Agreement No. CE 80/2014 (CE)

Site Formation and Infrastructural Works for Eight Housing Sites in Ma On Shan - Feasibility Study

FINAL AIR VENTILATION ASSESSMENT (EXPERT EVALUATION) REPORT FOR SITES 1 AND 2 (UPDATED DEVELOPMENT PARAMETERS)

October 2019

(188563/B&V/081/Issue 1)

CEDD 土木工程拓展署 Civil Engineering and Development Department

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1 INTRODUCTION

1.1 Project Background

1.1.1 Eight pieces of potential land have been identified by the Government as proposed housing sites for the housing development in Ma On Shan (MOS). All of the proposed housing sites are currently zoned as "Green Belt" on the approved Ma On Shan Outline Zoning Plan No. S/MOS/22 whilst amendments to the respective Outline Zoning Plan (OZP) are required to meet the relevant statutory town planning requirements for implementation of the developments. To facilitate the rezoning exercise, this Engineering Feasibility Study (EFS) under Agreement No. CE80/2014(CE) has been conducted for the proposed housing sites with the aim to review the technical feasibility for housing developments.

1.1.2 Black & Veatch Hong Kong Limited (B&V) was commissioned by the Civil Engineering and Development Department (CEDD) in April 2015 to investigate, evaluate and establish the engineering feasibility for public and private housing developments (Development) at eight housing sites (Housing Sites) in Ma On Shan (hereinafter referred as the Project).

1.2 Description and Need of the Project

1.2.1 The proposed housing development under this feasibility study comprises public and private housing sites at various locations in MOS. Amongst them, four pieces of land (i.e. Sites 1 to 4) are for public housing whilst one piece of land (i.e. Site 5) will be for a primary school. In addition, the remaining sites (i.e. Sites A, C and D) are for a private housing development.

1.2.2 The proposed site formation and infrastructure works for the Project to support the housing developments in Ma On Shan comprise the followings:

a) Site formation works, including slope cutting and earth filling works, as well as geotechnical works, earth retaining structures and natural terrain hazard mitigation measures;

b) Road works, including construction of new roads, footpaths, improvement and upgrading of existing roads, provision of new junction etc.;

c) Water works, drainage and sewerage infrastructures;

d) Environmental mitigation measures;

e) Other infrastructural works including water supply and utility services connections (by respective agencies or utility undertakings); and

f) Natural Terrain Hazards Mitigation Measures.

1.2.3 To meet the soaring demand for public housing units, the Government recommended in the Long Term Housing Strategy (LTHS) Annual Progress Report 2018 that the development intensity of public housing sites can be enhanced for ongoing projects, if such increase in development intensity is technically feasible. In view of this, the technical assessment has taken into account the latest development parameters by adopting a higher domestic plot ratio for the public housing Sites 1 and 2.

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1.2.4 Site 1 and Site 2 will be addressed in this report and the other sites will be addressed in a separate report. Site 1 is located at the west of Cheung Muk Tau Tsuen, bounded by Ma On Shan Bypass at its north and west while Site 2 is located to the southeast of Cheung Muk Tau Tsuen and the south of Symphony Bay Villa Rhapsody. The location plan of Sites 1 and 2 is shown in **Figure 1.1**. The conceptual building block layout plan is shown in **Figure 1.2**, which is developed from the latest development parameters available at this stage and are provided in the following table:

		Site 1	Site 2
Gross Site Area (ha) (About)		1.38	1.46
Net Site Area (ha) (About)		Same as Gross Site Area	
Plot Ratio (1)	**Domestic**	6.5	6.5
	Non-Domestic (Retail)	0.2	0.2
	Non-Domestic (Kindergarten)	0.07	---
	Non-Domestic (Carpark)	0.6	0.6
Gross Floor Area (m^2)	**Non-Domestic (Retail)**	2,760	2,920
	Non-Domestic (Kindergarten)	970	---
	Non-Domestic (Welfare/Community)	10,070	10,220
	Non-Domestic (Carpark)	8,300	8,800
Maximum Building Height (mPD) (about)		+163	+165

Note:
(1) Welfare/Community facilities and carpark within Sites 1 and 2 are exempted from Plot Ratio/ Gross Floor Area calculation.
(2) The development parameters are subject to review at detailed design stage.

1.3 Objective of the Air Ventilation Assessment (Expert Evaluation)

1.3.1 The key purposes of the Expert Evaluation are

- to identify the good design features of the proposed development;
- to identify obvious problematic areas; and
- to propose appropriate mitigation measures.

Determination of whether further Initial Study or Detailed Study is required would be based on the findings of this Expert Evaluation.

1.4 Subject Site and its Environs

1.4.1 **Figure 1.1** shows the location of Site 1 and Site 2 and its environs.

Site 1

1.4.2 Site 1 is located at the west of Cheung Muk Tau Tsuen, bounded by Ma On Shan Bypass at its north and west. There are no existing public roads serving Site 1. Resumption of some private lands within Village Environ Boundary (VEB) might be required to extend the Nin Fung Road for traffic connection to Site 1. The eastern portion of Site 1 falls within consultation zone of Ma On Shan Water Treatment Works which is classified as a potentially hazardous installation under HKPSG.

1.4.3 Site 1 is currently zoned as "Green Belt" on the approved MOS OZP No. S/MOS/22.

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Site 2

1.4.4 Site 2 is located to the southeast of Cheung Muk Tau Tsuen and the south of Symphony Bay Villa Rhapsody. The proposed access road to Site 1 is extended to Site 2 with a roundabout at the north of Site 2. Site 2 also falls within the consultation zone of Ma On Shan Water Treatment Works.

1.4.5 Site 2 is currently zoned as "Green Belt" on the approved MOS OZP No. S/MOS/22.

1.5 Proposed Development

1.5.1 The preliminary master layout plan of Site 1 and Site 2 is shown in **Figure 1.2**.

Site 1

1.5.2 Site 1 is irregular in shape and the site area is 1.38 ha. Site 1 will consist of two residential blocks with proposed building height at around +163mPD (Block 1 will be located in the middle of the Site 1) and around +147mPD (Block 2 will be located at the southeast portion of Site 1) respectively. The podium of Site 1 will be at around +33mPD. A building separation of 15m will be allowed between Blocks 1 and 2 along NE to SW direction. A non-domestic facility of 5 storeys (around +45mPD) will be located at the northern portion of Site 1. In addition, there will be a 15m building separation along ENE to WSW between Block 1 and the non-domestic facility.

Site 2

1.5.3 Site 2 is also irregular in shape and the site area is 1.46 ha. Site 2 will consist of two residential blocks with proposed building height at around +165mPD (Block 1 will be located at the southwest portion of the Site 2) and around +153mPD (Block 2 will be located at the northeast portion of Site 2) respectively. The podium of the Site 2 is of around +45mPD. A 15m building separation will be allowed between Blocks 1 and 2 along SE to NW. .

1.6 Subject Constraints

1.6.1 Sai Sha Road and Ma On Shan Bypass run along from northern and western side of Site 1. Due to close proximity to Sai Sha Road and Ma On Shan Bypass, it is revealed that the proposed residential block of Site 1 would be subject to high traffic noise.

1.6.2 In order to minimize the road traffic noise impact, the residential block of Site 1 is proposed to be away from Sai Sha Road and Ma On Shan Bypass. It is anticipated that an increased buffer distance between noise source and residential blocks of Site 1 could alleviate the noise impact to the residential units.

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2 SITE WIND AVAILABLILTY

2.1 Site Wind Availability Data

2.1.1 Expert Evaluation is not a detailed study on air ventilation performance. It is therefore considered acceptable to use the Regional Atmospheric Modelling System (RAMS) data for Site Wind Availability as a starting point. Based on the location of Site 1 and Site 2, the RAMS data for the grid (096,066) have been extracted from the Site Wind Availability Data of the Planning Department's website.

2.1.2 **Figure 2.1** shows the relevant windrose diagrams representing the frequency and wind speed distribution at 200 m and 500 m height of the district concerned during the annual condition and summer condition (Jun – Aug). Based on the wind rose, the 500m wind data is representative of the wind characteristics giving a good indication of the free wind at the Subject Site. The 200 m site wind availability data represents wind data that takes into account the topographical effect around the Subject Site. Therefore, a lower level of windrose at 200 m height is selected to study the prevailing wind condition as it represents the incoming wind to the Subject Site and considers the influence on the prevailing winds by the surrounding topography.

2.1.3 According to the wind data at 200 m altitude, the annual prevailing wind directions for the sites are from NE, E and ESE; where summer prevailing wind directions are from ESE, SW and WSW. The wind frequency data under the annual and summer condition is shown in **Table 2.1** below.

