Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment Services under Agreement No. PLNQ 35/2009

Expert Evaluation and Advisory Report for

An Instructed Project for Tsuen Wan Area

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J9008-06 Tsuen Wan

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EXECUTIVE SUMMARY

CO₂nnsulting was commissioned by the Planning Department of HKSARG under the Term Consultancy for Expert Evaluation on Air Ventilation Assessment Services to assess the air ventilation impacts of the building height restrictions incorporated in the approved Tsuen Wan Outline Zoning Plan No. S/TW/28 and recommend mitigation measures to alleviate the impacts.

The methodology adopted here follows that for an expert evaluation in the "Technical Guide for Air Ventilation Assessment for Developments in Hong Kong" as well as those requirements in the Project Brief.

The wind data in Tsuen Wan is obtained from the CLP Power Wind / Wave Tunnel Facility (WWTF) at The Hong Kong University of Science and Technology for the Tsuen Wan Study Area. The annual prevailing wind directions for the Project Area are: northerlies, north-easterlies and easterlies. The summer prevailing wind directions for the Project Area are: easterlies, southerlies, and south-westerlies.

Recommendations on Existing Scenario

Tsuen Wan is bounded by the foothills of Tai Mo Sha and the terrain of Tsuen Wan is mostly hilly except its centre. The majority of Tsuen Wan is relatively ventilated all year round, benefitting from downhill wind and sea breeze. Existing non-building areas in the form of vast green belts, G/IC sites and district / local open spaces and villages, such as Sai Lau Kok Garden, Jockey Club Tak Wah Park, Sha Tsui Road Playground, Kam Mun Hau Garden, Tsuen Wan Riviera Park, Tsuen Wan Park, Shing Mun Valley Sports Ground, Shing Mun Valley Park, Kwok Shui Road Park, Hoi On Playground are essential to maintain good air ventilation to the Project Area. These areas are encouraged to be maintained to allow penetration of wind inland. Castle Peak Road, Sha Tsui Road, Yeung Uk Road, Hoi Shing Road, Wo Yi Hop Road, Tuen Mun Road, Hoi On Road, Tai Chung Road, Tai Ho Road, Ma Tau Pa Road and Texaco Road are key wind corridors to ventilate the region.

Care should be taken the possibility when high-rises and super-high rises amalgamate and form a wind fence, such as those in Riviera Garden, Vision City, Chelsea Court, Discovery Park, the committed TW 5, the committed TW 6 and the committed TW 7 along the

waterfront. The adverse air ventilation impact is not severe at present as there are currently minimal surrounding buildings of similar scale. Future developments along the waterfront will adversely impact the air ventilation as they present significant obstacles to the sea breeze. Air paths are recommended for the committed TW 5, the committed TW 6, the committed TW 7 and the Waterside Plaza to minimise the adverse impact on air ventilation. Review of the layout plans show possibility of building gaps which can serve the purpose of air paths. Building gaps of about 50m at TW 5, 20m at TW6, 20m at TW7 and 20m at Waterside Plaza can encourage the south-westerlies to permeate through to the Tsuen Wan Town Centre. The podium-free design together with 3 non-building areas in the TWTL 393 help to minimise the adverse air ventilation. The subject site is under land use review and future studies would take into account the findings of the AVA study for the site. Quantitative AVA studies are recommended for these large sites.

The large-scaled housing estates, Cheung Shan Estate, Lei Muk Shue Estate, Shek Wai Kok Estate, are located around the north-eastern boundary of the Project Area, and do not have significant negative impacts on air ventilation in the region due to their location as well as the nearby natural green belt. It is therefore recommended to maintain the Sheung Kwai Chung green belt to improve air ventilation in the Project Area. However, since the sites of these housing estates are large, care should be given to the disposition of future redevelopment. Suggested Layouts with introduction of air paths and a large courtyard have been provided in the Study Report.

The existing Belvedere Garden and Bayview Garden, Tsuen Wan Centre, Tsuen King Garden of under forty to fifty storeys respectively create a wind fence and reduce ventilation to the hinterland. However the negative impact on air ventilation is localised due to the relatively undeveloped green belts, G/IC sites and open spaces.

The site adjacent to Sun Fung Centre is under construction, a residential development of under 174 mPD is already committed. This development will adversely impact on the air ventilation of the nearby Yau Ma Hom Tsuen, however the negative air ventilation impact is not as severe due to the vast open green belt available. The proposed non-building area of 20m to the western side of Sun Fung Centre will improve the effectiveness of the ventilation.

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Recommendations on Planned Scenario

Where podia are allowed, it is recommended to have smaller-scaled, permeable podia, or to align the edge of the podia to the building façade to encourage downdraft to reach pedestrian levels.

The maximum proposed height for the industrial area in the region has been decreased from 180mPD to 100mPD. This decrease in maximum building height is a mitigation strategy that would contribute to better air ventilation when coupled with future road widening and suitable building design.

Air paths are recommended for Fuk Loi Estate and Luk Yeung Sun Chuen respectively to minimise obstacles to wind and improve air ventilation for the Project Area. The existing open area at Nina Tower / Nina Hotel is recommended to be maintained in future development to create local ventilation pockets.

The height band of the existing industrial development intended for residential redevelopment along Kwok Shui Road is at 120mPD for "Residential (Group E)" ("R(E)") zone compared to the rather open nature of the ex- Kwai Chung Public School. As the sites under the "R(E)" zone are substantial in size, care should be taken with the design and massing of the future developments to allow air permeability.

The Proposed Joint Universities Research Archive (JURA) at the ex-Kwai Public Chung School Site at Kwok Shui Road (TWTL 416) is a large site. The existing condition is open with a maximum 60 mPD. The proposed maximum height of 90mPD is acceptable, but care should be taken in the disposition and massing of future development to allow air permeability.

