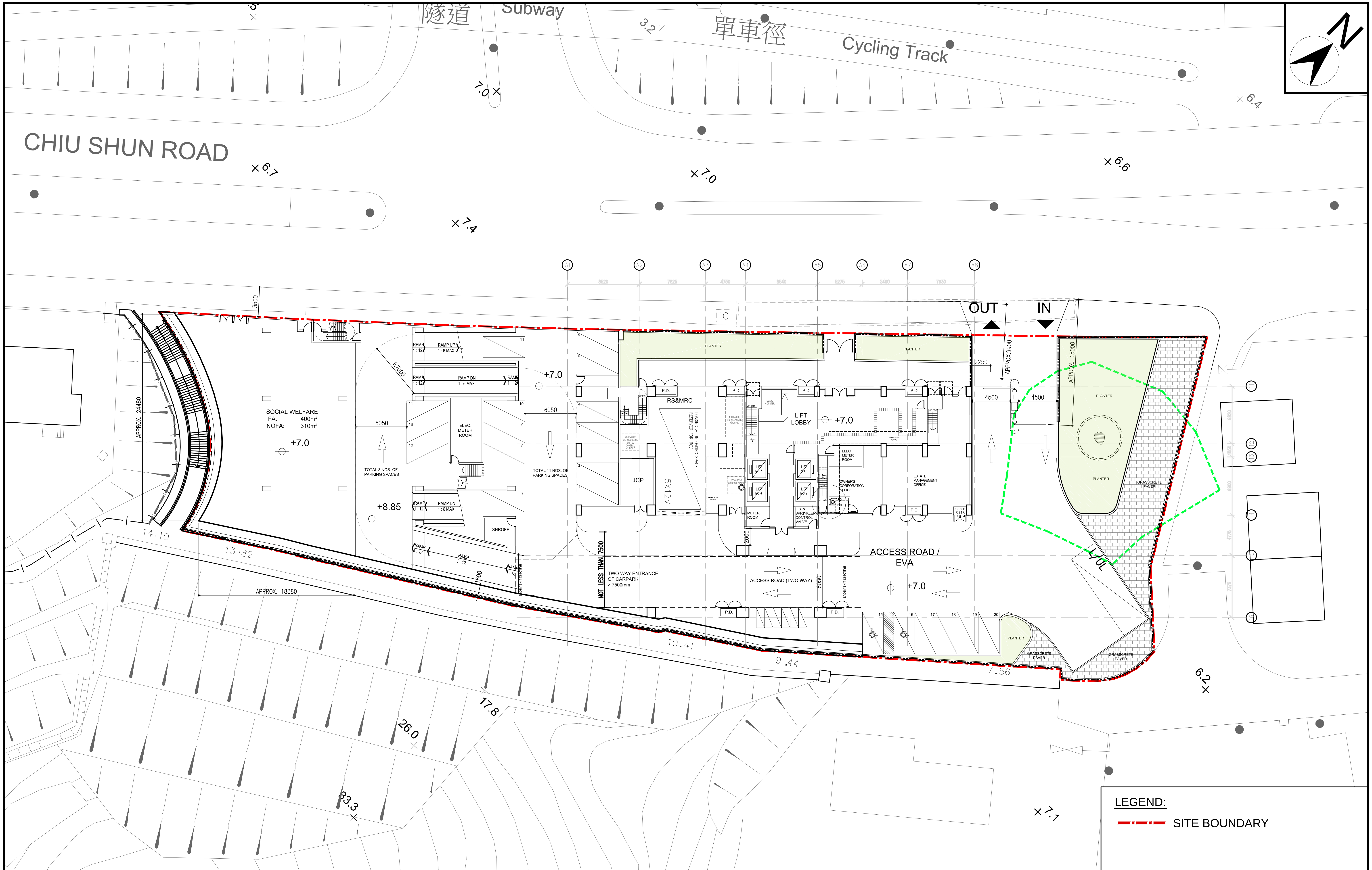
7.5 The Project Area is located at the east of Chiu Shun Road, near the Yuk Ming Court and La Cite Noble. The proposed development has incorporated a landscape area at the north portion which would allow winds from east and northeast to reach pedestrian level of Chiu Shun Road. Meanwhile, despite the long frontage, the low-rise nature of the non-domestic portion would likely allow skimming air flow to reach the downwind side, thus alleviate the possible wind influence.

7.6 In addition to the good design features identified, the followings are some general recommendations that would be adopted as far as practical in the detailed design stage of the Proposed Development to facilitate wind penetration:

- Building Permeability (refer to P in the PNAP APP-152 Sustainable Building Design Guideline);
- Building setback;
- Avoidance of long continuous facades;
- Minimized podium bulk;
- Reference could also be made to recommendations of design measures in the Hong Kong Planning Standards and Guidelines;
- Wind permeable fence wall;
- Natural ventilation design in carpark space;
- Alternative approach (such as acoustic window and/ or acoustic balcony) in resolving noise issue to reduce extent of noise barriers for more effective air paths; and
- Minimized podium bulk to further mitigate the ventilation impact at site perimeter.

