

Appendix J

Air Ventilation Assessment (Expert Evaluation)

ARUP

| Jul 2025

Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D. 32 and Adjoining Government Land, Wong Yi Au, Tai Po, New Territories

Air Ventilation Assessment – Expert Evaluation

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 292635

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1. Introduction

Arup Hong Kong Limited (Arup) has been commissioned to conduct the Air Ventilation Assessment (AVA) – Expert Evaluation (EE) for the Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D. 32 and Adjoining Government Land, Wong Yi Au, Tai Po, New Territories ("the Application Site"). The Application Site is currently zoned as "Green Belt" ("GB") on the Draft Tai Po Outline Zoning Plan No. S/TP/31. The Study Site of this Study includes the Application Site, an indicative scheme of proposed access road, and an indicative saltwater pump station.

1.1 Objective

The objective of the Study is to investigate the wind performance of the Proposed Comprehensive Development in the form of AVA – EE. The AVA – EE will be conducted in accordance with the "Technical Circular No. 1/06 – Air Ventilation Assessments" (Technical Circular) and its Annex A "Technical Guide for Air Ventilation Assessment for Developments in Hong Kong" (Technical Guide), which is jointly issued by Housing, Planning and Lands Bureau and Environmental, Transport and Works Bureau on 19th July 2006.

1.2 Study Tasks

The major task of this study is to carry out an expert evaluation on the characteristics of the site wind availability data of the development area and assessment of the wind performance of the proposed development in a qualitative way. The expert evaluation will cover the following tasks:

- Identify the wind condition
- Identify problem areas
- Identify good design features

2. Site Characteristics

The Application Site, with a site area of about 14,879 sq. meters, is currently proposed to be developed into four residential blocks with podium for clubhouse, carpark and other ancillary facilities, which falls within an area zoned as "Green Belt" ("GB"). Apart from the Application Site, the Study Site of this Study also includes an indicative road connecting Yung Yi Road to the Study Site with a 3m tall indicative saltwater pumping station at the northeastern end of the road. The indicative road and indicative saltwater pumping station are subject to detailed design. The Study Site is located at Wong Yi Au, in between Wong Yi Au Village and peak of Lai Chi Shan, as shown in Figure 1.

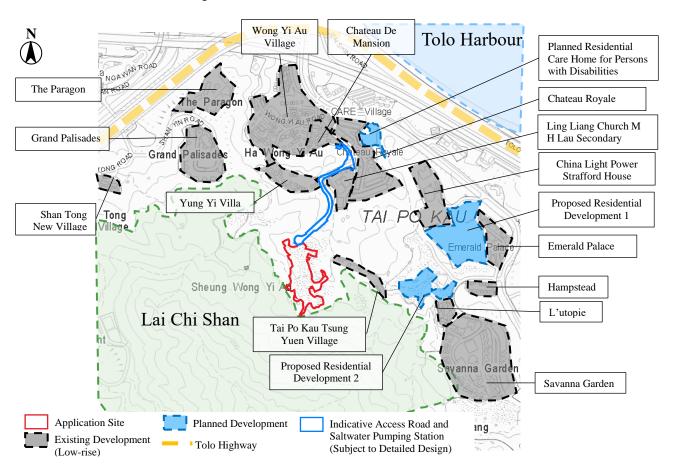


Figure 1 Study Site and Surrounding Area (Source: Lands Department)

The Study Site is located at Wong Yi Au on the northern hillslope of Lai Chi Shan (+282mPD) overlooking Tolo Harbour. The Study Site is surrounded by Lai Chi Shan from south-east to west direction.

To the north-west of the Study Site, there is generally hilly topology of Lai Chi Shan. Further down the Lai Chi Shan in north-west direction of the Study Site, there are generally low-rise, medium-density residential developments, e.g. Shan Tong New Village (+48-54mPD), Grand Palisades (+85-94mPD) and The Paragon (+48-69mPD).