The proposed maximum building height of ex-Tai Wo Hau Factory Estate Site (TWTL 415) reaches 100 mPD. The disposition and massing at the subject site are under planning. As the site is large, the design and massing should include an air path through the site to allow air movement.

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1. INTRODUCTION

 CO_2 nnsulting was commissioned by the Planning Department of HKSARG under Category A Service of the Term Consultancies for Air Ventilation Assessment Services (AVAs). The objective is to assess the air ventilation impacts of the plot ratio / gross floor area and building height restrictions under the approved Outline Zoning Plan (OZP) No. S/TW/28 Tsuen Wan Area and recommend mitigation measures to alleviate the impacts.

The main tasks are to provide the followings:

- Site inspection and analysis of the wind data and environment of the Project Area;
- A qualitative evaluation of the air ventilation impacts of the development as illustrated under the planned scenario as compared to the existing scenario; and
- Recommendations of mitigation and improvement measures.

Figure 1 shows the boundary of the Project Area. Figure 2 shows aerial photos of the Project Area. Figure 3 shows various views within the Project Area. The methodology adopted here follows that for an expert evaluation in the "Technical Guide for Air Ventilation Assessment for Developments in Hong Kong" as well as those requirements in the Project Brief.

2. SITE INFORMATION

The Project Area covers Tsuen Wan area which is located at the southern coast of the New Territories around 16km by road from Tsim Sha Tsui, Kowloon, with an area of approximately 743.48 hectares (according to S/TW/28). See Figure 1. The Project Area descends from the foothills of Tai Mo Shan in the North to the waterfront of the Victoria Harbour in the south. It is bounded by Wo Yi Hop Road in the east and Yau Kom Tau in the west. Kwai Chung is the adjacent district (outside of the Project Area) in the south-east direction.

For the purpose of referencing in the study report, the total Project Area is dissected into the following regions, as shown in Figure 1. Figure 2 shows the landmarks of the Project Area, in terms of air ventilation assessments.

Sub areas	Location	Descriptions	Terrain
Tsuen Wan Town	Bounded by Castle Peak Road –	unded by Castle Peak Road – Mixed land use of residential developments	
Centre	Tsuen Wan, Cheung Pei Shan	(R1, R2) and Comprehensive Development	to 26 mPD)
	Road, Texaco Road, Hoi Hing	Area (CDA), Industrial (I), with some Open	
	Road and the waterfront.	Space (O), Other Specified Uses (OU) and	
		Government /Institution or Community (G/IC).	
Sheung Kwai	Bounded by Cheung Pei Shan	Majority are open space, in terms of Green Belt	hilly (7 mPD
Chung and Shing	Road, Wo Yi Hop Road, Castle	(GB), District Open Space (DO), or Local Open	to 105.8
Mun Valley	Peak Road – Kwai Chung and	Space (LO); Residential developments (R2,	mPD)
	Texaco Road North.	RS) and villages (V).	
Tsuen Wan Bay	Tsuen Wan Bay Bounded by Tai Mo Shan and Majority are Green Belts (GB) with some		foothill (2.9
Western Area and	Western Area and Hoi On Road and the residential developments (R), Open Space (DO		mPD to
Yau Kom Tau	waterfront.	or LO) and G/IC.	
Tsuen King Circuit	Tsuen King Circuit Bounded by Tai Mo Shan, Route Majority are Green Belts (GB), District Ope		hilly (6.6
and Tso Kung	Twisk, Castle Peak Road –	Space (DO) with some residential	mPD to 199
Tam Tsuen Wan, Cheung Pei Shan developments (R), and G/IC.		mPD)	
	Road and Mass Transit Railway		
	(West Rail Line).		
Fu Yung Shan and Bounded by Tai Mo Shan,		Majority are Green Belts (GB), District Open	hilly (28.7
Wo Yi Hop	Cheung Pei Shan Road and	Space (DO) with some Government /	mPD to 206
	Route Twisk.	Institution or Community Uses (G/IC), and	mPD)
		residential developments (R), villages (V).	

Table 1 Characteristics of Sub-Areas within Project Area



Figure 1 The Project Area of Tsuen Wan

(Image source: Google maps, http://maps.google.com.hk)



b) Sheung Kwai Chung and Shing Mun Valley: Housing Estate with Abundant Green Belt Figure 2 Aerial Photos of the Project Area (Image source: Survey & Mapping Office, Lands Department, The Government of HKSAR)



d) Tsuen King Circuit and Tso Kung Tam: Foothills of Tai Mo Shan Figure 2 Aerial Photos of the Project Area (continued)

(Image source: Survey & Mapping Office, Lands Department, The Government of HKSAR)



e) Fu Yung Shan and Wo Yi Hop: Foothills of Tai Mo Shan with some Villages Figure 2 Aerial Photos of the Project Area (continued)

(Image source: Survey & Mapping Office, Lands Department, The Government of HKSAR)





Figure 3a Views of Tai Chung Road (a key air path) Looking Northeastward showing Discovery Park

(Image source: CO2nnsulting Ltd.)



Figure 3b Views of Tai Chung Road (a key air path) Looking Southwestward showing Clague Garden Estate





Figure 3c View of Tai Ho Road (a key air path) Looking Southwestward showing Vision City (Image source: CO₂nnsulting Ltd.)



Figure 3d Castle Peak Road – Tsuen Wan (a key air path) Looking Northwestward Showing Allway Gardens on the slope of Fu Yung Shan (Image source: CO₂nnsulting Ltd.)





Figure 3e Sai Lau Kok Garden on Castle Peak Road – Tsuen Wan

(Image source: CO₂nnsulting Ltd.)



