

Appendix 4: Air Ventilation Assessment (Expert Evaluation)

Prepared by

Ramboll Hong Kong Limited

**SECTION 16 APPLICATION - LAYOUT PLAN SUBMISSION
AND PROPOSED MINOR RELAXATION OF BUILDING HEIGHT
RESTRICTION FOR PERMITTED FLAT USE AT 131 POK FU
LAM ROAD, HONG KONG, RBL 136RP**

AIR VENTILATION ASSESSMENT (EXPERT EVALUATION)

Date **Oct 2023**

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Project Reference **WLKPKFLMEI00**Document No. **R8148_V1.0**

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1. INTRODUCTION

1.1 Project Background

- 1.1.1 The Application Site currently occupied by Ebenezer School (and associated developments) at Pok Fu Lam Road is proposed to be redeveloped for residential use. The Application Site is currently zoned Residential (Group C)7 ("R(C)7") under Pok Fu Lam Outline Zoning Plan (OZP) No. S/H10/21. This Section 16 application is for the purpose of submitting a layout plan and to request for a minor relaxation of building height restriction. This Air Ventilation Assessment (Expert Evaluation) (AVA-EE) is prepared for the proposed residential redevelopment at the Application Site as one of the technical supporting documents for the Section 16 application.
- 1.1.2 Ramboll Hong Kong Limited has been commissioned by the applicant to prepare this AVA-EE. The development scheme is provided by Handi Design (Project Architect).

1.2 Objective

- 1.2.1 This AVA-EE report has been prepared to evaluate if the proposed redevelopment would have any impact on the overall air ventilation performance of the assessment area by comparing the Proposed Scheme with the Existing Development.

1.3 Application Site and its Environs

- 1.3.1 The Application Site is of elongated shape with long frontage adjacent to Pok Fu Lam Road (around 138mPD). It amounts to about 6,460 sqm and is currently occupied by Ebenezer School and Home for the Visually Impaired. It is bounded by Pok Fu Lam Road on northeast side. The vehicular access point to Pok Fu Lam Road is on the southeast end.
- 1.3.2 The general topography of surrounding area is sloping down from northeast/east to southwest/west. The surrounding uses are mainly residential developments on the opposite side of Pok Fu Lam Road to the northeast to east, premises of University of Hong Kong on west side, and Queen Mary Hospital to the further north separated by existing residential developments. The lot to the immediate southeast is zoned for residential use as well. The Application Site is surrounded by vegetated slope on southeast, south, west and northwest. Victoria Road elevated more than 50m lower than the Application Site is to the further southwest. Areas to the further south to west are occupied by residential developments at much lower elevations.
- 1.3.3 **Figure 1** shows the locations of the Application Site and its environs.

1.4 Baseline Scheme

- 1.4.1 The Baseline Scheme refers to the Existing Development. There are altogether 2 separate building structures within the Application Site currently. They include Ebenezer School and Home for the Visually Impaired, and Old Age Home.
- 1.4.2 Ebenezer School and Home for the Visually Impaired is the largest block. It is of elongated shape with a continuous frontage of around 122m in parallel to Pok Fu Lam Road. There is maximum 6 storeys and the building height is 151mPD.
- 1.4.3 Old Age Home is of 5 storeys and located at the southeast end corner of the Application Site which is nearest to the vehicular access point. It is of elongated shape with a frontage of around 31m generally in parallel to Pok Fu Lam Road. The building height is comparable to Ebenezer School.

- 1.4.4 There is a building separation of about 5m between Ebenezer School and Home for the Visually Impaired and Old Age Home. Old Age Home is separated from the nearest building (Ebenezer New Hope School to the south) by around 15m.

1.5 Proposed Scheme

- 1.5.1 The proposed redevelopment consists of 4 residential towers (T1 to T4) elevated at maximum 164mPD (measured at main roof level) which is constructed on a slope with an elevation of +121.7mPD. There is no gap between T1 to T3. A gap (about 8m) exists between T3 and T4. The building towers are connected to create a long frontage facing east/west direction. The towers are generally arranged to be further away from Pok Fu Lam Road and the southern portion of the Application Site is assigned as landscape area.
- 1.5.2 T4 is setback from southern boundary by around 5m. The separation distance between building structure of T4 and nearest Ebenezer New Hope School to the south can be increased to about 20m after development. Other than that, the setback distance of the building mass in the proposed redevelopment from eastern boundary fronting Pok Fu Lam Road is at least 10m. The setback distance from the eastern boundary promotes the wind penetration in the E/W direction along Pok Fu Lam Road.
- 1.5.3 Beside the residential towers, clubhouse facilities and one outdoor swimming pool will be located near to the southwest boundary of the Application Site and farthest away from Pok Fu Lam Road. Moreover, planter and landscape area are provided at the podium level to enable wind circulation within the Application Site.
- 1.5.4 The project architect also confirmed that the Proposed Scheme could comply with the SBD Guidelines. The MLP and section plan of the Proposed Scheme is shown in **Appendix 1**.

