TERM CONSULTANCY FOR AIR VENTILATION ASSESSMENT SERVICES

Cat. A1– Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment (PLNQ 35/2009)

Final Report

Tsuen Wan West Area

Nov 2011

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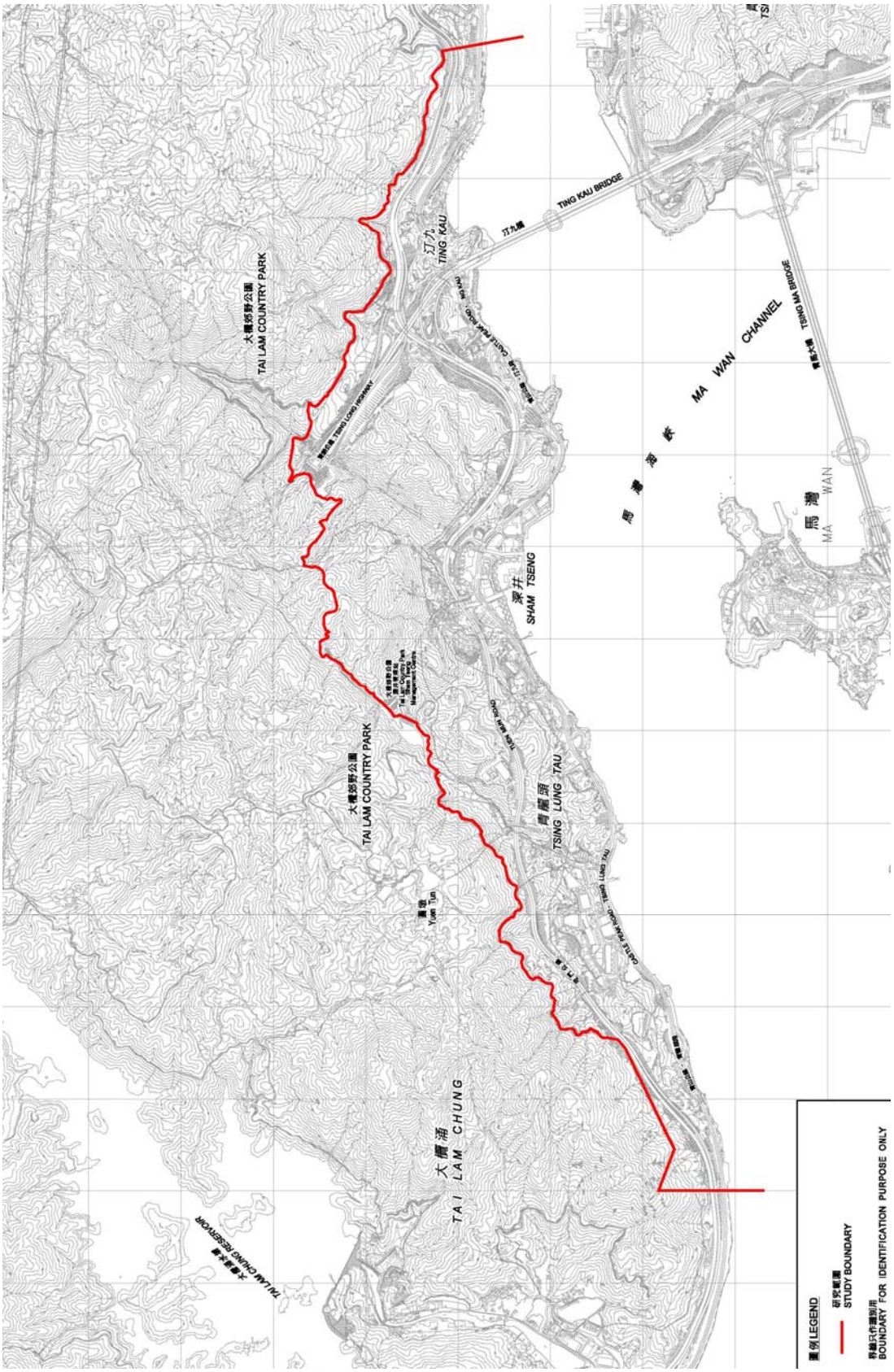
The Study Area



Expert Evaluation Report of Tsuen Wan West Area

Executive summary

0.1 Wind Availability

(a) Based on the available wind data, the annual wind of the study area (Tsuen Wan West Area) is mainly from the northeast and east. The summer wind mainly comes from the east, south and southeast quarters.
(b) Cooler air movements from the hills north of the study area and sea breezes from the south are beneficial to air ventilation in the study area.

0.2 Existing conditions

(a) Compared to some of the metro areas in Hong Kong, the study area has large greenery coverage. Utilizing the green areas appropriately to enhance the air paths through the study area to the waterfront is possible and should be attempted.

(b) On the whole, the building ground coverage and the building bulk of the study area are not high. The shape of the study area is elongated with good exposures to its north-south frontages. Therefore, it is anticipated that building related poor air ventilation issues are unlikely.

(c) For expert evaluation, the study area can be divided into three sub-areas: Ting Kau area, Sham Tseng area and Tsing Lung Tau area. Buildings in Ting Kau are mainly low-rise and low density residential buildings, typically below 20 mPD in height. Tsing Lung Tau contains medium density developments, with varying building heights. Building related poor air ventilation issues are unlikely in these two sub-areas.

(d) Sham Tseng is the “urban core” of the study area with high-rise residential buildings (some of which are above 190 mPD), low-rise village houses and low-rise commercial buildings. It is still useful to respect, maintain and enhance the existing gaps and streets in this area.

0.3 The Existing Conditions with Committed and Potential Redevelopment Projects

(a) There are a few committed redevelopment projects scattered in the study area. In Ting Kau area, the new proposed private housing buildings (Figure 6.1) will not be a problem to the surrounding area from the air ventilation issue point of view.

(b) The potential residential redevelopments in Sham Tseng area (Figure 6.3) are located on two R(E) sites butting Ocean Pointe, it is anticipated that the project proponents will follow Government’s relevant requirements. At the planning level, it is recommended that the gap between Bellagio and Ocean Pointe be

maintained. In addition, it is also recommended that the gap at Sham Tsz Street be widened to improve permeability and thus air ventilation from the waterfront.

0.4 Expert Evaluation and Recommendations of the Initial Planned Scenario

(a) Due to Hong Kong's high-density urban morphology, it is not advisable to only rely on building height restriction (or minor changes of building heights) to maintain and/or improve air ventilation. For most of the areas, air ventilation will achieve better performance if more effective measures are also applied, including formation of breezeways, air paths, open spaces, gaps between buildings and building permeability especially near ground level.

(b) On the whole, it appears that the building height restriction proposed is more or less similar to the existing building heights except three developments (i.e. Bellagio, Ocean Pointe and Lido Garden) at Sham Tseng waterfront. These sites will have the building height restricted that they are not allowed for redevelopment up to the existing building height. With careful design and disposition of buildings on site, this should not result in adverse air ventilation issues.

(c) As the study area is located on the waterfront and is back by extensive green areas, with appropriately spaced out air paths, the elongated study area should not have severe air ventilation issues.

(d) As a general principle, buildings on the waterfront should be carefully designed with good gaps between towers to maintain permeability of air ventilation to its wake areas (weak wind areas behind buildings). If needed, project proponent may conduct further AVA studies to ascertain the air ventilation performance of their designs, and to improve their designs at the detail design stage. On an area-average basis, the rule of thumb is 40-50% permeability for good air ventilation and 25 to 35% for reasonable air ventilation. Wall like structures with no gap in between is not encouraged.

(e) The initial planned scenario has incorporated a number of useful non-building areas (NBAs) including the widened gap at Sham Tsz Street. The permeability provided by the north-south oriented NBAs for the waterfront areas in Sham Tseng is reasonable for maintaining / improving air ventilation of the surrounding areas.

(f) The initial planned scenario keeps most of the existing GIC/OU sites (Figure 7.2) as low-rise buildings. GIC/OU sites with low-rise buildings and greeneries that are connected to or next to the air paths should be maintained for enhancing the air ventilation performance of the surrounding areas.

0.5 Further works

(a) Based on the expert assessment, the study area has no major air ventilation issue. Further AVA study for the OZP review is not necessary.

Expert Evaluation Report of Tsuen Wan West Area

1.0 The Assignment

1.1 In order to provide better planning control on the building height upon development/redevelopment, the approved Tsuen Wan West Outline Zoning Plan (OZP) No. S/TWW/17 (the Plan) is being reviewed with a view to incorporating appropriate development restrictions in the Notes for various development zones of the OZP to guide future development/redevelopment. It is considered necessary to conduct an expert evaluation to assess the preliminary Air Ventilation impacts of the proposed building height restrictions.

1.2 This expert evaluation report is based on the materials given by Planning Department to the Consultant including:

The approved Tsuen Wan West Outline Zoning Plan
The height (in mPD) of existing building towers and podiums
The height (in mPD) of proposed/ committed buildings towers and podiums
The proposed GFA /PR and building height restrictions (in mPD) for commercial and residential sites in Tsuen Wan West.
The proposed building height restrictions (in no. of storeys or mPD) for “G/IC” and “OU” zones in Tsuen Wan West
The proposed developments in Tsuen Wan West

1.3 The consultant has studied the above mentioned materials. During the preparation of the report, the consultant has visited the site and has working sessions with Planning Department.

2.0 Background

2.1 Planning Department’s study: “Feasibility Study for Establishment of Air Ventilation Assessment System” has recommended that it is important to allow adequate air ventilation through the built environment for pedestrian comfort.

2.2 Given Hong Kong’s high density urban development, the study opines that: “more air ventilation, the better” is the useful design guideline.

2.3 The study summarizes 10 qualitative guidelines for planners and designers. For the preparation of OZPs, all the breezeways/air paths, street grids and orientations, open spaces, non-building areas, waterfront sites, scales of podium, building heights, building dispositions, and greeneries are all important strategic considerations.

2.4 The study also suggests that Air Ventilation Assessment (AVA) be conducted at 3 stages: Expert Evaluation, Initial Studies, and Detailed Studies. The suggestion have been adopted and incorporated into HPLB and ETWB Technical Circular no. 1/06. The key purposes of Expert Evaluation are to:

(a) Identify good design features.
(b) Identify obvious problem areas and propose some mitigation measures.
(c) Define “focuses” and methodologies of the Initial and/or Detailed studies.
(d) Determine if further study should be staged into Initial Study and Detailed Study, or Detailed Study alone.

2.5 To conduct the Expert Evaluation systematically and methodologically, it is necessary to undertake the following information analyses:

(a) Analyse relevant wind data as the input conditions to understand the wind environment of the Area.
(b) Analyse the topographical features of the Area, as well as the surrounding areas.
(c) Analyse the greenery/landscape characteristics of the Area, as well as the surrounding areas.
(d) Analyse the land use and built form of the Area, as well as the surrounding areas.

Based on the analyses:

(e) Estimate the characteristics of the input wind conditions of the Area.
(f) Identify the wind paths and wind flow characteristics of the Area through slopes, open spaces, streets, gaps and non-building areas between buildings, and low-rise buildings; also identify stagnant/problem areas, if any.
(g) Estimate the need of wind for pedestrian comfort.

Based on the analyses of the EXISTING urban conditions:

(h) Evaluate the strategic role of the Area in air ventilation term.
(i) Identify problematic areas which warrant attention.
(j) Identify existing “good features” that needs to be kept or strengthened.

Based on an understanding of the EXISTING urban conditions:

(k) Compare the prima facie impact, merits or demerits of the building height restrictions as proposed by Planning Department on Air Ventilation.
(l) Highlight problem areas, if any. Recommend improvements and mitigation measures if possible.
(m) Identify focus areas or issues that may need further studies. Recommend appropriate technical methodologies for the study if needed.

3.0 The Wind Environment

3.1 Hong Kong Observatory (HKO) stations provide useful and reliable data of the wind environment in Hong Kong (Figure 3.1). There are some 46 stations operated by HKO in Hong Kong. Together, they allow a very good general understanding of the wind environment especially close to ground level.

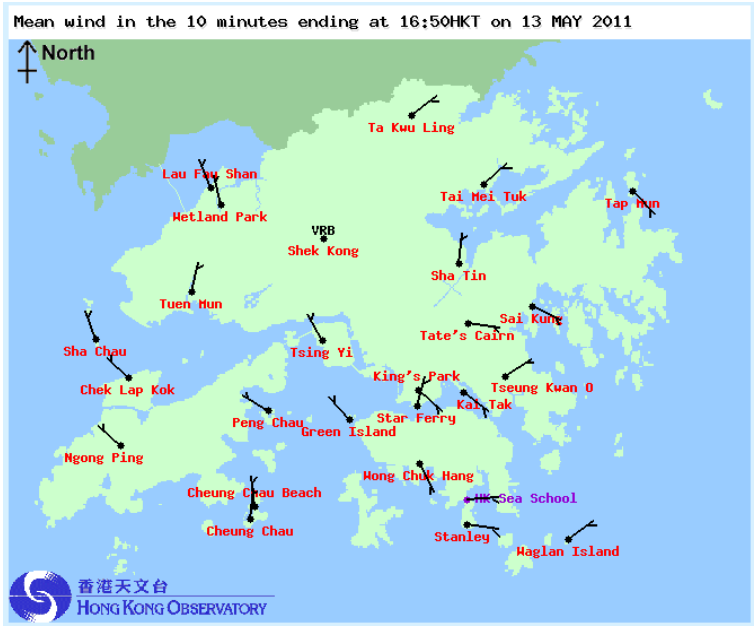


Figure 3.1 Some of the HKO stations in Hong Kong. This is a screen capture at 16:50 on 13 May 2011 from the HKO website. The arrows show the wind directions and speeds of the time.