Figure 3f Sha Tsui Road Playground on Sha Tsui Road

(Image source: CO₂nnsulting Ltd.)





Figure 3g Sha Tsui Road (air path) Looking Northwestward

(Image source: CO2nnsulting Ltd.)



Figure 3h Nina Tower and Nina Hotel





Figure 3i View of Industrial Developments and Riviera Gardens in Tsuen Wan Town Centre (left) and Tsing Yi outside Project Area (right) from Nina Hotel





Figure 3j View Towards Tsuen King Circuit showing Allway Gardens and Tsuen Wan Centre from Fu Yung Shan (Image source: CO₂nnsulting Ltd.)



Figure 3k View Towards Tsuen Wan Town Centre, Sheung Kwai Chung and Shing Mun Valley from Fu Yung Shan (Image source: CO₂nnsulting Ltd.)





Figure 3I Jockey Club Tak Wah Park on Tsuen Wan Market Street

(Image source: CO₂nnsulting Ltd.)



Figure 3m Tsuen Wan Riviera Park and Riviera Garden Facing the Waterfront





Figure 3n Tsuen Wan Riviera Park Providing Access to Breeze (Image source: CO₂nnsulting Ltd.)



Figure 3o View Towards Tsuen Wan Bay Western Area (Belvedere Garden and Serenade Cove) from Hoi Hing Road (Image source: CO₂nnsulting Ltd.)





Figure 3p Lei Muk Shue Estate

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3. WIND ENVIRONMENT

The wind data refers to the experimental data conducted by the CLP Power Wind / Wave Tunnel Facility (WWTF) at The Hong Kong University of Science and Technology for the Tsuen Wan Study Area. The wind data is sufficient for this exercise, as this is a qualitative study requiring qualitative wind data, primarily prevailing wind directions.

The annual and summer wind data at a height of 500m and 200m at the junction of Yeung Uk Road and Ma Tau Pa Road, are shown in Figures 4 and 5 respectively. It can be seen that the prevailing wind directions at these two heights are similar. The annual prevailing wind directions for the Project Area are: northerlies, north-easterlies and easterlies. The summer prevailing winds are: easterlies, southerlies and south-westerlies.





a. Annual



b. Summer

Figure 4 Wind Rose for Tsuen Wan at 500m

(Wind roses source: CLP Power Wind / Wave Tunnel Facility (WWTF) at The Hong Kong University of Science and Technology)







b. Summer

Figure 5 Wind Rose for Tsuen Wan at 200m

(Wind roses source: CLP Power Wind / Wave Tunnel Facility (WWTF) at The Hong Kong University of Science and Technology)

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4. Existing scenario

4.1 Topography and Existing Building Height Profile

The following observations of the characteristics of the project area are noted:

- The terrain of Tsuen Wan is mostly hilly except for its centre, referred to as Tsuen Wan Town Centre in this study report.
- Tsuen Wan Town Centre is adjacent to the foothills of Tai Mo Shan in the north and adjacent to the waterfront of the Victoria Harbour in the south. Tsuen Wan Town Centre consists of low to middle-rise residential developments with height not more than 120mPD and with some open space areas lining the sea front. Some high-rise buildings with height from approximately 180mPD to 310mPD, such as Nina Tower, Vision City, are scattered in the region. The committed CDAs with height under 186.75mPD are located at the waterfront. The industrial developments mostly with height not more than 120mPD are densely distributed at the north-west and south-east areas of Tsuen Wan Town Centre.
- Sheung Kwai Chung and Shing Mun Valley sit on the foothill of Fu Yung Shan, mainly consist of vegetated District Open Space, local villages of no more than 3-storey and large-scaled housing estates.
- The sub-areas, Tsuen Wan Bay Western Area and Yau Kom Tau, Tsuen King Circuit and Tso Kung Tam, and Fu Yung Shan and Wo Yi Hop, rest on a foothill of Ha Fa Shan and Fu Yung Shan, mainly consist of green belt areas with some residential developments located at the south of each sub-area. The residential developments with height not more than 150 mPD are scattered in Tsuen Wan Bay Western Area, and should enjoy some sea breeze. There are two large-scaled residential developments, Bayview Garden (under 40 storeys) and Belvedere Garden (under 50 storeys) along the waterfront. The residential developments in Tsuen King Circuit are sparsely distributed on the slope with height approximately from 90 mPD and 210 mPD. The large-scaled developments include Tsuen Wan Centre and Tsuen King Garden. Most of the residential developments in Fu Yung Shan and Wo Yi Hop are local villages of 3-storey dwellings except for some

middle-rise residential developments such as The Cliveden (within the range of 11 to 20 storeys) and The Cairnhill (over 20 storeys).

The wind flow in the project area is impacted not only by the disposition, massing, site coverage and height of buildings, but also the water mass nearby and the surrounding hills. The proximity of water mass will bring cooler breeze. The land heats up more rapidly than the water, causing the air over the land to rise and be replaced by the cool air from over the water. Existing non-building areas in the form of open space, such as Sha Tsui Road Playground, Sai Lau Kok Garden, Jockey Club Tak Wah Park, Kam Mun Hau Garden. Tsuen Wan Park, Tsuen Wan Riviera Park, Hoi On Road Playground, Shing Mun Valley Sports Ground, Shing Mun Valley Park and Kwok Shui Road Park are essential wind corridors¹ to the Project Area. These regions are encouraged to be maintained to allow penetration of wind inland.

The Project Area benefits from the occupation of the hills of Fu Yung Shan, and the proximity of the Tai Mo Shan Country Park. As the northerlies and north-easterlies meet the hills, it creates a zone of increased velocity on the windward side of the hills, and a region of decreased velocity on the leeward side of the hill. The velocity is increased as the wind sweeps around the sides and over the top of the hill as shown in Figure 6. Even on a calm day, upward air movement can be created as the sun warms the hills slopes, and creates a thermal gradient between the top of the hill and its base. The air movement cycle reverses when the air cools in the evening; it descends the hills and brings cooler wind to the base of the hills. The natural green belt provided by Fu Yung Shan is a good example. Winds descend the faces of these green slopes and bring coolth to the base of the hill.

