# Appendix H
# Air Ventilation Assessment

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# 1 INTRODUCTION

## 1.1 Study Background

1.1.1 AECOM has been commissioned by CEDD to provide an Air Ventilation Assessment (AVA) to support Section 16 Planning Application for a total of 17 housing sites (the Project Sites) on top of the previous planning application No. A/KTN/54 and the approved Outline Zoning Plan (OZP) No. S/KTN/2, in which the plot ratios and building height restrictions are proposed to be relaxed for additional housing supply and community facilities.

1.1.2 As the proposed changes are only related to plot ratios and building heights with no major changes in the road layouts, building morphologies as well as the urban grid, by carrying out a qualitative AVA in the form of Expert Evaluation is considered appropriate to support the Planning Application by presenting a study of the potential air ventilation impacts associated with the proposed changes to confirm the suitability of the increase in plot ratio and relaxation of building heights for the proposed developments within the Project Sites from the perspective of air ventilation.

# 2 PURPOSE AND STRUCTURE OF THIS AVA EXPERT EVALUATION REPORT

## 2.1 Purpose of this Report

2.1.1 The objective of the Preliminary Air Ventilation Assessment in the form of Expert Evaluation (AVA-EE) is to ensure that air ventilation impacts are duly considered as one of the main criteria in the planning and design process for the increase in plot ratios and building height relaxation of the proposed developments with the Project Sites.

2.1.2 This Preliminary AVA-EE would provide a qualitative assessment to the design and/or design options and facilitates (including the planned/committed development(s) of the nearby area) and identification of potential air ventilation problems and issues that would need warrant attention. It would also identify major breezeway(s), air-path(s), problematic area(s), localized wind effects and possible change in wind patterns due to the intensification of the proposed developments within the 17 Project Sites. Possible design improvements and mitigation measures would be proposed if required in this report as well as recommendations on the necessity of further quantitative AVA Studies will also be provided.

2.1.3 This Expert Evaluation will be conducted in accordance with “Housing Planning and Lands Bureau – Technical Circular No. 1/06, Environment, Transport and Works Bureau – Technical Circular No. 1/06” issued on 19th July 2006 (the Technical Circular) and “Technical Guide for Air Ventilation Assessment for Development in Hong Kong – Annex A” (the Technical Guide).

## 2.2 Structure of the Expert Evaluation Report

2.2.1 Apart from the introductory section on the study background (**Section 1**) and the current section describing the purpose of this AVA Report (**Section 2**), the other sections are structured as follows:

- **Section 3** on the brief description on the Kwu Tung North New Development Area (KTN NDA) and the Project Sites.
- **Section 4** discusses the Project Sites with examination of adjacent existing, planned and committed developments, land usage and the surrounding topographic characteristics.
- **Section 5** identifies the prevailing wind directions via analyzing the applicability of relevant available wind data.
- **Section 6** detailed the proposed development layouts and scenarios for evaluation.
- **Section 7** carries out the Expert Evaluation by identifying the major wind corridors and assesses qualitatively the likely prevailing wind patterns and directions at the pedestrian level at/near the Project Sites within the KTN NDA and its surroundings.
- **Section 8** further recommends potential strategies for further design optimization and recommends good air ventilation design measures to the proposed developments within the Project Sites.
- **Section 9** summarizes and concludes the AVA Expert Evaluation Report.

# 3 KTN NDA AND PROJECT SITES

## 3.1 Description of the Site Environs

3.1.1 The Kwu Tung North New Development Area (KTN NDA) is located at the inland areas of North East New Territories and to the east is the Fanling North New Development Area (FLN NDA). The new KTN NDA is roughly trapezoid in shape in which within it covers Tsung Yuen, Ho Sheung Heung, Long Valley and Yin Kong to its eastern portion; Fung Kong, Tung Fong and Tong Kok at its center portion; Kwu Tung, Shek Tsai Leng, Dills Corner Garden and Pak Shek Au located at its southern portion. The northern portion within the KTN NDA boundary is the knoll of Fung Kong Shan and to the further north of the KTN NDA are terrains of Crest Hill while to the west of the KTN NDA exist the areas belonging to Lok Ma Chau.

3.1.2 This KTN NDA is around 447 ha in total coverage. Currently, the areas are mainly occupied by brownfield uses (i.e., some rural workshops and warehouses activities) and temporary structures. There are also some rural residential dwellings and vegetation scattered in between the brownfield uses. The proposed KTN NDA is bounded by Sheung Yue River to the east, the terrains of Lok Ma Chau to the west, the terrains of Crest Hill to the north and Fanling Highway to its south. The western part of the KTN NDA under the First Phase Assignment is currently under site formation and construction. The seventeen Project Sites (i.e., A1 to A5 and B1 to B12), which are the major focus of the current AVA Study, are near each other at the central to south-western portions within the KTN NDA. The location and the environs of the KTN NDA and the Project Sites are illustrated in **Figure 3.1**.

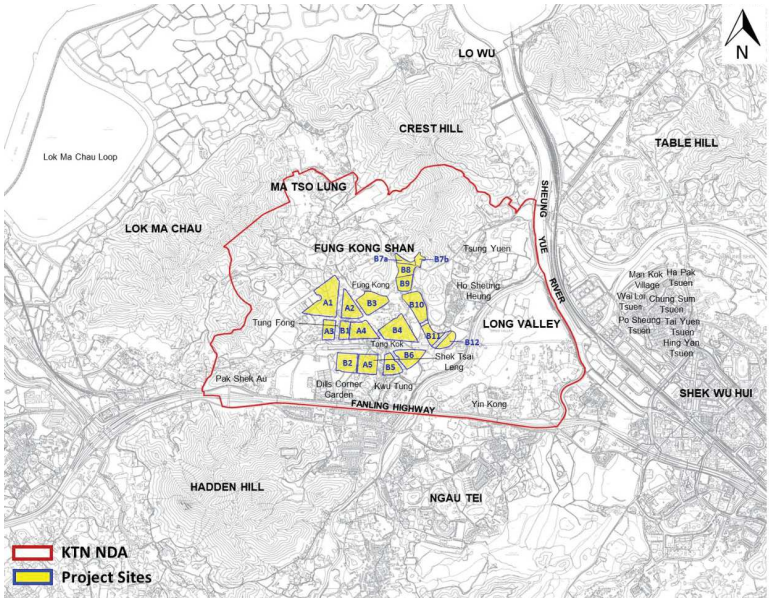



**Figure 3.1 Location of the KTN NDA and Project Sites**





# 4 LAND USE, TOPOGRAPHY AND EXISTING URBAN MORPHORLOGIES

## 4.1 Land Use

4.1.1 On the Outline Zoning Plan, there are various types of planned land uses within the KTN NDA as shown on **Figure 4.1**.

4.1.2 Reflecting the rural character of the KTN NDA, the largest statutory designation across the KTN NDA is "Green Belt" areas, mainly located to the northern sector of the KTN NDA with certain areas of "Government, Institution or Community (G/IC)" land uses mixed within. There are also "Agricultural" lands, "Other Specified Uses" lands and "Village Type Developments" spotted mainly at the eastern sector of the KTN NDA.

4.1.3 Among the 17 Projects Sites located at the central to south-western sector of the KTN NDA, 7 of which are zoned for "Residential (Group A)" developments while the rest 10 are zoned for "Residential (Group B)". The existing developments within the Project Sites are occupied by brownfields, temporary structures and low-rise village houses of Tung Fong, Fung Kong, Tong Kok and Shek Tsai Leng. There are also a few "Residential (Group A)" and "Residential (Group B)" lands located at the immediate vicinity of the Project Sites. Majority of the areas at Dills Corner Gardens had already been zoned as "Other Specified Uses" ("OU") annotated "Business and Technology Park", "OU" annotated "Commercial/Residential Development with Public Transport Interchange", "OU" annotated "Mixed Use" and "Government, Institution or Community" usage lands, with minor part of lands in between the cluster of the Project Sites falling under the "Open Space" zones on the prevailing Approved KTN OZP (Plan No. S/KTN/2) The northern part of the NDA is zoned as "OU" annotated "Research and Development".

4.1.4 Since the KTN NDA is located at the rural areas of Hong Kong, the majority lands surrounding the KTN NDA are "Green Belt", "Agriculture", "Other Specified Uses" annotated for Business and Technology Park" as well as scattered areas of "Village Type Development". To the west of the Project Sites outside the KTN NDA are Green Belt areas of Lok Ma Chau, while to the north of the Project Sites are mainly Green Belt areas of Fung Kong Shan and to the further north are the "Agricultural" lands of Ma Tso Lung the "Green Belt" areas belonging to Crest Hill. There are currently scattered low-rise developments located to the immediate east of the Project Sites which would be planned to be developed into GIC buildings and residential blocks while the village houses of Ho Sheung Heung would be retained. To the further east outside the KTN NDA across the Sheung Yue River/Shek Sheung River are some "Other Specified Uses" lands and village houses of Wai Lo Tsuen. To the south of the Project Sites, across the Fanling Highway are zoned as "Residential (Group C)" land use, which are existing low rise residential developments of Europa Garden, the Valais and Casas Domingo.

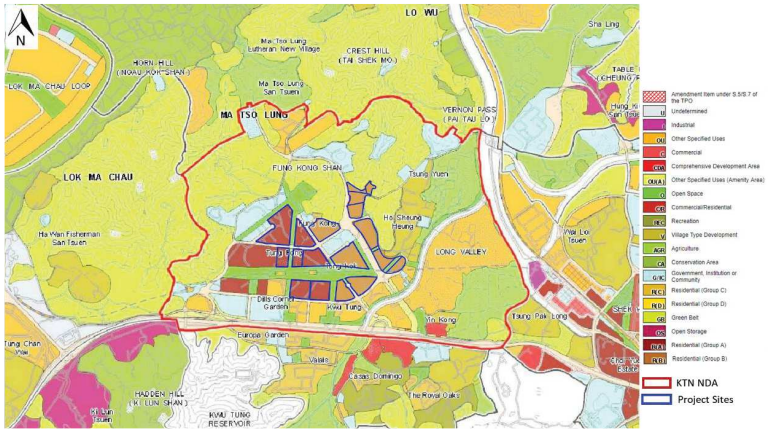



**Figure 4.1 Land Use within and near the KTN NDA**

## 4.2 Topography

4.2.1 The KTN NDA is in the north-eastern portion of the New Territories. As shown in **Figure 4.2**, most of the Project Sites are located at a sizable flatland surrounded by hilly terrains with varying height. The topographical height of the terrains to the north and further north-eastern directions to the KTN NDA are the hilly terrains of Crest Hill and Sandy Ridge respectively with terrain height of more than 100mPD. To the near east of the KTN NDA are Fanling and Sheung Shui New Town situated on the flatlands as well as the terrains of High Hill located to the far east. There are also hilly terrains of approximately 100mPD belonging to the Lok Ma Chau area located to the near west of the KTN NDA, while the lands belonging to San Tin are relatively flat.

4.2.2 The topographies located at the southwest, southern and south-eastern portion of KTN NDA are generally less than 50 mPD. The most observable terrains to the south and south westerly directions of the KTN NDA are Hadden Hill with maximum terrain altitude of 200mPD and Ngau Tam Shan with maximum terrain elevation of 340mPD respectively. Less steeper terrains of Fuk Tsuen Shan (~50mPD) can be found to be located at the south-east directions of the KTN NDA and Kei Lak Tsai with maximum elevation of 250mPD can be found to the further south-east directions. **Figure 4.2** illustrates the topographies near the KTN NDA.

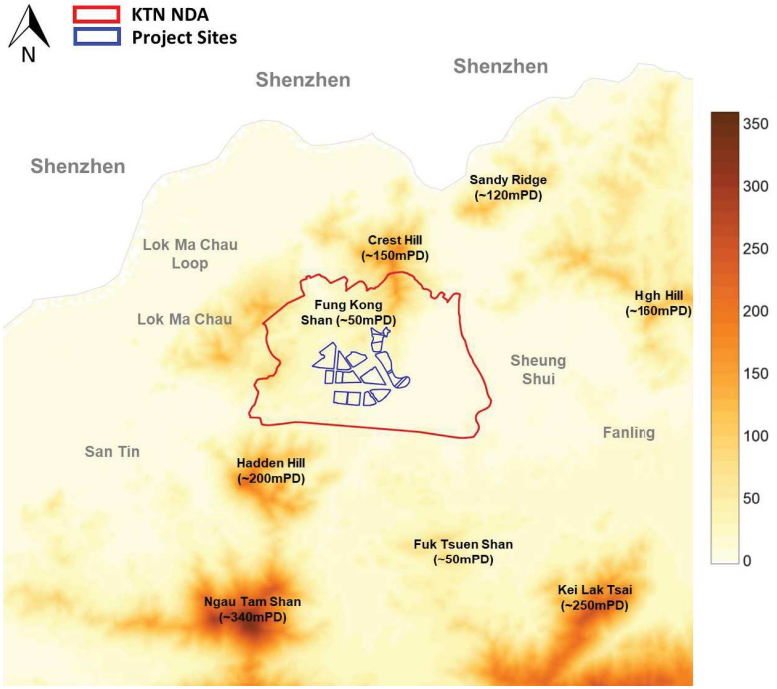



**Figure 4.2 Topographical Map near the KTN NDA and Project Sites**





## 4.3 Existing Urban Morphology

4.3.1 The KTN NDA is located at the north-eastern portion of the New Territories that is relatively less developed areas of Hong Kong. The KTN NDA is currently generally covered by rural settlements or low-rise low-density residential villages, as well as open storage yards or rural industries.

4.3.2 The KTN NDA is generally relatively flat. Several existing village environs are located inside the KTN NDA in which these villages environs are mostly preserved or to be built with 3-storey in height. These existing villages include the Tsung Yuen and Ho Sheung Heung as well as Yin Kong located at the eastern section of the KTN NDA. The areas located to the north and west of the KTN NDA are relatively rural with a few existing village house developments namely the Ma Tso Lung San Tsuen, Chau Tau Tsuen, Pun Uk Tsuen and San Tin Heung. The Lok Ma Chau Loop located to the north-west direction of the KTN NDA is planned to be developed into mid-rise buildings of approximately 54mPD.

4.3.3 To the south of the KTN NDA, at the east of the Hadden Hill exist several low density private residential developments include but not limited to the Europa Garden, Valais, Casas Domingo, The Royal Oaks, Goodwood Park, Regent Garden, St. Andrews Place and Oakville etc. To the south-east of the KTN NDA, on both sides of the portion of Fanling Highway near Shek Wu Hui, relatively urbanized areas can be found with existence of several housing estates which include the Cheung Lung Wai Estate, Ching Ho Estate, Tai Ping Estate, Choi Yuen Estate, and the Po Shek Wu Estate.

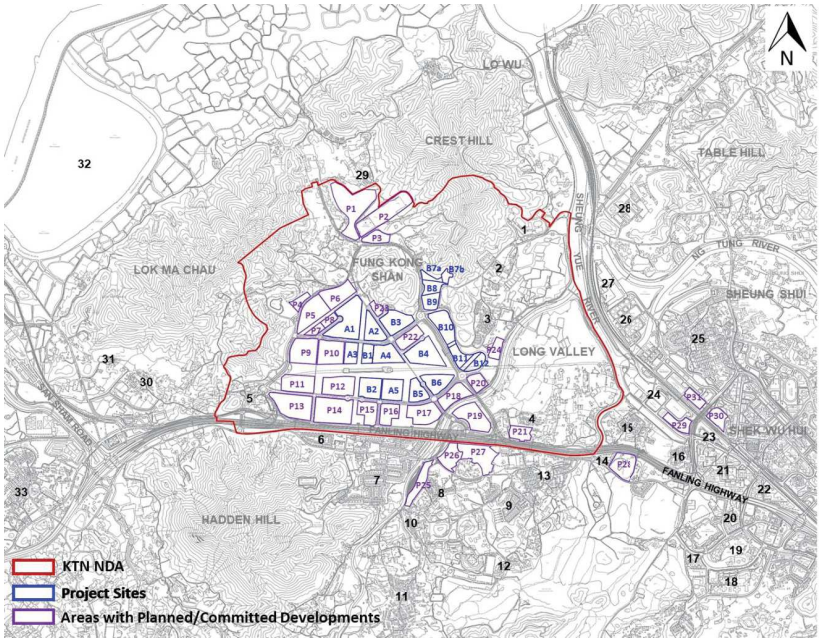
4.3.4 To the east of the KTN NDA across the Sheung Yue River/ Shek Sheung River mainly are lands for Industrial usage where Hi Tech Centre, Advanced Technology Centre and Jumbo Plaza are located. There are also buildings of the two Sewage Treatment Works namely the Shek Wu Hui Sewage Treatment Works and the Sheung Shui Treatment Works located to the east side of the KTN NDA. To the east and north of the Shek Wu Hui Treatment Works are the Sheung Shui Slaughterhouse and Chung Sum Tsuen with its surrounding villages respectively. The locations of the above-mentioned places are marked in **Figure 4.3**.

4.3.5 The seventeen Project Sites are located within the KTN NDA, marked as A1 to A5 and B1 to B12 in **Figure 4.3**. Within the KTN NDA, surrounded the Project Sites cluster, exist extensive areas with planned / committed developments. These areas are marked with prefix P from P1 to P24 in **Figure 4.3**.

4.3.6 P1 to P3 areas are located to the north of the Project Site cluster are mainly planned to be constructed into GIC and other specified usage buildings. The P4 to P8 areas and the P13 to P14 areas located to the near northwest and southwest directions of Project Sites A1 and A3 respectively are mainly planned for GIC usages. Areas P9 to P12 located to the west of the Project Site cluster respectively are planned to be constructed into high rise residential blocks with ancillary facilities. Other planned specified usage buildings such as Hospitals, Clinics, Health Centers, Commercial and Research Development Buildings as well as GIC buildings such as schools can be found at areas P13 to P20, located to the southerly and south easterly directions of the Project Site cluster. It is worthwhile to point out that Non-Building Areas (NBAs) have been incorporated within areas P15 to P19 as well as Project Sites B10 to B14. Terraced podiums which are considered as one of the good design measures in improving the air ventilation performance can be found within areas P10, P12 and P15.

4.3.7 Apart from the areas with committed / planned developments within the KTN NDA (i.e., P1 to P24), there are also several areas with planned / committed residential developments at the near vicinity of the KTN NDA (i.e., P25 to P31). The four areas P25 to P27 located to the south direction as well as area P28 located to the south-east direction of the KTN NDA are planned to be developed into private residential blocks. There would also be high-rise residential blocks anticipate appearing within areas P29 to P31.

4.3.8 The illustrational figures in **Annex I** provide an overview of the building layouts and morphologies within areas with planned / committed developments as well as the maximum building heights and locations of NBAs and terraced podiums.




| Description | Approximate Max. Building Heights (mPD) | Description | Approximate Max. Building Heights (mPD) |
|---|---|---|---|
| ***Project Sites*** | | | |
| A1 | ~180mPD | A2 | ~160mPD |
| A3 | ~145mPD | A4 | ~140mPD |
| A5 | ~135mPD | B1 | ~130mPD |
| B2 | ~130mPD | B3 | ~95mPD |
| B4 | ~85mPD | B5 | ~80mPD |
| B6 | ~80mPD | B7(a), (b) | ~100mPD |
| B8 | ~90mPD | B9 | ~85mPD |
| B10 | ~110mPD | B11 | ~90mPD |
| B12 | ~90mPD | | |
| ***Planned and Committed Developments within the KTN NDA*** | | | |
| P1 – Other Specified Uses (Research and Development, Commercial) | ~65mPD | P2 – Existing Firing Range | - |
| P3 – GIC Buildings | ~65mPD | P4 – GIC Building (School) | ~52mPD |
| P5 – GIC Buildings (District Headquarters and its Associated Married Staff Quarters, Divisional Police Station) | ~101mPD | P6 – GIC Buildings (Standard Swimming Pools and Sports Centre) | ~53mPD |
| P7 – GIC Buildings (Schools) | ~44mPD | P8 – GIC Buildings (Schools) | ~52mPD |
| P9 – Residential Buildings | ~151mPD | P10 – Residential Buildings | ~146mPD |
| P11 – Residential Buildings | ~135mPD | P12 – Residential Buildings | ~120mPD |
| P13 – GIC Buildings (Hospital, Polyclinic and General Clinic / Health Centre) | ~63mPD | P14 – GIC Buildings | ~64mPD |





| Description | Approximate Max. Building Heights (mPD) | Description | Approximate Max. Building Heights (mPD) |
|---|---|---|---|
| P15 – Mixed Use (Residential and Commercial Buildings) | ~110mPD | P16 – Other Specified Uses (Business and Technology Park) | ~60mPD |
| P17 – Other Specified Uses (Business and Technology Park) | ~55mPD | P18 – Other Specified Uses | ~55mPD |
| P19 – Other Specified Uses (Business and Technology Park) | ~55mPD | P20 – Other Specified Uses (Business and Technology Park) | ~55mPD |
| P21 – Residential Buildings | ~18mPD | P22 – GIC Buildings (School) | ~35mPD |
| P23 – GIC Buildings (School) | ~44mPD | P24 – Village Houses | ~16mPD |
| ***Planned and Committed Developments outside and near the KTN NDA*** | | | |
| P25 – Residential Buildings | ~23mPD | P26 – Residential Buildings | ~75mPD |
| P27 – Residential Buildings | ~75mPD | P28 – Residential Buildings | ~130mPD |
| P29 – Residential Buildings | ~143mPD | P30 – Residential Buildings | ~130mPD |
| P31 – Residential Buildings | ~149mPD | | |
| ***Existing Developments within and near the KTN NDA*** | | | |
| 1. Lo Wu Correctional Institute | 4 storeys | 2. Tsung Yuen | ~23mPD |
| 3. Ho Sheung Heung | ~23mPD | 4. Yin Kong | ~16mPD |
| 5. Pak Shek Au/Planned Plant for district cooling system | ~35mPD | 6. Europa Garden | ~36mPD |
| 7. Valais | ~23mPD | 8. Casas Domingo | ~22mPD |
| 9. The Royal Oaks | ~27mPD | 10. Goodwood Park | ~17mPD |
| 11. Regent Garden | ~22mPD | 12. St. Andrews Place | ~41mPD |
| 13. Oakville | 3-4 storeys | 14. Golf Parkview | ~31mPD |
| 15. Tsung Pak Long | ~17mPD | 16. Tai Tau Leng | ~15mPD |
| 17. Cheung Lung Wai Estate | ~143mPD | 18. Ching Ho Estate | ~133mPD |
| 19. Royal Green | ~136mPD | 20. Tai Ping Estate | ~91mPD |
| 21. Choi Yuen Estate | ~90mPD | 22. Yuk Po Court | ~71mPD |
| 23. Po Shek Wu Estate | ~114mPD | 24. Hi Tech Centre, Advanced Technology Centre, Jumbo Plaza | ~40mPD |
| 25. Chung Sum Tsuen and surrounding villages | ~20mPD | 26. Shek Wu Hui Sewage Treatment Works | ~25mPD |
| 27. Sheung Shui Slaughterhouse | 4 storeys | 28. Sheung Shui Treatment Works and Freshwater Pumping Station | - |
| 29. Ma Tso Lung San Tsuen | ~25mPD | 30. Chau Tau Tsuen | ~13mPD |
| 31. Pun Uk Tsuen | ~19mPD | 32. Lok Ma Chau Loop | Proposed development of around ~54mPD |
| 33. San Tin Heung | ~19mPD | | |

**Figure 4.3 Existing / Committed / Planned Major Developments near / within the KTN NDA**

# 5 WIND AVAILABILITY

## 5.1 Planning Department RAMS Wind Data

5.1.1 Natural wind availability is crucial to the investigation of wind ventilation performance and identification of prevailing wind directions. There are three sources of site wind data – RAMS data from Planning Department, experimental wind tunnel data and measured data from weather station (from Hong Kong Observatory, HKO).

5.1.2 In this section, computed wind data from the Regional Atmospheric Modelling System (RAMS), at the region near the KTN NDA are analyzed and compared to identify the prevailing wind directions.

5.1.3 Hong Kong Planning Department (PlanD from hereafter) released a set of predicted wind data from the simulation via RAMS model. The wind data representing the predicted wind availability is extracted from a total of five grids on the coverage of the Project Sites. The identified grids with respect to the KTN NDA are schematically shown in **Figure 5.1**. The annual and summer wind roses at 200m level at these identified grids are presented in **Figure 5.2** below.