Table 2.1 Summary of RAMS Data and Wind Direction under Annual and Summer Condition at 200m

Wind Direction	Probability for Annual Condition	Probability for Summer Condition
N	1.9%	0.9%
NNE	8.3%	1.3%
NE	**14.0%**	2.5%
ENE	8.5%	3.3%
E	**15.3%**	9.6%
ESE	**14.6%**	**10.8%**
SE	8.9%	9.7%
SSE	4.9%	9.2%
S	3.7%	8.7%
SSW	3.8%	9.2%
SW	5.1%	**13.7%**
WSW	4.0%	**10.1%**
W	2.9%	6.2%
WNW	1.9%	2.9%
NW	1.2%	1.3%
NNW	1.0%	0.6%

Note: **Bold** characters with the highlight in grey represent the selected prevailing wind directions for evaluation

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2.1.4 With reference to the Final Report – Ma On Shan Area for Cat. A1 – Term Consultancy for Expert Evaluation and Advisory Services on Air Ventilation Assessment (PLNQ 37/2007) (AVA Report for Ma On Shan Area) prepared by Department of Architecture, and Chinese University of Hong Kong, Site 1 and Site 2 are located close to the Location A mentioned in the "AVA Report for Ma On Shan Area". The 450m wind data is representative of the wind characteristics of the free wind at the Subject Site while the 120 m wind data represents wind data that takes into account the topographical effect around the Subject Site. Therefore, the wind data at 120m at Location A has been referenced and adopted for the current study (**Figure 2.2**). As shown by the windroses for the annual and summer periods, the NE, ENE and E winds are the dominant wind directions in the annual period, and the winds from E, SE and SW are the dominant wind directions in summers.

2.1.5 After reviewing the wind data, it is concluded that the annual winds mainly come from NE, ENE, E and ESE directions. During summers, the winds from E, ESE, SE, SW and WSW are the dominant wind directions.

2.2 Topography and Building Morphology

2.2.1 **Figure 2.3** and **Figure 2.4** show the topography and building morphology of the concerned area.

Topography

2.2.2 A waterfront is about 500m away to the north of Site 1 and Site 2 and the topography near the waterfront is generally flat. The ground elevation is around +20mPD for two sites and increases gradually towards southern side. Ma On Shan Country Park occupies the area from southeast to southwest. The Hunch Backs (Ngau Ngak Shan) is located about 1.4km to the south of Site 1 and Site 2 with hill top at around +676mPD. Given the large distance between the sites and the hilly terrain, it is not likely the hill topography will have significant ventilation impacts on sites under SE to S directions. Therefore, the wind flow pattern at the sites would be slightly influenced by the surrounding topography. **Figure 1.1** indicates the location of The Hunch Backs (Ngau Ngak Shan) for reference.

Building Morphology

2.2.3 Site 1 and Site 2 are currently zoned "Green Belt" under the approved MOS OZP No. S/MOS/22. As shown in **Figure 1.1**, the surrounding development is a cluster of low to mid-rise residential developments located at the north to northeast of the sites such as Symphony Bay Villa Concerto, Symphony Bay Villa Rhapsody, Cheung Muk Tau Tsuen, Nai Chung, Sai O and low-rise educational and recreational developments including Li Po Chun United World College and Cheung Muk Tau Holiday Centre and hence potential building blockages are considered low.

2.2.4 There are high-rise residential developments located at the west to northwest of the sites, including Monte Vista, Lake Silver, Lee On Estate, Kam Lung Court and future development at STTL 605, etc., which would obstruct part of the incoming winds to penetrate its downstream areas, however as the prevailing winds are not in NW quadrant, effect of those high-rise developments on the Subject Site is minimal. The

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proposed building height of future development at STTL 605 would not exceed +95mPD. **Figure 2.3** indicates the topography features of the Subject Site and its surrounding developments.

2.2.5 As the heights of most of the existing developments and planned GIC developments near the sites are low-rise to mid-rise developments, they will not impose significant ventilation impact to sites under NE, ENE, E, ESE, SE, SW and WSW prevailing wind condition. However, the mid-rise development close to the Subject Site on northeast would slightly obstruct the incoming wind from northern portion. Furthermore, it is observed that there are noise barriers (around 2 to 5m in height) along Sai Sha Road and Ma On Shan Bypass (as indicated in **Figure 2.4**). They slightly obstruct the incoming wind and induce small wind shadow regions at nearby residential development.

2.2.6 The building heights and locations of the surrounding developments from two sites are tabulated in **Table 2.2** and illustrated in **Figure 2.4**. It is noted that Symphony Bay Villa Concerto, Symphony Bay Villa Rhapsody, Sai O, Cheung Muk Tau Tsuen, Monte Vista and Lake Silver are located near the sites.

Table 2.2 Building Height of Existing and Future Neighbouring Development

Name of Development	Building Height	Location from Site 1	Location from Site 2
Symphony Bay Villa Concerto	~38 to ~42mPD	NE	N
Symphony Bay Villa Rhapsody	~62mPD	NE	N
Future Development at Sha Tin Town Lot No. 605 (Future Development at STTL 605)	Not more than 95mPD	N	NW
Sai O	~18 to ~28mPD	ENE	NE
Nai Chung	~12 to 21mPD	ENE	NE
Cheung Muk Tau Tsuen	~29 to ~35mPD	E	NW
Li Po Chun United World College	~34mPD	N	NW
Cheung Muk Tau Holiday Centre	~29 to 30mPD	NNE	N
Double Cove	~115 to ~130mPD	NW	NW
Monte Vista	~110mPD	W	W
Lake Silver	~160 to ~183mPD	WNW	WNW
Wu Kai Sha Village	~18 to 27mPD	W	W
Lee On Estate	~117 to 130mPD	W	W
Kam Lung Court	~119mPD	WSW	WSW
Villa Athena	~104 to 111mPD	W	W
Saddle Ridge Garden	~123 to 137mPD	SW	SW
Kam Ying Court	~155 to 157mPD	SW	SW
Planned GIC developments	(Maximum Building Height (2-Storeys)	E	E

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2.3 Summary of Site Wind Availability

2.3.1 **Figure 2.3** and **Figure 2.4** indicate the pedestrian wind flows and the future development under annual and summer conditions in the concerned area.

Annual Condition

2.3.2 It is noted that the annual prevailing wind directions for the sites are from NE, ENE, E and ESE.

2.3.3 Due to the building morphology of the northeast side of Site 1 and Site 2, ENE and NE winds could flow through the building separation of existing stepped residential developments (i.e. Cheung Muk Tak Holiday Centre, Symphony Bay Villa Concerto and Symphony Bay Villa Rhapsody), but the winds would be reduced before reaching Site 1 and Site 2 and its surrounding areas. Additionally, as the existing condition of Site 1 and Site 2 are open spaces, the incoming wind is expected to penetrate across Site 1 and Site 2 freely towards the downstream areas.

2.3.4 Under E wind, there is a large open space located at upstream areas of Site 1 and Site 2, which acts as wind entrance for the sites. There are three low-rise planned GIC development (2-storeys) located at the east side of the Site 2. The prevailing wind can penetrate to the sites and then flow atop these low-rise GIC developments and reach its surrounding areas such as Monte Vista, Lee On Estate, Kam Lung Court and Saddle Ridge Garden. As the existing condition of the sites is open space, the incoming wind is expected to penetrate across the sites freely towards its downstream areas. However, as the terrain to the east of Site 2 is around 20 to 80 mPD, it is expected that the E wind is partially blocked by the terrain before reaching Site 1 and Site 2.

2.3.5 Under ESE wind, it is noted that the Ma On Shan Country Park occupies the area from southeast to southwest of Site 1 and Site 2. Due to the hilly terrain at the south-east and south-west of the sites, it is expected that the ESE prevailing wind would be obstructed by the topography, such that the ESE prevailing wind is expected to be weakened before reaching the sites and then further to its downstream areas such as Double Cove, future development at STTL 605, Lake Silver and Wu Kai Sha Village.

Summer Condition

2.3.6 It is noted that the summer prevailing wind directions for Site 1 and Site 2 are from E, ESE, SE, SW and WSW.

2.3.7 Under E wind, the prevailing winds can penetrate to Site 1 and Site 2, and then flow to its surrounding areas. Although Symphony Bay Villa Rhapsody would obstruct part of incoming E wind to Site 1 and hilly terrain would lower E wind availability of Site 2, the existing condition of the sites is open spaces, the incoming wind is expected to penetrate across Site 2 freely towards Site 1 and its downstream areas. Therefore, the wind environment at the sites under E direction is expected to be satisfactory.

2.3.8 Under ESE wind, as mentioned that Ma On Shan Country Park would block the ESE

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wind from reaching the Site 2 and Site 1. It is expected that the hilly terrain at the south-east and south-west of the sites would weaken the ESE prevailing wind before reaching the sites. As a result, the wind performance of the sites would slightly be deteriorated under the ESE wind condition.

2.3.9 Under SE wind, the hilly terrain would partially obstruct the winds from reaching the downstream areas including Site 1, Site 2, Cheung Muk Tau Tsuen, Li Po Chun United World College and Future Development at STTL 605. As a result, the wind performance of the sites would slightly be reduced under the SSE wind condition.

2.3.10 Under SW and WSW winds, there are existing high-rise buildings such as Kam Ying Court, Saddle Ridge Garden, Kam Lung Court, Monte Vista, etc., which may partially obstruct the winds from WSW to reach the low to mid-rise developments in downstream areas such as Cheung Muk Tau Tsuen, Symphony Bay Villa Rhapsody, Site 1 and Site 2. Ma On Shan Bypass is generally aligned in parallel to the NE - SW direction, which could potentially act as summer air path, while Sai Sha Road is aligned along ENE-WSW direction, which also facilitate wind flowing from WSW directions. The SW and WSW incoming winds along Ma On Shan Bypass would penetrate to the sites and its surrounding areas. Thus, it is anticipated that winds would still be able to penetrate the sites and reach to its downstream areas.

