

Planning Department

**Term Consultancies for
Air Ventilation
Assessment Services**

Expert Evaluation on Ho
Man Tin Area

REVISION 3

Planning Department

**Term Consultancies for
Air Ventilation
Assessment Services**

Expert Evaluation on Ho
Man Tin Area

January 2008

Ove Arup & Partners Hong Kong Ltd
Level 5, Festival Walk,
80 Tat Chee Avenue,
Kowloon Tong, Kowloon,
Hong Kong
Tel +852 2528 3031 Fax +852 2268
www.arup.com

This report takes into account the
particular instructions and requirements
of our client.

It is not intended for and should not be
relied upon by any third party and no
responsibility is undertaken to any third
party

Job number 25146

Job title	Term Consultancies for Air Ventilation Assessment Services	Job number	25146
-----------	--	------------	-------

Document title	Expert Evaluation on Ho Man Tin Area	File reference	
----------------	--------------------------------------	----------------	--

Document ref

Revision	Date	Filename	Draft1.doc		
Draft 1	21/11/07	Description	First draft		
			Prepared by	Checked by	Approved by
		Name	Various	Rumin Yin	Raymond Yau
		Signature			
Issue	04/12/07	Filename	AVA expert evaluation Ho man Tin issue1.doc		
		Description	Proposed scheme		
			Prepared by	Checked by	Approved by
		Name	Various	Rumin Yin	Raymond Yau
		Signature			
Revised	10/12/07	Filename	AVA expert evaluation Ho man Tin Revised 1 (7 Dec 2007).doc		
		Description			
			Prepared by	Checked by	Approved by
		Name	Various	Rumin Yin	Raymond Yau
		Signature			
Revision 2	24/12/07	Filename	AVA expert evaluation Ho man Tin Revised 1 (24 Dec 2007).doc		
		Description	Revision to incorporate the comments from Urban Planning		
			Prepared by	Checked by	Approved by
		Name	Various	Rumin Yin	Raymond Yau
		Signature			

Issue Document Verification with Document

Job title	Term Consultancies for Air Ventilation Assessment Services	Job number
-----------	--	------------

Document title	Expert Evaluation on Ho Man Tin Area	File reference
----------------	--------------------------------------	----------------

Document ref

Revision	Date	Filename	AVA expert evaluation Ho man Tin Revised 3 (09 Jan 2008).doc		
Revision 3	09/01/08	Description	Revision to incorporate the new graphics from Urban Planning		
			Prepared by	Checked by	Approved by
		Name	Various	Rumin Yin	Raymond Yau
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

Issue Document Verification with Document

Contents

	Page
1 Introduction	1
2 Objective	1
3 Scope of Study	1
4 Study Area	2
4.1 Site Boundary	2
4.2 Site Characteristic	3
5 Wind Availability	5
5.1 Wind Data from MM5 Simulation Result	5
6 Expert Evaluation	7
6.1 Existing Condition	7
6.2 Proposed height restrictions	15
6.3 Problematic areas and mitigation methods	23
6.4 Recommendation for further study	32
7 Conclusion	33

1 Introduction

Ove Arup and Partners Hong Kong Limited (Arup) was commissioned by Planning Department to provide an expert evaluation on the proposed building heights of the development sites within the Ho Man Tin Area from air ventilation perspective. This consultancy study is based on the Air Ventilation Assessment framework as set out in Technical Circular No. 1/06 issued jointly by Housing, Planning and Lands Bureau and Environment, Transport and Works Bureau and its Annex A – Technical Guide for Air Ventilation Assessment for Development in Hong Kong.

2 Objective

The objective of this assignment is to assess the likely impact of the proposed building heights of the development sites within the study area on the pedestrian wind environment as compared to the existing condition.

3 Scope of Study

The scope of work includes the tasks as follows.

- To identify any potential problem areas due to the proposed building heights;
- To provide recommendation on how the problems may be alleviated;
- To identify any key wind corridors should be preserved or reserved;
- To advise whether any further detailed study is required for focused areas and the scope of the detailed study required.

4 Study Area

4.1 Site Boundary

The study area Ho Man Tin covers about 210ha. It is located at Central Kowloon, bounded by Boundary Street to the north, the Kowloon-Canton Railway and Princess Margaret Road to the west, Chatham Road North to the south, the eastern slopes of Ho Man Tin Hill and Lomond Road, Tin Kwong Road and Shun Yung Street to the east. It has been substantially developed and forms part of the existing urban areas of Kowloon. (Figure 1)

Owing to the hilly terrain, the street level of Ho Man Tin Area ranges a +6mPD to +75mPD. The eastern part of the site is Ho Man Tin Estate which is located at a relatively high elevation of approximately + 60mPD. Also, the existing tallest building within the study area is situated in this Estate. The southern part of the site is relatively open. Several parks and reservoirs are found in this area, including King's Park Services Reservoir, Ho Man Tin West Service Reservoir, Ho Man Tin East Services Reservoir Playground and Ho Man Tin Park.

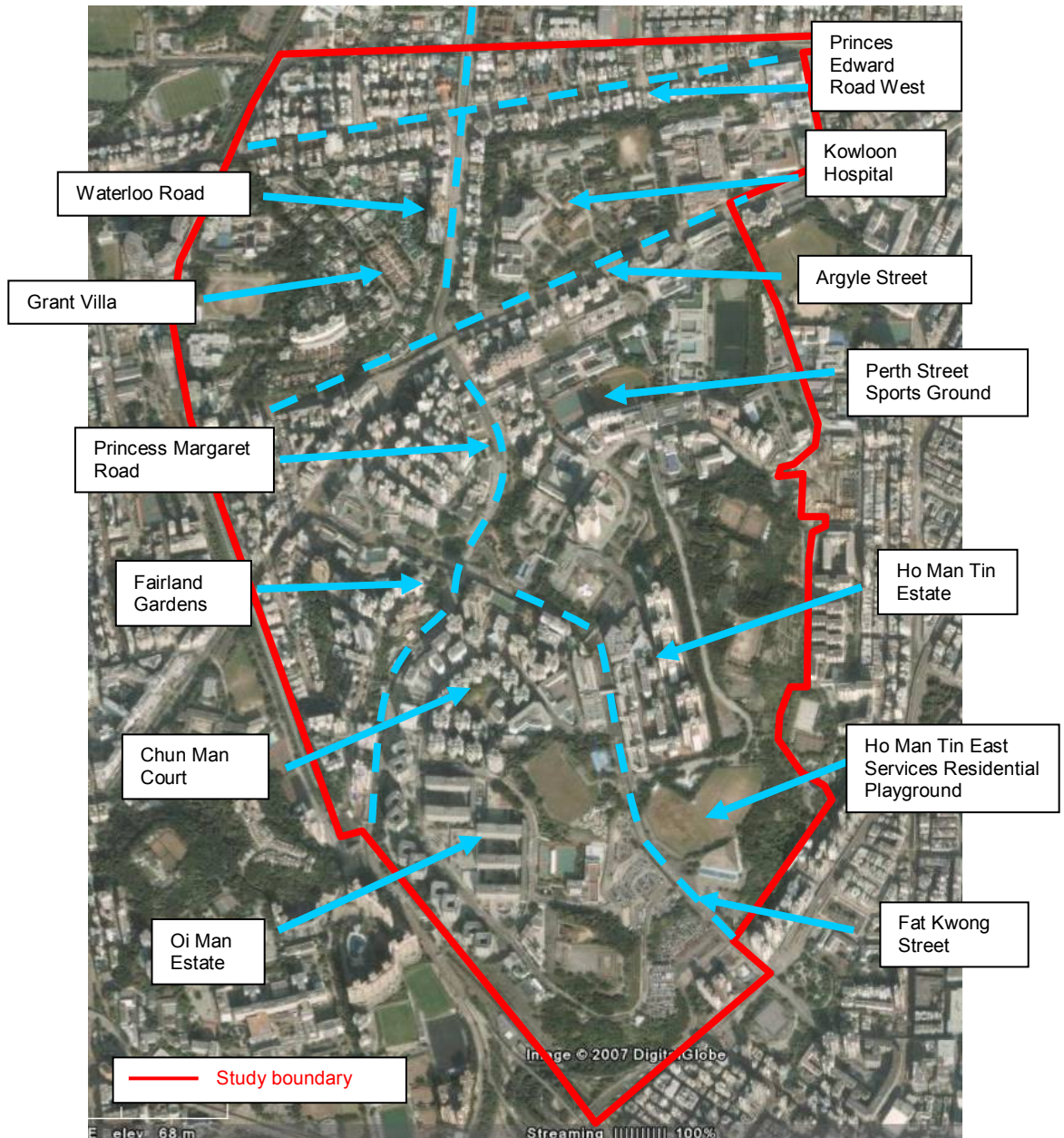


Figure 1 The Study Area (source from Google Earth)

4.2 Site Characteristic

The Ho Man Tin Area is located at the central part of the Kowloon Peninsular. Highlands form its southern part and is adjoining King's Park, Hung Hom and Ma Tau Kok. Low and flat land is located to the north of Argyle Street adjoining Kowloon Tong. The Ho Man Tin area is mainly a medium-density residential development area, except the Kardoorie Avenue area, which is built as a low-density neighbourhood. The overall townscape and streetscape of the Ho Man Tin area are unique and the highland of the area is also prominent.



Argyle Street



Fat Kowng Street



King Man House



Prince Edward Road West



Princes Margaret Road



King George V School



Ho Man Tin Estate



Proposed Ventilation Building Site



Waterloo Road - Southern Segment



Waterloo Road - northern Segment



Chung Hau Street Parking Area



Sheung Foo Street Parking Area

5 Wind Availability

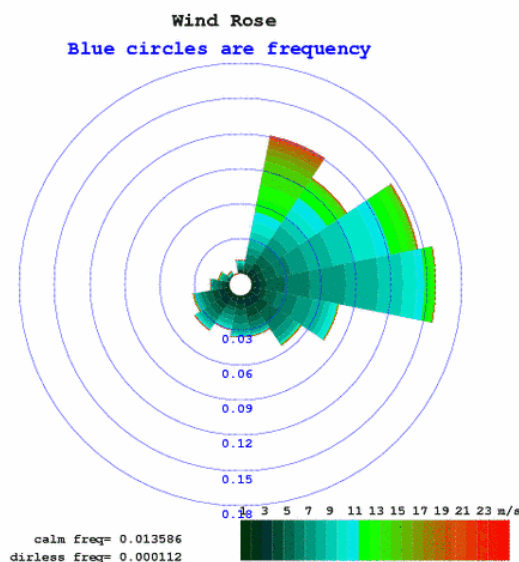
The wind availability of the site is an essential item to investigate the wind performance of the development. Since no Hong Kong weather station is located within the site, site wind availability data (V_w) is achieved by mathematical models by following AVA guideline, which is provided by Planning Department.

5.1 Wind Data from MM5 Simulation Result

To facilitate AVA expert evaluation study, the wind data of MM5 simulation results at the height of 230 m above Ho Man Tin Area from HKUST¹ was provided by Planning Department and utilised in this study.

As the wind data below 200 m may be distorted by the highrise buildings and could not present the realistic wind characteristic of the site, the wind data at height of 230 m above the sea level were selected to demonstrate the wind characteristic of the site, with the consideration of surrounding topographical impact on the wind direction.