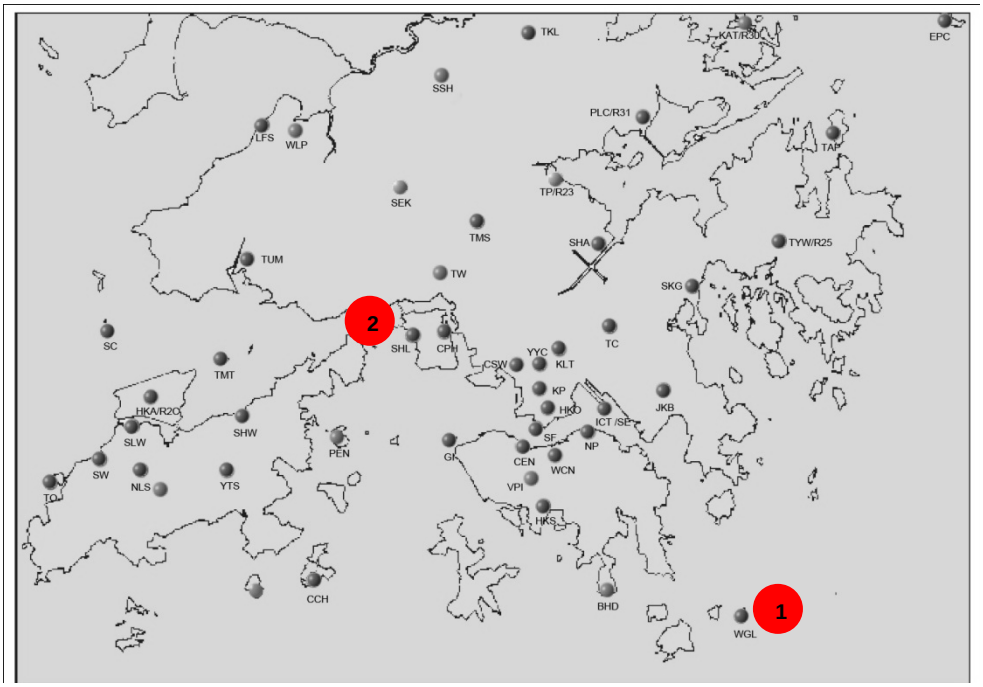


Figure 3.2 The HKO stations at 1: Waglan Island (WGL), 2: Tsing Yi (SHL),

3.2 The HKO station at Waglan Island (WGL) is normally regarded by wind engineers as the reference station for wind related studies (Figure 3.3). The station has a very long measuring record, and it is unaffected by Hong Kong's complex topography (unfortunately, it is known not to be able to capture the thermally induced local wind circulation like sea breezes too well). Based on WGL wind data, studies are typically employed to estimate the site wind availability taking into account the topographical features around the site.

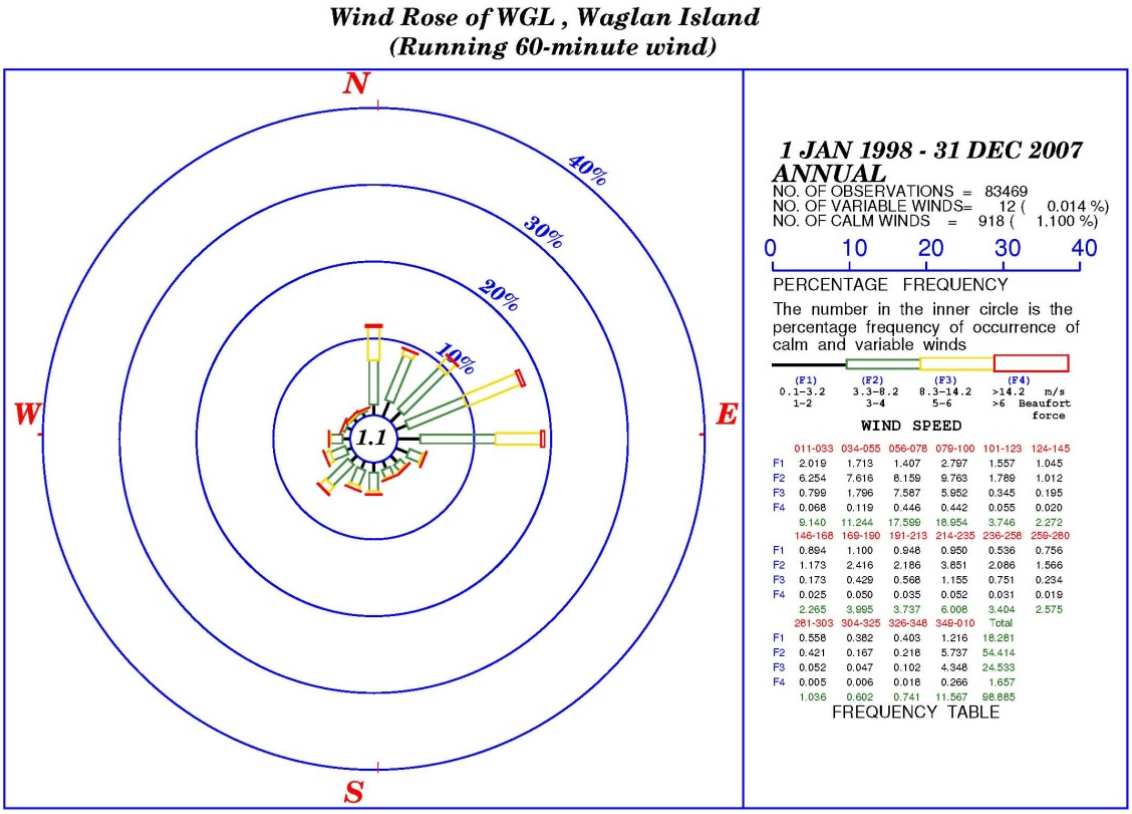


Figure 3.3 Wind rose of WGL 1998 – 2007 (annual) (Wind data in 1998 – 2007 are the latest available 10-year data from HKO to the consultant).

3.3 Examining the annual wind rose of WGL, it is apparent that the annual prevailing wind in Hong Kong is from the East. There is also a major component of wind coming from the North-East; and there is a minor, but nonetheless observable component from the South-West. Around 70% of the time, WGL has weak to moderate wind (0.1m/s to 8.2 m/s).

3.4 For the study, it is useful to understand the wind environment seasonally or monthly (Figure 3.4 and 3.5). In the winter months of Hong Kong, the prevailing wind comes from the North-East. In the summer months, they come from the South-West. As far as AVA is concerned, in Hong Kong, the summer wind is very important and beneficial to thermal comfort. Hence, based on WGL data, it is very important to plan our city, on the one hand, to capture the annual wind characteristics, and on the other hand, to maximize the penetration of the summer winds (mainly from the South-West) into the urban fabric.

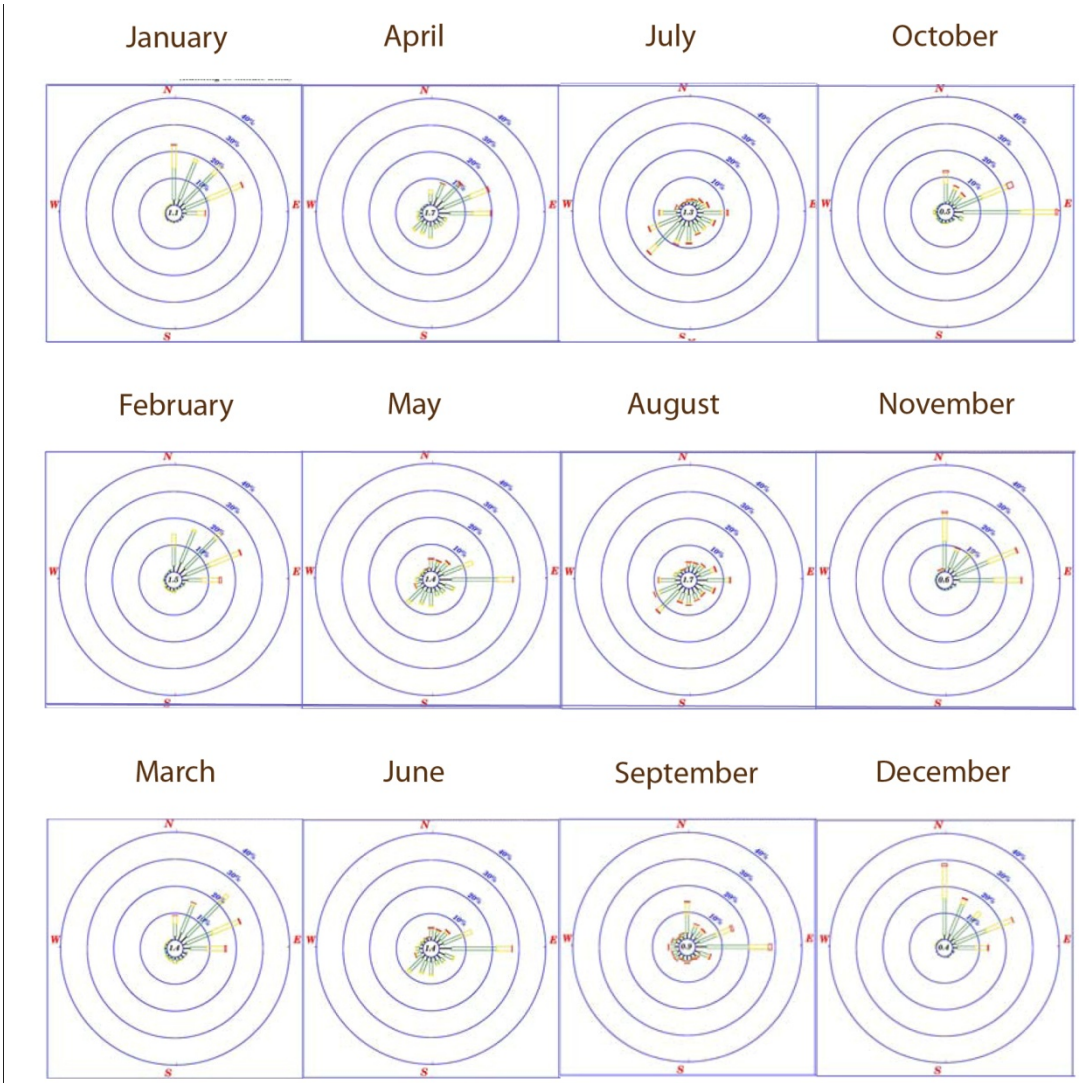


Figure 3.4 monthly wind roses of WGL 1998 – 2007

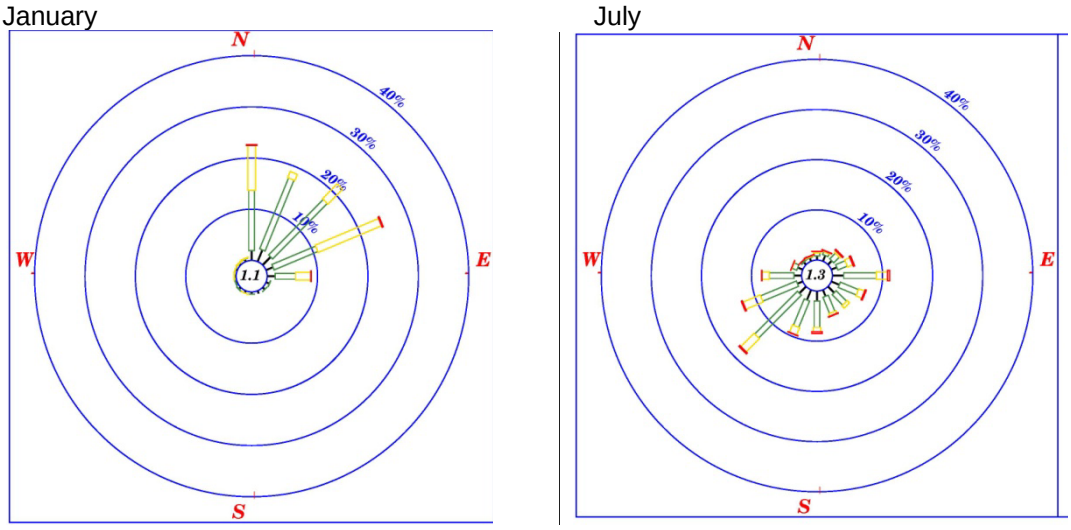


Figure 3.5 Wind roses of WGL 1998 – 2007 (Jan and July)

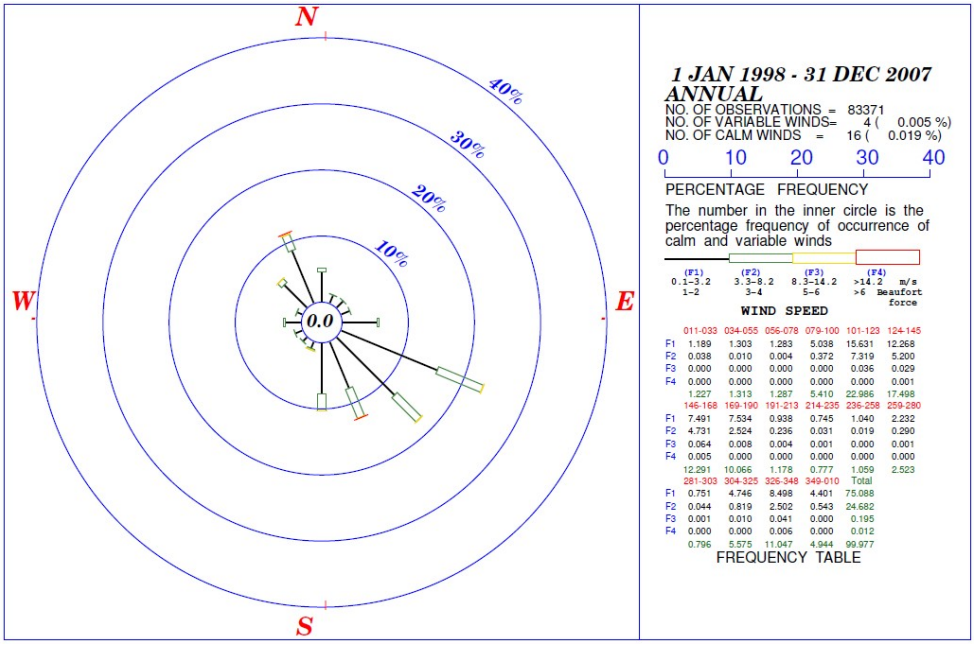


Figure 3.6 Wind rose of Tsing Yi 1998-2007 (annual)