To the north and northeast of Study Site are various low-rise, low density village houses such as Yung Yi Villa (+45-61mPD), Wong Yi Au Village (+16-42mPD), Chateau De Mansion (+26mPD), Chateau Royale (+23-50mPD) and a Planned Residential Care Home for Persons with Disabilities¹ (+37mPD). Low-rise Ling Liang Church M H Lau Secondary School (+34-60mPD) is located at the northeast of the Study Site.

Low-rise Tai Po Kau Tsung Yuen Village (+86-88mPD) is located at the immediate east of the Study Site. Further to the northeast, there are low-rise buildings, such as China Light Power Strafford House (+75mPD) and Hampstead (+73-78mPD) along with planned developments Proposed Residential Development 1² (4-7 storeys). To the southeast, there are low-rise, low density Proposed Residential Development 2³ (+79mPD) and existing low-rise private residential developments, including Emerald Palace (+59-79mPD), L'utopie (+89mPD), and Savanna Garden (+87-120mPD).

3. Site Wind Availability Data

To investigate the wind performance of the Development, the characteristic of the natural wind availability of the site is essential. Site wind availability data presented in the wind rose could be used to assess the wind characteristics in terms of the magnitude and frequency of approaching wind from different wind directions. According to the *AVA Technical Circular*⁴ for Developments in Hong Kong, the site wind availability data will be referred to the simulated RAMS data from Planning Department.

Planning Department (PlanD) has set up a set of simulated meso-scale data of Regional Atmospheric Modelling System (RAMS) of the territory for AVA Study, which can be downloaded from Planning Department Website⁵.

Among the wind data at three levels (200m, 300m and 500m), wind data at 200m would be suitable to represent the wind data with consideration of surrounding morphology. The location of the Development falls within four location grids: (x:080, y:069), (x:081, y:069), (x:080, y:068), (x:081, y:068) in the RAMS database, as indicated in Figure 2.

The annual and summer wind roses at 200m are shown in Figure 3 to Figure 6. From these wind roses, the annual and summer prevailing wind directions are ENE/ E/ ESE and E/SSW/ SW/S/SSE, respectively.

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¹ Planning Application for the Government Land at Government Land at Former Fish Marketing Organization Tai Po Primary School, Wong Yi Au, Tai Po, New Territories, available at: https://www.tpb.gov.hk/tc/plan_application/Attachment/20240315/s16_A_TP_694_0_gist.pdf

² HKSAR Government Press Release for Tai Po Town Lot No. 230 at Tai Po Road - Tai Po Kau, Tai Po Kau, Tai Po, available at: https://www.info.gov.hk/gia/general/201607/26/P2016072600806.htm

³ Planning Application for the Government Land at Yau Yiu Avenue, Tai Po, available at: https://www.ozp.tpb.gov.hk/api/Perm/Gist?caseNo=A%2fTP%2f627&lang=EN&ext=pdf&dType=in

⁴ Housing, Planning and Lands Bureau and Environment, Transport & Works Bureau, Technical Circular No.1/06 Air Ventilation Assessment and its Annex A – Technical Guide for Air Ventilation Assessment for Developments in Hong Kong, dated 19th July, 2006.

⁵ Simulated RAMS wind data from Planning Department, available at: http://www.pland.gov.hk/pland_en/info_serv/site_wind/site_wind/index.html

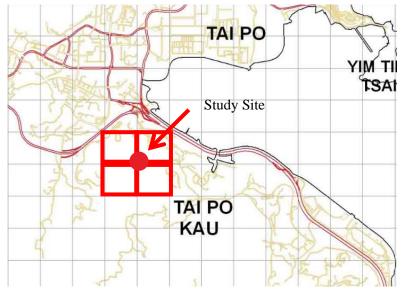


Figure 2 RAMS Grid and the Study Site Location

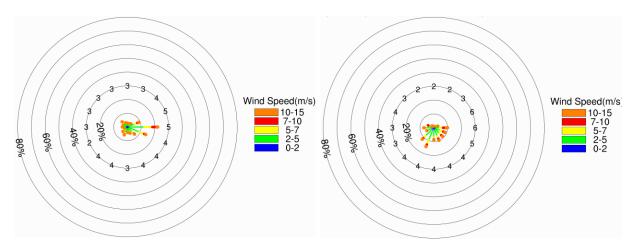


Figure 3 Annual (left) and Summer (right) Wind Rose at 200m Extracted from the Grid (x:080, y:069) of RAMS