As shown in Figure 2, it can be concluded that Eastern (E) and North-Eastern (NE) winds dominate the annual wind frequency. While in summer period, the winds are mainly coming from South-western (SW) and Eastern (E) directions. Similar to the annual wind frequency characteristic, Eastern (E) and North-Eastern (NE) winds dominate in non-summer period.



¹ Acknowledgment: The MM5 wind data applied here was adopted from the Institute for the Environment (IENV), the Hong Kong University of Science and Technology (HKUST)

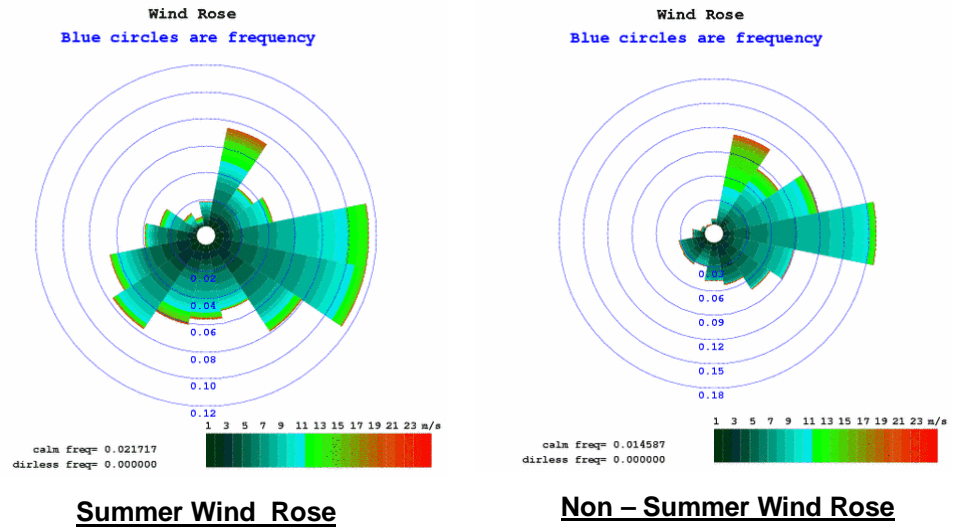


Figure 2 Annual and seasonal wind rose from MM5 data

6 Expert Evaluation

6.1 Existing Condition

The existing building heights of the site are shown in Figure 3.

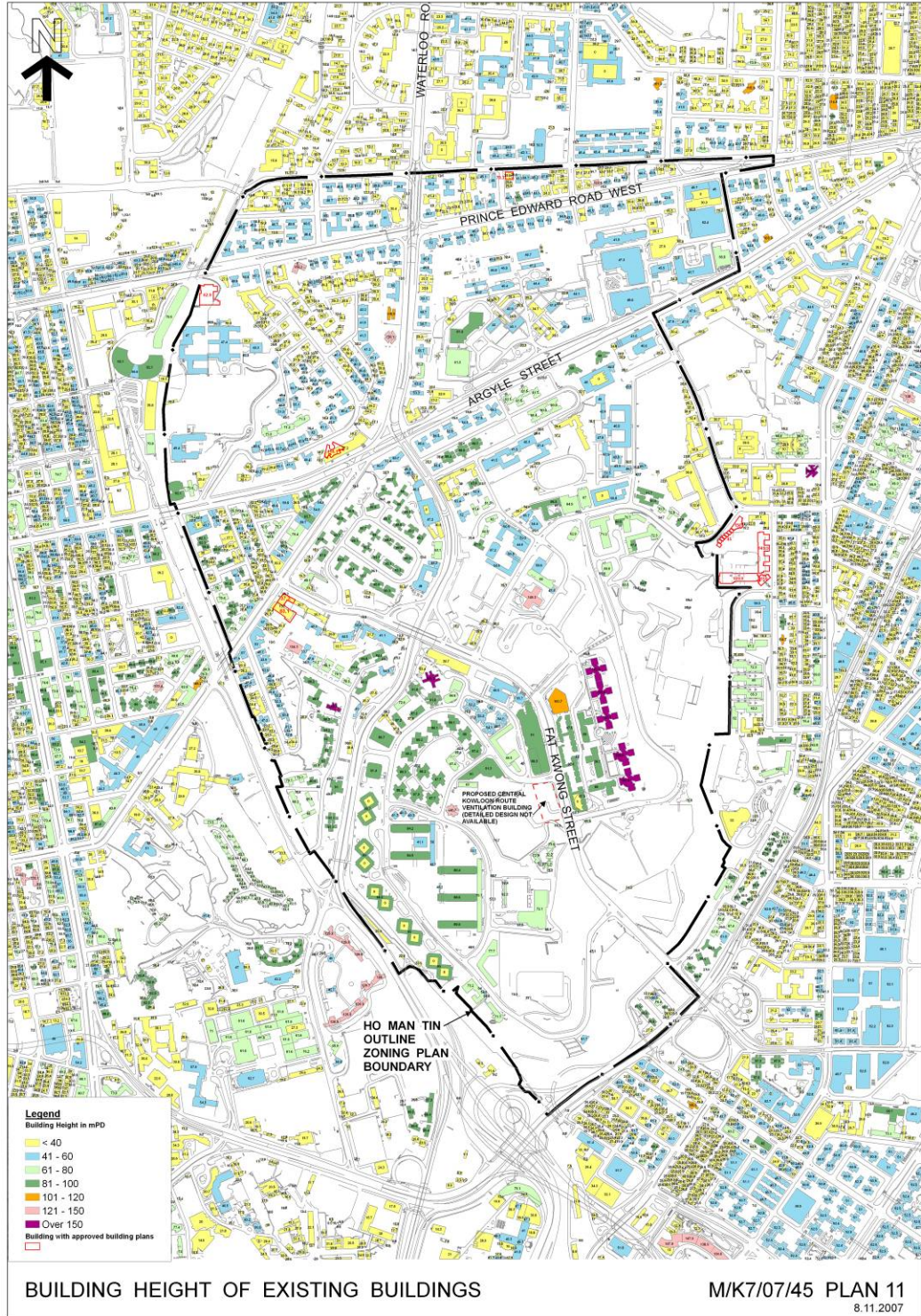


Figure 3 Building height of existing buildings

The wind environment characteristics of the existing area are summarised as follows.

- The whole site is mainly characterized by medium-density and medium-rise buildings. The area to the north of Argyle Street is flat and lies along Boundary Street. Prince Edward Road West and Argyle Street (street level between +7mpD to 14 mpD) in the east-west direction. It is a low to medium density residential area with buildings mainly from +20 mpD to +50mpD (2 to 17 storeys) in height. The area to the south of Argyle is the highland of Ho Man Tin (Street level ranging from +7 mpD to +70 mpD). The building heights in this area is diverse, ranging from about +25mpD to +167 mpD (2 storeys to 41 storeys). Due to this relatively non-dense building environment, the ventilation performance for Ho Man Tin area may not be stagnant. However, some high-rise and high density buildings are situated at the southern part of the site, the ventilation performance for those areas may be relatively poorer than the northern part of the site, due to this congested layout.
- Several main roads such as Prince Edward Road West, Argyle Street and Waterloo Road may serve as the major wind corridors of the site.
- The street patterns at the southern area are irregular, full of twist and turns. The connectivity of streets is also unsatisfactory, such as Hau Man Street, Fat Kwong Street and Princess Margaret Road. This may reduce air penetration effect along the streets.
- One of the important characteristics of Ho Man Tin area is the presence of several major open areas, like parks and services reservoirs. These open areas greatly increase the porosity of Ho Man Tin Area and keep the relatively good ventilation performance in this area.
- The north-eastern boundary of the Site abuts on Mau Tau Wai and Kowloon City. This area may be treated as one of the main wind entrances for E and NE winds.
- The inbuilt area at the southern part connects to the junction of Chatham Road South and Hong Chong Road, which may be the main wind corridor linking Ho Man Tin Area with Tsim Sha Tsui Area.

6.1.1 Non – summer Wind Condition

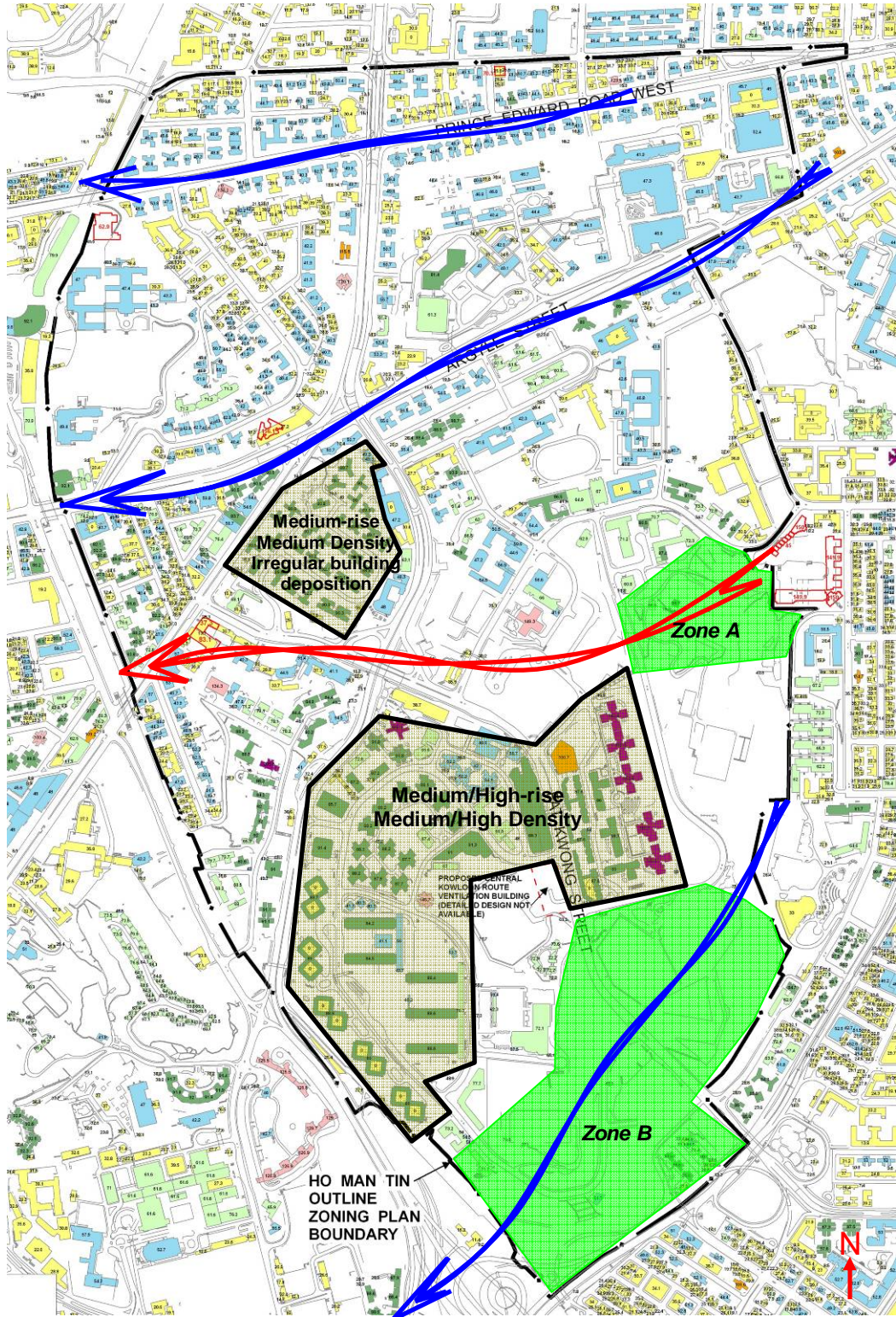


Figure 4 Wind performance in non-summer period

In non-summer period, the prevailing winds are from E and NE directions, as shown in Figure 4. The site wind performance can be summarized as following:

- The Prince Edward Road West acts as the main wind corridor. It delivers wind down to the north part of Mong Kok Area.