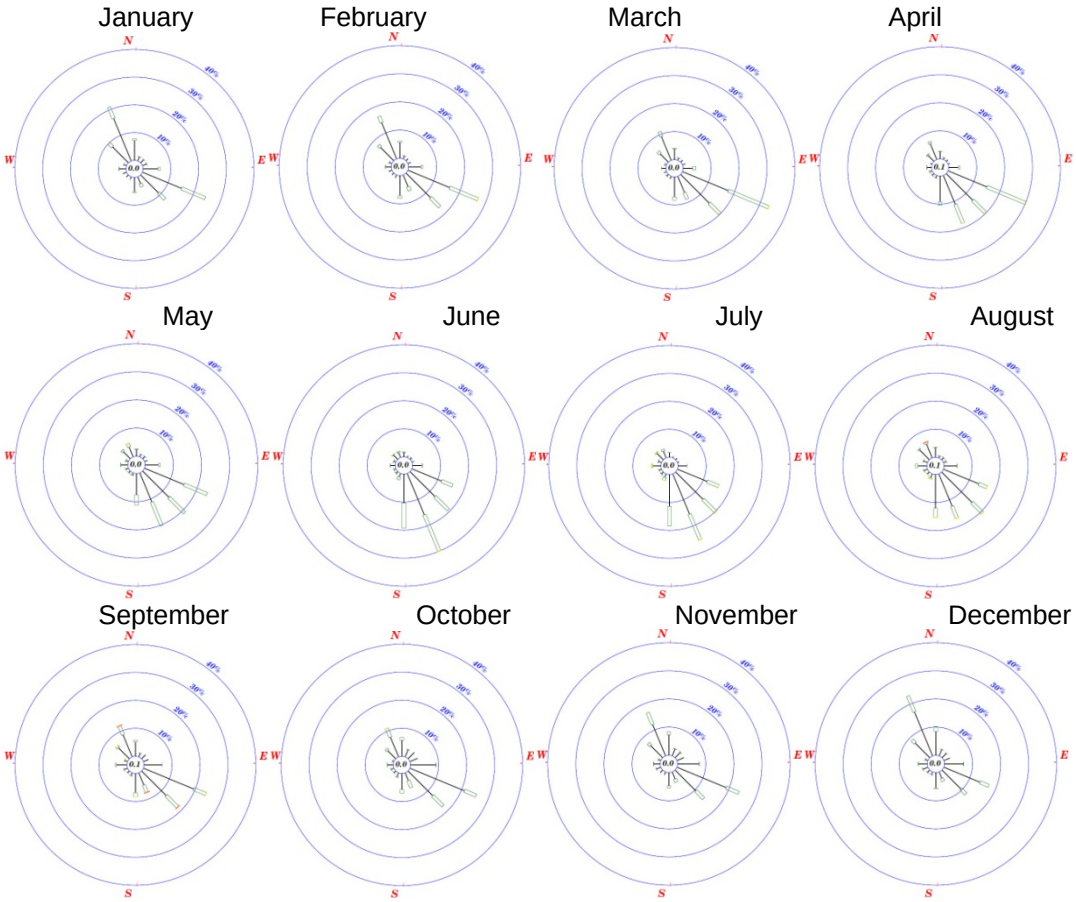


Figure 3.7 monthly wind roses of Tsing Yi 1998 – 2007

January July

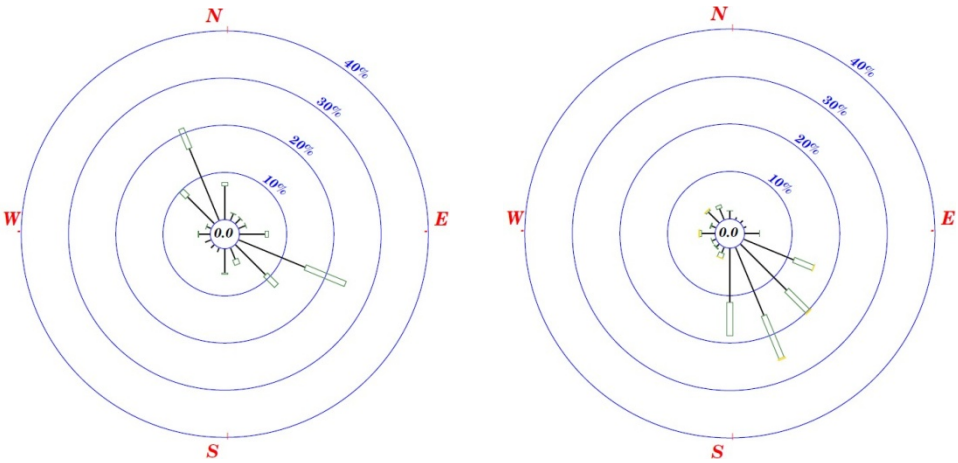


Figure 3.8 Wind roses of Tsing Yi 1998 – 2007 (Jan and July)

3.5 Apart from WGL, wind data of Tsing Yi station have also been extracted from HKO for reference (Figure 3.6 to Figure 3.8) as the nearest station measuring wind environment.

3.6 Researchers at Hong Kong University of Science and Technology (HKUST), Prof Alexis Lau and Prof Jimmy Fung, have model simulated a set of wind data using MM5-CALMET. The data period cover the whole year of 2004. Based on this dataset, 3 locations of the Area are extracted at 60m, 120m and 450m above ground (Figures 3.9 to 3.15).

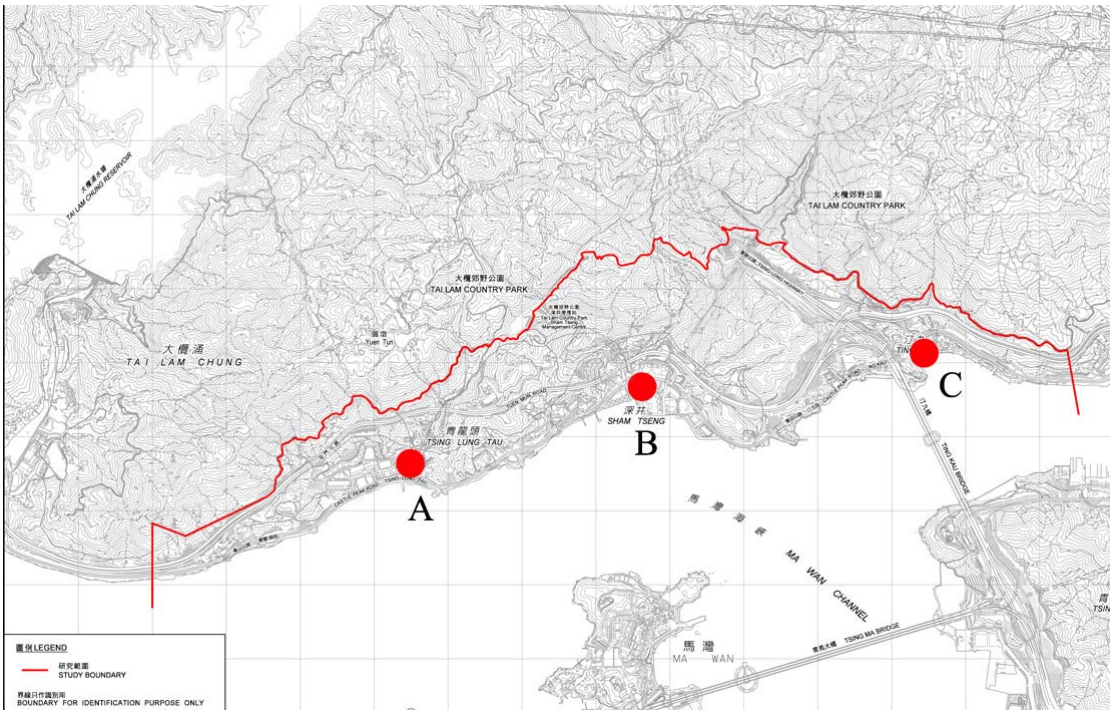


Figure 3.9 The 3 locations of MM5 extracted data

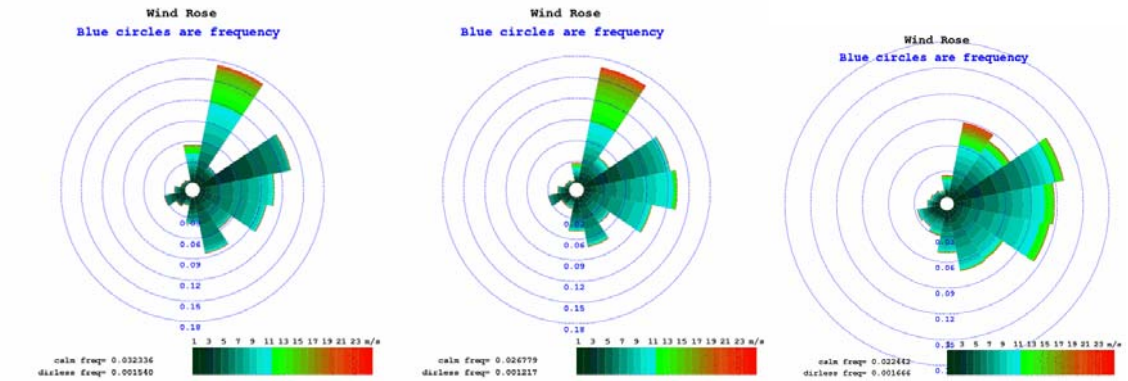


Figure 3.10 Wind roses (annual) at A (left: 60m; middle: 120m; right: 450m)

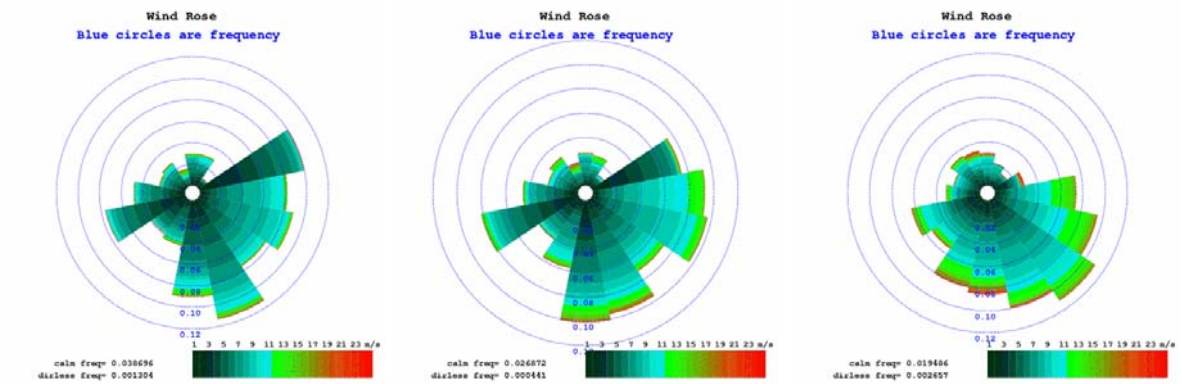


Figure 3.11 Wind roses (summer) at A (left: 60m; middle: 120m; right: 450m)

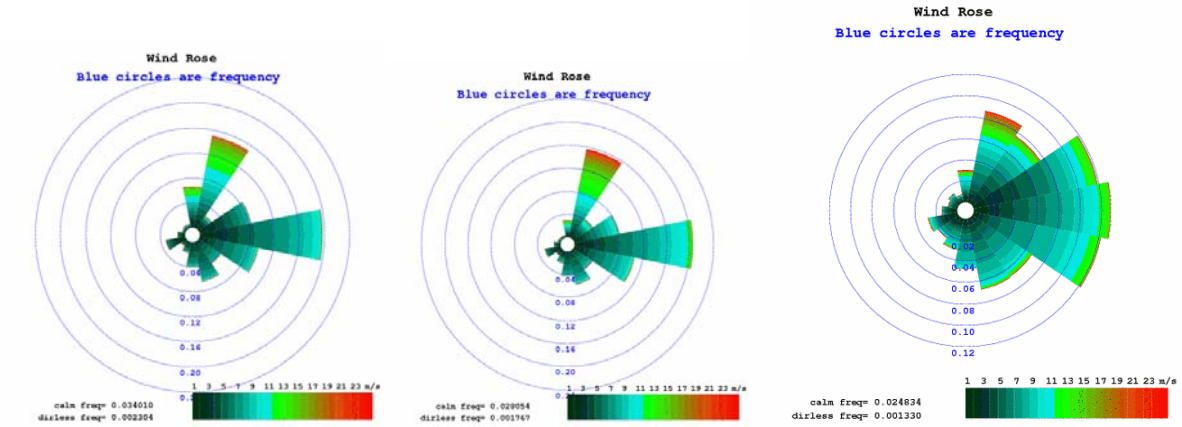


Figure 3.12 Wind roses (annual) at B (left: 60m; middle: 120m; right: 450m)

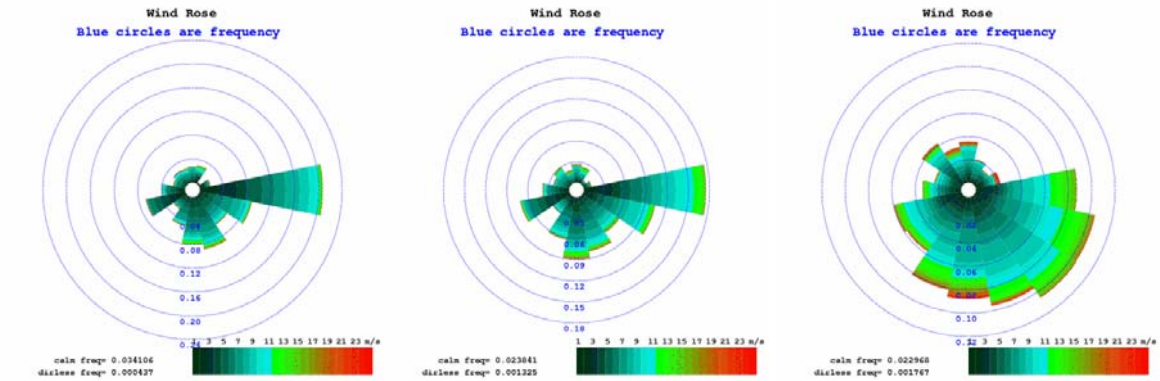


Figure 3.13 Wind roses (summer) at B (left: 60m; middle: 120m; right: 450m)