¹ Wind corridors are passages which allow wind breeze to permeate. Wind corridors can be in the form of open space areas, major air paths, non-building areas or building gaps with street width of at least 15 to 20m (measured by building face to building face).



Figure 6 Influence of Terrain on Wind Flow



Figure 7 Existing Scenario showing Major Existing Air Paths²

² Air paths can bring prevailing winds, sea breeze, or downhill wind.

4.2 Existing Summer and Annual Scenarios

Section 3 has identified the summer prevailing wind directions as easterlies, southerlies and south-westerlies; whilst the annual prevailing wind directions are northerlies, north-easterlies and easterlies. The information on the existing scenario, as provided by the Planning Department, presents the existing building profile including the approved and committed developments. It is used as a basis for appreciating the existing wind environment and understanding the effects of development restrictions. Figure 7 shows the prevailing winds for the existing scenario, the major air paths are marked by arrows.

The major air paths towards the centre of Tsuen Wan are summarised in Table 2. It can be seen that these wind corridors³ are essential for air ventilation all year round.

Summer air paths		Annual air paths		
Easterlies	Southerlies and Southwesterlies	Easterlies	Northeasterlies	
Castle Peak Road	Wo Yi Hop Road	Castle Peak Road	Tuen Mun Road	
Sha Tsui Road	Tuen Mun Road	Sha Tsui Road	Castle Peak Road	
Yeung Uk Road	Castle Peak Road	Yeung Uk Road	Cheung Pei Shan	
Hoi Shing Road	Hoi On Road	Hoi Shing Road	Road	
	Tai Chung Road		Tai Chung Road	
	Tai Ho Road		Tai Ho Road	
	Ma Tau Pa Road		Ma Tau Pa Road	
	Texaco Road		Texaco Road	

Table 2 Major Air Paths in Tsuen Wan

4.2.1 Tsuen Wan Town Centre

Tsuen Wan Town Centre is the centre of Tsuen Wan, the majority of the developments are ten storeys (30 mPD), with some developments of 120mPD and beyond. Throughout the year, Tsuen Wan Town Centre enjoys easterlies through Castle Peak Road, Sha Tsui Road

³ Wind corridors are passages which allow wind breeze to permeate. Wind corridors can be in the form of open space areas, major air paths, non-building areas or building gaps with street width of at least 15 to 20m (measured by building face to building face).

and Yeung Uk Road, north-easterlies through Cheung Pei Shan Road, Tai Ho Road, Ma Tau Pa Road and Texaco Road. This area also benefits from downhill wind from Tai Mo Shan and sea breeze coming from its southwest. Tsuen Wan Town Centre enjoys ample sea breeze due to its proximity to the waterfront coupled with the open space such as Tsuen Wan Park and Tsuen Wan Riviera Park, the G/IC site at the intersection of Hoi Shing Road and Tai Chung Road, i.e. CLP Power Hong Kong Limited Hoi Shing Road Substation, as well as the Tsuen Wan Chinese Permanent Cemetery outside of the Project Area.

The open spaces, Jockey Club Tak Wah Park, Sha Tsui Road Playground, Sai Lau Kok Garden, Kam Mun Hau Garden assist in creating ventilation pockets⁴ in the region, when the neighbouring buildings are typically 30 to 60mPD. These open areas will help to minimise skimming flow and improve the local air ventilation. There are isolated super high-rise developments such as the Nina Tower (310 mpD) and Nina Hotel (above 150 mPD), which create downdraft locally and ventilate the nearby streets. However, care should be taken when high-rises or super-high rises amalgamate and form a potential wind fence⁵, such as those in Riviera Garden, Vision City, Chelsea Court, Discovery Park, the committed TW 5, the committed TW 6 and the committed TW7 along the waterfront which would impede summer and annual winds somewhat in Tsuen Wan Town Centre. See Figure 8. Table 3 summarises the impacts of these developments. The air ventilation is sufficient at present as the majority of the developments in the centre of Tsuen Wan Town Centre are around 30mPD. In the case of Discovery Park, the adverse air ventilation impact is not severe as there are currently minimal surrounding buildings. Future developments along the waterfront will adversely impact the air ventilation as they present significant obstacles to the sea breeze.

⁴ Ventilation pockets are usually formed by the open space areas or areas with low-density and low-rise developments with access of wind breeze. The positive impacts of ventilation pockets on air ventilation are localised.

⁵ Wind fences or breaks are obstacles formed by inappropriate dispositions or slab-type of large scale developments. These wind fences inhibit permeability of wind breeze.

Developments	Function	Height	Negative Impact	Wind Directions	
			due to		
Riviera Garden	Residential	120 mPD to	Large-scale and	Southerlies,	
		150 mPD	dense distribution	south-westerlies	
				and sea breeze	
Vision City	Residential	180 mPD to	Fence-type	Easterlies	
		210 mPD	buildings		
			disposition		
Chelsea Court	Residential	180 mPD to	Fence-type	Southerlies	
		210 mPD	buildings		
			disposition		
Discovery Park	Residential	150 mPD to	Fence-type	Downhill wind,	
		180 mPD	buildings	northerlies and	
			disposition	north-westerlies	
Committed TW 5	Residential	Under	Large-scale and	Southerlies,	
		186.75 mPD	large podia	south-westerlies	
				and sea breeze	
Committed TW 6	Residential	Under 179.5	Large-scale and	Southerlies,	
		mPD	large podia	south-westerlies	
				and sea breeze	
Committed TW 7	Residential	Under 152	Large-scale and	Southerlies,	
		mPD	large podia	south-westerlies	
				and sea breeze	

Table 3 Summary of Negative Impacts due to Individual Developments in Tsuen Wan Town Centre

Figure 8 Existing/Committed Scenario in Tsuen Wan Town Centre

⁶ Air paths can bring prevailing winds, sea breeze, or downhill wind.

