Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009
Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment
For an Instructed Project for Yau Ma Tei Area

Prepared for:

Planning Department

Prepared by:
ENVIRON Hong Kong Limited

Date:
Oct 2010

Project Number:
PLNMKYMTAI00

Reference:
R1495_V1.3a

Prepared by:

Calvin Chiu
Manager

Approved by:

David Yeung
Managing Principal

ENVIRON Hong Kong Limited
Room 2310, China Resources Building
26 Harbour Road, Wan Chai, Hong Kong
(852) 3743 0788

Q:\Projects\PLDMKYMTAI00\Report\YMT\R1495_V1.3a.doc

Contents

Page

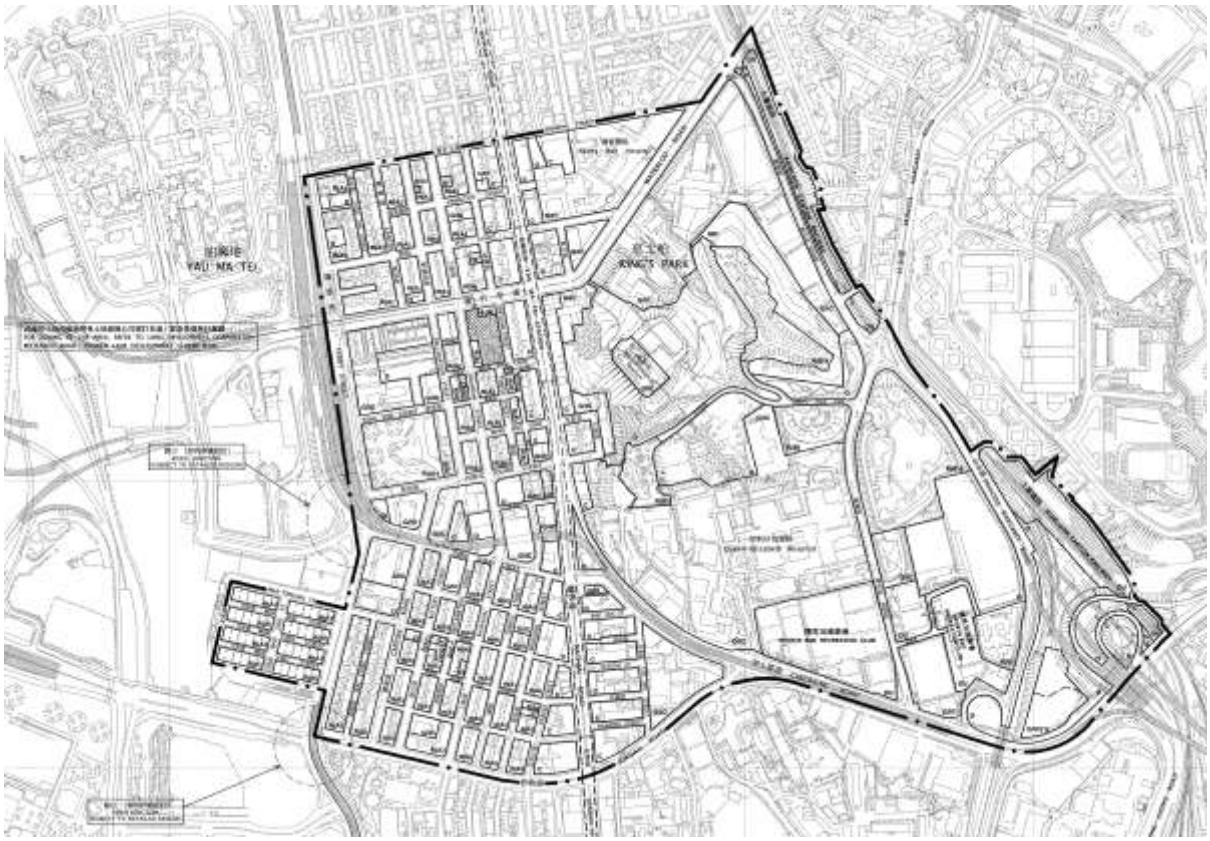
List of Figures

List of Appendices

Executive Summary

Study Area

The study area is the area covered by Yau Ma Tei OZP in Kowloon Peninsula.



Study Area – Yau Ma Tei OZP

Wind Availability

Northeasterly, easterly and westerly wind is prevailing annually whereas southwesterly and southeasterly wind is dominant in summer.

Existing Scenario

The study area has a lot of open space among the eastern side and allows wind penetration disregard that there exists some scattered high-rise residential and community college development around. Considering that easterly wind is already blocked by building blocks (Oi Man Estate) on the eastern side of Princess Margaret Road in Ho Man Tin, these high-rise developments within the study area do not impose significant "additional" impact.

The western part of the study area is low-lying and relies more on the building landscape to provide necessary air paths for wind penetration. Building clusters within the area are generally rectangular in shape and with longer aspect perpendicular to east-west axis. There are through road carriageways running principally along north-south and east-west axis.

Open space near the southeast side and along the existing railway alignment forms breezeway and major air path and can help wind distribution. Other O and G/IC sites are important in welcoming westerly wind entry.

Major carriageways such as Nathan Road, Ferry Street, Waterloo Road, Jordan Road are important air paths. Other narrower roads such as Pitt Street, Kansu Street and Public Square Street also allow westerly wind penetration to inner area. Kansu Street (generally 19m wide), in particular, has bottleneck problem (around 13m wide between 2 commercial building lots along Nathan Road) and is the subject for improvement.

The longer aspect of a number of building clusters (to the west of Hamilton Road, Wing Sing Lane, Ning Po Street, Nanking Street) of about 200m is perpendicular to the east-west axis and is not beneficial to important easterly and westerly wind flow. These building clusters also block local carriageways on its east and/or west sides.

Another long and continuous building cluster of commercial development (about 180m long) along Nathan Road near Waterloo Road and Wing Sing Lane makes it difficult for easterly wind to reach pedestrian level of Nathan Road.

The existing Kwong Wah Hospital would block existing carriageways to the north (Fa Yuen Street and Tung Choi Street. Noteworthy is that QEH is situated at a location between the air path of east/west wind flow; thus its building height should be carefully controlled. The central parcel of QEH has higher building height and imposes some blockage against east/west wind flow.

There is plenty of open space to the south of QEH serving as breezeway connecting to Ho Man Tin area to the east.

The committed Phase 8 development of HKPU is located at one of the existing breezeways and would impact easterly/westerly wind flow. It is noted that a portion of the development has been designated as public open space to minimise the impact.

Initial Planned Scenario

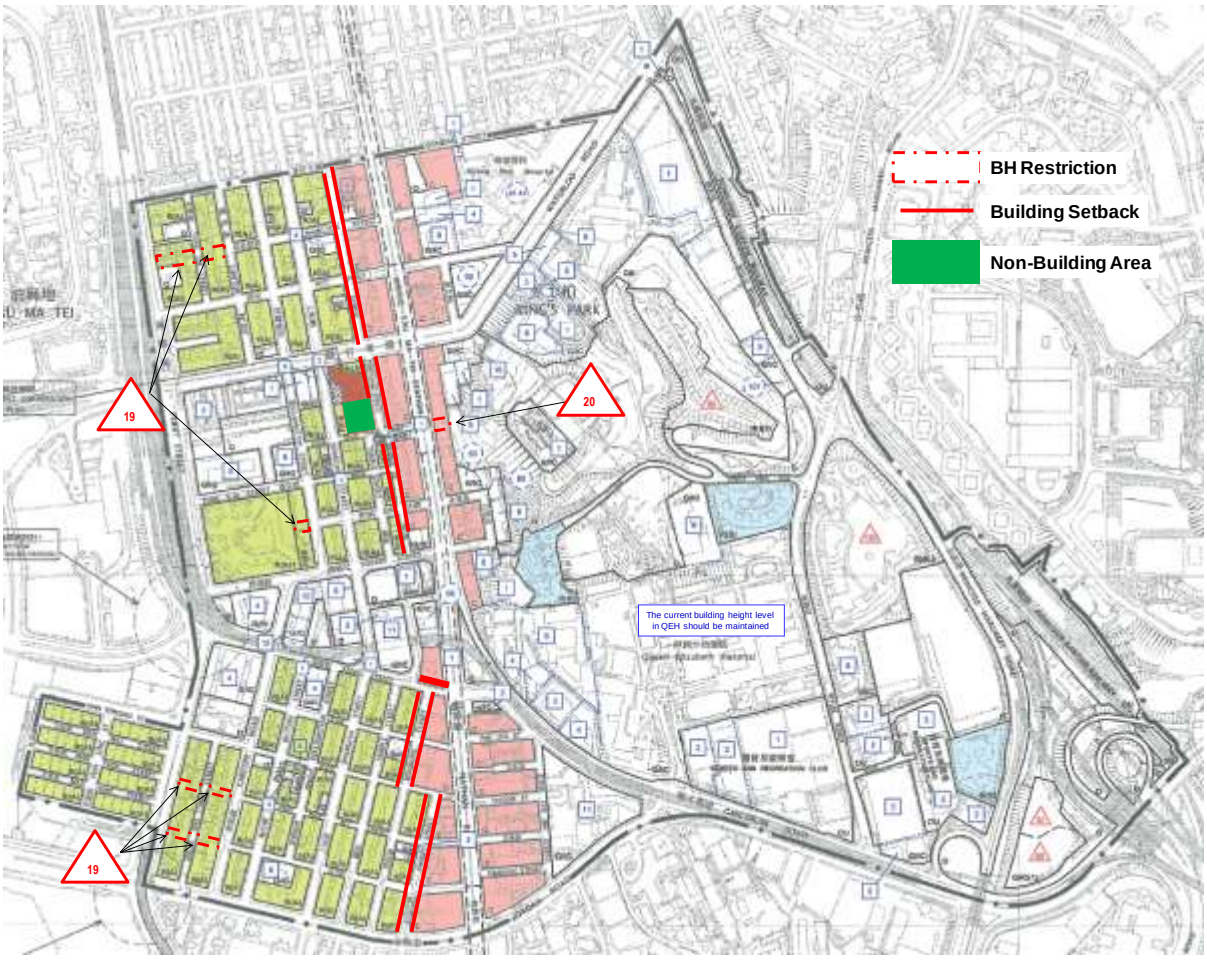
Initial Planned Scenario

Under the initial planned scenario, BH limit is set at 80 or 100mPD. There is no alteration to the existing street pattern. No extra open space is designated. For OU, O and G/IC zoned areas, the BH limit also tallies with the existing situation mostly except for Kwong Wah Hospital which is under planning for possible future expansion.

With the building heights increased upon redevelopment, negative air ventilation impact due to urban canyon effect is expected as H/W ratio is getting higher. Problem of existing situation such as blockage of carriageway has not been addressed as well.

Recommendations

Based on the Initial Planned Scenario, recommendations have been given including BH restriction and building setback, designation of non-building area to preserve good characteristics as well as revised BH limit for Queen Elizabeth Hospital. The BH restrictions recommended at 8 building clusters aim to re-create air paths to address street blockage issue. Building setback aims to address bottleneck problem along Kansu Street and carriageways (Portland Street, Woosung Street, Parkes Street, Arthur Street) with high H/W ratio problem. For QEH, the area should maintain the current building height level so as to preserve the existing air path for east/west wind flow.



Recommendations

Further Study

For future development of larger scale (e.g. redevelopment of Kwong Wah Hospital and expansion/redevelopment of Queen Elizabeth Hospital), there is more room to finetune the design for the benefit of air ventilation such as to open up area aligned with existing air path and/or to improve the existing air path. Air ventilation assessment (quantitative) is therefore recommended to be conducted for development of larger scale.

1.0 Introduction

1.1 Assignment

1.1.1 This expert evaluation report for Yau Ma Tei Area was prepared based on materials provided by Planning Department on 9 July 2010. Materials for Yau Ma Tei Area provided to the Consultant include but not limited to the followings:

- Wind Data
- Aerial Photo
- Survey Sheets (1:1000)
- Existing/Committed Building Height Profile (Number of Storeys/mPD)
- Existing Spot Height
- Committed Development Sites (Podium & Building Footprint)
- Existing Building Height Restrictions under the Yau Ma Tei OZP
- Proposed Building Height Restrictions under the Yau Ma Tei OZP
- Potential Redevelopment Sites in Yau Ma Tei

1.2 Scope of Work

1.2.1 In this study, the Consultant is required to conduct a baseline analysis of the study area in Yau Ma Tei and followed by an expert evaluation of the Initial Planned Scenario and Revised Scenario, if any.