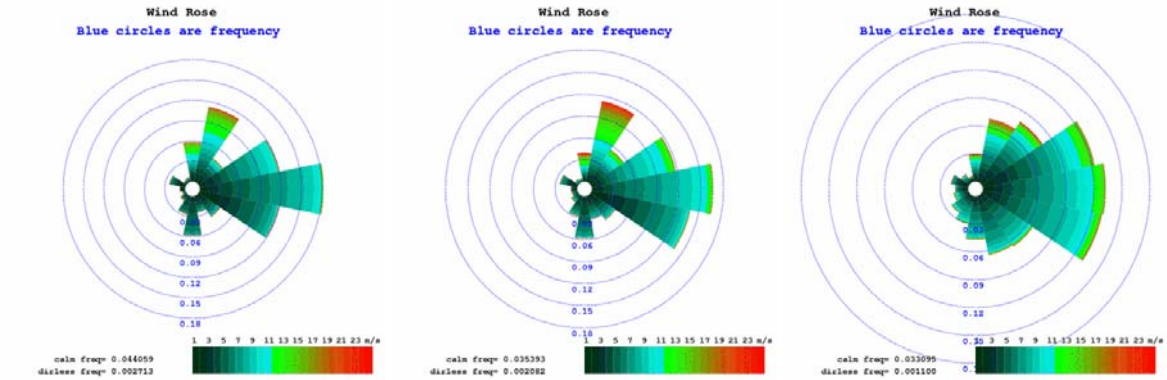


Figure 3.14 Wind roses (annual) at C (left: 60m; middle: 120m; right: 450m)

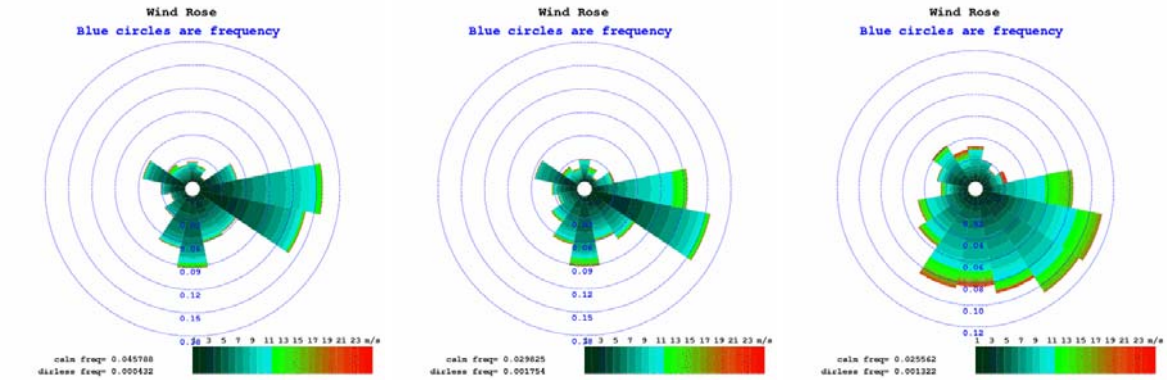


Figure 3.15 Wind roses (summer) at C (left: 60m; middle: 120m; right: 450m)

3.7 Using the model simulated MM5 data, the annual and the summer prevailing wind directions of the study area and the surroundings can be evaluated as in Figure 3.16 and 3.17.

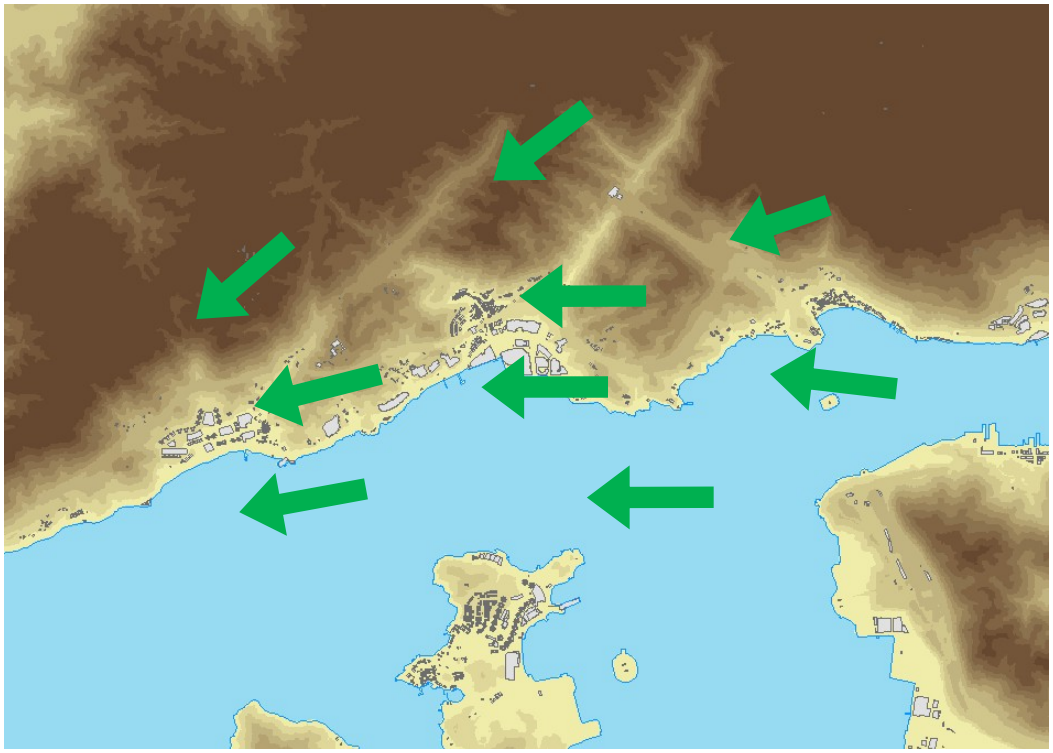


Figure 3.16 Prevailing wind directions at 60m (annual) based on MM5-CALMET model simulation.

Figure 3.17 Prevailing wind directions at 60m (summer months Jun-Aug) based on MM5-CALMET model simulation.

3.8 In summary, based on the available wind data, one may conclude that the annual wind of the study area is mainly from the East and North-East. The direction of summer wind is ranging from the East, South and South-East.

4.0 Topography and the Wind Environment

4.1 The vegetated hills to the north of the study area can benefit the area with katabatic cool air mass movements especially in the evening. This cooler air movement can flush and cool down the study area. The katabatic air movement is particularly prominent along valleys.

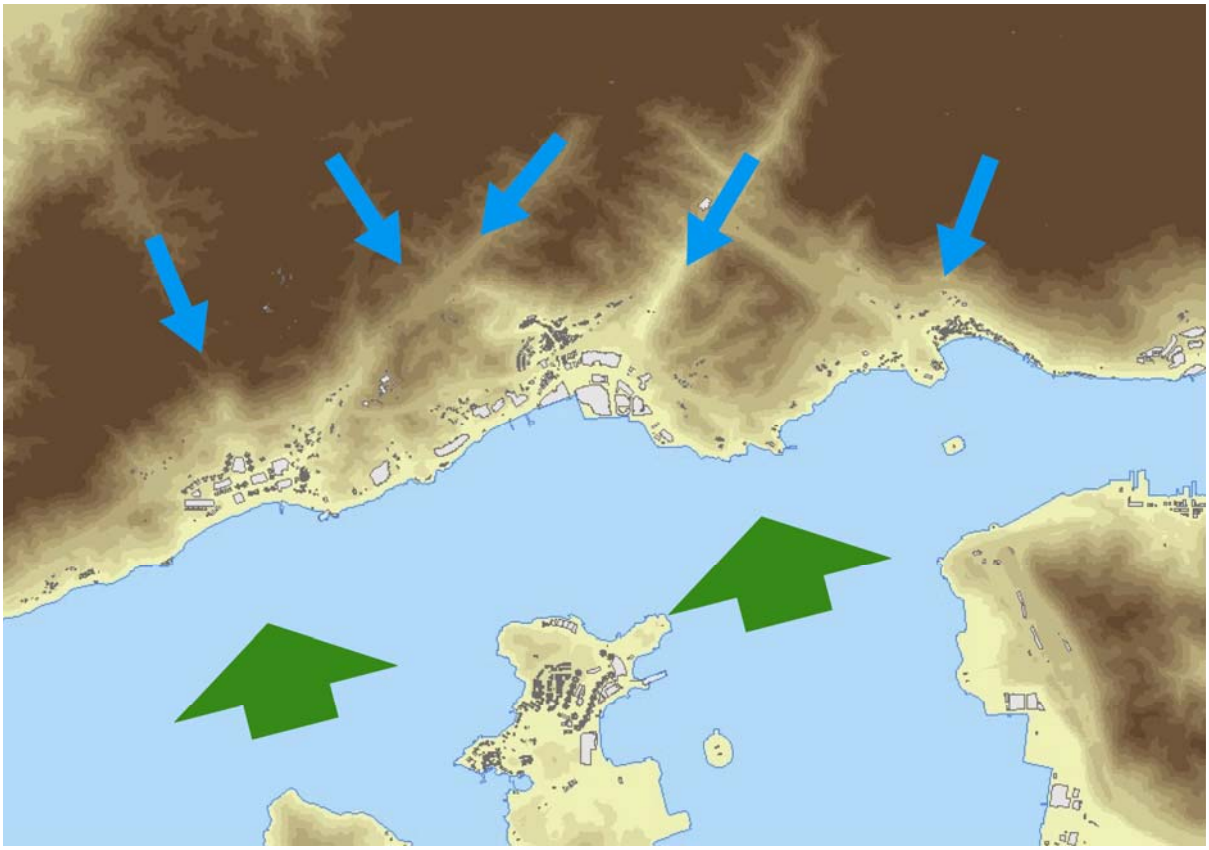


Figure 4.1 Katabatic air movements along the valleys (blue allows). Localised sea breezes from the waterfront (green arrows)

4.2 Localized sea breezes can also benefit the study area especially in the day time.

4.3 Hence, it is useful to bear in mind the north-south katabatic and localized sea breezes movement beneficial to the study area.

