

Planning Department

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**Category A1 - Term Consultancy for
Expert Evaluation and Advisory Services on
Air Ventilation Assessment**

**Pak Shek Kok (East) Central Area,
Tai Po**

Expert Evaluation – Final Report

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1 INTRODUCTION

Background

- 1.1 The Hong Kong Planning Department (PlanD) has reviewed the land use of Pak Shek Kok (East) Outline Zoning Plan (OZP) No. S/PSK/11 and considered that it is necessary to conduct an expert evaluation to assess the preliminary air ventilation impacts of the proposed development proposal and development restrictions which include the imposition of appropriate development restrictions to guide future development or redevelopment of the area.
- 1.2 In October 2013, AECOM Asia Company Ltd. (the Consultant) was commissioned by the PlanD to undertake an Expert Evaluation Study for the First Development Scheme with proposed land use zoning and various development restrictions of the Pak Shek Kok (East) Central Area, Tai Po to examine the air ventilation performance of the development building designs and layouts in the study area qualitatively.
- 1.3 This expert evaluation report is based on the following materials given by the PlanD to the Consultant:
- Pak Shek Kok (East) Outline Zoning Plan.
 - Indicative layout of Potential Residential Developments at Pak Shek Kok which is the scheme adopted for assessment within the Study Area.
 - Base Map of Pak Shek Kok (East).
 - Indicative Layout of Committed Developments in Pak Shek Kok (East)
- 1.4 In the preparation stage of the expert evaluation report, the Consultant has studied the given materials listed in paragraph 1.3 and carried out site visit and inspection.

Objectives of the Expert Evaluation Study

- 1.5 The objective of this study is to assess the air ventilation impacts of the development proposals for various zones, for incorporation into the OZP within the area. The expert evaluation study has made reference to PlanD's study: "Feasibility Study for Establishment of Air Ventilation Assessment System" which recommended that it is important to allow adequate air ventilation through the built environment for pedestrian comfort.
- 1.6 The key purposes of the Expert Evaluation are to identify the good design features of the proposed development layout, identify obvious problematic areas and propose appropriate mitigation measures. Determination of whether further Initial Study or Detailed Study is required would be based on the findings of the Expert Evaluation.
- 1.7 This Expert Evaluation Report aims to present the following findings in a systematic approach as follows:
- Analyse the relevant wind data to understand the wind environment of the Study Area plus its surroundings;
 - Identify and analyse the major topographical features of the Study Area and its immediate vicinity. In addition, greeneries/landscape characteristics of the Study Area as well as its surroundings will also be identified;
 - Identify and analyse the land use and built form of the Study Area as well as its immediate surrounding areas including existing developments and committed future developments;
 - Based on the wind data, identify wind paths and wind flow characteristics of the Study Area through open spaces, streets, gaps and non-building areas between buildings and also identify stagnant/shadow zones if they exist;

- Based on the analyses of existing urban conditions, identify existing good features that shall be retained/strengthened at the same time spotting wind problematic regions that warrant attention;
- Based on the understanding of existing urban conditions, evaluate and compare qualitatively the prima facie impact, merits or demerits of the building height restrictions within the Study Area as proposed by the Planning Department in terms of air ventilation performance. In addition, problematic areas will be highlighted under the First Development Scheme and improvements/mitigation measures will be proposed with reference to the Urban Design Guidelines in the “Hong Kong Planning Standards and Guidelines” and also relevant statutory plans, building regulations and planning briefs; and
- Recommend appropriate technical methodologies if further initial study/detailed study for Study Area is required.

2 WIND ENVIRONMENT

- 2.1 Natural wind availability is crucial to the investigation of wind ventilation performance. There are a total of 46 weather stations (See **Figure 2.1**) 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 are valuable and provide valuable insights to aid a general understanding the surface wind environment especially near pedestrian level.

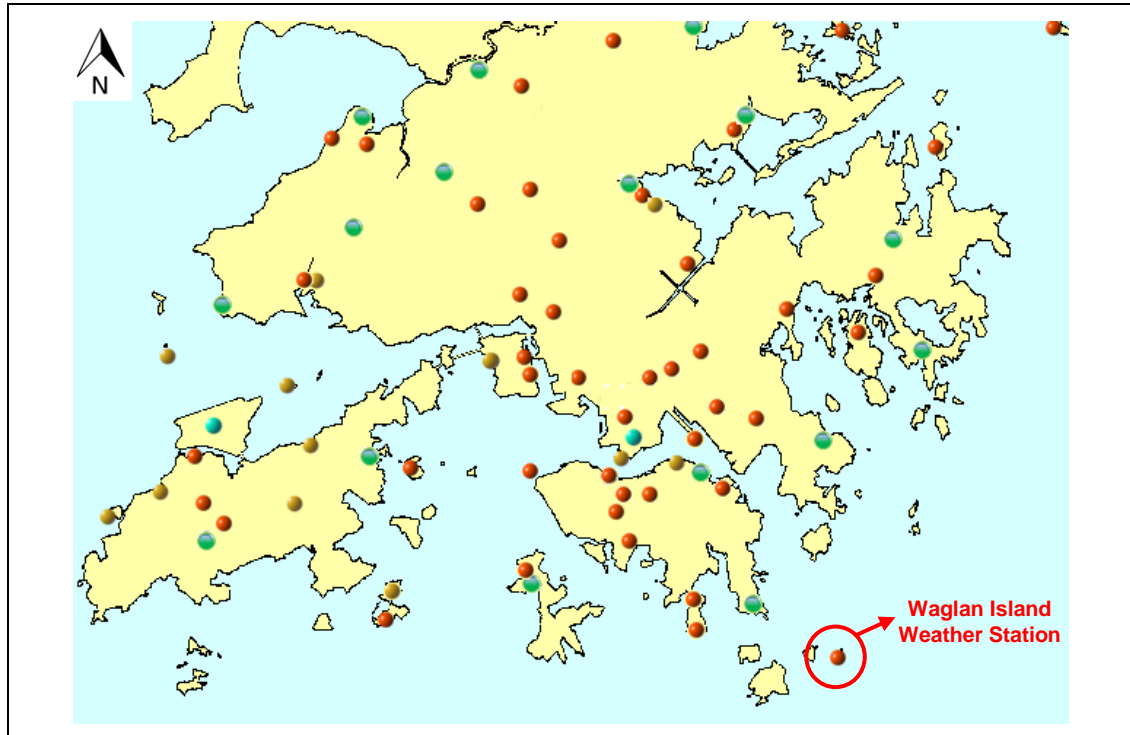


Figure 2.1 Locations of Waglan Island Weather Station and HKO Weather Stations

- 2.2 The automatic wind station at Waglan Island (WGL) has a very long measurement record and also its measured wind data is not affected by Hong Kong's complex topography. Therefore, the wind data from this station are adopted to estimate the site wind availability in wind related studies prior to taking into account the topographical features around the site.
- 2.3 By referring to the annual wind rose at WGL station from the years 1998 to 2007 shown in **Figure 2.2** below, it is clear that the winds from the north eastern quadrant have high probability of occurrence and are considered to be dominant wind directions. Among the wind directions from the north eastern quadrant, the easterly wind possesses a 20% frequency occurrence which is consistent with the annual prevailing wind in Hong Kong. Apart from the easterly wind, it should be noticed that a major component of wind also comes from the north east direction.
- 2.4 Apart from the point mentioned in paragraph 2.3 above, there is a minor but not negligible component of wind coming from the southwest direction. It is also observed that the occurrence of weak to moderate winds (speed ranging from 0.1m/s to 8.2m/s) occur approximately 70% of time.
- 2.5 Referring to the monthly wind roses at WGL station from years 1998 to 2007 shown in **Figure 2.3**, during winter seasons, the prevailing wind comes from the north east, while during summer seasons, the prevailing wind comes from the south western quadrant. In Hong Kong, summer wind is very important and beneficial for thermal comfort; therefore, identification of the annual wind characteristics is crucial.