2.0 Wind Availability

2.1.1 The study area is the area covered by Yau Ma Tei Outline Zoning Plan (OZP) in Kowloon Peninsula. **Figure 1** shows the study area.

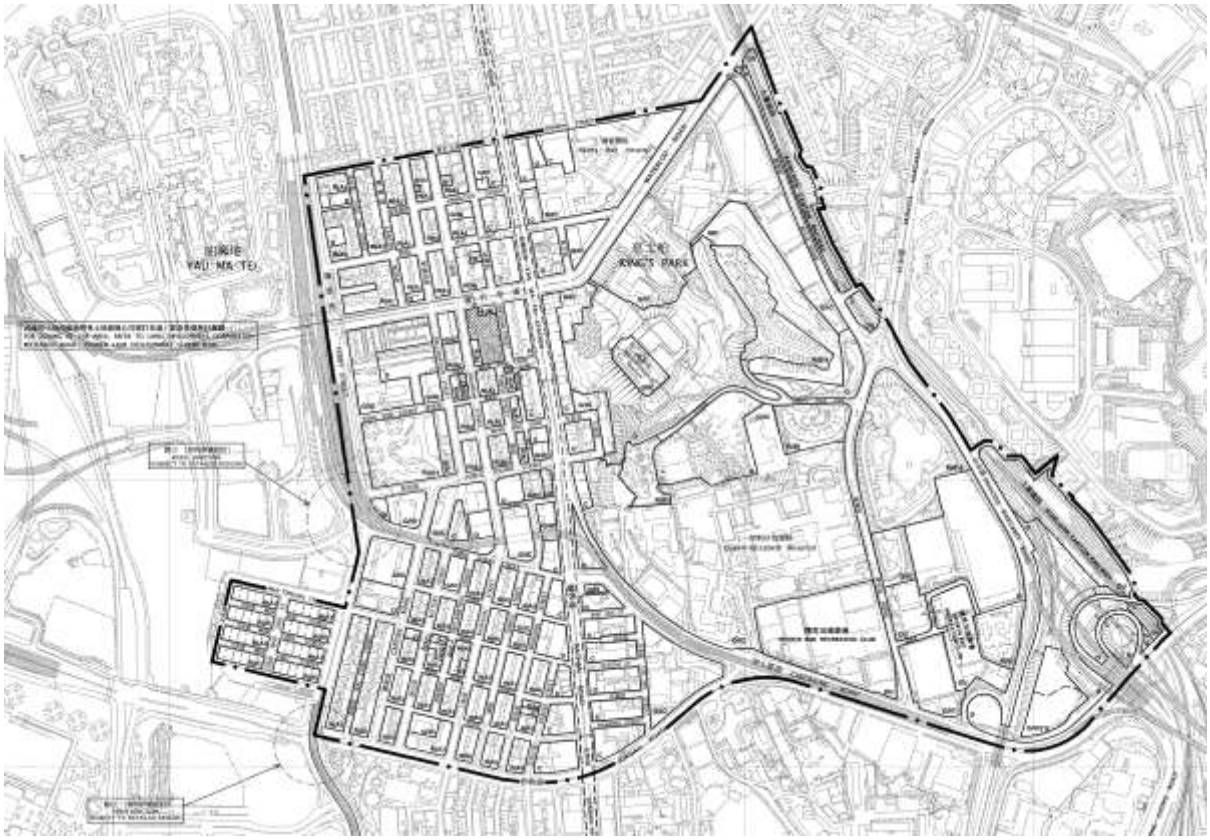


Figure 1 Study Area – Yau Ma Tei OZP

2.1.2 The wind availability analysis is based on both long term measurement data prepared by Hong Kong Observatory (HKO) and simulated wind availability data by Hong Kong University of Science and Technology (HKUST) which are the best available and relevant information.

2.2 Measurement Data at Weather Station

2.2.1 HKO weather monitoring stations scattered in Hong Kong provide reliable data of wind environment. **Figure 2** shows the location of weather station in Hong Kong. The station at King's Park with ground elevated at 65mPD is within the study area and is considered most representative of the site wind availability.

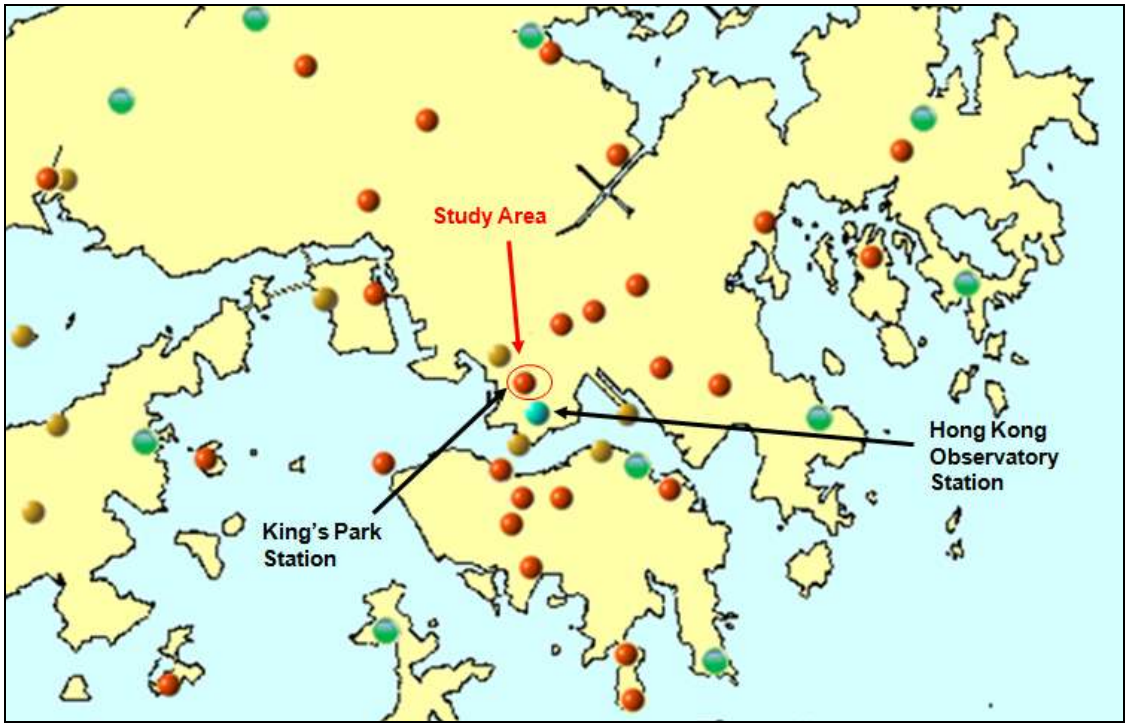


Figure 2 **Location of HKO Weather Station and the Study Area**

2.2.2 Summer and Annual Wind Rose result at King's Park are presented in **Figure 3** and **Figure 4** for reference. Wind Rose has been prepared based on long term monitoring data (at least 17-year long).

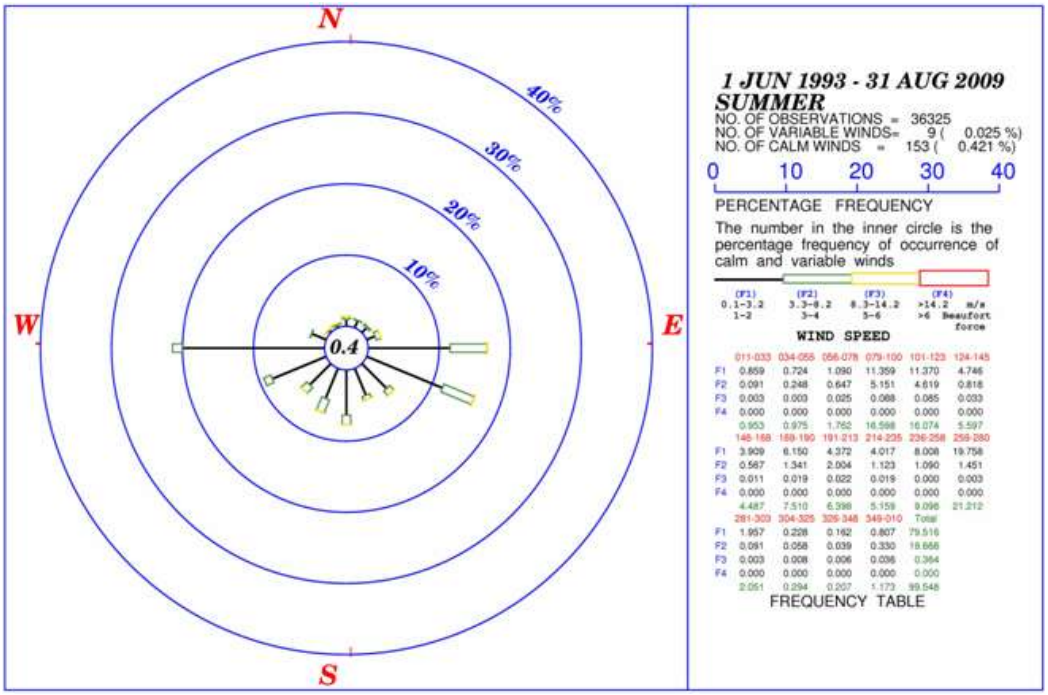


Figure 3 **Summer Wind Rose Result at King's Park Weather Station**

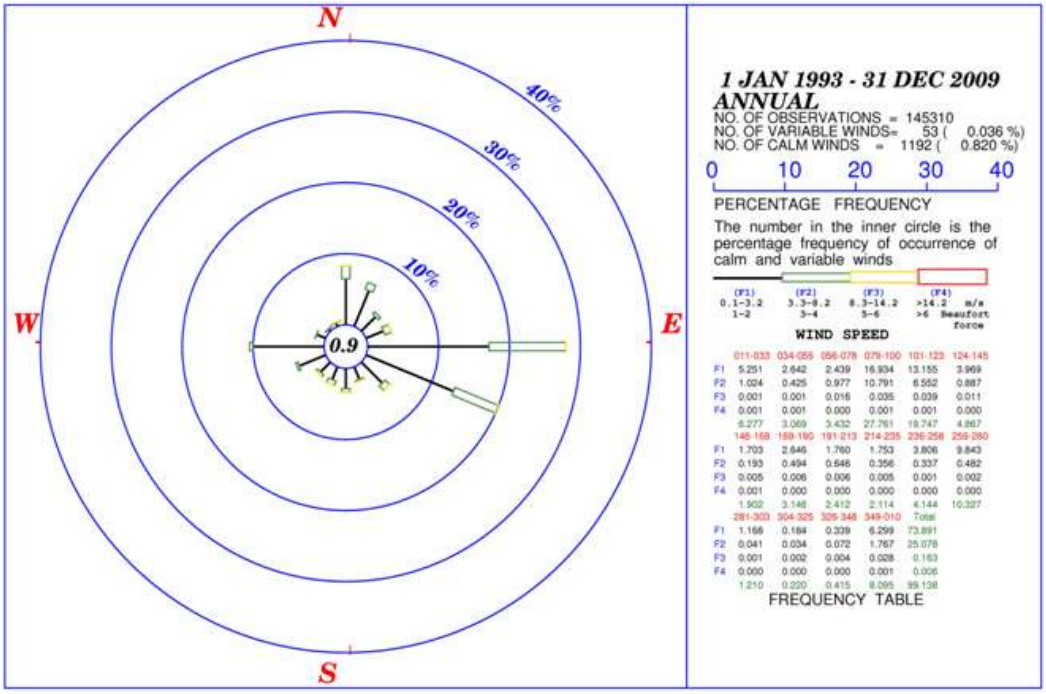


Figure 4 Annual Wind Rose Result at King's Park Weather Station

2.2.3 According to Wind Rose result at King's Park station, westerly, easterly (including ESE wind) and southerly wind is found prevailing in summer (Jun to Aug). Easterly wind, west wind and northerly wind is prevailing annually.

2.2.4 The measurement data is affected by both topography and building landscape. King's Park station is elevated underneath building canopy and also lower than the higher ground elevation of Ho Man Tin district (up to around 100mPD) to the east.

2.2.5 It is observed that westerly wind is prevailing in summer. It may be explained by reduced importance of easterly wind due to blockage by higher ground on windward side.

2.3 Simulated Wind Availability Data

2.3.1 Data from HKUST has been prepared based on MM5 simulation. The simulation period is whole year of 2004. The simulated data allows to project to different elevations. The simulated data at 450m is representative of wind data above urban canopy and generally least affected by topography and building morphology.