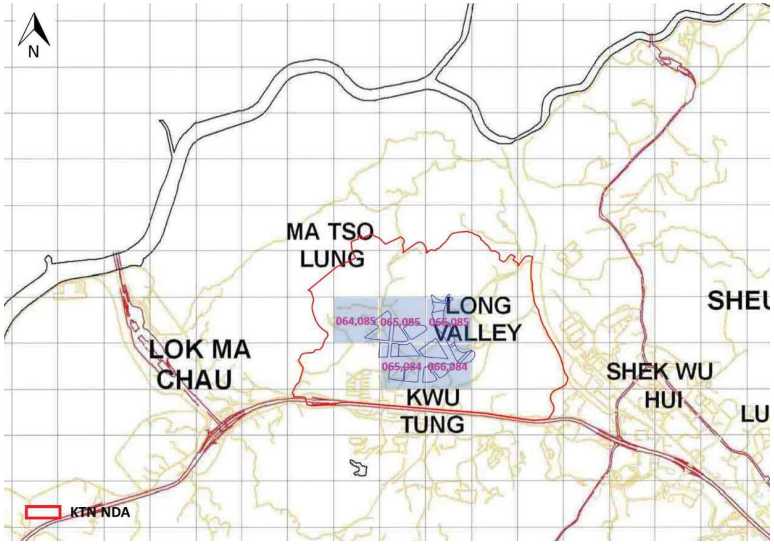
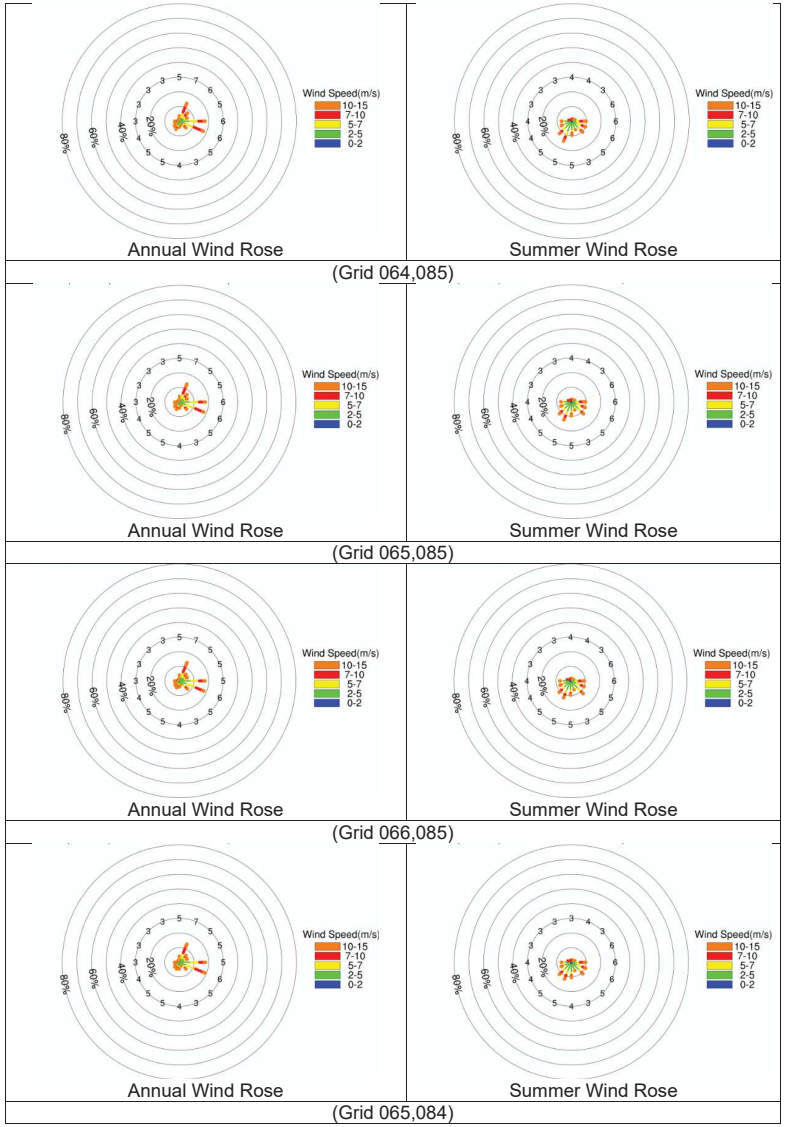



**Figure 5.1 Locations of RAMS grids covering the Project Sites for Wind Data Extraction**







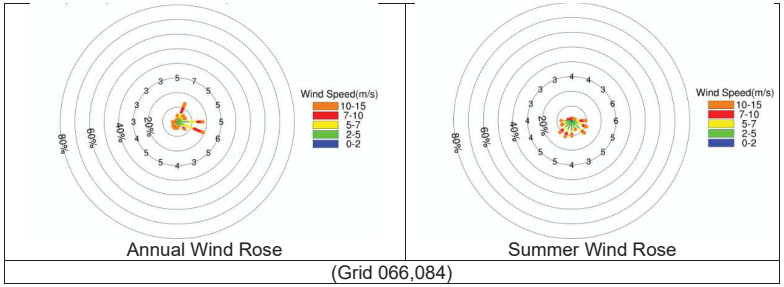



**Figure 5.2 200m Annual and Summer Wind Roses of the five RAMS grids covering the Project Sites**

5.1.4 Directional wind with the highest percentage of occurrences is identified for both annual and summer seasons with the percentage occurrences for the wind directions tabulated in **Table 5.1a** and **Table 5.1b**. As observed from these tables, grids covering the Project Sites have prevailing wind from NNE, E, and ESE would generally dominate the wind availability for annual season. During summer seasons, the prevailing wind mostly originate from the southern quadrant, including ESE, SE, S, SSW and SW, dominating the wind environment. with average of more than 10% of percentage occurrences for the five identified RAMS grids.

**Table 5.1a Frequencies of Annual Occurrence of Individual Wind Directions at 200mPD for KTN NDA and Project Sites**

| Wind Directions | Annual, 200m | | | | |
|---|---|---|---|---|---|
| | | Frequency Occurrence | | | |
| | Grid (64,85) | Grid (65,85) | Grid (66,85) | Grid (65,84) | Grid (66,84) |
| N | 3.6% | 3.9% | 4.1% | 4.2% | 4.3% |
| **NNE** | **13.2%** | **13.3%** | **13.6%** | **13.3%** | **13.4%** |
| NE | 7.9% | 7.2% | 6.3% | 6.5% | 5.9% |
| ENE | 5.9% | 5.8% | 5.9% | 5.9% | 6.0% |
| **E** | **17.6%** | **17.8%** | **17.6%** | **17.9%** | **17.6%** |
| **ESE** | **17.8%** | **18.1%** | **18.1%** | **18.8%** | **19.1%** |
| SE | 6.4% | 7.0% | 7.9% | 6.4% | 7.1% |
| SSE | 2.6% | 2.5% | 2.6% | 2.6% | 2.7% |
| S | 4.2% | 4.1% | 4.2% | 4.5% | 4.5% |
| SSW | 6.0% | 5.4% | 5.1% | 5.1% | 4.8% |
| SW | 4.7% | 4.5% | 5.1% | 4.4% | 4.2% |
| WSW | 3.3% | 3.3% | 3.2% | 3.2% | 3.1% |
| W | 3.2% | 3.2% | 3.3% | 3.1% | 3.2% |
| WNW | 1.4% | 1.4% | 1.4% | 1.5% | 1.5% |
| NW | 0.8% | 1.1% | 1.0% | 1.1% | 1.1% |
| NNW | 1.4% | 1.4% | 1.4% | 1.5% | 1.5% |





**Table 5.1b Frequencies of Summer Occurrence of Individual Wind Directions at 200mPD for KTN NDA and Project Sites**

| Wind Directions | Summer, 200m | | | | |
|---|---|---|---|---|---|
| | | Frequency Occurrence | | | |
| | Grid (64,85) | Grid (65,85) | Grid (66,85) | Grid (65,84) | Grid (66,84) |
| N | 1.4% | 1.6% | 1.7% | 1.6% | 1.6% |
| NNE | 1.8% | 1.8% | 1.9% | 1.8% | 1.8% |
| NE | 1.3% | 1.3% | 1.2% | 1.2% | 1.3% |
| ENE | 2.6% | 2.6% | 2.6% | 2.7% | 2.6% |
| E | 9.8% | 9.9% | 9.6% | 9.9% | 9.6% |
| **ESE** | **10.2%** | **10.2%** | **10.2%** | **10.7%** | **10.9%** |
| **SE** | **10.4%** | **11.6%** | **12.4%** | **11.2%** | **11.9%** |
| SSE | 6.3% | 6.1% | 6.5% | 6.2% | 6.4% |
| **S** | **9.6%** | **9.6%** | **9.8%** | **10.5%** | **10.4%** |
| **SSW** | **14.7%** | **13.4%** | **12.6%** | **12.4%** | **11.8%** |
| **SW** | **12.1%** | **11.6%** | **11.2%** | **11.7%** | **11.4%** |
| WSW | 7.7% | 7.8% | 7.8% | 7.5% | 7.3% |
| W | 7.1% | 7.2% | 7.4% | 6.9% | 7.2% |
| WNW | 2.4% | 2.5% | 2.6% | 2.8% | 2.8% |
| NW | 1.2% | 1.4% | 1.3% | 1.5% | 1.5% |
| NNW | 1.4% | 1.4% | 1.2% | 1.4% | 1.5% |

## 5.2 Wind Tunnel Experimental Wind Data

5.2.1 With reference to the "Experimental Site Wind Availability Study for The North-East New Territories New Development Areas" which was conducted in 2010. The site wind availability study was conducted using a 1:2000 scale topographical model to determine the effects of surrounding topography and urban environment on mean wind speeds and turbulence intensities above the KTN NDA and FLN NDA. Although **Figure 5.3** shows both the two NDAs and its corresponding locations of the measurement points in the site wind availability study, focus would be on the wind data for the KTN NDA as the major aim of this current study and report is for evaluation of the air ventilation performance of the eleven Project Sites within KTN Area. Photographs of the 1:2000 scale topographical model of the KTN in the low-speed test section under north, east, south, and west directions are shown in **Figure 5.4** for reference.

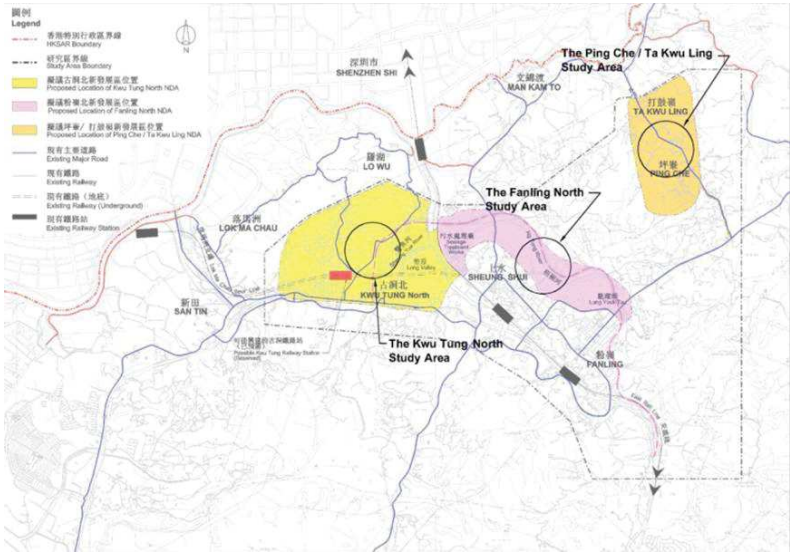



**Figure 5.3 Wind Tunnel Test for KTN NDA**





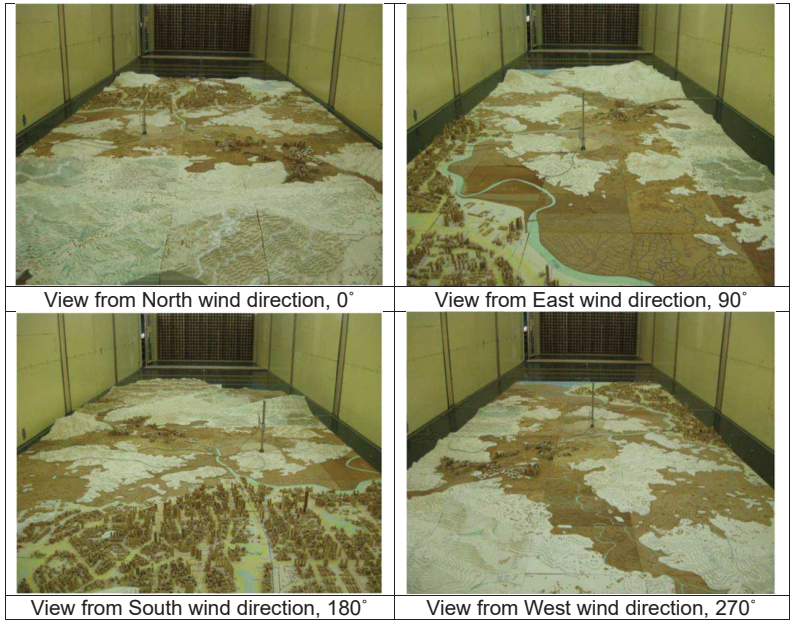



**Figure 5.4 1:2000 scale topographical model of the Kwu Tung North Study Area in the low-speed test section from different views**

5.2.2 The wind tunnel testing techniques used for the site wind availability study satisfied the quality assurance requirements stipulated in the Australasian Wind Engineering Society Quality Assurance Manual, AWES-QAM-1-2001 (2001) and the American Society of Civil Engineers Manual and Report on Engineering Practice No. 67 for Wind Tunnel Studies of Buildings and Structures (1999). The site wind availability study was also conducted in accordance with the recommendations of Planning Department's Feasibility Study for Establishment of Air Ventilation Assessment System – Final Report (2005) and Technical Guide for Air Ventilation Assessment for Developments in Hong Kong (2006).

5.2.3 The wind tunnel testing results were subsequently combined with a statistical model to determine directional wind characteristics and availability for KTN NDA. The annual and summer wind roses at the KTN NDA are shown in **Figure 5.5**. The wind rose result indicated the dominance of each of the 16 wind directions and the distribution of the wind speed at 100mPD.

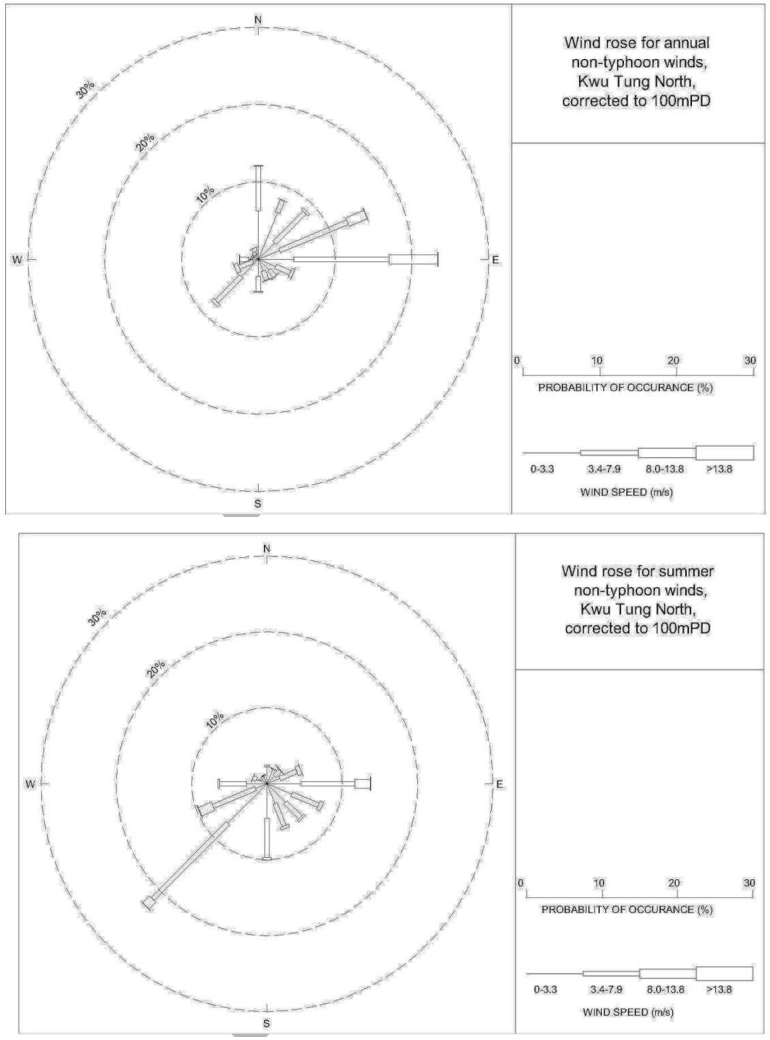



**Figure 5.5 Wind Roses for annual and summer, non-typhoon winds for Kwu Tung North corrected to 100mPD**

5.2.4 The wind roses from the experimental site wind availability study indicate that the annual prevailing winds at KTN are mainly dominated by wind coming from E, ENE, N directions, while the majority of the summer wind are from the E, S and SW directions. In addition, the frequencies of annual and summer season occurrence of individual wind directions at 100mPD for the KTN NDA are shown in **Table 5.2**.





**Table 5.2 Frequencies of Annual and Summer Season Occurrence of Individual Wind Directions at 100mPD for KTN NDA**

| Wind Direction | % of Annual Occurrence | % of Summer Occurrence |
|---|---|---|
| **0º (N)** | **12.1%** | 2.5% |
| 22.5º (NNE) | 8.3% | 2.2% |
| 45º (NE) | 8.8% | 2.5% |
| **67.5º (ENE)** | **15.1%** | 4.8% |
| **90º (E)** | **23.4%** | **13.8%** |
| 112.5º (ESE) | 4.9% | 7.9% |
| 135º (SE) | 3.1% | 6.5% |
| 157.5º (SSE) | 3.0% | 6.4% |
| 180º (S) | 4.3% | **10.1%** |
| 202.5º (SSW) | 0.0% | 0.0% |
| 225º (SW) | 8.1% | **22.8%** |
| 247.5º (WSW) | 3.2% | 9.7% |
| 270º (W) | 2.5% | 6.5% |
| 292.5º (WNW) | 1.0% | 2.0% |
| 315º (NW) | 0.6% | 1.1% |
| 337.5º (NNW) | 1.5% | 1.2% |

## 5.3 HKO Weather Station Wind Data

5.3.1 The Lok Ma Chau and Au Tau stations near to the KTN NDA and Project Sites are automatic rainfall stations and do not have wind data. The Tai Lung Automatic Weather Station, Sheung Shui Automatic Weather Station and Beas River Automatic Weather Station as shown in **Figure 5.6** are the operating weather stations that are nearest to the Project Sites and the KTN NDA. However, these weather stations do not have wind measurement data and cannot be used for wind data comparative purposes for this Study. The nearest weather station with wind measurement data is Wetland Park Weather Station far away from the KTN NDA and Project Sites. Considering the far distance of this weather station to the KTN NDA and the Project Sites, wind data from Wetland Park Weather is also considered not appropriate to be used for comparison purposes.

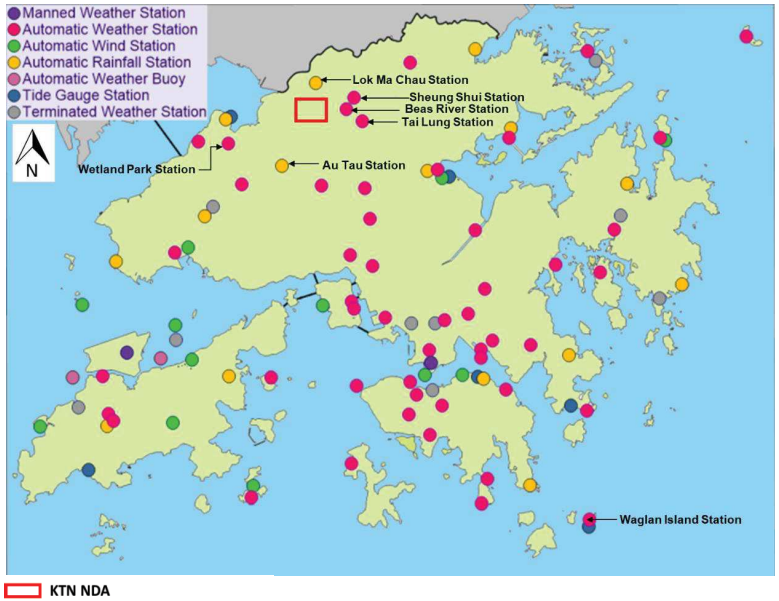
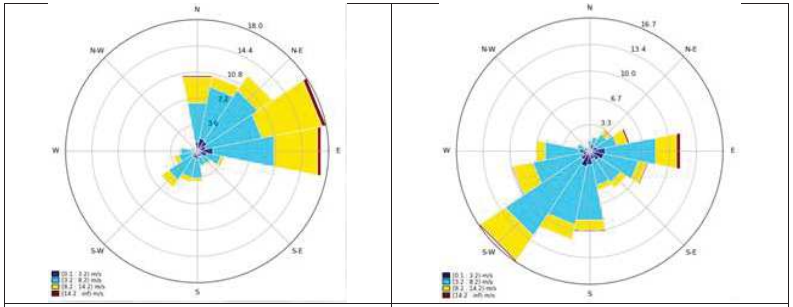



**Figure 5.6 Locations of HKO Weather Stations**

5.3.2 Apart from the above-mentioned weather stations, the Waglan Island Weather Station with generally uninterrupted exposure to wind, can be a representative reference for the prevailing wind over the whole Hong Kong region. However, the Waglan Island Weather Station is situated at a far distance from the KTN NDA and the Project Sites and is also considered not representative to be used as a source to identify prevailing wind directions towards the KTN NDA. The annual and summer wind roses of Waglan Island are presented in **Figure 5.7** for information. Based on the discussions in paragraph 5.3.1 and above, wind data from HKO weather stations would be omitted to be used as a reference to identify the prevailing wind directions in this Study.



| Annual Wind Rose (2000-2020) | Summer Wind Rose (July 2000-2020) |
|---|---|

**Figure 5.7 Wind Roses recorded at Waglan Island Weather Station (2000-2020)**





## 5.4 Summary

5.4.1 As the Experimental Site Wind Availability Study for The North-East New Territories New Development Areas conducted in 2010 focused on the site wind for the KTN NDA, it is therefore considered more appropriate to adopt the set of wind tunnel experimental data to identify the prevailing wind directions. The wind data from HKO weather station and RAMS model would still be presented above as a reference. The wind availability data from the wind tunnel experiment suggest that the annual prevailing wind towards the Project Sites is coming from N, ENE and E directions, while in summer, the wind environment would heavily rely on the E, S and SW wind. **Figure 5.8** illustrates the prevailing wind directions toward the KTN NDA and Project Sites.

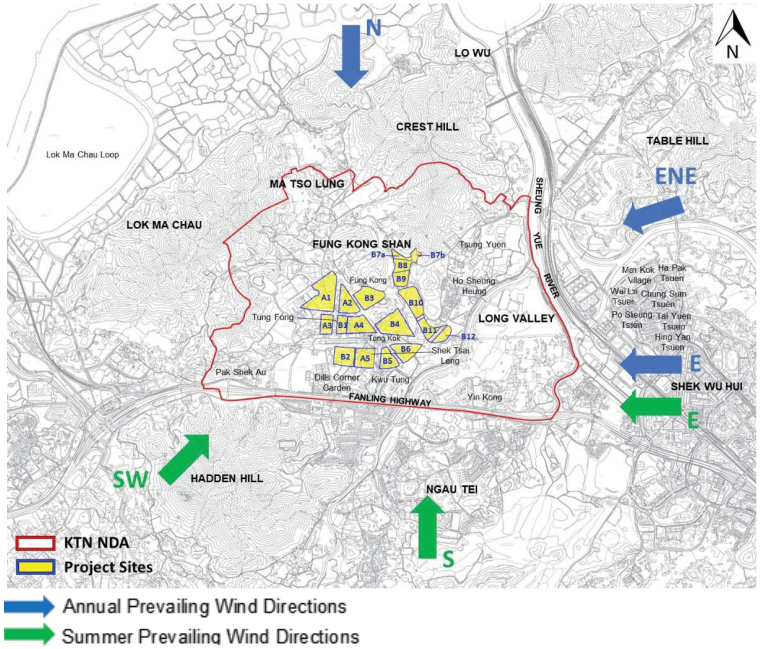



**Figure 5.8 Illustration of Prevailing Wind Directions approaching the KTN NDA and Project Sites**

# 6 THE BASE AND PROPOSED SCENARIOS

## 6.1 Background

6.1.1 Two Development Scenarios are examined in this Study, namely Base Scenario and the Proposed Scenario. The Base Scenario reflects the development restrictions in the Kwu Tung North Outline Zoning Plan (OZP) with updates to incorporate the schemes in the approved s.16 applications No. A/KTN/54, A/KTN/83 and A/KTN/84. Under these planning permissions, minor relaxation in Plot Ratios (PR) and/or Building Height Restrictions (BHR) was approved in Planning Areas 12, 13, 19, 21, 24 and 26.

6.1.2 As compared with the Base Scenario, minor relaxation in PR and BHR in Remaining Phase including Planning Areas 12, 13, 14, 15, 20, 21, 22, 23, 25 and 26 (i.e., Project Sites A1 to A5 and B1 to B12) are proposed. **Table 6.1** shows the change in relevant development parameters.