Figure 9 shows the committed CDA development sites in Tsuen Wan Town Centre, these sites are long and can potentially be turned into a wind shield. These include TW 5, TW 6 and TW 7. These committed developments along the waterfront will adversely impact the air ventilation as they present significant obstacles to the sea breeze. Air paths should be introduced to these sites to minimise the adverse impact on air ventilation, as shown in Figure 9. Review of the layout plans show possibility of building gaps which can serve the purpose of air paths. Building gaps of about 50m at TW 5, 20m at TW6, 20m at TW7 and 20m at Waterside Plaza can encourage the south-westerlies to permeate through to the Tsuen Wan Town Centre. Upon redevelopment, quantitative AVA studies are recommended for these significant sites.

The Tsuen Wan Town Lot 393 has incorporated a systematic study on parameters to minimise the negative impact on air ventilation. The proposed design is podium free and has incorporated 3 non-building areas: a non-building area of approximately 38m; a ventilation corridor at the lower level of Tower 2; and a non-building area of 15m on the north-west boundary of the site. The combination of these strategies help to improve the permeability of breeze to the areas inland. The subject site is under land use review and future studies would take into account the findings of the AVA study for the site. See Figure 10. Quantitative AVA studies are recommended for this site.

Figure 10 TWTL 393 with Non-building Areas

4.2.2 Sheung Kwai Chung and Shing Mun Valley

Sheung Kwai Chung and Shing Mun Valley are hilly, with the majority of natural vegetated slopes. See Figure 11. Annually, Sheung Kwai Chung and Shing Mun Valley enjoy easterlies through Castle Peak Road, north-easterlies through Cheung Pei Shan Road, the downhill wind coming from its north and east, and also benefits from any transpiration cooling effect from the vegetated land and hill side. In the summer months, Sheung Kwai Chung and Shing Mun Valley also enjoy southerlies through Wo Yi Hop Road and Texaco Road North. The Green Belt, Shing Mun Valley Sports Ground, Shing Mun Valley Park, Kwok Shui Road Park, coupled with the low density residential villages provide pleasant air ventilation to the region. The large-scaled housing estates, Cheung Shan Estate, Lei Muk Shue Estate, Shek Wai Kok Estate, are located around the boundary of Sheung Kwai Chung and Shing Mun Valley, and do not have significant negative impacts on air ventilation in the region due to their location as well as the undeveloped green belt at the centre of Sheung Kwai Chung and Shing Mun Valley.

As Sheung Kwai Chung and Shing Mun Valley are east of the Project Area, it is the gateway to the breeze for downhill wind and easterlies. It is therefore essential to maintain the Green Belt and Open Space in the region, as shown in Figure 11.

Figure 11 Existing/Committed Scenario in Sheung Kwai Chung and Shing Mun Valley

4.2.3 Tsuen Wan Bay Western Area and Yau Kom Tau

Tsuen Wan Bay Western Area and Yau Kom Tau are located on the foothill and is on the seafront, with ample green belt areas and open space along the sea front, such as Hoi On Road Playground, and natural vegetated lands in the hinterland. Throughout the year, Tsuen Wan Bay Western Area and Yau Kom Tau enjoy abundant wind: downhill wind from its north and north-easterlies; and south-westerlies through Tuen Mun Road, Hoi On Road and Castle Peak Road, as well as sea breeze. There are sufficient wind breeze to permeate throughout the region. Of most concern with the existing/ committed development are the Belvedere Gardens (under 50 storeys) and the Bayview Garden (under 40 storeys), however the negative impact on air ventilation is localised due to the relatively undeveloped green belts, G/IC sites and open spaces.

Figure 12 Existing/Committed Scenario in Tsuen Wan Bay Western Area and Yau Kom Tau

4.2.4 Tsuen King Circuit and Tso Kung Tam

Tsuen King Circuit and Tso Kung Tam are hilly with the majority of land use being green belts and natural slopes. The residential developments located at the foothill would enjoy the downhill wind, and benefit from any transpiration cooling effect from the vegetated hillside throughout the year. It is essential to maintain this sparse distribution of the middle to high-rise residential developments to allow sufficient downhill wind going through to Tsuen Wan Town Centre, Tsuen Wan Bay Western Area and Yau Kom Tau. Care should be given to the disposition of Tsuen Wan Centre, Tsuen King Garden, as these twenty to forty storeys high rises can potentially form a wind fence⁷ as shown in Figure 13 (marked in red) and impede air ventilation.

Figure 13 Existing/Committed Scenario in Tsuen King Circuit and Tso Kung Tam

4.2.5 Fu Yung Shan and Wo Yi Hop

Fu Yung Shan and Wo Yi Hop lie on the vegetated hill, similar to Tsuen King Circuit and Tso Kung Tam, with the majority of land use being green belts and natural slopes, thus Fu Yung Shan and Wo Yi Hop also enjoy similar wind breeze and transpiration cooling effect as Tsuen

⁷ Wind fences or breaks are obstacles formed by inappropriate dispositions or slab-type of large scale developments. These wind fences inhibit permeability of wind breeze.

King Circuit and Tso Kung Tam. In general, the majority of the developments are villages of residential dwellings not more than three storeys at the foothill, except for the two substantial developments, The Cliveden (under 20 storeys) and The Cairnhill (over 20 storeys).