5.0 The existing condition

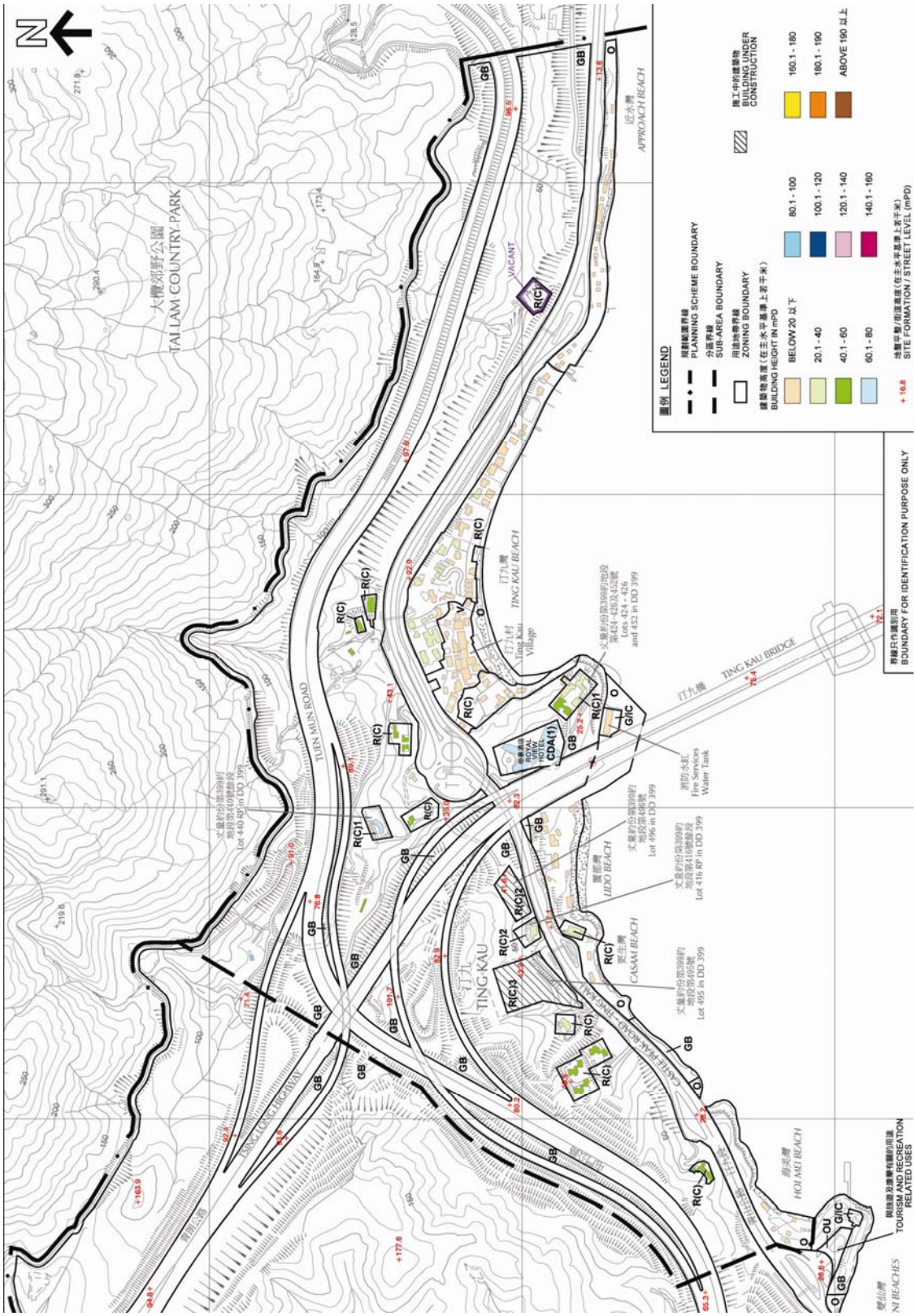


Figure 5.1 The existing building height profile in Ting Kau in mPD

Figure 5.2 The existing building height profile in Sham Tseng in mPD

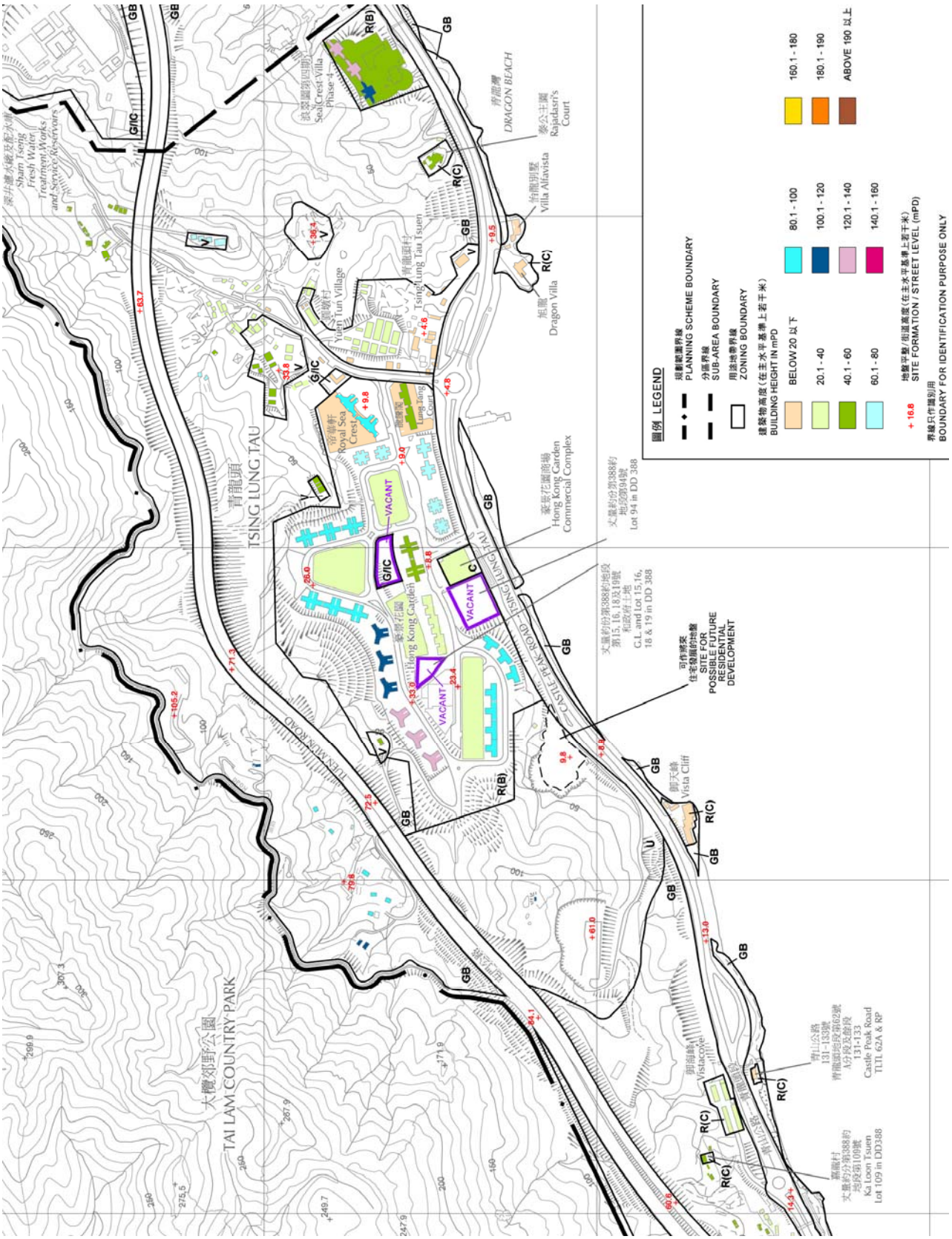


Figure 5.3 The existing building height profile in Tsing Lung Tau in mPD

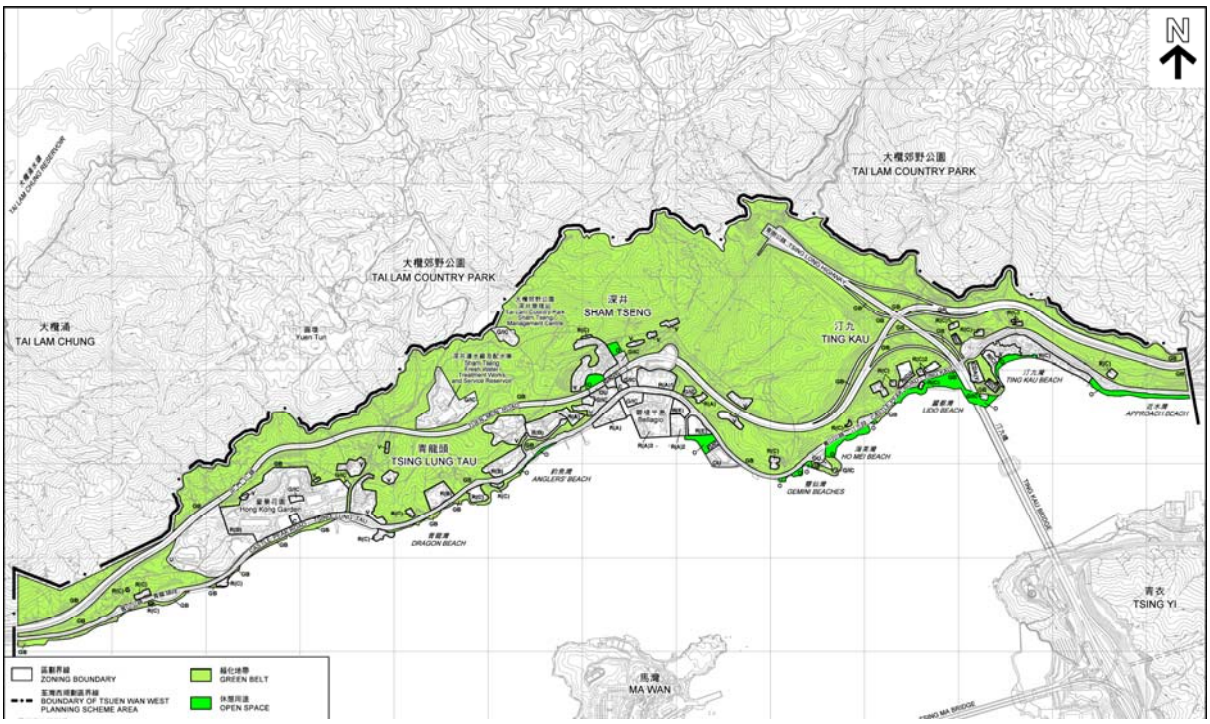


Figure 5.4 A greenery map of the area based on land use data

5.1.1 The existing building heights (in mPD) for the three sub-areas: Ting Kau, Sham Tseng, Tsing Lung Tau are shown in figure 5.1 to figure 5.3 respectively.

5.1.2 Most buildings in Ting Kau are 1-3 storey village houses except the Royal View hotel, which is about 45 meters (76.45mPD) high and has large building footprint. Buildings of low building heights sparsely scattered or slightly packed will not have air ventilation problems. A single high-rise building that is also isolated will not pose the air ventilation problems to its surrounding areas.

5.1.3 Tsing Lung Tau has a number of medium-density residential developments, such as Hong Kong Garden and Royal Sea Crest. The building blocks are rather isolated with open spaces and low-rise podium structures in-between. As such, severe air ventilation problems are not anticipated.

5.1.4 Sham Tseng has a row of high-rise residential developments along the waterfront, such as Sea Crest Villa (Phase 1 to 3), Lido Gardens, Bellagio, Ocean Pointe, Rhine Garden, and so on, along its waterfront. There is a gap between Sea Crest Villa Phase 2 and 3, hence Pai Min Kok village will not be unduly affected in terms of air ventilation. There are two gaps east and west of Lido Garden that would allow reasonable air ventilation to filter through so that Sham Tseng village will not be unduly affected in terms of air ventilation. There are two gaps east and west of Bellagio that would allow air ventilation to filter through to the G/IC site on its north. Sham Tsz Street, although a bit narrow at the moment, and the gap between Bellagio and Ocean Pointe, and provide useful reliefs allowing sea breezes to filter through to the areas north of the two developments. It is useful to respect, maintain and enhance the gaps and the street as identified above.

5.1.5 For Sham Tseng's Garden Bakery sites, as a general principle, buildings on the waterfront should be carefully designed with good gaps between towers to maintain permeability of air ventilation to its wake areas (weak wind areas behind buildings). On an area-average basis, the rule of thumb is 40-50% permeability for good air ventilation, and 25 to 35% for reasonable air ventilation. Wall like structures with no gap in between is not encouraged.

5.1.6 Compared to some of the metro areas in Hong Kong, the study area has large greenery coverage (Figure 5.4). Utilizing the green areas appropriately to enhance the air paths through the study area to the waterfront is possible and should be attempted.

5.2 An evaluation of the air paths

5.2.1 The annual prevailing wind comes from east and northeast directions (Figure 3.16). The summer sea breezes come from the South (Figure 3.17). In general, Castle Peak Road and the east-west oriented streets in Tsing Lung Tau serve as air paths for the annual east wind. The north-south oriented streets and gaps from the waterfront serve as air paths for the summer sea breeze from the south and Southeast.

5.2.2 Tsing Lung Tau
Figure 5.5 shows the annual wind and Figure 5.6 shows the summer wind and sea breezes.

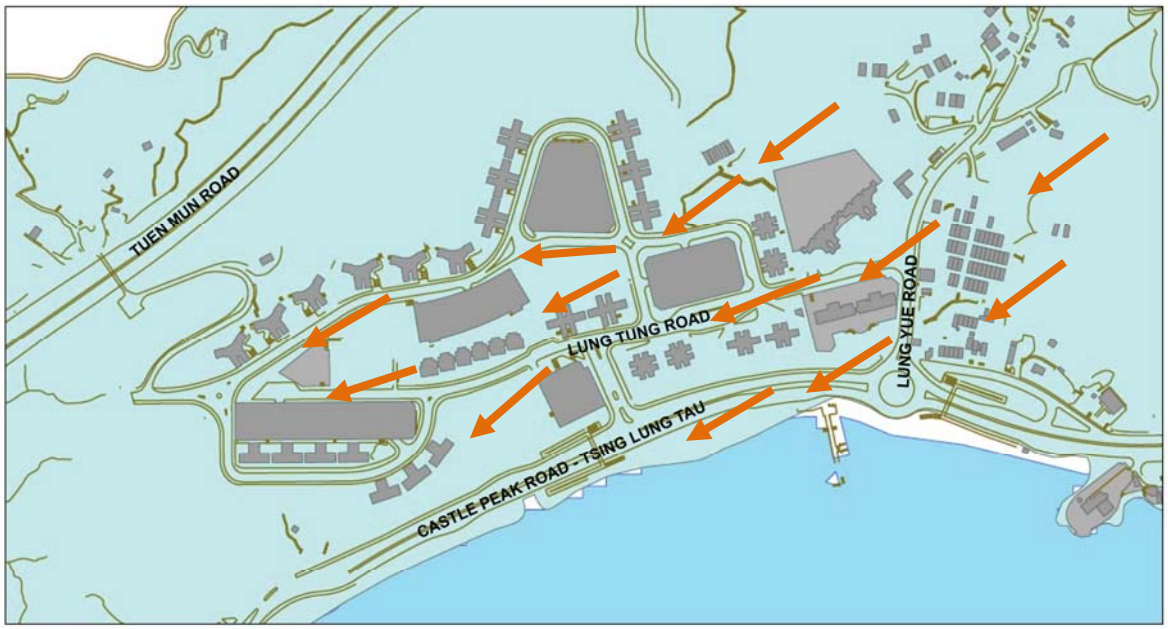


Figure 5.5 Annual prevailing wind directions of Tsing Lung Tau area

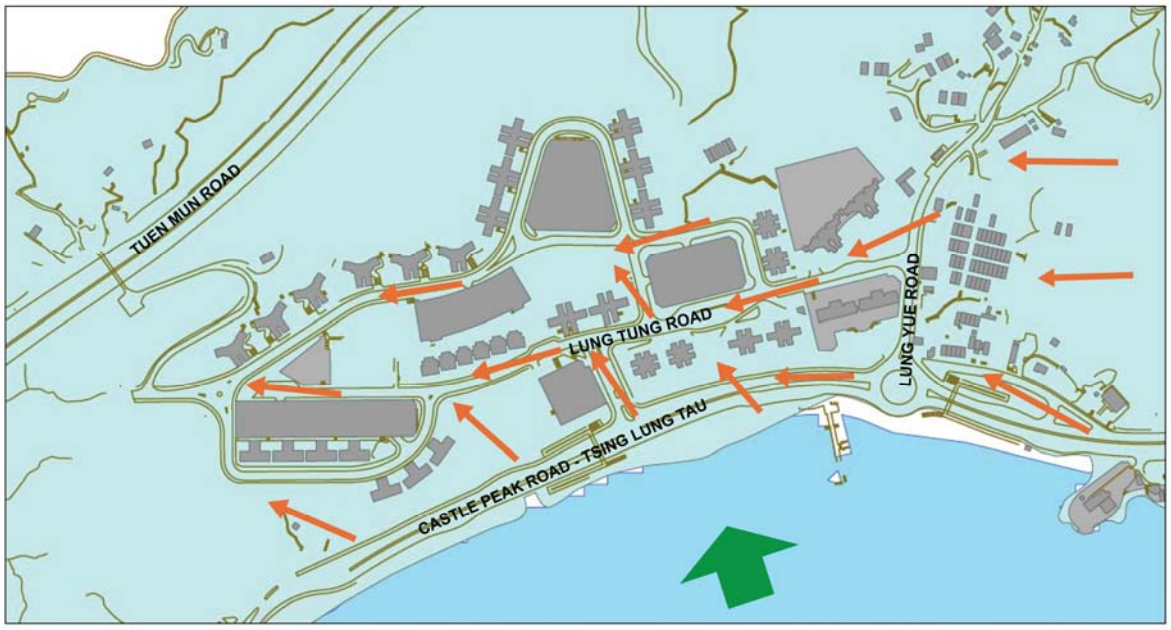


Figure 5.6 Summer prevailing wind directions of Tsing Lung Tau area (orange arrows). In addition, the area also benefits with the sea breezes from the south (green arrow).