**Table 6.1 Difference in Development Parameters at the Project Sites**

| Site No. | Planning Area | Public/ Private | Zoning | Site Area (about) (ha) [Land Area in 'Road'/ "GB"] (about) (ha) [1] | Under OZP | | | | Under Approved Planning Application No. A/KTN/54 | | | | Proposed under this Application | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Total Maximum Plot Ratio | Domestic Maximum Plot Ratio | Non-Domestic Plot Ratio | Maximum Building Height (mPD) | Total Maximum Plot Ratio | Domestic Plot Ratio | Non-Domestic Plot Ratio | Maximum Building Height (mPD) | Total Maximum Plot Ratio [2] | Domestic Plot Ratio | Non-Domestic Plot Ratio | Maximum Building Height (mPD) |
| A1 | 12 | Public | R(A)2 | 5.14 | 5.0 | 4.5 | 0.5 | 135 | 5.8 | 5.22 | 0.58 | N/A | 6.73 [3] | 5.85 | 0.88 | 180 |
| A2 | 13 | Public | R(A)2 | 2.20 | 5.0 | 4.5 | 0.5 | 135 | 5.8 | 5.22 | 0.58 | N/A | 6.5 | 5.85 | 0.65 | 160 |
| A3 | 20 | Public | R(A)1 | 1.50 | 6.0 | 5.0 | 1.0 | 115 | N/A | N/A | N/A | N/A | 7.8 | 6.5 | 1.3 | 145 |
| A4 | 21 | Public | R(A)3 | 2.53 | 5.0 | 4.0 | 1.0 | 125 | 5.8 | 4.64 | 1.16 | 130 | 6.5 | 5.2 | 1.3 | 140 |
| A5 | 26 | Public | R(A)3 | 2.33 | 5.0 | 4.0 | 1.0 | 110 | 5.8 | 4.64 | 1.16 | 120 | 6.5 | 5.2 | 1.3 | 135 |
| B1 | 20 | Private | R(A)1 | 1.13 | 6.0 | 5.0 | 1.0 | 115 | N/A | N/A | N/A | N/A | 7.2 | 6.0 | 1.2 | 130 |
| B2 | 25 | Private | R(A)1 | 2.34 | 6.0 | 5.0 | 1.0 | 115 | N/A | N/A | N/A | N/A | 7.2 | 6.0 | 1.2 | 130 |
| B3 | 14 | Private | R(B) and Road | 2.83 [0.04] | 3.5 | 3.5 | 0.0 | 80 | N/A | N/A | N/A | N/A | 4.2 | 4.2 | 0 | 95 |
| B4 | 22 | Private | R(B) | 3.81 | 3.5 | 3.5 | 0.0 | 75 | N/A | N/A | N/A | N/A | 4.2 | 4.2 | 0 | 85 |
| B5 | 26 | Private | R(B) | 1.79 | 3.5 | 3.5 | 0.0 | 75 | N/A | N/A | N/A | N/A | 4.2 | 4.2 | 0 | 80 |
| B6 | 26 | Private | R(B) and Road | 2.35 [0.03] | 3.5 | 3.5 | 0.0 | 75 | N/A | N/A | N/A | N/A | 4.2 | 4.2 | 0 | 80 |
| B7 | 15 | Private | R(B) | 1.25 | 3.5 | 3.5 | 0.0 | 85/95 | N/A | N/A | N/A | N/A | 4.2 | 4.2 | 0 | 100 |
| B8 | 15 | Private | R(B), GB and Road | 1.30 [0.05] | 3.5 | 3.5 | 0.0 | 85 | N/A | N/A | N/A | N/A | 4.2 | 4.2 | 0 | 90 |
| B9 | 15 | Private | R(B) | 1.17 | 3.5 | 3.5 | 0.0 | 80 | N/A | N/A | N/A | N/A | 4.2 | 4.2 | 0 | 85 |
| B10 | 23 | Private | R(B) and Road | 2.87 [0.04] | 3.5 | 3.5 | 0.0 | 95 | N/A | N/A | N/A | N/A | 4.43 | 4.2 | 0.23 [4] | 110 |
| B11 | 23 | Private | R(B) | 1.28 | 3.5 | 3.5 | 0.0 | 90 | N/A | N/A | N/A | N/A | 4.2 | 4.2 | 0 | 90 |
| B12 | 23 | Private | R(B) | 0.78 | 3.5 | 3.5 | 0.0 | 90 | N/A | N/A | N/A | N/A | 4.2 | 4.2 | 0 | 90 |

[1] Site area and area shown as 'Road'/ "GB" subject to detailed survey.

[2] TPR: Total Plot Ratio, DPR: Domestic Plot Ratio, NDPR: Non-domestic Plot Ratio. To allow flexibility, development of public housing sites are restricted to the TPR while DPR and NDPR will be worked out by HD at Planning Brief stage. Private housing developments are restricted to the specified DPR and NDPR in the table, if any.

[3] Site A1: TPR includes a public transport terminus/interchange of 12,000 $m^2$.

[4] Site B10: NDPR includes a public transport terminus/interchange of 3,500 $m^2$.

## 6.2 Formed Roads and Separations in between Project Sites

6.2.1 The surroundings of the Project Sites are relatively open and currently covered by low-rise squatters and structures. According to the current OZP, road networks and separations are anticipated to be formed as shown in **Figure 6.1**. The major roads and the corresponding sections are marked and annotated in red color in **Figure 6.1**, for ease of discussion of wind flow patterns in the later sections of the report. In addition, the major separations formed between the Project Sites and the surrounding planned/committed development sites are also indicated with magenta color. There are a total of thirteen major roads and four major separations identified. While noise barriers are required to be incorporated along part of the major roads for mitigating the potential traffic noise impacts, such noise barriers together with the elevated highways would inevitably affect the localised pedestrian wind environment. The locations of the noise barriers are shown in the **Appendix E** for information.

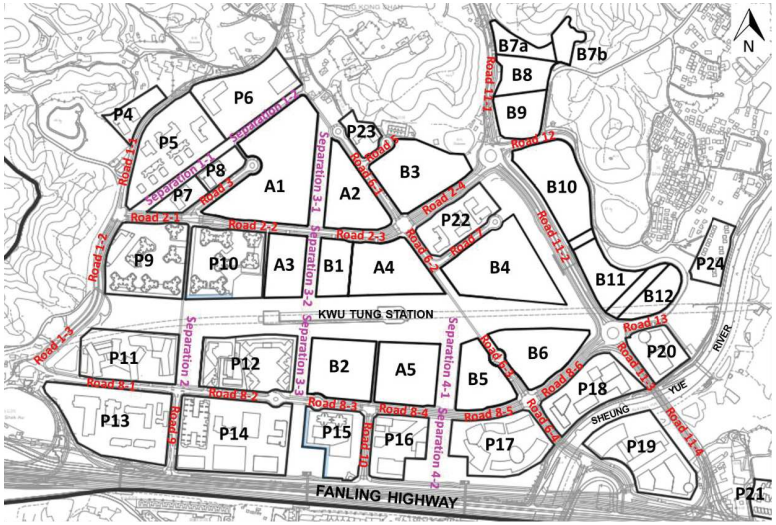



**Figure 6.1 Annotation and Indication of the New Roads and Separations formed by Project Sites and the Surrounding Planned/Committed Developments**

## 6.3 Base and Proposed Scenarios

6.3.1 **Figure 6.2** shows the overall layout within Project Sites A1 to A5 and B1 to B12 within the KTN NDA under the Base Scenario and the Proposed Scenario as well as some of the planned/committed developments that surround the Project Sites. Illustrational figures for zoomed out areas from the Project Sites under the Base and Proposed Scenarios are also provided in **Figure A4** and **Figure A5** in **Annex I** for reference. Brief discussions on the differences between the Base Scenario and Proposed Scenario for each of the Project Sites are also provided in this subsection. The layouts are indicative for technical assessment purpose which is subject to revision at detailed design stage.





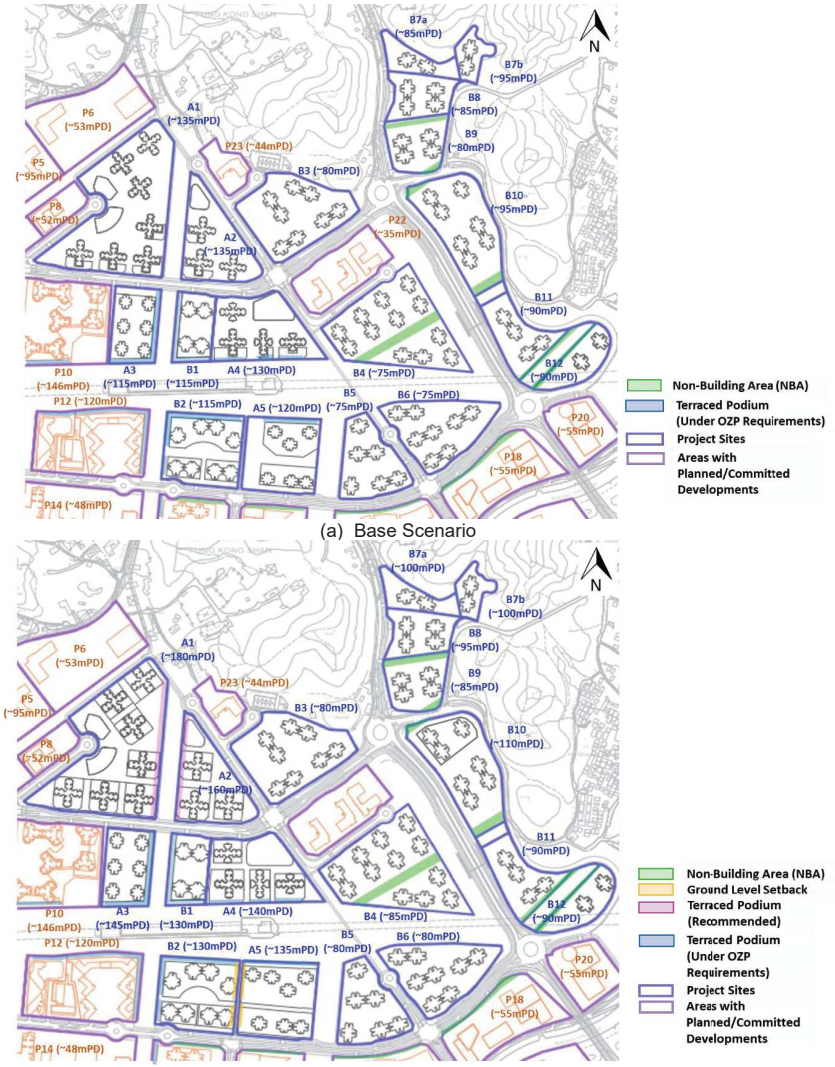



**Figure 6.2 Building Layouts within the Project Sites under the Base Scenario and Proposed Scenario**

6.3.2 In general, the overall domestic building footprints within each of the Project Sites under the Proposed Scenario are 10% larger as compared to the Base Scenario. Provision of non-domestic podiums, if any, beneath the domestic blocks also enlarged the overall non-domestic footprints. Apart from that, the footprints of the non-domestic blocks, if any, in the Proposed Scenario have also been enlarged by 10% as compared to the Base Scenario. The Project Sites with prefix "A" are Public Housing Sites while the ones with prefix "B" are Private Housing Sites. Brief descriptions within each Project Site are provided below:

***Public Housing Project Sites:***

*Project Site A1*

6.3.3 Under the Base Scenario, Project Site A1 contains domestic blocks with Building Height Restriction of 135mPD under OZP stipulation and standalone non-domestic blocks of 49mPD in height. Podiums can be found around some of the domestic blocks (see **Figure 6.2(a)** and **Figure A4**).

6.3.4 The Proposed Scenario for Project Site A1 is also designed with domestic blocks and standalone non-domestic blocks of 42mPD. Differing from the Base Scenario, terraced podiums adopting stepping designs are recommended to incorporate underneath the domestic blocks specifically underneath the domestic blocks abutting Separation 3-1. The maximum Building Height Restriction is relaxed to 180mPD (see **Figure A3**). Nevertheless, building morphologies are generally unaltered under the Proposed Scenario as compared to the Base Scenario.

*Project Site A2*

6.3.5 Under the Base Scenario, Project Site A2 is designed with domestic blocks and non-domestic blocks. Non-domestic podiums can also be found around the domestic blocks abutting Separation 3-1 (see **Figure 6.1** and **Figure 6.2(a)**) with the prevailing Building Height Restriction of 135mPD (see **Figure A2**) under OZP stipulation in force. A massive non-domestic block (47mPD) also appears within Project Site A2 (see **Figure 6.2(a)** and **Figure A4**).

6.3.6 Under the Proposed Scenario, Project Site A2 is also designed domestic blocks and a standalone non-domestic block of around 40mPD (see **Figure 6.2(b)** and **Figure A5**). Differing from the Base Scenario, terraced podiums are recommended underneath domestic blocks abutting Separation 3-1 (see **Figure 6.1** and **Figure 6.2(b)**). The maximum Building Height Restriction is relaxed to 160mPD (see **Figure A3**).

*Project Site A3*

6.3.7 The Base Scenario of Project Site A3 is designed with several domestic blocks situated above a massive non-domestic podium block. The non-domestic podium block adopts stepping podium design which promotes air ventilation at local areas (see **Figure 6.2(a)** and **Figure A4**). The prevailing Building Height Restriction is 115mPD under OZP stipulation (see **Figure A2**).

6.3.8 The Proposed Scenario of Project Site A3 is also designed with domestic blocks located above an enlarged massive non-domestic podium as under the Base Scenario. The Building Height is proposed to be relaxed to 145mPD (see **Figure A3**). Same as the Base Scenario, the non-domestic podium block adopts terraced podium design under the Proposed Scenario (see **Figure 6.2(b)**, and **Figure A5**).

*Project Site A4*

6.3.9 The Base Scenario of Project Site A4 is designed with domestic blocks of 130mPD. A standalone non-domestic block of 40mPD is placed within this Project Site with smaller non-domestic terraced podium blocks surround some of the domestic blocks (see **Figure 6.2(a), Figure A2** and **Figure A4**).

6.3.10 The Proposed Scenario for Project Site A4 adopt similar building layout as compared to the Base Scenario with building heights of domestic blocks relaxed to 140mPD and a standalone non-domestic block of 32mPD (see **Figure A3**). In addition, enlarged podiums are to be found beneath the domestic blocks. To minimize the air ventilation impacts, terraced podium designs are adopted for the podiums underneath the domestic blocks.

*Project Site A5*

6.3.11 Under the Base Scenario, Project Site A5 is designed with domestic blocks of 120mPD (see **Figure A2**) as illustrated **in Figure 6.2(a)** and **Figure A4**. Terraced podiums can be found underneath the domestic blocks.

6.3.12 The Proposed Scenario (**Figure 6.2(b)** and **Figure A5**) for Project Site A5 is also designed with domestic blocks placed above terraced podiums as under the Base Scenario (**Figure**





**6.2(a)** and **Figure A4**). The maximum Building Height Restriction is relaxed to 135mPD (see **Figure A3**). Ground level setback is suggested for the proposed developments located near the western boundary of Project Site A5, targeting to widen the separation in between Project Sites A5 and B2.

***Private Housing Project Sites:***

*Project Site B1*

6.3.13 The Base Scenario within Project Site B1 is designed with domestic blocks with Building Height Restriction of 115mPD (see **Figure A2**) located above a massive podium. Podium with terraced design can be found within Project Site B1 (see **Figure 6.2(a)** and **Figure A4**).

6.3.14 The Proposed Scenario within Project Site B1 is also designed with domestic blocks with Building Height Restriction relaxed to 130mPD (see **Figure A3**) located above a massive podium. The domestic building footprints under the Proposed Scenario are slightly larger as compared to the Base Scenario. Same as the Base Scenario, podium with terraced design is adopted within Project Site B1 (see **Figure 6.2(b)** and **Figure A5**).

*Project Site B2*

6.3.15 Under the Base Scenario, Project Site B2 is designed with domestic blocks as revealed in **Figure 6.2(a)**. Domestics blocks are located above non-domestic podium with terraced designs. The prevailing Building Height Restriction of 115mPD under OZP stipulation is considered within Project Site B2 (see **Figure A2** and **Figure A4**).

6.3.16 The Proposed Scenario for Project Site B2 is designed with domestic blocks as shown in **Figure 6.2(b)**. Same as the Base Scenario, these domestics blocks are located above massive podiums with terraced design. However, the maximum Building Height Restriction is relaxed to 130mPD (see **Figure A3**) and the overall domestic building footprints under the Proposed Scenario are slightly larger as compared to the Base Scenario. In addition, ground level setback is recommended to be incorporated for the proposed developments located near the eastern boundary of Project Site B2, targeting to widen the separation in between the Project Site B2 and its adjacent Project Site A5.

*Project Site B3*

6.3.17 The domestic building blocks under the Base Scenario within Project Site B3 are podium free ones with maximum heights of 80mPD (see **Figure A2**). These podium free domestic building blocks are placed away from the Project Site Boundary (see **Figure 6.2(a)** and **Figure A4**).

6.3.18 There are not many differences between the building morphologies of the Proposed Scenario and the Base Scenario within Project Site B3 (see **Figure 6.2(b)** and **Figure A5**). Apart from the slight enlargement in overall and individual domestic building footprints under the Proposed Scheme, the maximum Building Height Restriction is relaxed to 95mPD (see **Figure A3**).

*Project Site B4*

6.3.19 Under the Base Scenario, Project Site B4 is occupied with podium free domestic blocks as shown in **Figure 6.2(a)** and **Figure A4**. The Building Height Restriction of 75mPD under OZP stipulation is considered (see **Figure A2**). A 30m-wide non-building area (NBA) in north-east to south-west direction is reserved at the southern part of the Project Site B4, which complies with the requirement stipulated on the OZP (see **Figure 6.2(a)** and **Figure A4**).

6.3.20 The Proposed Scenario for Project Site B4 is also designed with similar podium free domestic blocks with slightly larger building footprints as shown in **Figure 6.2(b)** and **Figure A5**. The maximum Building Height Restriction is relaxed to 85mPD (see **Figure A3**). The 30m-wide non-building area (NBA) in north-east to south-west direction at the southern part of the Project Site B4 is retained for wind diversion and penetration to the inner downwind areas of the Project Site (see **Figure 6.2(b)** and **Figure A5**).

*Project Site B5*

6.3.21 The Base Scenario of Project Site B5 is designed with podium free domestic blocks of 75mPD under OZP stipulation (see **Figure A2, Figure 6.2(a)** and **Figure A4**). The domestic blocks are placed in a scattered manner away from the Project Site Boundary.

6.3.22 There is slight relaxation of building heights of the podium free domestic blocks from 75mPD to 80mPD in The Proposed Scenario. The domestic blocks in the Proposed Scenario are still placed in a scattered manner away from the Project Site Boundary (see **Figure 6.2(b)**, **Figure A3** and **Figure A5**). The overall and individual domestic building footprints under the Proposed Scheme are slightly larger as compared to the Base Scenario.

*Project Site B6*

6.3.23 Same to Project Site B5, the domestic building blocks under the Base Scenario within Project Site B6 have heights of 75mPD (see **Figure A2**). These podium free domestic building blocks placed away from the Project Site Boundary (see **Figure 6.2(a)** and **Figure A4**).

6.3.24 There are not many differences between the building morphologies of the Proposed Scenario and the Base Scenario within Project Site B6 (see **Figure 6.2(b)** and **Figure A5**). Apart from the slight enlargement in overall and individual domestic building footprints under the Proposed Scheme, the maximum Building Height Restriction is relaxed to 80mPD (see **Figure A3**).

*Project Site B7*

6.3.25 Project Site B7 is split into two subsites (Project Site B7a and B7b) with different Building Height Restrictions. Under the Base Scenario, Project Site 7a has a Building Height Restriction of 85mPD while Project Site 7b has a Building Height Restriction of 95mPD. Within the Project Site appears podium free domestic blocks placed in a scattered manner (see **Figure A2, Figure 6.2(a)** and **Figure A4**).

6.3.26 The Proposed Scenario of Project Site B7 is also designed with podium free domestic blocks with no observable alternation in building orientations and arrangements as compared with the Base Scenario. However, the maximum building height is relaxed from 85/95mPD to 100mPD with slight enlargement in building footprints (see **Figure A3, Figure 6.2(b)** and **Figure A5**).

*Project Site B8*

6.3.27 Located to the immediate south of Project Site B7, the Project Site B8 for private housing developments has imposed a Building Height Restriction of 85mPD heights under the Base Scenario (see **Figure A2**). Podium free domestic building blocks would appear within this Project Site (see **Figure 6.2(a)** and **Figure A4**).

6.3.28 The Proposed Scenario of Project Site B8 is also designed with podium free domestic blocks with no observable alternation in building orientations and arrangements as compared with the Base Scenario. However, the maximum building height is slightly relaxed from 85mPD to 90mPD with slight enlargement in building footprints (see **Figure A3, Figure 6.2(b)** and **Figure A5**).

*Project Site B9*

6.3.29 Located adjacent to Project Site B8, the Project Site B9 for private housing developments has imposed a Building Height Restriction of 80mPD heights under the Base Scenario (see **Figure A2**). Podium free domestic building blocks would appear within this Project Site. In addition, a strip of Non-Building Area is imposed at the southern tip of this Project Site (see **Figure 6.2(a)** and **Figure A4**).

6.3.30 The Proposed Scenario of Project Site B9 is also designed with podium free domestic blocks with no observable alternation in building orientations and arrangements as compared with the Base Scenario. However, the maximum building height is slightly relaxed to 85mPD with slight enlargement in building footprints. The strip of Non-Building Area appears in the Base Scenario remains unchanged in the Proposed Scenario (see **Figure A3, Figure 6.2(b)** and **Figure A5**).





*Project Site B10*

6.3.31 Project Site B10 is planned to be developed into podium free private housing blocks. Non-Building Areas are incorporated within these two Project Sites with Building Height Restriction of 95mPD under the Base Scenario (see **Figure A2**, **Figure 6.2(a)** and **Figure A4**).

6.3.32 Under the Proposed Scenario, the Non-Building Areas within the Project Sites are retained with designs of a few domestic blocks located at the southern portion remained podium free. There appears a podium underneath the three domestic towers located within the northern portion of the Project Site B10. However, there is an increase in plot ratio as compared to the Base Scenario and a slight relaxation in maximum building height from 95mPD to 110mPD as well as a slight enlargement in building footprints (see **Figure A3**, **Figure 6.2(b)** and **Figure A5**).

*Project Sites B11 and B12*

6.3.33 Located to the near southeast direction of Project Site B10, Project Sites B11 and B12 are also proposed to be developed into podium free private domestic housing blocks with Building Height Restriction of 90mPD under the Base Scenario. Strips of Non-Building Areas are incorporated within these two Project Sites (see **Figure A2**, **Figure 6.2(a)** and **Figure A4**).

6.3.34 Under the Proposed Scenario, the podium free designs of the private housing blocks as well as the strips of Non-Building Areas are retained within the two Project Sites. The maximum building height of 90mPD is unchanged but with an increase in plot ratio as compared to the Base Scenario. This implied that the building footprints under the Proposed Scenario would be slightly enlarged as compared to the Base Scenario (see **Figure A3**, **Figure 6.2(b)** and **Figure A5**).

## 7 EXPERT EVALUATION ON THE BASE AND PROPOSED SCENARIOS

### 7.1 General

7.1.1 The KTN NDA containing the Project Sites is located at the rural areas of Hong Kong, the majority lands surrounding the KTN NDA are "Green Belt", "Agriculture", "Other Specified Uses" as well as scattered areas of "Village Type Development". To the west of the Project Sites outside the KTN NDA are Green Belt areas of Lok Ma Chau, while to the north of the Project Sites are mainly Green Belt areas of Fung Kong Shan and to the further north are the "Agriculture" lands of Ma Tso Lung the "Green Belt" areas belonging to Crest Hill. There are currently scattered low-rise developments located to the immediate east of the Project Sites which would be planned to be developed into G/IC buildings and residential blocks while the village houses of Ho Sheung Heung would be retained. To the further east outside the KTN NDA across the Sheung Yue River are some "Other Specified Uses" lands and village houses of Wai Lo Tsuen. To the south of the Project Sites, across the Fanling Highway are zoned as "Residential (Group C)" land use, which are existing low rise residential developments of Europa Garden, the Valais and Casas Domingo.

7.1.2 Among the seventeen Projects Sites (A1 to A5 and B1 to B12) located at the central to south-western sector of the KTN NDA, seven are zoned for "Residential (Group A)" developments while the rest ten are zoned for "Residential (Group B)". The existing developments within the Project Sites are occupied by brownfields, temporary structures and low-rise village houses of Tung Fong, Fung Kong, Tong Kok and Shek Tsai Leng. There are also a few "Residential (Group A)" and "Residential (Group B)" lands located at the immediate vicinity of the Project Sites. Majority of the areas at Dills Corner Gardens had already been zoned as "Other Specified Uses" and "Government, Institution or Community" usage lands, with minor part of lands in between the cluster of the Project Sites falling under the "Open Space" zones on the prevailing Approved KTN OZP (Plan No. S/KTN/2).