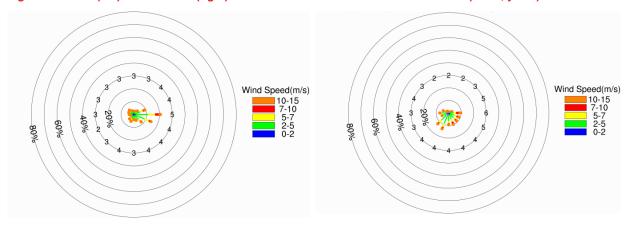


Figure 4 Annual (left) and Summer (right) Wind Rose at 200m Extracted from the Grid (x:081, y:069) of RAMS

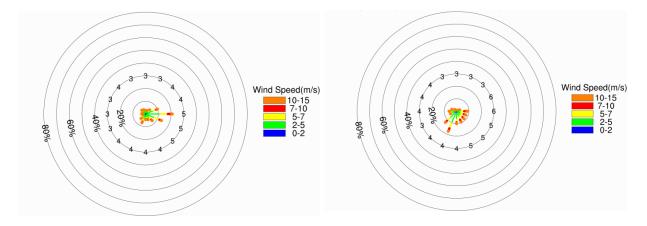


Figure 5 Annual (left) and Summer (right) Wind Rose at 200m Extracted from the Grid (x:080, y:068) of RAMS

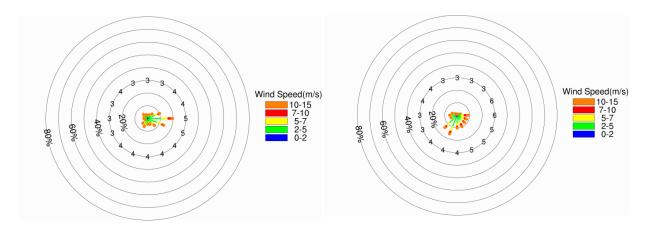


Figure 6 Annual (left) and Summer (right) Wind Rose at 200m Extracted from the Grid (x:081, y:068) of RAMS

4. Studied Scenarios

To evaluate the potential ventilation impact of the proposed changes of the Study Site, two schemes have been studied in this Air Ventilation Assessment – Expert Evaluation, namely, Baseline Scheme and Indicative Scheme.

4.1 Baseline Scheme

The Baseline Scheme reflects the existing condition that there are no existing or planned developments. The Study Site is currently zoned as "Green Belt" ("GB"), "Village Type Development" ("V") and "Government, Institution or Community" ("G/IC") zone as shown in Figure 7.



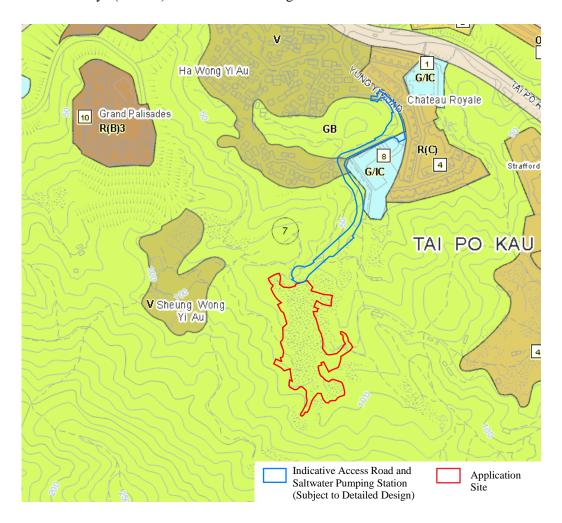


Figure 7 Layout Plan of Baseline Scheme

4.2 Indicative Scheme

The Indicative Scheme consists of a 1-storey basement for Carpark, as well as a 1-storey podium for Clubhouse, GIC and E&M purposes. Above the podium, there are two (2) nos. of residential towers. The Indicative Scheme comprises of two parts, namely the indicative access road at the northern portion, which includes an indicative saltwater pumping station approximately 3 meters tall at its northeastern end (both subject to detailed design), and the proposed residential development (Application Site) at the southern portion, as indicated in Figure 8. The planning parameter of Indicative Scheme is summarized in Table 1. The master layout plan is shown in Figure 8 and Appendix A.