Appendix A

Layout of the Proposed Development



PROJECT
PROPOSED SSF DEVELOPMENT
AT CHIU SHUN ROAD, TKO

DRAWING TITLE
GROUND FLOOR PLAN

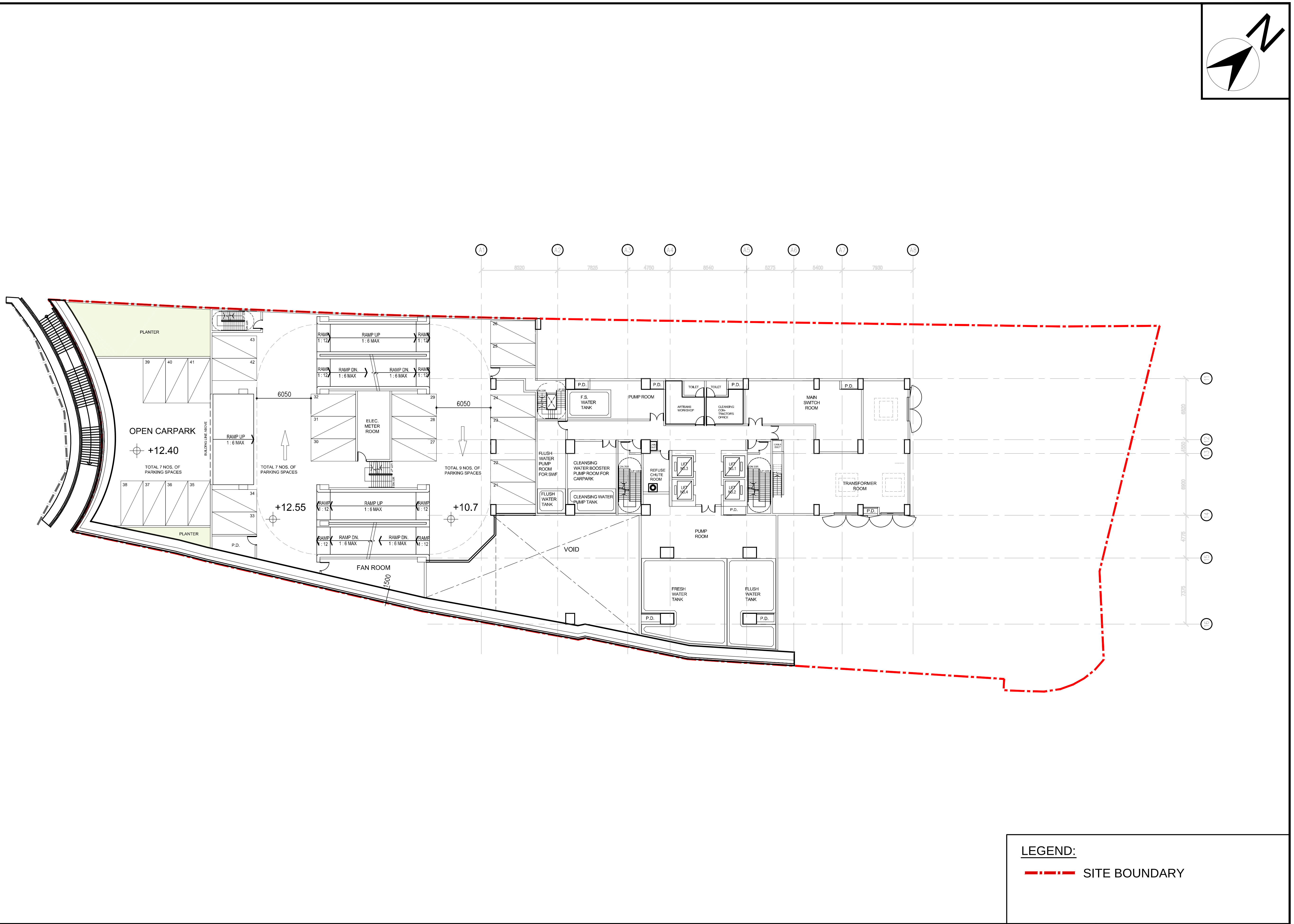
1:200(A1)

房屋署
HOUSING DEPARTMENT

DRAWING NO.
SK06/BLK/A/01

DATE:
13.03.2019

09



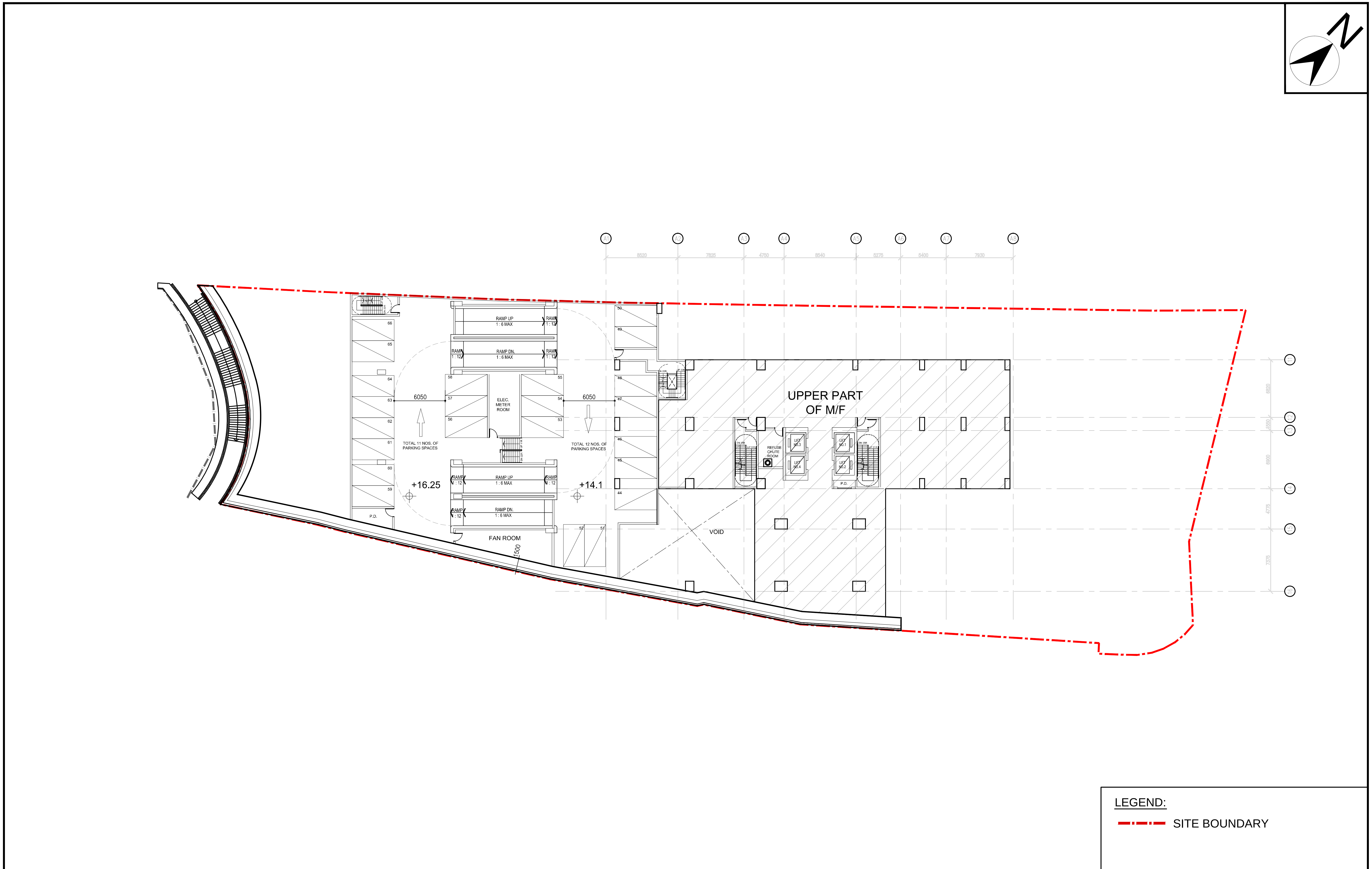
PROJECT
PROPOSED SSF DEVELOPMENT
AT CHIU SHUN ROAD, TKO

DRAWING TITLE
MEZZANINE FLOOR PLAN AND
FIRST FLOOR OF CARPARK

1:200(A1)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO. SK06/BLK/A/02
DATE: 13.03.2019
10