5.2.3 Sham Tseng

Figure 5.7 shows the annual wind and Figure 5.8 shows the summer wind and sea breezes

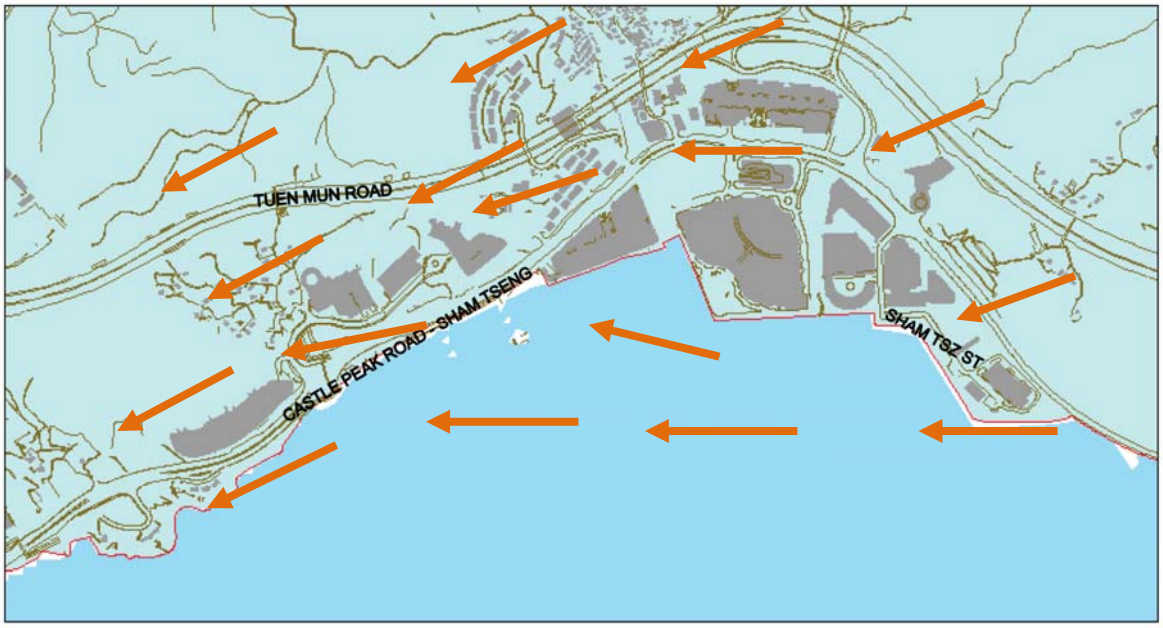


Figure 5.7 Annual prevailing wind directions of Sham Tseng area

Figure 5.8 Summer prevailing wind directions of Sham Tseng area (orange arrows). In addition, the area also benefits with the sea breezes from the south (green arrow).

6.0 The Existing Conditions with Committed and Potential Redevelopment Projects

6.1 There are a few committed and potential redevelopment projects scattered in the study area, see Figure 6.1 to 6.3.

6.2 In Ting Kau area, the new proposed private housing buildings (Figure 6.1) will not be a problem to the surrounding area as far as the air ventilation issue is concerned.

6.3 In Tsing Lung Tau area, the three potential residential development projects (Figure 6.2) are rather isolated. They will not be a problem to the surrounding area as far as the air ventilation issue is concerned.

6.4 The potential residential developments in Sham Tseng area (Figure 6.3) are located on two R(E) sites butting Ocean Pointe, it is anticipated that the project proponents will follow Government's relevant requirements. At the planning level, it is recommended that the gap between Bellagio and Ocean Pointe be maintained. In addition, it is also recommended that the gap at Sham Tsz Street be widened to improve permeability and thus air ventilation from the waterfront.

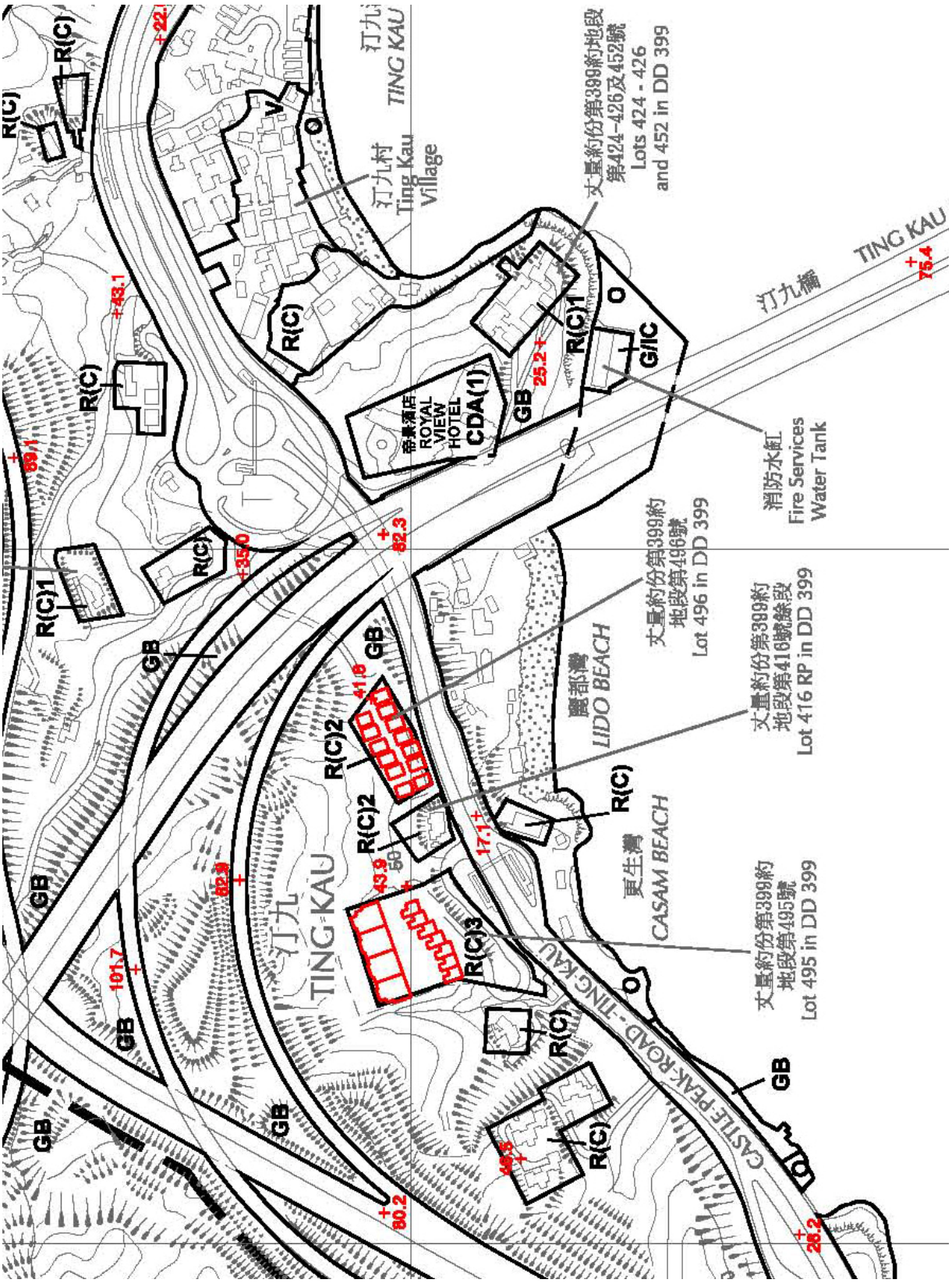


Figure 6.1 Proposed developments in Ting Kau area

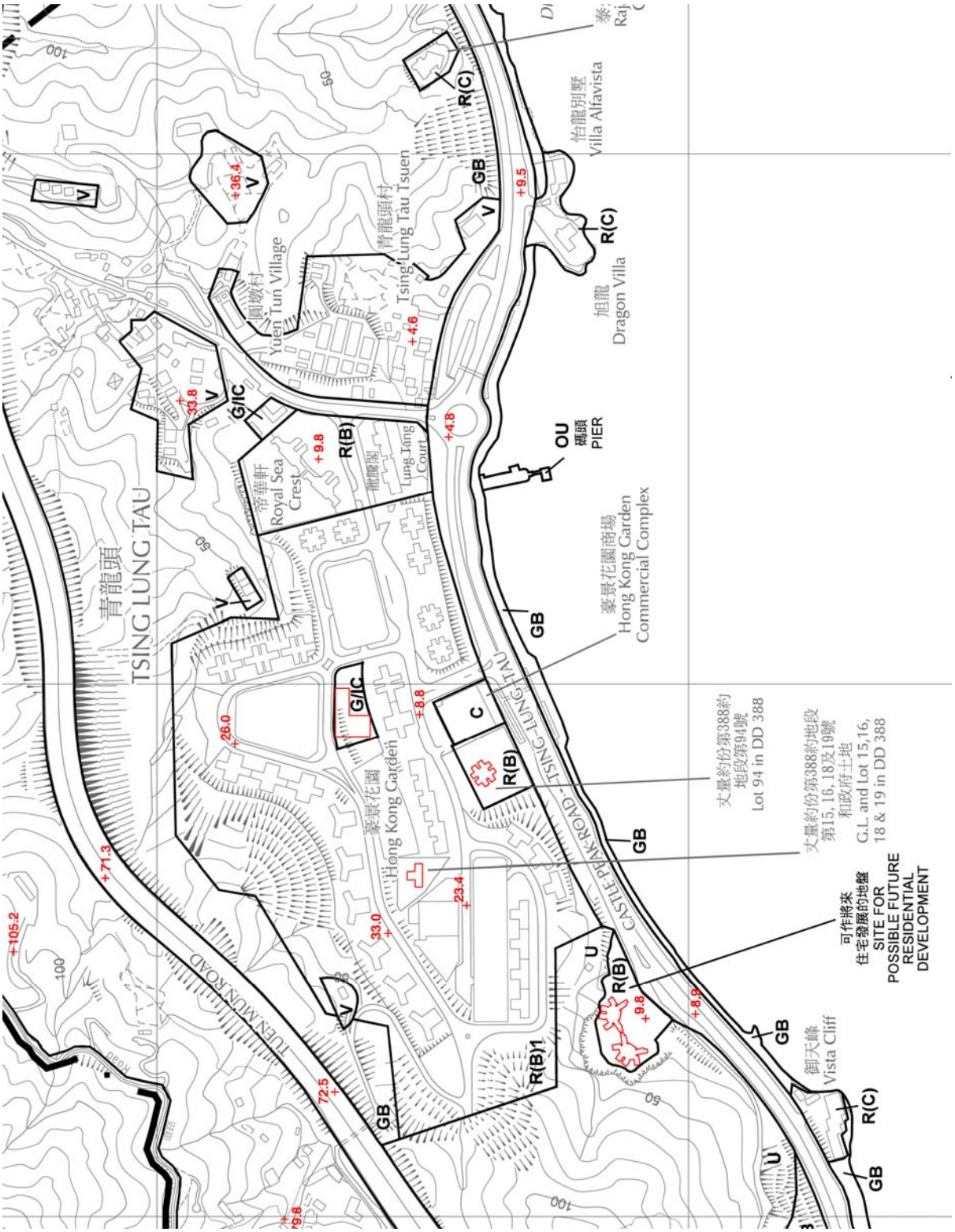


Figure 6.2 Proposed developments in Tsing Lung Tau area

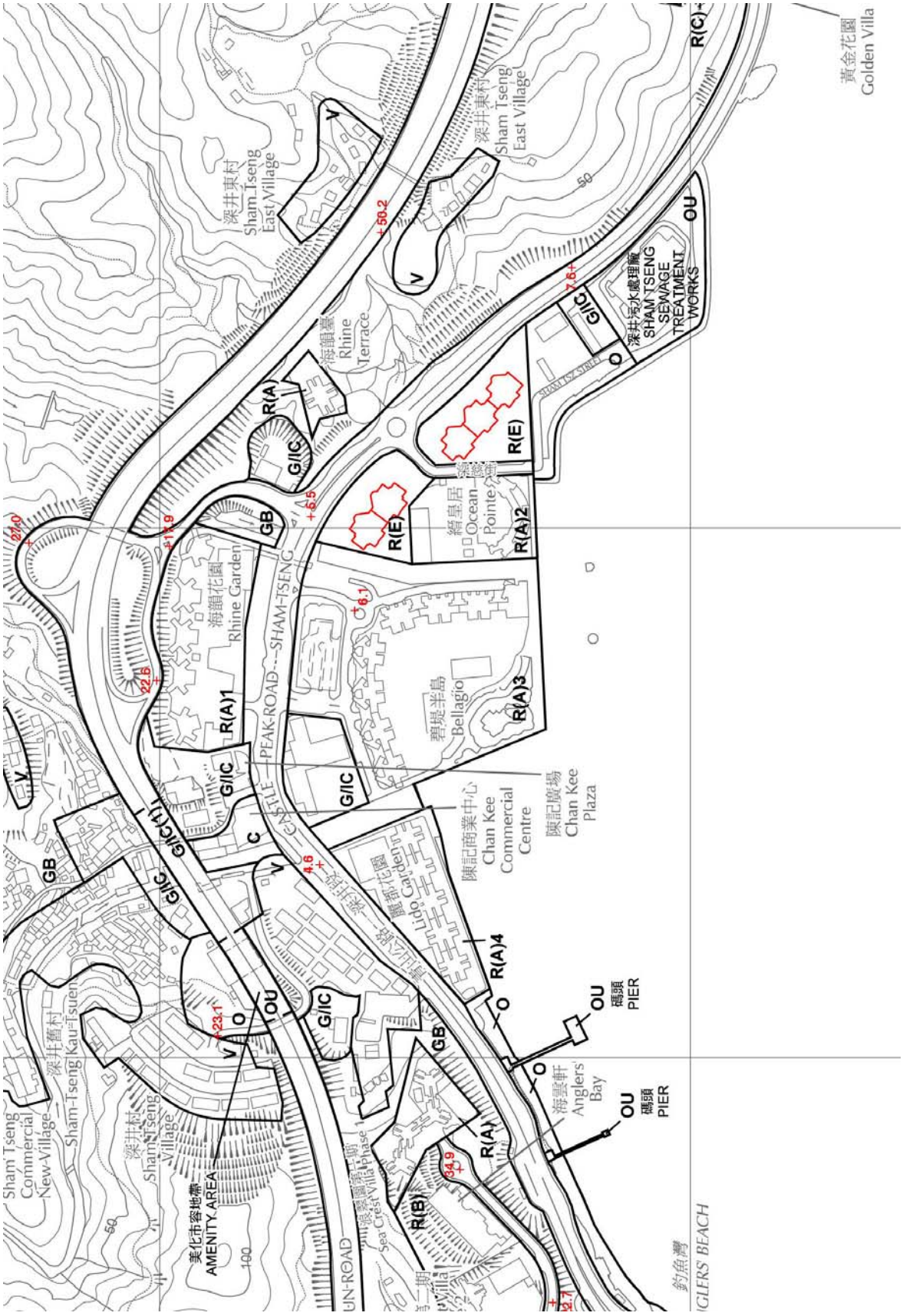


Figure 6.3 Proposed developments in Sham Tseng area

7.0 Expert Evaluation and Recommendations of the Initial Planned Scenario

7.1 Due to Hong Kong's high-density urban morphology, it is not advisable to only rely on building height restriction (or minor changes of building heights) to maintain and/or improve air ventilation. For most of the areas, air ventilation will achieve better performance if more effective measures are also applied, including formation of breezeways, air paths, open spaces, gaps between buildings and building permeability especially near ground level.