2. SITE WIND AVAILABILITY DATA

2.1 Site Wind Availability Data

- 2.1.1 According to the Planning Department's website, a meso-scale Regional Atmospheric Modeling System (RAMS) was used to produce a simulated 10-year wind climate at the horizontal resolution of 0.5 km x 0.5 km covering the whole territory of Hong Kong. The simulated wind data represents the annual, winter and summer wind condition at various levels, i.e. 200 m, 300 m, and 500 m above terrain.
- 2.1.2 The RAMS data of the grid (X: 071, Y: 031) has been extracted from the Site Wind Availability Data of Planning Department's website representative of the Application Site and surrounding area.
- 2.1.3 Based on the wind roses with different heights (200, 300 or 500m) available, the 200m site wind availability data represents wind data that takes into account the topographical effect around the Application Site. Therefore, a lower level of wind roses at 200 m height is selected to study the prevailing wind condition as it represents the incoming wind to the Application Site and considers the influence on the prevailing winds by the surrounding topography.
- 2.1.4 According to the wind roses at 200 m altitude, the annual prevailing wind directions for the Application Site are E, ENE and NE; whereas the summer prevailing wind directions are SSW, S and SSE.
- 2.1.5 **Figure 2** shows the relevant wind roses diagrams representing the frequency and wind speed distribution at 200m height in annual and summer conditions. The wind frequency data is provided in **Table 2.1** below.

Table 2.1 Summary of RAMS Data and Wind Direction at 200m

Wind Direction	Probability for Annual Condition (%)	Probability for Summer Condition (%)
N	2.5%	0.9%
NNE	7.0%	1.2%
NE	9.3%	1.2%
ENE	15.2%	3.9%
E	15.9%	8.8%
ESE	7.2%	6.4%
SE	7.0%	8.2%
SSE	6.9%	11.5%
S	7.9%	16.1%
SSW	7.7%	17.8%
SW	4.4%	10.9%
WSW	2.0%	3.8%
W	2.1%	3.4%
WNW	1.3%	2.0%
NW	1.7%	2.5%
NNW	1.8%	1.4%

Note: Bolded characters highlighted in grey represent the selected prevailing wind directions for evaluation.

2.2 Topography and Building Morphology

- 2.2.1 The Proposed Development is located on west side of Hong Kong Island. The peak nearest to the Application Site is High West elevated at 494mPD and over 700m away

to the northeast. The surrounding area is sloping down from east/northeast to west/southwest. The influence of local topography to the wind flow pattern around the Application Site is considered significant. Yet, as the slope to the northeast is mostly covered by vegetation, katabatic wind flow is expected so that more northeasterly wind would flow near to and above the slope and down to the surrounding area of the Application Site. Yet, the existing buildings on northeast side on opposite side of Pok Fu Lam Road would impose some wind blockage. Wind flow pattern in upwind direction under northeasterly wind would be more influence by building mass.

- 2.2.2 On south to west sides of the Application Site, the topography is lower and there is absence of clusters of high building structure nearby at such directions. The only building on south side is Ebenezer New Hope School which is elevated at 134mPD. Moreover, the triangular shape of this school building (with facades not perpendicular to southerly wind prevailing in summer) can also allow wind to flow around it easier. Therefore, southerly wind will experience less obstruction.

2.3 Summary of Existing Site Wind Availability

- 2.3.1 According to the wind availability data, the annual wind directions of the area include easterlies and north-easterlies.
- 2.3.2 A lower level of wind rose at 200m height is selected to study the prevailing wind condition as it represents the incoming wind to the Application Site and considers the influence on the prevailing winds by the surrounding topography.
- 2.3.3 According to the wind roses a 200m altitude, the annual prevailing wind directions for the Application Site are E, ENE and NE; whereas the summer prevailing wind directions are SSW, S and SSE.
- 2.3.4 Referring to **Table 2.1** above, the wind probability from E and ENE directions are 15.9% and 15.2% respectively and is considered to be the most dominant annual wind direction for the area. The NE (9.3%) wind is also dominant annual prevailing wind directions other than these.
- 2.3.5 There are more existing developments on ENE and NE sides of the Application Site and they are also elevated higher so that they will likely reduce the NE and ENE wind availability to the Application Site. Building on the east side is elevated relatively lower so that blockage effect is less significant.
- 2.3.6 Referring to **Table 2.1** above, the wind probability from SSW and S directions are 17.8% and 16.1% respectively and is considered to be the most dominant summer wind direction for the area. The SSE (11.5%) wind is also dominant summer prevailing wind directions other than these.
- 2.3.7 As discussed, topography on south side is elevated lower. There is also absence of cluster of building structure on south site except Ebenezer New Hope School. Blockage effect is less significant. There should be high summer wind availability.
- 2.3.8 **Figure 3** and **Figure 4** show the expected air flow pattern under the existing annual and summer wind conditions.