- The Argyle Street is another main wind corridor. It services the adjoining area such as Kowloon Hospital, Grant Villa, etc, and allows wind from Ma Tou Kok Area to middle part of Mong Kok Area.
- The street pattern of the southern part of Ho Man Tin Area is irregular. Poor street connectivity may affect the wind penetration into the hinterland and result in relative poor wind performance.
- Some high-rise and high density sites are found in Ho Man Tin Area. This congested layout may affect the air circulation at low level and also confine the wind passage at high level.
- The wind corridor marked as red above is identified as the localized wind corridor. The vacant space and the low rise building cluster along this wind corridor allow the wind at open area of Ho Man Tin High Level Service Reservoirs (zone A in Figure 4) passing through central of Ho Man Tin area and then to southern part of Mong Kok Area.
- The open areas at south-eastern of the site (i.e. Ko Shan Road Park, Ho Man Tin East Services Reservoirs Playground and King's Park Services Reservoirs and some vacant sites, shown as Zone B in Figure 4) are important for air circulation in Ho Man Tin area itself and to northern part of Tsim Sha Tsui Area under non-summer NE wind condition.

6.1.2 Summer wind Condition

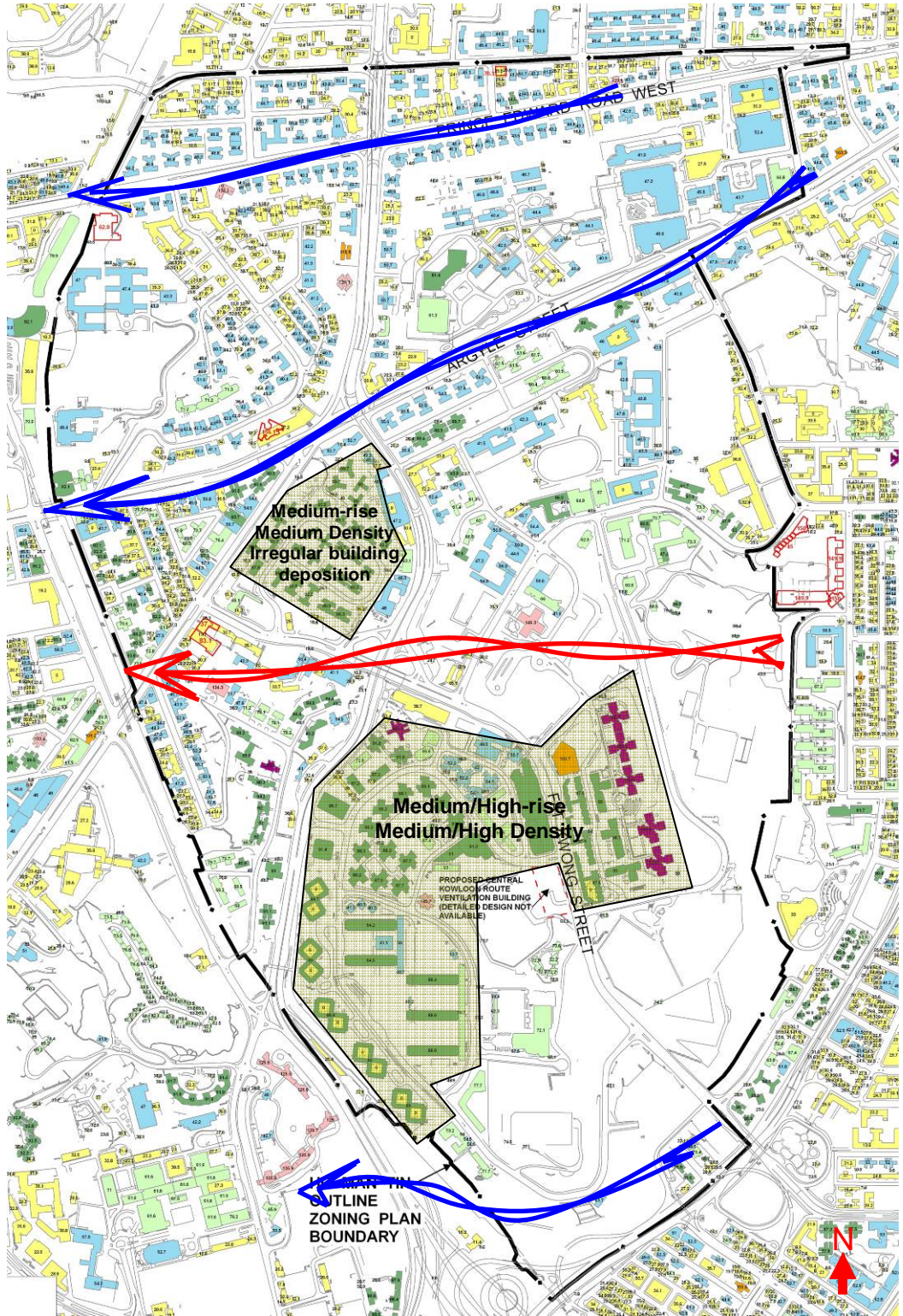


Figure 5 Wind corridor in summer period – Eastern Wind

In summer period, the prevailing winds are from E and SW directions. Figure 5 shows the wind corridors under the summer eastern prevailing wind condition. The wind performance of the study area is summarized as below.

- The function of Prince Edward Road West and Argyle Street is similar to those under non – summer condition. They are treated as the main wind corridor for Ho Man Tin Area and allow wind to pass from Kai Tak Area to Mong Kok Area.
- The localized wind corridor is still functional, allowing wind to reach the southern part of Mong Kok Area.
- Wind from southern Ma Tau Wai passes through the open area of southern Ho Man Tin to King's Park Area.

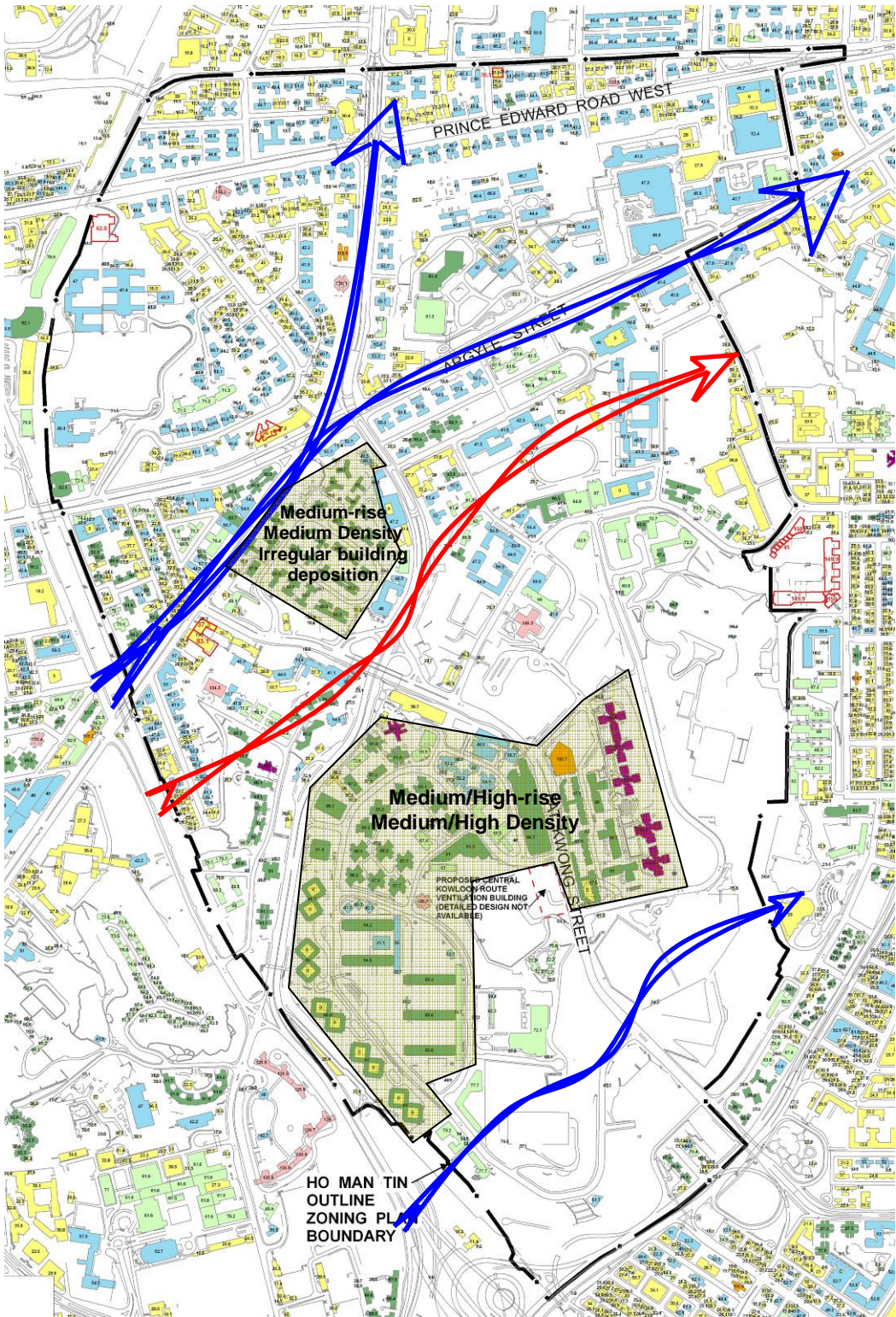


Figure 6 Wind corridor in summer period – South-Western Wind

Figure 6 shows the wind corridors under the summer south-western prevailing wind condition. The wind performance is summarized below.

- Southern segment of Waterloo Road acts as the main wind corridor. Wind disperses to northern part of Ho Man Tin area along Waterloo Road North and Argyle Street.
- The localized wind corridor (Red line in Figure 6) still performs well under SW prevailing wind. But it may shift upward to the area between King's Park and Tin Kwong Road Recreation Ground due to topographical effect, flowing to the eastern direction at the lowest elevation.
- The open space at the southern part of the site allows wind passing freely from northern part of Tsim Shi Tsui Area to southern part of Ma Tau Wai Area.

6.2 Proposed height restrictions

The air ventilation evaluation of Ho Man Tin OZP under the proposed building height restriction during non-summer and summer period is evaluated in this section. Figure 7 and Figure 8 show the OZP proposed building height restriction. Key wind corridor, wind performance and potential problem areas are also identified.