Table 1 Development Parameter of Indicative Scheme

Application Site Area (sq.m)	14,879
Gross Floor Area (sq.m)	Domestic: 35,710 ⁶ ; Non-domestic: 0
Building Height (mPD)	+96.00 (Tower 1, 2); +92.85 (Tower 3);
	+89.70 (Tower 4);

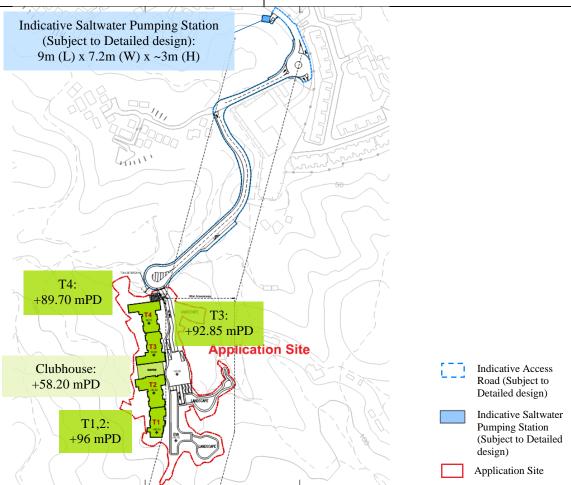


Figure 8 Master Layout Plan of Indicative Scheme

The following wind enhancement features have been adopted in the Indicative Scheme:

 $^{^6}$ Clubhouse GFA 1606.97m² (4.5 % of total domestic GFA) is exempted from GFA calculation.

- 15m Building separation between T2 and T3 to provide air path
- 80m Building setback from edge of eastern boundary to provide breezeway for valley wind

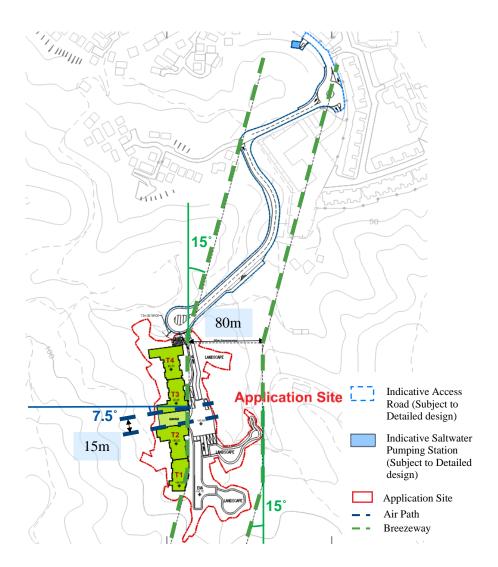


Figure 9 Proposed Wind Enhancement Features

5. Expert Evaluation of Directional Analysis

5.1 ENE/E Winds

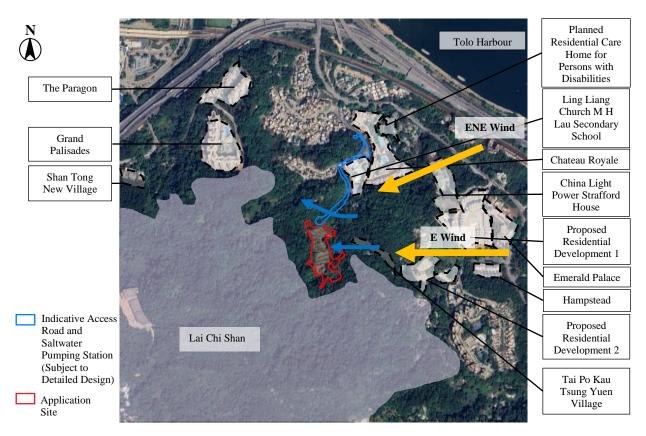


Figure 10 Wind Environment under ENE/E wind

East-north-east (ENE) wind is one of the annual prevailing winds whereas the east (E) wind is the prevailing wind under both annual and summer condition.