3. EXPERT EVALUATION OF AIR VENTILATION PERFORMANCE OF THE PROPOSED DEVELOPMENT

3.1 Assessment Methodology

3.1.1 Section 2 above describes the wind availability at the Application Site, and the dominant wind flow during annual and summer conditions. It is identified that the annual prevailing winds for the area are from E, ENE and NE directions whereas the summer prevailing winds are from SSW, S and SSE directions. The proposed development layout at the Application Site will be evaluated against the dominant wind directions identified, i.e. E portion; ENE and NE portion, and SSW to SSE portions.

3.2 Annual Wind Flow

E Wind

- 3.2.1 **Figure 5** illustrate the prevailing wind from E wind direction for the Proposed Scheme.
- 3.2.2 E wind among the most prevailing annual wind directions has least obstruction experienced in up wind direction, considering both topography and building mass.
- 3.2.3 Under the Proposed Scheme, the building height is only slightly higher than the Baseline Scheme so that wind can still flow over the building mass to further downwind area as under existing condition and impact is minor.
- 3.2.4 In addition, wider building separation (20m) is now created between the proposed development and existing Ebenezer New Hope School and the gap is also well oriented to facilitate E wind penetration. More wind can penetrate through the Application Site to downwind area.
- 3.2.5 With improvement of building separation, it is expected that the proposed development would result in some improvement of air ventilation in downwind area and can offset the impact due to slight increase of building height.

ENE and NE Wind

- 3.2.6 **Figure 5** illustrate the prevailing wind from ENE/NE wind directions for the Proposed Scheme.
- 3.2.7 Under ENE and NE prevailing wind, similar to the E wind, wind can still flow over the building mass to further downwind area as under existing condition in spite of increased building height.
- 3.2.8 The building separation of 20m between the proposed development and existing Ebenezer New Hope School is oriented to east direction so that it can allow more ENE wind penetration and NE wind penetration will be relatively difficult. In all circumstances, it will allow more wind penetration when compared to the existing condition with building separation of about 15m.

3.3 Summer Wind Flow

SSE, S and SSW Wind

- 3.3.1 **Figure 6** illustrate the prevailing wind from SSE, S, and SSW wind directions for the Proposed Scheme.
- 3.3.2 Both the 20m building separation between the proposed development and existing Ebenezer New Hope School would not function to effectively allow wind penetration under summer prevailing wind direction.

- 3.3.3 However, the Proposed Scheme would likely outperform the Baseline Scheme due to the fact that the building mass is now shifted more away from Pok Fu Lam Road. Wind flowing over the building mass can reach pedestrian level along Pok Fu Lam Road and further downwind area easier.
- 3.3.4 Moreover, the building setback from the eastern and western site boundaries promote wind penetration towards the downstream area. At least 10m of setback distance between T4 and eastern site boundary would effectively facilitate SSE wind along Pok Fu Lam Road. The footpath near the western site boundary (about 5m) would allow SSE and S wind to penetration through the Application Site.
- 3.3.5 Besides, the SSW and S wind would penetrate through building separation between T3 and T4 (about 8m) towards the downstream area. It is expected that the ventilation performance of the Proposed Scheme would not be worsen.

3.4 Summary of Air Ventilation Performance and Design Measures

- 3.4.1 The Proposed Scheme would result in improvement of air ventilation among pedestrian area in the surrounding when compared to the Baseline Scheme (existing condition with Ebenezer School and associated facilities).
- 3.4.2 Major design features leading to better wind performance are summarised below:
- a) Change of building disposition to widen the building separation between the development and nearest Ebenezer New Hope School from 15m to 20m;
 - b) Further setback from Pok Fu Lam Road (at least 10m) so that wind from south to west direction can flow over the building mass and then reach the pedestrian level on downwind direction easier.

4. CONCLUSION

- 4.1.1 A qualitative assessment on the air ventilation performance of the Proposed Development has been carried out.
- 4.1.2 According to the findings of this AVA-EE, the annual prevailing wind comes from E, ENE and NE directions, while the summer prevailing wind comes from SSW, S and SSE directions. After considering the potential ventilation impacts on the Application Site of the Proposed Development, the layout of the Proposed Development has been formulated with due considerations on the air ventilation aspect.
- 4.1.3 By considering the existing topography and the location of the existing built area, it is likely that annual prevailing ENE and NE wind availability has been reduced due to existing buildings to the northeast while annual prevailing E wind is less obstructed. The summer prevailing wind is also less obstructed.
- 4.1.4 The Proposed Scheme for the Proposed Development has incorporated various effective mitigation measures including change of building disposition to widen the building separation between the development and nearest Ebenezer New Hope School from 15m to 20m; and at least 10m further setback from Pok Fu Lam Road so that wind from south to west direction can flow over the building mass and then reach the pedestrian level on downwind direction easier. It is likely that the good feature can offset ventilation impact due to increased building height.
- 4.1.5 Therefore, it is expected that the Proposed Development would not result in any worse-off impact.