PROJECT

PROPOSED SSF DEVELOPMENT
AT CHIU SHUN ROAD, TKO

DRAWING TITLE

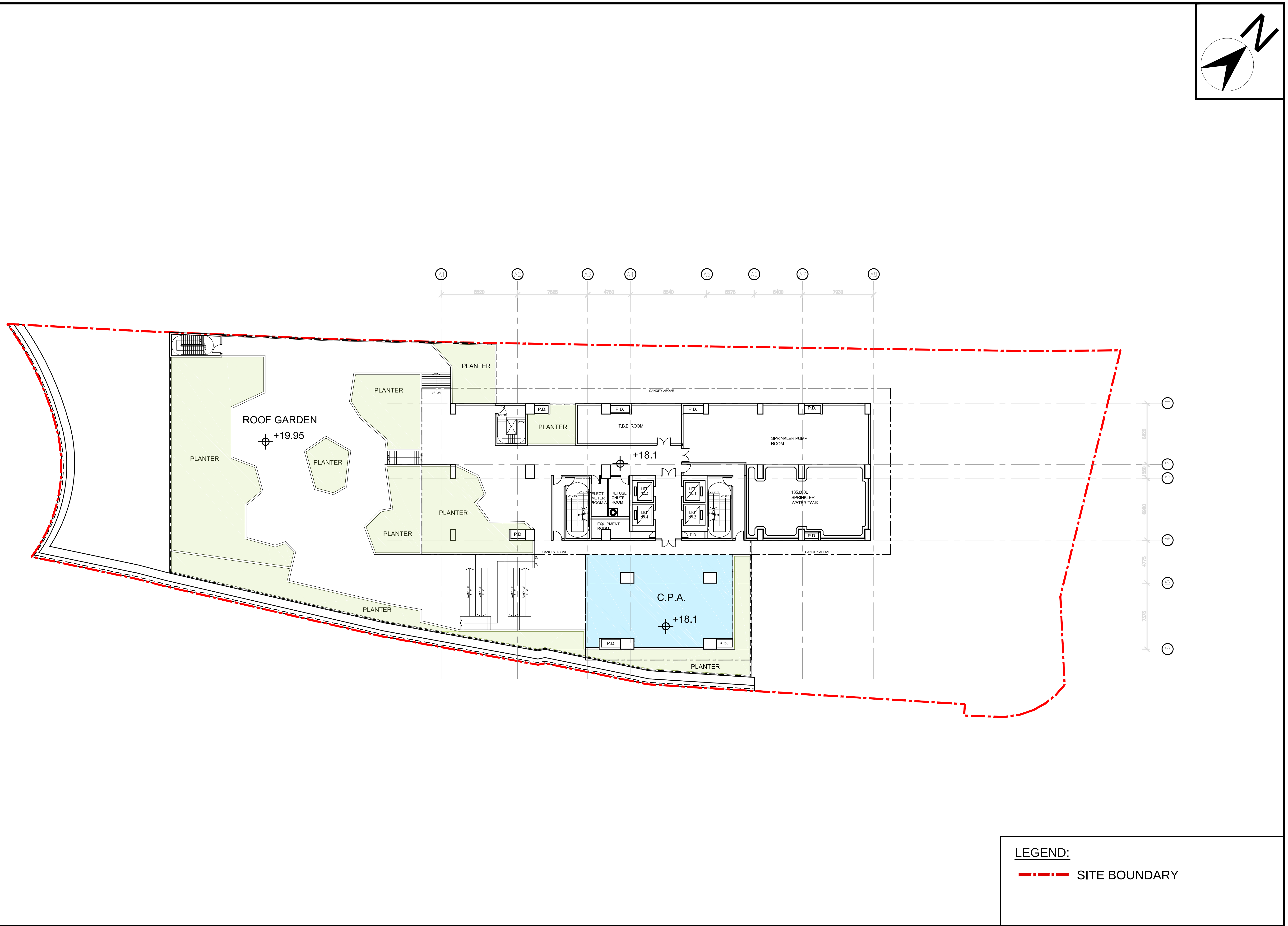
UPPER PART OF MEZZANINE FLOOR PLAN AND
SECOND FLOOR OF CARPARK

1:200(A1)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO.
SK06/BLK/A/03

DATE:
13.03.2019



PROJECT

PROPOSED SSF DEVELOPMENT
AT CHIU SHUN ROAD, TKO

DRAWING TITLE

COVERED LANDSCAPE FLOOR PLAN

1:200(A1)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO.
SK06/BLK/A/04

DATE:
13.03.2019

12

	B	C	TOTAL
1-31/F (31)	6	10	16
31-38/F (7)	6	8	14
Total	228	366	594
	39%	61%	100%

Efficiency Ratio : 77.5%

PROJECT
PROPOSED SSF DEVELOPMENT
AT CHIU SHUN ROAD, TKO

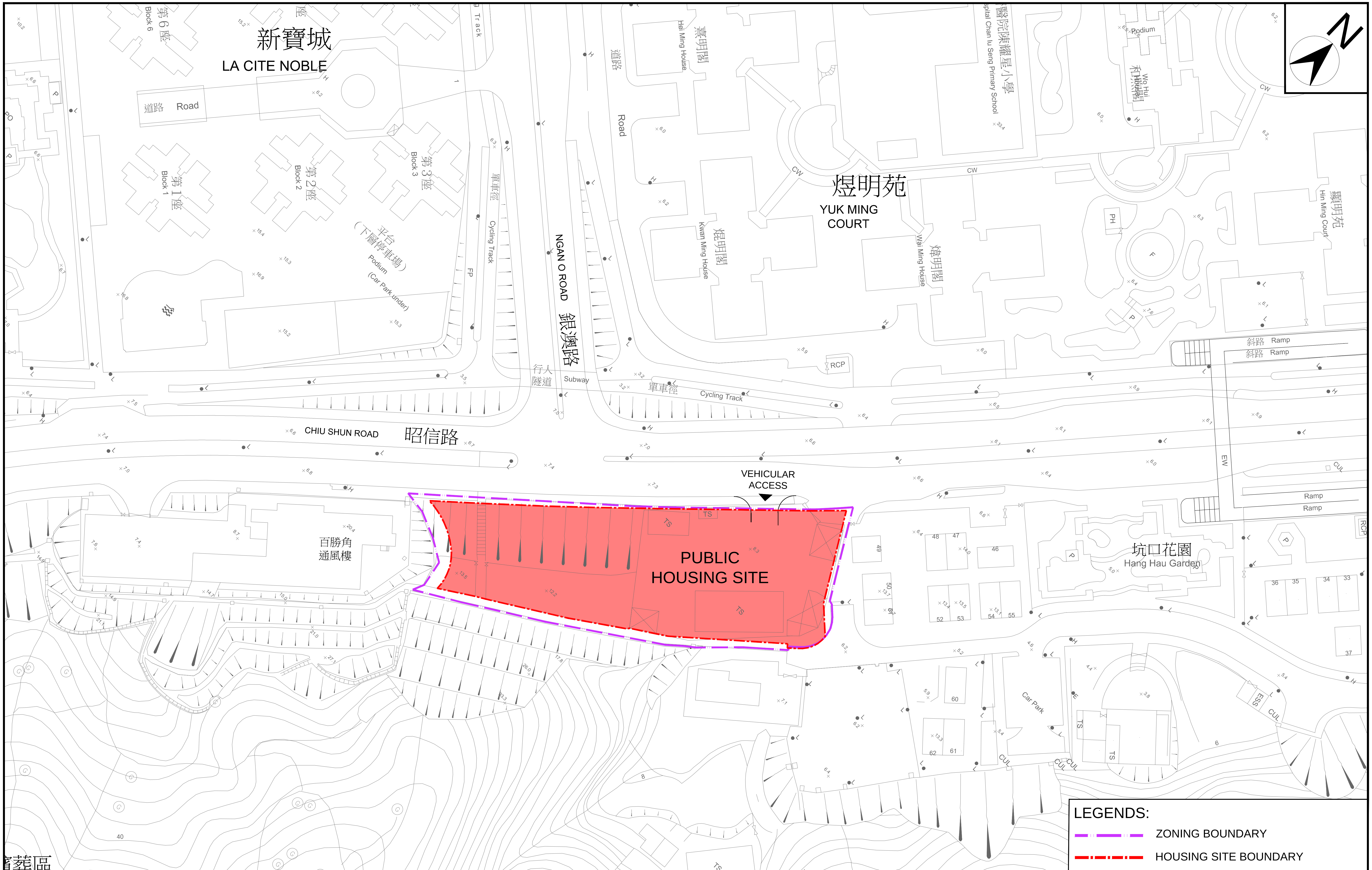
DRAWING TITLE
TYPICAL FLOOR PLAN

1:100(A1)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO.

DATE:



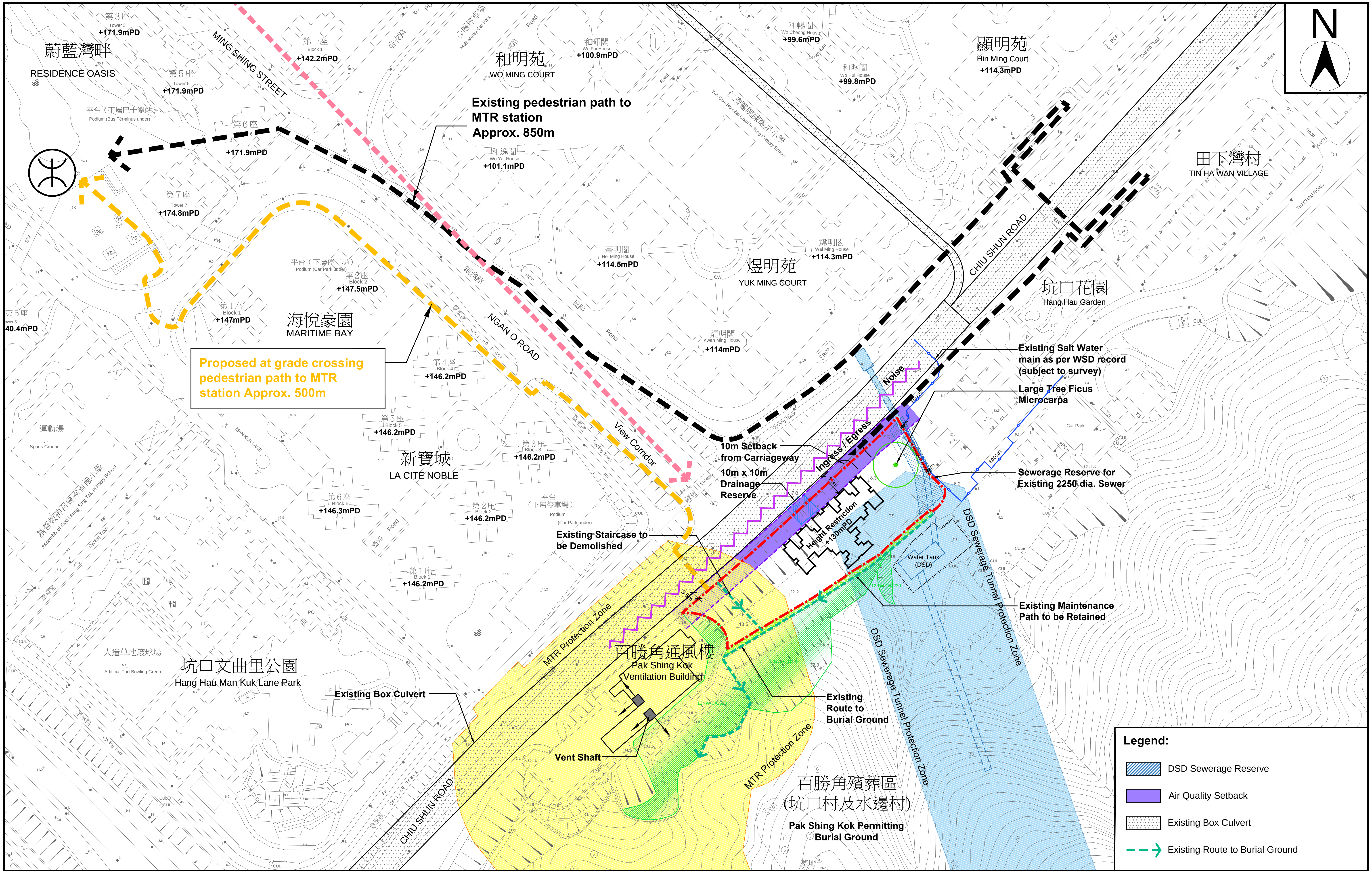
PROJECT
PROPOSED SSF DEVELOPMENT
AT CHIU SHUN ROAD, TKO

DRAWING TITLE
SITE LOCATION PLAN

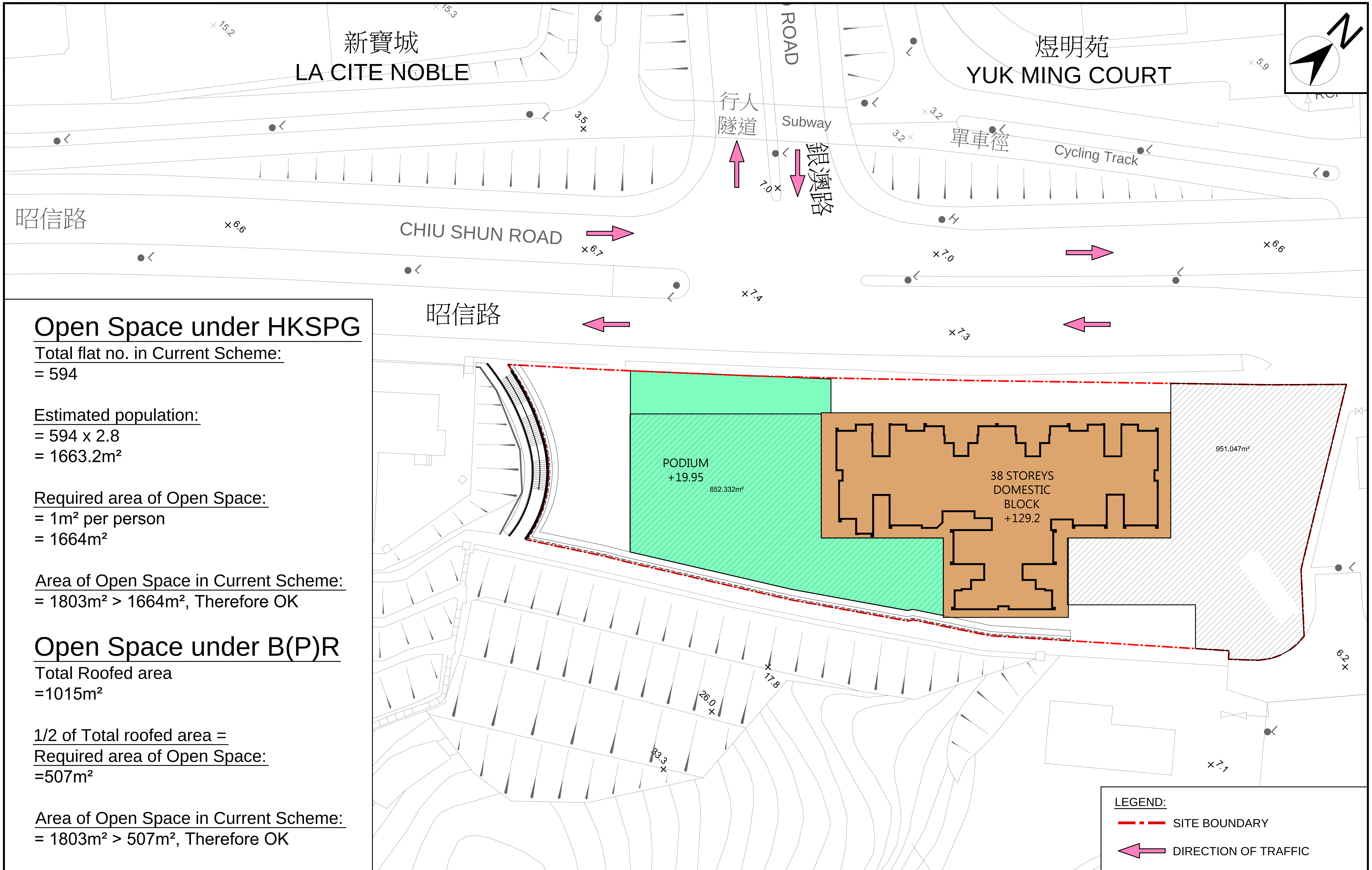
1:1000(A1)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO.	DATE:	
SK06/SITE/A/01	05.03.2019	01



PROJECT	DRAWING TITLE	房屋署 HOUSING DEPARTMENT
PROPOSED SSF DEVELOPMENT AT CHIU SHUN ROAD, TKO	SITE CONSTRAINT PLAN 1:1000(A1)	DRAWING NO. SK06/SITE/A/02 DATE: 18.03.2019 02