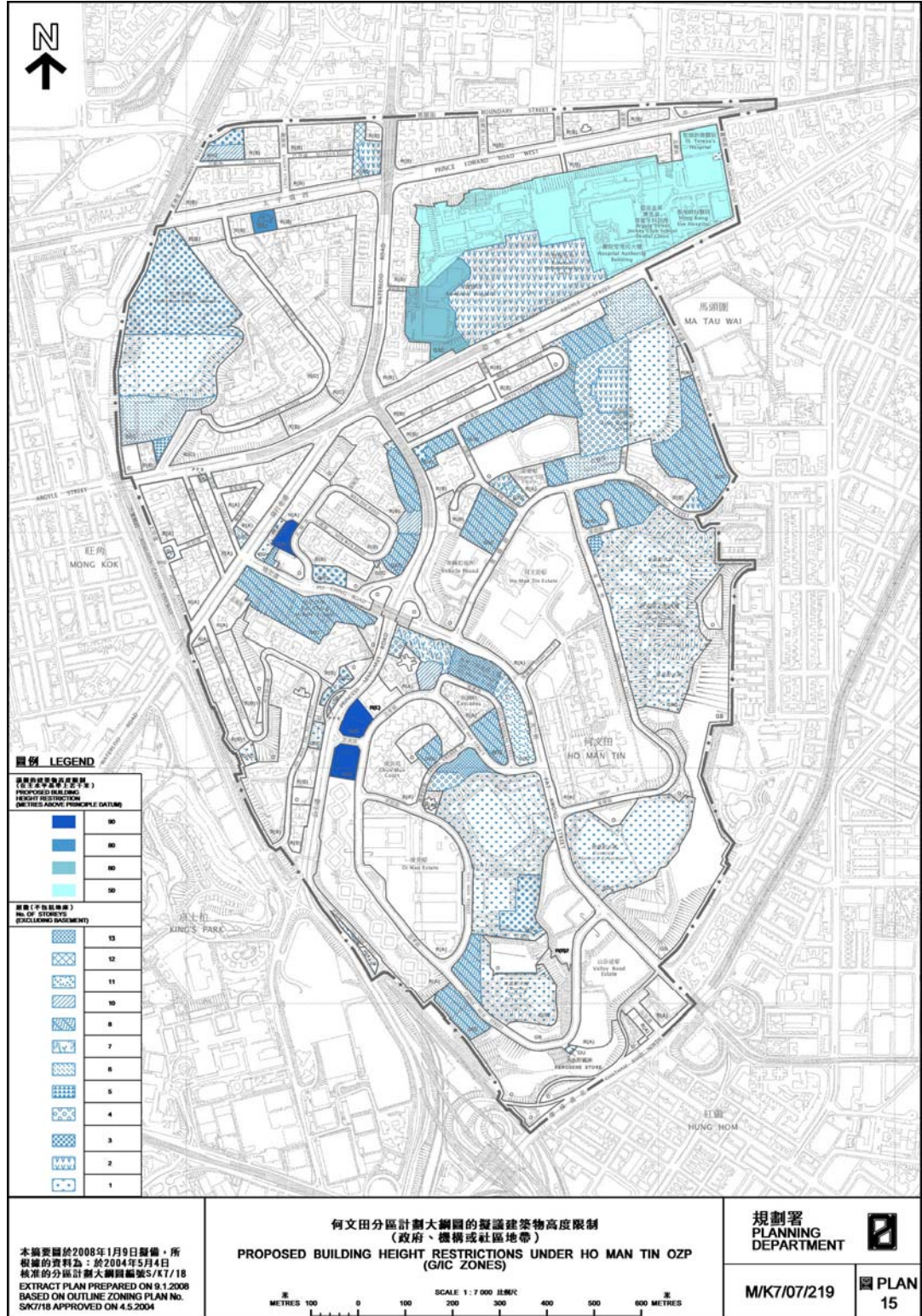


Figure 7 Proposed building height restrictions for G/C zones on Ho Man Tin OZP

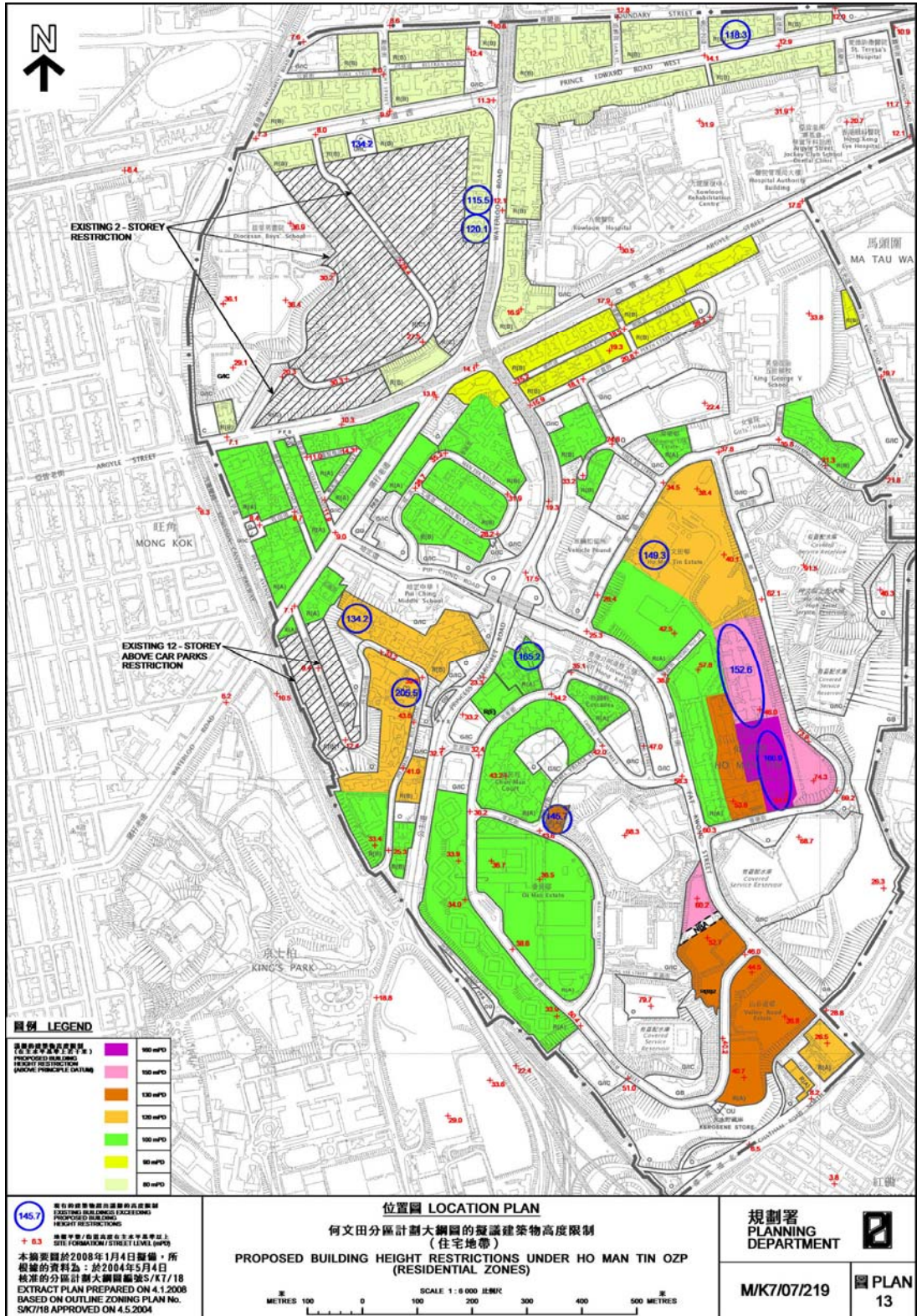


Figure 8 Proposed building height restrictions for residential zones on Ho Man Tin OZP

The Area has been planned mainly for private residential and public housing, mixed with several commercial and government zones. Most of the proposed building height restrictions in the Area range between +80mPD and +160mPD for Residential zone and not are taller than +90mPD for G/IC Zone. Since the street arrangement cannot be changed, the main wind corridors shall remain the same as the existing condition.

6.2.1 Non – Summer wind condition

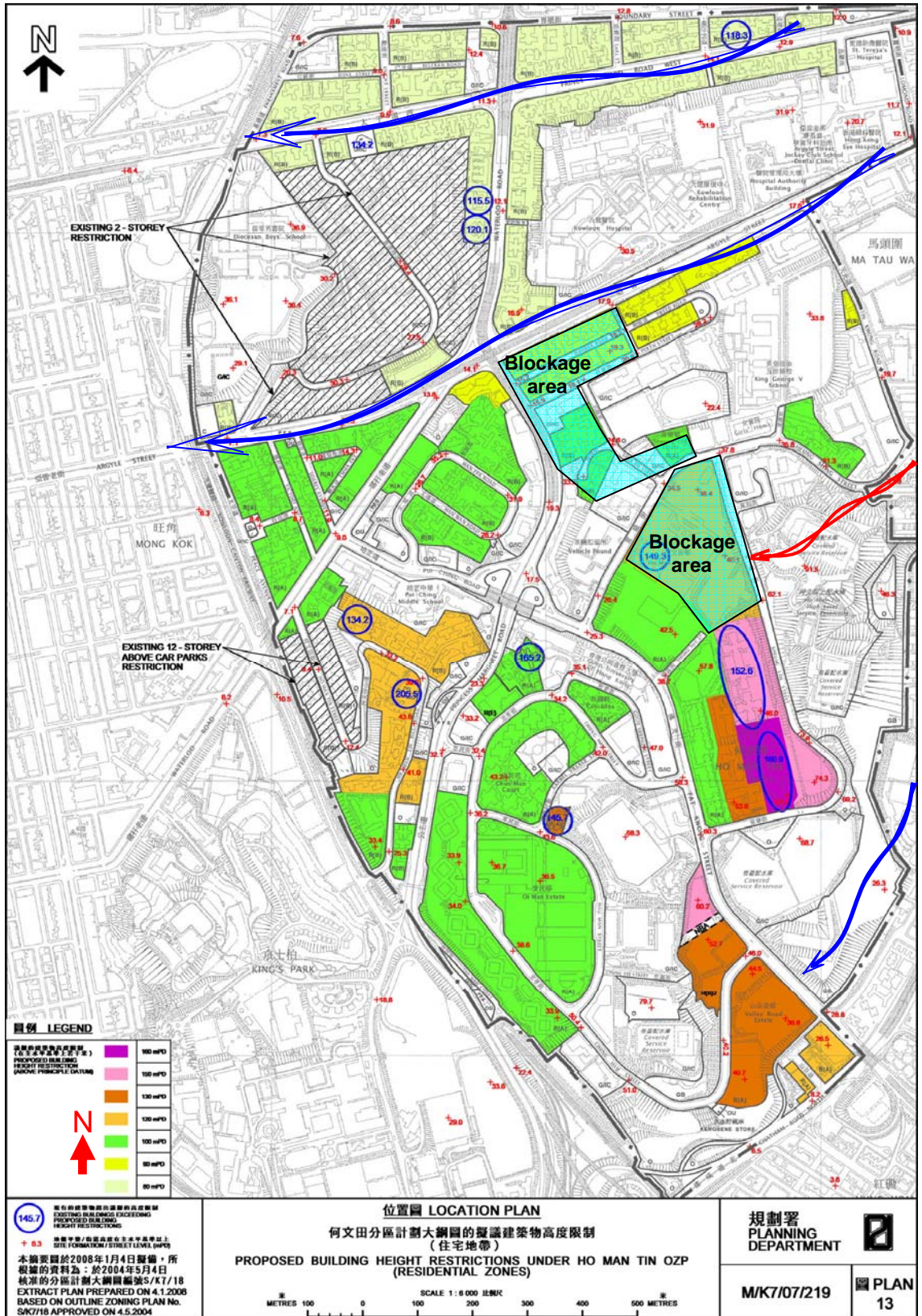


Figure 9 Non – Summer wind pattern

Aforementioned, the prevailing winds are from E and NE directions in non-summer period. Therefore, Prince Edward Road West and Argyle Street still act as the wind corridors at the northern part of the site.