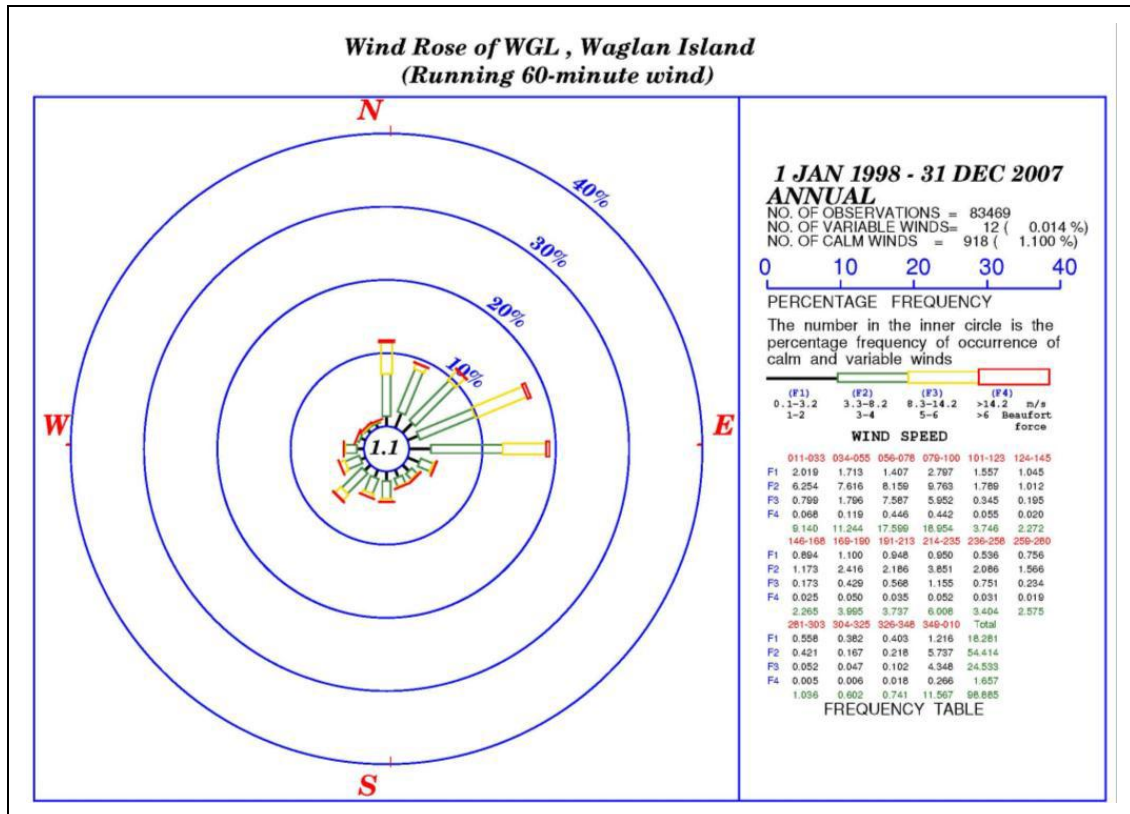


Figure 2.2 Wind Rose of WGL Weather Station (1998 – 2007)

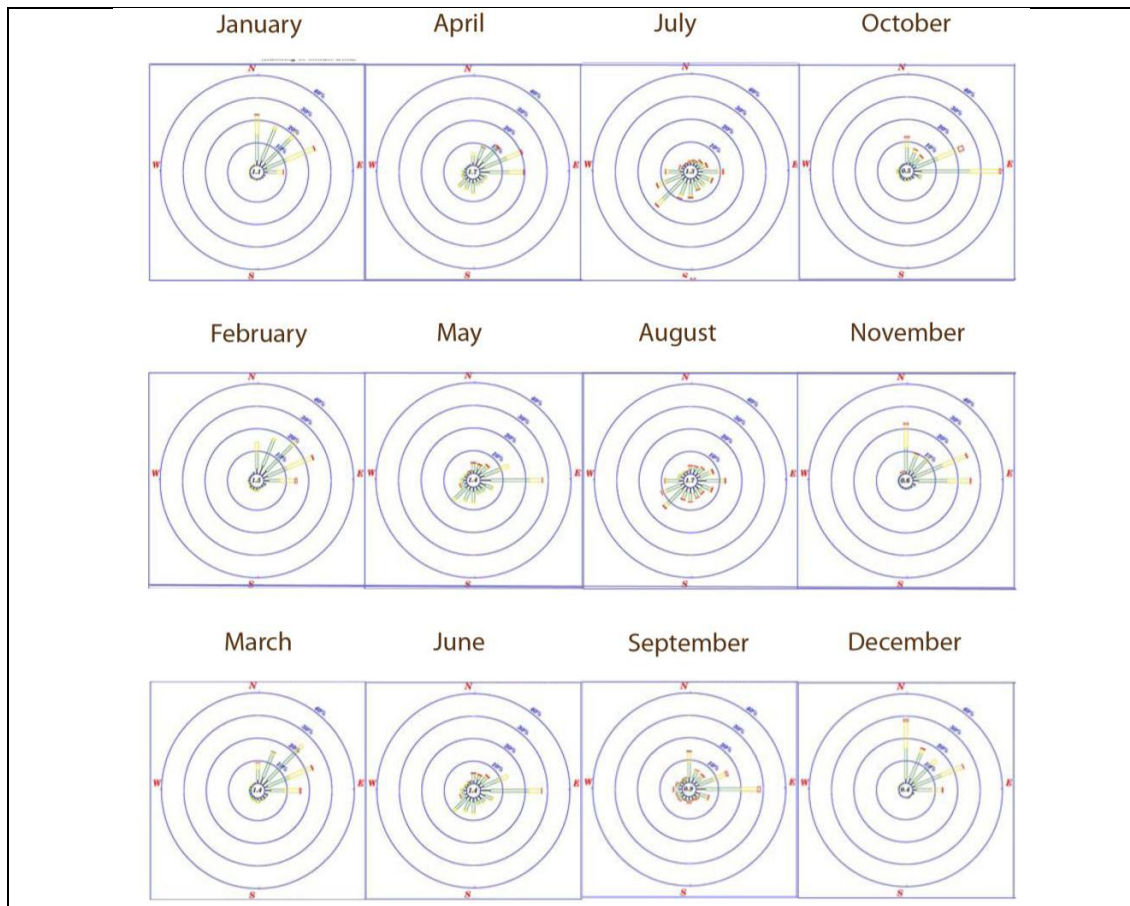


Figure 2.3 Monthly Wind Roses of WGL (1998 – 2007)

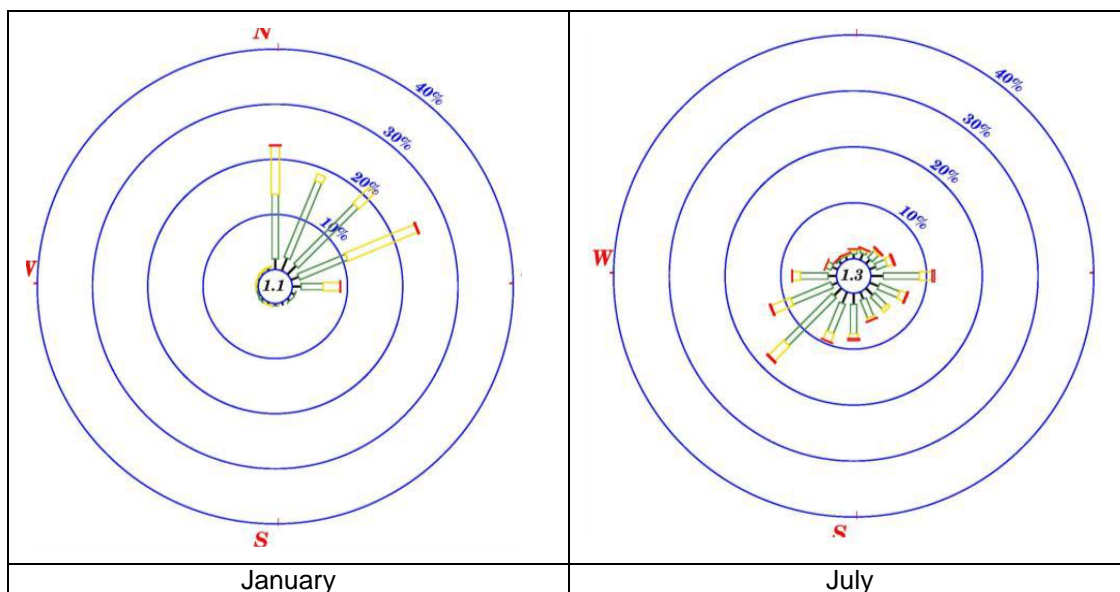


Figure 2.4 Zoomed in Wind Roses (January & July) of WGL (1998 – 2007)

大埔滘 Tai Po Kau

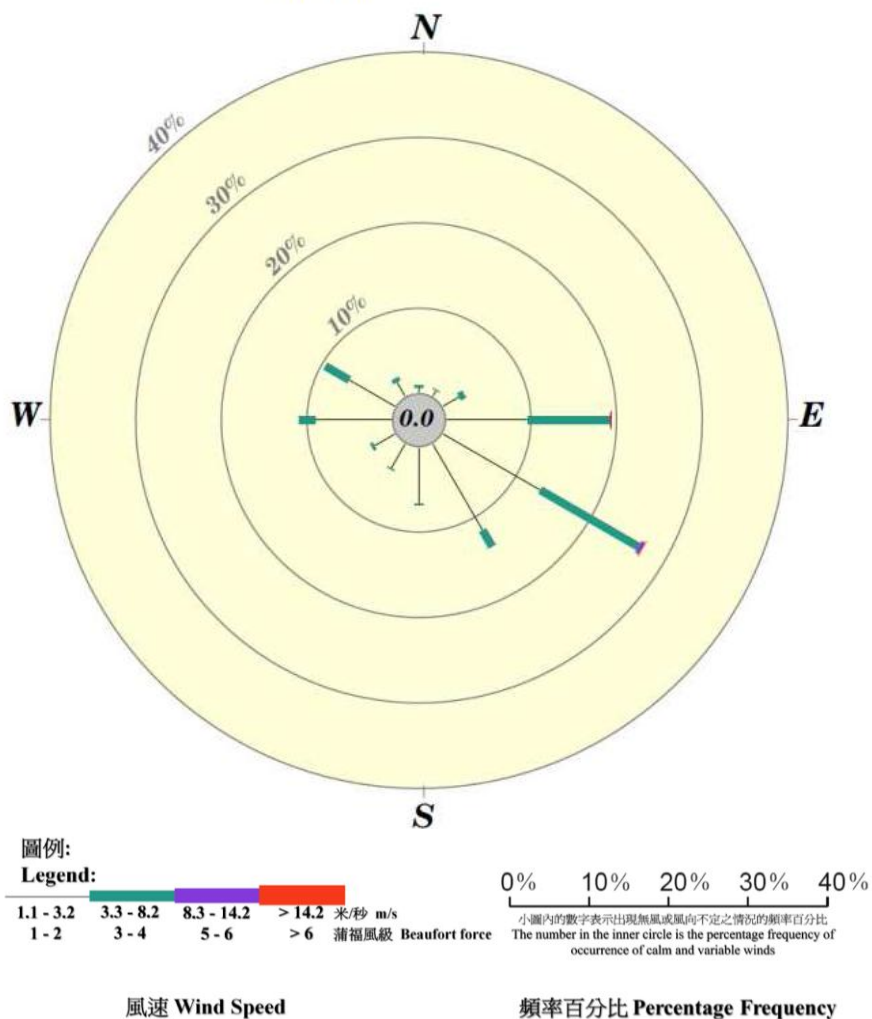


Figure 2.5 Wind Rose of Tai Po Kau Weather Station (2012)