Figures

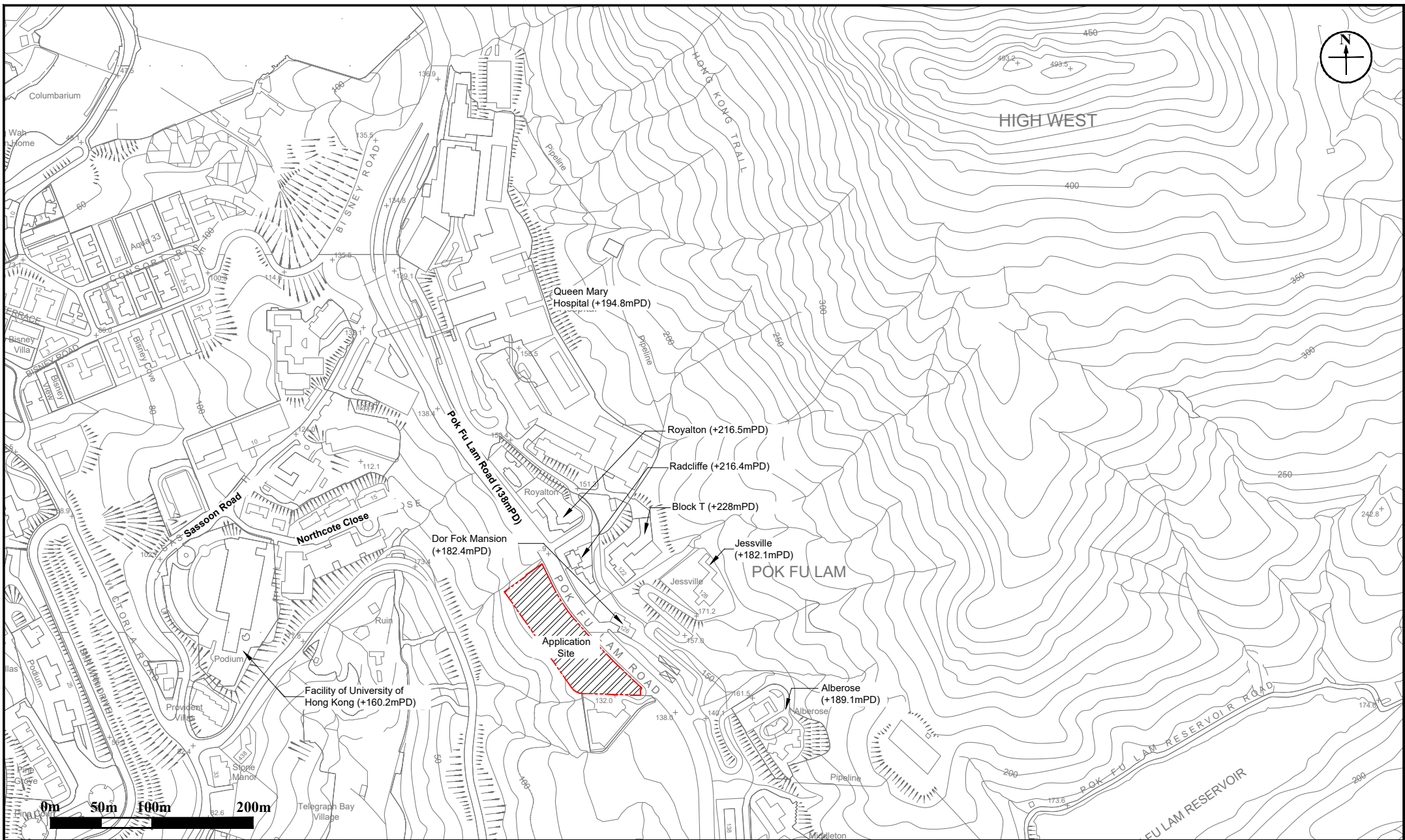


Figure: 1

Title: Location of the Application Site and Its Environs

Project: Section 16 Application - Layout Plan Submission and Proposed Minor Relaxation of Building Height Restriction for Permitted Flat Use At 131 Pok Fu Lam Road, Hong Kong, RBL 136RP