While the road pattern remains unchanged, the higher building height permitted under the planned scenario along the roads may weaken the wind conveying ability along the street.

Compared with the existing condition, the following could be observed:

- The route for the localized wind corridor may be blocked by proposed new building at current vacant site.
- The macroscopic air-circulation of central Ho Man Tin and part of Mong Kok area may be affected with the localized wind corridor (as red line shown in Figure 4) is blocked.
- The proposed buildings at Valley Road may worsen the air circulation at the southern part.

6.2.2 Summer Wind Condition

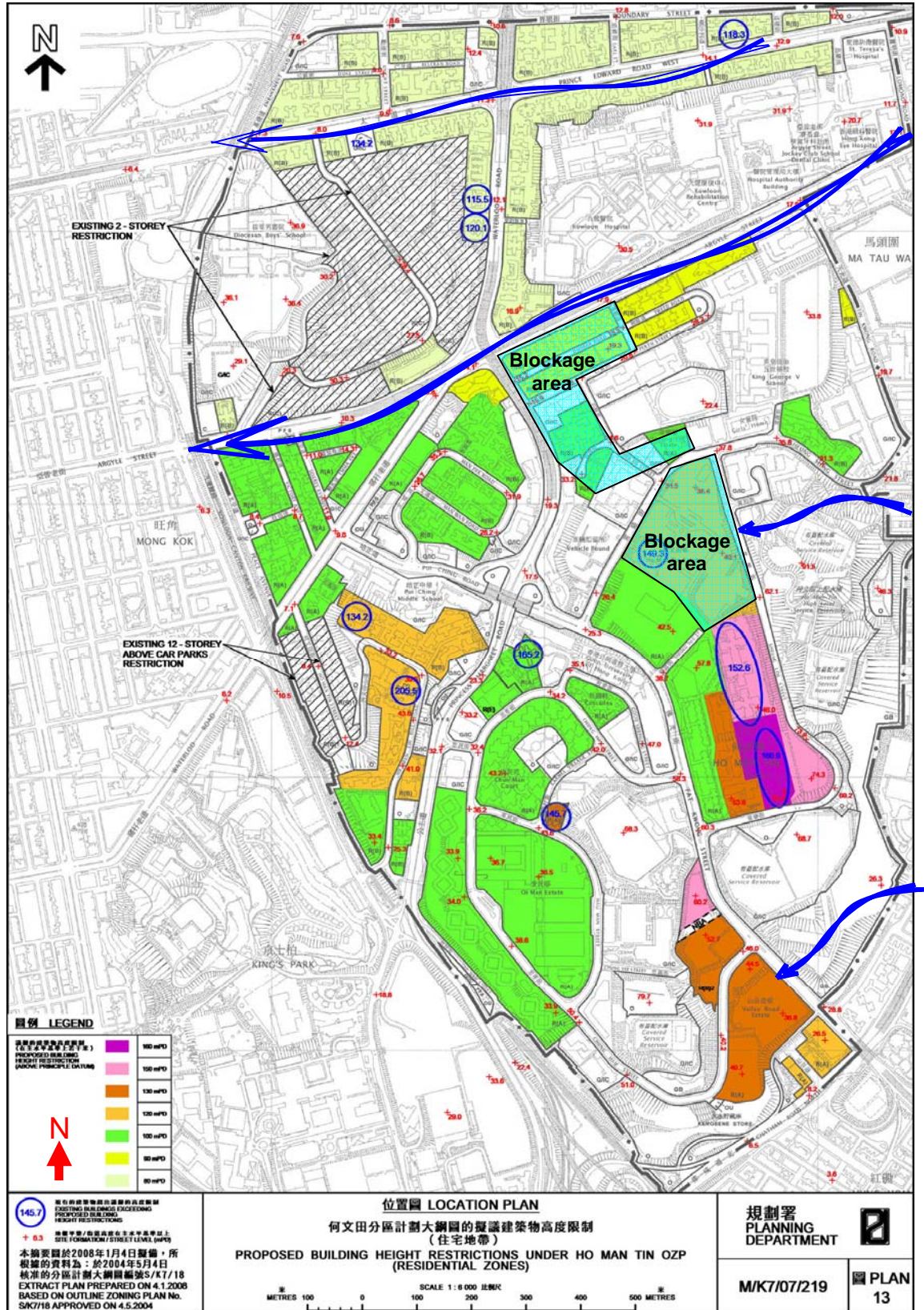


Figure 10 Summer wind condition – Eastern wind

The prevailing winds are from E and SW directions in summer period. Under summer eastern wind condition, Prince Edward Road West and Argyle Street still act as the wind corridor at the northern part of the site.

Compared with the existing condition, the following could be observed:

- The localized wind corridor may vanish as the air path is blocked by the newly proposed development of Ho Man Tin Estate and development along Shek Ku Street.
- The wind corridor at the southern part of Ho Man Tin Area may be blocked by the proposed development at Valley Road.

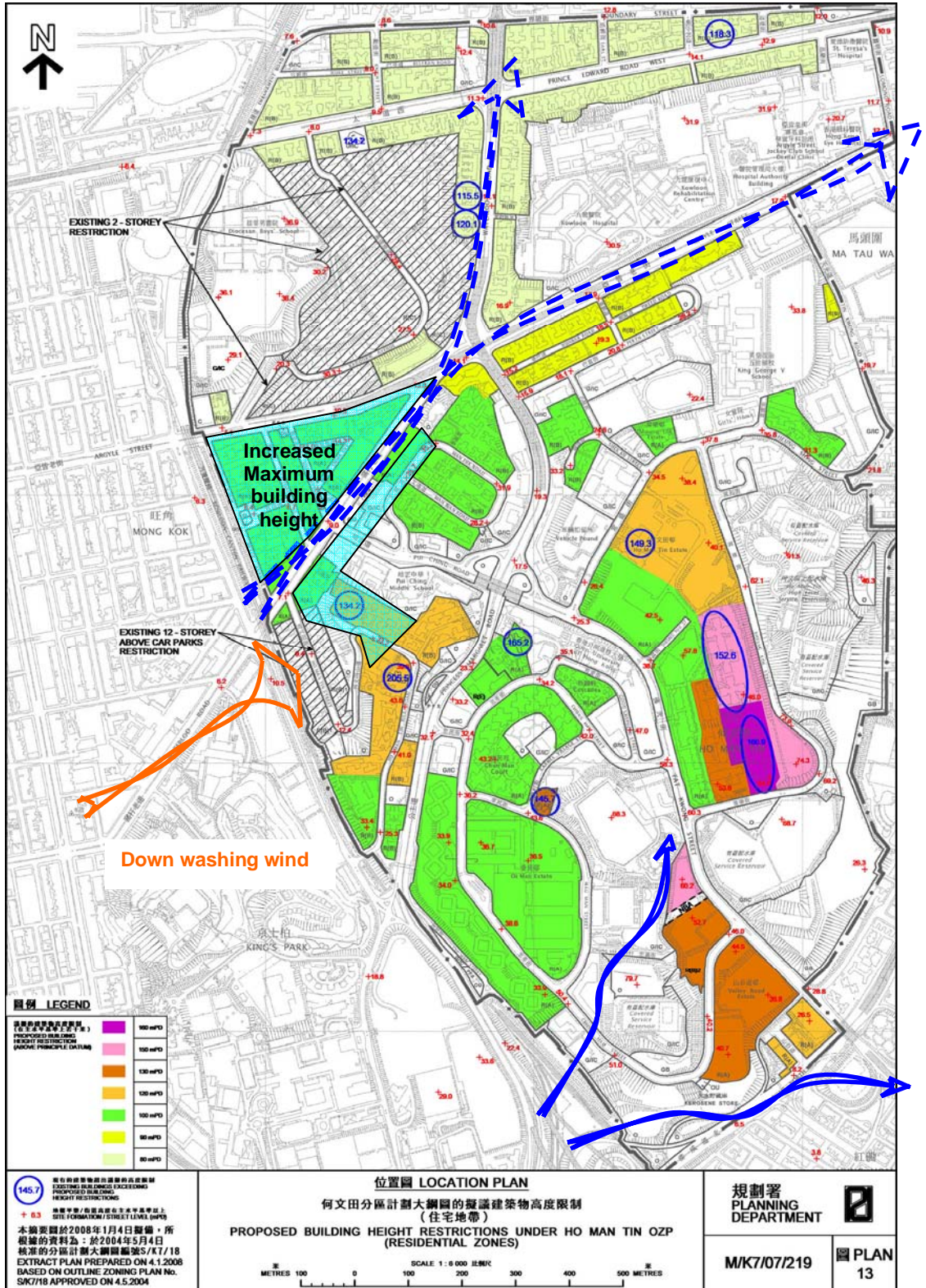


Figure 11 Summer wind condition – South-Western wind

As shown in above figure, under South-Western wind condition, which is less happened than eastern wind, some existing wind corridors may not work at all under the scenario with the proposed height restrictions. The wind performance in some areas may be worse than the existing condition. Compared with the existing condition, the following could be observed:

- Along the southern segment of Waterloo Road, the existing building height varied from +40mpD to +100 mpD, the proposed maximum building height is +120mPD. The increased maximum building height may weaken the delivery ability of wind along Waterloo Road. Consequently, the amount of wind reaches the northern segment of Waterloo Road and Argyle Street may be reduced.
- The existing localized wind corridor (Red line as shown in Figure 6) may be totally blocked under the planned scenario. Instead of going deeply into the inbuilt area of Ho Man Tin Area, where is occupied mainly by GIC facilities, the approach wind may be blocked and driven to Wylie Road due to downwash effect.
- With the proposed development in the south part of the site, the approach wind may divide into two branches and disperses in the hinterland of Ho Man Tin area.

6.3 Problematic areas and mitigation methods

The potential problem areas are identified with mitigation measures discussed in this section.