2.3.11 To sum up, although the nearby building clusters (to the north, northeast, southwest and west-southwest), and the high topography from southeast to southwest, it is anticipated that existing site wind availability is considered satisfactory under both annual and summer conditions because Sai Sha Road and Ma On Shan Bypass are considered as the major air corridors under annual and summer conditions and the area to the south of Ma On Shan Bypass and Sai Sha Road is relatively open for wind penetration, wind flow to the road network should not be restricted.

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3 EXPERT EVALUATION OF AIR VENTILATION PERFORMANCE OF THE PROPOSED DEVELOPMENT

3.1 Assessment Methodology

3.1.1 **Section 2** describes the site wind availability at both Site 1 and Site 2, and the dominant wind flow during annual and summer conditions. It is noted that the annual prevailing wind directions for the area are from NE, E and ESE; where summer prevailing wind directions are from E, ESE, SE, SW and WSW. The proposed building design of two sites will be evaluated against the dominant wind directions identified, i.e. northeast and east portions, southeast portion and southwest portion.

3.2 Wind Flow from Northeast and East Portions

3.2.1 **Figure 3.1** and **Figure 3.2** illustrate the wind flows from ENE, NE and E wind directions respectively.

3.2.2 As discussed in **Section 2.3**, wind from NE, ENE, E and ESE are the dominant annual prevailing wind directions, while E is one of the dominant summer prevailing wind directions. For NE and ENE winds, the prevailing wind could flow through the building separation of existing stepped residential developments (i.e. Cheung Muk Tau Holiday Centre, Symphony Bay Villa Concerto and Symphony Bay Villa Rhapsody), but the winds would slightly be reduced before reaching Site 1 and Site 2. For the E wind direction, there is a large open space located at upstream areas of Site 1 and Site 2, which acts as wind entrance for the sites. Therefore, the wind environment at the sites under E direction is expected to be satisfactory.

<u>NE and ENE Wind</u>

3.2.3 As there are existing mid-rise developments (Symphony Bay Villa Rhapsody, Symphony Bay Villa Concerto, Cheung Muk Tau Holiday Centre, Li Po Chun United Would College) located at the north of the Sites, the decline of incoming NE winds would be expected. For Site 1, with a large buffer distance (more than 70m) to Cheung Muk Tau Tsuen (see **Figure 1.2**), one 15m building separation between Block 1 and Block 2 and one 15m width separation between the non-domestic facility and Block 1, the NE and ENE prevailing winds pass through these building separations and reach to surrounding areas. Moreover, the low-rise non-domestic facility in Site 1 would allow the incoming NE and ENE wind penetrate atop the building towards the downstream areas such as Monte Vista and Kam Ying Court along Ma On Shan Bypass.

3.2.4 For Site 2, it is noted that the incoming NE and ENE wind would be blocked by the existing mid-rise development (Symphony Bay Villa Rhapsody), thus low wind availability is expected in Site 2. In addition, Site 2 would create a wind shadow in the immediate leeward region. It is considered that the downstream areas would be under the wind shadow of the building blocks.

3.2.5 However, as the downstream area of Site 2 is not accessible by the public, the potential impact of Site 2 is insignificant. In addition, it is expected that the higher building height (around +153mPD to 165mPD) of the proposed development would

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induce downwash of upper-level wind to the pedestrian level within the site. Therefore, it is anticipated that unfavourable impacts in terms of wind environment would be compromised. **Figure 3.1** illustrates the wind flow from NE and ENE wind direction.

E wind

3.2.6 For Site 1, it is noted that the proposed development would block the E wind from reaching its downstream areas such as Lake Silver, Monte Vista, Lee On Estate and Kam Lung Court. The decline of wind environment at the downstream areas would be expected. To enhance the ventilation performance of Site 1 and its surrounding areas, the 15m building separation location between the non-domestic facility and block 1 in Site 1 would allow the penetration of wind through Site 1 to its downstream area such as Lake Silver. Thus the unfavourable air ventilation impact is reduced. Moreover, as the low-rise of non-domestic facility would be proposed near the northern boundary of Site 1, it would allow the incoming E winds from Cheung Muk Tau Tsuen to penetrate towards to the downstream areas including Monte Vista and Lee On Estate. In addition, as the building separation (around 230m) between Site 1 and the nearby residential development (Lake Silver, Monte Vista) is large, it is expected that the performance of wind ventilation would be promoted. Hence, it is anticipated that unfavourable impact in terms of wind environment would be reduced.

3.2.7 For Site 2, it is anticipated that the existing wind penetration is lowered by the hilly terrain under annual E condition. A large buffer distance will be provided between the proposed residential block (i.e. Block 2) of Site 2 and the nearby residential development, it is anticipated that prevailing E wind would pass through this separation and reach northern portion of Cheung Muk Tau Tsuen and Site 1, with wake area induced at southern part of Cheung Muk Tau Tsuen by Site 2.

3.2.8 However, the higher building height (around +153mPD to +165mPD) of the proposed development would induce downwash of upper-level E winds to the pedestrian level of Site 1 and southern portion of Cheung Muk Tau Tsuen. Therefore, it is anticipated that unfavourable impact in terms of wind environment would be reduced. **Figure 3.2** illustrates the wind flow from E wind direction.

3.3 Wind Flow from Southeast Portion

3.3.1 **Figure 3.3** and **Figure 3.4** illustrate the wind flows from ESE and SE respectively.

3.3.2 Both annual and summer winds come from southeast portion. It is expected that the ESE and SE prevailing wind to be weakened before reaching the sites due to blockage from the hilly terrain of Ngau Ngak Shan and Ma On Shan Country Park located from southeast and south of Sites 1&2.

ESE Wind

3.3.3 While under the prevailing wind from ESE, the downstream areas influenced by proposed developments at Site 1 and Site 2 would include Cheung Muk Tau Tsuen, Lake Silver and future development at STTL 605. Thus, it is expected that the

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proposed developments would slightly decline in terms of air ventilation performance in the aforementioned areas.

3.3.4 Ma On Shan Country Park is located at the southeast side of the Sites, it would obstruct the ESE winds from reaching the downstream areas including Site1, Site 2, Cheung Muk Tau Tsuen and Symphony Bay Villa Rhapsody. As a result, the wind performance of the Sites and its downstream areas would be slightly reduced under the ESE wind condition. For Site 1, the proposed building blocks would further block the ESE prevailing winds from reaching the downstream areas such as Lake Silver. Hence, it is expected that site wind availability of downstream areas is considered low.

3.3.5 However, it is noted that with a large separation (around 140m) (see **Figure1.2**) between Site 1 and Site 2, the prevailing winds would still be able to pass through this effective wind corridor to the downstream areas including Cheung Muk Tau Tsuen, future development at STTL 605. The building orientation of Blocks 1 & 2 in Site 1 would capture the upper-level ESE wind and create downwash to the pedestrian level within the site area, which is then diverted towards Cheung Muk Tau Tsuen by building orientation of blocks and non-domestic facility.

3.3.6 For Site 2, a 15m wide building separation between Block 1 and Block 2 would be incorporated to allow some portion of ESE prevailing wind to pass towards the downstream areas such as Cheung Muk Tau Tsuen. Therefore, it is anticipated that incoming ESE wind would be weakened by proposed development at Site 2 compared with existing condition.

SE Wind

3.3.7 Similar to ESE wind condition, hilly terrain located at the southeast side of the Sites would obstruct the SE winds from reaching the downstream areas including Site 1, Site 2, Cheung Muk Tau Tsuen, Symphony Bay Villa Concerto and future development at STTL 605. As a result, the wind performance of the Sites and its downstream areas would be slightly reduced under the SE wind condition. Also, the proposed high-rise residential blocks would further obstruct the wind flow and induce a wake area to the downstream areas.

3.3.8 When compared with the existing condition, the high-rise proposed development would inevitably provide significant wind blockage impact to the downstream areas such as Cheung Muk Tau Tsuen, Lake Silver and future development at STTL 605. However, the wide separation distance between Site 1 and Site 2 incorporated would facilitate the SE wind flow from Ma On Shan Country Park to reach downstream areas such as Cheung Muk Tau Tsuen and future development at STTL 605.

3.3.9 In order to mitigate the adverse impact on air ventilation, Site 2 would incorporate a 15m building separation between two residential blocks along southeast-northwest wind direction. Based on the building permeability deign incorporated in the proposed development, the SE air paths would be able to penetrate the Sites and

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into the local areas including Cheung Muk Tau Tsuen.

3.3.10 Moreover, for Site 1, the building blocks would block the SE prevailing winds from reaching the downstream areas such as Lake Silver, Monte Vista and its surrounding areas. However, as there would be large building separation between Site 1 and the nearby residential developments (Lake Silver, Monte Vista and Cheung Muk Tau Tsuen), it is expected that the pedestrian wind comfort would be enhanced. Therefore, it is anticipated that ventilation performance of the surrounding areas would be increased and unfavourable impact in terms of wind environment would be reduced.

3.4 Wind Flow from Southwest Portion

3.4.1 **Figure 3.5 and Figure 3.6** illustrate the wind flow from SW and WSW wind directions respectively.