Open Space under HKSPG

Total flat no. in Current Scheme:
= 594

Estimated population:
= 594 x 2.8
= 1663.2m²

Required area of Open Space:
= 1m² per person
= 1664m²

Area of Open Space in Current Scheme:
= 1803m² > 1664m², Therefore OK

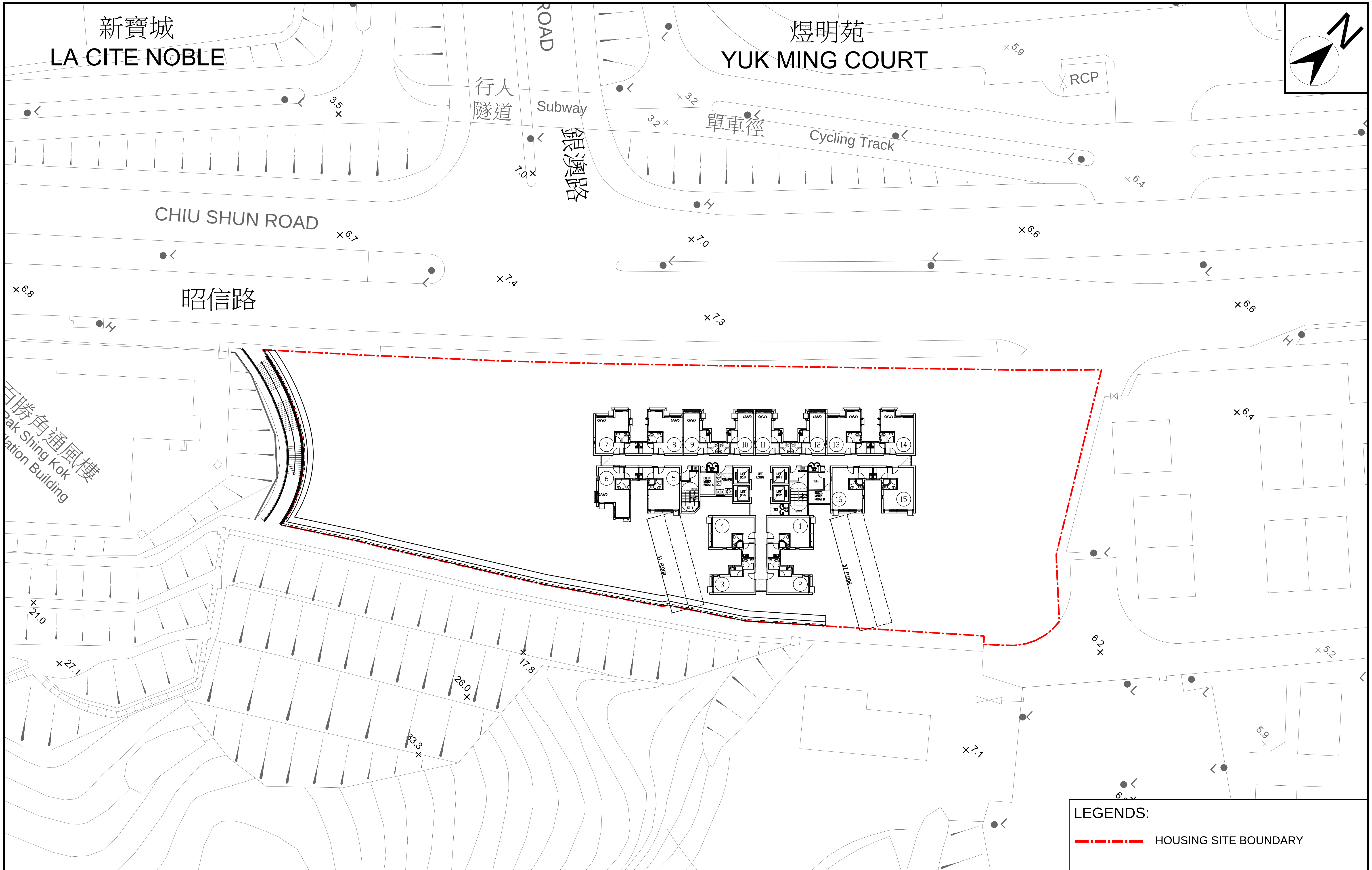
Open Space under B(P)R

Total Roofed area
=1015m²

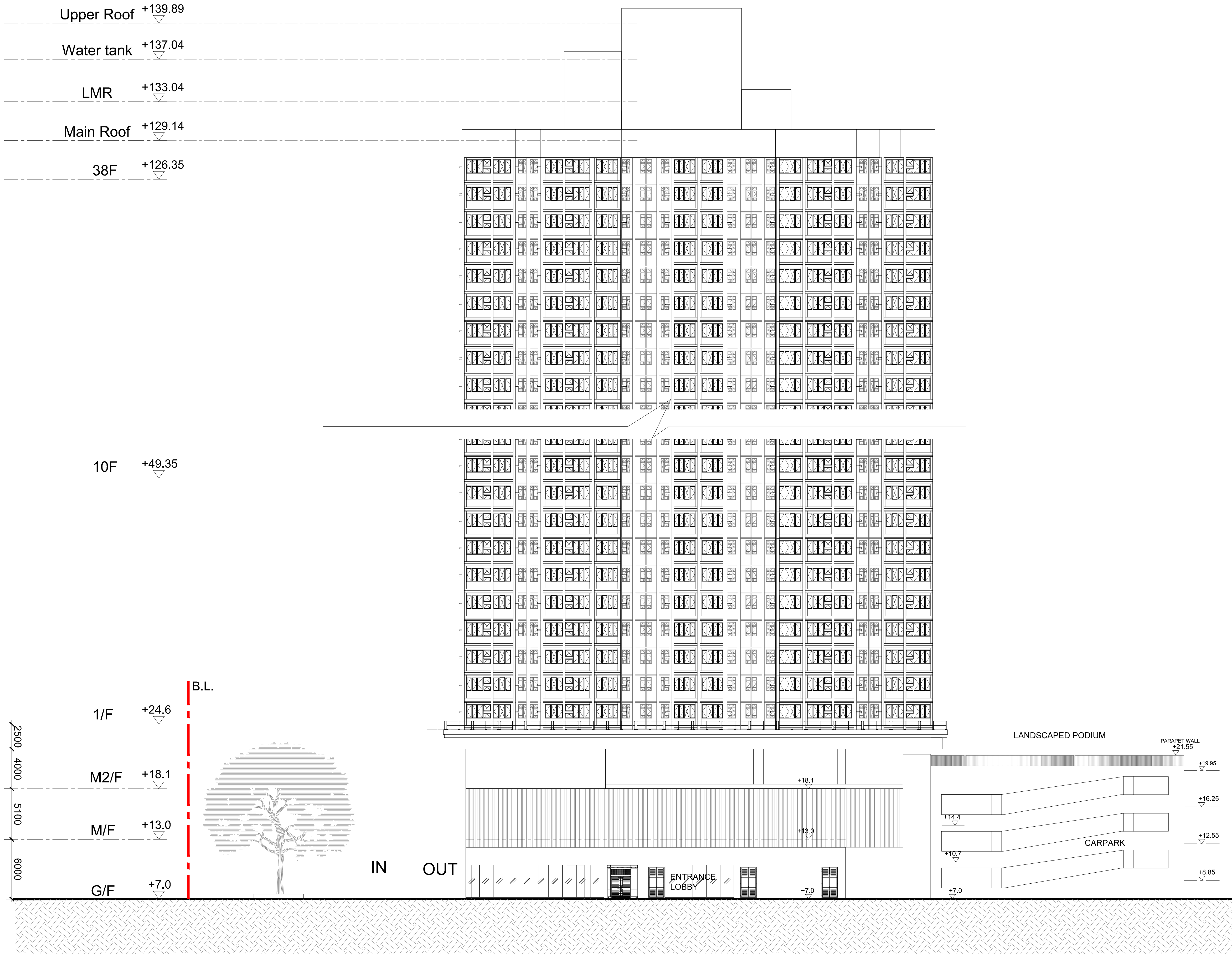
1/2 of Total roofed area =
Required area of Open Space:
=507m²