6.3.1 Northern part of Ho Man Tin Estate

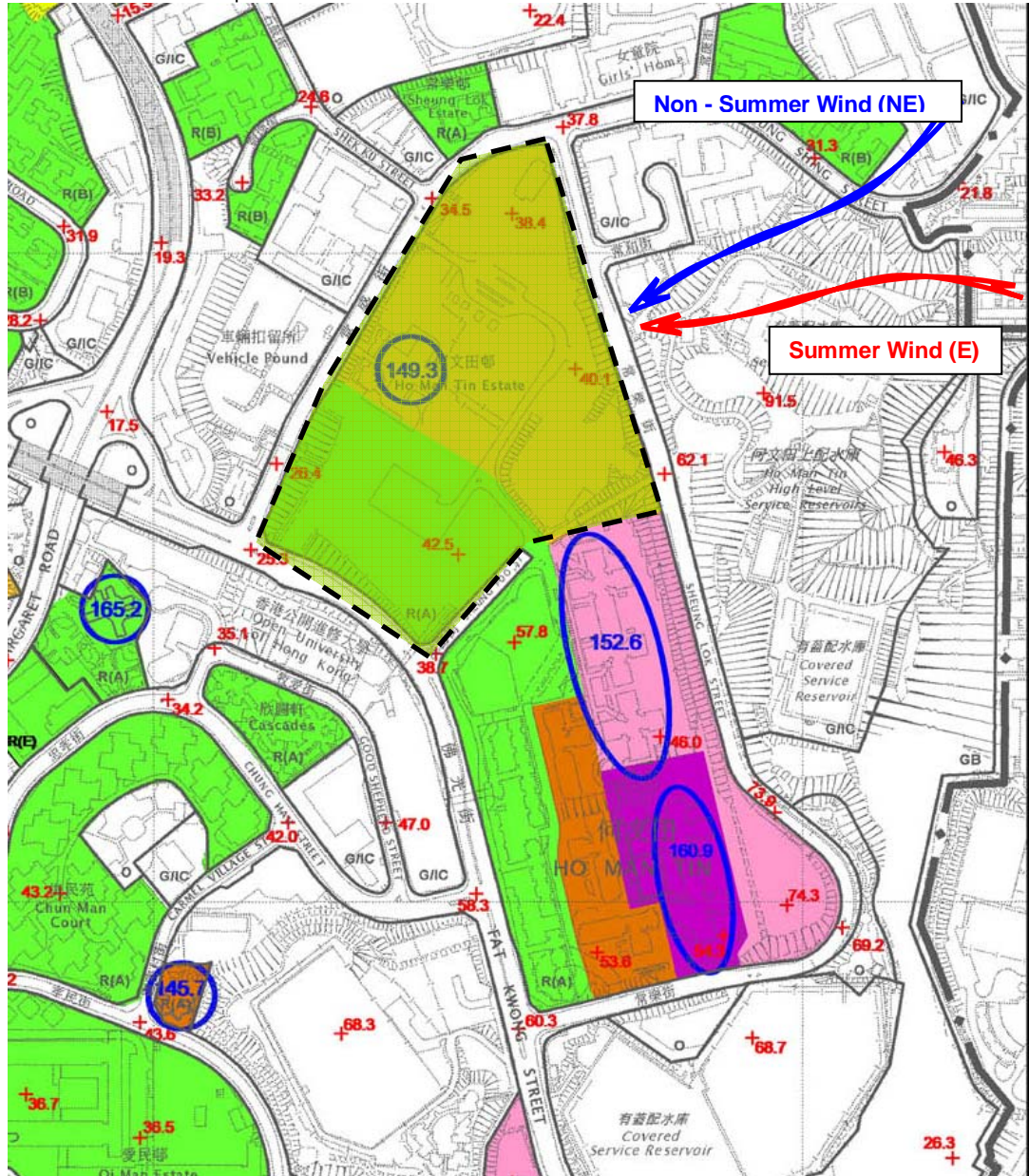


Figure 12 Northern part of Ho Man Tin Estate

Under existing condition, the area highlighted above is almost vacant. The aforementioned localized wind corridor (Marked as red line in Figure 4 and Figure 5) allows wind passing through this site to the heart of Ho Man Tin Area, then to the adjacent part of Mong Kok Area.

Under the planned scenario, a maximum building height of +130mPD is proposed. This may block wind corridor of the existing vacant area. Due to this strategically location for wind penetration, it is suggested to

- o Designate wind corridors in alignment with the prevailing wind direction (E & NE). The land use may be substantially revised to ensure a good wind penetration over the site; or

- Set the proposed maximum building height as low as possible (similar to existing condition), and
- Reduce the site coverage of the site as far as possible.

6.3.2 Sites near southern segment of Waterloo Road

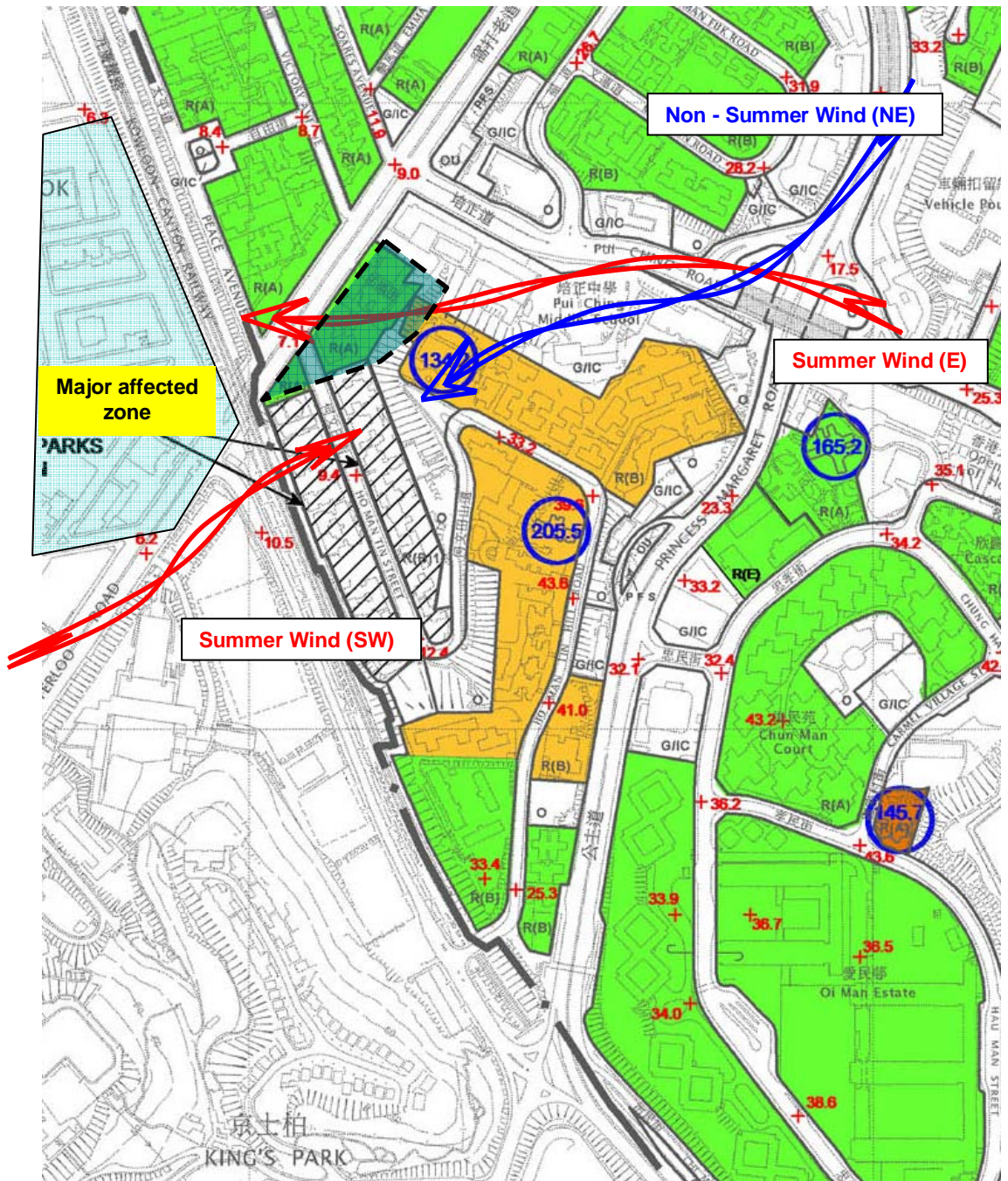


Figure 13 Sites near south segment of Waterloo Road

Even the mitigation method recommended in section 6.3.1 is adopted, the localized wind corridor is also affected by the sites marked above. This area is the main wind corridor of wind coming from South-west, East and North-East directions.

Currently, the building height for highlighted area is around +60mPD. The proposed maximum building height for these areas would increase to +100mPD. It may result in the blockage of wind entrance and affect seriously the performance of the localized wind corridor.

To moderate this, it is suggested to

- o reduce the proposed building height as low as possible (similar to existing condition), or

- increase the building porosity of these areas to create an effective wind corridor for wind penetration.

6.3.3 Site in front of Perth Street Sports Ground

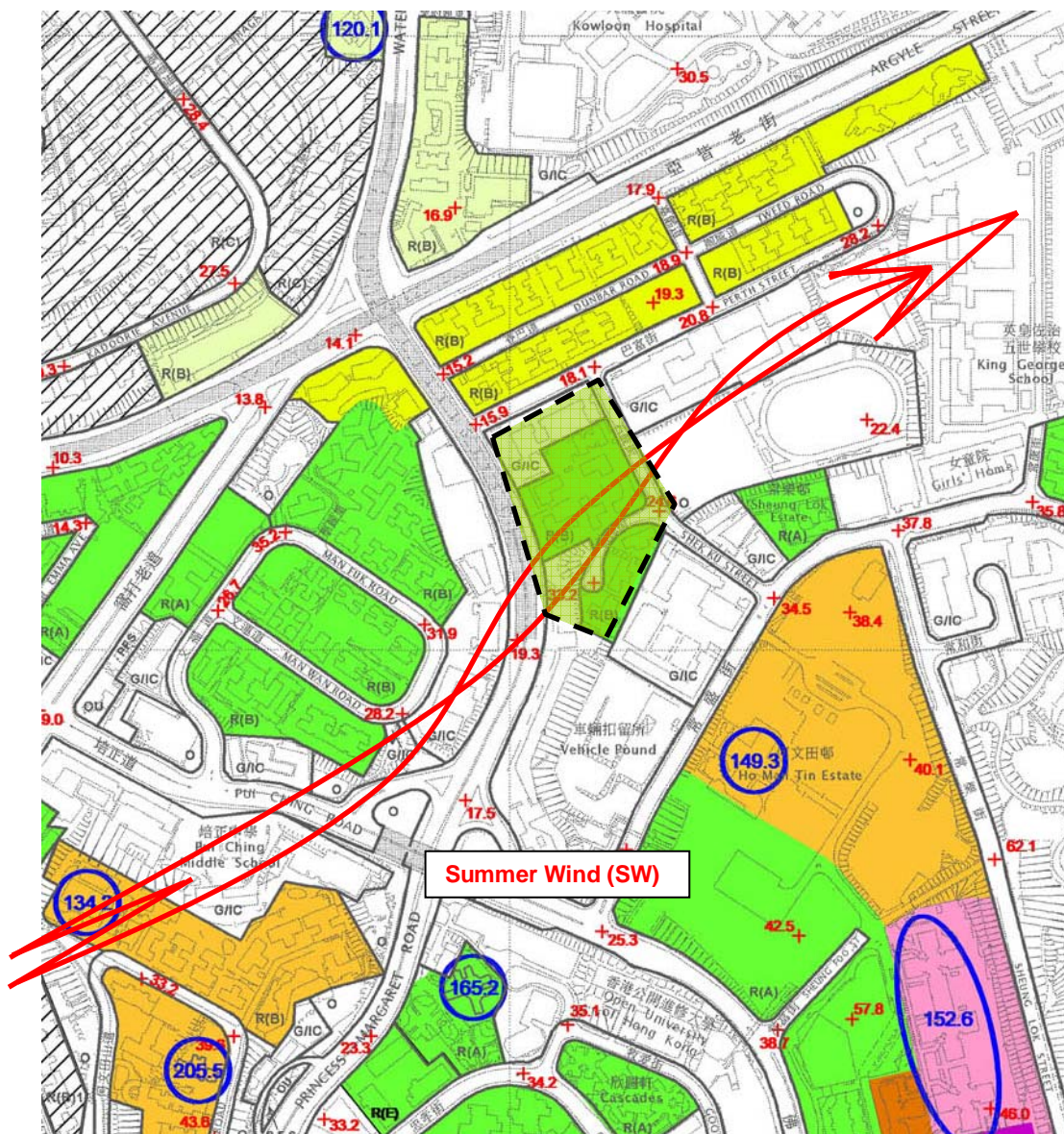


Figure 14 Site in front of Perth Street Sports Ground.