RAMBOLL

Drawn by: SL
 Checked by: CC
 Rev.: 1.0
 Date: Nov 2023

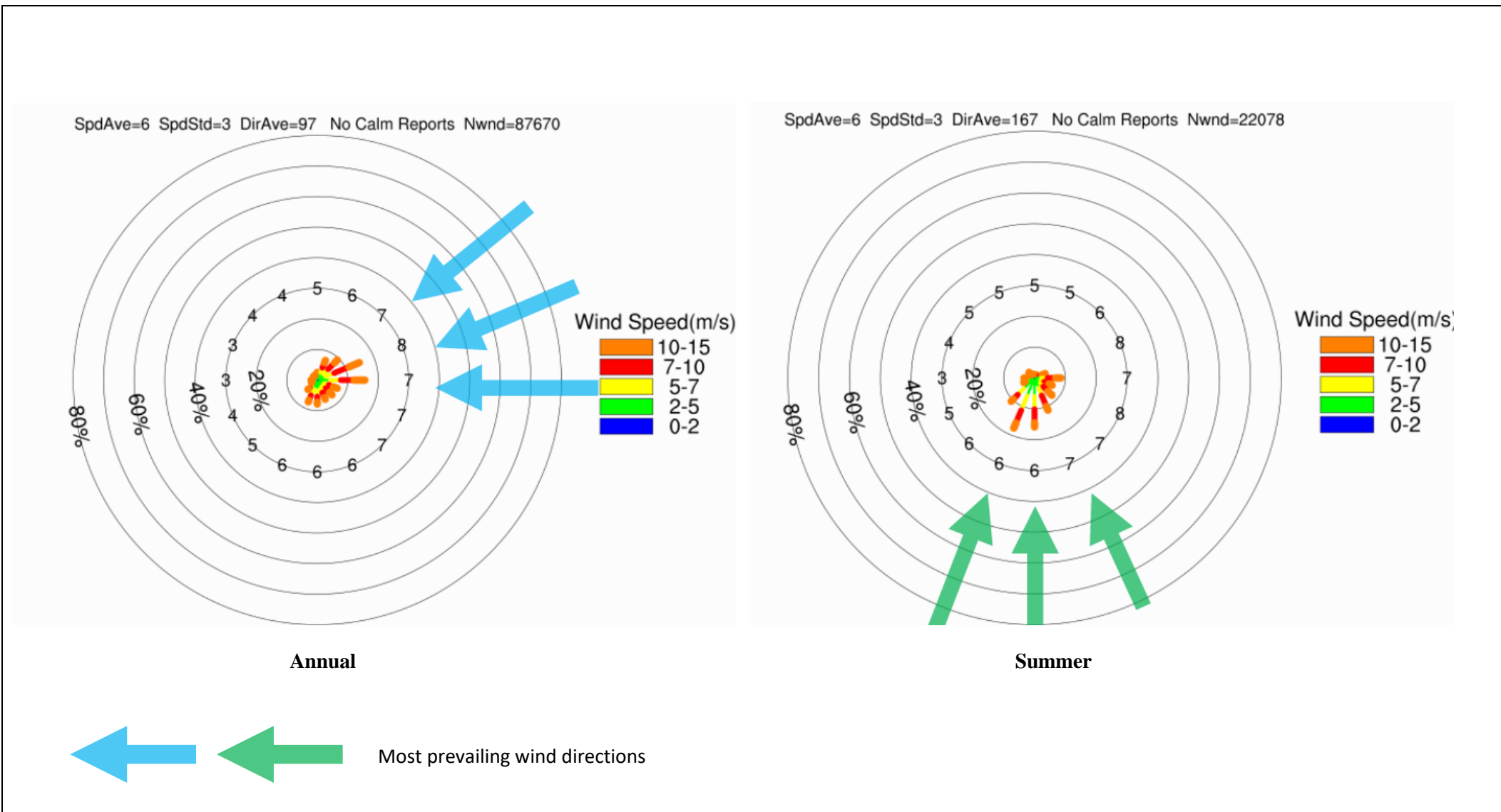


Figure: 2	
Title: Windrose Diagram representing V_{∞} of the Area under Concern at 200m above ground (X:071, Y:031)	Drawn by: AL
	Checked by: CC
Project: Section 16 Application - Layout Plan Submission and Proposed Minor Relaxation of Building Height Restriction for Permitted Flat Use At 131 Pok Fu Lam Road, Hong Kong, RBL 136RP	Rev.: 1.0
	Date: Jul 2021