2.3.2 **Figure 3** shows the MM5 Wind Rose result at 120m (approximate urban canopy layer height) and 450m (approximate wind boundary layer height) which are representative of the wind availability of Yau Ma Tei OZP area.

Height: 120m Height: 450m

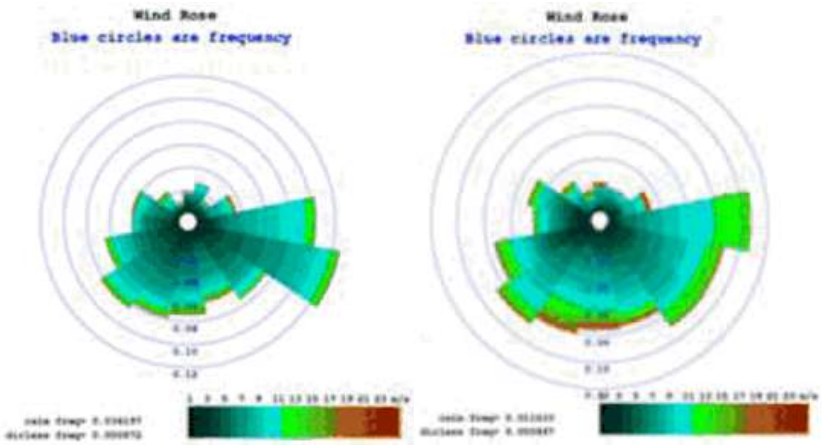


Figure 5 Summer Wind Rose Result for the Study Area based on MM5 Simulation

2.3.3 The Wind Rose result at 450m indicates that southeasterly and southwesterly wind is prevailing in summer. At 120m, the importance of southerly to southeasterly wind decreases when building landscape is accounted. At all elevations, southeasterly and southwesterly wind is still prevailing.

Height: 120m Height: 450m

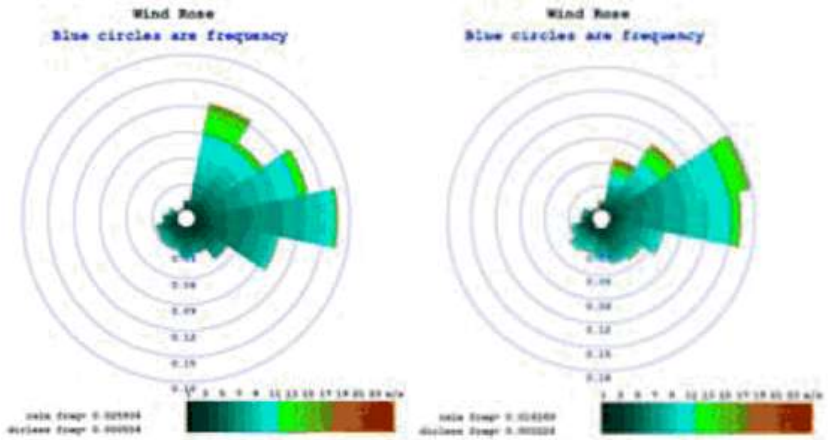


Figure 6 Annual Wind Rose Result for the Study Area based on MM5 Simulation

2.3.4 The Wind Rose result at 450m shows that easterly wind and northeasterly wind is dominant annually. At 120m, the importance of easterly wind is relatively reduced. Northeasterly and easterly wind prevails at all elevations.

2.4 Topography and Building Morphology of the Surroundings

2.4.1 **Figure 7** shows the aerial photo of the study area and the surroundings. The surrounding area covers Mong Kok to the north, Ho Man Tin to the east, Tsim Sha Tsui to the south and South West Kowloon to the west.

Figure 7 Aerial Photo for the Study Area and Surroundings (Source: Google Map)

2.4.2 The area to the north of Kowloon Peninsula is generally hilly. Hilly areas such as Beacon Hill and Eagle's Nest are located over 3km to the north of the study area.

2.4.3 The area of Mong Kok OZP is generally flat with elevation ranging from 3.1 to 9.1mPD. Mong Kok district is generally covered with ageing tenement buildings and with scattered higher buildings as well. Northerly wind may rely more on the existing air path along Nathan Road and Ferry Street, for example, to reach the study area. The carriageways along Mong Kok district and the study area are through roads and capable as air path for wind penetration along north/south directions.

2.4.4 Northeasterly and easterly wind needs to pass Ho Man Tin district before reaching the study area. The ground elevation of the area of Ho Man Tin OZP varies. A section of Waterloo Road is along northeast-southwest axis. Wind penetration along Waterloo Road is anticipated. The elevation of Ho Man Tin district is generally higher than the study area and with the highest elevation reaching over 100mPD (at Ho Man Tin High Level Service Reservoir Playground). Moreover, there are existing buildings (e.g. Oi Man Estate) erected along the eastern boundary of the study area. These buildings are erected at higher ground so that the elevation is as high as 80 to 100mPD. The combination of topography and buildings within this district forms a relatively impermeable area. Therefore, it is likely that some northeasterly wind will be diverted to flow along northerly direction respectively (say, along Princess Margaret Road) to near the pedestrian level of the study area. Similarly, easterly wind will be diverted to flow around the relative impermeable area of Ho Man Tin district from southeasterly direction (say, along East Rail alignment).

2.4.5 Within the area of Tsim Sha Tsui OZP to the south of the study area, the ground elevation is low for the western portion while the eastern portion is up to around

60mPD and is comparable to the study area. Taller buildings can be found near central and southern portion of Tsim Sha Tsui area while the buildings nearby the study area (e.g. along Jordan Road) are lower. Princess Margaret Road and Hong Chong Road are to the southeast of the study area and form an air path for southeasterly wind penetration. The area near to the southeast side of the study area (i.e. area bounded by Gascoigne Road, Cox's Road, Austin Road and Chatham Road South) is generally open ground and allow southeast wind passing over building to reach lower level. South wind needs to pass through the entire Tsim Sha Tsui district before reaching the study area whereas southeast and southwest wind can reach the study area easier. The south wind availability will be relatively lower.

2.4.6 The area of South West Kowloon OZP to the west of the study area is generally flat. Newly constructed developments can be found in this area. In particular, the MTR Kowloon Station comprehensive development consists of high-rise buildings including Sorrento, The Waterfront, The Arch, The Harbour Side, The Cullinan & International Commerce Centre (ICC) sited over the podium of MTR Kowloon Station. In addition, the planned XRL West Kowloon Terminus, WKCD, Site C & D at Austin Station would impose wind blockage problem against the study area. The shortest distance of the existing development from the study area is about 200m so that there is opportunity for wind to flow around the comprehensive development before reaching the study area. The planned development is more close to the study area so that the potential wind blockage (especially southwest wind) impact is more significant. Southwest wind may be diverted to flow along southerly or westerly direction. Charming Garden is near to the northwest corner of the study area and is up to around 70mPD. The wind obstruction effect is localized. Other than these two developments, the western side is generally open and can receive westerly wind breeze without much difficulty. Wind at lower level may channel through Waterloo Road, Kansu Street and Jordan Road to inner region of the study area.

2.5 Summary of Wind Availability Data

Summer Wind Availability

2.5.1 The measurement data at King's Park Weather Station indicates that W, E, ESE & WSW wind directions are dominant. On the other hand, the simulated wind availability data of Yau Ma Tei area shows that E to WSW wind is prevailing.

2.5.2 All sources of wind availability data agree to the fact that wind from southeasterly and southwesterly direction is dominant. There also exists breezeway, air path and open space on these directions so that summer wind would not be significantly obstructed and altered.

Annual Wind Availability

2.5.3 The measurement data at King's Park Weather Station indicates that northerly, easterly and W wind is dominant. On the other hand, the simulated wind availability data of Yau Ma Tei area shows that northeasterly and easterly wind is dominant.

2.5.4 All sources of wind availability data agree that E wind is prevailing and annual wind of the study area is mainly from the northeast quadrant. On the other hand, W wind should be regarded as important as well as reflected in measurement data and likely due to the unobstructed topography on the western side. While easterly wind will be reduced due to topography, it still bears significance in terms of annual wind availability.

2.5.5 **Figure 8** summarises important wind directions for the study area. Taking into account the topography, building landscape and existence of breezeway linking in the surrounding area, the wind availability is depicted. E and N wind importance is considered increased. Westerly wind is important for absence of blockage on the western waterfront. The figure indicates likely scenario of how important wind direction approaches the study area. The solid arrow represents air flow in lower elevation passing over open area, along breezeway (defined in this context as wide (usually of not less than 100m wide) and long unobstructed area which allows wind to flow along and act as major air path for wind penetration where air path is considered of smaller scale) and important air paths. The sub-figure on the bottom left corner indicates the importance of wind direction annually and in summer.

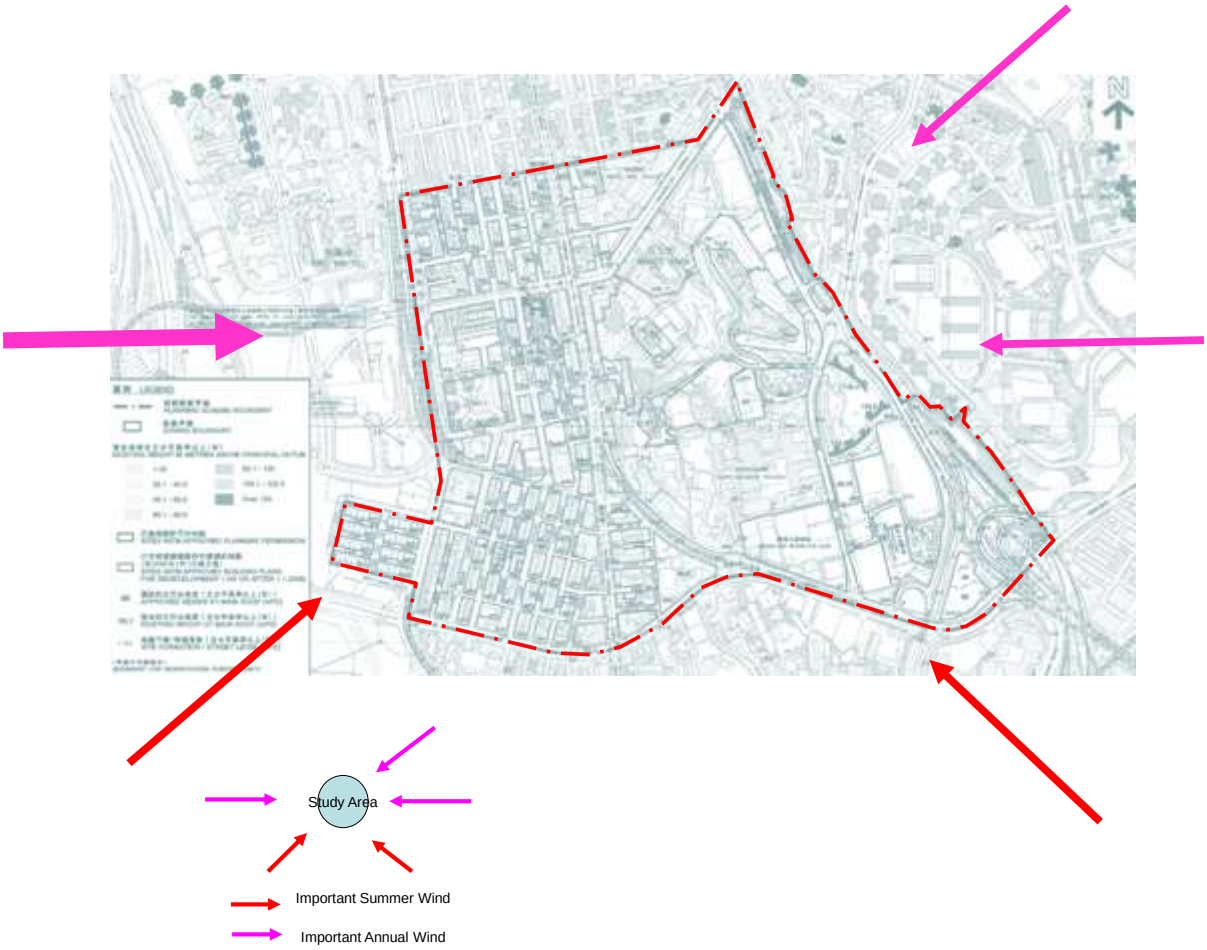


Figure 8 **Summary of Important Wind Directions for the Study Area**

3.0 Existing Condition of the Study Area

3.1 Location

3.1.1 The study area is within the urbanized area in Kowloon Peninsula. It is immediate to Mong Kok OZP to the north, South West Kowloon OZP to the southwest and west, Tsim Sha Tsui OZP to the south and Ho Man Tin OZP to the east. The nearest seashore is at about 550m to the west along New Yau Ma Tei Typhoon Shelter.