As the prevailing winds from ENE and E travel towards the Study Site, it will skim over the low-rise developments at windward side, from the Tolo Harbour. The incoming ENE wind will skim over Planned Residential Care Home for Persons with Disabilities, China Light Power Strafford House, Chateau Royale and Ling Liang Church M H Lau Secondary School before reaching the Study Site. Meanwhile, for E wind, the low-rise developments such as Proposed Residential Development 1, Emerald Palace, Hampstead and Proposed Residential Development 2 are skimmed over, then Tai Po Kau Tsung Yuen Village, lastly reaches the Study Site. (Orange arrows in Figure 10)

The linkage of the said low-rise buildings along the prevailing wind directions allows the incoming wind to reach the Study Site from eastern boundary with no obstruction. On the other hand, in consideration of the hilly profile of the Lai Chi Shan, a portion of the incoming wind is expected to be diverted to travel along the hilly surface towards Grand Palisades. (Blue arrows in Figure 10)

The Indicative Scheme has a long frontage area in the north-south direction, where the Study Site are likely to block the prevailing wind coming from ENE/E direction. However, by incorporating wind enhancement features, the impacts are alleviated as discussed below.

5.1.1 Discussion

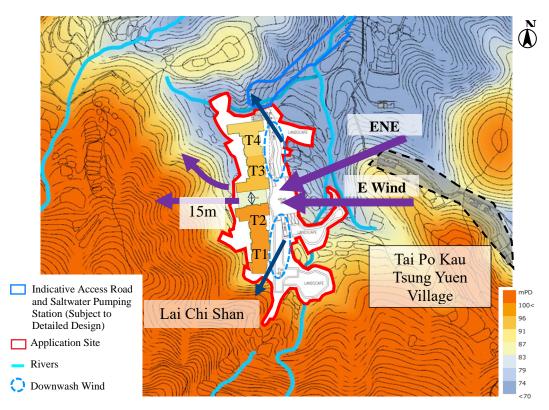


Figure 11 Wind Environment of the Indicative Scheme at ENE/E winds

Baseline Scheme of the Study Site currently has no existing or planning development, therefore under ENE and E wind, the incoming wind would enter the Study Site, passes through and travel along the hilly surface of Lai Chi Shan at its leeward. Similarly, the indicative northern road, which features a 3m tall indicative saltwater pumping station that is lower in height than the adjacent low-rise village houses, along with its small building massing, would impose minimal ventilation impact on the surrounding buildings.

Minimal ventilation impact would be expected by the Application Site under Indicative Scheme to be imposed due to the wind environment being dominated by Lai Chi Shan and no nearby development at the leeward side. Regardless, thorough considerations were also given into the design of the residential towers to achieve with full compliance with the SBD requirements to improve the permeability of the Study Site.

Under Indicative Scheme, as the wind travels over the low-rise development from the ENE and E directions and reach the study site, the 15m building separation between residential Tower 2 and 3 would allow the incoming ENE and E wind to penetrate through the Study Site to travel along the hilly terrain of Lai Chi Shan. (Purple arrows in Figure 11)

The ENE/E wind reaching the abutted residential tower and podium edge facing east of Tower 1 and 2 causes downwash wind to reach the pedestrian level at the east of Study Site (Blue circles in Figure 11), improving

ventilation locally. Then, the downwashed winds are diverted by building facades to the north and south of the Study Site. (**Blue** arrows in Figure 11) Subsequently, wind shadow would be created at the localised leeward area of the Study Site, causing a relatively calm wind environment. Nevertheless, as there would be mainly hilly range, which is not frequently accessible by pedestrian, the ventilation impact would be minimal.