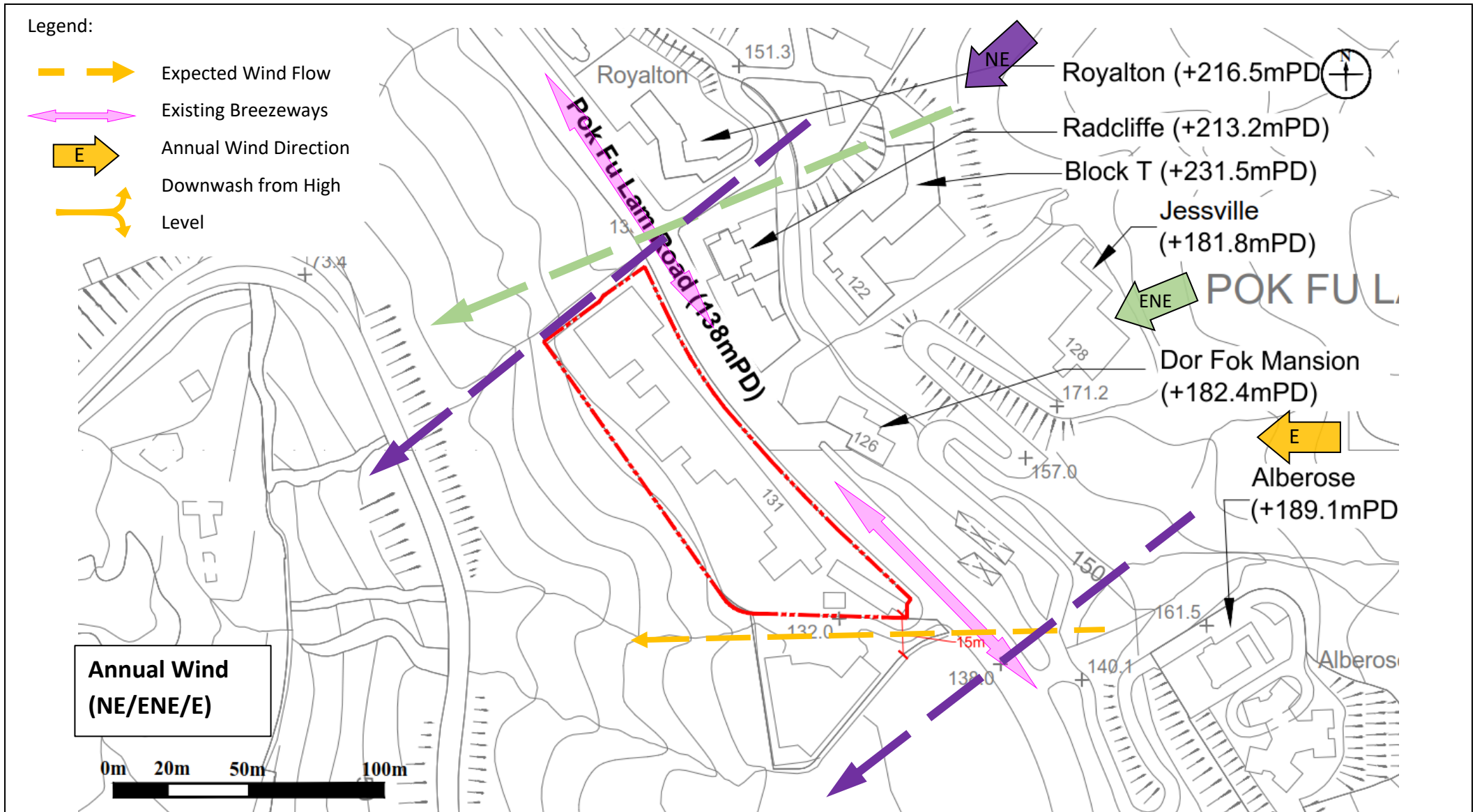


Figure: 3	RAMBOLL
Title: Illustration of Wind Flow from Annual Prevailing Wind Directions for Existing Condition	Drawn by: AW
Project: Section 16 Application - Layout Plan Submission and Proposed Minor Relaxation of Building Height Restriction for Permitted Flat Use At 131 Pok Fu Lam Road, Hong Kong, RBL 136RP	Checked by: CC
	Rev.: 1.0
	Date: Oct 2023