3.1.2 It is bounded by Dundas Street to the north, Ferry Street and Man Cheong Street to the west, Jordan Road and Gascoigne Road to the south, the alignment of East Rail and Princess Margaret Road to the east. The total area exceeds 120ha.

3.2 Topography

3.2.1 The topography of the study area is generally flat on the western side with elevation ranging from 3.4 to 8.1mPD. The higher ground elevation on the eastern side is up to 66.7mPD at King's Park meteorological station.

3.2.2 The higher ground within the study area includes King's Park, Queen Elizabeth Hospital, open recreational area and scatter residential development. It is composed of scattered R(B) areas (e.g. King's Park Hill, King's Park Villa, Parc Palais, Wylie Court), G/IC, OU sites and open space bounded by Waterloo Road, Nathan Road and Gascoigne Road.

3.3 Building Morphology

3.3.1 As mentioned above, the area on the western side is flat. largely covered with buildings. Most ageing tenement buildings within the western part of the study area are of not more than 40mPD. Some other ageing buildings such as buildings bounded by Man Cheong Street and Ferry Street are around 60mPD. Buildings along Nathan Road are generally higher and usually range from 40 to 80mPD.

3.3.2 Development lots within this area is mainly zoned as R(A), C, O and G/IC.

3.3.3 Building clusters within the low-lying area are generally rectangular in shape and with longer aspect perpendicular to east-west axis. There are through road carriageways running principally along north-south and east-west axis. The building clusters with longest aspect (about 200m long) are two "R(A)" sites bounded by Jordan Road, Canton Road, Ferry Street and Saigon Street (see photos for location nos. 29 & 30 in **Appendix A**). Another building cluster with long aspect (about 180m long) is the "C" site to the east of Nathan Road which is between Waterloo Road and Wing Sang Lane (see photos for location no. 11).

3.3.4 The building clusters on northern and southern sides of Kansu Street make an angle of about 20 degree. There is no significant impact due to slightly different orientation (According to the experience of the consultant from Wind Tunnelling Study, wind pass along streets with up to 30 degree turning would not be significantly reduced. Moreover, urban design guidelines of HKPSG also suggests that to allow individual building blocks to capture more wind for better indoor natural ventilation, the angle between the axis of the building blocks and the prevailing wind direction should be within 30 degrees.).

3.3.5 While there are quite a number of through roads along east-west axis leading sea breeze to inner area, these roads are generally narrow and of less than or about 10m wide only and is currently not an important air path[1]. There is local air ventilation problem due to blockage.

3.3.6 Wider carriageways include Princess Margaret Road, Gascoigne Road, Jordan Road, Waterloo Road, Ferry Street and Nathan Road (see photos for location nos. 1, 3, 6, 15, 17, 25, 31 & 34). Nathan Road and Ferry Street are aligned along the north-south axis and of at least 30m wide (see photos for location nos. 3, 15, 17 & 31). A section of Ferry Street together with the open space along Charming Garden is wider than 100m and is a potential breezeway as well (see photos for location nos. 15 & 17).

3.3.7 Chatham Road North is in connection with Gascoigne Road and Jordan Road both about 30m wide and allows easterly and westerly wind flow. A section of Princess Margaret Road in Ho Man Tin district is connecting with Wylie Road to allow northeasterly wind penetration. Another section of Princess Margaret Road in connection with Hong Chong Road and East Rail alignment forms a major air path of up to around 80m wide to welcome southeasterly wind flow. Waterloo road (nearly 30m wide) is not a straight road and would make an angle of 45° near Nathan Road so that air flow will be hindered. Nevertheless, the alignment can welcome important westerly and northeasterly wind. Other carriageways including Public Square Street (18m wide) and Kansu Street (13m wide) is aligned along east-west axis and can welcome westerly wind.

3.3.8 The higher ground consists of park/garden, playground, institutions, hospitals, other government buildings and scattered high-rise developments which are up to 130mPD (at Parc Palais) (see photos for location no. 39). These developments are constructed according to the topography and do not form any regular pattern. There are at least 50m separations between nearest developments. Moreover, most of the areas of the higher ground is open space or covered by low-rise building only.

3.3.9 Urban area usually relies on open roads, open space and low-rise building areas as breezeway and air paths. The eastern portion of the study area is occupied by open

[1] An air path normally refers to pathway of around or more than 20m wide

space mainly, thus would not heavily rely on open roads for ventilation. This area is in connection with the major air path along East Rail alignment and Waterloo Road leading northeast wind to the study area. The western portion of the study area would more rely on wide carriageway for wind penetration.

3.3.10 The carriageways are around 12m wide. 4 pieces of G/IC sites with committed developments up to 67mPD high. They are Proposed Redevelopment of Diocesan Girls' School and Junior School located at the junction of Jordan Road and Gascoigne Road (see photos for location no. 32), Proposed Phase 8 Development of Hong Kong Polytechnic University (HKPU) at the junction of Princess Margaret Road and Chatham Road North (see photos for location no. 37), Proposed Extension of Hong Kong Red Cross Blood Transfusion Service to the immediate west of King's Park Villa (see photos for location no. 40), and proposed new premises for Methodist School to the immediate west of King's Park Sports Ground (see photos for location no. 38). The developments are up to 15 storeys and 67mPD.

Figure 9 Identified Breezeway and Air Path

3.3.11 **Figure 9** shows the identified existing breezeway and air path within the study area.

3.4 Existing Site Wind Condition

3.4.1 For the purpose of discussion, the study area is divided into a number of sub-areas. The division of sub-areas is based on different orientation of the roads and building clusters among the study area.

3.4.2 According to the clustering of buildings, the study area can be divided into 3 sub-areas for the purpose of analysis. **Figure 10** shows the division of sub-areas.

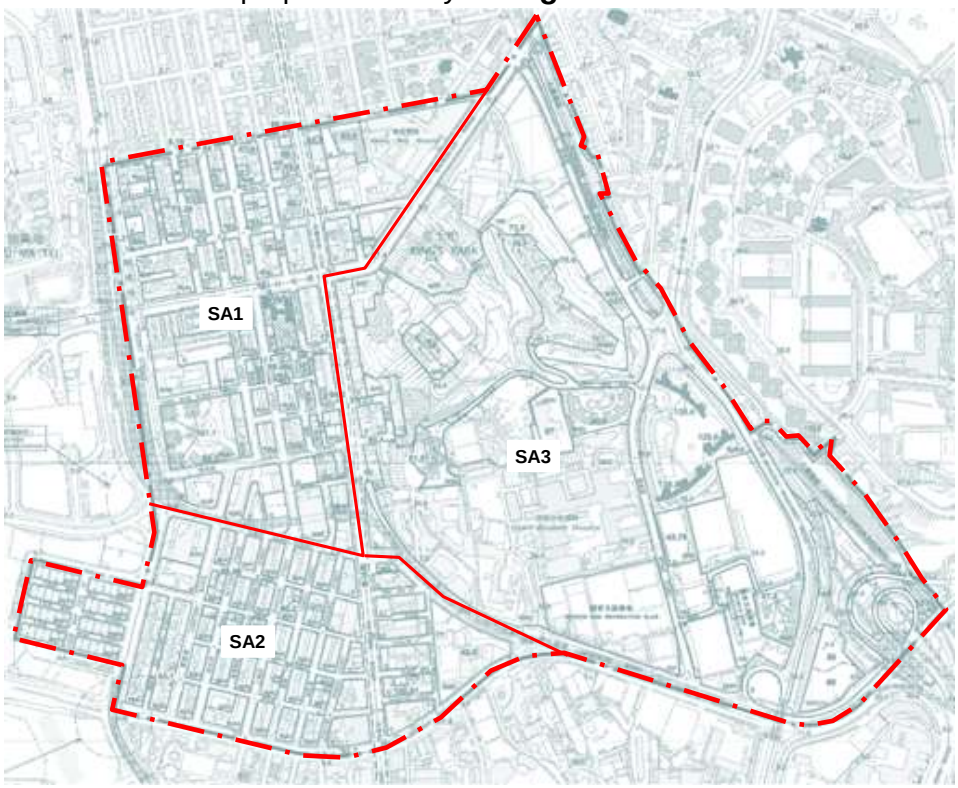


Figure 10 Division of Sub-Areas within the Study Area

SA1:

3.4.3 This sub-area has building clusters aligned along the same axis as Nathan Road.

3.4.4 Development lots are mainly zoned as R(A), C, G/IC and O uses. Commercial zoned areas are mainly on two sides of Nathan Road (see photos for location nos. 3 & 31). Kwong Wah Hospital is situated along Waterloo Road and with the buildings (up to about 49mPD) mainly aligned along the same carriageway. The buildings are interlinked and obstruct existing carriageways including Tung Choi Street and Fa Yuen Street to the north.

3.4.5 Major carriageways include Ferry Street, Nathan Road and Waterloo Road are at least 30m wide (see photos for location nos. 1, 3, 6, 15, 17 & 31).

3.4.6 There are two groups of O and G/IC sites found (see **Figure 11**). The first group of such sites is along Waterloo Road and is currently occupied by a wholesale fruit market and 3 school developments and up to about 30mPD. Another group is bounded by Public Square Street and Kansu Street comprising rest gardens, ball courts, playground, clinic, police station, government offices, carpark building and community uses, and up to about 68mPD (the northern portion of this area group does not exceed 37mPD).

3.4.7 The highest development is 8 Waterloo Road comprising 2 towers with building height up to 132.1mPD (see photos for location no. 8). Two towers are interlinked to form a massive structure. Temple Street to the south stops at this development. However, as there exists an open area to the south of the towers which connect Temple Street and Portland Street, southerly wind along Temple Street is expected to flow along Portland Street to further downwind area then.

3.4.8 The other development is Prosperous Garden with 5 towers and building height up to 87.1mPD. Effective gaps between buildings range from 4m to 12m. Area of around 115m x 115m is occupied. To the east is the longer aspect of a building cluster blocking connection with Wing Sing Lane to the further east.

3.4.9 Commercial buildings along Nathan Road are up to 88.1mPD (see photos for location nos. 2 & 12). Buildings on two sides of Shanghai Street and Reclamation Street are generally lower.

3.4.10 The groups of O and G/IC sites allow westerly wind entry to inner area. Major roads such as Waterloo Road and Nathan Road act as air paths. In addition, Pitt Street (16m wide), Public Square Street (18m wide) and Kansu Street (generally around 19m) along east-west axis can receive westerly wind as well. The latter 2 streets have connection to air paths to the further east so that it can probably receive easterly wind as well. However, there is a bottleneck along Kansu Street near Nathan Road between 2 commercial building lots with width of around 13m only so that easterly/westerly wind along Kansu Street would be restricted.

3.4.11 It would be relatively difficult for easterly wind to reach pedestrian level along Nathan Road due to the high ground and steep slope of King's Park area as well as blockage due to existing blocks to the east of Nathan Road. Moreover, two east-west aligned local carriageways (Hamilton Road, Wing Sing Lane) are blocked and cannot receive westerly wind.

3.4.12 There are a number of committed developments scattered with maximum building height off around 99mPD along Nathan road. All these developments would not alter the existing street pattern and do not form continuous barrier like structure. Therefore, these scattered developments would unlikely have significant air ventilation impact on the immediate area.

3.4.13 **Figure 11** shows the air flow, likely good feature and problem area at SA1.