7.1.3 The seventeen Project Sites (A1 to A5 and B1 to B12) are located at a sizable flatland surrounded by hilly terrains with varying height. The topographical height of the terrains to the near north and further north-eastern directions to the Project Sites are the hilly terrains of Fung Kong Shan/Crest Hill and Sandy Ridge respectively. To the near east of the KTN NDA are Sheung Shui and Fanling Towns situated on the flatlands as well as the terrains of High Hill located to the far east. There are also hilly terrains of approximately 100mPD belonging to the Lok Ma Chau area located to the near west of the KTN NDA, while the lands belonging to San Tin are relatively flat. The most observable terrain to the south and south westerly directions of the Project Sites is the Hadden Hill with maximum terrain altitude of 200mPD.

7.1.4 Owing to the relatively rural nature of the Project Sites and the KTN NDA, and the Project Sites are currently occupied by low-rise squatters and structures. The wind flows driven by the prevailing wind can freely penetrate the Project Sites under the current conditions. After the proposed developments within the Project Sites A1 to A5 and B1 to B12 as well as their surroundings in the future, road networks and separations are anticipated to be formed to facilitate the penetration of the prevailing wind.

7.1.5 Two Development Scenarios would be examined in this Study, namely Base Scenario and the Proposed Scenario (see **Figure 6.2**, **Figure A4** and **Figure A5**). Under the Base Scenario and Proposed Scenario, as discussed in **Section 6** above, both domestic residential blocks, non-domestic podiums and ancillary buildings are to be appeared within the Project Sites. Both Base and Proposed Scenarios would maintain all air ventilation good design measures (i.e., building separations, adopt terraced podium designs and incorporate designated Non-Building Areas (NBAs)) as required under the OZP to promote the air ventilation performance. All major wind corridors under the Proposed Scenario would be remained and without affecting its effectiveness for facilitating wind penetration through the subject sites when compared with Base Scenario. Besides, additional good measures (i.e., terraced podiums and ground level setbacks) at designated strategic locations are recommended to be adopted under the indicative building layout of the Proposed Scenario as much as possible.

7.1.6 In view of the discussion in paragraph 7.1.5, the changes in the building morphologies in the Proposed Scenario would inevitably result in slight change in localized pedestrian wind environment around the Project Sites when compared with the Base Scenario. However, it is





anticipated that the overall wind environment around the Project Sites would not be significantly affected under the Proposed Scenario as compared to the Base Scenario due to the keeping of all air ventilation good design measures that appears under the Base Scenario in the Proposed Scenario and the incorporation of additional good design measures in the aspect of air ventilation. All these measures help in maintaining the wind environment under the Proposed Scenario.

## 7.2 Major Wind Corridors

7.2.1 By taking the topographical features and the planned/committed built environment into consideration, a few major wind corridors are identified in the vicinity of the Project Sites of the KTN NDA and illustrated in **Figure 7.1**.

7.2.2 Start describing from the western side of the Project Sites, the wind corridor formed in between Areas P4 and P5 abutting Areas P9 and P11 (i.e., along Roads 1-1, 1-2 and 1-3 in **Figure 6.1**) would facilitate the flow of northerly/southerly/east-north easterly and the south-westerly prevailing wind to maintain the wind environment near Areas P4, P5, P9, P11 and P13 (see Marker (1) in **Figure 7.1**).

7.2.3 The north-south orientated wind corridor joined by Separations 3-1 to 3-4 in between Project Sites A1, A3, Areas P12, P14 and Project Sites A2, B1, B2, Area P15 (refer to **Figure 6.1**) would connect Fung Kong Shan and Fanling Highway, promoting the penetration of northerly and southerly prevailing wind (see Marker (2) in **Figure 7.1**).

7.2.4 Roads 11-1 to 11-4 (refer to **Figure 6.1**) would form another wind corridor that benefits the flow of the northerly and southerly prevailing wind. This wind corridor abuts Areas P18 to P20, P22 to P23 as well as Project Sites B3, B4, B6 to B12, which facilitates the prevailing wind flow from Fung Kong Shan towards Fanling Highway and vice versa across the Sheung Yue River (see Marker (3) in **Figure 7.1**).

7.2.5 The Sheung Yue River also acts as a major wind corridor. The branch stream of Sheung Yue River would direct the east-north easterly and south westerly wind towards Areas P17 to P20, P24 as well as regions near the Long Valley (see Marker (4) in **Figure 7.1**).

7.2.6 A wind corridor is formed by connecting Road 12 between Project Sites B9 and B10, Road 2-4 between Area P22 and Project Site B3 and Road 2-2, Road 2-3 between Project Sites A1, A2, A3, B1 and A4. The annotations of roads are illustrated in **Figure 6.1**. NBAs within Project Sites B9 and B10 help to widen Road 12 and enhance the effectiveness of this wind corridor, in particular to facilitate the easterly and east-north easterly prevailing wind from Tsung Yuen towards Areas P22, P23 as well as Project Sites A1 to A4, B1, B3 and B7 to B10 (see Marker (5) in **Figure 7.1**).

7.2.7 Another wind corridor is formed by linking up Ho Sheung Heung and Kwu Tung Station which facilitate the flow of east-north easterly and easterly prevailing wind. As there are Non-Building Areas (NBAs) incorporated within the Project Site B10 and also Project Site B4, which leads to the formation of this major wind corridor which facilities the prevailing wind from villages houses of Ho Sheung Heung to reach the Kwu Tung Station (see Marker (6) in **Figure 7.1**).

7.2.8 There is another major wind corridor connecting the lower regions of Ho Sheung Heung near Area P24 and Roads 8-1 to 8-6 (refer to **Figure 6.1** for annotation of roads and Marker (7) in **Figure 7.1** for the location of wind corridor). There are two strips of NBAs incorporated within Project Sites B11 and B12, in which they would facilitate the ENE prevailing wind to penetrate these two Project Sites and flow along this major wind corridor along Roads 8-1 to 8-6. In addition, the portion of this major wind corridor formed by Roads 8-1 to 8-4 also benefits the flow of easterly prevailing wind towards Pak Shek Au areas while the portion formed by Roads 8-5 and 8-6 favor the flow of south westerly prevailing wind towards the planned/committed residentials within Project Sites B11 and B12.

7.2.9 Fanling Highway aligning in roughly east-west direction would facilitate the flow of easterly prevailing wind (see Marker (9) in **Figure 7.1**). In addition, there exists a green corridor in the middle portion of the KTN NDA, which elongated from Long Valley across the Sheung Yue River and along Road 13 between Areas P20 and Project Site B12 (refer to **Figure 6.1**) towards Kwu Tung Station as well as further downstream regions immediate north to Pak Shek Au. This green corridor would also take up the role as wind corridor and facilitate the easterly wind to penetrate through the Project Sites and flow to the west (see Marker (8) in **Figure 7.1**).





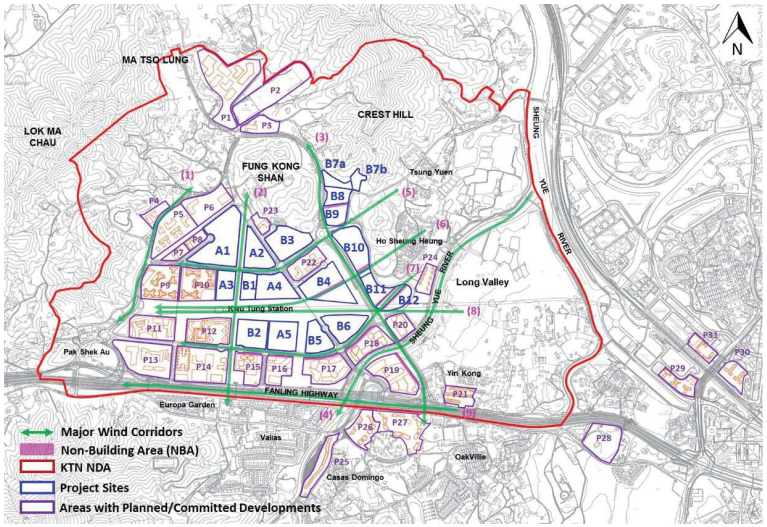



**Figure 7.1 Major Wind Corridors near Project Sites**

## 7.3 Good Air Ventilation Features to be Retained and Additional Air Ventilation Measures to be Incorporated in the Proposed Scenario

*Good Air Ventilation Features to be Retained*

7.3.1 Several major wind corridors have been identified under the identified prevailing wind directions. These identified wind corridors are useful in maintaining the wind environment within and at the surroundings of the Project Sites. The identified wind corridors under each prevailing wind directions have been discussed in detail in Section 7.2 above in which the most are along major roads, and the most observable wind corridors include but not limited to the Fanling Highway, along the Kwu Tung Station and the Sheung Yue River etc.

7.3.2 From the discussion of indicative proposed building layouts under the Base Scenario and Proposed Scenarios in Section 6, it is observed and understood that these identified major wind corridors are retained and remained non-obstructed under the proposed layouts of the Base Scenario as well as after the proposed developments of the Proposed Scenario.

7.3.3 There are Non-Buildings Areas (NBAs) incorporated within Areas P15 to P19, Project Sites B4 and B9 to B12. These identified NBAs are retained at the same locations among the Base and Proposed Scenario. While the enlargement in building footprints to satisfy the GFA/Plot Ratio requirements for the Project Sites under the Proposed Scenario as compared to the Base Scenario, the Proposed Scenario would retain all designated NBAs at the same locations with the same width when compared with Base Scenario.

7.3.4 Two storeys of terraced and stepping podiums consistent with the designs under the current OZP are adopted for the Project Sites B1 and B2, planned for Private Housing Developments under both the Base and Proposed Scenarios. For another nine Project Sites B3 to B9, B11, B12 planned for Private Housing Developments in the Base and Proposed Scenarios, proposed residential towers with podium free designs are adopted. For the other three Project Sites A3 to A5 planned for Public Housing Developments, higher podium structures of 3 storeys but with terraced podium designs consistent with those under the current OZP at some of these podiums are incorporated to promote downward air flow to the pedestrian level.

7.3.5 Variation in building height profiles between some of the Project Sites and certain surrounding committed/planned developments that promote downwash wind can be observed in both the Base and Proposed Scenarios. The designs mentioned above which are good design

measures in the perspective of maintaining air ventilation performance at/near the Project Sites, to be appeared under the Base Scenario, are all retained and incorporated for the proposed developments within the Project Sites under the Proposed Scenario.

*Additional Good Air Ventilation Measures to be Incorporated*

7.3.6 Addition good air ventilation design measures are incorporated into the proposed building developments within certain Project Sites under the Proposed Scenario, targeting for better wind permeability and elongation of wind corridors. Terraced podiums are recommended adopted underneath the proposed domestic towers within Project Sites A1 and A2 under the Proposed Scenario, close to Separation 3-1. Ground level setbacks are integrated at strategic locations at certain proposed buildings within Project Sites B2 and A5 (see **Figure 6.2(b)** and **Figure A5** for locations of ground setbacks). After these ground setbacks are included, a better connectivity in the north south directions with better penetration of northerly and southerly prevailing wind can be achieved.

7.3.7 The evaluation of the two Scenarios would be based on the potential change in anticipated wind flow patterns, the change in extent of the wind wake areas, building permeabilities, identification of wind sensitive and potential areas as well as major district wind corridors/local air paths under identified prevailing wind directions. To recap, the difference between the Base and Proposed Scenarios in this Expert Evaluation would only be those within the Project Sites. Those planned and committed development layouts within surrounding Areas P1 to P31 (building layouts discussed in detail in Section 4 above) would serve as background. Furthermore, the most up to date road layouts would be adopted. The directional analysis and anticipated wind flow patterns under the Base and Proposed Scenarios are discussed below.





## 7.4 Expert Evaluation

***Under N Annual Prevailing Wind Direction***

*Base Scenario*

7.4.1 Under the Base Scenario, northerly wind would flow along Road 1-1 in between the committed school within Area P4 and GIC blocks within Area P6, and Road 1-2 located at the westward of Area P9 and towards the committed/planned high-rise Residential Blocks within Area P11 without much blockage. The northerly wind would then be stopped by these high-rises from reaching the further downstream regions (see Marker (1) in **Figure 7.2(a)**).

7.4.2 After skimming over the planned schools within Areas P7 and P8, the northerly wind from Road 2-1 would flow via the separation between Area P9 and P10 and continue its flow across the Kwu Tung Station towards the Europa Garden after flowing along the separation between Area P11 and Area P12 (Separation 2 marked in **Figure 7.2(a)**) as well as along Road 9 between Areas P13 and P14 (see Marker (2) in **Figure 7.2(a)**).

7.4.3 The separation (Separations 3-1 to 3-4 in **Figure 7.2(a)**) formed between Project Sites A1, A3, Areas P12, P14 and Project Sites A2, B1, B2, Area P15 links up the Fung Kong Shan and Fanling Highway and serves as a major district wise north-south directional wind corridor (see Marker (3) in **Figure 7.2(a)**). This major wind corridor would help to maintain the wind environment at the surroundings of Project Sites A1-A3, B1-B2 as well as Areas P12, P14 and P15.

7.4.4 After skimming over the proposed schools within Area P22, the northerly wind would flow along Road 6-2 towards the Kwu Tung Station and continue to flow along separations (i.e., Separations 4-1 and 4-2 in **Figure 7.2(a)**) between Project Sites A5/B6 and Areas P16/P17 towards the Fanling Highway (see Marker (4) in **Figure 7.2(a)**).

7.4.5 Road 11-1 abutting Project Sites B7 to B9 serves as a major north-south wind corridor that would direct the wind from Crest Hill to reach Project Site B5 (see Marker (5) in **Figure 7.2(a)**). The upwind schools located within Area P22 has a lower building height than the proposed blocks within Project Site B4, therefore, it is expected downwash wind would occur along Road 7 under the Base Scenario. Weakening of northerly wind is anticipated after flowing past Project Sites B4, B5 and B6. However, the proposed blocks within these Project Sites adopt podium free designs and are placed in a scattered manner, in which these good design measures would help to maximize the northerly wind availability towards downwind Areas P17 and P18 for the Base Scenario. Another branch stream of northerly wind would flow along Road 11-2 towards Road 11-3, which maintain the wind environment near Project Sites B10 to B12 and Project Site B4.

7.4.6 The Sheung Yue River would serve as another major district wise wind corridor in which the northerly wind originated from the regions near Ho Sheung Heung would flow along this river and reach the downwind areas near Area P20 and towards Area P19 (see Marker (6) in **Figure 7.2(a)**).

7.4.7 Among the seventeen Project Sites (i.e., A1 to A5 and B1 to B14), building separations can be seen in between majority of the proposed blocks within the Project Sites, which would enhance the wind permeability and reduce the wind impacts. **Figure 7.2(a)** illustrates the anticipated northerly annual prevailing wind flow for the Base Scenario.

7.4.8 Furthermore, as the proposed blocks within the Project Site A1 (135mPD) has lower building heights when compared to the committed developments within Area P10 (145mPD), it is anticipated downwash wind would occur along Road 2-2. Apart from that, the proposed blocks within Project Site A3 (115mPD) have a slightly lowered building height than Area P12 (120mPD) located at its downwind for the Base Scenario. Downwash wind is also anticipated to occur at regions between Project Site A3 and Area P12 near Kwu Tung Station under the northerly wind.

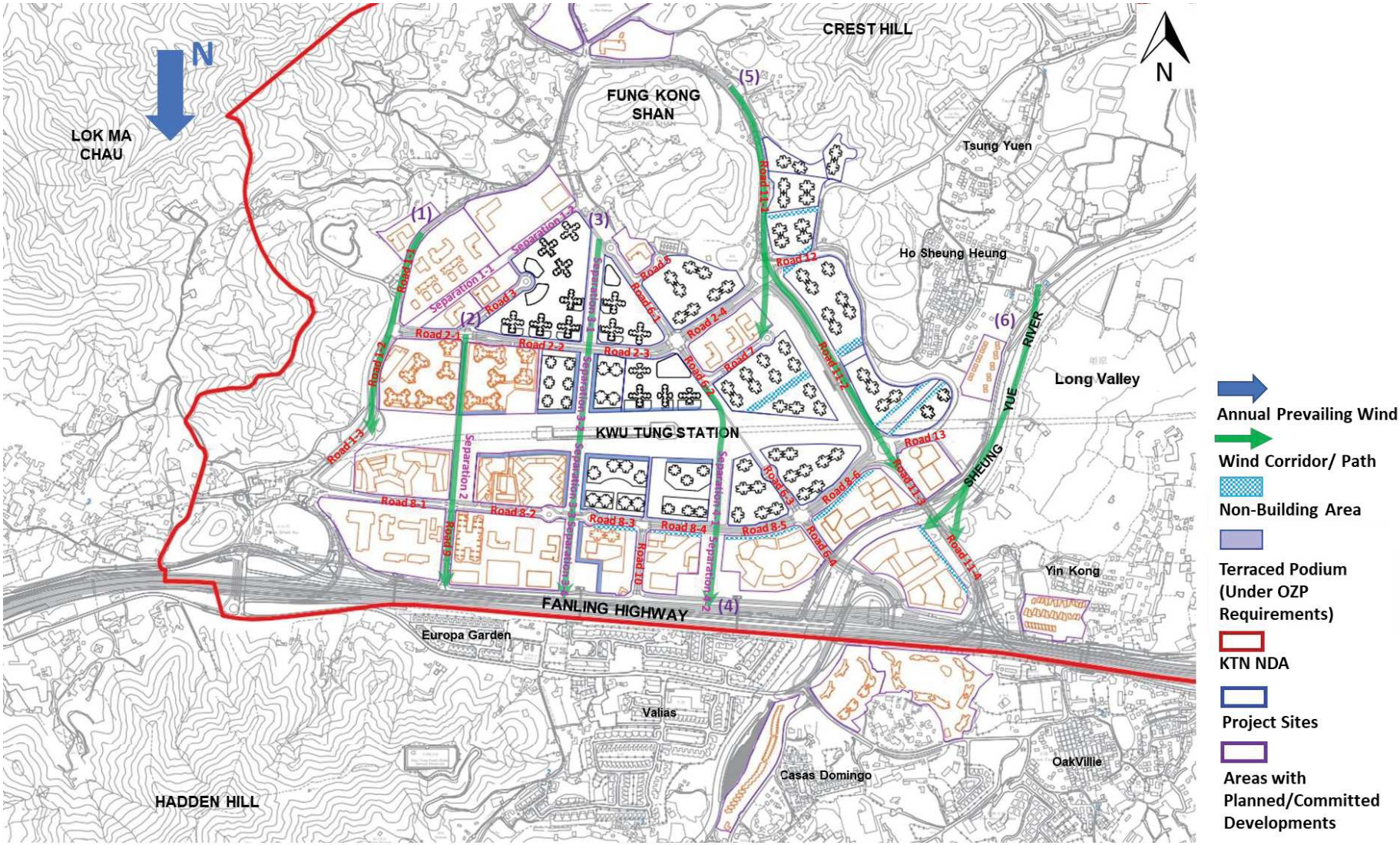



**Figure 7.2(a) Wind Flow under the N Annual Prevailing Wind for the Base Scenario**

*Proposed Scenario:*

*General*

7.4.9 The proposed development layout under the Proposed Scenario has retained the good air ventilation design measures incorporated in the Base Scenario. These include the podium free designs as well as two storeys terraced podiums for the proposed buildings within the Private Housing Sites (i.e., Podium free designs for Project Sites B3 to B9, B11 and B12; two storeys terraced podium within Project Sites B1, B2) and three storeys terraced podiums within the Public Housing Sites A1 to A5; the NBAs incorporated within Project Site B4 as well as within Project Sites B9 to B12. Apart from the good design measures under the Base Scenario retained, the Proposed Scenario has incorporated ground level setbacks within the proposed buildings within Project Sites B2 and A5 and terraced podiums underneath domestic blocks within Project Sites A1 and A2.

*Similarities in Pedestrian Wind Environment as compared to the Base Scenario*

7.4.10 Similar to the Base Scenario, northerly wind would flow along Road 1-1 in between the committed school within Area P4 and GIC blocks within Area P6, and Road 1-2 located at the westward of Area P9 and towards the committed/planned high-rise Residential Blocks within Area P11 and then sheltered by these high-rises from reaching the further downstream regions under the Proposed Scenario (see Marker (1') in **Figure 7.2(b)**).

7.4.11 Owing to the consistent building morphologies at the surrounding areas of the Project Site, the local air path originated from Road 2-1 towards the Europa Garden via separation between Areas P9 and P10 and along Road 9 identified under the Base Scenario remains unchanged and effective under the Proposed Scenario (see Marker (2') in **Figure 7.2(b)**).

7.4.12 The separation (Separations 3-1 to 3-4 in **Figure 7.2(b)**) formed between Project Sites A1, A3, Areas P12, P14 and Project Sites A2, B1, B2, Area P15 links up the Fung Kong Shan and Fanling Highway still serves as a major district wise north-south directional wind corridor under the Proposed Scenario (see Marker (3') in **Figure 7.2(b)**). In addition, terraced podiums are recommended to be incorporated underneath the proposed domestic towers located on both sides of Separation 3-1 under the Proposed Scenario, which better facilitates the flow of northerly prevailing wind and enhances the effectiveness of this major wind corridor.

7.4.13 Similar to the Base Scenario, after skimming over the proposed schools within Area P22, the wind path is still effective for the northerly wind to flow along Road 6-2 towards the Kwu Tung Station and continue to flow along separations (i.e., Separations 4-1 and 4-2 in **Figure 7.2(b)**) between Project Sites A5/B5 and Areas P16/P17 towards the Fanling Highway under the Proposed Scenario (see Marker (5') in **Figure 7.2(b)**).

7.4.14 Similar to the Base Scenario, Road 11-1 abutting Project Sites B7 to B9 serves as a major north-south wind corridor that would direct the wind from Crest Hill to reach Project Site B4 under the Proposed Scenario (see Marker (6') in **Figure 7.2(b)**). Another branch stream of northerly wind would flow along Road 11-2 towards Road 11-3, which maintain the wind environment near Project Sites B10 to B12 and Project Site B4.

7.4.15 Also appeared in the Base Scenario, the Sheung Yue River would serve as another major district wise wind corridor under the Proposed Scenario. The northerly wind originated from the regions near Ho Sheung Heung would flow along this river and reach the downwind areas near Area P20 and towards Area P19 under the Proposed Scenario (see Marker (7') in **Figure 7.2(b)**).

*Differences in Pedestrian Wind Environment as compared to the Base Scenario*

7.4.16 More massive podiums can be found within the Project Sites A1 to A5 and B10 under the Proposed Scenario with taller domestic blocks as the building height restrictions have relaxed. It is anticipated that the Proposed Scenario would induce wind wakes with larger extent and coverage to the downstream areas of the Project Sites as compared to the Base Scenario. In particular, the proposed buildings within Project Site A1 would have an observable increase in maximum building heights from 135mPD in the Base Scenario to 180mPD in the Proposed Scenario, inducing larger wind wakes that would likely to influence the downwind areas where Area P10 and Project Site A3 are located. Area P12 located to the downwind of Project Sites





A1 and A3 may influenced by the cumulative wind impacts induced by the proposed developments within these two Project Sites. In view of the above, design strategies in aspects of air ventilation performance should be explored for the future proposed developments within Project Sites A1 and A3 to enhance wind permeability and to alleviate the wind wakes induced.

7.4.17 Owing to the enlargement in footprint of proposed blocks and the incorporation of a larger podium beneath proposed blocks within Project Site A4, the northerly wind towards the Kwu Tung Station and the further downwind areas would be weakened under the Proposed Scenario as compared to the Base Scenario. Alternatively, additional good air ventilation design measures such as terraced podiums are adopted for the proposed buildings within Project Site A4 under the Proposed Scenario. The proposed buildings within Project Sites B2 and A5 have incorporated ground setbacks, causing the formation of a wind corridor from Project Sites B2 and A5 along Road 10 towards the Fanling Highway (see Marker (4') in **Figure 7.2(b)**). However, it is worthwhile to point out that the increase in maximum building heights for the proposed developments within Project Sites B2 and A5 would inevitably generate larger wakes that would cover the Areas P15 and P16 located to the immediate downwind.

7.4.18 The upwind schools located within Area P22 has a more observable building height differences with the proposed blocks within Project Site B4 and B5 under the Proposed Scenario, therefore, it is expected stronger downwash wind would occur along Road 7 under the Proposed Scenario as compared to the Base Scenario.

7.4.19 With a larger building footprint and slightly taller building heights under the Proposed Scenario as compared to the Base Scenario, the proposed building blocks within Project Sites B4, B5 and B6 would generate wind wakes that cover a slightly larger downwind area under the Proposed Scenario as compared to the Base Scenario (i.e., Areas P17 and P18). However, the proposed blocks within the above-mentioned Project Sites still adopt podium free designs and are placed in a scattered manner, in which these good design measures would help to facilitate the northerly wind flow towards downwind Areas P17 and P18 for the Proposed Scenario. Similarly, the heights of the proposed buildings within Project Sites B7 to B12 are also slightly relaxed under the Proposed Scenario, and a podium is included underneath three of the domestic towers within Project Site B10, implying larger wake areas would be induced influencing downwind areas as compared to the Base Scenario.