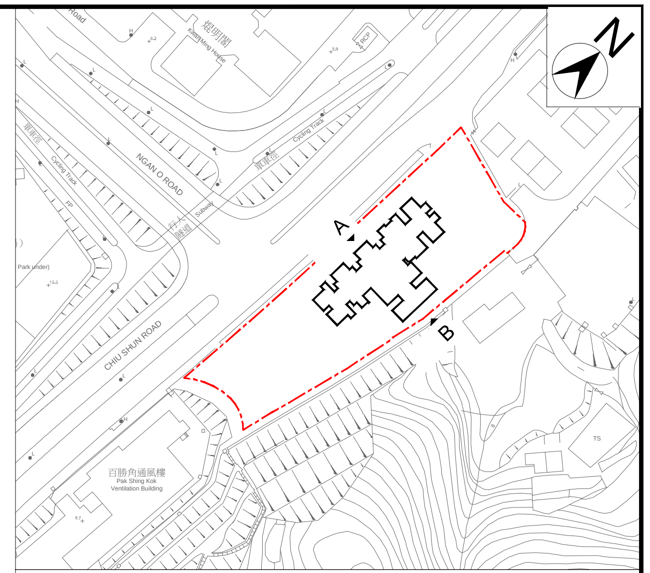
Area of Open Space in Current Scheme:
= 1803m² > 507m², Therefore OK

PROJECT PROPOSED SSF DEVELOPMENT AT CHIU SHUN ROAD, TKO	DRAWING TITLE MASTER LAYOUT PLAN 1:500(A1)	房屋署 HOUSING DEPARTMENT DRAWING NO. SK06/SITE/A/03 DATE: 05.03.2019 03



PROJECT PROPOSED SSF DEVELOPMENT AT CHIU SHUN ROAD, TKO	DRAWING TITLE SITE LAYOUT PLAN AT TYPICAL FLOOR 1:500(A1)	房屋署 HOUSING DEPARTMENT DRAWING NO. SK06/SITE/A/03 DATE: 05.03.2019 04