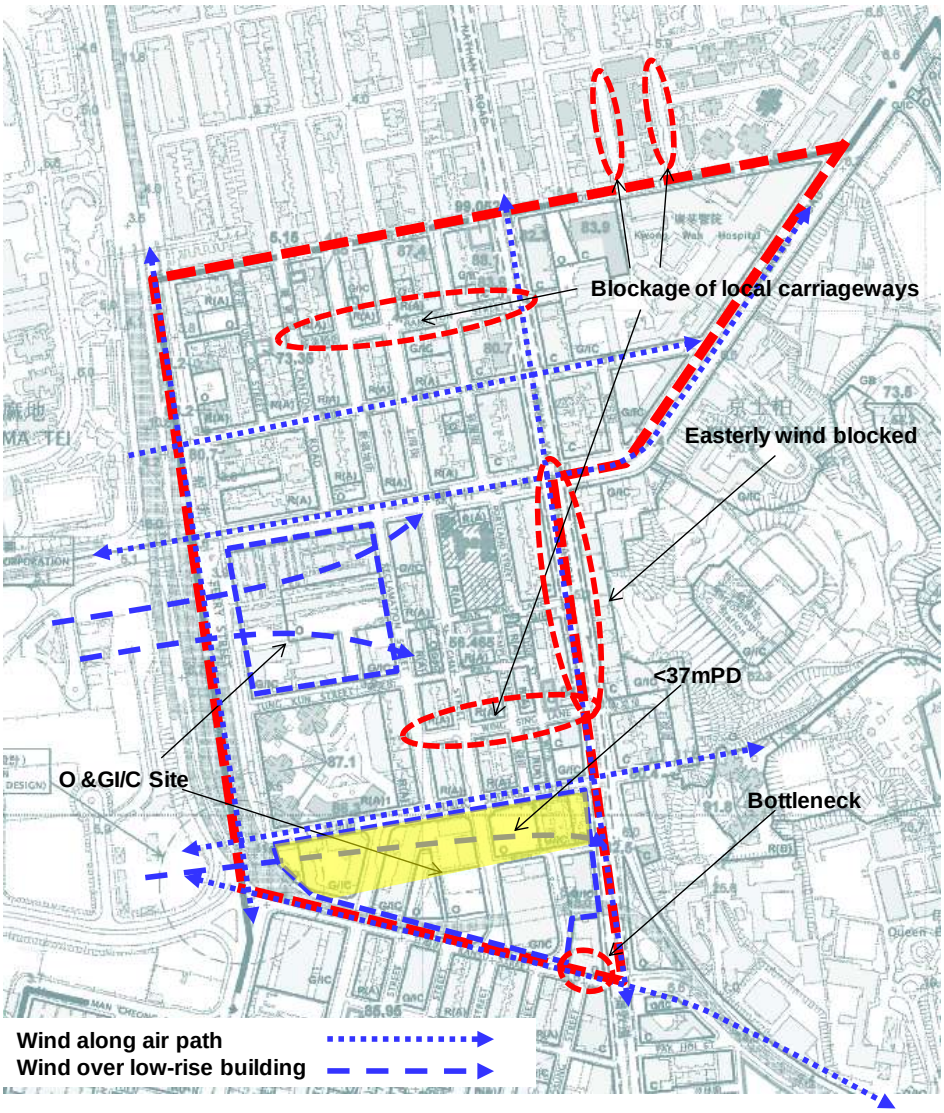


Figure 11 Illustration of Air Flow, Good Feature and Problem Area at SA1

SA2:

3.4.14 There are 8 number of elongated R(A) building clusters on the western side aligned along east-west axis and with least blockage against westerly wind.

3.4.15 The building clusters with longest aspect (about 200m long) are two "R(A)" sites bounded by Jordan Road, Canton Road, Ferry Street and Saigon Street (see photos for location nos. 29 & 30). The longer aspect is perpendicular to easterly/westerly wind direction and impose blockage for carriageways (including Ning Po Street and Nanking Street to the east; Man Wai Street, Man Yuen Street and Man Ying Street to the west) on east and west sides.

3.4.16 There is a group of O and G/IC site along Ferry Street comprising electricity substation and open playground that can welcome westerly wind entry (see photos

for location no. 19). However, there is no wide carriageways to the east (road width of Pak Hoi Street is around 9m only) and therefore, the benefit is localized.

3.4.17 Westerly wind along Jordan Road can reach Gascoigne Road to further downwind area. Easterly wind can flow along the same air path. In this case, the open space at Hospital of PLA Forces, United Services Recreation Club to the south of Gascoigne Road outside SA2 plays an important road to enhance wind flow (see photos for location nos. 35 & 36).

3.4.18 There are a number of committed developments with maximum height up to around 101mPD. Except for the planned Diocesan Girls' School and Junior School (45.6mPD) at the junction of Jordan Road and Gascoigne Road which would bear some significance to the air flow along these two carriageways, other committed development would not alter the street pattern and result in significant wall effect against wind flow.

3.4.19 **Figure 12** shows the air flow, likely good feature and problem area at SA2.

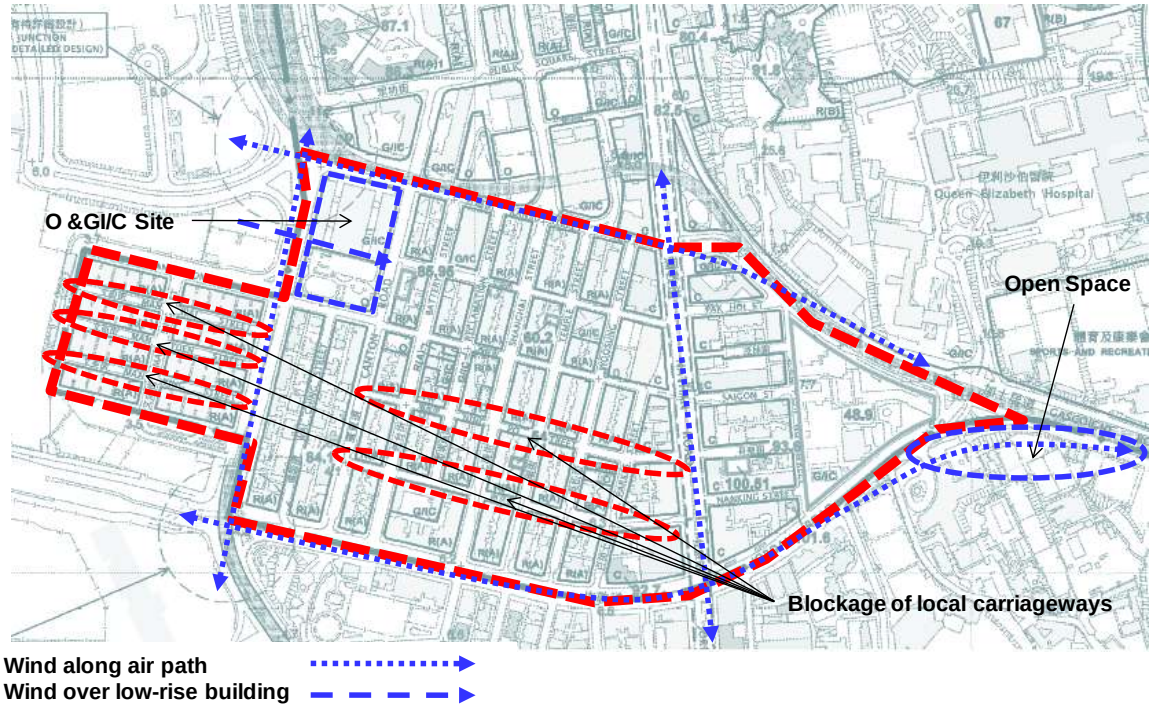


Figure 12 Illustration of Air Flow, Good Feature and Problem Area at SA2

SA3:

3.4.20 The sub-area is mainly covered by G/IC, OU, O and GB uses and with scattered R(B) site and C site along Nathan Road. It is mainly the higher ground area but also included blocks along Nathan Road. The two highest points are at King's Park (66mPD) and at Parc Palais (39mPD) (see photos for location nos. 39 & 40). The southern side of SA3 is relatively lower.

3.4.21 Queen Elizabeth Hospital (QEH) comprises a number of building blocks with building height ranging from 22.6mPD to 76.2mPD. The building height at northern portion of QEH is lower and ranges from 22.6mPD to 42.2mPD only. It serves to provide a major air path of about 40m wide which can allow east/west wind penetration.

3.4.22 The central part is mainly covered by a podium of 23.6mPD. Building blocks on the central part (typically ranging from 61mPD to 76.2mPD) are interlinked which together with Parc Palais at 39mPD to the east would impose relatively significant blockage against east/west wind flow from or to the group of O and G/IC site within SA1 to the west and the King's Park Sports Ground to the east.

3.4.23 There are plenty open space to the south of QEH and Parc Palais including YMCA Recreation Ground, King's Park Sports Ground and King's Park Hockey Ground. The open space creates breezeway to allow east-west wind flow. The south east corner of SA3 is currently occupied by spaghetti of highway and is open for wind penetration as well. Apart from QEH which is of building height up to about 76mPD, the only obstacles nearby the breezeway are existing Wylie Court (up to 88mPD) and the Proposed Phase 8 Development of HKPU at the junction of Princess Margaret Road and Chatham Road North (see photos for location no. 37),. Both developments would have blockage to air flow. The proposed Phase 8 Development of HKPU is sited at the existing breezeway. The height is up to 60mPD and together with Lee Shau Kee Building of HKPU would result to reduce the existing breezeway (usually of over 100m wide) to 60m wide. It would impact on easterly and westerly wind flow. The impact is ameliorated by the fact that only a portion of the site would be up to 60mPD and a portion of the development as public open space at ground level. On the other hand, adequate space covered by existing open playgroud (over 190m) is left between Wylie Court/Phase 8 Development of HKPU and QEH so that the performance of the other existing breezeway in between is still considered satisfactory.

3.4.24 Similarly, open playground can be found along the existing railway alignment which allows for a major air path for southeasterly wind.

3.4.25 There are a number of high-rise developments including Parc Palais (up to 130mPD), a community college building along Wylie Road (107mPD), King's Park Villa (91mPD) and the Regalia (92mPD). Parc Palais, King's Park Villa and the Regalia are aligned along nearly the same east-west axis and therefore impose less impact against westerly and easterly wind flow. Considering that easterly wind is already blocked by building blocks on the eastern side of Princess Margaret Road in Ho Man Tin, these high-rise developments within the study area do not impose significant "additional" impact.

3.4.26 Wylie Road has connection with Princess Margaret Road and can receive northeasterly wind.

3.4.27 The southwest side of this sub-area (i.e. west of QEH) consists of a number of institutions with building height up to about 37mPD. QEH includes building blocks up to about 72mPD. The stepping height profile allows westerly wind to reach pedestrian level easier.

3.4.28 The higher ground around King's Park makes it difficult for easterly wind to reach Nathan Road to the immediate west. However, more importantly, the high-rise commercial building cluster along Nathan Road is about 180m long. There is absence of building gap in-between and would result in wall effect obstructing easterly/westerly wind flow. Easterly wind would have difficulty to reach pedestrian level of Nathan Road.

3.4.29 There are some other committed developments including Proposed Extension of Hong Kong Red Cross Blood Transfusion Service to the immediate west of King's Park Villa (see photos for location no. 40), and proposed new premises for Methodist School to the immediate west of King's Park Sports Ground (see photos for location no. 38). Both developments would not significantly impact the existing breezeway and air path.

3.4.30 **Figure 13** shows the air flow, likely good feature and problem area at SA3.

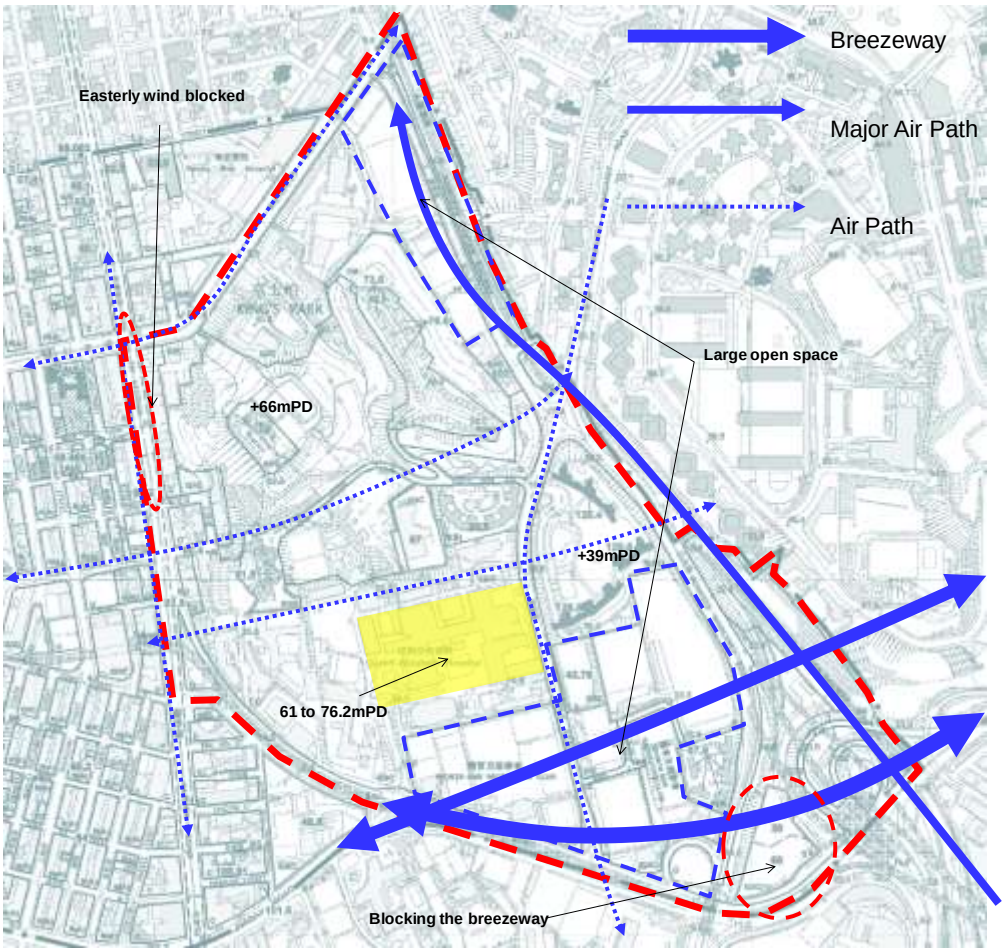


Figure 13 Illustration of Air Flow, Good Feature and Problem Area at SA3

3.5 Summary of Major Features with Positive/Negative Effect on Air Ventilation

3.5.1 The study area has a lot of open space among the eastern side. The western part of the study area relies more on the building landscape to provide necessary air paths for wind penetration. Existing carriageways usually serve such purpose. Therefore, there is a genuine need to preserve the existing street grid pattern and explore opportunities for improvement by widening of particular carriageways identified of importance. Carriageway of at least 15m to 20m is preferred to act as air path to allow wind penetration. Moreover, through road should be created where possible.