- 2.6 By referring to the annual wind rose at Tai Po Kau station in 2012 shown in **Figure 2.5** above, it is observed that the winds from the east and south eastern quadrants have high probability of occurrence and are considered to be dominant wind directions.
- 2.7 Apart from the wind data from the HKO automatic weather stations mentioned above, the simulation data obtained from the Fifth-Generation Penn State/NCAR Mesoscale Model (MM5) can also representatively reflect the general wind pattern within the study area that is induced by nearby topographical features.
- 2.8 Annual and Summer wind roses which covers the entire year of 2004 at 450m height generated from the MM5 model at the study area is extracted from the “Final Report – Pak Shek Kok (East) Area under Cat A1 Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment (PLNQ 35/2009)” and shown in **Figure 2.6** below.

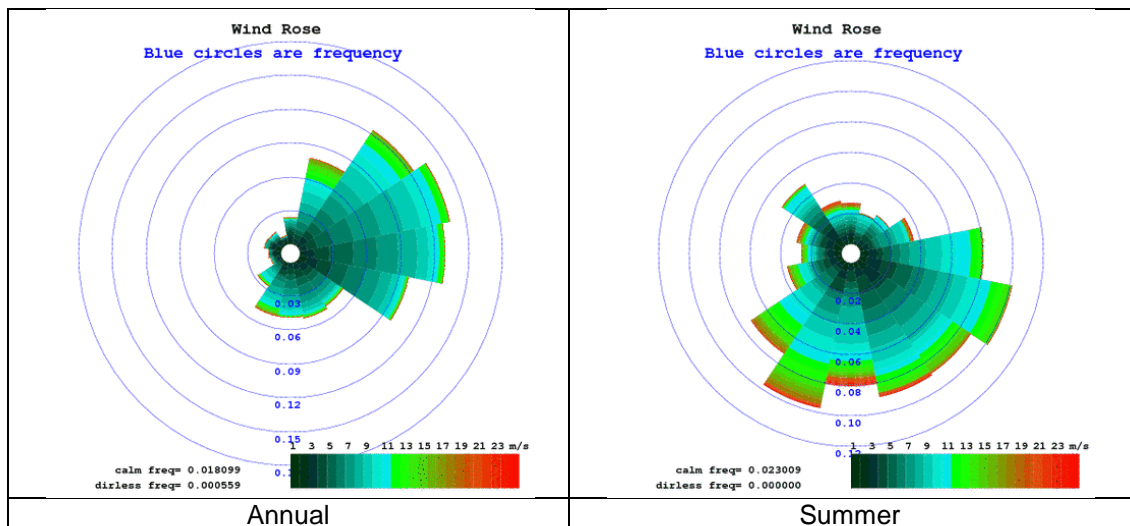
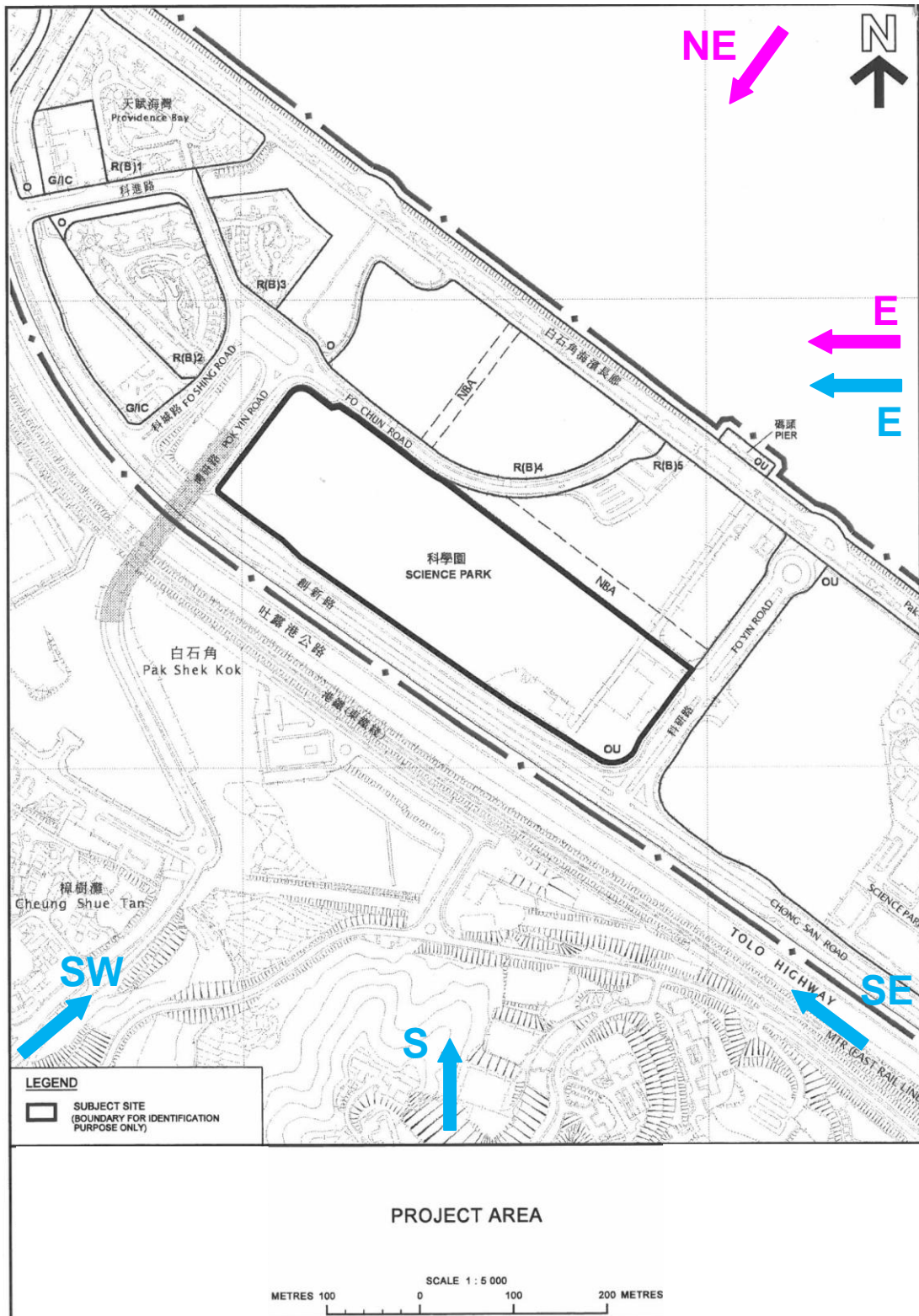


Figure 2.6 Annual and Summer Wind Roses at 450m obtained from MM5 model

- 2.9 Based on the MM5 wind data, the annual wind of the study area is mainly from the Northeast and East direction while the summer wind is coming from the southerly quadrants including South, Southeast and Southwest directions. It should be noted that easterly wind also contributes to certain portion of the summer wind towards the study area.
- 2.10 By summarizing the wind data from both the Hong Kong Observatory and the MM5 model, it can be concluded that the annual wind comes from the Northeast and East directions while the summer wind comes from the East, Southeast, South and Southwest directions.





Annual Prevailing Wind 
 Summer Prevailing Wind 

Figure 2.7 Summary of prevailing winds towards the Study Area

3 TOPOGRAPHY AND THE EXISTING WIND CONDITIONS

- 3.1 **Figure 3.1** shows a digital elevation map of the study area. It can be seen from the figure that the Study Area is fronting the Tolo Harbour which rises from the sea level to around 5mPD. There are hilly topographies lying to the south western directions beyond the Study Area boundary with increasing topological heights further away from the Tolo Harbour.