7.2 On the whole, refer to Figure 7.1 (a, b and c) and 7.2 (a, b and c), it appears that the building height restriction proposed is more or less similar to the existing building heights except three developments (i.e. Bellagio, Ocean Pointe and Lido Garden) at Sham Tseng waterfront. These sites will have the building height restricted that they are not allowed for redevelopment up to the existing building height. With careful design and disposition of buildings on site, this should not result in adverse air ventilation issues.

7.3 As the study area is located on the waterfront and is back by extensive green areas (Figure 5.4), with appropriately spaced out air paths, the elongated study area should not have severe air ventilation issues.

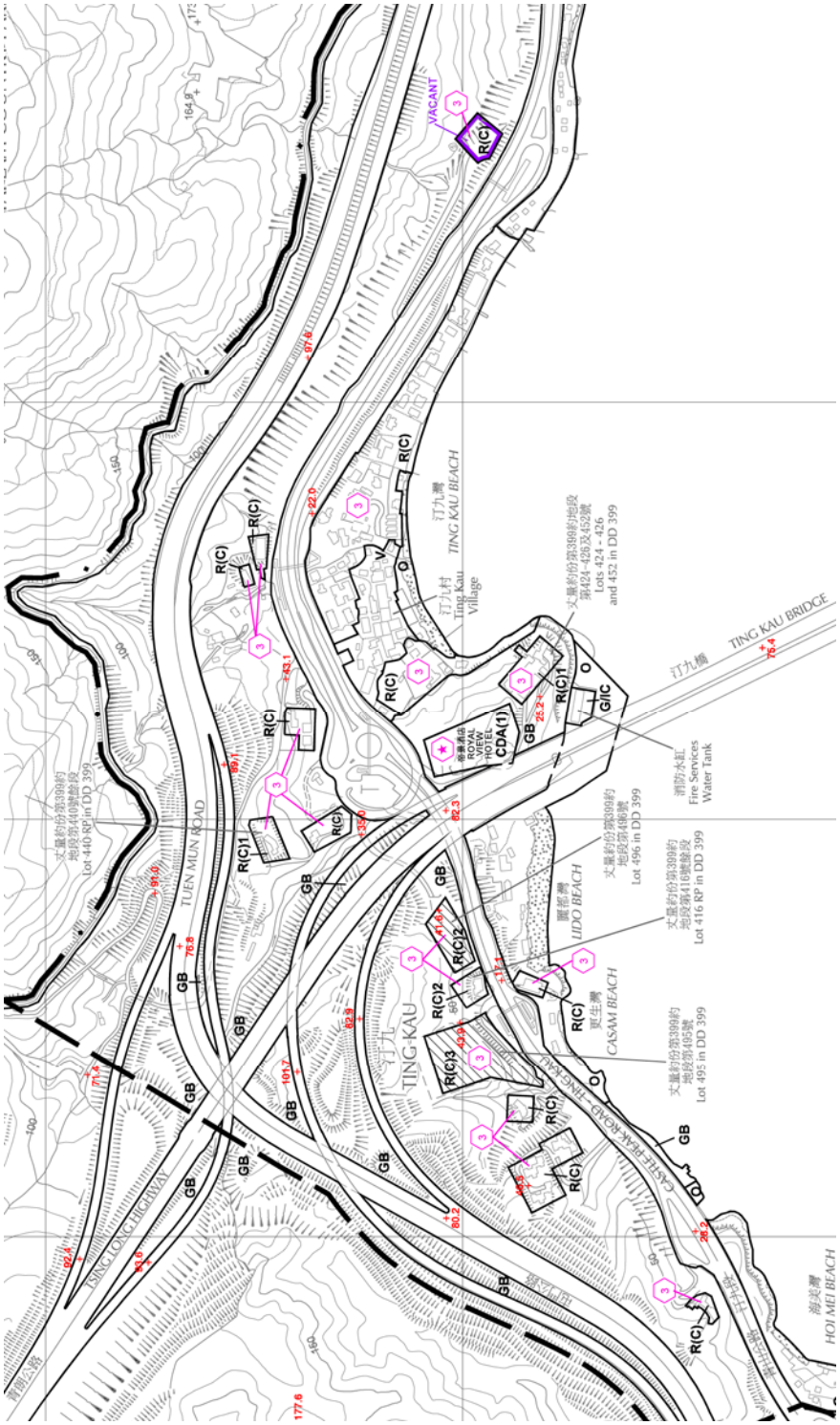
7.4 As a general principle, buildings on the waterfront should be carefully designed with good gaps between towers to maintain permeability of air ventilation to its wake areas (weak wind areas behind buildings). If needed, project proponent may conduct further AVA studies to ascertain the air ventilation performance of their designs, and to improve their designs at the detail design stage. On an area-average basis, the rule of thumb is 40-50% permeability for good air ventilation and 25 to 35% for reasonable air ventilation. Wall like structures with no gap in between is not encouraged.

7.5 The initial planned scenario has incorporated a number of useful non-building areas (NBAs) including the widened gap at Sham Tsz Street (Figure 7.1b). The permeability provided by the north-south oriented NBAs for the waterfront areas in Sham Tseng is reasonable for maintaining / improving air ventilation of the surrounding areas.

7.6 The initial planned scenario keeps most of the existing GIC/OU sites (Figure 7.2) as low-rise buildings. GIC/OU sites with low-rise buildings and greeneries that are connected to or next to the air paths should be maintained for enhancing the air ventilation performance of the surrounding areas.

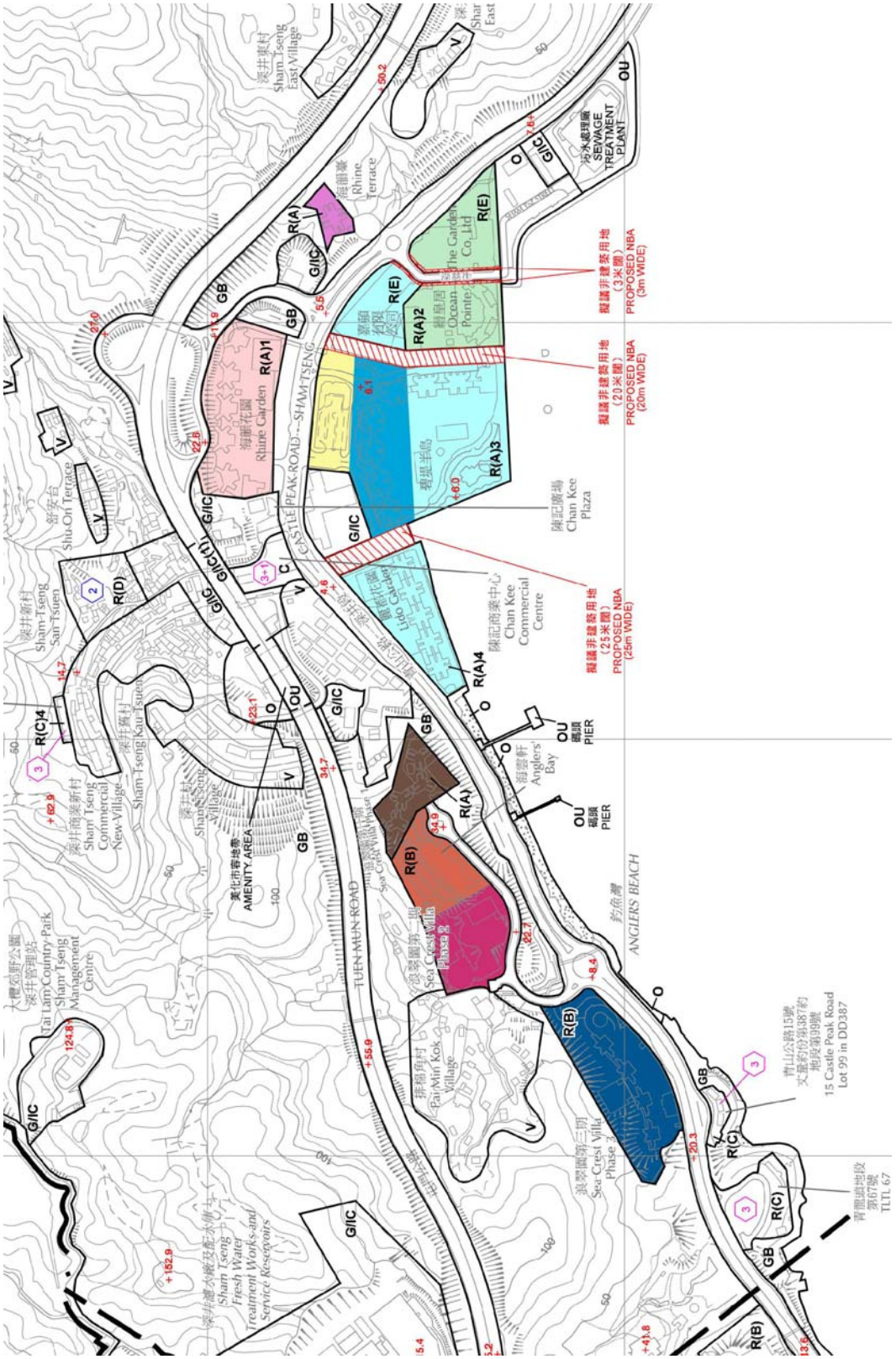
8.0 Further works

8.1 Based on the expert assessment, the study area has no major air ventilation issue. Further AVA study for the OZP review is not necessary.



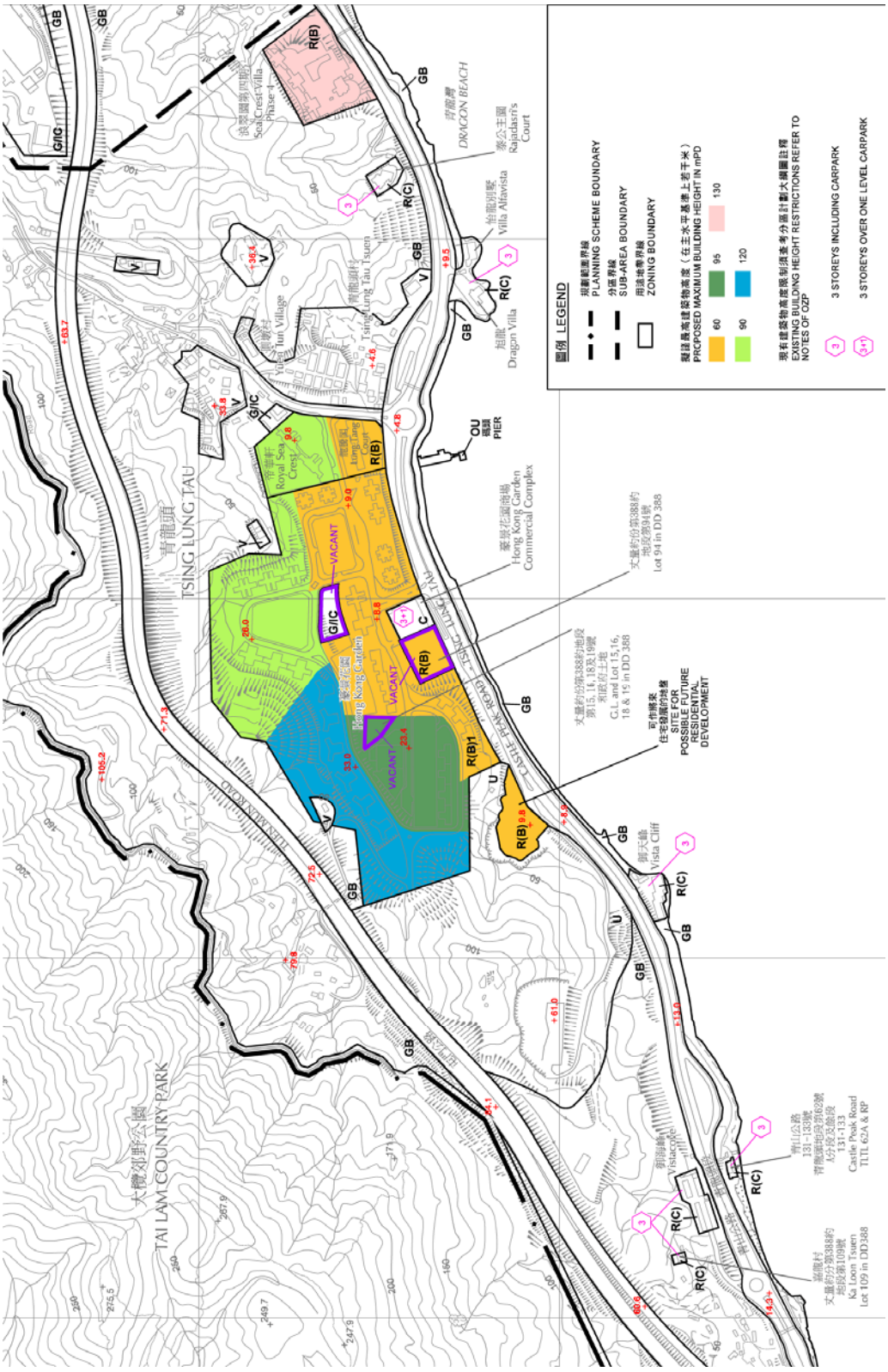
(a)

Figure 7.1 The Initial Planned Scenario of the Area (proposed building height restrictions for commercial and residential development sites in mPD) (a: Ting Kau; b: Sham Tseng; c: Tsing Lung Tau).