3.5.2 In addition, open space within the urban area can provide linkage to allow wind distribution and even serve as breezeway for wind entry. Open space with greening can help to reduce urban heat island effect. All open space already dedicated should be preserved as well.

3.5.3 Open space near the southeast side and along the existing railway alignment forms major breezeway and air path and can help wind distribution. Other O and G/IC sites near the western side are important in welcoming westerly wind entry.

3.5.4 The existing streets serve for wind penetration. Narrower roads may effect to channelize air coming from relatively open area and amplify wind speed. However, considering that the study area is at low ground, wind speed has already been reduced due to roughness. Amplification due to channeling is not considered a significant problem. Major carriageways such as Nathan Road, Ferry Street, Waterloo Road, Jordan Road are important air paths. Other narrower roads such as Pitt Street, Kansu Street and Public Square Street also allow westerly wind penetration to inner area. Kansu Street, in particular, has bottleneck problem between 2 commercial building lots and is the subject for improvement.

3.5.5 The longer aspect of the building clusters is perpendicular to the east-west axis and is not beneficial to important easterly and westerly wind flow.

3.5.6 There are local carriageways currently blocked by buildings including Hamilton Street, Wing Sing Lane, Ning Po Street, Nanking Street, etc. Moreover, long and continuous building cluster of commercial developments along Nathan Road also makes it difficult for easterly wind to reach pedestrian level of Nathan Road. The committed Phase 8 development of HKPU is located at the existing breezeway and would impact easterly/westerly wind flow. It is noted that a portion of the development has been designated as public open space to minimise the impact.

3.6 General Direction of Air Ventilation Improvement

3.6.1 In order to improve air ventilation in urbanized area at which taller building can hardly be avoided, the direction should be to retain, enhance and/or create breezeway/air

path through designation of open space, non-building area, setback of buildings, etc. It also includes linkage of open space and breezeway/air path with each other.

3.6.2 The nearest seashore is the western side and southeast corner of the study area. As a general rule, buildings nearer to seashore should have shorter BH and with increasing height in inner region to promote air flow to inner area. Especially, breezeway leading sea breeze to inner region is particularly important. Wall effect must be avoided near the shore.

3.6.3 Building clusters with longer aspect perpendicular to prevailing wind direction should be avoided or significant wall effect would be resulted.

3.6.4 More open space should be designated near the junction of carriageways to improve the linkage to facilitate wind penetration. Such open space is especially effective for carriageways aligned with slight different angle (say, not more than 30 degree).

4.0 Evaluation of Initial Planned Scenario

4.1 Key Characteristics of Initial Planned Scenario

4.1.1 **Figure 14** shows the initial planned scenario. According to the initial planned scenario, the building height (BH) limit is generally specified as 80mPD.

4.1.2 A limit of 100mPD is allowed for building lots along Nathan Road. 8 Waterloo Road is of BH limit reflecting the existing characteristics and of the highest BH limit (132mPD). Other high-rise developments have the BH limit reflecting the existing characteristics as well.

4.1.3 For OU, O and G/IC zoned areas, the BH limit also tallies with the existing situation mostly except for Kwong Wah Hospital which is under planning for possible future expansion. Moreover, it is noted that some of the existing low-rise buildings in QEH are also allowed to be redeveloped to the BH restriction of 76mPD.

4.1.4 Except for some lot areas where the BH limit tallies with the existing situation or slightly lower than the existing building height (e.g. Prosperous Garden), there will be general increase of BH allowed and it provides motivation for redevelopment.

Figure 14 Initial Planned Scenario

4.2 Evaluation of Air Ventilation Performance

General:

4.2.1 The BH limit along the entire Nathan Road is 100mPD and may form a monotonously high and apparently continuous wall structure obstructing easterly and westerly wind flow.

SA1:

4.2.2 The Scenario does not alter the existing street pattern. On the other hand, the bottleneck problem of Kansu Street is not resolved as well.

4.2.3 There are developments of varying heights within this sub-area. The rows of building near to the western side are already up to around 60 to 88mPD. The BH limit of 80mPD would not significantly alter the existing situation.

4.2.4 Some carriageways such as Arthur Street are of about 9m wide only. The building height to street width (H/W) ratio[2] can be up to 11:1. For most of the carriageways (including Portland Street), the width is around 15m and H/W ratio is around 5:1 to 7:1 (H/W ratio of Portland Street is around 6.5). For Nathan Road, the H/W ratio is around 3:1.

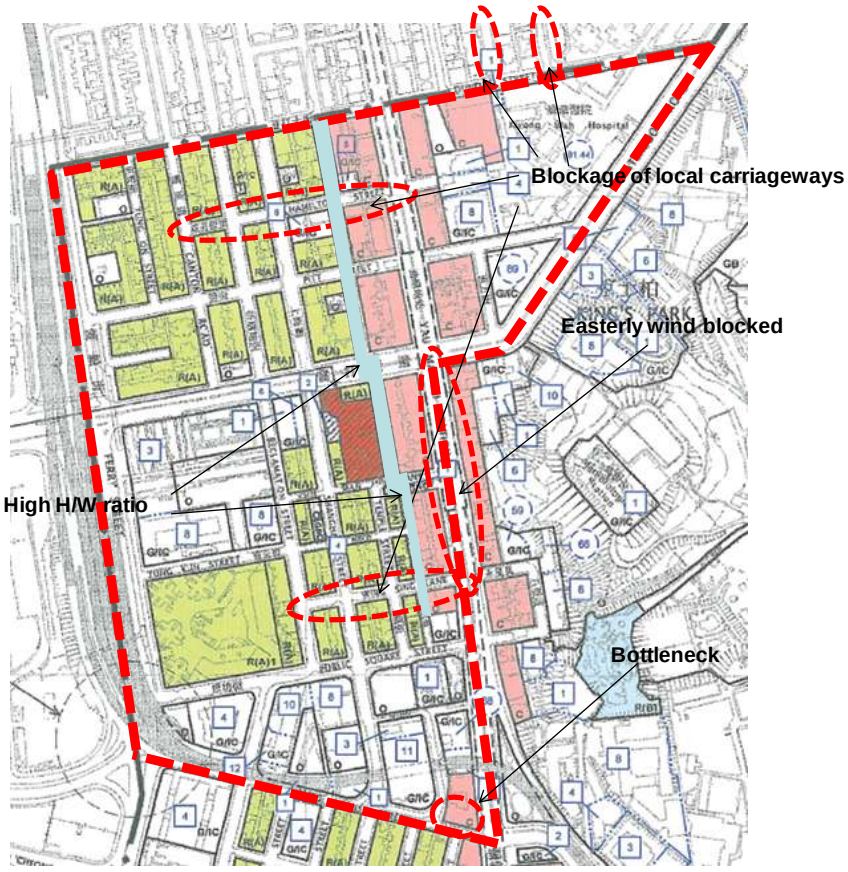


Figure 15 Identified Problem for SA1 under Initial Planned Scenario

[2] For H/W ratio, W is measured as the distance between buildings on two sides. The higher the H/W ratio, the more difficult wind from higher location can reach down to pedestrian level. A ratio of 2:1 is considered ideal whereas the ratio of 3:1 in urban area is generally considered satisfactory.

SA2:

4.2.5 The Scenario does not alter the existing street pattern. The problem of Ning Po Street and Nanking Street being obstructed is not resolved as well.

4.2.6 The existing building height in SA2 is generally lower with more ageing buildings. The east-west aligned carriageways are mostly 10m wide. The Scenario would result in H/W ratio of 8:1 mostly and even up to 10:1. For north-south aligned carriageways including Woosung Street and Parkes Street, the width is around 15 to 16m respectively. The respective H/W ratios are 6.5 and 6 based on the Initial Planned Scenario.

4.2.7 Generally, lower buildings should be located in windward direction and near waterfront area as recommended under HKPSG. Congestion of tall buildings forming a high wall-like structure to the front of the prevailing wind or along the waterfront should be avoided. The Scenario, however, does not suggest any height profile. However, the immediate northern and southern sides of the area nearest to waterfront area (i.e. area bounded by Man Cheong Street and Man Wui Street) are vacant so that it is less important from technical standpoint to impose more stringent BH limit for the area nearest to waterfront.

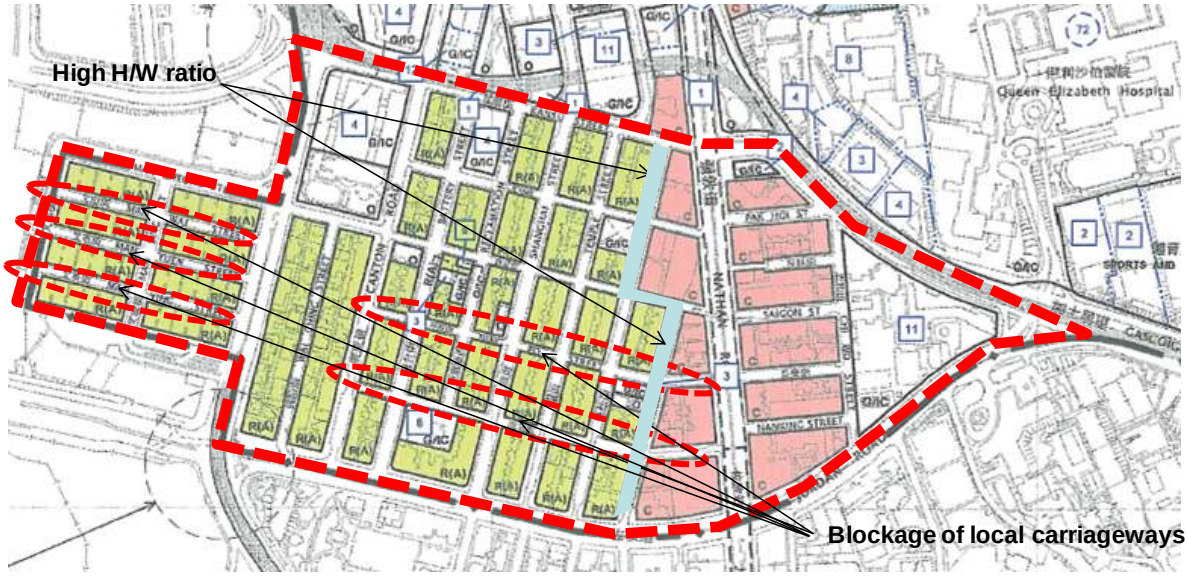


Figure 16 Identified Problem for SA2 under Initial Planned Scenario

SA3:

4.2.8 The Scenario mainly reflects the existing characteristics or committed development within this sub-area. The BH limit of commercial area along Nathan Road is 100mPD and will be around 20m to 50m taller than the existing building height.

4.2.9 The problem of having long aspect of continuous commercial area (180m long) obstructing easterly/westerly wind flow has not been addressed.