Figure 14 Existing/Committed Scenario in Fu Yung Shan and Wo Yi Hop

⁸ Air paths can bring prevailing winds, sea breeze, or downhill wind.

5.2 Area of Concern

Figure 15 shows the indicative redevelopment of some sites assuming redevelopment up to the proposed maximum development restrictions on the OZP, in addition to the existing and approved / committed ones. The design, disposition and height of new development shown in this figure are hypothetical.

5.2.1 General

Where podia are allowed, it is recommended to have smaller-scaled podia, create permeable podia, or align the edge of the podia to the building façade to encourage downdraft to reach pedestrian levels, as shown in Figure 16.

Figure 16 Recommendations for Podia

5.2.2 Tsuen Wan Town Centre

Figure 18 shows the planned scenario for Tsuen Wan Town Centre. The majority of the existing residential developments are in the height of 30mPD to 90mPD in the centre of Tsuen Wan Town Centre. The street widths in this area are typically 15 m to 20m, measured from building face to building face. With existing and committed building heights of 30mPD to 90mPD, or the proposed maximum building height of 80 to 100 mPD, skimming flow is likely to occur in the centre of Tsuen Wan Town Centre, which means that little Summer winds or downhill winds are likely to reach the pedestrian level, as shown in Figure 17. Therefore, Tai Chung Road, Tai Ho Road and Ma Tau Pa Road, will be key wind corridors⁹ in ventilating the region, as shown in Figures 18 and 19. The dimensions provided in Figure 19 are guidelines to improve the effectiveness of such wind corridors based on the principle of minimising blockage to wind flow.

The wind skims over the brows of buildings.

Figure 17 Skimming Flow in the centre of Tsuen Wan Town Centre

⁹ Wind corridors are passages which allow wind breeze to permeate. Wind corridors can be in the form of open space areas, major air paths, non-building areas or building gaps with street width of at least 15 to 20m (measured by building face to building face).

Figure 18 Planned Scenario for Tsuen Wan Town Centre

The existing building height in the industrial area ranges from 15.8mPD to 180.4mPD. To provide better air ventilation when coupled with future road widening and suitable building design, the proposed maximum building height of 100mPD in the industrial area in the region is considered appropriate.

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Figure 19 Recommended Maximum Building Height and Minimum Building-to-Building Face Road Widths for Tsuen Wan Town Centre

It is recommended to further improve the ventilation by introducing an air path within Fuk Loi Estate, as this is a large site, and the future redevelopment may bring negative impact to the region if the disposition of the buildings forms an obstacle to the wind. See Figure 21. An air path of 20m is recommended to connect to Sha Tsui Road Playground to create a wind corridor¹⁰ and minimise the wind fence¹¹ effect of the large-scaled Fuk Loi Estate, subject to further quantitative AVA study. This wind corridor can either be aligned with Tai Ho Road, or the centre of Sha Tsui Road Playground, to make use of the permeability of the Open Space. The dimension of 20m provided here is based on the principle of minimising blockage to wind flow.

¹⁰ Wind corridors are passages which allow wind breeze to permeate. Wind corridors can be in the form of open space areas, major air paths, non-building areas or building gaps with street width of at least 15 to 20m (measured by building face to building face).

¹¹ Wind fences or breaks are obstacles formed by inappropriate dispositions or slab-type of large scale developments. These wind fences inhibit permeability of wind breeze.

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Figure 21 Recommended Air Path in Fuk Loi Estate and open plaza near Nina Tower / Nina Hotel

Care must be taken for large sites such as Nina Tower / Nina Hotel to include the existing open area in future redevelopment. These open area is recommended to be maintained, as shown in Figure 21. The podia for these developments should also be kept to a minimal, or made permeable as shown in Figure 16.

Another large-scaled development is Luk Yeung Sun Chuen. An air path is recommended to be introduced in this large site to prevent wind fence¹² effect, as shown in Figure 22. The existing building gaps in Luk Yeung Sun Chuen are approximately 10m, introduction of an air path to 20m in the centre of the site, as shown in Figure 22 can improve the air

¹² Wind fences or breaks are obstacles formed by inappropriate dispositions or slab-type of large scale developments. These wind fences inhibit permeability of wind breeze.

ventilation by creating a wind corridor¹³, subject to the redevelopment of the comprehensive development.

Figure 22 Recommended Air Path for Luk Yeung Sun Chuen

¹³ Wind corridors are passages which allow wind breeze to permeate. Wind corridors can be in the form of open space areas, major air paths, non-building areas or building gaps with street width of at least 15 to 20m (measured by building face to building face).

5.2.3 Sheung Kwai Chung and Shing Mun Valley

Figure 23 shows the planned scenario for Sheung Kwai Chung and Shing Mun Valley. Sheung Kwai Chung and Shing Mun Valley consist of ample open space in terms of Shing Mun Valley Sports Ground and Shing Mun Valley Park and vast green belt. The air ventilation in the region is acceptable, ample breeze is enjoyed by local residents, in particular the villagers. The larger scaled and substantial development includes Lei Muk Shue Estate, Shek Wai Kok Estate and Cheung Shan Estate, as well as the industrial Sun Fung Centre and its neighbours on Kwok Shui Road. The proposed Lei Muk Shue Estate consists of two height bands, and these are 170mPD and 190mPD. As the site itself is large, disposition such as the existing one can adversely impact on the air ventilation, it is therefore recommended to incorporate air paths and introduce a large courtyard within the site as shown in Figure 24, to act as ventilation corridors and ventilation pocket¹⁴ respectively, subject to further quantitative AVA study.

¹⁴ Ventilation pockets are usually formed by the open space areas or areas with low-density and low-rise developments with access of wind breeze. The positive impacts of ventilation pockets on air ventilation are localised.