7.4.20 As compared to the Base Scenario, the district wise wind flow patterns can generally be maintained with slight changes in local wise wind flow patterns under the building layouts in the Proposed Scenario. Building separations are incorporated to enhance the wind permeability and reduce the wind impacts. Proposed building morphologies specifically within Project Sites B2 and A5 are recommended to incorporate ground level setbacks, aiming to increase building separation distances as well as elongating identified wind corridors and wind paths.

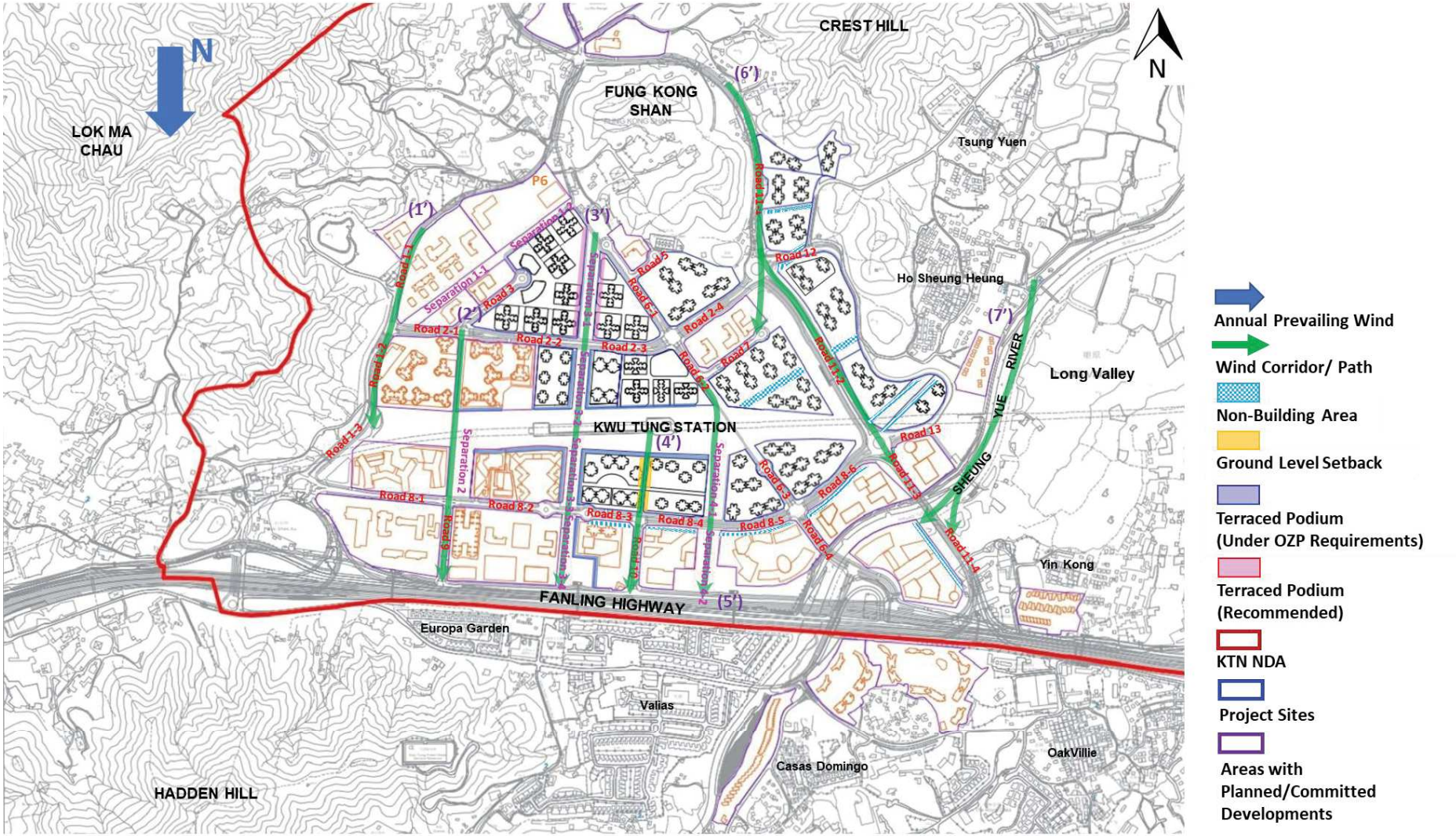



**Figure 7.2(b)** **Wind Flow under the N Annual Prevailing Wind for the Proposed Scenario**

***Under ENE Annual Prevailing Wind Direction***

*Base Scenario*

7.4.21 One pathway of the ENE annual prevailing wind originated from the Fung Kong Shan would flow along Road 1-1 sandwiched in between the planned school within Area P4 and the planned GIC buildings within Area P5, towards the downwind areas (see Marker (1) in **Figure 7.3(a)**). Another pathway of ENE wind would flow along the separation (i.e., Separations 1-1 and 1-2) in between Project Site A1, Areas P7/P8 and Areas P5/P6 towards Road 1-2 and the further downwind areas (see Marker (2) in **Figure 7.3(a)**). The two ENE wind corridors annotated as Markers (1) and (2) would help to maintain the air ventilation performance at the vicinity of Project Site A1 where Areas P4 to P8 are located.

7.4.22 The ENE wind originated from Tsung Yuen would flow along the Road 12 in between Project Sites B9 and B10 along Road 2-4 towards Project Site A4, the ENE wind would then be directed to flow along Road 2-3 (see Marker (3) in **Figure 7.3(a)**). It should be noted that there are two strips of NBAs incorporated at the south boundary of Project Site B9 and north boundary of Project Site B10 that would widen Road 12 and ensure better flow of the ENE prevailing wind.

7.4.23 There is a good penetration of ENE annual prevailing wind from the village houses of Ho Sheung Heung towards the Kwu Tung Station areas through penetrating the NBA located within Project Site B10 as well as the Non-Building Areas (NBA) incorporated within Project Site B4. This major ENE wind corridor under the Base Scenario is annotated by Marker (4) in **Figure 7.3(a)**.

7.4.24 The ENE annual prevailing wind originated from the southern regions of Ho Sheung Heung would penetrate Project Sites B11 and B12 via strips of NBAs placed within as well as via the building separations in between the proposed blocks located within. The ENE wind will flow across Road 11-2 and directed towards Roads 8-6, 8-5, 8-4 and 8-3 in between Project Sites A5, B5, B6 and Areas P15 to P18 (see Marker (5) in **Figure 7.3(a)**). It is worthwhile to mention that there are NBAs placed at the northern boundaries of Areas P15 to P18, which would widen the Roads 8-3 to 8-6 and enhance the effectiveness of this wind corridor.

7.4.25 The ENE wind originated from the Long Valley flowing along the Sheung Yue River between Areas P18 and P19 towards Area P17 and Fanling Highway serves as an effective ENE district-wise wind corridor (see Marker (6) in **Figure 7.3(a)**).

7.4.26 By studying the building height variations of the proposed developments within the Project Sites and the planned developments at the surrounding areas under the Base Scenario in **Figure A2**. Downwash wind is anticipated to occur at the Kwu Tung Station area as well as along Roads 2-1 and 2-2, Roads 6-1 and 6-2 under the ENE prevailing wind for the Base Scenario. These induced downwash wind due to the difference in building heights of the proposed/planned developments are essential to maintain the local wind environment near the Project Sites and their surrounding areas.

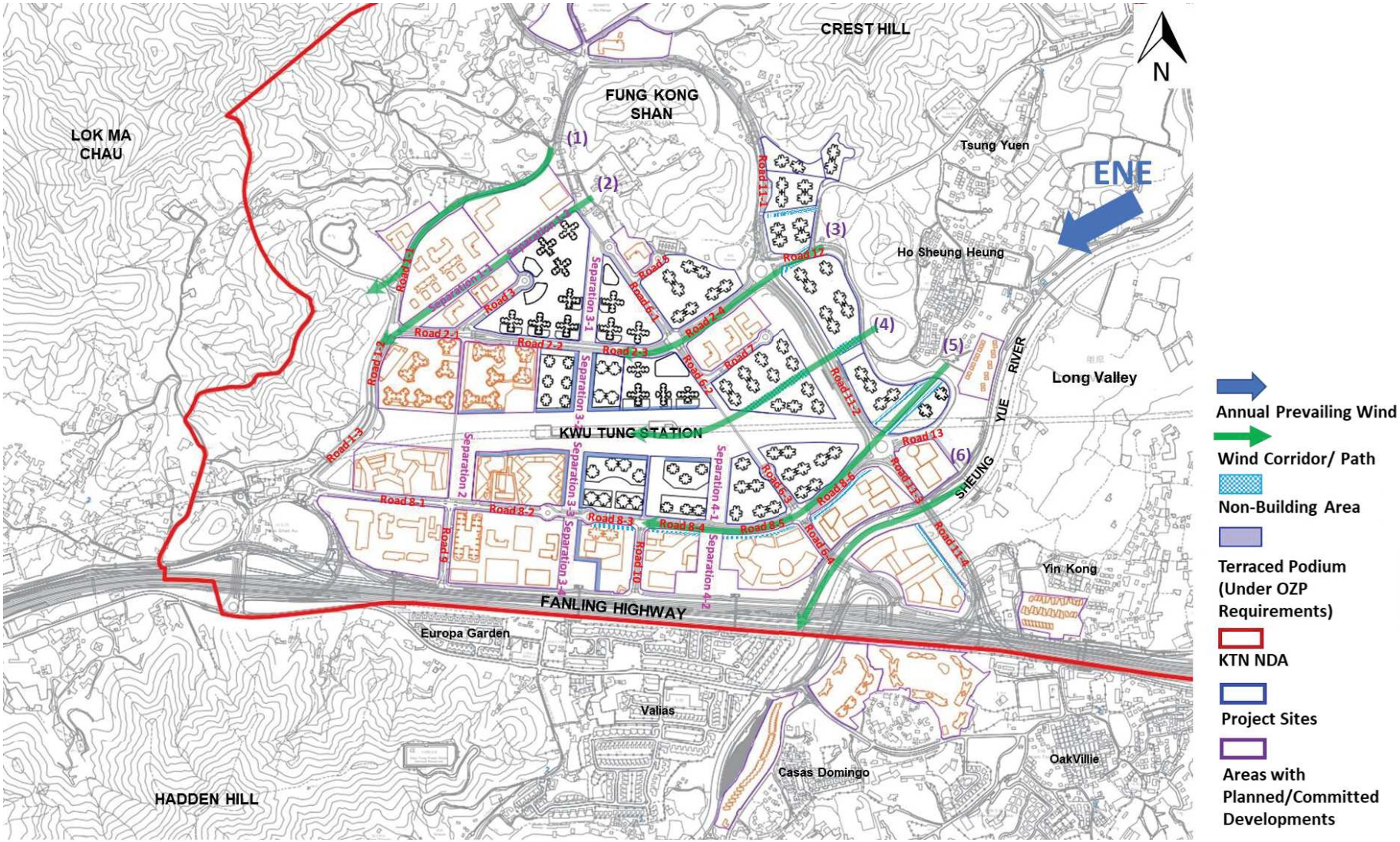



**Figure 7.3(a)** **Wind Flow under the ENE Annual Prevailing Wind for the Base Scenario**

*Proposed Scenario*

*Similarities in Pedestrian Wind Environment as compared to the Base Scenario*

7.4.27 Under the Proposed Scenario, the pathway of the ENE annual prevailing wind originated from the Fung Kong Shan would remain unchanged by flowing along Road 1-1 sandwiched in between the planned school within Area P4 and the planned G/IC buildings within Area P5, towards the downwind areas as in the Base Scenario (see Marker (1') in **Figure 7.3(b)**). As there is no change in the surrounding morphologies near the Project Sites, another pathway of ENE wind from Fung Kong Shan would flow along the separation (i.e., Separations 1-1 and 1-2) in between Project Site A1, Areas P7/P8 and Areas P5/P6 towards Road 1-2 and the further downwind areas (see Marker (2') in **Figure 7.3(b)**). Similar to the Base Scenario, the two ENE wind corridors annotated as Markers (1') and (2') would help to maintain the air ventilation performance at the vicinity of Project Site A1 where Areas P4 to P8 are located under the Proposed Scenario.

7.4.28 As there is no observable change in the building arrangements and orientations of the proposed domestic blocks as well as the locations of the incorporated NBAs within the upstream Project Sites B9 to B12, the ENE wind originated from Tsung Yuen would still flow along the Road 12 in between Project Sites B9 and B10 along Road 2-4 abutting Project Site B3 towards Project Site A4, the ENE wind would then be directed to flow along Road 2-3 under the Proposed Scenario (see Marker (3') in **Figure 7.3(b)**). The two strips of NBAs incorporated at the south boundary of Project Site B9 and north boundary of Project Site B10 still appears under the Proposed Scenario and would serve to widen Road 12. As a result, it is anticipated there would be no observable alteration in the wind flow patterns under the Proposed Scenario as compared to the Base Scenario.

7.4.29 Good penetration of ENE wind can still be observed under the Proposed Scenario from the village houses of Ho Sheung Heung towards the Kwu Tung Station areas through penetrating the NBA placed in between the proposed blocks within Project Site B10 as well as the Non-Building Area (NBA) incorporated within Project Site B4 with no observable changes in wind flow patterns. This major ENE wind corridor is annotated by Marker (4') in **Figure 7.3(b)**.

7.4.30 As there is no observable change in the building arrangements/orientations of proposed buildings within the upstream Project Sites B11, B12. In addition, the general placements of proposed buildings within the Project Sites B5 and B6 as well as Areas P18 and P19 remain unchanged, similar to the Base Scenario, the ENE annual prevailing wind originated from the southern regions of Ho Sheung Heung would penetrate Project Sites B11 and B12 via strips of NBAs placed within as well as via the building separations in between the proposed blocks located within. The ENE wind will flow across Road 11-2 and directed to flow Roads 8-6, 8-5, 8-4 and 8-3 in between Project Sites B2, A5, B5, B6 and Areas P15 to P18 under the Proposed Scenario (see Marker (5') in **Figure 7.3(b)**). The NBAs placed at the northern boundaries of Areas P15 to P18 in the Base Scenario still appear under the Proposed Scenario. Same as in the Base Scenario, this would widen the Roads 8-3 to 8-6 and enhance the effectiveness of this wind corridor under the Proposed Scenario.

7.4.31 As in the Base Scenario, the ENE wind originated from the Long Valley flowing along the Sheung Yue River between Areas P18 and P19 towards Area P17 and the Fanling Highway serves as an effective ENE district-wise wind corridor to maintain the wind environment under the Proposed Scenario (see Marker (6') in **Figure 7.3(b)**).

*Differences in Pedestrian Wind Environment as compared to the Base Scenario*

7.4.32 As compared to the Base Scenario, the overall domestic building footprints under the Proposed Scenario within the Project Sites are generally larger. More massive podiums can be found within the Project Sites A1 to A5 and part of Project Site B10 under the Proposed Scenario with taller domestic blocks as the building height restrictions have relaxed. It is anticipated that the Proposed Scenario would induce wind wakes with larger extent and coverage to the downwind regions as compared to the Base Scenario. In particular, there is a relative more observable increment in maximum building height within Project Site A1 as compared to other mentioned Project Sites in the Proposed Scenario as compared to the Base Scenario, therefore, larger wind wakes induced by the proposed developments within Project Site A1 would appear and are likely to influence the downwind regions near Areas P7,





P8 and P10. In view of the above, efforts should be carried out to explore design strategies in enhancing air ventilation performance for the future proposed developments within Project Site A1.

7.4.33 In addition, the increase in proposed building heights within Project Sites B2 and A5 as well as the enlargement of podiums within Project Site A5 would generate larger wakes in the Proposed Scenario as compared to the Base Scenario that would cover the downstream Areas P12, P14 and P15 under the ENE prevailing wind. Thus, these mentioned areas are regarded as potential wind sensitive areas.

7.4.34 Although there is no observable change in the building arrangements and orientations of the proposed domestic blocks within the Project Sites B3, B7 to B12 with the locations of the incorporated NBAs remain unchanged, the building heights within the aforementioned Project Sites are relaxed with slight enlargement in building footprints. In particular, a podium is placed underneath three of the domestic towers within Project Site B10. As a result, it is anticipated the proposed buildings within Project Sites B3, B7 to B12 would generate larger wind wakes to the downstream regions (i.e., Project Sites A2, B4, B6, Area P22) under the Proposed Scenario as compared to the Base Scenario.

7.4.35 By investigating the building height variations of the proposed developments within the Project Sites and the planned developments at the surrounding areas under the Proposed Scenario in **Figure A3**. Owing to the more observable differences in proposed building heights within the Project Sites and the planned/committed developments at the corresponding surrounding areas, strengthened downwash wind as compared to the Base Scenario is anticipated to occur at the Kwu Tung Station area as well as along Roads 2-1 and 2-2, Roads 6-1 and 6-2 under the ENE prevailing wind for the Proposed Scenario. The induced downwash wind is essential to maintain the local wind environment near the Project Sites and their surrounding areas.

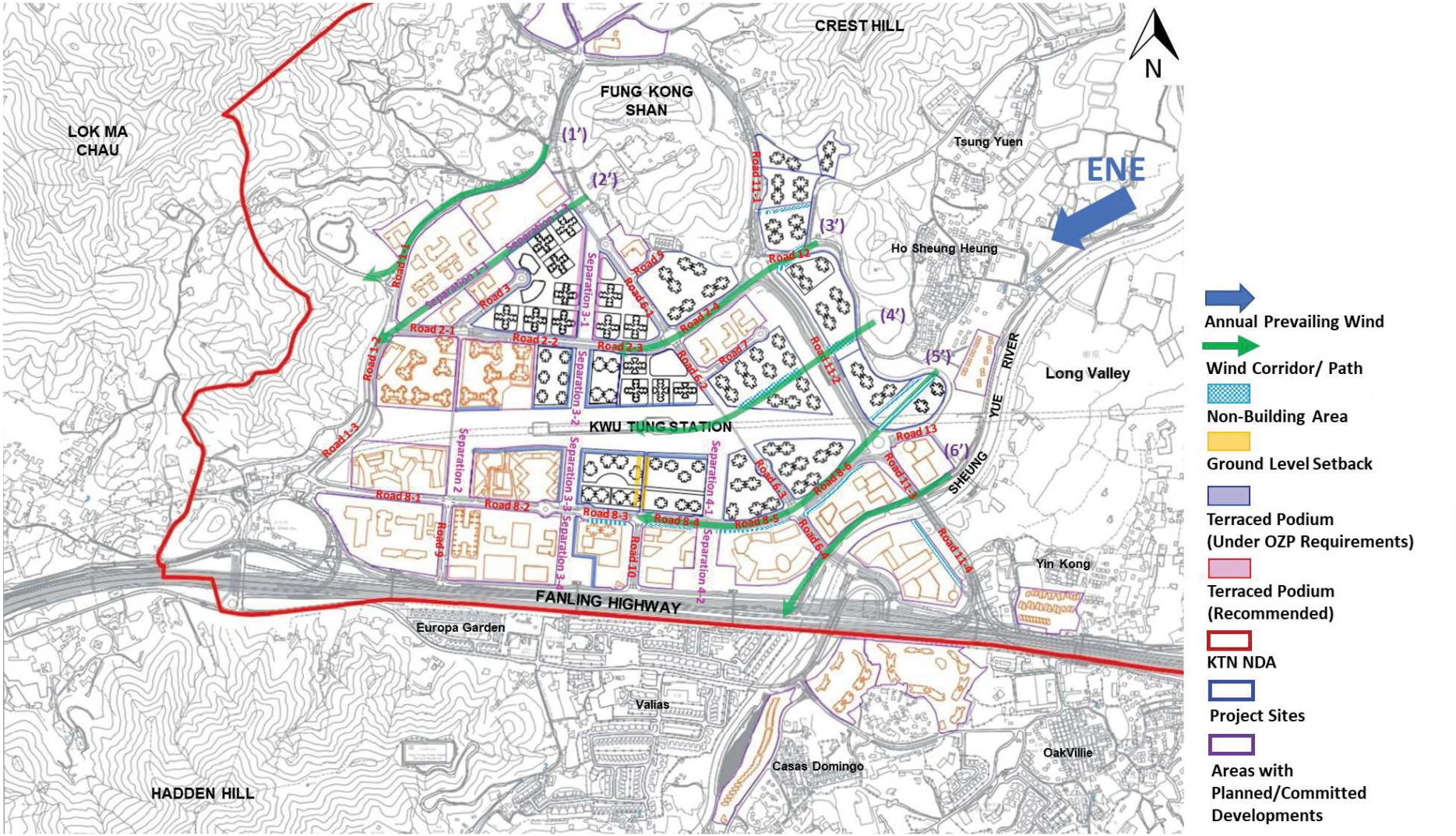



**Figure 7.3(b)** **Wind Flow under the ENE Annual Prevailing Wind for the Proposed Scenario**

***Under E Annual and Summer Prevailing Wind Direction***

*Base Scenario*

7.4.36 An easterly wind path originated from the village houses of Ho Sheung Heung would be divided into two streams of wind flow. One of the streams would flow via Road 12 located in between Project Sites B9 and B10 and continue to be directed and flow along Road 2-4, Road 2-3 and Road 2-2, while another stream of the easterly wind would flow via the sideway of Project Site B3 towards the school within Area P23. There are two strips of NBAs incorporated at the south boundary of Project Site B10 and north boundary of Project Site B11 that would widen Road 12 and ensure the penetration of the E prevailing wind (see Marker (1) in **Figure 7.4(a)**).

7.4.37 The NBAs placed within Project Site B10 and within Project Site B4 would facilitate the flow of easterly prevailing wind from the Ho Sheung Heung towards the Kwu Tung Station across Road 11-2. The NBAs linking together the Kwu Tung Station and Ho Sheung Heung would form an effective wind corridor that would benefit the penetrating of the easterly wind (see Marker (2) in **Figure 7.4(a)**). The building morphologies within Project Site B4 would result in a diversion of a stream of easterly wind to flow along Road 11-2 in the direction of Fung Kong Shan.

7.4.38 The E prevailing wind originated from Sheung Yue River would penetrate the southern regions of Project Site B12 and penetrate across the east-west orientated wind corridor along Kwu Tung Station towards Road 1-3 (see Marker (3) in **Figure 7.4(a)**).

7.4.39 The E prevailing wind from Road 8-6 will utilize Roads 8-1 to 8-5, as the easterly wind pathway to facilitate wind flow between the Project Sites B2, A5, B5, B6 and Areas P15 to P18 (see Marker (4) in **Figure 7.4(a)**). It is worthwhile to point out that NBAs are placed at the northern boundaries of Areas P15 to P18, which would widen the Roads 8-3 to 8-6 and enhancing the effectiveness of this easterly wind corridor.

7.4.40 Fanling Highway that locates adjacent to the southern side of KTN NDA boundary, is identified as one of the major E wind corridors for facilitating the district-wise air ventilation performance. The easterly wind would flow along Fanling Highway after the stream of easterly wind from the regions near Area P21 (see Marker (6) in **Figure 7.4(a)**) is merge with the stream of easterly wind from the Long Valley that is directed to flow along the portion of Sheung Yue River between Areas P18 and P19 (see Marker (5) in **Figure 7.4(a)**).

7.4.41 By studying the building height variations of the proposed developments within the Project Sites and the planned developments at the surrounding areas under the Base Scenario in **Figure A2**. Downwash wind is anticipated to occur along Roads 6-1, 6-2, 9 and 10 as well as along the major separations: Separation 2, Separation 3-3, Separations 4-1 to 4-2 formed in between the Project Sites and the surrounding areas under the E prevailing wind for the Base Scenario. These induced downwash wind due to the difference in building heights of the proposed/planned developments are essential to maintain the local wind environment.