3.4.2 As mentioned in **Section 2.3**, Ma On Shan Country Park and Ngau Ngak Shan are located at the upstream area of Site 1 and Site 2. It is expected that the SW and SSW prevailing winds would be weakened before reaching the sites. Under SW and SSW wind conditions, Sai Sha Road and Ma On Shan Bypass are aligning in ENE-WSW and NE-SW directions respectively, which would serve as wind corridors to allow better wind penetration at the northern and western part of the Site 1 under summer SW and WSW wind.

SW Wind

3.4.3 For Site 1, it is noted that Cheung Muk Tau Tsuen is located to the downstream area under SW wind direction. SW and WSW wind would be weakened by the hilly terrain before passing around Site 1 and reaching Cheung Muk Tau Tsuen. Moreover, the proposed high-rise residential building would further shelter the wind and induce a wake area to downstream areas. However, the building design has incorporated two 15m building separations between two residential blocks, and Block 1 and the non-domestic facility along SW-NE wind direction respectively, it is anticipated that unfavourable impacts in terms of wind environment would be reduced.

3.4.4 For Site 2, it is expected that the high-rise residential blocks of proposed developments would shelter the SW wind flowing towards the downstream areas such as Symphony Bay Villa Rhapsody. The decline of wind performance at the downstream areas would be expected. However, the proposed buildings in Site 2 are aligned in SW to NE direction such that to the sheltering effect on the SW wind would be minimal. Also, the wide separation distance between Site 1 and Site 2, would allow the SW winds to pass through and reach the downstream areas. Therefore, it is anticipated that unfavourable impact in terms of wind environment would be reduced.

WSW Wind

3.4.5 For Site 1, it is noted that Cheung Muk Tau Tsuen and Symphony Bay Villa Rhapsody are located at the downstream area under WSW wind direction. The proposed

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high-rise residential blocks would weaken the WSW wind. Similar to SW wind conditions, the two 15m building separations incorporated between Block 1 and Block 2, and Block 1 and the non-domestic facility would allow WSW wind penetration towards Cheung Muk Tau Tsuen and further to Symphony Bay Villa Concerto. Hence the adverse impact on air ventilation performance compared with existing open ground condition in the surrounding areas would be lowered under WSW wind.

3.4.6 For Site 2, the proposed high-rise residential blocks would induce a wake area to downstream area such as Symphony Bay Villa Rhapsody. With the notional design of Site 2 mentioned in the previous section, the wide separation distance between Site 1 and Site 2, would allow the WSW winds to pass through and reach the downstream areas. Therefore, it is anticipated that unfavourable impact in terms of wind environment would be reduced.

3.5 Summary of Air Ventilation Performance

3.5.1 Currently, there are no building structures in both Site 1 and Site 2. It is believed that the new high-rise development would obstruct wind flow to downstream areas. Under the annual NE and ENE wind condition, the proposed development would not cause significant air ventilation impact to the downstream areas. Under E wind condition, the proposed development would have blockage of incoming E winds towards to the downstream areas such as Lake Silver, Monte Vista, Lee On Estate and Kam Lung Court. However, there is a wide separation between the proposed development and the nearby residential buildings (Lake Silver, Monte Vista), it is expected that the induce wind ventilation impact would be minimal. Under ESE and summer SE wind direction, it is expected that Cheung Muk Tau Tsuen, Symphony Bay Villa Concerto and future development at STTL 605 would be under the wind shadow areas. Under summer SW and SSW wind condition, it is expected that the high-rise residential blocks of proposed development would provide wind blockage to the downstream areas (Cheung Muk Tau Tsuen and Symphony Bay Villa Rhapsody). However, the proposed building separations in the notional design would facilitate wind penetration and no significant impact would be induced to surrounding areas.

3.6 Building Design Features

3.6.1 The proposed detailed building design is illustrated in **Figure 1.2.** The following good design features are adopted in the proposed design in order to enhance air ventilation to Subject Site and its surrounding areas:

A. Building separation of around 15m in width, aligning in approximately ENE to WSW direction is incorporated between non-domestic facility and Block 1 at Site 1, for facilitating wind penetration mainly from SW and WSW winds to benefit its downstream areas including Cheung Muk Tau Tsuen; and

B. Building separation of 15m wide, aligning in approximately NE to SW direction is incorporated between Block 1 and Block 2 on Site 1, which would facilitate wind penetration mainly from NE and ENE wind to benefit its downstream areas; and

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C. Building separation of 15m wide, aligning in approximately NW to SE direction is incorporated between Block 1 and Block 2 on Site 2 which would facilitate wind penetration mainly from SE and ESE winds and benefit its downstream areas.

3.7 Further Recommended Design Principles for Scheme Optimization

3.7.1 As discussed in above section, good design features are proposed to facilitate air ventilation to the surrounding areas. The proposed features are essential for minimizing air ventilation impact to the surrounding areas. However, the development shall not be limited to the proposed design and shall include other features as far as possible at the detail design stage. For instance, the following recommendations shall be considered:

- Maximize building permeability with reference to PNAP APP-152;
- Minimisation of podium bulk with ground coverage of no more than 65%;
- Building setback with reference to PNAP APP-152;
- For public housing, greenery of at least 20% and an overall target of 30% is aimed to be achieved, preferably at grade;
- Avoid continuous long continuous façades; and
- Reference could also be made to the recommendations of good building design in the Hong Kong Planning Standards and Guidelines.

3.7.2 Moreover, it is recommended that quantitative AVA should be carried out at the detailed design stage to demonstrate that the wind performance of the future scheme would have no unacceptable impact and to optimize scheme design at the detailed design stage.

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4 CONCLUSIONS

4.1.1 Qualitative assessment of wind environments with regard to the proposed housing developments in Ma On Shan has been carried out under the AVA study.

4.1.2 Based on the findings of this Study, it is observed that the annual prevailing wind come from NE, ENE, E and ESE directions while the summer prevailing wind come from E, ESE, SE, SW and WSW directions.

4.1.3 In order to minimise the potential ventilation impacts upon Sites 1 and 2, the layout of the proposed housing development has been carefully designed after a qualitative assessment of wind performance of the site under existing condition and the proposed indicative Schemes. A preliminary assessment on site characteristics and wind availabilities has been conducted, which indicate as follows:

For existing condition at Sites 1 and 2:

- The annual NE and ENE wind will be weakened by the surrounding mid-rise developments while the E and ESE wind will be weakened by existing hilly terrains.
- Summer winds will be weakened by existing hilly terrains before reaching the Site 1 and Site 2.

For indicative Scheme of Site 1 and Site 2 at Subject Site:

- Wind shadow may be casted by the building blocks, which may affect wind availability at the downstream areas such as Monte Vista, Lee On Estate, Kam Lung Court and Symphony Bay Rhapsody under the annual prevailing NE wind, ENE wind, E wind, summer prevailing ESE wind and SE Wind.
- Building separations of 15m aligning with NE-SW is proposed to promote wind penetration through Site 1.
- Building separations of 15m aligning with NW-SE is proposed to promote wind penetration through Site 2.

4.1.4 With proposed design features, it is considered that the proposed development would not have significant adverse impact to the surrounding environment.

4.1.5 In consideration of uncertain site conditions and site restrictions, the adoptable design features are basically limited. Nevertheless some currently viable design features such as adequate space between buildings and building setback to promote air movement for localized area has been considered. It is anticipated that some potential impacts on air ventilation would be alleviated under aforesaid prevailing winds. In addition, for further wind enhancement, it is suggested that the implementation of any other design features through the recommendations under Sustainable Building Design Guidelines PNAP APP-152 will be studied in detailed design stage, including building permeability, building setback and greenery. Their viability as well as adoptability will be reviewed as much as possible.

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4.1.6 A quantitative AVA should be carried out to show that the wind performance of the future scheme would have no unacceptable impact and to optimize scheme design at the detailed design stage.