5.2 ESE Wind

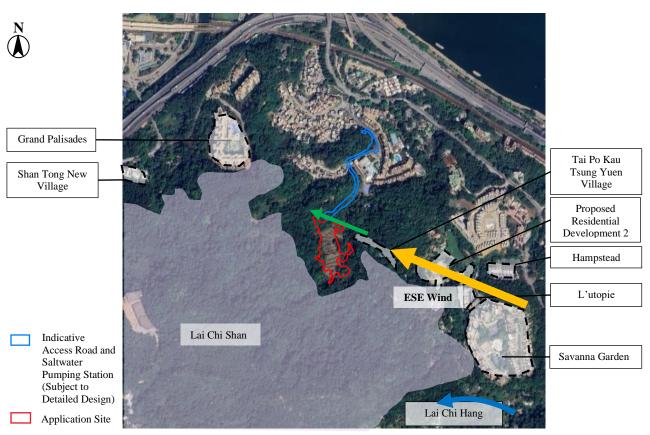


Figure 12 Wind Environment under ESE wind.

East-south-eastly (ESE) wind is one of the major annual prevailing wind directions coming along the coastline. A portion of the incoming ESE wind will be diverted by Lai Chi Shan, causing incoming wind to travel towards Lai Chi Hang. (Blue arrow in Figure 12)

A majority of the ESE wind would skim over the low-lying portion of Lai Chi Shan along low-rise developments, Savanna Garden, Hampstead and L'utopie, then the Proposed Residential Development 2, and finally, the Tai Po Kau Tsung Yuen Village located at the immediate upwind location of the Study Site. The linkage of low-rise buildings and open spaces aligned along the ESE wind direction at the windward side of the Study Site creates a pathway for incoming wind to travel down the hill and reach the Study Site. (Orange arrow in Figure 12)

The incoming ESE wind would continue to travel towards Grand Palisades at the north of the Study Site. (Green arrow in Figure 12) Although the Study Site would be located at the leeward side of the surrounding low-rise residential buildings, the upwind developments would cause little impact to incoming wind. However,

the northeastern portion of Lai Chi Shan, located immediately upwind from the Study Site, will create a relatively calm wind environment under ESE wind.

5.2.1 Discussion

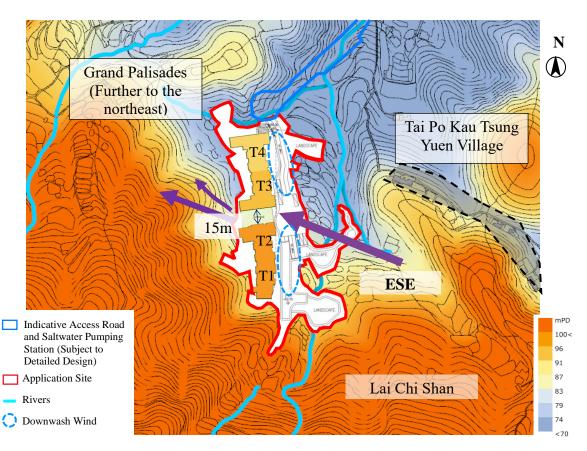


Figure 13 Wind Environment of Indicative Scheme under ESE Wind

With no existing or planned development at the Study Site for the Baseline Scheme, the ESE wind would be able to travel across Lai Chi Shan to reach the leeward area with no obstruction, providing sufficient ventilation for Grand Palisades. The general wind environment of the leeward side is dominated by Lai Chi Shan.

Similar to the Baseline Scheme, the indicative northern road features a 3-meter-tall indicative saltwater pumping station that is lower in height than the adjacent low-rise village houses, along with its small building massing, therefore negligible ventilation impact would be imposed on surrounding buildings. Meanwhile, the general wind environment for the Indicative Scheme is dominated by Lai Chi Shan as the maximum building height of the Indicative Scheme is maintained lower than Lai Chi Shan in the prevailing wind direction. Some localized ventilation impacts are expected near the Study Site.