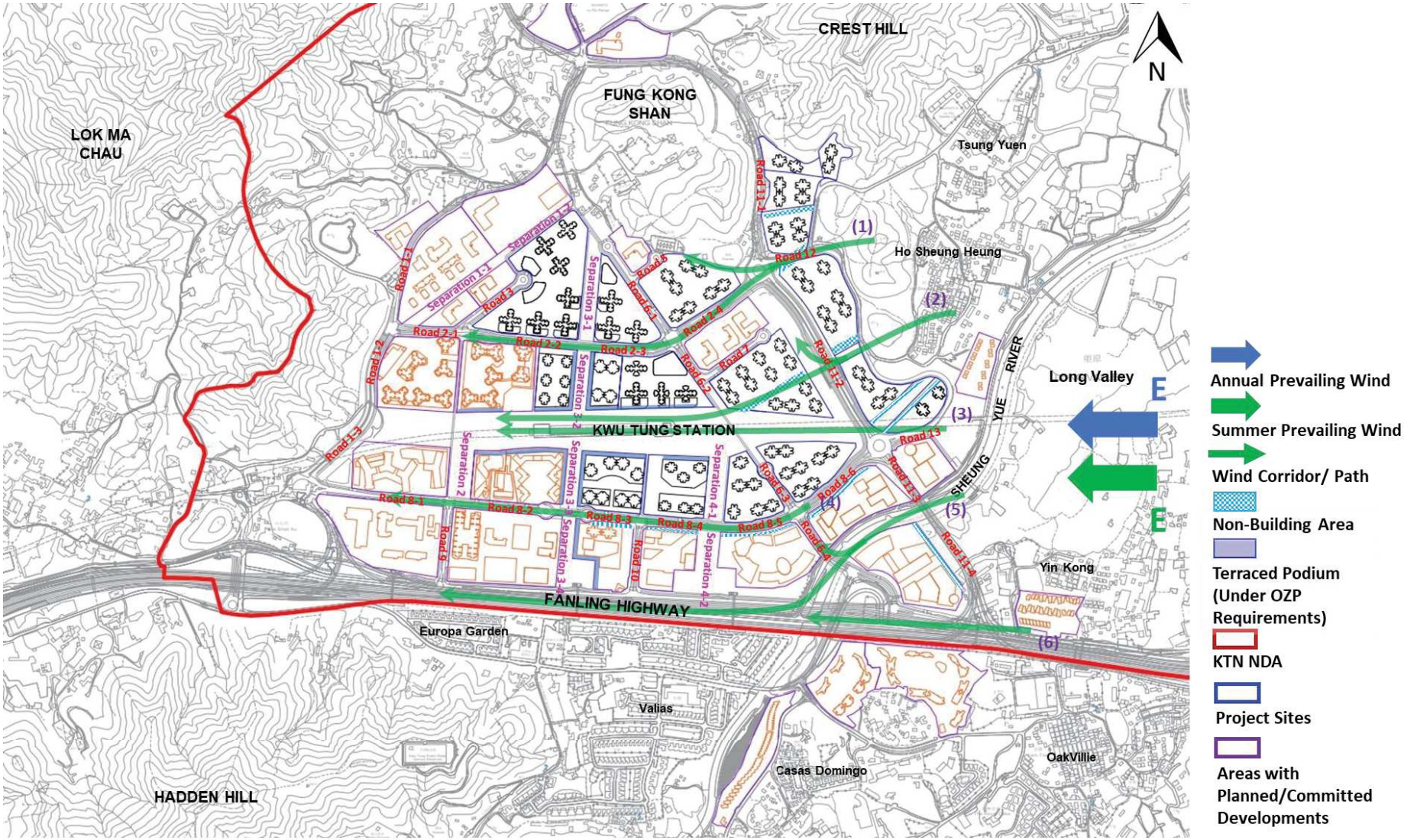



**Figure 7.4(a) Wind Flow under the E Annual and Summer Prevailing Wind for the Base Scenario**

*Proposed Scenario*

*Similarities in Pedestrian Wind Environment as compared to the Base Scenario*

7.4.42 As the building morphologies at the surrounding areas of the Base Scenario and Proposed Scenario are the same, the E wind path originated from the village houses of Ho Sheung Heung would remain unchanged by flowing along Road 12 located in between Project Sites B9 and B10 and divided into two streams of wind flow. The descriptions in paragraph 7.4.34 for the Base Scenario remain valid for the Proposed Scenario. There are two strips of NBAs incorporated at the south boundary of Project Site B9 and north boundary of Project Site B10 that would widen Road 12 and ensure the penetration of the E prevailing wind under the Proposed Scenario (see Marker (1') in **Figure 7.4(b)**).

7.4.43 The easterly wind flow patterns via the NBAs placed with Project Site B10 and within Project Site B4 from Ho Sheung Heung towards the Kwu Tung Station across Road 11-2 remains unchanged in the Proposed Scenario as compared to the Base Scenario. The NBAs linking together the Kwu Tung Station and Ho Sheung Heung would form an effective wind corridor that would benefit the penetrating of the easterly wind (see Marker (2') in **Figure 7.4(b)**). Same as in the Base Scenario, the building morphologies within Project Site B4 under the Proposed Scenario would result in a diversion of a stream of easterly wind to flow along Road 11-2 in the direction of Fung Kong Shan.

7.4.44 The two identified district-wise E wind corridors in the Base Scenario remain unchanged and effective under the Proposed Scenario. Areas along the Kwu Tung Station as well as Fanling Highway, which are aligned in E-W direction would help to maintain the district-wise air ventilation performance (see Markers (3') and (6') in **Figure 7.4(b)**).

7.4.45 The stream of easterly wind from Road 8-6 and flow along Road 8-1 to 8-5 under the Base Scenario remains the same under the Proposed Scenario (see Marker (4') in **Figure 7.4(b)**). Similar to the situation in the Base Scenario, the incorporation of NBAs at the northern boundaries of Areas P15 to P18 would widen the Roads 8-3 to 8-6 and enhance the effectiveness of this easterly wind corridor under the Proposed Scenario.

7.4.46 With the unchanged in sideward building morphologies, the easterly wind from the Long Valley would be directed to flow along the portion of Sheung Yue River sandwiched in between Areas P18 and P19. This stream of easterly wind would merge with the stream of easterly wind coming from the Yin Kong regions near Area P21 and continue to flow along the Fanling Highway (see Markers (5') and (6') in **Figure 7.4(b)**).

7.4.47 By investigating the building height variations of the proposed developments within the Project Sites and the planned developments at the surrounding areas under the Proposed Scenario in **Figure A3**, locations where downwash wind is anticipated to occur under the Proposed Scenario are generally consistent with the Base Scenario which are along Roads 6-1, 6-2, 9 and 10 as well as along the major separations: Separation 2, Separations 3-1 to 3-2, Separations 4-1 to 4-2 formed in between the Project Sites and the surrounding areas under the E prevailing wind for the Proposed Scenario.

*Differences in Pedestrian Wind Environment as compared to the Base Scenario*

7.4.48 Similar to that under the ENE prevailing wind, as compared to the Base Scenario, the overall domestic building footprints under the Proposed Scenario within the Project Sites are generally larger. More massive podiums can be found within the Project Sites A1 to A5 and part of Project Site B10 under the Proposed Scenario with taller domestic blocks as the building height restrictions have relaxed. It is anticipated that the Proposed Scenario would induce wind wakes with larger extent and coverage to the downwind regions as compared to the Base Scenario under the easterly annual and summer prevailing wind. It is worthwhile to mention that the wind environment at Areas P6, P7 and P8 located at the immediate downwind of Project Site A1 as well as the wind environment at Area P10 located to the immediate downwind of Project Site A3 would be influenced by the larger wind wakes generated by the taller proposed buildings within these Project Sites after relaxation of building heights under the Proposed Scenario as compared to the Base Scenario.

7.4.49 In addition, the increase in proposed building heights within Project Sites B2 and A5 as well as the enlargement of podiums within Project Site A5 would generate larger wakes in the





Proposed Scenario as compared to the Base Scenario that would cover the downstream Area P12 under the E prevailing wind. Thus, this area is regarded as one of the potential wind sensitive areas.

7.4.50 As the proposed buildings within Project Sites B8 to B10 have a slight relaxation of building heights under the Proposed Scenario, slightly stronger wind channeling effects are anticipated along the NBA within these Project Sites. However, larger wake areas under the Proposed Scenario potential affecting the downwind Area P22 are anticipated to appear.

7.4.51 With more observable differences in proposed building heights within the Project Sites and the planned/committed developments at the corresponding surrounding areas, strengthened downwash wind as compared to the Base Scenario is anticipated to occur along Roads 6-1 and Road 6-2 as well as near Separation 4-1. The induced downwash wind is essential to maintain the local wind environment at/near the Project Sites under the Proposed Scenario.

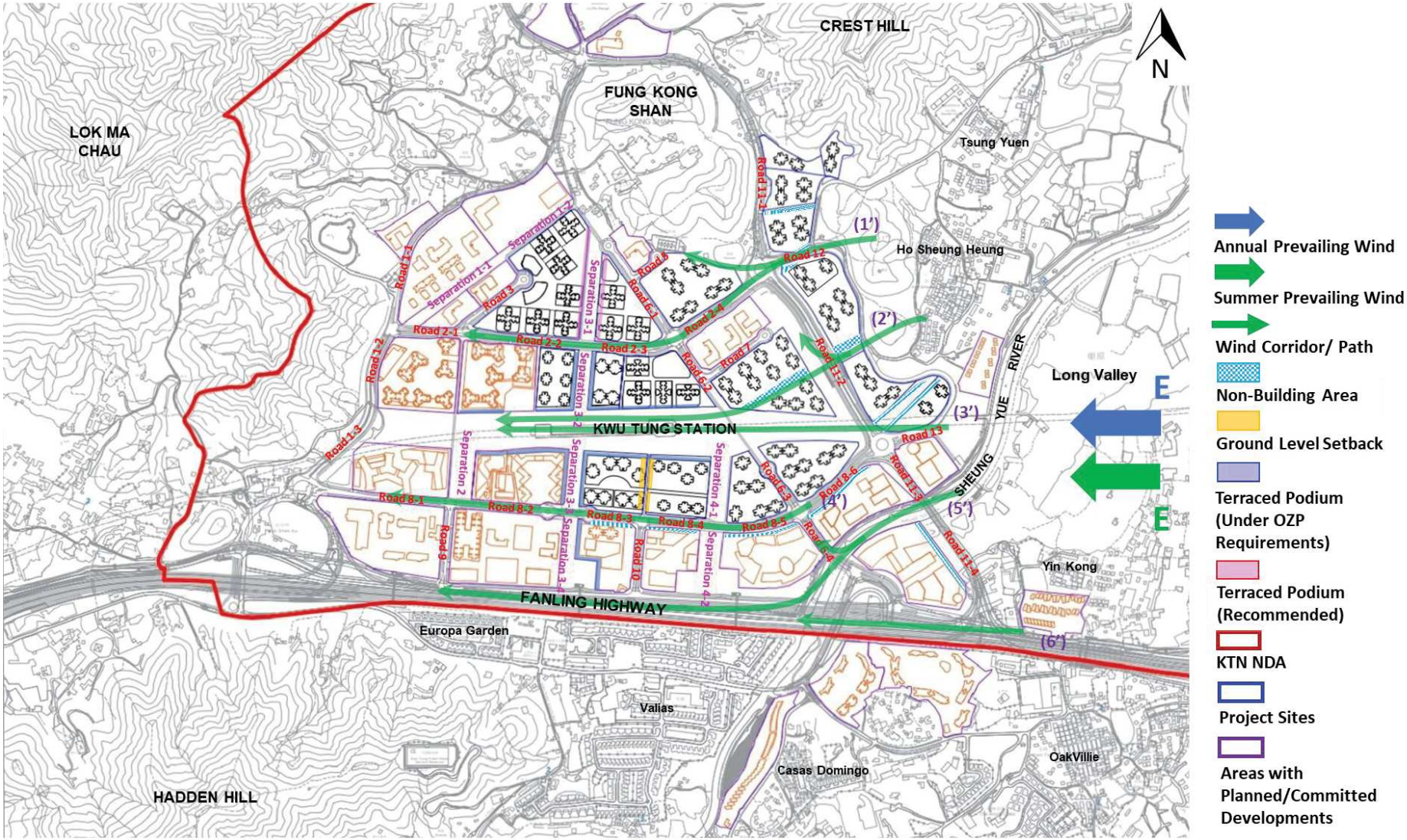



**Figure 7.4(b) Wind Flow under the E Annual and Summer Prevailing Wind for the Proposed Scenario**

***Under S Summer Prevailing Wind Direction***

*Base Scenario*

7.4.52 Under the Base Scenario, the southerly wind would be sheltered by the committed/planned high-rise residential blocks within Area P11. The southerly wind would flow along Road 1-2 located at the westward of Area P9 towards Road 1-1 via sidewards of the committed school within Area P4 towards the north without much further blockage (see Marker (1) in **Figure 7.5(a)**).

7.4.53 A local southerly wind path originated from the Europa Garden near the Fanling Highway towards Areas P7 and P8 is identified under the Base Scenario (see Marker (2) in **Figure 7.5(a)**). The southerly wind originating from the Fanling Highway would flow along Road 9 between Areas P13 and P14 as well as the separation between Area P11 and Area P12 (Separation 2 marked in **Figure 7.5(a)**) towards the Kwu Tung Station regions. After flowing past the separation between Areas P9 and P10, the southerly wind would reach Road 2-1 and the planned schools within Areas P7, P8.

7.4.54 The separation (Separations 3-1 to 3-4 in **Figure 7.5(a)**) formed between Project Sites A1, A3, Areas P12, P14 and Project Sites A2, B1, B2, Area P15 links up the Fung Kong Shan and Fanling Highway and serves as a major district wise north-south directional wind corridor (see Marker (3) in **Figure 7.5(a)**). This major wind corridor would help to maintain the wind environment at the surroundings of Project Sites A1-A3, B1, B2 as well as Areas P10, P12 and P14.

7.4.55 The southerly wind originated from Fanling Highway after flowing along separations (i.e., Separations 4-1 and 4-2 in **Figure 7.5(a)**) between Project Sites A5/B5 and Areas P16/P17, would flow towards the Kwu Tung Station and be directed to continue its pathway along Road 6-2 (see Marker (4) in **Figure 7.5(a)**).

7.4.56 Owing to the urban grid and placement of the proposed buildings within Areas P17 and P19, the southerly wind originated from the Fanling Highway would be diverted into two streams. The first stream would flow along Roads 6-4 and 6-3 in between Areas P17/P19 and Project Sites B5 and B6 respectively, while another stream of the southerly prevailing wind would be directed to flow along the portion of Sheung Yue River sandwiched in between Areas P18 and P19 (see Marker (5) in **Figure 7.5(a)**).

7.4.57 Weakening of southerly wind is anticipated after flowing past the Project Sites B4, B5 and B6. However, the proposed blocks within the above-mentioned Project Sites adopt podium free designs and are placed in a scattered manner with building separations, in which all these good design measures would help to facilitate the southerly wind availability towards downwind Project Sites B7 to B11 for the Base Scenario. Road 11-1 abutting Project Sites B7 to B9 serves as a major north-south wind path that would help to maintain the wind environment at the surroundings of Project Sites B3, B7 to B9 and Area P22 (see Marker (6) in **Figure 7.5(a)**).

7.4.58 The Sheung Yue River would serve as another major district wise wind corridor in which the southerly wind originated from the Fanling Highway and the regions near Area P18, and Area P21 near to Yin Kong would flow along this river and reach the downwind areas near Area P24 and regions east of Ho Sheung Heung (see Marker (7) in **Figure 7.5(a)**).

7.4.59 By observing the building height distributions within the Project Sites and the surrounding areas under the Base Scenario (see **Figure A2**), locations where downwash wind occurs under the S prevailing wind are along Road 8 (i.e., Road 8-1 to Road 8-6), where the planned buildings within Areas P13 to P18 have a less taller building heights as compared to those within Areas P11, P12 and Project Sites B2, B5, B6 and A5. Apart from that, downwash wind is also anticipated to occur along Roads 2-1 to 2-4 as well as the regions near the Kwu Tung Station, where the buildings facing the southerly prevailing wind have building heights lower than that of the rear ones.

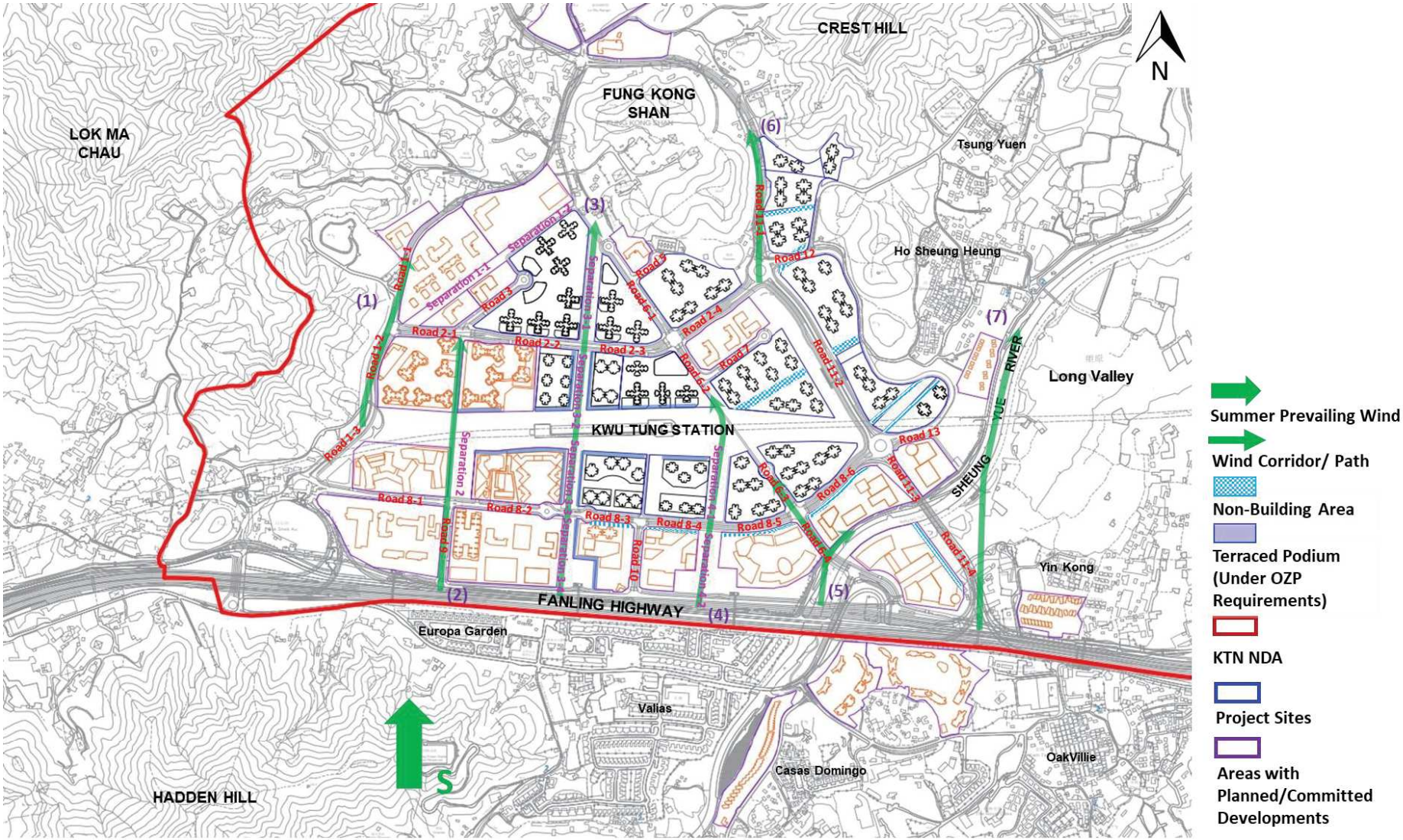



**Figure 7.5(a) Wind Flow under the S Summer Prevailing Wind for the Base Scenario**

*Proposed Scenario*

*General*

7.4.60 The proposed development layout under the Proposed Scenario has retained the good air ventilation design measures incorporated in the Base Scenario. These include the podium free designs as well as two storeys terraced podiums for the proposed buildings within the Private Housing Sites (i.e., Podium free designs for Project Sites B3 to B9, B11, B12; two storeys terraced podium within Project Sites B1, B2) and three storeys terraced podiums within the Public Housing Sites A1 to A5; the NBAs incorporated within Project Sites B4, B9 to B12. Apart from the good design measures under the Base Scenario retained, the Proposed Scenario are recommended to be incorporated with ground level setbacks within the proposed buildings within Project Sites B2 and A5 as well as terraced podiums within Project Sites A1 and A2 (see **Figure 7.5(b)**).

*Similarities in Pedestrian Wind Environment as compared to the Base Scenario*

7.4.61 Under the Proposed Scenario, there are no differences in the surrounding building morphologies within Areas P4 to P14 located to the western side of the Project Sites. Therefore, the anticipated wind flows described in paragraphs 7.4.52 to 7.4.53 for the Base Scenario are valid for the Proposed Scenario (see Markers (1'), (2') in **Figure 7.5(b)**).

7.4.62 The separation (Separations 3-1 to 3-4 in **Figure 7.5(b)**) formed between Project Sites A1, A3, Areas P12, P14 and Project Sites A2, B1, A5, Area P15 links up the Fung Kong Shan and Fanling Highway, which also appears in the Base Scenario, serves as a major district wise north-south directional wind corridor under the Proposed Scenario (see Marker (3') in **Figure 7.5(b)**). This major wind corridor would help to maintain the wind environment at the surroundings of Project Sites A1-A3, B1, B2 as well as Areas P10, P12, P14 and P15 under the Proposed Scenario.

7.4.63 Remained consistent as in the Base Scenario, the southerly wind originated from Fanling Highway after flowing along separations (i.e., Separations 4-1 and 4-2 in **Figure 7.5(b)**) between Project Sites A5/B5 and Areas P16/P17, would flow towards the Kwu Tung Station and be directed to continue its pathway along Road 6-2 under the Proposed Scenario (see Marker (5') in **Figure 7.5(b)**).

7.4.64 Owing to the unchanged urban grid and placement of the proposed buildings within Areas P17 to P19 under the Proposed Scenario as compared to the Base Scenario, the southerly wind originated from the Fanling Highway would be diverted into two streams and the wind flow under the Proposed Scenario remains unchanged as under the Base Scenario (see Marker (6') in **Figure 7.5(b)**).

7.4.65 The proposed blocks within Project Sites B4 to B6 under the Proposed Scenario still adopt podium free designs and are placed in a scattered manner with building separations, in which all these good design measures would help to maximize the southerly wind availability towards downwind Project Areas B7 to B12 for Proposed Scenario. Similar to the Base Scenario, the weakened south prevailing wind would then flow along Road 11-1 abutting Project Sites B7 to B9 and serves as a major north-south wind corridor that would help to maintain the wind environment at the surroundings of Project Sites B3, B7 to B9 and Area P22 under the Proposed Scenario (see Marker (7') in **Figure 7.5(b)**).

7.4.66 By observing the building height distributions within the Project Sites and the surrounding areas under the Proposed Scenario (see **Figure A3**), locations where downwash wind occurs under the S prevailing wind for the Proposed Scenario are consistent to the places identified under the Base Scenario. The locations where downwash occur are along Road 8 (i.e., Road 8-1 to Road 8-6), as well as along Roads 2-1 to 2-4 and regions near the Kwu Tung Station.

*Differences in Pedestrian Wind Environment as compared to the Base Scenario*

7.4.67 Terraced podiums are recommended to be incorporated underneath the proposed domestic towers located on both sides of Separation 3-1 within Project Sites A1 and A2 under the Proposed Scenario, which better facilitates the flow of southerly prevailing wind to the downstream areas under the Proposed Scenario as compared to the Base Scenario. The proposed buildings within Project Site A1 would have an observable increase in maximum





building heights from 135mPD in the Base Scenario to 180mPD in the Proposed Scenario, inducing larger wind wakes that would likely to influence the downwind areas where Areas P6 and P8 are located. Apart from the proposed buildings within Project Site A1, the proposed developments within Project Site A2 also exhibit an increment in maximum building height in the Proposed Scenario as compared to the Base Scenario, in which larger wind wakes are anticipated to appear that would cover Area P23 and affecting the wind environment there. In view of the above, efforts should be paid to explore design strategies that would enhance air ventilation performance for the future proposed developments within Project Sites A1 and A2 aiming to increase wind permeability and to alleviate the influences of the wind wakes induced.

7.4.68 To facilitate the flow of southerly wind originated from the Fanling Highway due to the enlarged podium with Project Site A5 under the Proposed Scenario, by incorporating additional good air ventilation design measures including ground level setbacks for the proposed buildings within Project Sites B2 and A5 under the Proposed Scenario, the identified wind corridor is elongated, and linkage is formed between Road 10 towards Kwu Tung Station (see Marker (4') in **Figure 7.5(b)**).

7.4.69 As the proposed building blocks within Project Sites B4 to B12 have a relaxation of building heights ranging from 5mPD to 15mPD and enlargement in building footprints in the Proposed Scenario, further weakening of southerly wind is anticipated after flowing past these Project Sites under the Proposed Scenario as compared to the Base Scenario. In particular, the larger wind wakes induced by the proposed buildings within Project Site B4 would reach Area P22, in which this area is identified as a potential wind sensitive area.

7.4.70 Despite there are more observable building height profile differences in the Proposed Scenario as compared to the Base Scenario, in which it is anticipated the magnitude of the downwash wind would be stronger under the Proposed Scenario, however, it should be noted that the relaxation in building heights under the Proposed Scenario would result in taller buildings which would generate larger wake areas appearing at downstream areas as compared to the Base Scenario.