KEY PLAN 1:2500

PROJECT
PROPOSED SSF DEVELOPMENT
AT CHIU SHUN ROAD, TKO

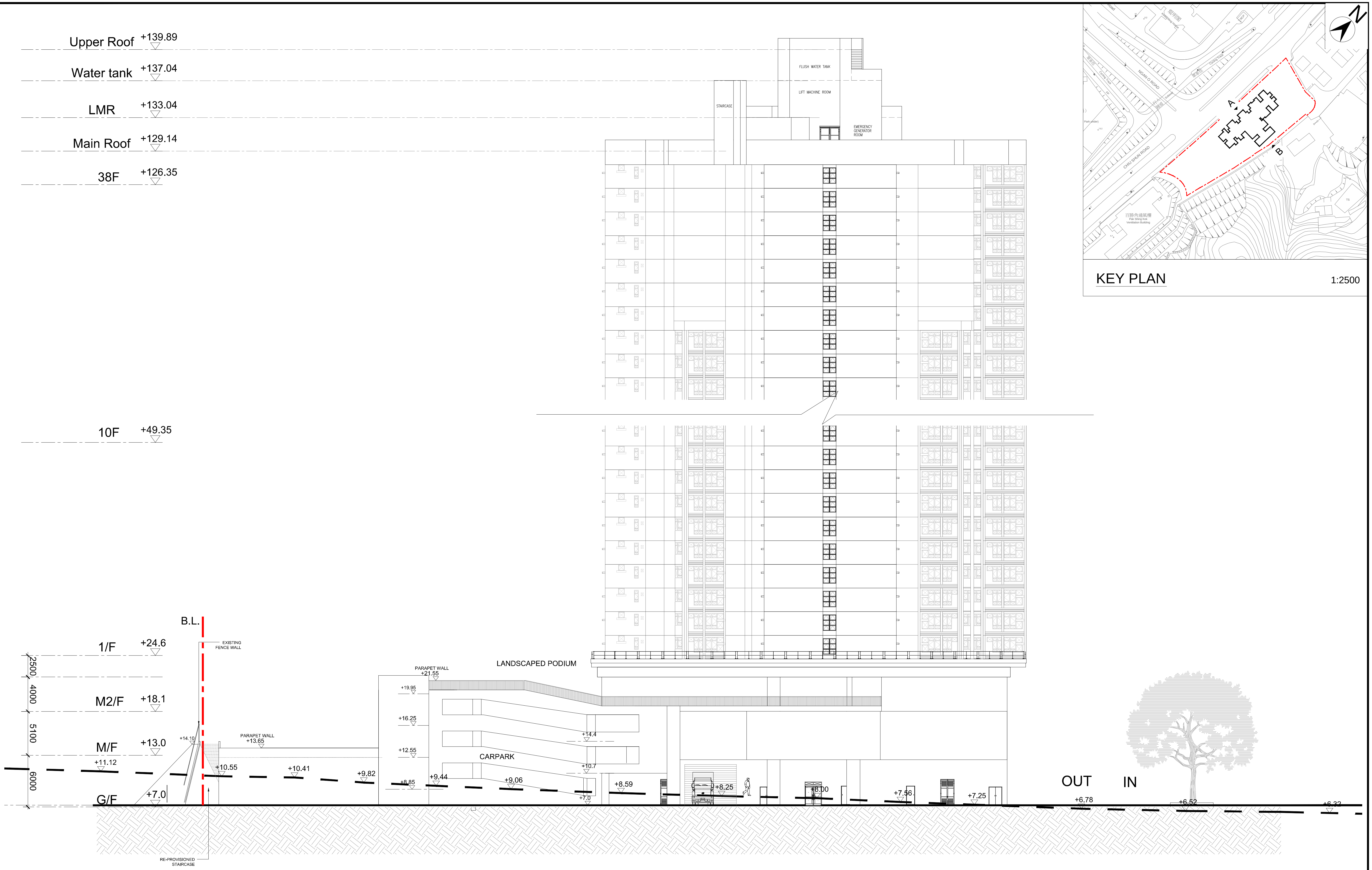
DRAWING TITLE
ELEVATION A

1:200(A1)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO.

DATE:



PROJECT

PROPOSED SSF DEVELOPMENT
AT CHIU SHUN ROAD, TKO

DRAWING TITLE

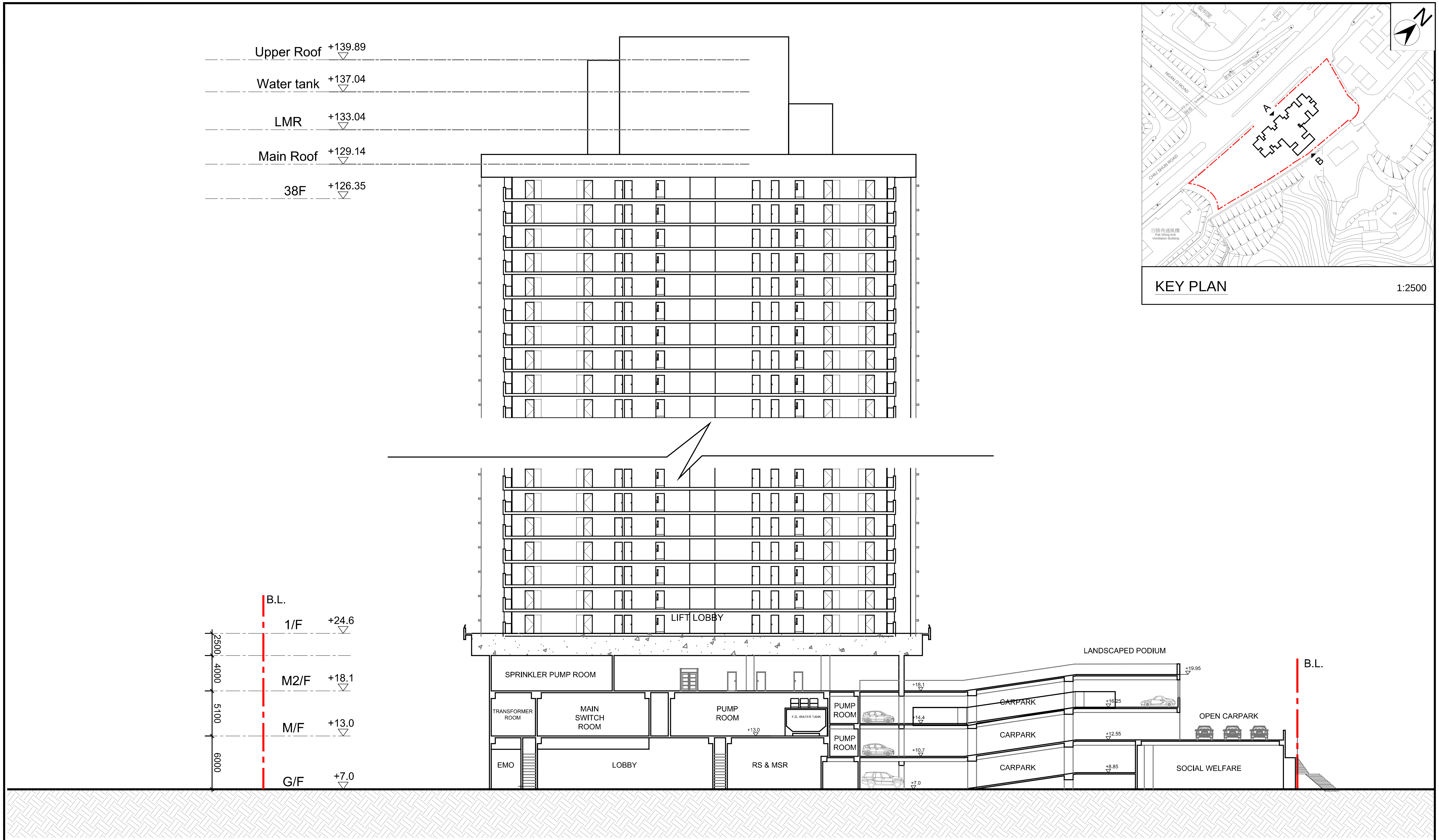
ELEVATION B

1:200(A1)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO.