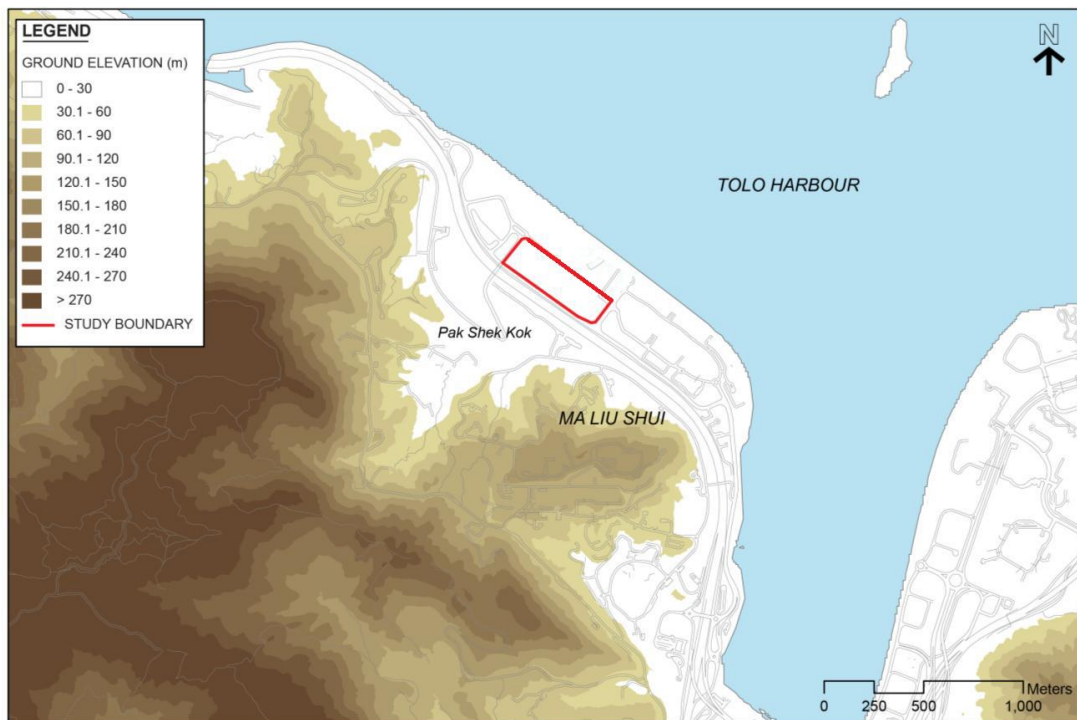


Figure 3.1 Digital Elevation Map of the Study Area

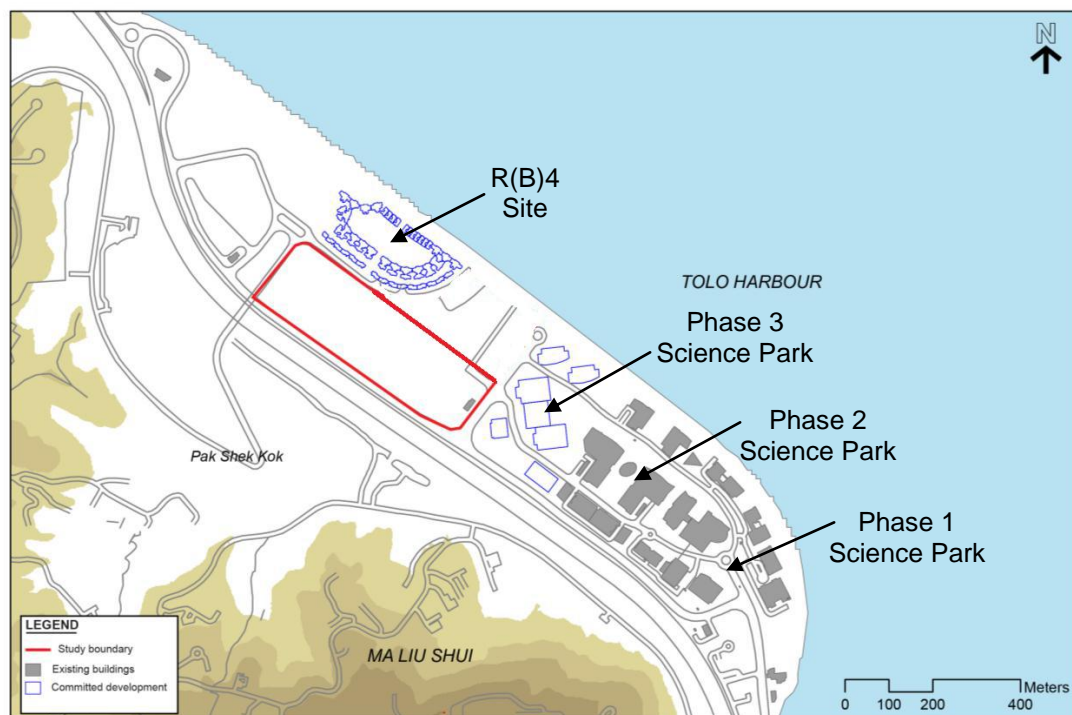


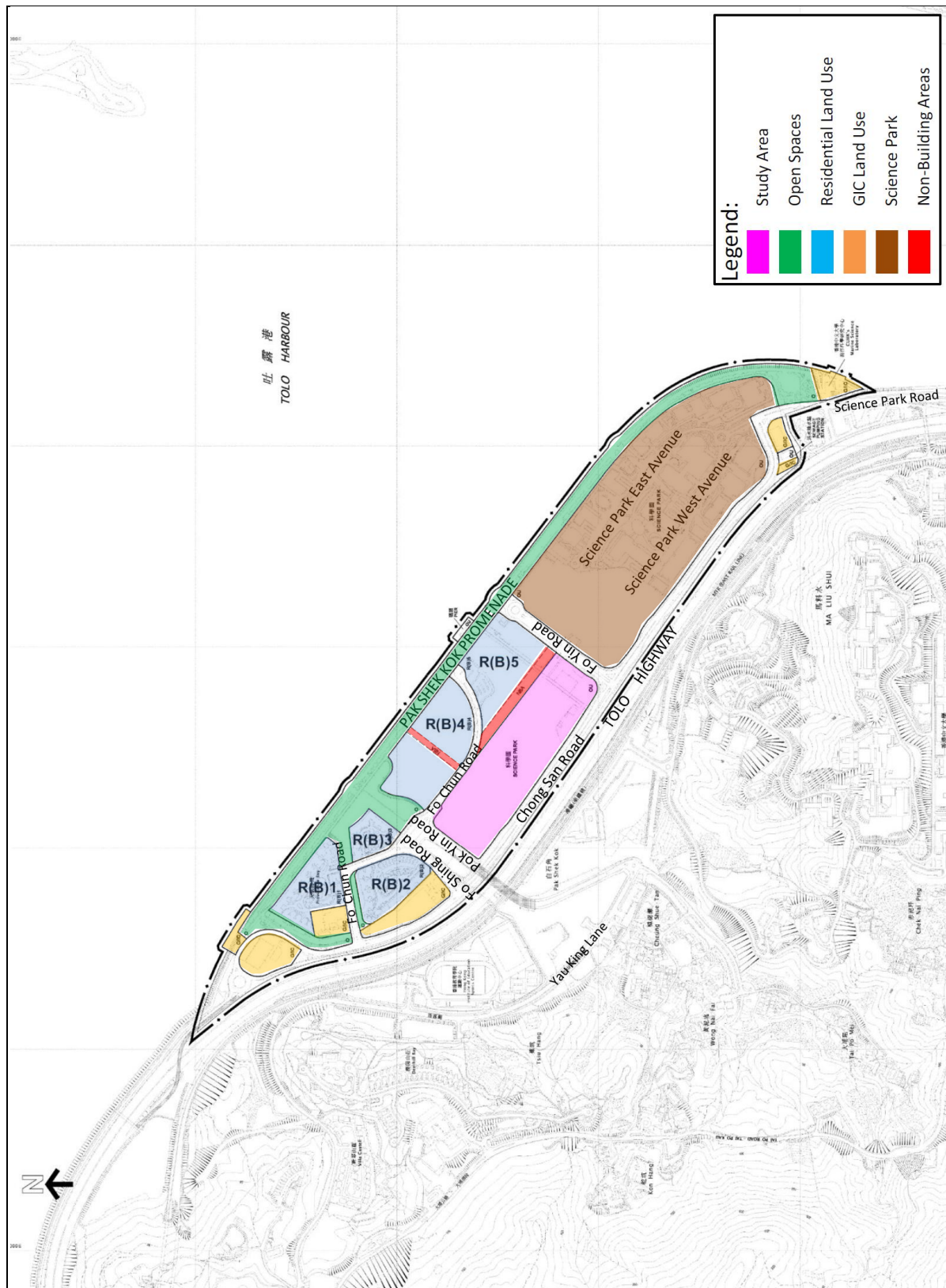
Figure 3.2 Urban conditions and committed developments in Pak Shek Kok

- 3.2 The hilly terrain to the south and south west directions of the Study Area will create a shelter to the summer prevailing winds coming from the southern and south western directions thus weakens the magnitude of these winds towards it.
- 3.3 As shown in **Figure 3.2** above, there are few obstacles (only two to three block buildings at the Science Park Phase 3 and further east is the open water areas of the Tolo Harbour) in the eastern direction of the Study Area; therefore, the annual prevailing wind from the east direction can reach the Study Area with minor obstruction. Under the north eastern wind directions, the wind coming from the Tolo Harbour will be partially blocked by the committed residential developments in the R(B)4 site.
- 3.4 The committed developments within the R(B)4 site mentioned in paragraph 3.3 above are medium density mid rise residential building blocks with maximum building height of approximately 50mPD. The wind from the north eastern direction is expected to create a wind wake region of approximately 50m at the leeward side of the buildings. As a result, any region of the Study Area beyond 50m from the committed development in R(B)4 is expected not to give rise to any air ventilation issues.
- 3.5 Three phases of Science Park are shown in **Figure 3.2** above. Phase 1 and Phase 2 of the Hong Kong Science Park have already been completed in 2004 and 2011 which are medium rise building blocks of 7 to 10 storeys in height. Phase 3 of the Science Park is still under development which would possess a similar building intensity as Phases 1 and 2 are scheduled for completion in 2016. Under the south easterly prevailing wind directions, it is expected that the wind can enter the Study Area through the building separation gaps, major roads, and open spaces in the Science Park.