Apart from the ESE wind penetrating through the 15m building separation, the majority of the incoming wind from the ESE direction would be downwashed and reach pedestrian level in the eastern part landscape area of the Study Site due to residential tower and podium edge facing east of residential towers has been abutted. (Blue circles in Figure 13) Subsequently, wind shadow would be created at the localised leeward area of the Study Site causing a relatively calm wind environment. The calm wind environment would be alleviated with 15m building separation between Tower 2 and 3 that a portion of ESE wind reaching the Study Site would

travel through, allowing some of the ESE wind continues to travel across Lai Chi Shan. (Purple arrows in Figure 13)

5.3 SW/SSW/S/SSE Winds

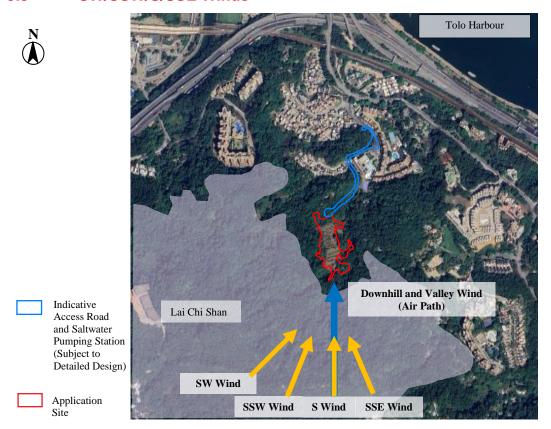


Figure 14 Wind Environment under SW/SSW/S/SSE winds

Southwest (SW), south-south-west (SSW), south (S) and south-south-east (SSE) wind directions are four of the major prevailing wind directions in summer. The Study Site is located at the foot of Lai Chi Shan, surrounded by its hilly terrain at its West to East. Wind from the southerly quarters will be slightly weakened by the shielding effects of the Lai Chi Shan.

Referring to Tai Po AVA Expert Evaluation report in 2010⁷, katabatic air movements would be expected at the windward side of the Study Site, a stream of downhill and valley wind from the vegetated hill slope (Blue arrow in Figure 14) would be formed with the assistance by the summer prevailing winds. (Orange arrows in Figure 14) The downhill and valley wind assisted by the summer prevailing winds would reach the Study Site at southern site boundary following Lai Chi Shan's curvature along the river.

⁷ Term Consultancy for AVA Services - Expert Evaluation on Air Ventilation Assessment for Tai Po Area, available at: https://www.pland.gov.hk/pland_en/info_serv/ava_register/ProjInfo/AVRG51_AVA_FinalReport.pdf

5.3.1 Discussion

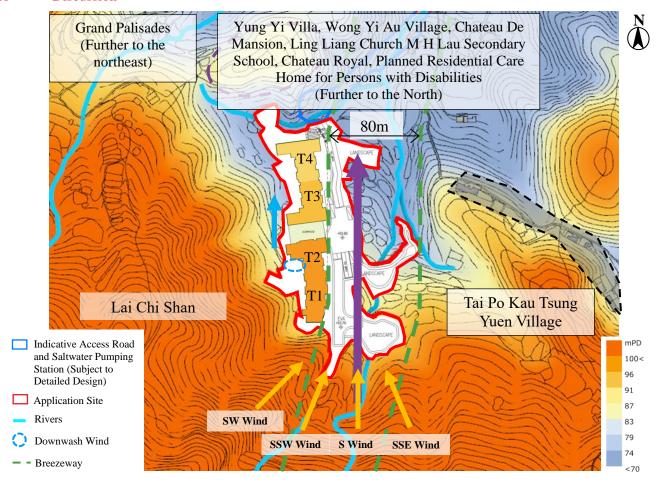


Figure 15 Wind Environment of Indicative Scheme under SW/SSW/S/SSE winds.

With no existing or planned development, for the Baseline Scheme of the Study Site, as the SW, SSW, S and SSE wind travel through the Study Site, no obstructions would be posed to the leeward developments, for example Wong Yi Au Village, Yung Yi Villa, Chateau De Mansion, Ling Liang Church M H Lau Secondary School, Chateau Royale and Planned Residential Care Home for Persons with Disabilities, enabling adequate ventilation for the said areas. Similarly, the indicative northern road under the Indicative Scheme, featuring a 3m tall indicative saltwater pumping station with a small building massing, which is lower in height than the adjacent low-rise village houses, will impose no ventilation impact on the surrounding buildings.