Figure 23 Planned Scenario for Sheung Kwai Chung and Shing Mun Valley

Courtyard

− → Air paths of 20m

€

(b) Suggested Layout with Ventilation

(a) Existing Layout

Figure 24 Layout of Lei Muk Shue Estate

The existing maximum building height in Shek Wai Kok Estate is approximately 120 mPD. The proposed maximum building height of 130 mPD is similar to the existing one. Of more importance here is the disposition of building blocks within the site. The existing slab type build-form and disposition are not ideal, and if possible, the planned scenario should adopt the arrangement as shown in Figure 25, subject to further quantitative AVA study.

(a) Existing Layout

(b) Suggested Layout with Ventilation

Figure 25 Layout of Shek Wai Kok Estate

The Cheung Shan Estate site is smaller than the other ones described, but should also pay attention to minimisation of wind fence¹⁵, though the impact will be limited by the abundance of open space in its vicinity. It is re-iterated here that podia should be permeable and smaller-scaled as shown in Figure 16.

The industrial Sun Fung Centre, Mita Centre, City Industrial Complex, Chevalier Cold Storage Building, Safety Godown and North East Warehouse along Kwok Shui Road can potentially amalgamate to be a large-scaled development, and form a wind screen. The site adjacent to Sun Fung Centre is under construction, a residential development of under 174 mPD is already committed. This development will adversely impact on the air ventilation of the nearby Yau Ma Hom Resite Village, however the negative air ventilation impact is not as severe due to the vast open green belt available. The proposed non-building area of 20m to the western side of Sun Fung Centre will improve the effectiveness of the ventilation. See Figure 26.

Figure 26 Proposed Non-building Area on Sun Fung Centre

¹⁵ Wind fences or breaks are obstacles formed by inappropriate dispositions or slab-type of large scale developments. These wind fences inhibit permeability of wind breeze.

The green belt and villages such as Tai Pak Tin Tsuen, Shek Wai Kok Sun Village, Kwu Hang Tsuen, Hoi Pa Sun Tsuen, Da Chuen Ping Village and Sheung Kwai Chung Wai, consist of village houses of three storeys or less, these areas shall be maintained as they are in the wind corridor¹⁶ to ventilate the region.

The height band of the existing industrial development intended for residential redevelopment along Kwok Shui Road is at 120mPD for "R(E)" zone compared to the rather open nature of the ex- Kwai Chung Public School. As the sites under the "R(E)" zone are substantial in size, care should be taken with the design and massing of the future developments to allow air permeability.

The Proposed Joint Universities Research Archive (JURA) at the ex-Kwai Public Chung School Site at Kwok Shui Road (TWTL 416) is a large site. The existing condition is open with a maximum 60 mPD. The proposed maximum height of 90mPD is acceptable, but care should be taken in the disposition and massing of future development to allow air permeability.

The proposed maximum building height of ex-Tai Wo Hau Factory Estate Site (TWTL 415) reaches 100 mPD. The disposition and massing at the subject site are under planning. As the site is large, the design and massing should include an air path through the site to allow air movement.

¹⁶ Wind corridors are passages which allow wind breeze to permeate. Wind corridors can be in the form of open space areas, major air paths, non-building areas or building gaps with street width of at least 15 to 20m (measured by building face to building face).

5.2.4 Tsuen Wan Bay Western Area and Yau Kom Tau

Figure 27 shows the planned scenario of Tsuen Wan Bay Western Area and Yau Kom Tau with recommendations. The waterfront Tsuen Wan Bay Western Area enjoys ample wind for a great part of the year. Most development is scattered along the sea front, with a green belt as its back drop. These waterfront sites can however form a wall to the sea breeze, if disposition and air ventilation are not considered together. The existing Belvedere Garden and Bayview Garden of under 50 and 40 storeys respectively create a wind fence¹⁷, preventing ventilation to the hinterland. However, the adverse air ventilation is not significant since the majority of the land behind these substantial waterfront sites are green belt, and contain no or little developments. It is recommended that the vast green belt, villages and low-rise G/IC sites at Yau Kom Tau are to be maintained.

Figure 27 Planned Scenario of Tsuen Wan Bay Western Area and Yau Kom Tau with Recommendations

¹⁷ Wind fences or breaks are obstacles formed by inappropriate dispositions or slab-type of large scale developments. These wind fences inhibit permeability of wind breeze.

5.2.5 Tsuen King Circuit and Tso Kung Tam

Figure 28 shows the planned scenario of Tsuen King Circuit and Tso Kung Tam. The majority of Tsuen King Circuit and Tso Kung Tam is green belt and open space with sufficient air ventilation. There is no major concern with the planned scenario in the region. Care should be given to the disposition to Tsuen Wan Centre and Tsuen King Centre, though the maximum building height remains similar. The adverse impact however is not significant due to the proposed Tso Kung Tam Ecological Park and Chai Wan Kok Archaeological Site in its vicinity.

Figure 28 Planned Scenario of Tsuen King Circuit and Tso Kung Tam

5.2.6 Fu Yung Shan and Wo Yi Hop

Fu Yung Shan and Wo Yi Hop are mostly undeveloped with green belt and G/IC sites. The two more substantial developments are The Cliveden and The Cairnhill. These two developments are isolated and do not have significant adverse impact to air ventilation in the region. The characteristics of the vast local villages should be maintained as these are upstream of any wind to the sub-areas: Tsuen Wan Town Centre, Sheung Kwai Chung and Shing Mun Valley, and Tsuen King Circuit and Tso Kung Tam. See Figure 29.