4 LANDUSE AND EXISTING URBAN MORPHOLOGY

Land Use

- 4.1 The draft Pak Shek Kok (East) Outline Zoning Plan No. S/PSK/11 (the Plan) was exhibited for public inspection during October 2013. The Plan is shown in **Figure 4.1** below and the land use types are stated below:
- The areas hatched in blue colour and purple colours are marked as residential land use. The areas hatched in green colour and orange colour are open spaces and “government institution or community” land uses respectively. The areas hatched in red colour are non-building areas.
 - The area hatched in blue colour in **Figure 4.1** below partly bounded by Pak Shek Kok Promenade and Fo Chun Road and located to the west of Fo Yin Road is zoned as “R(B) 5” with the incorporation of a non-building area.
 - The area hatch in blue colour bounded by Chong San Road, Pok Yin Road and Fo Chun Road and located to the west of Fo Yin Road is annotated as “Science Park”.
 - The area bounded by Fo Shing Road, Chong San Road and Fo Chun Road opposite to zone “R(B)2” is zoned as “Government, Institution or Community” land use.
 - A strip of non-building area is incorporated into the “R(B) 4” zone at Fo Chun Road which is hatched in red colour.



- 4.2 The Study Area hatched in purple colour will be used for Residential Developments. The zones located to the north, north eastern and north western directions of the Study Area which are hatched in blue colour are also used for Residential Developments. The developments in these zones are low to mid rise buildings with maximum heights ranging from 35mPD to 50mPD. There are two non-building areas within “R(B)4” and “R(B)5” toned red in **Figure 4.1**.
- 4.3 The zones hatched in orange colour are primarily for the provision of Government, Institution or Community (GIC) facilities. There are a total of seven GIC sites within the Pak Shek Kok Area. Existing GIC facilities include the Marine Science Laboratory of the Chinese University of Hong Kong (around 25mPD in height) located to the far southern tip of the Pak Shek Kok Area include a refuse collection point, an electricity substation and a public transport terminus together with a sewage pumping station along Chong San Road adjoining the “R(B) 2” zone.
- 4.4 Apart from the GIC facilities mentioned in paragraph 4.3, there are also a few planned GIC facilities including a primary school at Fo Chun Road, a fire station cum ambulance depot and a fire tug pier at the northern part of the Pak Shek Kok Area.
- 4.5 Open Spaces are hatched in green in **Figure 4.1** above. The open spaces in the Pak Shek Kok Area consist of an existing waterfront promenade running along the north eastern boundary of the Pak Shek Kok Area together with a cycle track. There is also an open space area between the residential developments “R(B)1”, “R(B)3” and “R(B)4” zones.

Urban Morphology

- 4.6 **Figure 4.2** below shows the major existing and committed developments at the vicinity of the Study Area.

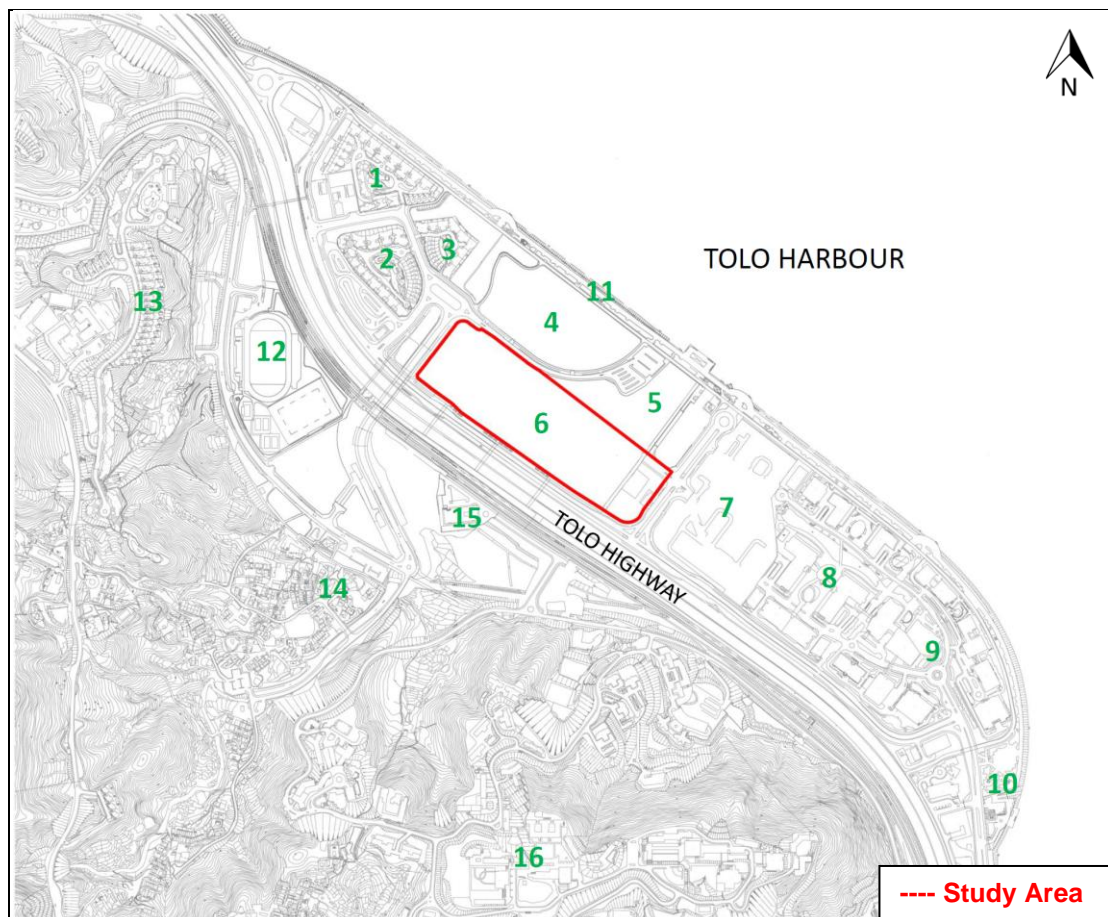


Figure 4.2 Existing and committed developments in Pak Shek Kok (East) Area





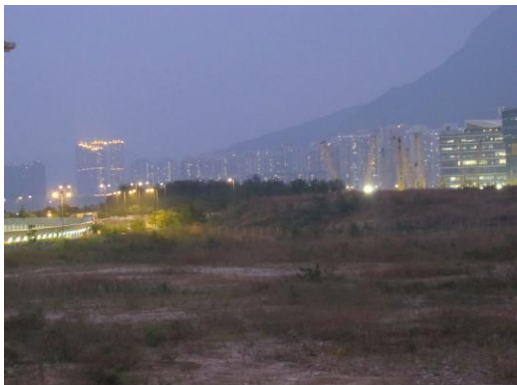



	
<p>1. Residential Group B 1 [R(B) 1]</p>	<p>2. Residential Group B 2 [R(B)2]</p>
	
<p>3. Residential Group B 3 [R(B) 3]</p>	<p>4. Residential Group B 4 [R(B) 4]</p>
	