For the summer SW wind, beside the blockage area mentioned in Section 6.3.2, another area that would affect the wind corridor is also spotted: the existing building height at the highlighted site varies from +27mPD to +62mPD, while the proposed maximum building height is +100mPD. This may block the aforementioned localized wind corridor under summer SE wind condition.

It is suggested to

- Keep the proposed maximum building for this site as low as possible, or
- provide wind corridor for wind penetration, e.g. the existing Kingtak street with no building area.

so as to keep the ventilation performance similar to the existing one after development. Also it is strongly suggested to control the building coverage of the site upon its redevelopment, so as to enhance the air penetration ability of this localized wind corridor.

6.3.4 Localized wind Corridor – Connection of Ma Tau Wai and Mong Kok Area

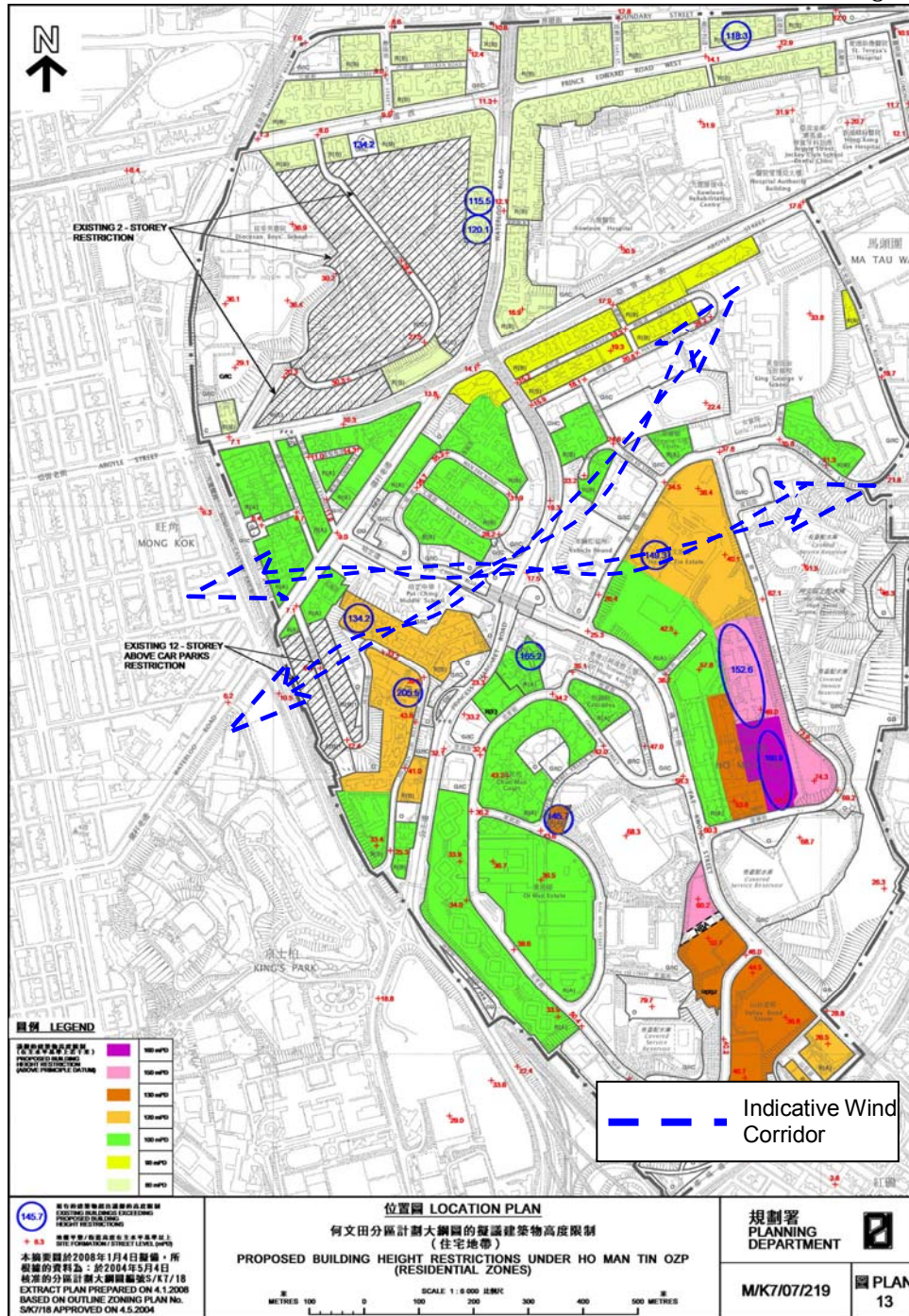


Figure 15 Localized Wind Corridor

Sections 6.3.1 to 6.3.3 have discussed that the buildings located along the localized wind corridor be kept as low as possible or widen building gaps to form effective wind corridors. To keep this localized wind corridor, all the recommended mitigation measures mentioned in sections 6.3.1 to 6.3.3 should be considered as a whole, otherwise, the localized wind corridor may still be disrupted at one of the other locations and its performance would be adversely affected.

6.3.5 Site along southern segment of Waterloo Road

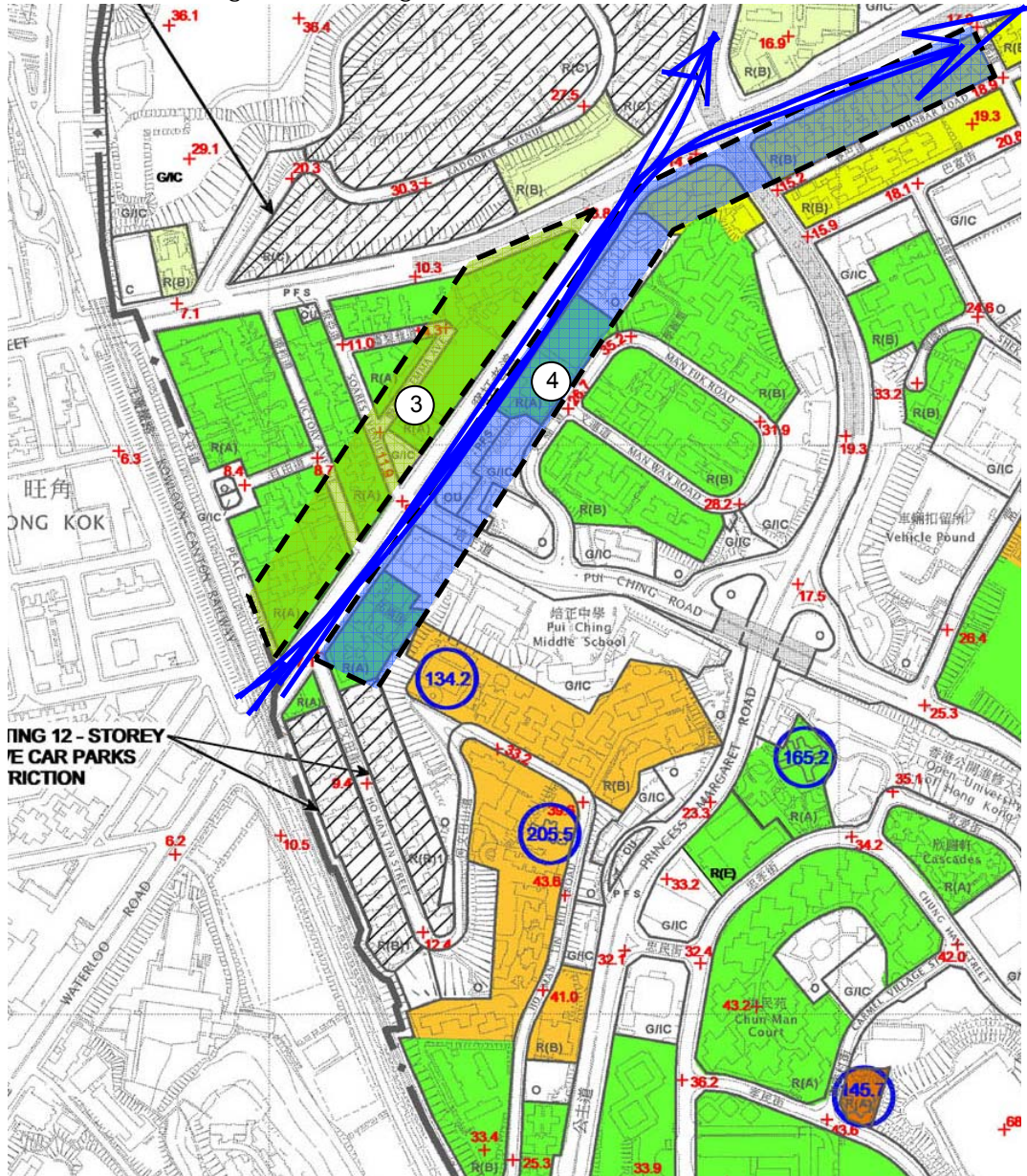
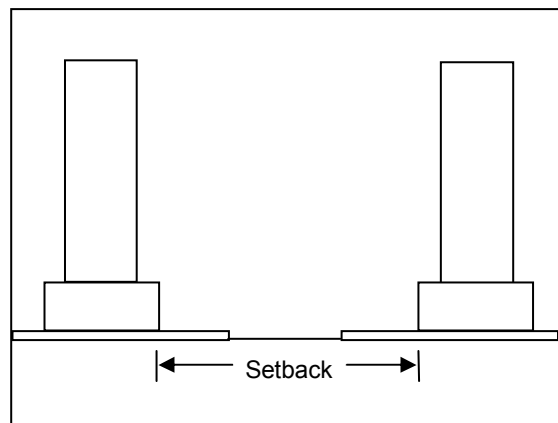


Figure 16 Site along southern segment of Waterloo Road

Under the existing condition, maximum building heights for site (3) and site (4) are +85mPD to +91mPD respectively, while the proposed maximum building height for these areas would be +120mPD. The increased building height along Waterloo Road may reduce the ventilation performance along this road.

It is suggested along to setback the buildings along Waterloo Road to increase the ventilation capability.