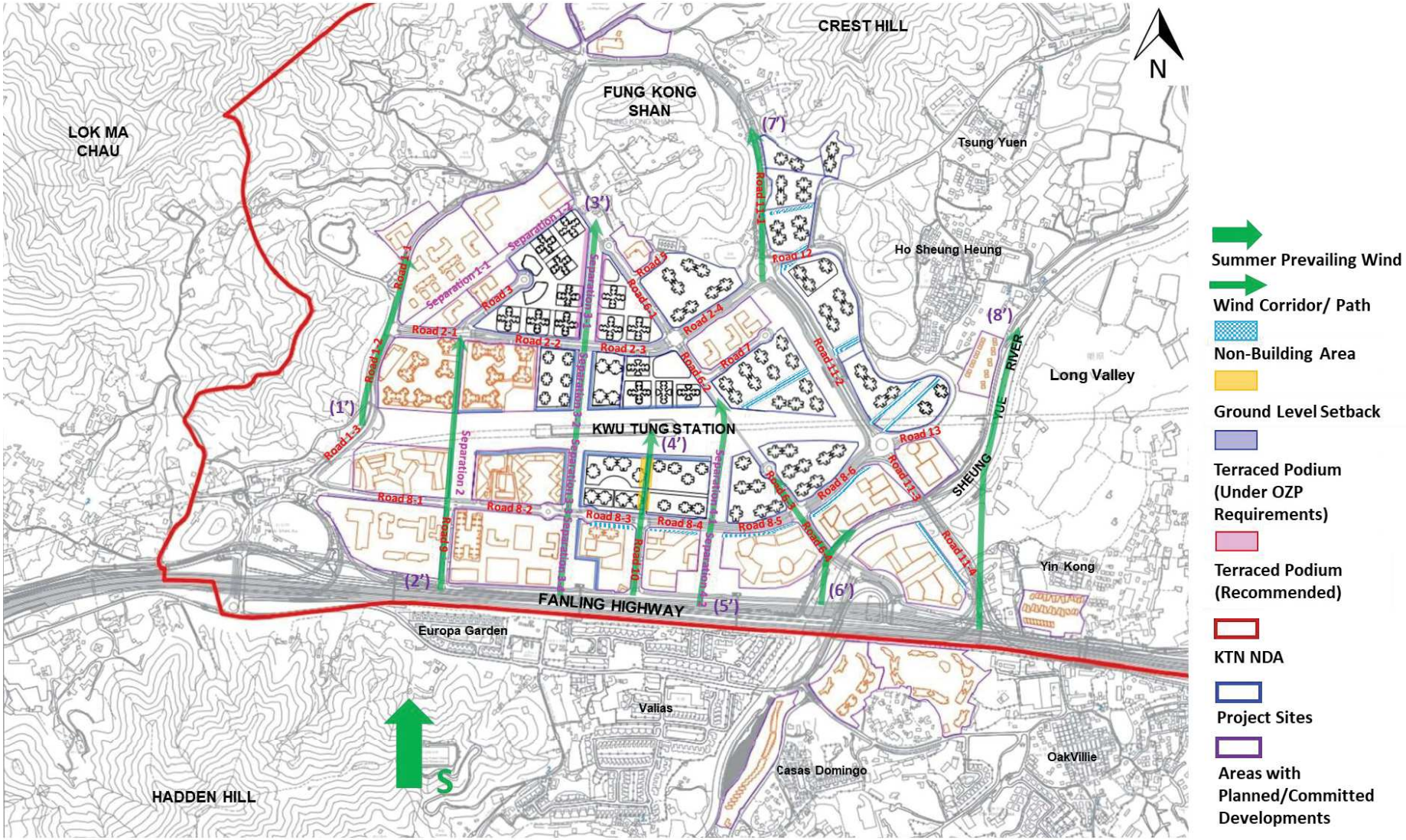



**Figure 7.5(b) Wind Flow under the S Summer Prevailing Wind for the Proposed Scenario**

***Under SW Summer Prevailing Wind Direction***

*Base Scenario*

7.4.71 Three major SW summer wind corridors are identified. The first one is Road 1-1 flowing between the planned school within Area P4 and the GIC blocks within Area P5 towards Fung Kong Shan (see Marker (1) in **Figure 7.6(a)**). The second one is along the Separations (i.e., Separation 1-1 and Separation 1-2) formed between Areas P5/ P6 and Areas P7/ P8/ Project Site A1 towards Fung Kong Shan (see Marker (2) in **Figure 7.6(a)**). The third one is originating from the Fanling Highway, travels between Areas P18 and P19 and sideway of Area P20, across the Sheung Yue River towards the Long Valley (see Marker (9) in **Figure 7.6(a)**).

7.4.72 Dominant by the urban grid, the SW wind flowing along the Fanling Highway would have several diversion streams of wind to enter Road 9, Separation 3-4, Road 10 as well as Separation 4-2 (see Marker (8) in **Figure 7.6(a)**).

7.4.73 As majority of the proposed buildings within the Project Sites and the planned/committed developments at the surrounding areas are not orientated in a SW-NE direction, elongated and connected air pathways penetrating the Project Sites can hardly be found under the SW summer prevailing wind for the Base Scenario. However, there are still some wind paths can be identified after sheltering by the proposed developments within the Project Sites.

7.4.74 The SW wind after sheltered by the proposed residentials within Project Site A2 would flow along Road 5 abutting the northwestern boundary of Project Site B3 (see Marker (3) in **Figure 7.6(a)**). In addition, the SW wind from Road 2-3 near Project Sites B1 and A4 would flow along Road 2-4 and via Road 12 towards the Ho Sheung Heung and Tsung Yuen regions (see Marker (4) in **Figure 7.6(a)**). There are two strips of NBAs incorporated at the south boundary of Project Site B9 and north boundary of Project Site B10 that would widen Road 12 and ensure the better penetration of the SW prevailing wind. Another SW wind path towards Project Site B10 is identified to be along Road 7 located in between Area P22 and Project Site B4 (see Marker (5) in **Figure 7.6(a)**).

7.4.75 Two another SW wind paths toward the Ho Sheung Heung Areas are spotted. The first one is from the Kwu Tung Station Area by flowing along the SW-NE aligned NBAs placed within Project Site B4 as well as within Project Site B10, across Road 11-2 towards the village houses of Ho Sheung Heung (see Marker (6) in **Figure 7.6(a)**). The second SW wind path is identified to be along Road 8-5 and Road 8-6 by penetrating the southern portion of Project Site B11 via the building separations with NBAs placed towards Ho Sheung Heung (see Marker (7) in **Figure 7.6(a)**).

7.4.76 By observing the building height distributions within the Project Sites and the surrounding areas under the Base Scenario (see **Figure A2**), locations where downwash wind occurs under the SW prevailing wind are along Road 8 (i.e., Road 8-1 to Road 8-6), where the planned buildings within Areas P13 to P18 have a less taller building heights as compared to those within Areas P11, P12 and Project Sites B2, A5, B5 and B6. Apart from that, downwash wind is also anticipated to occur along Roads 2-2 and 2-3 where proposed buildings within Project Sites A3, A4 and B1 are lower than that of those within Project Sites A1 and A2. Furthermore, downwash wind is also anticipated at regions of the Kwu Tung Station near Project Sites B1/A4 and B2/A5, as well as along Roads 11-1 and 11-2 where the proposed/planned developments within Project Sites B3, B4, Areas P22, P23 have lower building heights than the planned developments within Project Sites B7 to B12.

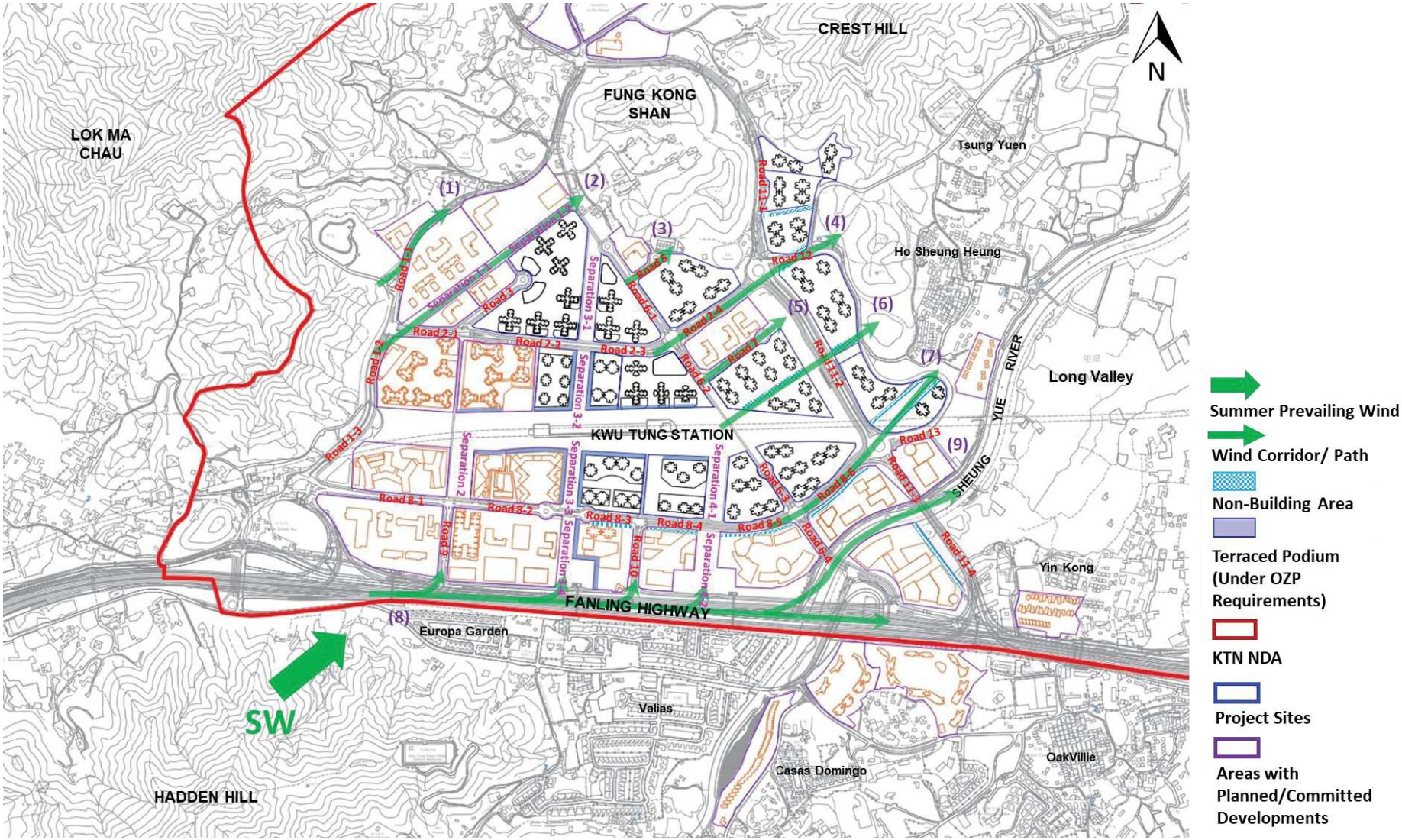



**Figure 7.6(a) Wind Flow under the SW Summer Prevailing Wind for the Base Scenario**

*Proposed Scenario*

*General*

7.4.77 Elongated and connected air pathways penetrating the Project Sites can hardly be found under the SW summer prevailing wind for the Proposed Scenario.

*Similarities in Pedestrian Wind Environment as compared to the Base Scenario*

7.4.78 The three major SW summer wind corridors identified in the Base Scenario are still effective under the Proposed Scenario (see Markers (1'), (2') and (9') in **Figure 7.6(b)**). Same as under the Base Scenario, the SW wind flowing along the Fanling Highway would have several diversion streams of wind to enter Road 9, Separation 3-4, Road 10 as well as Separation 4-2 in the Proposed Scenario (see Marker (8') in **Figure 7.6(b)**). As a result, the discussions on the wind flow patterns along the three identified wind corridors and Fanling Highway for the Base Scenario in paragraphs 7.4.71 to 7.4.72 are also valid for the Proposed Scenario.

7.4.79 The two strips of NBAs incorporated at the south boundary of Project Site B9 and north boundary of Project Site B10 that would widen Road 12 to ensure the better penetration of the SW prevailing wind in the Base Scenario are still retained in the Proposed Scenario.

7.4.80 Two another SW wind paths toward the Ho Sheung Heung Areas are spotted under the Proposed Scenario and remained unchanged as in the Base Scenario. The first one is from the Kwu Tung Station Area by flowing along the SW-NE aligned NBAs placed within Project Site B4 as well as Project Site B10, across Road 11-2 towards the village houses of Ho Sheung Heung (see Marker (6') in **Figure 7.6(b)**). The second SW wind path is identified to flow along Road 8-5 and Road 8-6 by penetrating the southern portion of Project Site B11 via the building separations with NBAs placed towards Ho Sheung Heung (see Marker (7') in **Figure 7.6(b)**).

7.4.81 By observing the building height distributions within the Project Sites and the surrounding areas under the Proposed Scenario (see **Figure A3**), locations where downwash wind occurs under the SW prevailing wind are similar to that under the Base Scenario. These places include along Road 8 (i.e., Road 8-1 to Road 8-6); along Roads 2-2 and 2-3; at regions of the Kwu Tung Station near Project Sites B1/A4 and B2/A5, as well as along Roads 11-1 and 11-2.

*Differences in Pedestrian Wind Environment as compared to the Base Scenario*

7.4.82 Considering the observable relaxation in maximum building height within Project Site A1 under the Proposed Scenario, wind wakes with larger extent is anticipated to be induced by the proposed buildings within Project Site A1 under the Proposed Scenario as compared to the Base Scenario. These wind wakes would affect the wind environment at regions near Fung Kong Shan with relatively less frequent pedestrian access, as well as Area P23 located to the downwind.

7.4.83 As the proposed developments within Project Site A2 adjacent to Project Site A1 have taller building heights and enlarged podiums, they would generate larger wind wakes that cover the immediate downwind areas where Area P23 is located and create greater sheltering effects as compared to the Base Scenario. However, the further weakened SW wind after sheltered by the taller proposed residentials within Project Site A2 would still flow along Road 5 abutting the northwestern boundary of Project Site B3 (see Marker (3') in **Figure 7.6(b)**). In addition, the weakened SW wind from Road 2-3 near Project Sites B1 and A4 would flow along Road 2-4 and via Road 12 towards the Ho Sheung Heung and Tsung Yuen regions (see Marker (4') in **Figure 7.6(b)**).

7.4.84 Another SW wind path towards Project Site B10 is identified to flow along Road 7 located in between Area P22 and Project Site B4 (see Marker (5') in **Figure 7.6(b)**). However, it is anticipated that the wind along Road 7 would be slightly weaker under the Proposed Scenario as compared to the Base Scenario, because of the taller and more compact building morphologies with the upwind Project Site A4. The taller buildings and the more massive podiums with compact morphologies within Project Site A4 under the Proposed Scenario would generate wind wakes that affect the wind environment within the downwind Area P22, and thus this area is identified as one of the potential wind sensitive areas.





7.4.85 Owing to the slight building height relaxation within Project Site B4, stronger wind channeling effects along the NBA is anticipated under the Proposed Scenario as compared to the Base Scenario. In addition, the proposed building heights within Project Sites B10 to B12 are relaxed under the Proposed Scenario implying larger wind wakes are anticipated to appear to cover the Ho Sheung Heung regions as compared to the Base Scenario.

7.4.86 Owing to more observable differences in proposed building heights within the Project Sites and the planned/committed developments at the surrounding areas under the Proposed Scenario as compared to the Base Scenario, it is expected that the magnitude of downwash wind under the Proposed Scenario is stronger than that under the Base Scenario. However, it should also be noted that the relaxation in building heights under the Proposed Scenario would result in taller buildings which would generate wind wakes that would cover a larger extent of the downstream areas as compared to the Base Scenario.

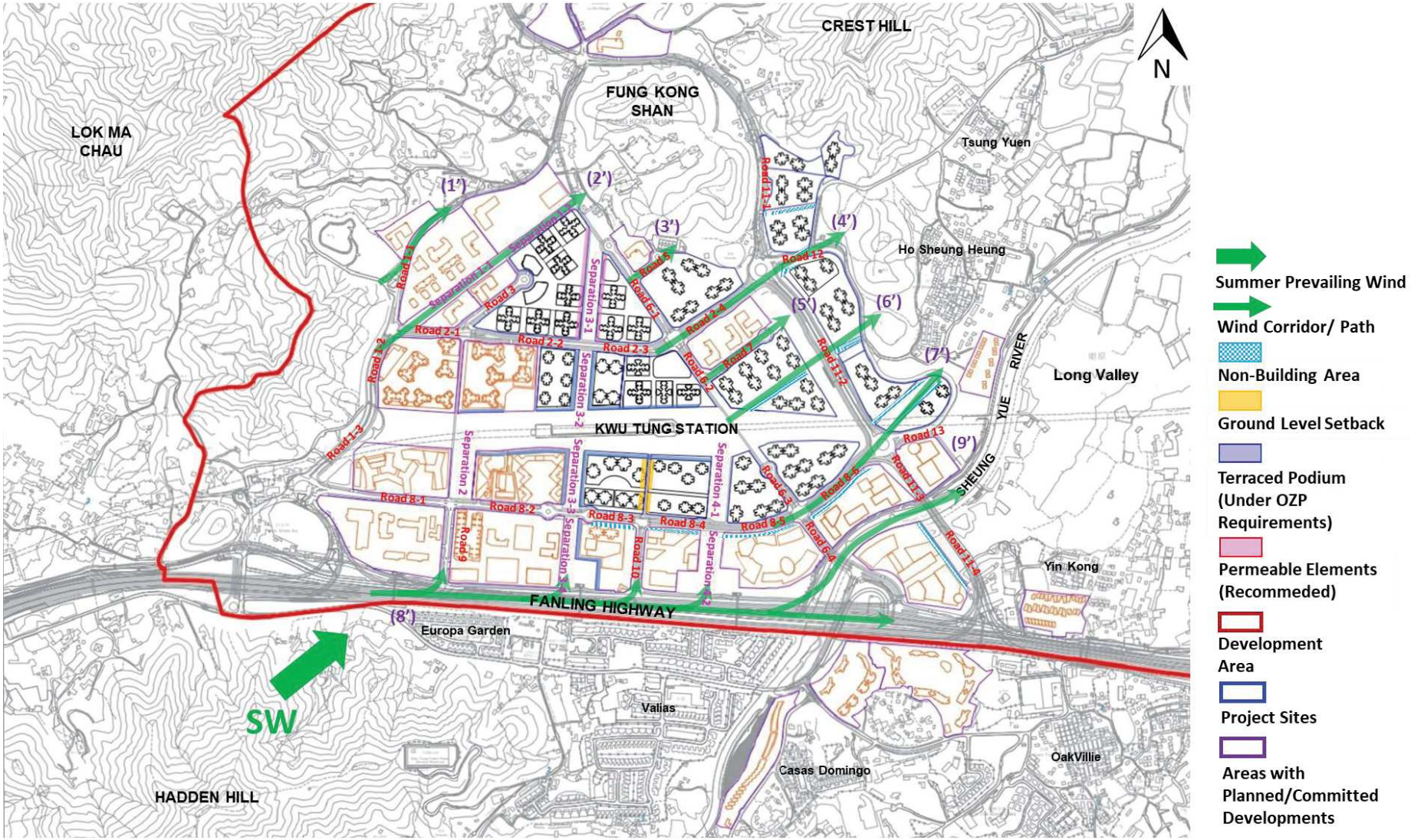



**Figure 7.6(b)** **Wind Flow under the SW Summer Prevailing Wind for the Proposed Scenario**

7.4.87 To summarize the above directional analysis, it is anticipated there is no great alteration in wind flow patterns between the Base Scenario and the Proposed Scenario. Instead, due to the overall increase in building heights and slightly larger building footprints under the Proposed Scenario as compared to the Base Scenario, it appears that the Proposed Scenario may induce larger wakes at the corresponding downstream areas when compared with the Baseline Scenario. However, stronger downwash wind and strengthened local wind channeling effects would appear under the Proposed Scenario as compared to the Base Scenario. Therefore, a district level decline in wind environment is not expected after the construction of the Proposed Scenario.

*Potential Wind Sensitive Areas under the Identified Prevailing Wind Directions*

7.4.88 Based on the directional analysis and discussions above, the potential wind sensitive areas identified under the northerly wind are the areas along Kwu Tung Station, Area P10 located to the downwind of Project Site A1; Area P12 located to the immediate downwind of Project Sites A1 and A3; Areas P15, P16 located to the downwind of Project Sites B2 and A5 as well as Areas P17 and P18 located to the downwind of the Project Sites B5 and B6.

7.4.89 For the east-north easterly wind, the potential wind sensitive regions are Areas P7, P8 and P10 with planned/committed developments located to the downwind of the Project Sites A1 and A3. In addition, Areas P12, P14 and P15 located to the downstream of Project Sites B2, A5 as well as Area P22 located to the downwind of Project Site B10 are identified as potential wind sensitive areas.

7.4.90 The potential wind sensitive areas identified under the easterly annual and summer prevailing wind are Areas P6, P7 and P8 with planned schools and GIC blocks as well as Area P10 with high rise residential blocks and ancillary facilities located to the downwind of the Project Sites A1 and A3. In addition, Area P12 located to the immediate downwind of Project Sites B2 and A5 as well as Area P22 with planned schools located to the downwind of Project Site B10 are identified as potential wind sensitive areas.

7.4.91 The potential wind sensitive areas identified under the southerly summer prevailing wind are Areas P6 and P8 with planned schools and GIC blocks as well as Areas P22 and P23 with planned residentials and schools located to the downwind of the Project Sites B4 and A2 respectively, while the potential wind sensitive areas identified under the south westerly summer prevailing wind include Areas P22 and P23 with planned schools located at downwind of Project Sites A4 and A2 as well as Ho Sheung Heung region with village houses located to the downwind of the Project Sites B10 to B12 under both the Base and Proposed Scenarios.





# 8 FURTHER PROPOSED SCENARIO OPTIMIZATION AND GOOD AIR VENTILATION DESIGN MEASURES

## 8.1 Hong Kong Planning Standards and Guidelines (HKPSG) and SBDG

8.1.1 In terms of maintaining the wind environment from the district level perspective, several principles for planning have been listed out in the Chapter 11 of the HKPSG and one of the most important principles is the alignments of breezeways and / or air paths in prevailing wind directions, accompanied by perpendicular insertion of air paths (see **Figure 8.1**). This would promote wind penetration through urbanized areas. Breezeways could be achieved by connecting major roads, open spaces, amenity areas, NBAs, building setbacks and low-rise building corridors.

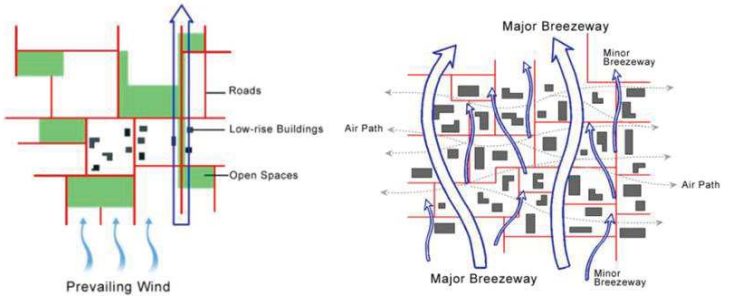



**Figure 8.1 Linkage of roads / open space / low-rise buildings to form paths of air flow**

8.1.2 Orientations of streets (see **Figure 8.2**) are also important for maximize the infiltration of prevailing winds into grid-patterned streets. The orientation of arrays of main streets/wide main avenues should best stay parallel to the prevailing wind directions, or with less than 30 degrees, being acceptable. Long street grid facing incoming winds should be avoided to minimize wind stagnant zones. Widening of streets/ building setbacks are also considered as a merit design feature.

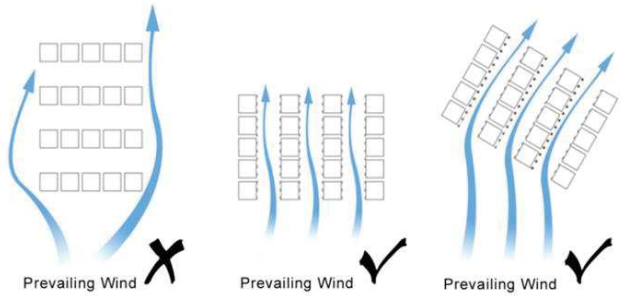



**Figure 8.2 Illustration of orientation of streets**

8.1.3 Height variation for buildings (see **Figure 8.3**) also has its role in facilitating the wind flows in urban district, especially in the form of height decreases towards the direction where prevailing wind originates, as this feature instigates the wind flowing in vertical directions throughout the district. With low-rise buildings and open spaces widely dispersed around, the effect would be intensified.

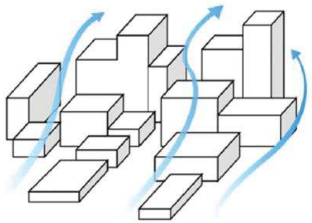



**Figure 8.3 Varying building height profile**

8.1.4 Further to the HKPSG, Sustainable Building Design Guideline (SBDG) aims to enhance building designs and permeability in avoiding screen wall effect and to promote air movements amongst developments to enhance better dispersion and air mixing. Building setback is one of the requirements under SBDG which can improve the wind environment at pedestrian level. According to the SBDG, buildings fronting a street of less than 15m wide should be set back so that no part of the building up to a level of 15m above the street level should be within 7.5m from the centerline of the street. The potential improvement on air ventilation caused by sites adopting building setback could be quite significant for those streets which are currently less than 15m wide. The illustration is shown in **Figure 8.4**.