END OF TEXT

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FIGURES

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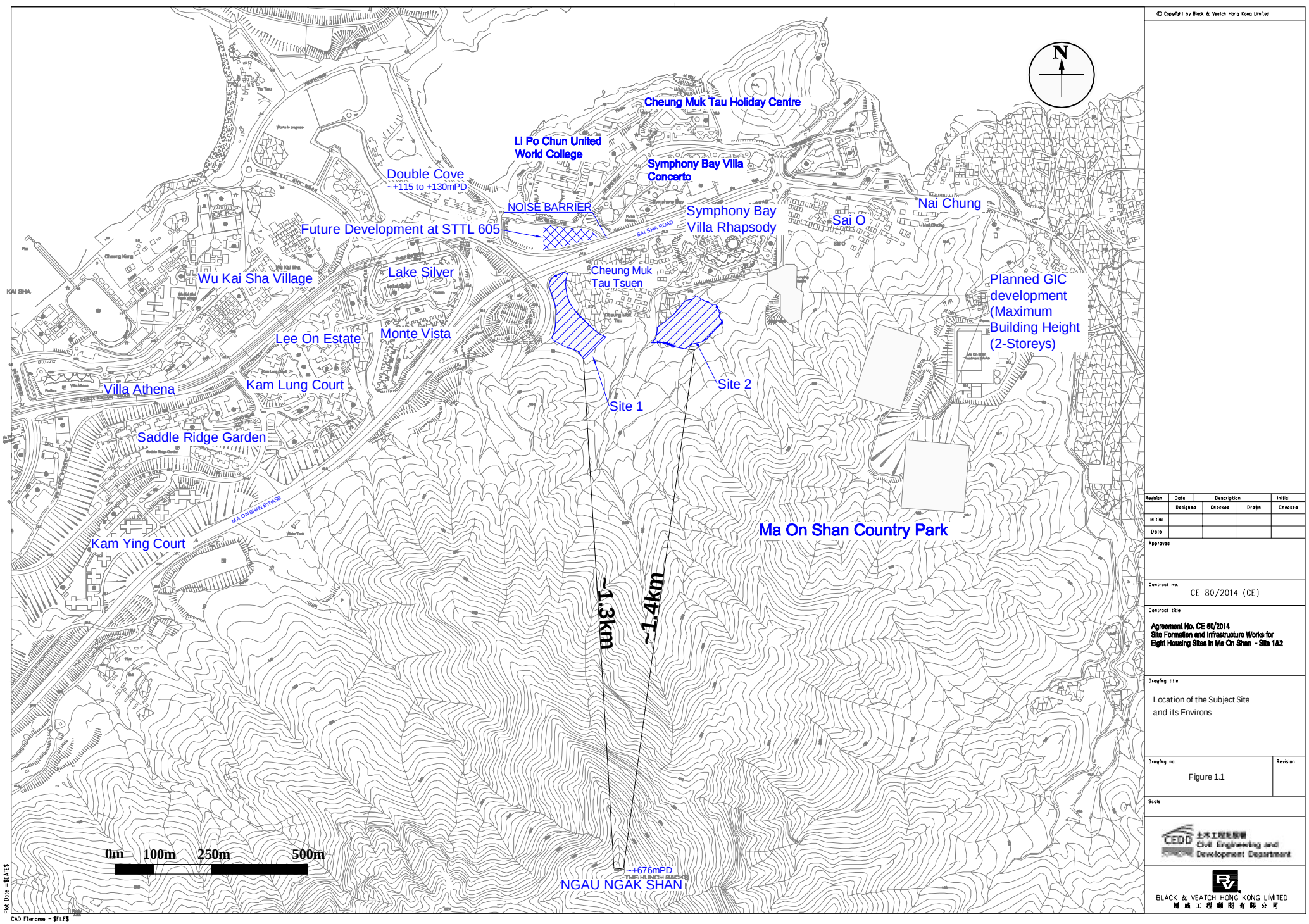

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Contract no.
CE 80/2014 (CE)

Contract title
Agreement No. CE 80/2014
Site Formation and Infrastructure Works for Eight Housing Sites in Ma On Shan - Site 1&2

Drawing title
Location of the Subject Site and its Environs

Drawing no.
Figure 1.1

Revision

Scale

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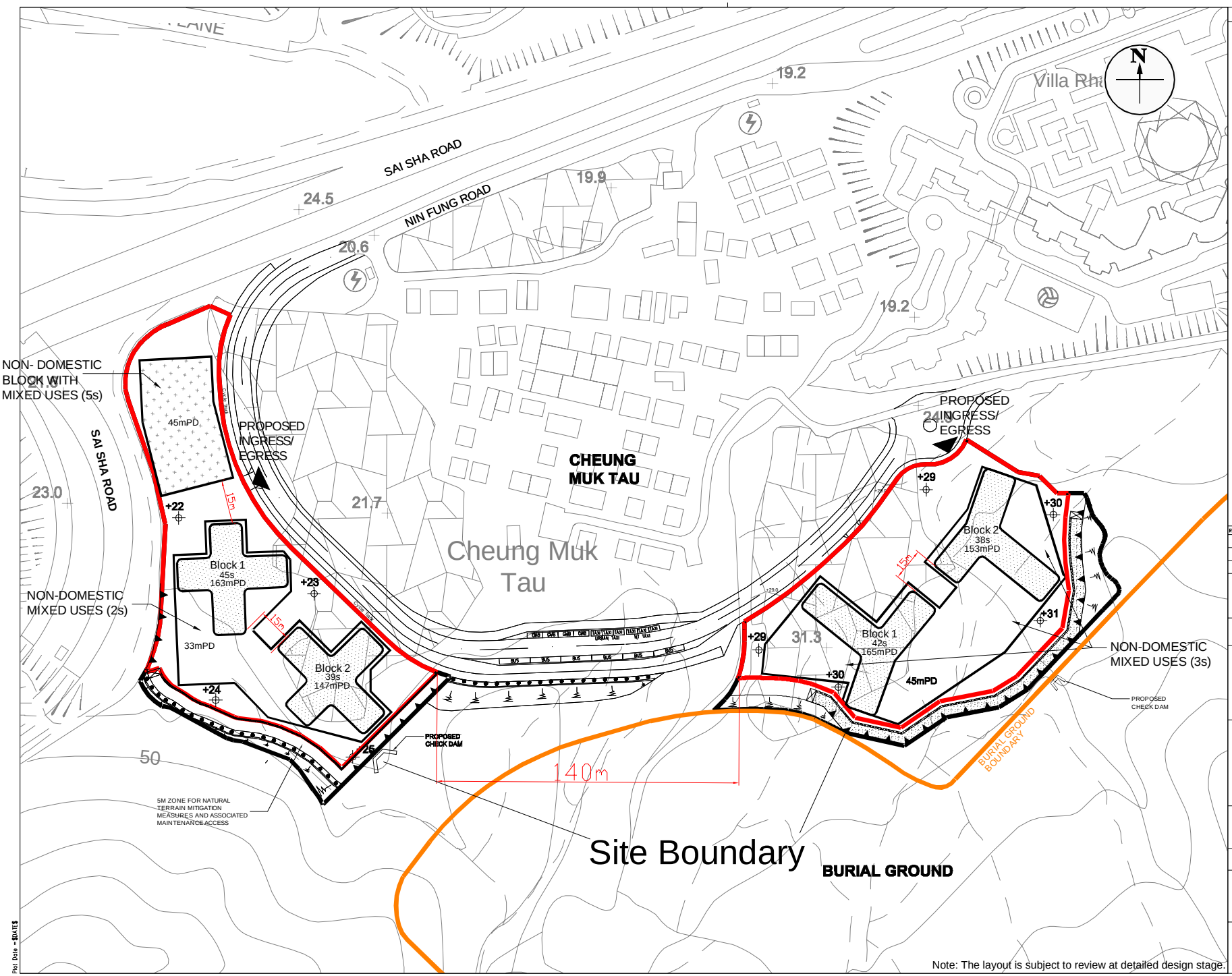

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Legend :

- Building Separation Distance
- Proposed Public Housing Site Boundary
- Proposed Housing Boundary subject to Detailed Design
- 15M Building Separation
- Proposed Slope
- Proposed Retaining Wall
- Proposed Bored Pile Wall
- Proposed Rigid Barrier (Subject to Detailed Design)
- Burial Ground Boundary

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Contract no.: CE 80/2014 (CE)

Contract title: Agreement No. CE 80/2014 Site Formation and Infrastructure Works for Eight Housing Sites in Ma On Shan - Site 1&2

Drawing title: Master Layout Plan and Blocking Layouts of Proposed Development

Drawing no.: Figure 1.2

Revision:

Scale:

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Note: The layout is subject to review at detailed design stage.