6.3.6 Sites at southern Ho Man Tin Area

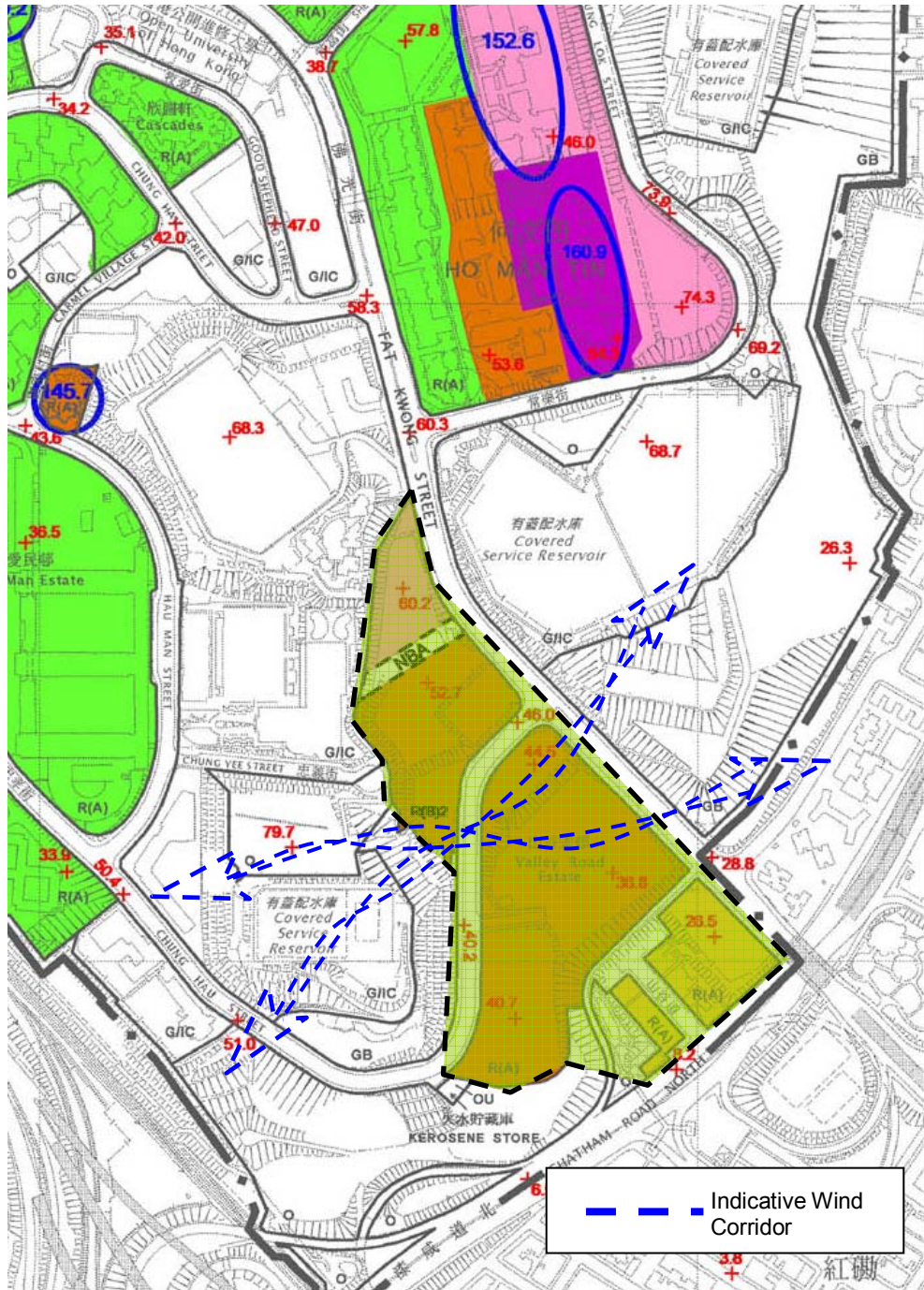


Figure 17 Sites at southern Ho Man Tin Area

The original vacant site in the southern part of Ho Man Tin Area is proposed to have a development with a maximum building height of around +120mPD to +150mPD. The proposed layout must be carefully planned to ensure E to W and NE to SW wind penetrations. Also, it is strongly suggested to increase the design porosity or decrease the site coverage to allow wind penetration through this site.

6.3.7 Site along Prince Edward Road West and northern segment of Waterloo Road

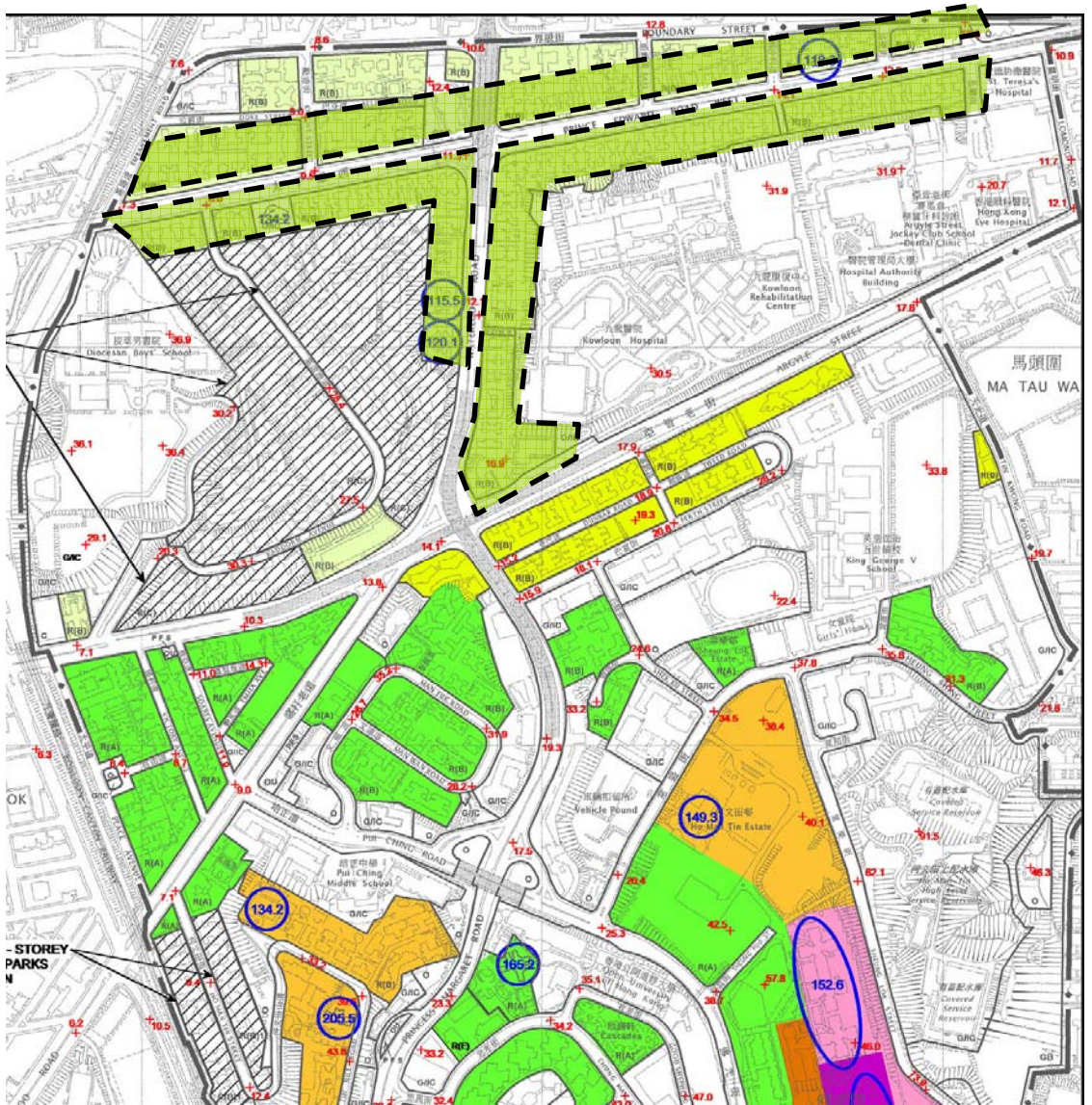


Figure 18 site along Prince Edward Road West and northern segment of Waterloo Road

Under the existing condition, the average building height for the highlighted area is about +50mPD. The proposed maximum building height would be +80mPD. The increased building height may decrease the wind delivery ability of these wind corridors. It is suggested to setback the buildings along the Waterloo Road and Prince Edward Road. This would widen the wind corridors and allow better wind penetration.

6.4 Recommendation for further study

Aforementioned, the localized wind corridor services as the main route. It delivers the wind at open area of Ho Man Tin High Level Service Reservoirs to central of Ho Man Tin area and then to southern part of Mong Kok Area. Therefore, a quantitatively AVA Initial Study on the areas that discussed in Section 6.3.1, 6.3.2 and 6.3.6, i.e. Northern part of Ho Man Tin Estate, Sites near southern segment of Waterloo Road and Valley Road Phase 1 is recommended, so as to assess the ability of wind penetration and to recommend design guidelines for future redevelopment from air ventilation perspective.

7 Conclusion

This report provides the expert evaluation on the AVA of the proposed building heights for the study area. It is a qualitative assessment of wind performance of the site under existing condition and the scenario with proposed building heights. A preliminary assessment on site characteristic and wind availability is conducted. The expert evaluation indicates that:

For existing condition,

- The Prince Edward Road West acts as the main wind corridor. It delivers wind up to the north part of Mong Kok Area.
- The Argyle Street is also regarded as another main wind corridor. It services the adjoining area alongside, such as Kowloon Hospital, Grant Villa, etc, to introduce wind from Kai Tak Area to middle part of Mong Kok Area.
- Some high-rise and high density sites are found in Ho Man Tin Area. This congested layout may affect the air circulation at low level and confine the wind passage at high level.
- A localized wind corridor is identified. It functions as a wind route connecting Ma Tau Wai Area and Mong Kok Area.
- The open areas at south-eastern part of the site (i.e. Ko Shan Road Park, Ho Man Tin East Services Reservoirs Playground and King's Park Services Reservoirs and those vacant sites) are important for air circulation for Ho Man Tin area.

For the planned scenario OZP,

- The effectiveness of Prince Edward Road West and Argyle Street as wind corridor may be weakened due to increased building heights along the streets.
- The route for the localized wind corridor may be blocked by proposed new developments, Ho Man Tin Estate and at the area near Mong Kok.
- The macroscopic air-circulation between Ho Man Tin/ Mong Kok may be affected if the localized wind corridor is blocked.
- The proposed building at the southern part of the site may reduce the air circulation while comparing to the existing condition.

Some mitigation measures are recommended to enhance the ventilation performance of possible problem areas. However, the air ventilation performance at the pedestrian level is not merely determined by the building height. It is the combination effect of site characteristics and different design features, including the site location, building disposition and building height, surrounding building layout and building height, podium design, sky garden and podium garden design, site wind availability etc. Despite that the study area has been built up, opportunity should be explored in long term to enhance the wind performance through the following measures:

- Preserve the localized wind corridor in the central part by reducing the maximum building height of that area as low as possible or revising the building layout plan to provide the wind corridor in alignment with the prevailing wind directions.
- Reduce the proposed building height at the area in front of Perth Street Sports Ground as low as possible; or provide wind corridor at that area for summer SW wind penetration, while limiting the site coverage.
- Reduce the proposed building height near south segment of Waterloo Road as far as possible or increase the building porosity of these areas to allow clear wind corridor.

- Design carefully the future building layout for the site at Valley Road Estate to designate wind corridor for E to W and NE to SW wind penetration and to increase site permeability.
- Set back the buildings along the Prince Edward Road West and the Waterloo Road, and hence widen wind corridor along these streets

Because of the importance of the air circulation along the localized wind corridor, a quantitative AVA Study, on the area of Northern part of Ho Man Tin Estate, sites near southern segment of Waterloo Road and the former Valley Road Estate phase 1 is recommended.