**Figure 8.4 Building setback**

8.1.5 Building separation increases permeability within the urban built environment to mitigate heat island effects arising from the undesirable screening effect of long buildings. Incorporating building porosity into building design promotes air movements amongst developments and enhances the diffusion and mixing of air. Permeability in the low zone is particularly important for improving air ventilation at pedestrian level. For those developments with podia, podium garden is recommended that allows wind to penetrate nearer to the pedestrian level. In addition, to further facilitate ventilation for those areas with podia, the podia have adopted terraced podium design as illustrated in **Figure 8.5**. Such design would direct downward airflow to the pedestrian level.

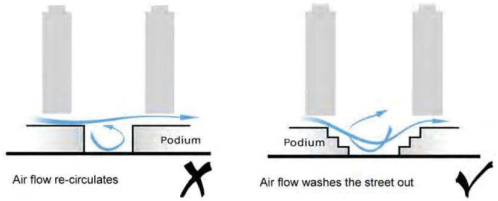



**Figure 8.5 Terraced podium design**





8.1.6 Some generic recommendations from the building level perspective are listed below to further enhance the wind permeability/ penetration and minimize the ventilation impacts to their surrounding areas:

- Avoid long continuous façades and face shorter frontages of proposed buildings to the prevailing wind directions
- Minimization/Break down of podium bulk with small ground coverage or adoption of podium-free design
- Adopt empty bay design on the ground floor of podium or incorporate permeable elements/podium gardens to enhance the wind permeability at pedestrian level
- Adopt terraced podium designs for podia to enhance ventilation.
- Reference to the recommendations of design measures in the Sustainable Building Design Guideline (SBDG) and Hong Kong Planning Standards and Guidelines (HKPSG)
- Ensure building permeability equivalent to 20% to 33.3% of total frontal area, with reference to PNAP APP-152
- Design the urban grids within the KTN NDA containing the Project Sites in accordance with major prevailing wind directions
- Adopt full building/podium setbacks at feasible locations, with reference to PNAP APP-152.
- Incorporate greeneries (preferably tree planting at grade) covering no less than 30% within the Project Sites

## 9 SUMMARY AND CONCLUSION

9.1.1 AECOM has been commissioned by CEDD to provide an Air Ventilation Assessment (AVA) to support Section 16 Planning Application for a total of 17 housing sites (the Project Sites) on top of the previous planning application No. A/KTN/54 and the approved Outline Zoning Plan (OZP) No. S/KTN/2, in which the plot ratios and building height restrictions are proposed to be relaxed for additional housing supply and community facilities.

9.1.2 From comparing the wind data from PlanD RAMS, wind tunnel experiment and HKO weather stations. As the Site Wind Availability Study by wind tunnel approach focused on the site wind for the KTN NDA, it is considered more appropriate to adopt the wind tunnel experimental data to identify the prevailing wind directions. The annual prevailing wind directions identified toward the Projects Sites are N, ENE and E while the summer prevailing wind directions are E, S and SW.

9.1.3 The KTN NDA containing the Project Sites is located at the rural areas of Hong Kong, “Green Belt”, “Agriculture”, “Other Specified Uses” as well as scattered areas of “Village Type Development” being the majority lands surrounding the KTN NDA. To the west of the Project Sites outside the KTN NDA are Green Belt areas of Lok Ma Chau, while to the north of the Project Sites are mainly Green Belt areas of Fung Kong Shan and to the further north are the “Agriculture” lands of Ma Tso Lung the “Green Belt” areas belonging to Crest Hill. There are currently scattered low-rise developments located to the immediate east of the Project Sites which would be planned to be developed into GIC buildings and residential blocks while the village houses of Ho Sheung Heung would be retained. To the further east outside the KTN NDA across the Sheung Yue River are some “Other Specified Uses” lands and village houses of Wai Lo Tsuen. To the south of the Project Sites, across the Fanling Highway are zoned as “Residential (Group C)” land use, which are existing low rise residential developments of Europa Garden, the Valais and Casas Domingo.

9.1.4 The existing developments within the Project Sites are occupied by brownfields, temporary structures and low-rise village houses of Tung Fong, Fung Kong, Tong Kok and Shek Tsai Leng. Among the seventeen Projects Sites (A1 to A5 and B1 to B12) located at the central to south-western sector of the KTN NDA, seven are zoned for “Residential (Group A)” developments while the rest ten are zoned for “Residential (Group B)”.

9.1.5 The seventeen Project Sites (A1 to A5 and B1 to B12) are located at a sizable flatland surrounded by hilly terrains with varying height. The topographical height of the terrains to the near north and further north-eastern directions to the Project Sites are the hilly terrains of Fung Kong Shan/Crest Hill and Sandy Ridge respectively. To the near east of the KTN NDA are Sheung Shui and Fanling Towns situated on the flatlands as well as the terrains of High Hill located to the far east. There are also hilly terrains of approximately 100mPD belonging to the Lok Ma Chau area located to the near west of the KTN NDA, while the lands belonging to San Tin are relatively flat. The most observable terrain to the south and south westerly directions of the Project Sites is the Hadden Hill with maximum terrain altitude of 200mPD.

9.1.6 Surround the seventeen Project Sites exist extensive areas with planned/committed developments. These surrounding areas are planned to be developed into schools, public and private residential towers, GIC blocks as well as other specified usage buildings such as Hospitals, Clinics, Health Centers, Commercial and Research Development blocks. The planned/committed building morphologies within these surrounding planned/committed areas near the Project Sites are assumed to be consistent under both the Base Scenario and Proposed Scenario when carrying out the Expert Evaluation.

9.1.7 Two Development Scenarios are examined in this Study, namely Base Scenario and the Proposed Scenario. Under the Base Scenario and Proposed Scenario, both domestic residential blocks, non-domestic podiums and ancillary buildings are to be appeared in the Project Sites. As shown on the indicative layouts, the proposed building orientations, number of building blocks and arrangements are assumed to remain consistent in the Base and Proposed Scenarios with major differences being the building heights being relaxed and the domestic towers as well as podium footprints being enlarged within majority of the Project Sites in the Proposed Scenario as compared to the Base Scenario expect for Project Site B10. For Project Site B10, there is a relaxation in maximum building height as well as an increase





in non-domestic plot ratio in the Proposed Scenario as compared to the Base Scenario. Nonetheless, the development schemes would be subjected to change at the detailed design stage. The mitigation measures proposed under the Proposed Scenario would be further studied and refined based on the development schemes of all public housing sites and the recommendation of any subsequent AVA at the detailed design stage.

9.1.8 The building layouts under Proposed Scenario of the Project Sites have paid the very best efforts in maintaining the wind environment by retaining the good designs measures including but not limited to adoption of podium free designs in certain private housing Project Sites (Project Sites B3 to B9, B11 and B12) and terraced podiums designs are adopted for Project Sites with podiums. In addition, the established major wind corridors/ wind paths under major prevailing wind directions are remain unblocked. Moreover, more observable variation in building height profiles with the surrounding committed/planned developments can be observed in the Proposed Scenario with relaxed building height restrictions, inducing stronger downwash wind in the Proposed Scenario as compared to the Base Scenario.

9.1.9 On top of the good design measures already incorporated in the Base Scenario, ground level setbacks at some proposed buildings within Project Sites B2 and A5 to widen the N-S wind corridors/wind paths are suggested under the Proposed Scenario, which is subject to change at the detailed design stage. Terraced podiums are proposed along site boundaries abutting the open space between Project Sites A1 & A2 to direct downward airflow to the pedestrian level and align with the terraced podium along the major north-south open space spine at Project Sites A3 & B1. Regardless of the building layouts to be adopted by future developers within Project Sites A1, A2, A5 and B2, terraced podium designs as well as ground level setbacks should be explored and considered to widen the N-S wind corridors/wind paths to promote the penetration of northerly and southerly prevailing wind.

9.1.10 In view of the above, it is anticipated there is no great alteration in wind flow patterns between the Base Scenario and the Proposed Scenario. Instead, due to the overall relaxation in building heights under the Proposed Scenario as compared to the Base Scenario, it appears that the Proposed Scenario may induce larger wakes in the downstream area when compared with the Baseline Scenario. However, stronger downwash wind and strengthened local wind channeling effects would appear under the Proposed Scenario as compared to the Base Scenario. Therefore, a district level decline in wind environment is not expected after the construction of the Proposed Scenario. In addition, several general mitigation measures, and general recommendations in accordance with the Sustainable Building Design Guidelines and the Hong Kong Planning Standards and Guidelines, have been suggested for incorporation in the advanced design stage, attempting to further enhance the local wind availability.

9.1.11 The established wind corridors/wind paths, Non-Building Areas and good air ventilation design measures including but not limited to podium free designs within certain private housing Project Sites, as well as terraced podiums adopted for Project Sites with podiums, are maintained in the Proposed Scenario. With additional measures such as ground level setbacks incorporated at some proposed buildings within Project Sites B2 and A5 to widen the N-S wind corridors/wind paths as well as terraced podium designs recommended to be adopted for the proposed developments within Project Sites A1 and A2 under the indicative building layouts for the Proposed Scenario, the potential air ventilation impacts should be reduced to a minimal extent with no district wise decline in the wind environment.

Annex I

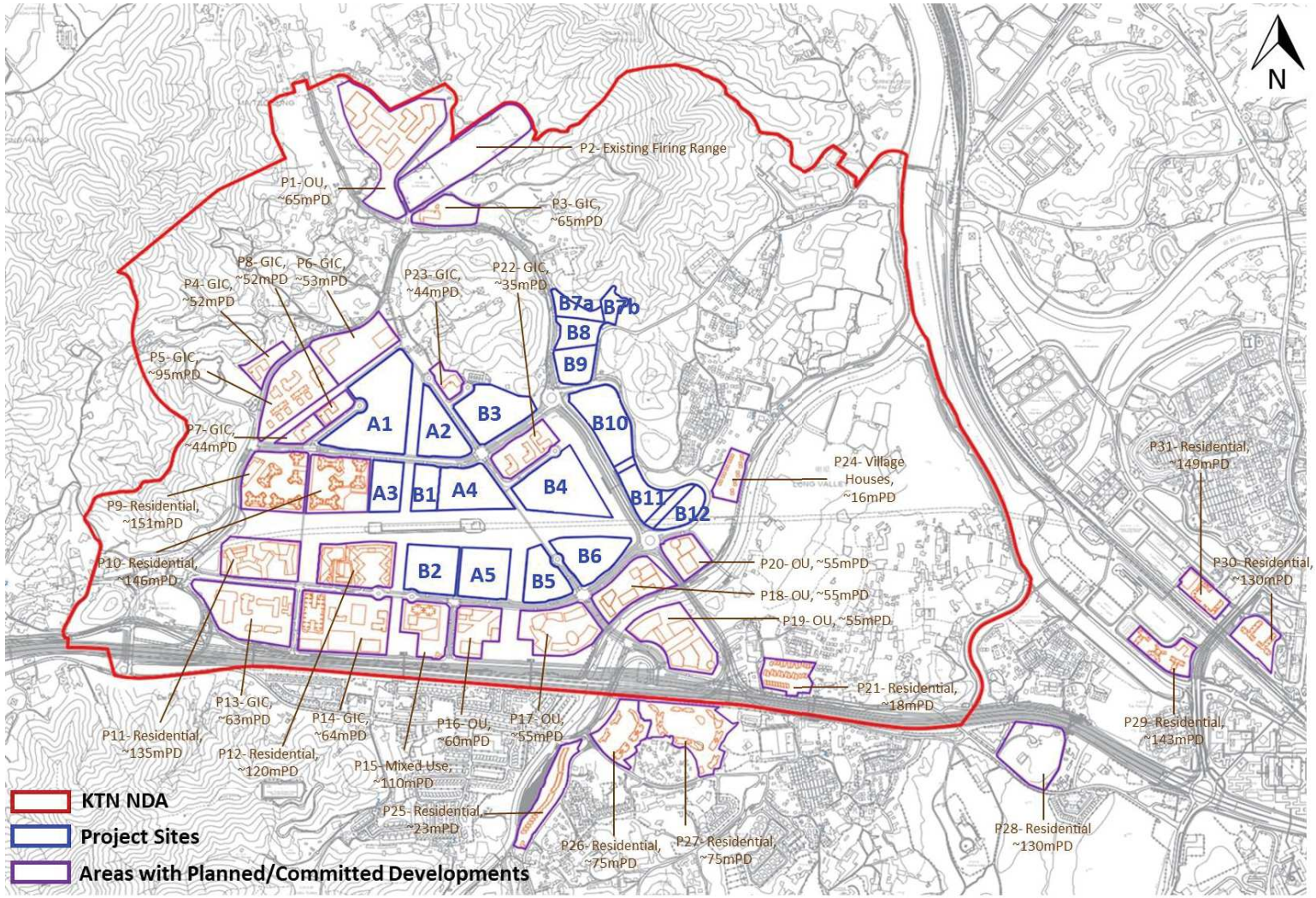



**Figure A1: Land Use and Maximum Building Heights of Planned/Committed Developments near/within the KTN NDA**

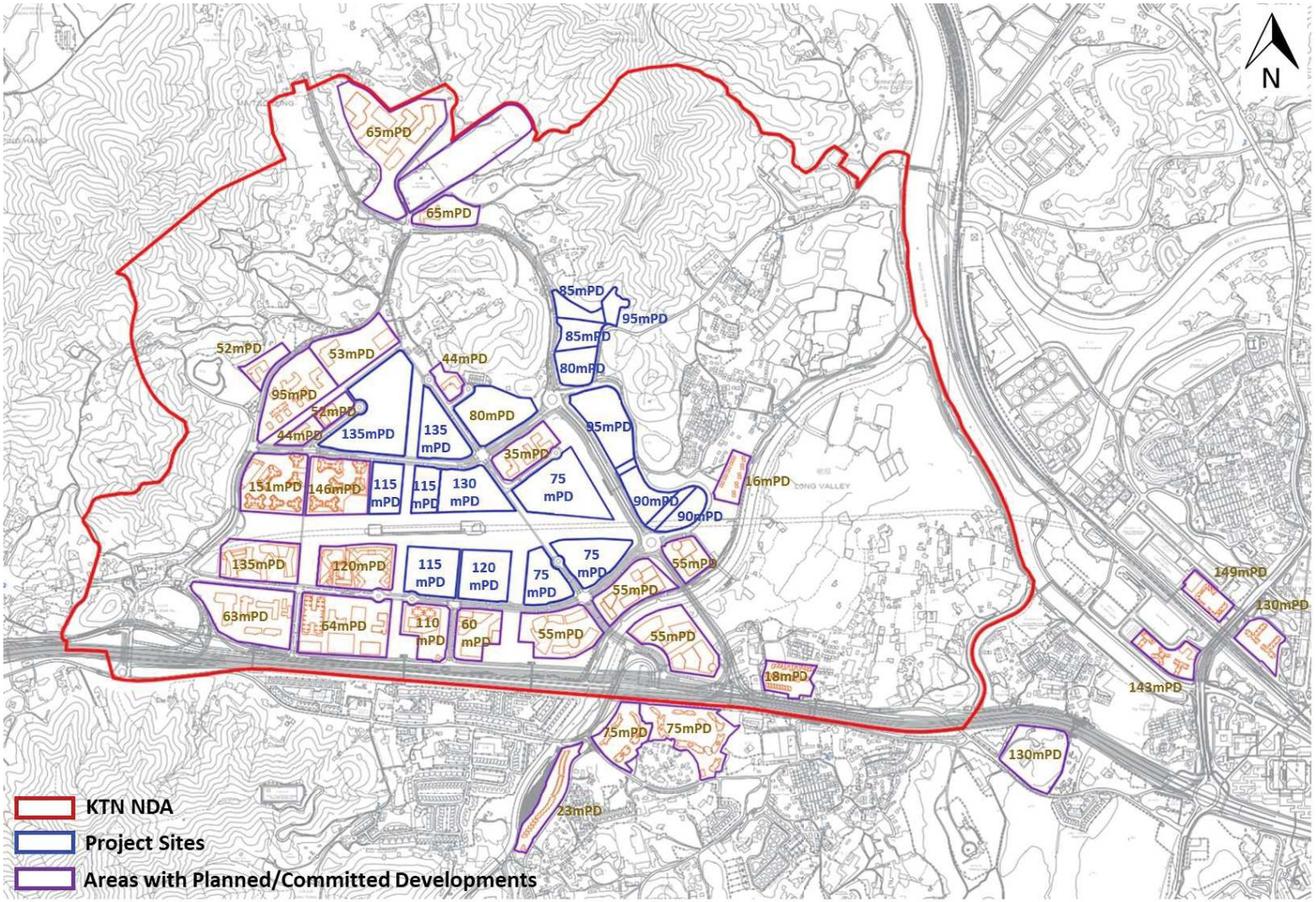



**Figure A2: Maximum Proposed Building Heights within the Project Sites and Areas with Planned/Committed Developments under the Base Scenario**

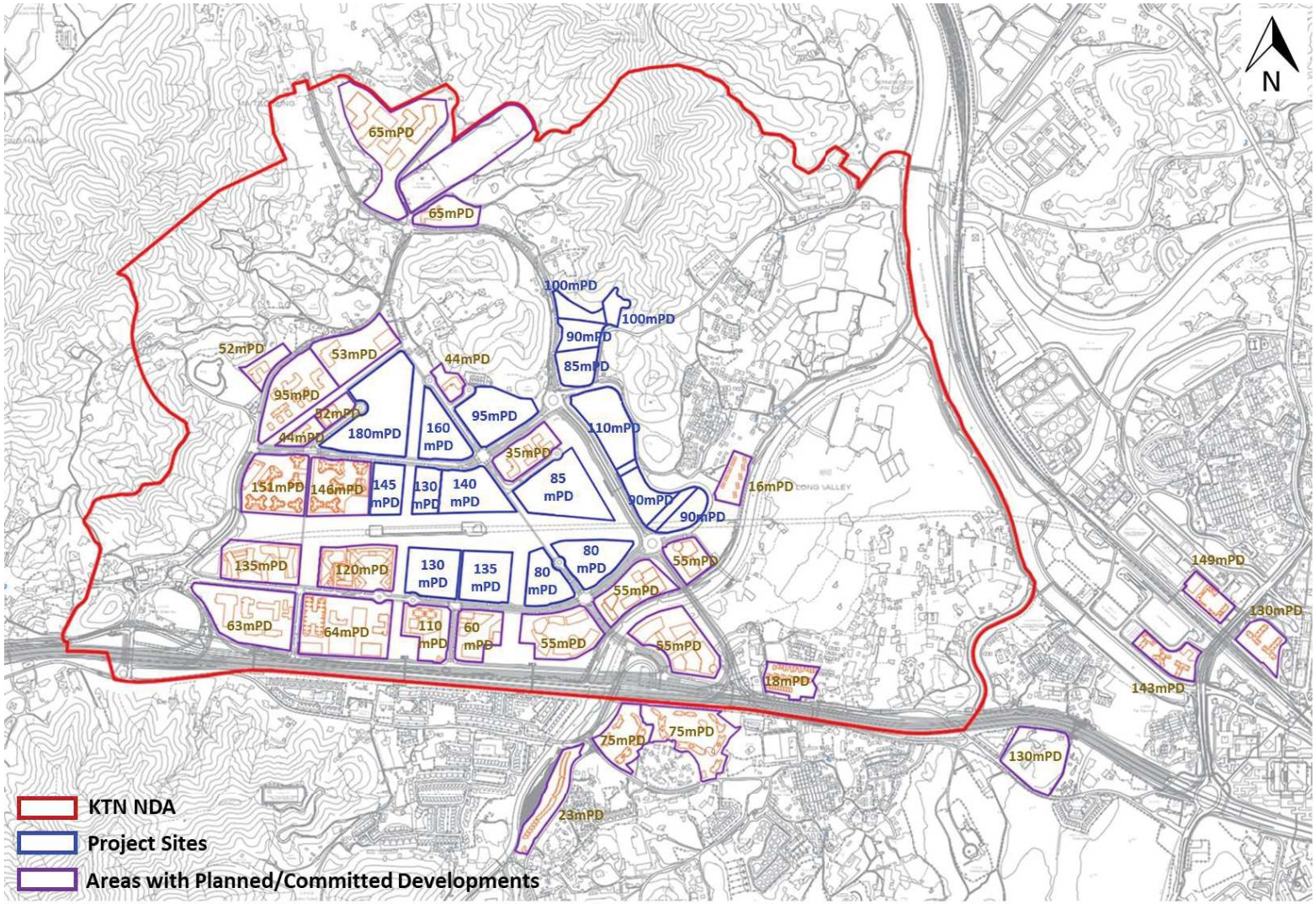



**Figure A3: Maximum Proposed Building Heights within the Project Sites and Areas with Planned/Committed Developments under the Proposed Scenario**


**Figure A4: Locations of Non-Building Areas, Terraced Podiums and Proposed Building Blocks within the Project Sites and Surroundings under the Base Scenario**

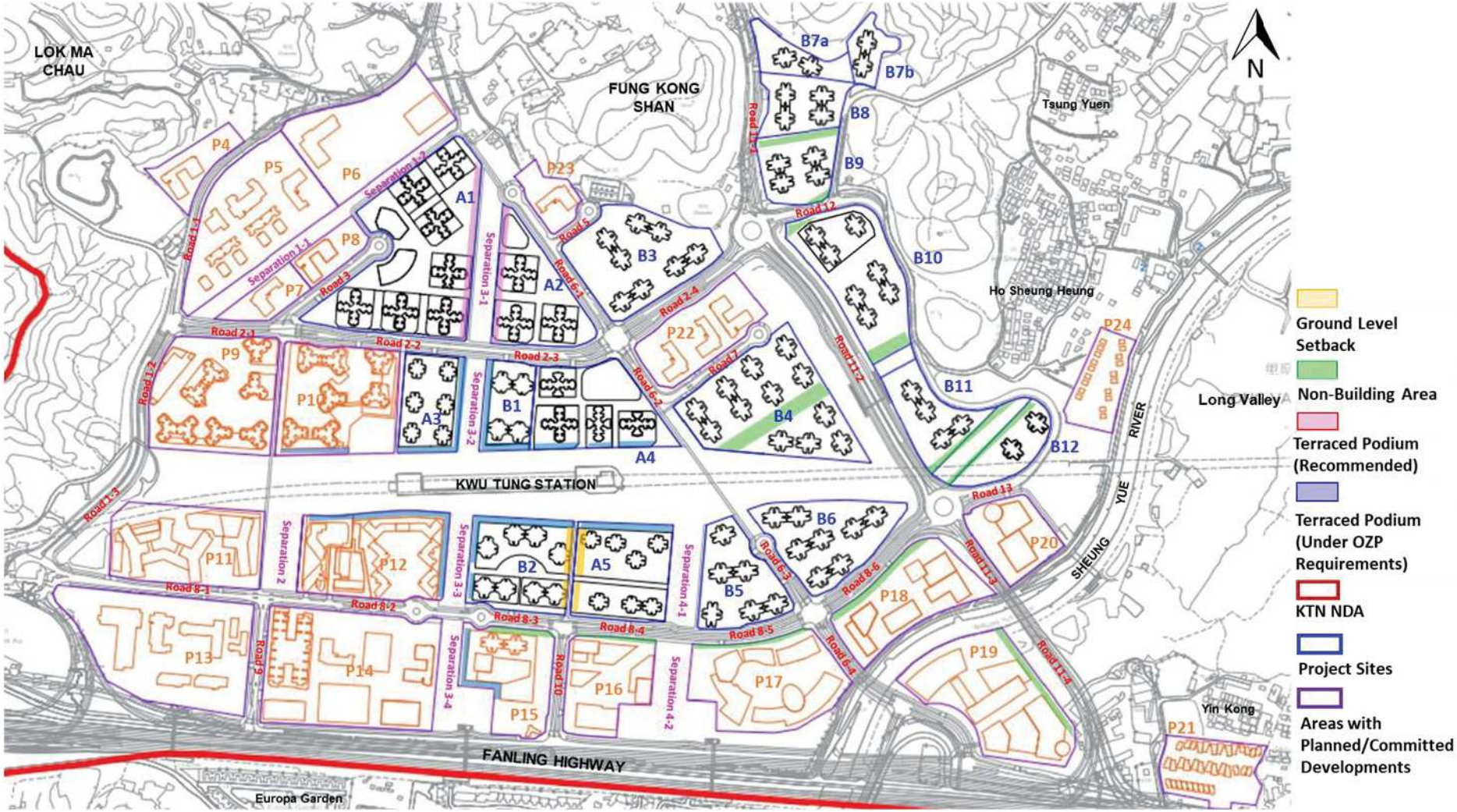



**Figure A5: Locations of Non-Building Areas, Terraced Podiums, Ground Level Setback, Locations of Permeable Elements and Proposed Building Blocks within the Project Sites and Surroundings under the Proposed Scenario**