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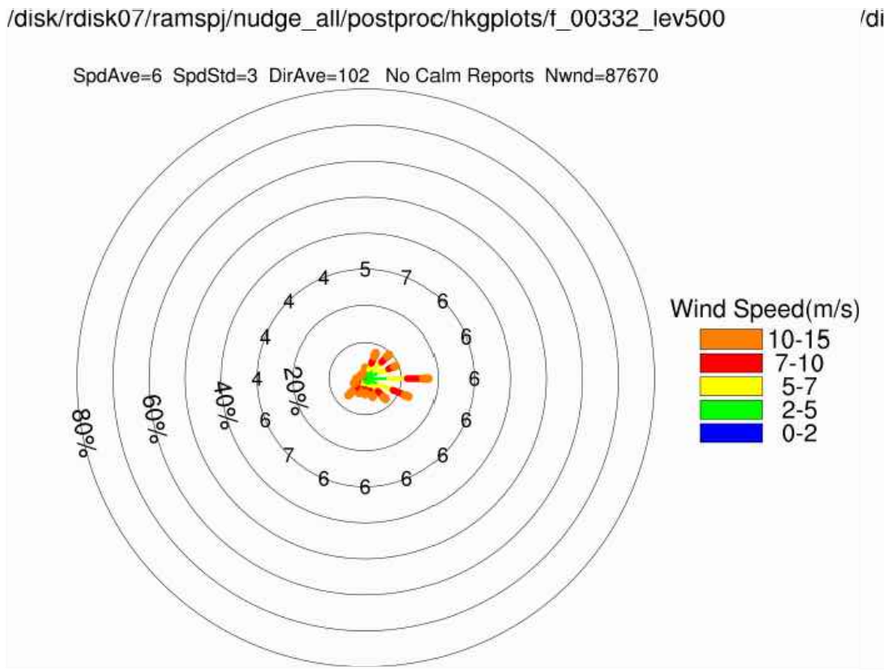
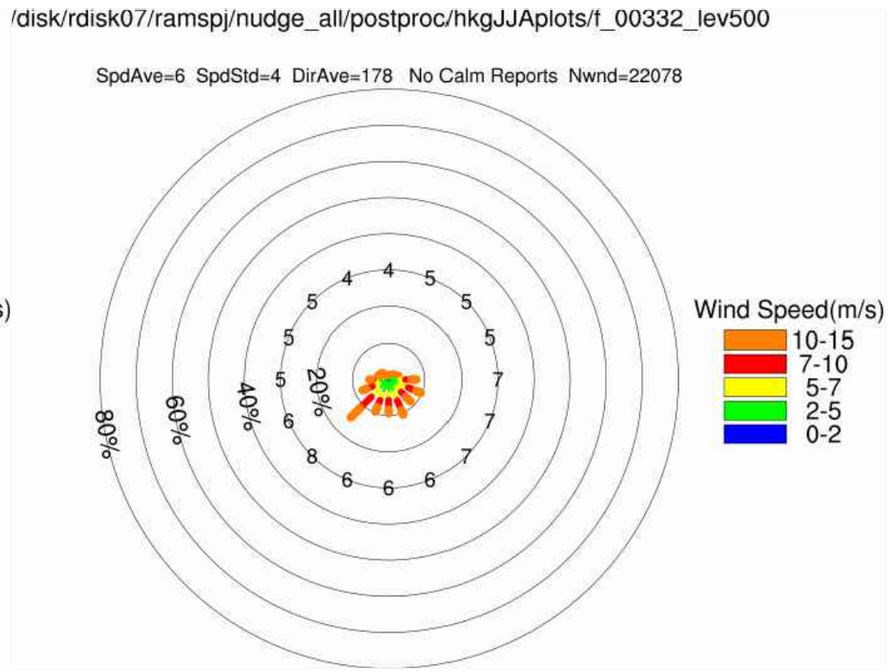
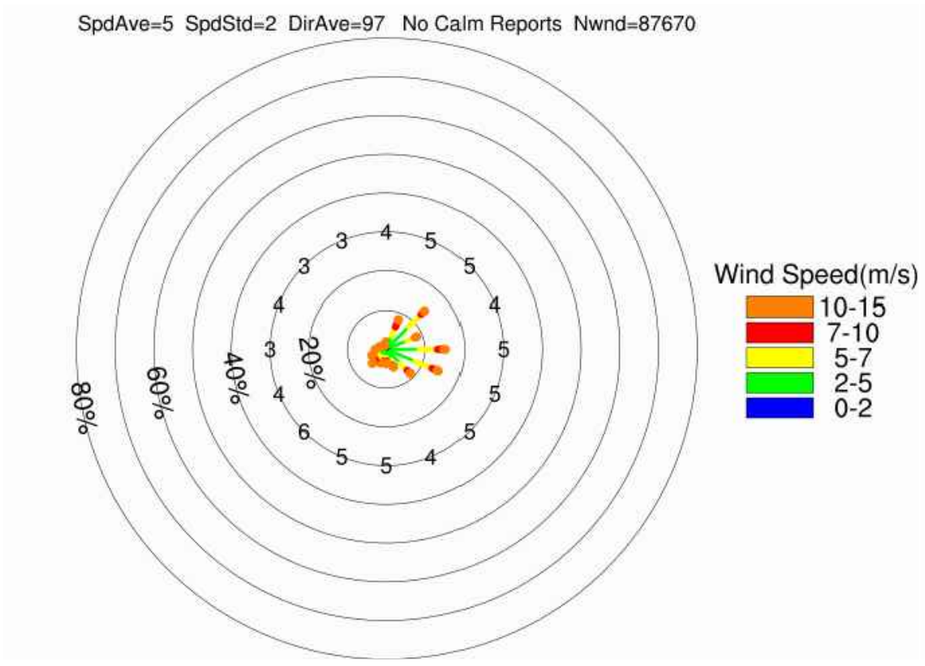
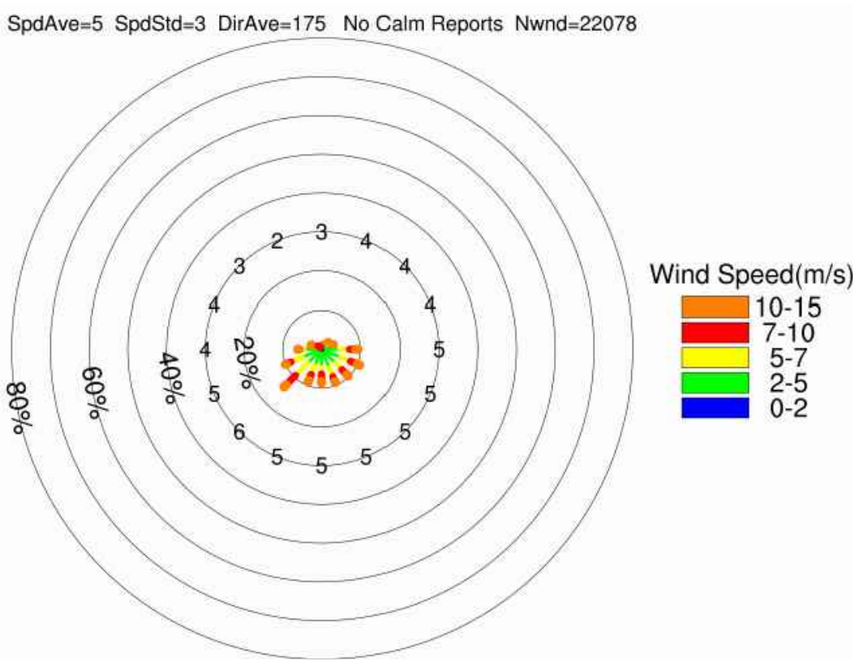




500m Annual Condition

500m Summer Condition





200m Annual Condition

200m Summer Condition

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Contract title: Agreement No. CE 80/2014 Site Formation and Infrastructure Works for Eight Housing Sites in Ma On Shan - Site 1&2

Drawing title: Windrose Representing Velocity at 500m and 200m of the Area Under Concern

Drawing no.: Figure 2.1

Revision:

Scale:

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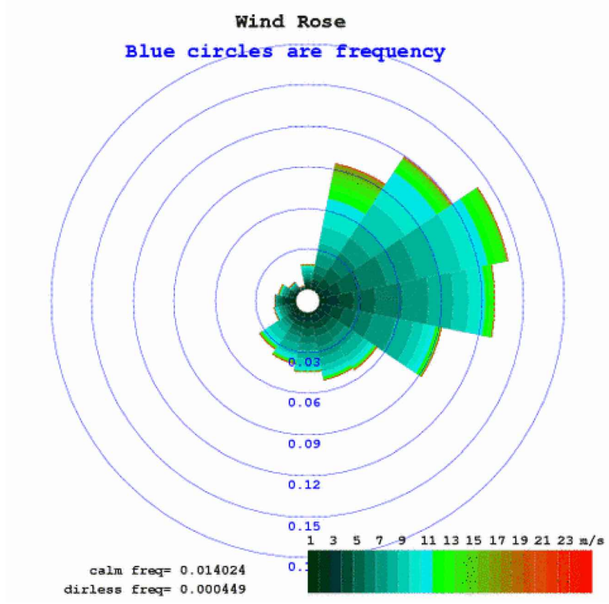

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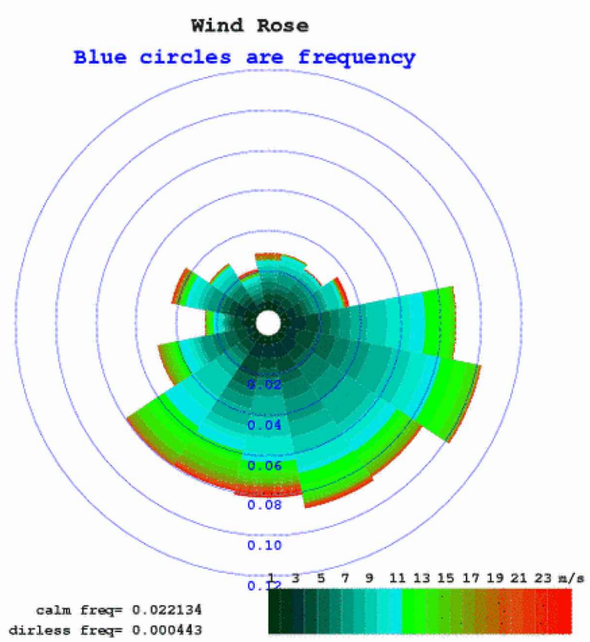
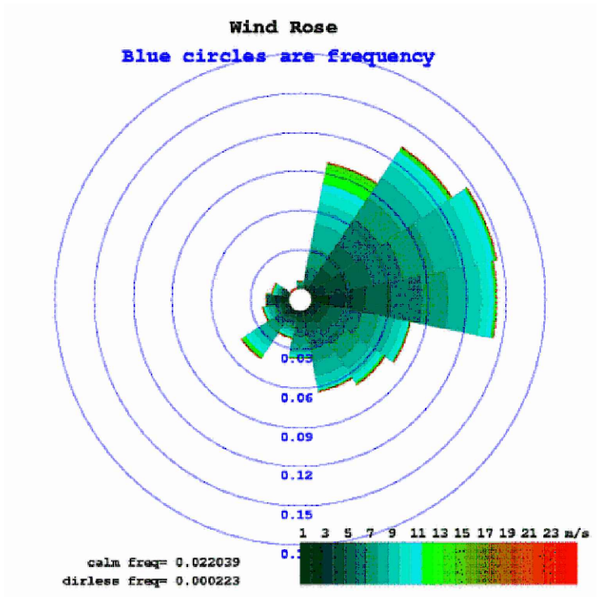
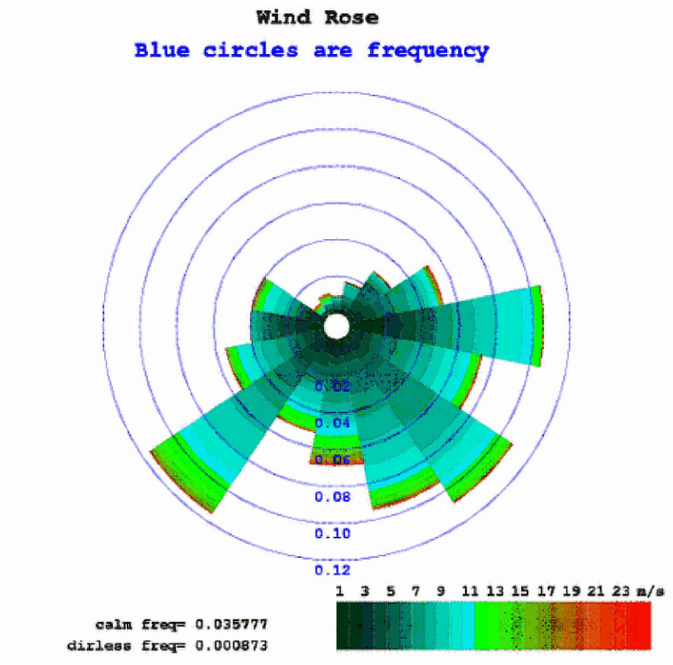