Figure 29 Planned Scenario of Fu Yung Shan and Wo Yi Hop with Recommendations

5.3 Further Study

Given the consideration of development right which will lead to high-rise buildings, control of building height in itself is not an effective means for better air ventilation. This study only provides an overview of the existing wind environment and recommends broad measures to minimise negative impacts and where appropriate, improvement to the existing conditions.

The Project Area benefits from vast undeveloped area and sufficiently wide streets with relatively low building height. The high-rise building and super-high rise structures are scattered rather than concentrated in the Project Area. Non-building area, air paths and building gap have been recommended throughout the Project Area to prevent blockages of wind corridors¹⁸ caused by future amalgamation of adjacent sites. Further AVA studies are recommended for the large committed development sites and the large-scaled estates in Figure 30. The sites are along the waterfront.

Figure 30 Further Study Areas

¹⁸ Wind corridors are passages which allow wind breeze to permeate. Wind corridors can be in the form of open space areas, major air paths, non-building areas or building gaps with street width of at least 15 to 20m (measured by building face to building face).

6. Conclusions

Tsuen Wan is bounded by the foothills of Tai Mo Shan and the terrain of Tsuen Wan is mostly hilly except its centre. The majority of Tsuen Wan is relatively ventilated all year round, benefitting from downhill wind and sea breeze. Existing non-building areas in the form of vast green belts, G/IC sites and district / local open spaces and villages, such as Sai Lau Kok Garden, Jockey Club Tak Wah Park, Sha Tsui Road Playground, Kam Mun Hau Garden, Tsuen Wan Riviera Park, Tsuen Wan Park, Shing Mun Valley Sports Ground, Shing Mun Valley Park, Kwok Shui Road Park, Hoi On Playground are essential to maintain good air ventilation to the Project Area. These areas are encouraged to be maintained to allow penetration of wind inland. Castle Peak Road, Sha Tsui Road, Yeung Uk Road, Hoi Shing Road, Wo Yi Hop Road, Tuen Mun Road, Hoi On Road, Tai Chung Road, Tai Ho Road, Ma Tau Pa Road and Texaco Road are key wind corridors to ventilate the region.

Care should be taken the possibility when high-rises and super-high rises amalgamate and form a wind fence, such as those in Riviera Garden, Vision City, Chelsea Court, Discovery Park, the committed TW 5, the committed TW 6 and the committed TW 7 along the waterfront. The adverse air ventilation impact is not severe at present as there are currently minimal surrounding buildings of similar scale. Future developments along the waterfront will adversely impact the air ventilation as they present significant obstacles to the sea breeze. Air paths are recommended for the committed TW 5, the committed TW 6, the committed TW 7 and the Waterside Plaza to minimise the adverse impact on air ventilation. Review of the layout plans show possibility of building gaps which can serve the purpose of air paths. Building gaps of about 50m at TW 5, 20m at TW6, 20m at TW7 and 20m at Waterside Plaza can encourage the south-westerlies to permeate through to the Tsuen Wan Town Centre. The podium-free design together with 3 non-building areas in the TWTL 393 help to minimise the adverse air ventilation. The subject site is under land use review and future studies would take into account the findings of the AVA study for the site. Quantitative AVA studies are recommended for these large sites.

The large-scaled housing estates, Cheung Shan Estate, Lei Muk Shue Estate, Shek Wai Kok Estate, are located around the north-eastern boundary of the Project Area, and do not have significant negative impacts on air ventilation in the region due to their location as well as

the nearby natural green belt. It is therefore recommended to maintain the Sheung Kwai Chung green belt to improve air ventilation in the Project Area. However, since the sites of these housing estates are large, care should be given to the disposition of future redevelopment. Suggested Layouts with introduction of air paths and a large courtyard have been provided in the Study Report.

The existing Belvedere Garden and Bayview Garden, Tsuen Wan Centre, Tsuen King Garden of under forty to fifty storeys respectively create a wind fence and reduce ventilation to the hinterland. However the negative impact on air ventilation is localised due to the relatively undeveloped green belts, G/IC sites and open spaces.

The site adjacent to Sun Fung Centre is under construction, a residential development of under 174 mPD is already committed. This development will adversely impact on the air ventilation of the nearby Yau Ma Hom Resite Village, however the negative air ventilation impact is not as severe due to the vast open green belt available. The proposed non-building area of 20m to the western side of Sun Fung Centre will improve the effectiveness of the ventilation.

Where podia are allowed, it is recommended to have smaller-scaled, permeable podia, or to align the edge of the podia to the building façade to encourage downdraft to reach pedestrian levels.

The maximum proposed height for the industrial area in the region has been decreased from 180mPD to 100mPD. This decrease in maximum building height is a mitigation strategy that would contribute to better air ventilation when coupled with future road widening and suitable building design.

Air paths are recommended for Fuk Loi Estate and Luk Yeung Sun Chuen respectively to minimise obstacles to wind and improve air ventilation for the Project Area. The existing open area at Nina Tower / Nina Hotel is recommended to be maintained in future development to create local ventilation pockets.

The height band of the existing industrial development intended for residential redevelopment along Kwok Shui Road is at 120mPD for "R(E)" zone compared to the rather open nature of the ex- Kwai Chung Public School. As the sites under the "R(E)" zone are

substantial in size, care should be taken with the design and massing of the future developments to allow air permeability.

The Proposed JURA at the ex-Kwai Public Chung School Site at Kwok Shui Road (TWTL 416) is a large site. The existing condition is open with a maximum 60 mPD. The proposed maximum height of 90mPD is acceptable, but care should be taken in the disposition and massing of future development to allow air permeability.

The proposed maximum building height of ex-Tai Wo Hau Factory Estate Site (TWTL 415) reaches 100 mPD. The disposition and massing at the subject site are under planning. As the site is large, the design and massing should include an air path through the site to allow air movement.

Figure 31 Summary of Recommendations to Minimise the Impact