DATE:



KEY PLAN 1:2500

PROJECT
PROPOSED SSF DEVELOPMENT
AT CHIU SHUN ROAD, TKO

DRAWING TITLE
SECTION A

1:200(A1)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO.

DATE:

Appendix B

Wind Probability Table

<u>Tabulated Results - Percentage Occurrence of Directional Winds</u>
<u>Annual - at 500m</u>

f_01510	Wind direction	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
V infinity (m/s)	Sum	0.033	0.072	0.107	0.167	0.180	0.076	0.051	0.044	0.045	0.061	0.067	0.041	0.023	0.010	0.010	0.011
00_to_01	0.019	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001
01_to_02	0.044	0.002	0.003	0.003	0.003	0.006	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.003	0.001	0.002	0.002
02_to_03	0.065	0.003	0.004	0.005	0.005	0.007	0.006	0.006	0.005	0.004	0.004	0.004	0.004	0.003	0.002	0.002	0.002
03_to_04	0.087	0.003	0.007	0.009	0.008	0.010	0.007	0.006	0.007	0.005	0.004	0.007	0.005	0.003	0.001	0.001	0.002
04_to_05	0.108	0.003	0.009	0.013	0.012	0.015	0.010	0.008	0.007	0.007	0.006	0.007	0.005	0.003	0.001	0.001	0.001
05_to_06	0.120	0.004	0.007	0.016	0.017	0.020	0.011	0.007	0.006	0.007	0.007	0.007	0.005	0.003	0.001	0.001	0.001
06_to_07	0.124	0.003	0.007	0.016	0.024	0.024	0.011	0.006	0.005	0.005	0.007	0.008	0.005	0.002	0.001	0.001	0.000
07_to_08	0.115	0.002	0.007	0.014	0.025	0.024	0.008	0.004	0.004	0.005	0.007	0.008	0.004	0.001	0.001	0.001	0.000
08_to_09	0.093	0.002	0.006	0.010	0.021	0.022	0.006	0.003	0.002	0.004	0.007	0.005	0.003	0.001	0.000	0.000	0.000
09_to_10	0.075	0.002	0.005	0.007	0.019	0.019	0.004	0.002	0.001	0.002	0.005	0.004	0.002	0.001	0.000	0.000	0.000
10_to_11	0.052	0.002	0.004	0.005	0.012	0.013	0.002	0.001	0.001	0.001	0.004	0.003	0.001	0.000	0.000	0.000	0.000
11_to_12	0.034	0.001	0.004	0.003	0.007	0.007	0.002	0.001	0.001	0.001	0.003	0.003	0.001	0.000	0.000	0.000	0.000
12_to_13	0.022	0.001	0.003	0.002	0.004	0.004	0.001	0.001	0.000	0.000	0.002	0.002	0.001	0.000	0.000	0.000	0.000
13_to_14	0.015	0.001	0.002	0.001	0.002	0.003	0.001	0.000	0.000	0.000	0.001	0.002	0.001	0.000	0.000	0.000	0.000
14_to_15	0.009	0.001	0.002	0.001	0.002	0.002	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000
15_to_16	0.006	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
16_to_17	0.004	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17_to_18	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18_to_19	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19_to_20	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20_to_21	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21_to_22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22_to_23	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23_to_24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Tabulated Results - Percentage Occurrence of Directional Winds
Summer - at 500m

f_01510	Wind direction	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
V infinity (m/s)	Sum	0.011	0.015	0.021	0.039	0.093	0.078	0.062	0.076	0.099	0.142	0.160	0.097	0.050	0.021	0.021	0.013
00_to_01	0.026	0.001	0.001	0.001	0.001	0.003	0.002	0.002	0.001	0.001	0.002	0.002	0.001	0.003	0.001	0.001	0.001
01_to_02	0.054	0.002	0.002	0.002	0.003	0.004	0.004	0.004	0.004	0.004	0.005	0.004	0.004	0.005	0.002	0.002	0.002
02_to_03	0.077	0.002	0.002	0.002	0.003	0.005	0.006	0.007	0.006	0.007	0.008	0.009	0.008	0.005	0.003	0.003	0.002
03_to_04	0.103	0.001	0.002	0.003	0.004	0.006	0.007	0.009	0.011	0.009	0.009	0.016	0.012	0.007	0.002	0.003	0.002
04_to_05	0.109	0.001	0.001	0.002	0.004	0.009	0.010	0.007	0.010	0.012	0.011	0.015	0.012	0.007	0.002	0.003	0.002
05_to_06	0.115	0.001	0.001	0.003	0.004	0.011	0.011	0.006	0.008	0.014	0.014	0.018	0.013	0.007	0.003	0.002	0.001
06_to_07	0.112	0.000	0.001	0.001	0.002	0.012	0.011	0.006	0.008	0.012	0.016	0.020	0.012	0.005	0.002	0.002	0.001
07_to_08	0.099	0.000	0.001	0.001	0.003	0.009	0.006	0.005	0.009	0.013	0.016	0.020	0.010	0.003	0.001	0.002	0.001
08_to_09	0.078	0.000	0.000	0.001	0.003	0.007	0.005	0.004	0.005	0.010	0.018	0.013	0.007	0.002	0.001	0.001	0.001
09_to_10	0.060	0.001	0.000	0.000	0.004	0.007	0.004	0.004	0.003	0.005	0.013	0.010	0.005	0.001	0.001	0.001	0.000
10_to_11	0.048	0.000	0.001	0.000	0.001	0.006	0.002	0.002	0.004	0.005	0.011	0.008	0.004	0.002	0.001	0.001	0.000
11_to_12	0.036	0.000	0.000	0.000	0.001	0.004	0.003	0.002	0.003	0.003	0.006	0.009	0.003	0.001	0.000	0.000	0.000
12_to_13	0.025	0.000	0.000	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.004	0.006	0.002	0.001	0.000	0.000	0.000
13_to_14	0.019	0.000	0.000	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.004	0.004	0.002	0.000	0.000	0.000	0.000
14_to_15	0.012	0.000	0.000	0.000	0.001	0.003	0.001	0.000	0.001	0.000	0.002	0.002	0.001	0.000	0.000	0.000	0.000
15_to_16	0.008	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.001	0.001	0.002	0.001	0.000	0.000	0.000	0.000
16_to_17	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000
17_to_18	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000
18_to_19	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19_to_20	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20_to_21	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21_to_22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22_to_23	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23_to_24	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000