450m Summer Condition



120m Annual Condition



120m Summer Condition

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Contract title
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Site Formation and Infrastructure Works for
Eight Housing Sites in Ma On Shan - Site 1&2

Drawing title
Windrose Representing Velocity at 450m and 120m of the Area Under Concern of Referenced AVA Report For Ma On Shan Area

Drawing no.
Figure 2.2

Revision

Scale

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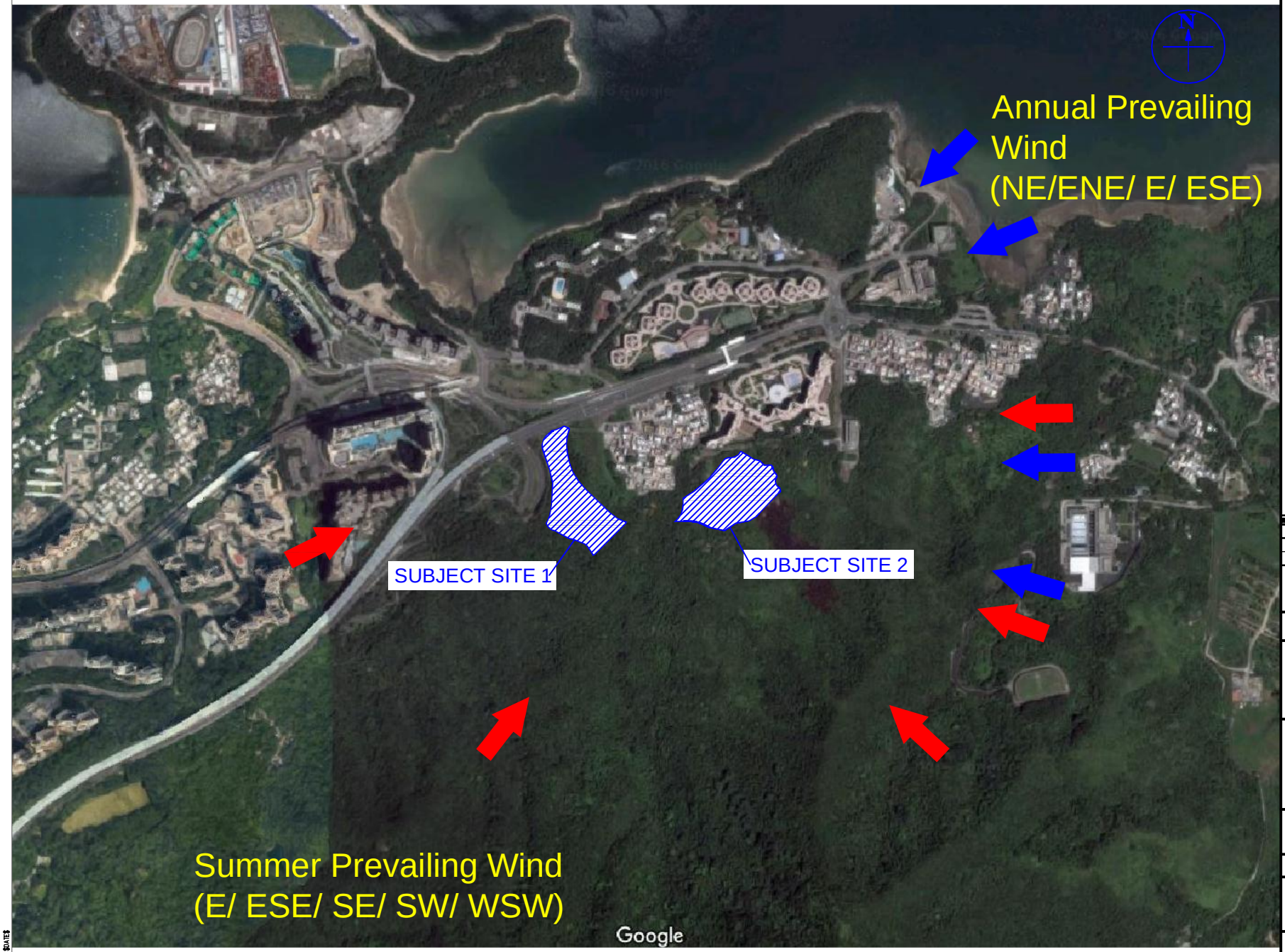

Summer Prevailing Wind

Annual Prevailing Wind

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Contract title
Agreement No. CE 80/2014
Site Formation and Infrastructure Works for
Eight Housing Sites in Ma On Shan - Site 1&2

Drawing title
Annual and Summer Prevailing Winds for Subject Site

Drawing no.
Figure 2.3

Revision

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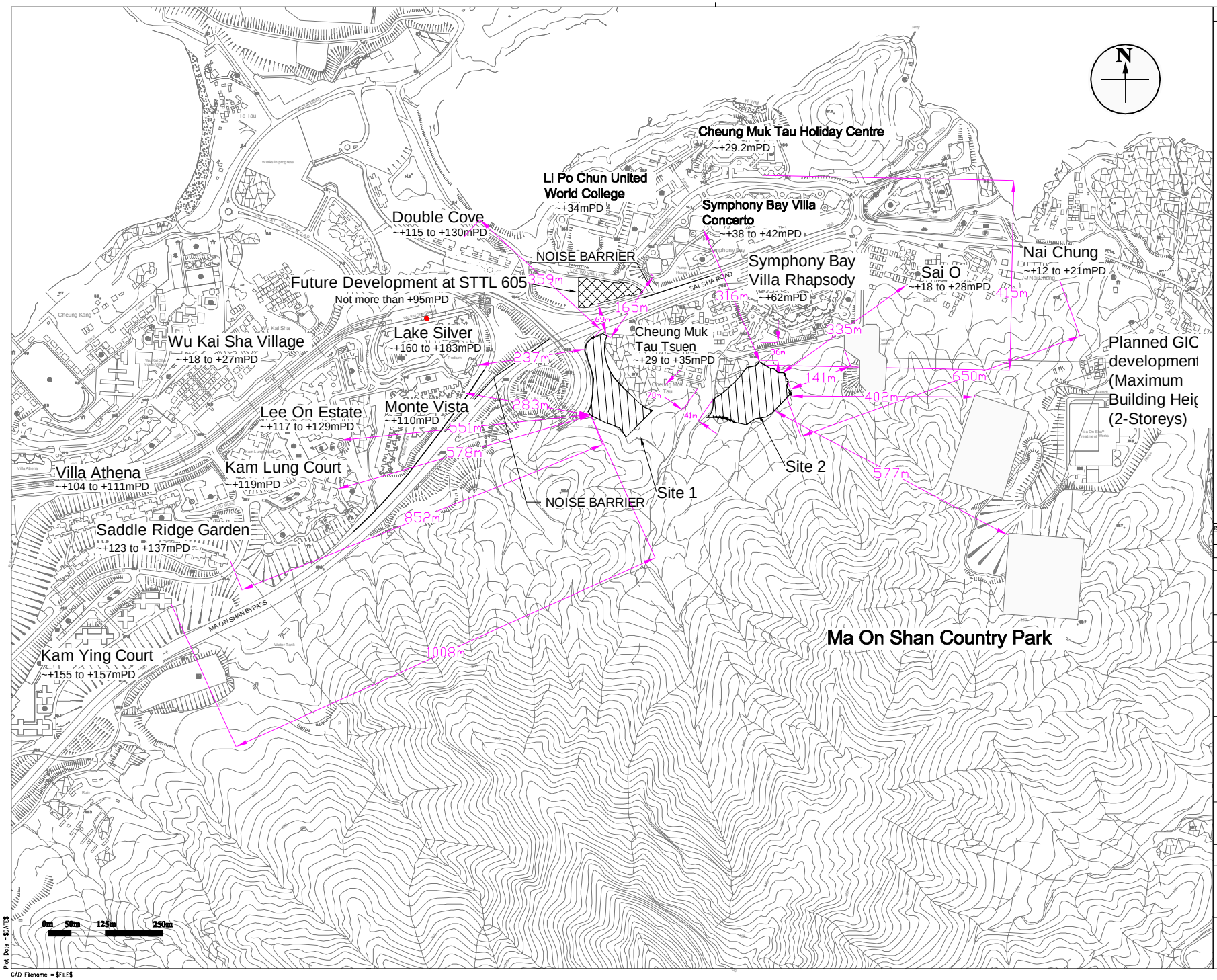