Under the Indicative Scheme, the majority of the SW, SSW, S and SSE winds (Orange arrows in Figure 15) will reach the Study Site as downhill and valley wind with no obstructions. (Purple arrow in Figure 15) The residential towers of the Indicative Scheme are positioned at the low-lying area of the hillslope of Lai Chi Shan reserving an 80 m N-S aligned breezeway at the eastern portion of the Study Site, which matches the natural terrain of the valley to allow downhill and valley wind to flow along and ventilate the leeward areas, such as Yung Yi Villa, Ling Liang Church M H Lau Secondary School, Wong Yi Au Village and Chateau De Mansion.

Building disposition with small frontal area facing the summer prevailing winds further alleviates the ventilation impact of the Study Site. A small portion of the incoming S, SW and SSW wind would be diverted by Tower 1, causing two streams of wind flows along the either side of the residential towers. One stream

would join the air flow along the 80 m breezeway. The other stream would travel along the hilly terrain of Lai Chi Shan on the western site boundary, subsequently reaches northern low-rise village developments. (Blue arrow in Figure 15) A portion of the incoming wind would be downwashed at the southern facing façade at Tower 2. (Blue circle in Figure 15)

In addition, the Lai Chi Shan with +282 mPD located at upwind location, as well as the purple circled portion of Lai Chi Shan with +86 mPD would dominate the wind environment at leeward low-rise village developments, such as Grand Palisades, Yung Yi Villa, Chateau Royale, etc. With 80m wide breezeway allowing the valley wind to travel through, the ventilation impact from the Proposed Development would be insignificant.

6. Conclusion

Qualitative assessment of the wind environment of the Study Site was conducted. According to the wind availability data from PlanD, the annual prevailing winds come from ENE, E and ESE directions while the summer prevailing winds are from E, SSW, SW, S and SSE directions.

6.1 Under Annual Wind Condition

Under annual condition, the wind environment under the Indicative Scheme would be similar as Baseline Scheme, which has no existing or planned developments currently. The indicative northern road featuring a 3-meter-tall indicative saltwater pumping station with a small building massing, which is lower in height than the adjacent low-rise village houses, would impose in negligible ventilation impact on surrounding buildings. In addition, the leeward wind environment being dominated by the shielding effect of Lai Chi Shan and no development located at the nearby leeward side. Furthermore, thorough considerations were given into the design of the Indicative Scheme to achieve with full compliance with the SBD requirements. In addition, a W-E aligned 15m building separation between Tower 2 and 3 is incorporated as air path to improve the permeability of the Study Site.

6.2 Under Summer Wind Condition

Under summer condition, the Study Site is located at the leeward side of Lai Chi Shan, on the path of downhill wind. There would be minimal ventilation impact imposed to the sensitive receivers in the leeward areas as compared with the Baseline Scheme, which has no existing or planned developments currently.

The indicative northern road featuring a 3-meter-tall indicative saltwater pumping station with a small building mass, which is lower in height than the adjacent low-rise village houses, would impose in negligible ventilation impact on surrounding buildings. A N-S aligned 80m breezeway is maintained by the building setback, which allows the downhill and valley wind assisted by SW, SSW, S and SSE winds to travel across the Study Site with no obstruction. With a small frontage area, and over 2H distance between the residential towers and the

leeward developments, insignificant ventilation impact would be expected to the leeward developments under Indicative Scheme.

6.3 Summary

In summary, there would be minimal ventilation impact on the surrounding development wind environment caused by the Indicative Scheme under both annual and summer wind conditions. Regardless, the impact of the Study Site has been kept to the minimal by various wind enhancement features, such as breezeway maintained and building separations. The air permeability of the Study Site has been enhanced and the obstruction of the air flow has been mitigated where possible. The localized ventilation impact imposed by the Indicative Scheme would be alleviated through these wind enhancement features.

Appendix A

Layout Plan of the Indicative Scheme