<p>5. Residential Group B 5 [R(B) 5]</p>	<p>6. Study Area</p>
	
<p>7. Science Park Phase 3</p>	<p>8. Science Park Phase 2</p>

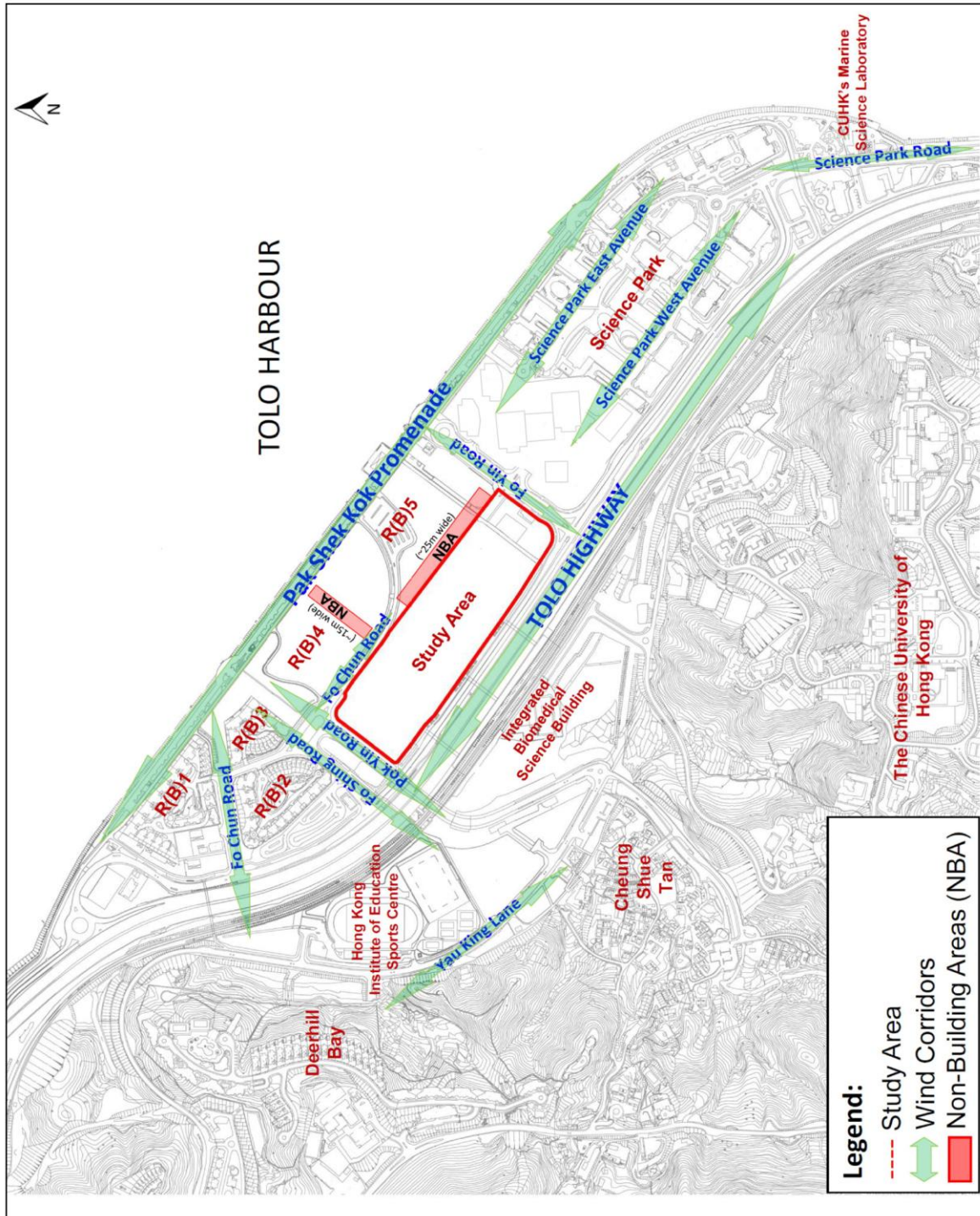


Figure 4.3 **Photos of Existing and committed developments in Pak Shek Kok (East) Area**

- 4.7 The Study Area is bounded by Fo Yin Road, Chong San Road, Pok Yin Road and Fo Chun Road at the central part of the Pak Shek Kok (East) Area which is sandwiched between the areas zoned for residential developments in the north and the west (sites zoned R(B)1 to R(B)5) and the Hong Kong Science Park Phase 3 (currently under construction) to the east.
- 4.8 The committed residential development buildings in the sites zoned R(B)1 to R(B) 5 are low to medium rise ones with maximum building heights approximately ranging from 35mPD to 50mPD.
- 4.9 The Study Area is fronting the Tolo Harbour with the Pak Shek Kok Promenade located at the north eastern direction running along the coastline of the Tolo Harbour. The three phases of the Science Park are located to the south eastern portion of the Study Area in which Phase 3 is still under construction. The existing Science Park has a gross area of about 22 hectares with low to medium rise buildings (height not more than 40 meters). The buildings within the Science Park possess sufficient separation distances and are sparsely populated. Coupled with decreasing building heights from the Tolo Highway towards the Tolo Harbour, no air ventilation issues is to be expected within the Science Park.
- 4.10 To the far south eastern direction of the Study Area locates the CUHK's marine laboratory, to the western direction is an open space named the Hong Kong Institute of Education Sports Centre. Further to the west are the residential building blocks of Deerhill Bay located in an area with relatively high terrain height. Apart from that, to the south western direction of the Study Area are the Integrated Biomedical Science Building and also the Cheung Shue Tan Village. To the far south direction situates the campus of the Chinese University of Hong Kong.

5 WIND CORRIDORS AND AIR PATHS

- 5.1 As mentioned in Section 2, the annual prevailing wind comes from the north eastern quadrant and eastern quadrant while the summer wind comes from the south, south west, south east and east directions. By understanding the prevailing wind directions and studying the building morphology within the Pak Shek Kok (East) Area, major wind corridors are identified as illustrated in **Figure 5.1**.
- 5.2 Under the south eastern wind directions, the Tolo Highway and the Pak Shek Kok Promenade serve as major breezeways. Apart from these two major breezeways, Science Park East Avenue, Science Park West Avenue and Fo Chun Road aligned in parallel with Tolo Highway also serve as wind corridors under the south east prevailing wind direction. Furthermore, Science Park Road aligned in the north south direction also takes up the role as wind corridor under the southerly wind since the winds coming from south can easily reach Science Park area before diverting into the Science Park East/West Avenue. These major roads are important in maintaining air ventilation during summer.
- 5.3 Apart from the roads mentioned in paragraph 5.2, Fo Yin Road, Fo Shing Road and Road L3 aligned in perpendicular to Tolo Highway act as wind corridors under the north easterly wind direction. These roads are crucial in maintaining penetration of winds in the surroundings of the Study Area.
- 5.4 There are two strips of non-building areas (NBA) including a 15m wide strip of NBA in the R(B) 4 zone and a strip of NBA of about 25m wide along the south western side of R(B) 5 zone so as to allow wind to penetrate through the central area of Pak Shek Kok. These two strips of NBA are marked in **Figure 5.1** below in which about 25 meters wide NBA which connects to the breezeway along Fo Chun Road and acts as a breezeway in the south eastern/north western direction. For the 15 meters NBA in the R(B)4 zone, it allows penetration of wind from Tolo Harbour under the north eastern direction through the proposed residential building blocks within the R(B)4 site to and beyond the Study Area.



6 EXPERT EVALUATION ON THE FIRST DEVELOPMENT SCHEME

- 6.1 The Pak Shek Kok (East) Area is mainly planned for medium rise residential and Science Park developments. The Study Area covers the central part of Pak Shek Kok (East) area and is sandwiched between the areas zoned for residential development in the north and west and the Hong Kong Science Park Phase 3 in the east.
- 6.2 The Study Area is mainly bounded by Fo Yin Road, Chong San Road, Pok Yin Road and Fo Chun Road. The Study Area of 8 hectares covers the central part of Pak Shek Kok (East) area subjected to a maximum plot ratio of 3.6 with building height restriction in the range of 60-65mPD. The indicative layout of potential developments at Pak Shek Kok is shown in **Figure 6.1**.
- 6.3 The splitting of Study Area into 4 sub sites (Site 1A, 1B, 1C and 1D) create breezeways between the proposed building clusters under the north eastern and south western wind directions as marked as green arrows in **Figure 6.1**. Furthermore, the splitting of Study Area is useful in reducing long wind wakes which will result in a better wind ventilation performance.
- 6.4 There exist currently two non-building areas (NBA). One is the 15m NBA strip located between Site 1A and Site 1B. This NBA strip creates the wind path within the R(B)4 Site (shown in **Figure 6.2**) located in front of the Study Area which is expected to facilitate the wind flow from the Tolo Harbour to penetrate into the Study Area. This NBA will also reduce wind wakes produced by the building developments within the R(B)4 site which would affect the frontage region of the Study Area under the north eastern wind directions. Imposition of another 25m-wide strip which elongates the south eastern wind corridor created by Fo Chun Road will facilitate penetration of the prevailing wind under the south eastern wind direction and enhance wind ventilation performance at the perimeter of the Study Area.
- 6.5 Site R(B)5 is located at north east to the Study Area. Since it is more close to the Tolo Harbour than the Study Area, it may possibly create blockage effect to the Study Area under the easterly or north easterly winds, if there would be high-rise clusters constructed in this site. It is suggested that the building height in this site should be restricted at 50mPD, in order to create stepping height effect with the buildings in the Study Area as shown in **Figure 6.3**. Another mitigation measure that could enhance the air ventilation condition if there might be any future development in site R(B)5 is to keep reasonable separation (~10m to 15m) between buildings in site R(B)5, which would create wind breezeways.
- 6.6 The NBAs, major wind corridors illustrated in **Figure 6.1** below are crucial in maintaining and enhancing wind ventilation performance within and to the vicinity of the Study Area; future changes in proposed development layouts and arrangements within the Study Area should retain the proposed NBA and major breezeways as marked in **Figure 6.1**.
- 6.7 Well designed road networks within the Study Area are useful to link up the wind corridors in the north eastern/south western directions and the south eastern/north western directions, thus enhance the penetration of the wind into the Study Area and facilitate the air flow within it. It should be noted that there is a proposed major road aligning parallel to Tolo Highway and Fo Chun Road in the south eastern/north western direction within the Study Area. This important proposed road links up the major wind corridors under the north eastern wind direction which is in perpendicular to it, meanwhile providing wind breezeway in an additional direction and promotes good wind comfort.
- 6.8 In the indicative layout, there are around 10 proposed building blocks with varying building heights ranging from approximately 53mPD to 60mPD within each sub site. These proposed buildings possess a stepping building height profile with decreasing building heights from Tolo Highway to Tolo Harbour. In addition, most of the proposed developments possess a podium free design which is useful in increasing wind permeability and reduce blockage to the prevailing winds.

- 6.9 During the design stage of the proposed buildings within the Study Area, reference has been made to Chapter 11 of the Hong Kong Planning Standard and Guidelines on recommended urban design guidelines for air ventilation which cover podium design and waterfront building design. Adequate wide gaps should be provided between building blocks to maximize the air permeability of the development as illustrated in **Figure 6.4** below as an example. In addition, extensive green areas and open spaces could be incorporated in areas between the proposed building blocks.
- 6.10 There are extensive vegetated hill slopes located in the south west directions of the Study Area. Minor katabatic (downhill) air movement can be expected from these vegetated slopes. Summarizing the points discussed in the paragraphs 6.3 to 6.9, it is expected that the current indicative proposed development layout as shown in **Figure 6.1** will not give rise to significant air ventilation issues.