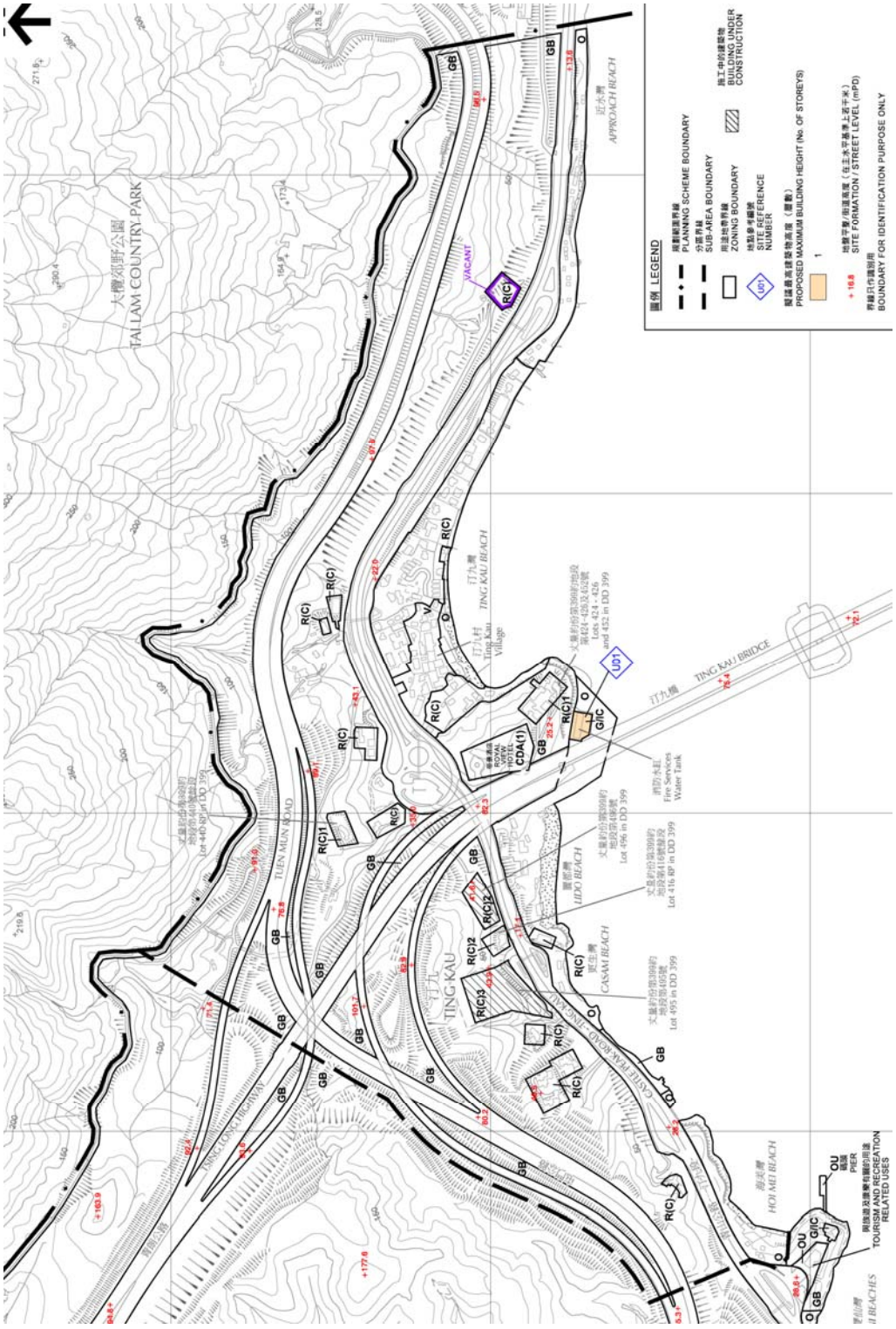
(b)

Figure 7.1 The Initial Planned Scenario of the Area (proposed building height restrictions for commercial and residential development sites in mPD) (a: Ting Kau; b: Sham Tseng; c: Tsing Lung Tau).



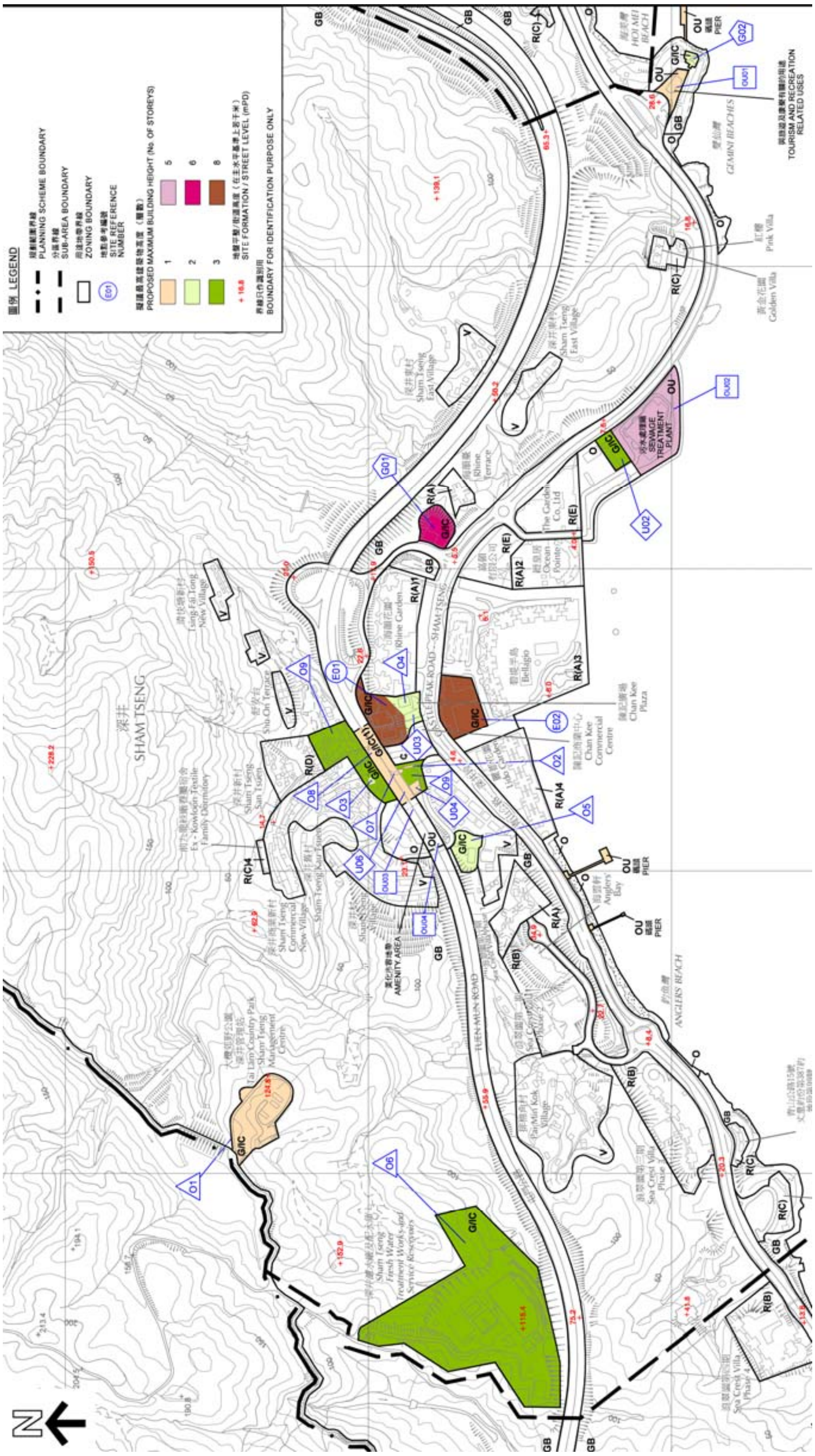
(c)

Figure 7.1 The Initial Planned Scenario of the Area (proposed building height restrictions for commercial and residential development sites in mPD) (a: Ting Kau; b: Sham Tseng; c: Tsing Lung Tau)



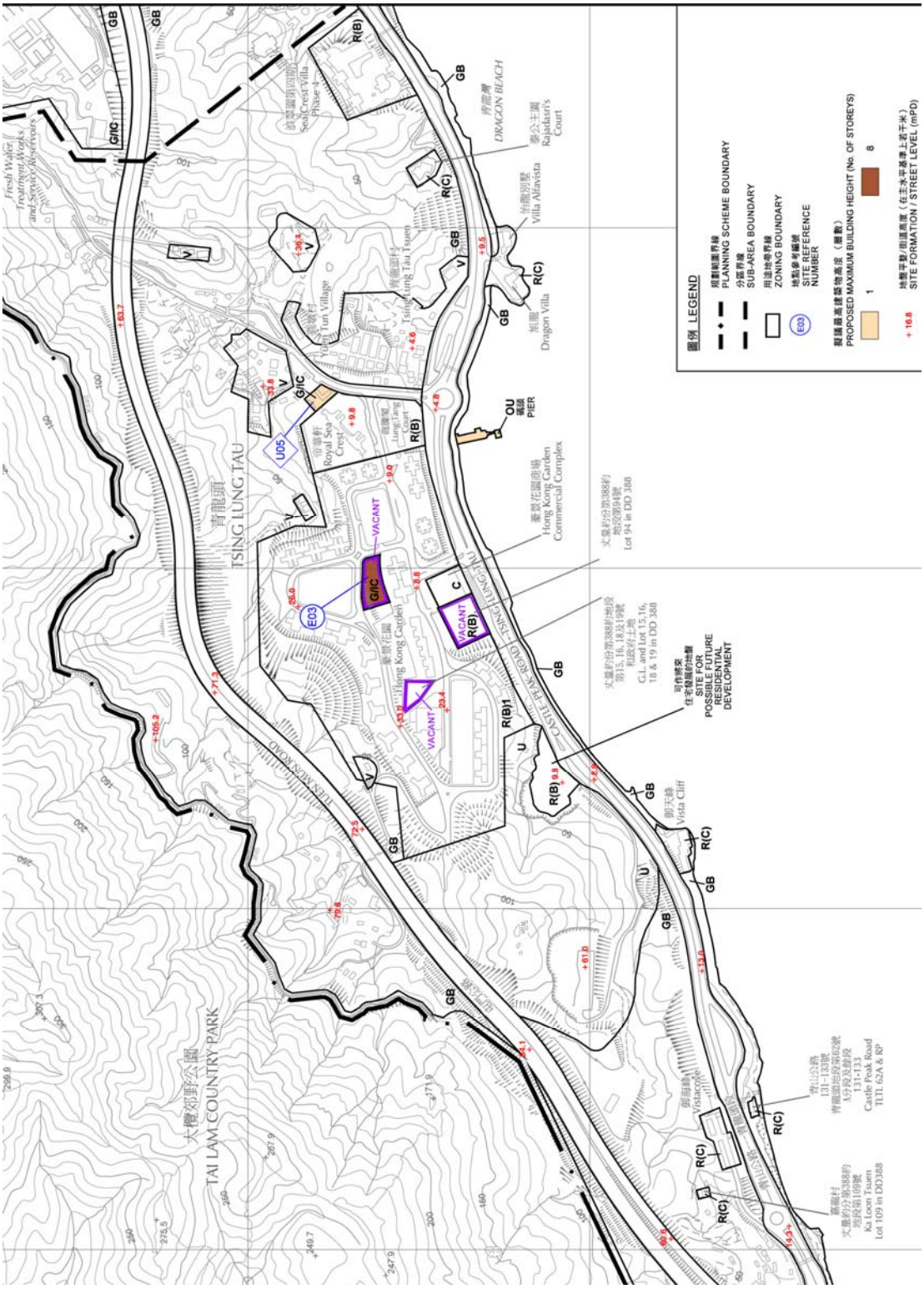
(a)

Figure 7.2 The Initial Planned Scenario of the Area (proposed building height restrictions for G/IC and OU sites in no. of storeys) (a: Ting Kau; b: Sham Tseng; c: Tsing Lung Tau)



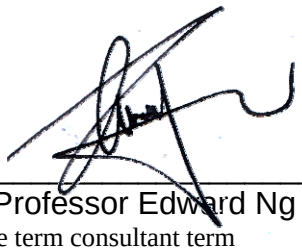
(b)

Figure 7.2 The Initial Planned Scenario of the Area (proposed building height restrictions for G/IC and OU sites in no. of storeys) (a: Ting Kau; b: Sham Tseng; c: Tsing Lung Tau)



(c)

Figure 7.2 The Initial Planned Scenario of the Area (proposed building height restrictions for G/IC and OU sites in no. of storeys) (a: Ting Kau; b: Sham Tseng; c: Tsing Lung Tau)



Date: 9 Nov 2011

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