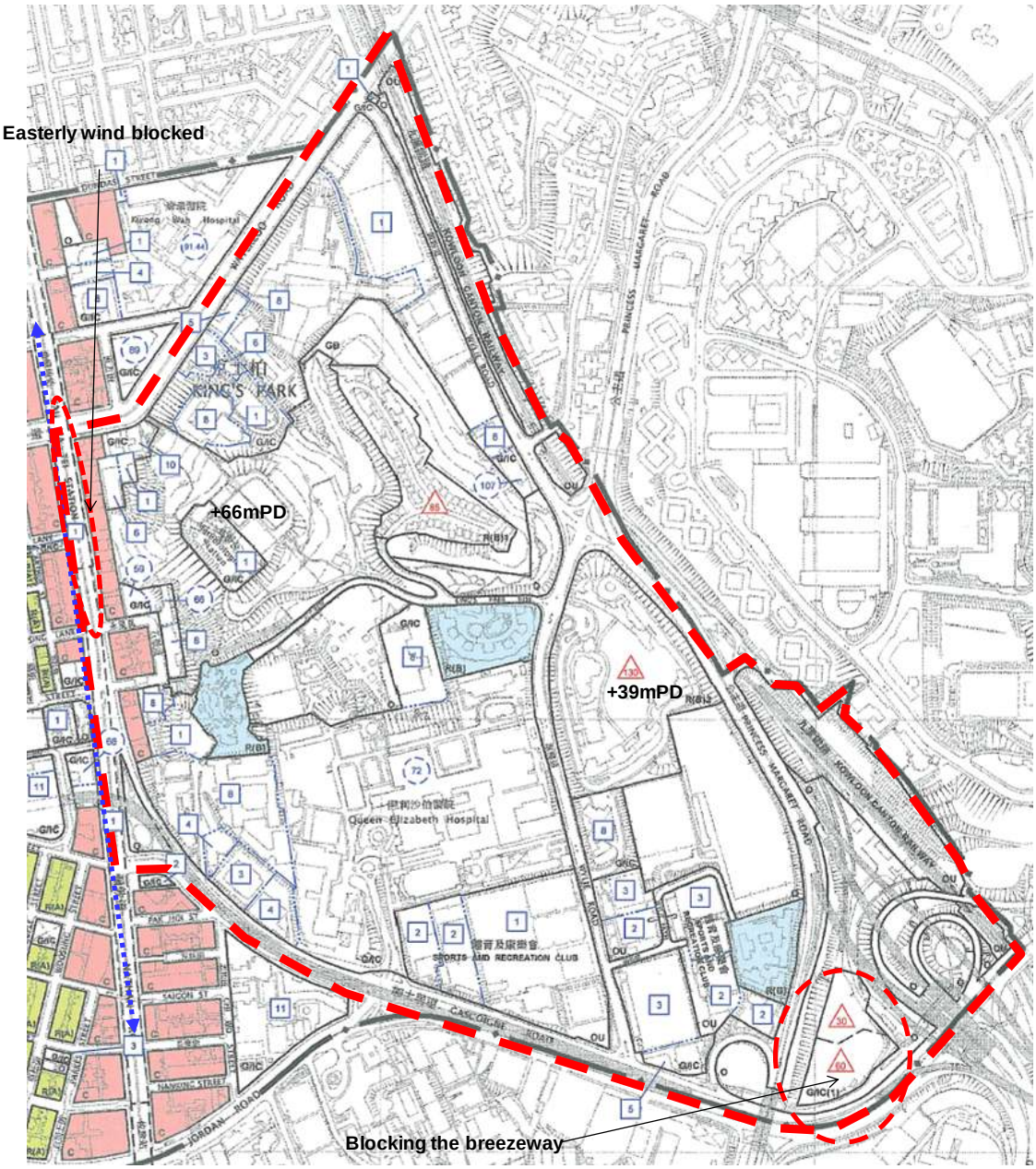


Figure 17 Identified Problem for SA3 under Initial Planned Scenario

4.3 Recommendations

4.3.1 **Figure 19** shows the recommended scheme based on evaluation of the initial planned scheme.

General:

4.3.2 According to the HKPSG, gradation of building heights would help wind deflection and avoid air stagnation. Some variation of BH limit along Nathan Road (up to 120mPD) has been recommended to create or amplify downwash effect in Mong

Kok OZP because areas around are in more inland area and cannot be benefited by sea breeze from western side. The study area of Yau Ma Tei OZP, however, is closer to western seashore. Moreover, the area between the study area and the western seashore is generally unobstructed. There also exists air paths (Jordan Road, Waterloo Road) and open areas (or area with low-rise building) fronting western boundary of the study area which can facilitate westerly wind penetration to inland. It is considered not essential to provide further building relaxation as it does in Mong Kok OZP.

4.3.3 To reduce the H/W ratio, setback requirement is imposed for building along Portland Street, Woosung Street and Parkes Street (all around 15 to 16m wide) as well as Arthur Street (9m wide). Towers during redevelopment should be setback by 3m from roadside. Setback is recommended at the elevation of 20mPD (i.e. 15m aboveground) and higher because podium structure of maximum 15m high is generally considered acceptable without significantly deteriorating the air ventilation performance. The effective width of the aforementioned streets (except Arthur Street) based on the recommendations will be increased to 21m and can act as effective air path for north/south wind penetration. For Arthur Street, the width will be increased to 15m. On the other hand, the H/W ratios will be reduced to 5:1 for Portland Street, Woosung Street and Parkes Street, and 6.5:1 for Arthur Street so that east/west wind at higher elevation can reach pedestrian level easier. Further increase of street width for Arthur Street is not considered practicable due to the small lot size on two sides.

SA1:

4.3.4 The area to the west of the study area is relatively unobstructed. The effectiveness of the air path along the existing Kansu Street is constrained by bottleneck of around 13m wide between two commercial areas along Nathan Road. Other than this bottleneck location, Kansu Street has a general effective width of not less than 19m. It is recommended to provide a setback of 6m for building structure at 20mPD (around 15m aboveground) and above so that the minimum width of the air path can be increased to 19m. Setback at 20mPD and above is considered a tradeoff for practicality for implementation.

4.3.5 According to the “Consultancy Study on Building Design that Supports Sustainable Urban Living Space in Hong Kong” commissioned by the Buildings Department, for sites smaller than two hectares with a façade of 60m or more, there should be a 20% intervening space while for sites larger than two hectares, there should be a 25% to 33.3% intervening space, depending on the building height. It also implies that a frontage of 60m of more is already considered excessive so that intervening space should be introduced. As such, BH restriction of 19mPD (around 15m aboveground) are proposed at 3 clusters (15m wide for two clusters with east/west frontage of 150m to the west of Hamilton Street and 16m wide for one cluster with east/west frontage of over 110m to the west of Wing Sing Lane) in order to extend the carriageways. The recommended width of the area with BH restriction is the same as the width of the carriageway it is aligned with.

4.3.6 The open space to the south of 8 Waterloo Road is especially important to connect carriageways including Temple Street and Portland Street to allow wind penetration to ameliorate impact due to massive structure at 8 Waterloo Road. The area is designated as non-building area to preserve this good feature.

SA2:

4.3.7 BH restriction of 19mPD (around 15m aboveground) for 10m wide is recommended at 4 locations to the west of Ning Po Street and Nanking Street in order to break the existing wall due to two long building clusters bounded by Canton Road, Saigon Street, Ferry Street and Jordan Road. Generally, a building structure of less than 15m aboveground is not considered excessive. Wind from such elevation should be able to reach the pedestrian level (2m aboveground) easier.

SA3:

4.3.8 BH restriction of 20mPD (around 15m aboveground) for 15m wide is recommended at a location to the east of Man Ming Lane within C zoned area to break the existing wall effect due to long building cluster along Nathan Road. The building gap of 15m is considered barely sufficient for easterly wind to penetrate and reach pedestrian level of Nathan Road.

4.3.9 For QEH, with an aim to maintain the existing air path for east/west wind flow on the northern side, the area should maintain the current height of the buildings, e.g. to reflect the low-rise nature in the north and to contain the height of the current medium-rise buildings in the south. In addition, there is opportunity identified to improve the air path along Gascoigne Road as shown in **Figure 18** upon redevelopment of QEH. Air ventilation assessment is recommended to optimize the design upon redevelopment.