Figure 6.1 Indicative layout and major wind corridors of potential developments at Pak Shek Kok

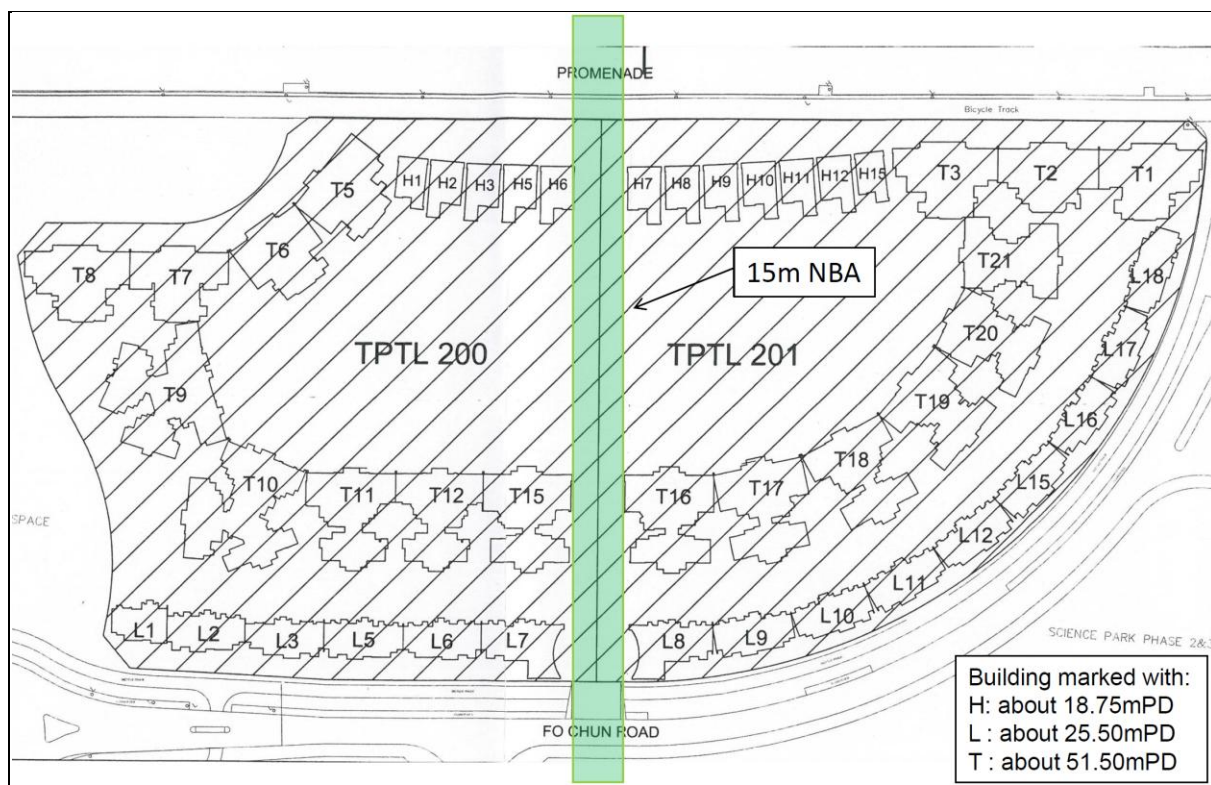


Figure 6.2 Committed development layout within R(B)4 Site and 15 meters NBA

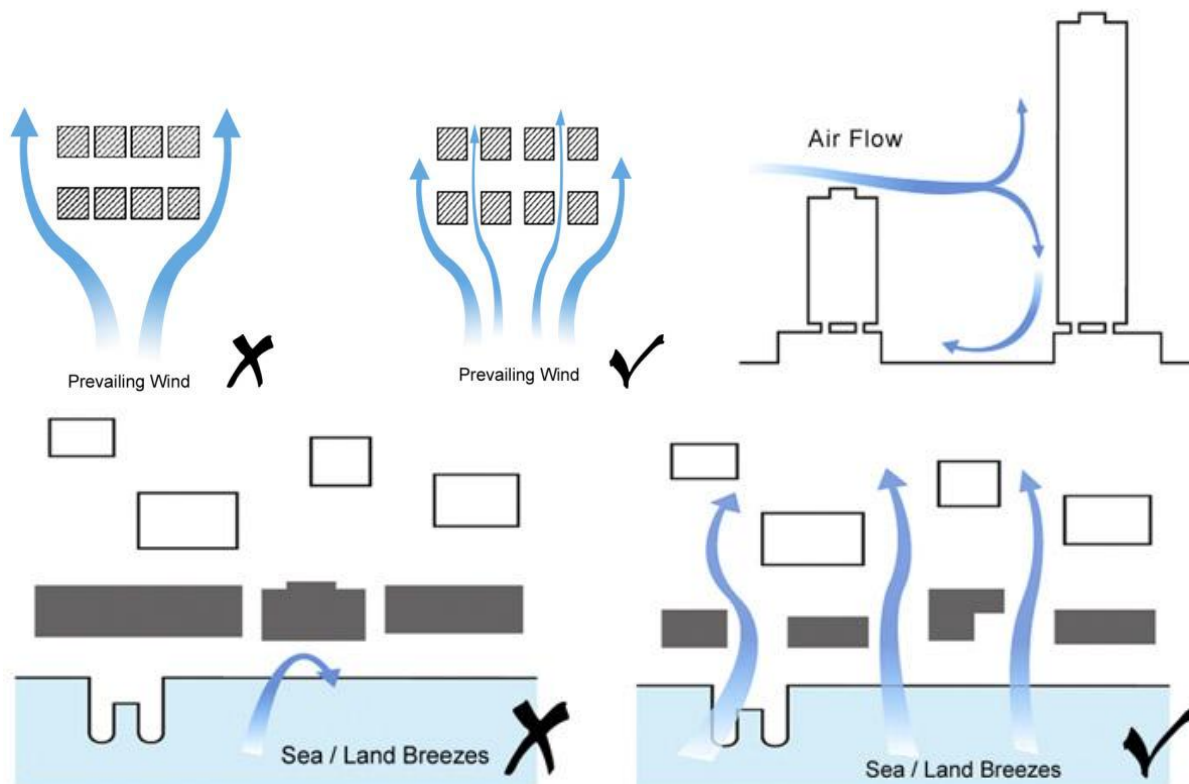


Figure 6.3 Guideline on building disposition, water front building design and design of stepping height profile for better air ventilation



***Figure 6.4 Separation gaps between buildings and buildings recommended for set back within Study Area**

* The layout plan shown in **Figure 6.4** is a draft preliminary design plan and might undergo changes in the future. The orange arrows indicating the separation gaps are only for illustration purposes. Please be noted that the width and length of the arrows do not have any special meanings

7 RECOMMENDATION ON THE FIRST DEVELOPMENT SCHEME

- 7.1 It is understood that a building of height H is generally possible to induce a wind wake of approximately H from the building. Inside the wake region, there exist weaker and more turbulent winds which are collectively referred to as a “wind shadow region” behind the building.
- 7.2 **Figure 7.1** shows the potential shadow region of approximately 60 meters (Tallest Building within Study Area ~60mPD) induced by the proposed developments within the Study Area.