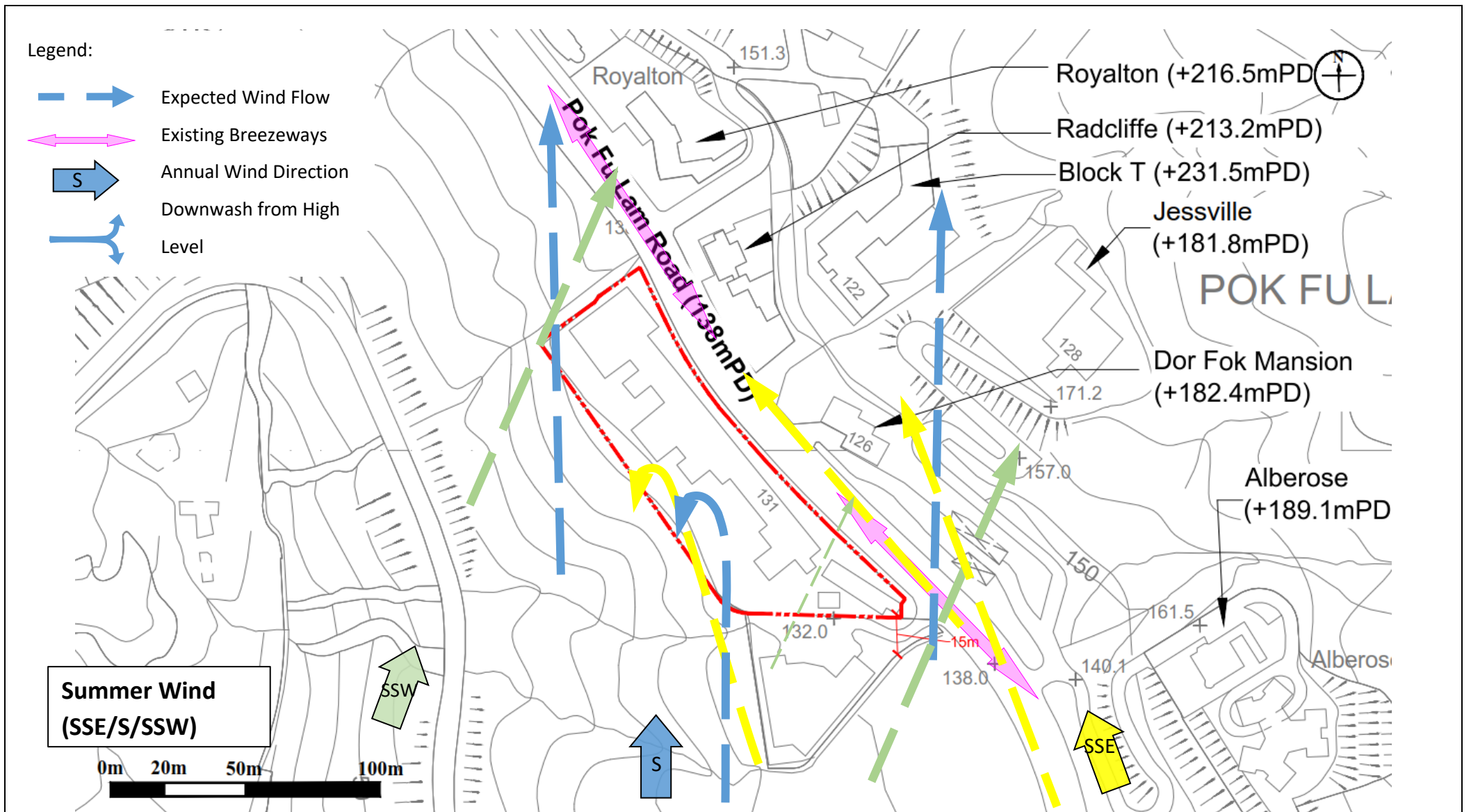


Figure: 4	RAMBOLL
Title: Illustration of Wind Flow from Summer Prevailing Wind Directions for Existing Condition	Drawn by: AW
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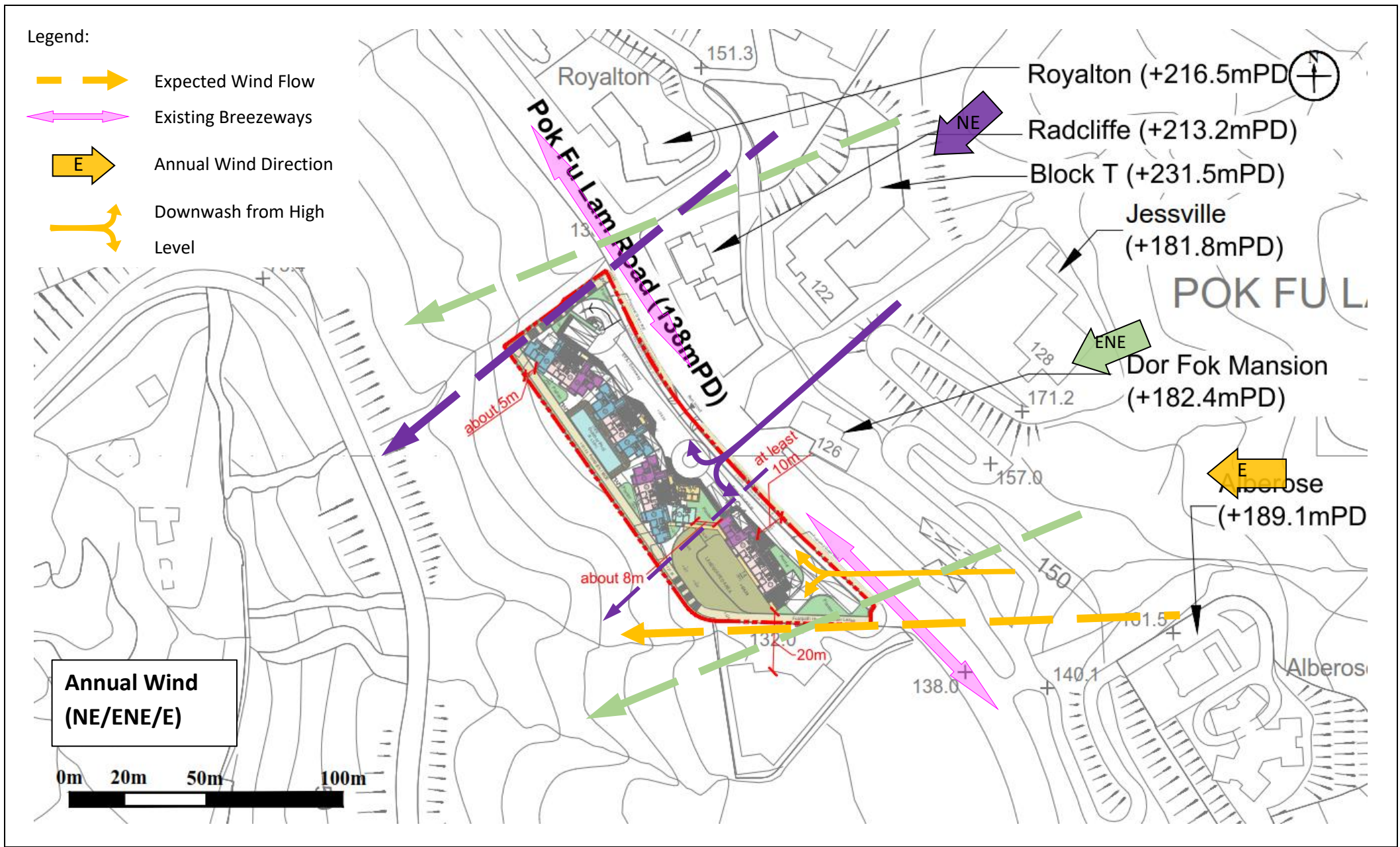