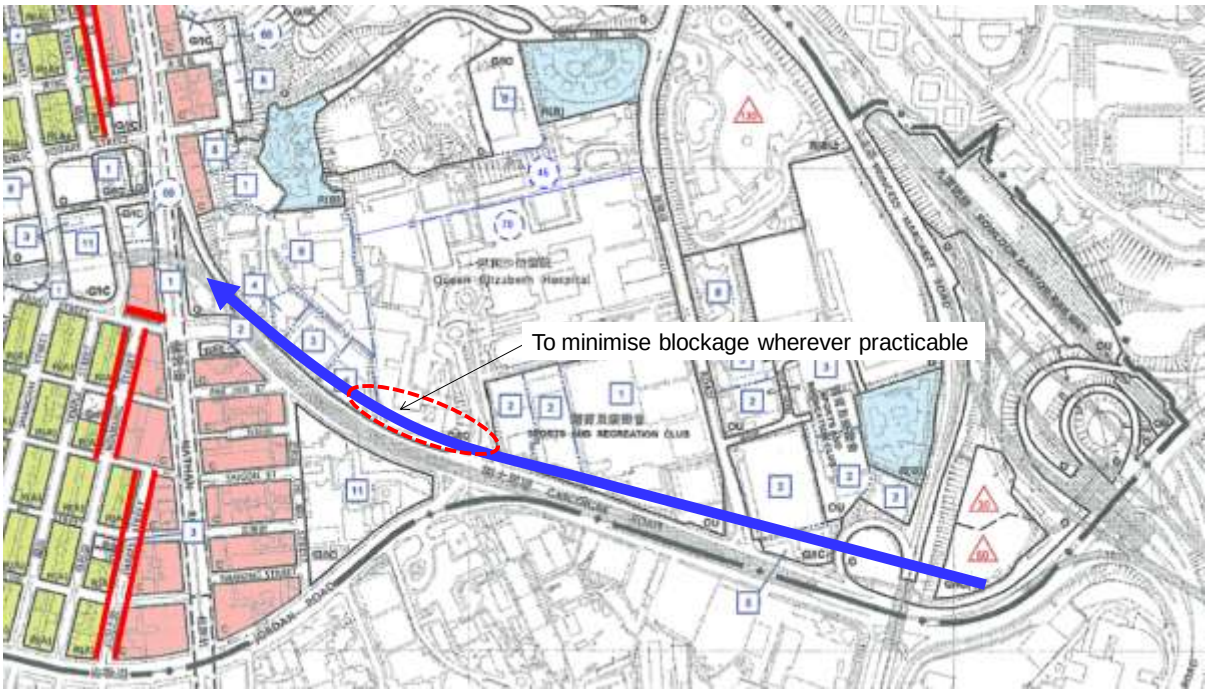


Figure 18 Opportunity to improve Air Path along Gascoigne Road

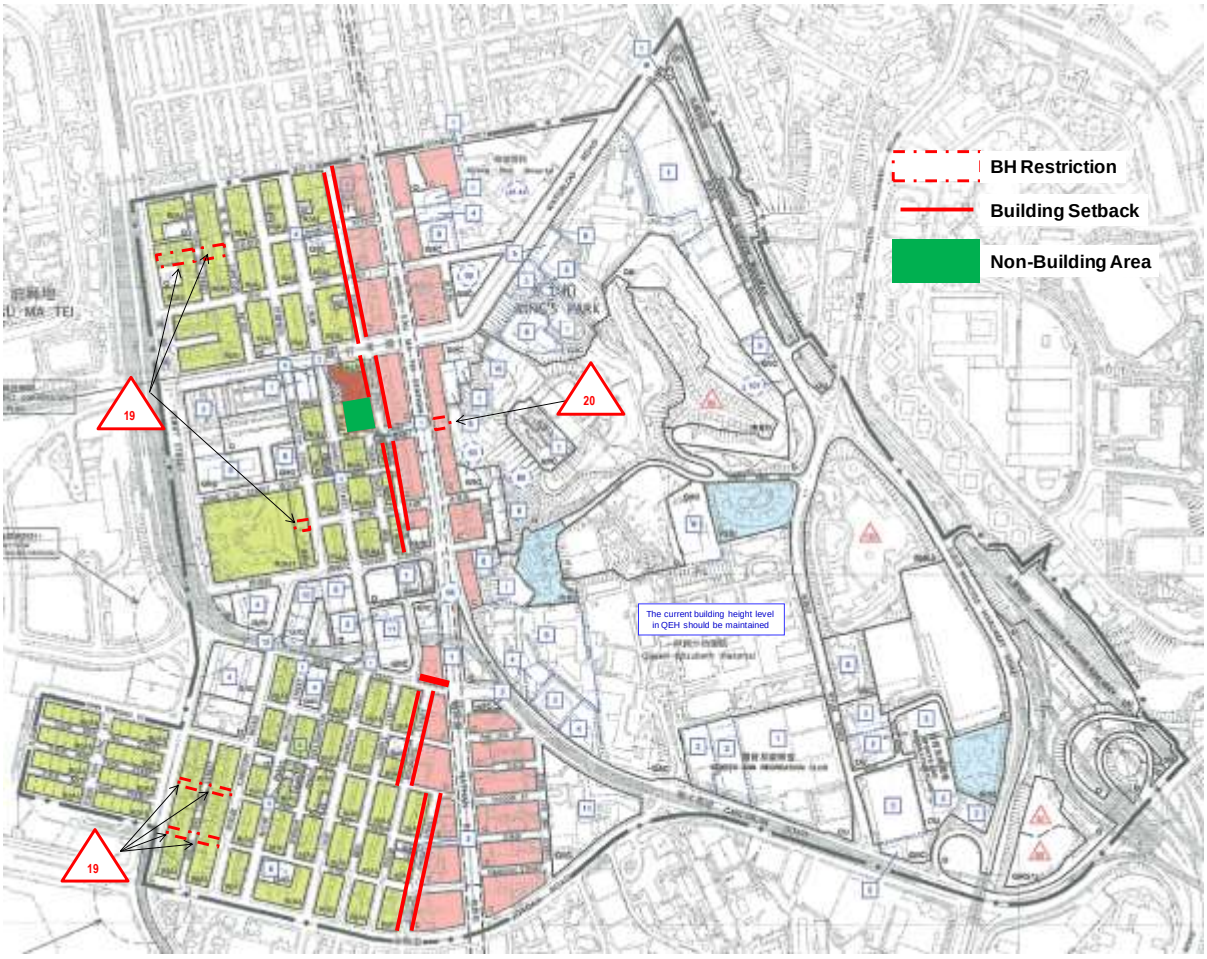


Figure 19 Recommended Scenario

5.0 Conclusion and Further Recommendations

5.1 Conclusion

5.1.1 The initial planned scenario has been evaluated qualitatively taking into consideration of the site wind availability, topography, existing and committed building morphology and potential development sites.

5.1.2 Based on the evaluation, it is identified that Kansu Street has bottleneck problem (around 13m wide between 2 commercial building lots along Nathan Road) and is the subject for improvement. Some of the carriageways (Hamilton Street, Wing Sing Lane, Man Wai Street, Man Yuen Street, Man Ying Street, Ning Po Street, Nanking Street) are currently blocked by building clusters with buildings compacted together. Kwong Wah Hospital also imposes blockage to Fa Yuen Street and Tung Choi Street. Long commercial building cluster (180m) along Nathan Road also obstructs easterly wind flow to pedestrian area of the same road. The committed Phase 8 development of HKPU is located at the existing breezeway and would block east/west wind flow.

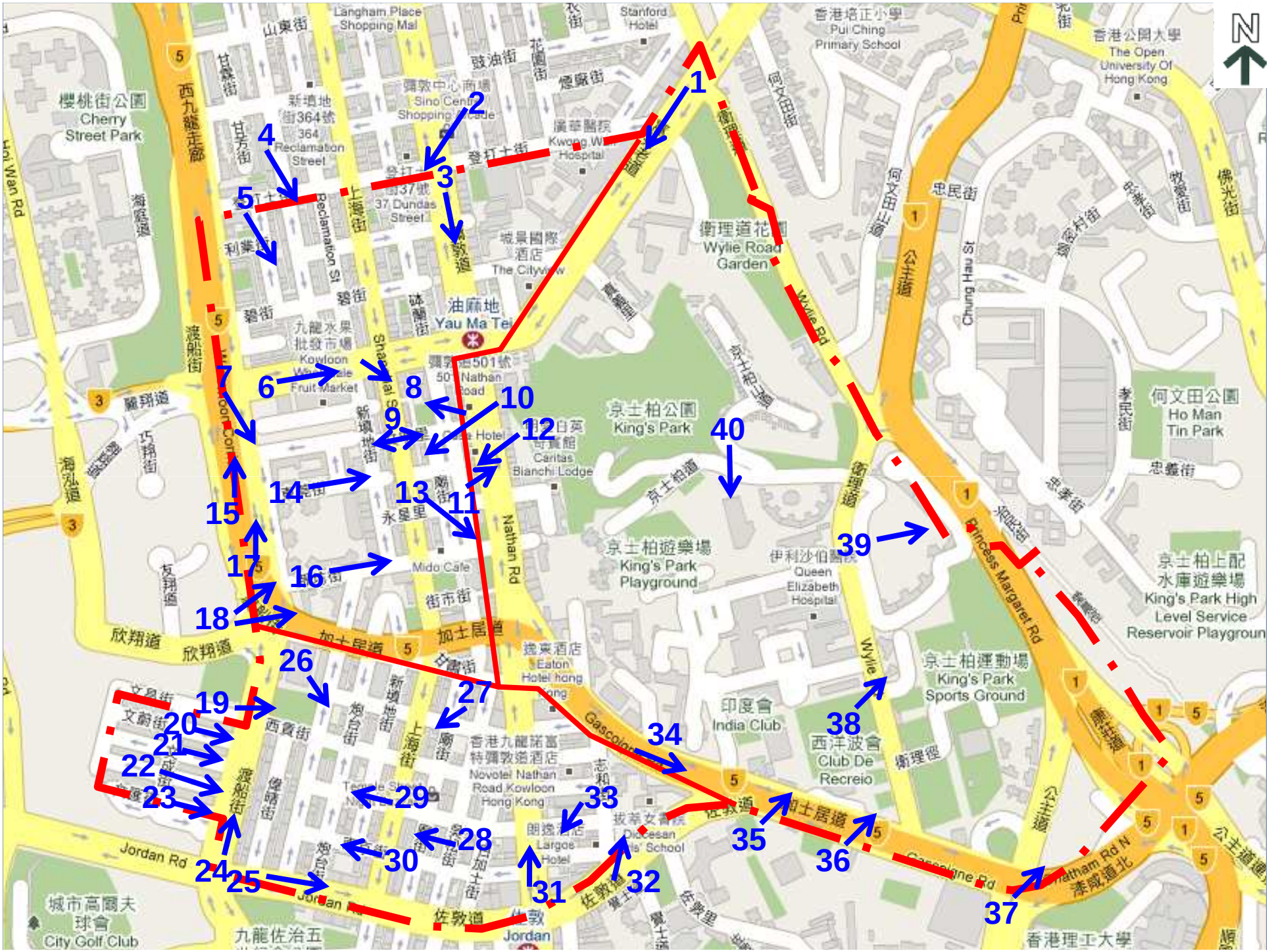
5.1.3 Referring to the initial planned scenario, the aforementioned problem has not been addressed. Moreover, the BH restriction would increase the H/W ratio and would have negative impact on air ventilation performance.

5.1.4 Recommendations have been made to improve the initial planned scenario from air ventilation standpoint. Mitigations are in terms of building setback and BH restriction, designation of non-building area to preserve good characteristics as well as revised BH limit for Queen Elizabeth Hospital with the objectives to address the aforementioned problems.

5.2 Further Study

5.2.1 For future development of larger scale (e.g. redevelopment of Kwong Wah Hospital and expansion/redevelopment of Queen Elizabeth Hospital), there is more room to finetune the design for the benefit of air ventilation such as to open up area aligned with existing air path and/or to improve the existing air path. Air ventilation assessment (quantitative) is therefore recommended to be conducted for development of larger scale.

Appendix A
Photos of Street View of the Study Area


N
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
Langham Place Shopping Mal
Stanford Hotel
香港培正小學 Pui Ching Primary School
香港公開大學 The Open University Of Hong Kong
櫻桃街公園 Cherry Street Park
Sino Centre Shopping Arcade
Kwong Wah Hospital
新填地街364號 364 Reclamation Street
37 Dundas Street
The Cityview
衛理道花園 Wylie Road Garden
何文田公園 Ho Man Tin Park
油麻地 Yau Ma Tei
九龍水果批發市場 Kowloon Wholesale Fruit Market
京士柏公園 King's Park
Caritas Bianchi Lodge
京士柏遊樂場 King's Park Playground
伊利沙伯醫院 Queen Elizabeth Hospital
京士柏運動場 King's Park Sports Ground
京士柏上配水庫遊樂場 King's Park High Level Service Reservoir Playground
Mido Cafe
Eaton Hotel hong kong
Novotel Nathan Road Kowloon Hong Kong
Largos Hotel
印度會 India Club
西洋波會 Club De Recreio
城市高爾夫球會 City Golf Club
九龍佐治五
香港理工大學
Nathan Rd
Princess Margaret Rd
Wylie Rd
Gascoigne Rd
Jordan Rd
佐敦道
加士居道
欣翔道
上海街
西九龍走廊

Location No.: 1 **Location: Waterloo Road (SA1)**

Location No.: 1 **Location: Waterloo Road (SA1)**

Location No.: 2 **Location: Dundas Street (SA1)**

Location No.: 3 **Location: Nathan Road (SA1)**

Location No.: 4 **Location: Canton Road (SA1)**

Location No.: 5 **Location: Tung On Street (SA1)**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Yau Ma Tei Area	ENVIRON

Location No.: 6 **Location: Waterloo Road (SA1)**

Location No.: 7 **Location: Ferry Street (SA1)**

Location No.: 8 **Location: Shanghai Street (SA1)**

Location No.: 8 **Location: Man Ming Lane (SA1)**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Yau Ma Tei Area	ENVIRON

Location No.: 9 **Location: Man Ming Lane (SA1)**

Location No.: 9 **Location: Man Ming Lane (SA1)**

Location No.: 10 **Location: Man Ming Lane (SA1)**

Location No.: 11 **Location: Nathan Road (SA1)**

Location No.: 12 **Location: Nathan Road (SA1)**

Location No.: 13 **Location: Arthur Street (SA1)**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Yau Ma Tei Area	ENVIRON

Location No.: 14 **Location: Tung Kun Street (SA1)**

Location No.: 15 **Location: Ferry Street (SA1)**

Location No.: 16 **Location: Public Square Street (SA1)**

Location No.: 17 **Location: Ferry Street (SA1)**

Location No.: 18 **Location: Ferry Street (SA1)**

Location No.: 18 **Location: Ferry Street (SA1)**

Location No.: 19 **Location: Ferry Street (SA2)**

Location No.: 20 **Location: Man Wai Street (SA2)**

Location No.: 21 **Location: Man Yuen Street (SA2)**

Location No.: 22 **Location: Man Ying Street (SA2)**

Location No.: 23 **Location: Man Shing Street (SA2)**

Location No.: 24 **Location: Ferry Street (SA2)**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Yau Ma Tei Area	ENVIRON

Location No.: 25 **Location: Jordon Road (SA2)**

Location No.: 26 **Location: Canton Road (SA2)**

Location No.: 27 **Location: Temple Street (SA2)**

Location No.: 28 **Location: Temple Street (SA2)**

Location No.: 29 **Location: Ning Po Street (SA2)**

Location No.: 30 **Location: Nan King Street (SA2)**

Location No.: 31 **Location: Nathan Road (SA2)**

Location No.: 32 **Location: Jordon Road (SA2)**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Yau Ma Tei Area	ENVIRON

Location No.: 33 **Location: Cheung Lok Street (SA2)**

Location No.: 34 **Location: Gascoigne Road (SA2)**

Location No.: 34 **Location: Gascoigne Road (SA3)**

Location No.: 35 **Location: Gascoigne Road (SA3)**

Location No.: 35 **Location: Gascoigne Road (SA3)**

Location No.: 36 **Location: Gascoigne Road (SA3)**

Location No.: 37 **Location: Gascoigne Road (SA3)**

Location No.: 38 **Location: Wylie Road (SA3)**

Project:	Term Consultancies for Air Ventilation Assessment Services Under Agreement No. PLNQ 35/2009 Category A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment For an Instructed Project for Yau Ma Tei Area	ENVIRON

Location No.: 39 **Location: Wylie Road (SA3)**

Location No.: 40 **Location: King's Park Rise (SA3)**