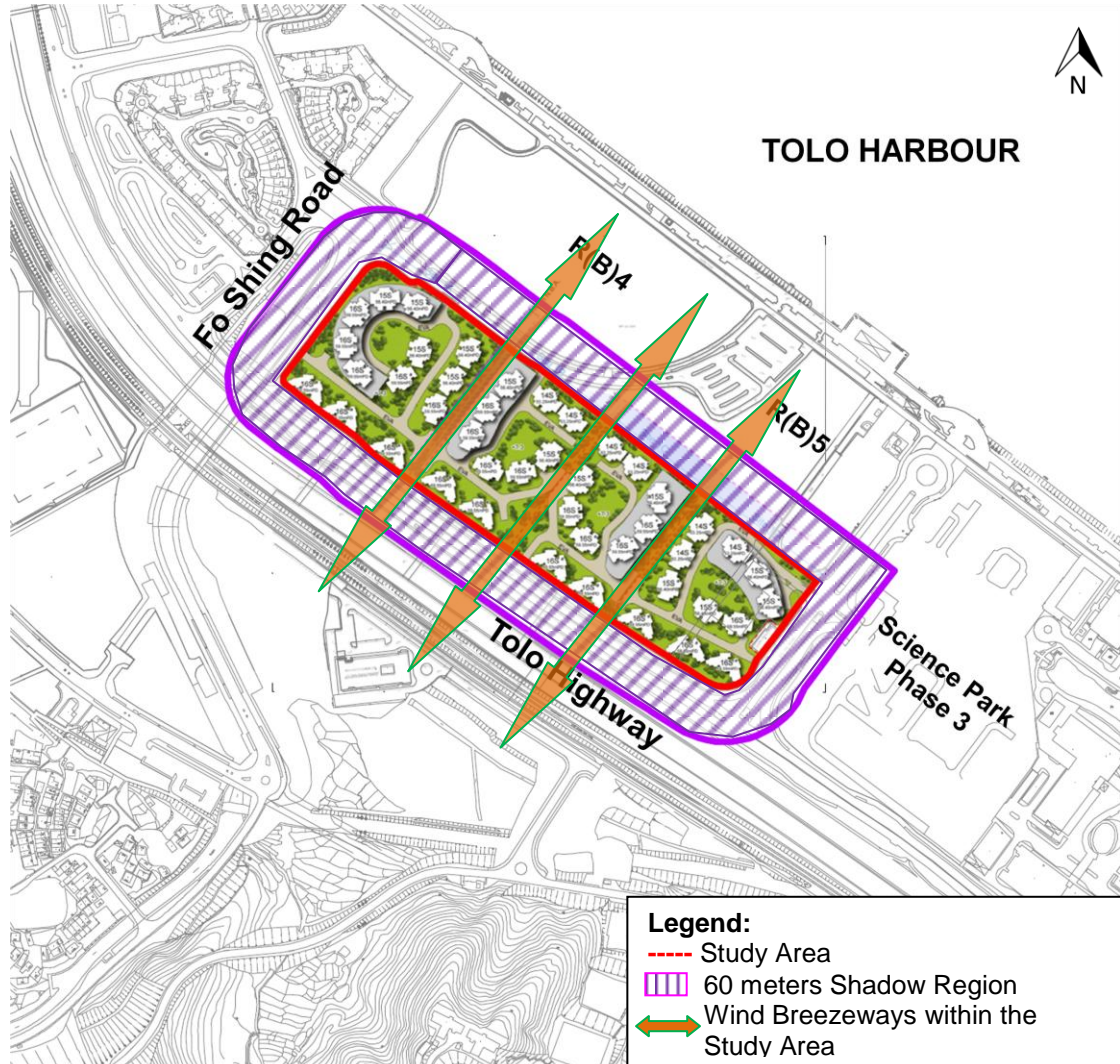


Figure 7.1 Possible wind wakes induced by proposed development within Study Area

- 7.3 The wakes induced under the south easterly wind and the north easterly winds are expected to reach Fo Shing Road and Tolo Highway which are major wind corridors and therefore are unlikely to result in negative impacts on air ventilation to the surroundings. However, wind wakes induced by the summer south westerly winds will create shadow zones to part of the R(B)4 site which might give rise to minor air ventilation issue there. Setting back the windward and leeward buildings under the summer south westerly winds as marked in **Figure 6.4** would help to slightly improve the wind ventilation performance at R(B)4 site.

- 7.4 The created breezeways by the splitting of Study Area into 4 sub sites (Site 1A, 1B, 1C and 1D) create breezeways between the proposed building clusters under the north eastern and south western wind directions will reduce long wind wakes induced and maintain wind performance within the Study Area and therefore must be retained.
- 7.5 It should be noted that the 15 meters wide breezeway created between Site 1A and 1B must be retained as this breezeway not only links up the Tolo Highway which is one of the major breezeway in the south eastern/ north western direction, it also connects to the NBA within the “R(B)4” zone. This 15 meters wide wind breezeway together with the Tolo Highway take up the role in maintaining the air ventilation performance at the north western portion of the Study Area. In addition the wind breezeways created between Site 1B/1C and Site 1C/1D are crucial in maintaining the wind performance within the south eastern portion of the Study Area. These wind breezeways which are recommended to be retained are marked in **Figure 7.1** above.
- 7.6 It should be noted that the committed developments within the R(B)4 site in front of the Study Area possess building heights of maximum 51.5 mPD which are lower than those frontage buildings within the Study Area ranging from approximately 53mPD to 56mPD. This stepping building height profile could be useful in diverting winds to the lower level of buildings and thus slightly enhance pedestrian wind comfort. It is suggested to maintain this kind of stepping building height profile to ensure satisfactory pedestrian wind comfort within the Study Area after the proposed developments.
- 7.7 The two NBAs mentioned in paragraph 6.4 above must be retained in order to achieve satisfactory air ventilation performance. In addition, in order to facilitate air flow within the air paths, any structures/obstacles higher and bulkier than low boundary walls or fences (not more than 3m height) should not be allowed to exist within the NBAs as the larger structures will increase roughness and reduce the efficiency of the NBAs as air paths.
- 7.8 Apart from the two current NBAs mentioned in paragraph 6.4 above, it is also suggested to create non building areas of separation distance 10 to 15 meters between Site 1B/1C or Site 1C/1D. The proposed NBAs are marked in **Figure 7.2** below. In order to ensure wind penetration and air flow within the Study Area, at least one of the proposed NBAs should be considered.



Figure 7.2 Further proposed NBAs within Study Area

- 7.9 In regard to the problem mentioned in paragraph 7.3 above, it is suggested to have further set back (5 to 10 meters) the frontage of the proposed buildings facing the Tolo Harbour in order to widen the Fo Chun Road to create a wider breezeway as shown in **Figure 6.4** above. Apart from that, a minor height relaxation of +5mPD (up to 65mPD) within the Study Area could be imposed along with the set back of the frontage buildings. These measures will not be likely to have great influence on the size of shadow region induced by the study area, thus it is not expected to cause significant air ventilation issues and pedestrian discomfort to the surrounding development.
- 7.10 Based on the above expert evaluation, it is expected that there is no significant air ventilation issues within the Study Area and its surroundings. Therefore, further study is considered to be not necessary.

8 SUMMARY AND CONCLUSION

- 8.1 In the preparation stage of the expert evaluation report, the Consultant has carried out a site visit and inspection.
- 8.2 The Study area is fronting Tolo Harbour with the Pak Shek Kok Promenade located at the north eastern direction running along the coastline of Tolo Harbour. It is bounded by Fo Yin Road, Chong San Road, Pok Yin Road and Fo Chun Road which are at the central part of the Pak Shek Kok (East) Area sandwiched between the areas zoned for committed residential developments in the north and the west and the Hong Kong Science Park Phase 3 (currently under construction) to the east.
- 8.3 By summarizing the wind data from both the Hong Kong Observatory and the MM5 model, it can be concluded that the annual wind comes from the Northeast and East directions while the summer wind comes from the East, Southeast, South and Southwest directions.
- 8.4 Under the south eastern wind directions, the Tolo Highway and the Pak Shek Kok Promenade serves as major breezeways. Apart from these two major breezeways, Science Park East Avenue, Science Park West Avenue and Fo Chun Road aligned in parallel with Tolo Highway also serve as wind corridors under the south east prevailing wind direction. Furthermore, Science Park Road aligned in the north south direction also takes up the role as wind corridor under the southerly wind. These major roads are important in maintaining air ventilation during the summer seasons.
- 8.5 Fo Yin Road, Fo Shing Road and Pok Yin Road aligned in perpendicular to Tolo Highway act as wind corridors under the north easterly wind direction. These roads are crucial in maintaining penetration of winds in the surroundings of the Study Area.
- 8.6 The Study Area of 8 hectares covers the central part of Pak Shek Kok (East) area subject to a maximum plot ratio of 3.6 with maximum building height restriction of 65 mPD. The splitting of Study Area into 4 sub sites creates breezeways between the proposed building clusters under the north eastern and south western wind directions. Furthermore, the splitting of Study Area would reduce long wind wakes and further reduce the air ventilation impact.
- 8.7 It should be noted that the 15 meters wide breezeway created between Site 1A and 1B must be retained. This 15 meters wide wind breezeway together with the Tolo Highway act as a role in maintaining the air ventilation performance at the north western portion of the Study Area. In addition the wind breezeways created between Site 1B/1C and Site 1C/1D are crucial in maintaining the wind performance within the south eastern portion of the Study Area.
- 8.8 There exist currently two non-building areas (NBA). The NBAs are major wind corridors crucial for maintaining and enhancing wind ventilation performance within and to the vicinity of the Study Area. Future changes in proposed development layouts and arrangements within the Study Area must retain the proposed NBA and major breezeways.

- 8.9 In addition to the existing two NBAs, further NBAs of width 10 to 15 meters is suggested to be created between Site 1B/1C or Site 1C/1D. These proposed NBAs would ensure wind penetration and air flow within the Study Area. Therefore, at least one of the proposed NBAs within the Study Area should be considered.
- 8.10 The wakes induced under the south easterly wind and the north easterly winds are expected to reach Fo Shing Road and Tolo Highway which are major wind corridors and therefore are unlikely to result in negative impacts on air ventilation to the surroundings. However, wind wakes induced by the summer south westerly winds will create shadow zones to part of the R(B)4 site which might give rise to minor air ventilation issue there.
- 8.11 It is suggested to have further set back (5 to 10 meters) of the frontage proposed buildings facing Tolo Harbour as marked in **Figure 6.4** in order to widen Fo Chun Road to create a wider breezeway. In order to facilitate air flow within the air paths, only minor structures such as low boundary walls or fences not higher than 3m are allowed to build within the NBAs. Higher and bulkier structures/obstacles are not allowed to be built as these structures will increase roughness and reduce the efficiency of the NBAs as air paths.
- 8.12 A minor height relaxation of +5mPD (up to 65mPD) of the current proposed developments within the Study Area could be imposed. This increment in building height will not have great influence on the size of shadow region induced, thus it is not expected to cause significant air ventilation issues to the surrounding development.
- 8.13 Based on the expert evaluation results, it is expected that there is no significant air ventilation issues within the Study Area and its surroundings. Therefore, further study is considered to be not necessary.