Figure: 5 Title: Illustration of Wind Flow from Annual Prevailing Wind Direction for Proposed Scheme	
	Drawn by: MK Checked by: CC
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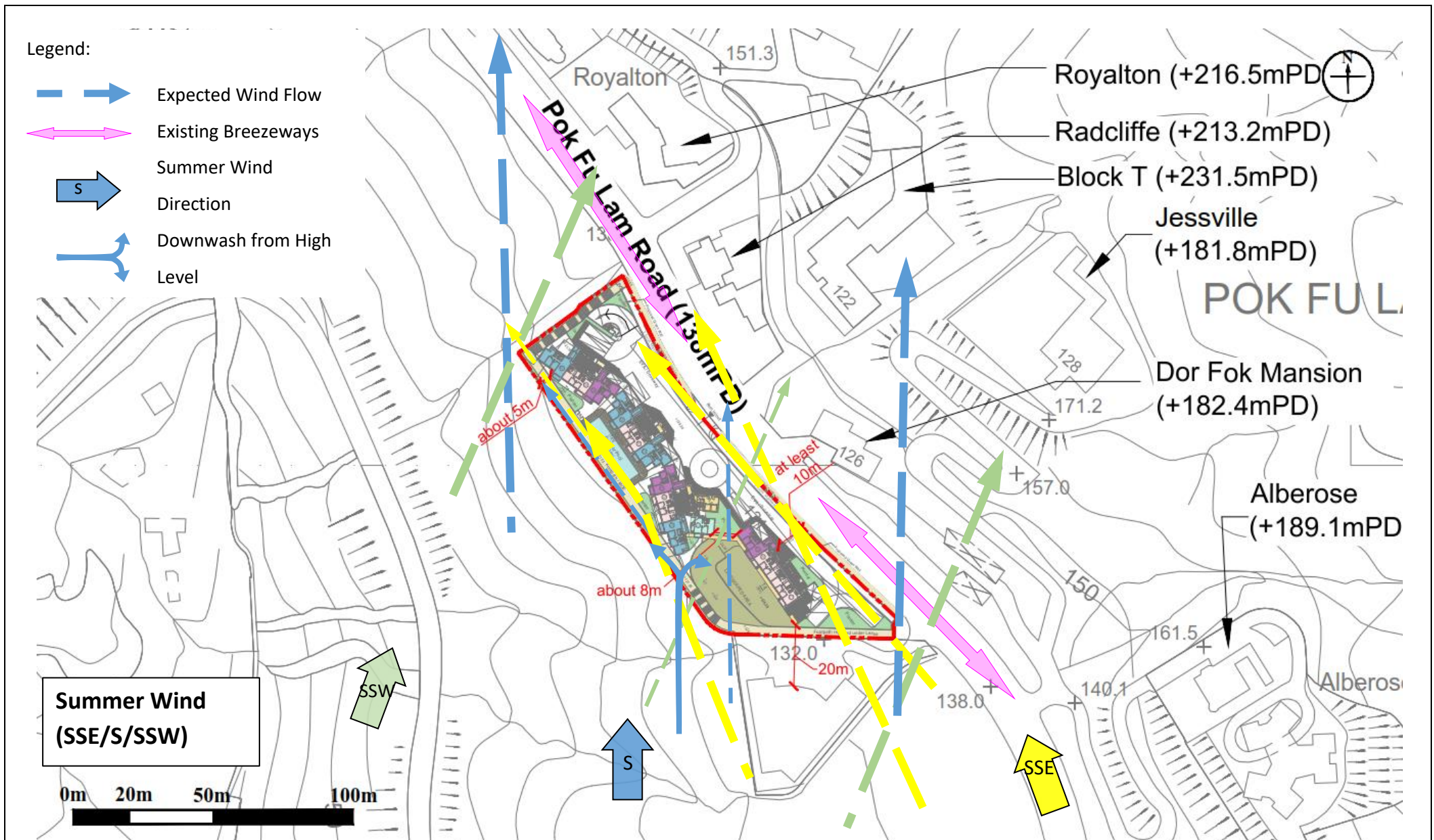


Figure: 6	RAMBOLL
Title: Illustration of Wind Flow from Summer Prevailing Wind Directions for Proposed Scheme	Drawn by: AW
	Checked by: CC
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	Date: Oct 2023

Appendix 1 Master Layout Plan of Proposed Scheme