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Agreement No .CE 80/2014 Site Formation and Infrastructure Works for Eight Housing Sites in Ma On Shan - Site 1&2

Drawing title
Building Height of Existing and Future Neighbouring Development

Drawing no.
Figure 2.4

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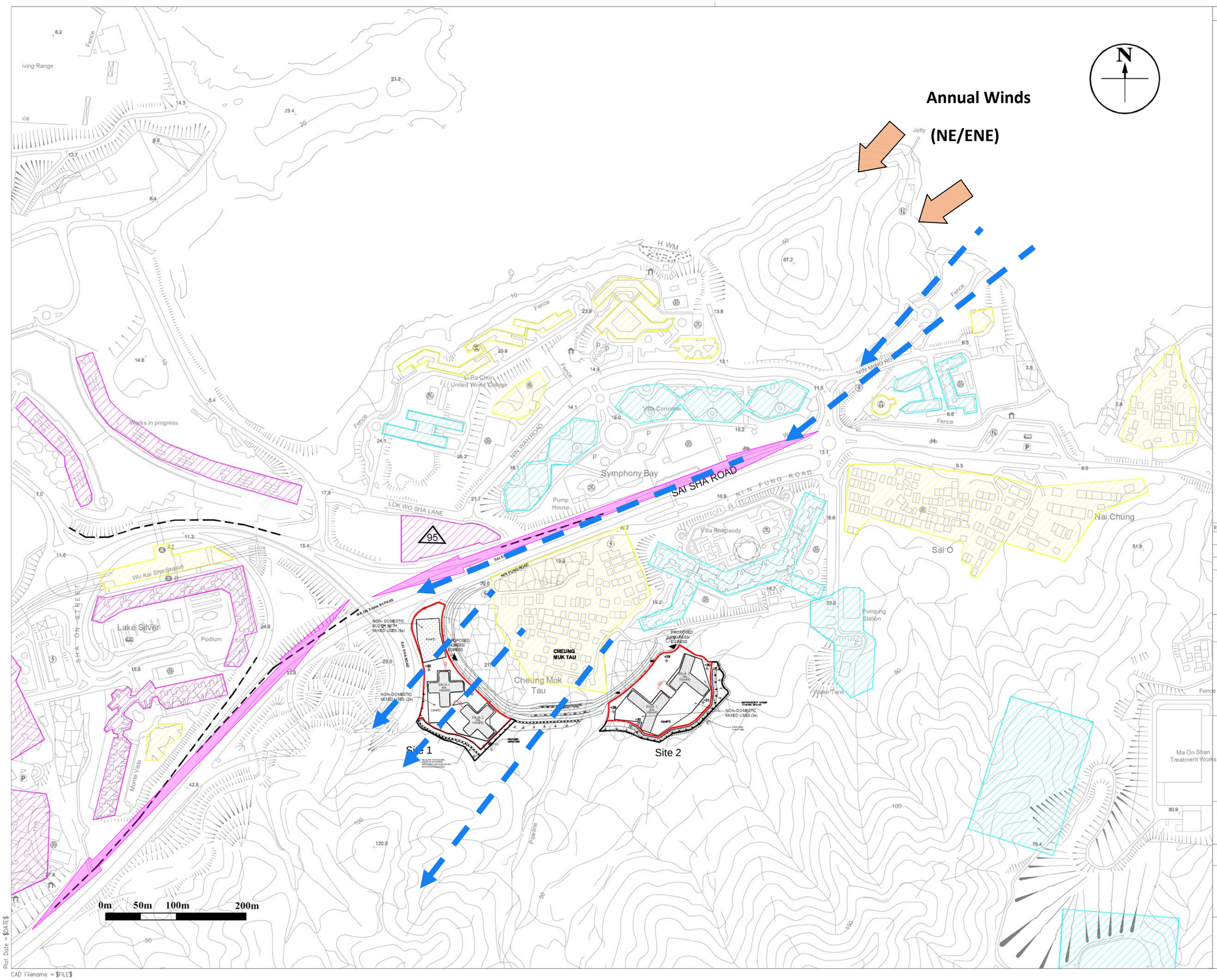

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Legend

- Low-rise Development
- Mid-rise Development
- High-rise Development
- Noise Barrier
- **Expected Wind flow**
- **Existing Breezeways**

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Contract title
Agreement No. CE 80/2014
Site Formation and Infrastructure Works for Eight Housing Sites in Ma On Shan - Site 2&1

Drawing title
Illustration of Wind Flow from NE and ENE Wind Direction

Drawing no.
Figure 3.1

Revision

Scale

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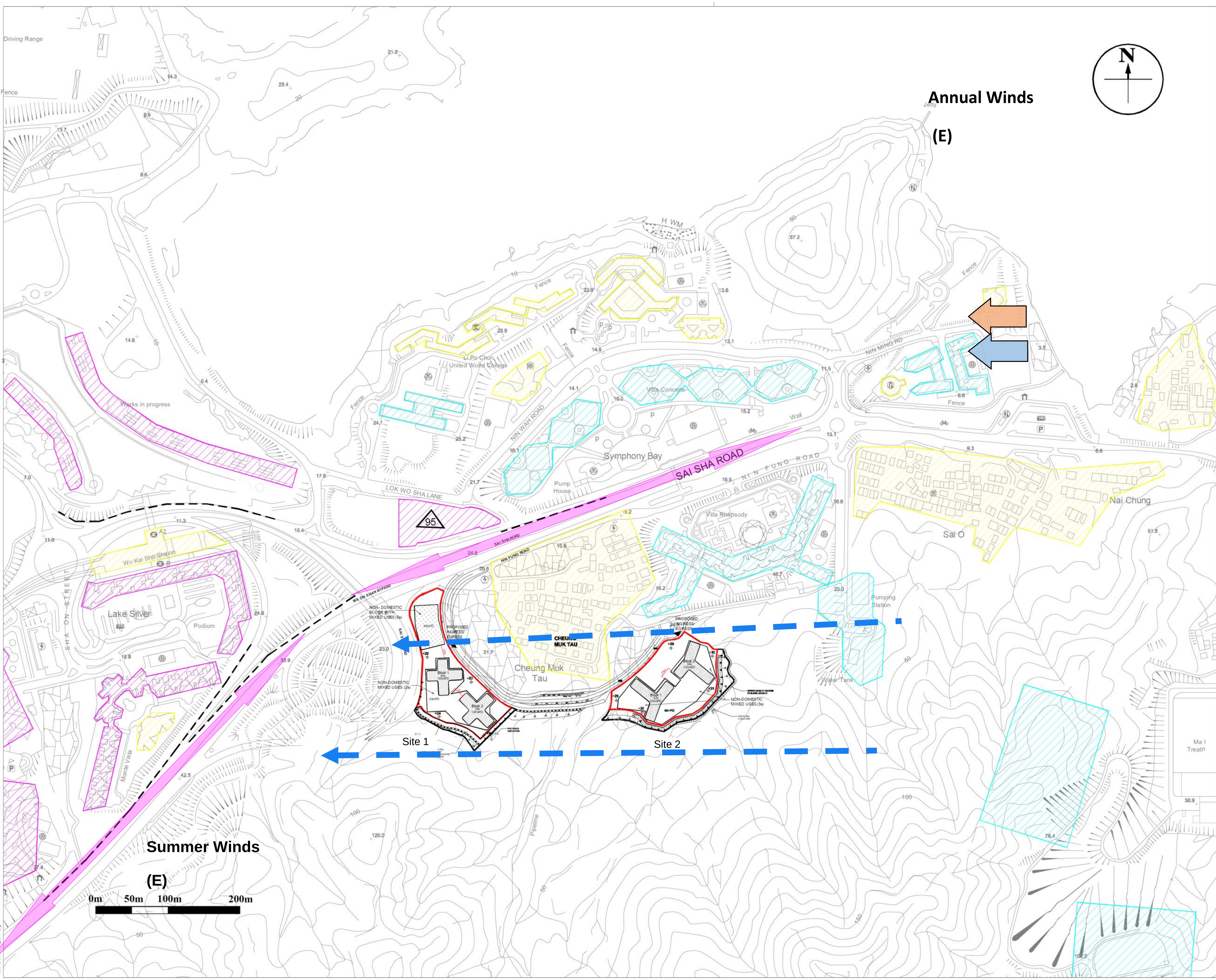

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Legend

- Low-rise Development
- Mid-rise Development
- High-rise Development
- Noise Barrier
- **Expected Wind flow**
- **Existing Breezeways**

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Contract title: Agreement No. CE 80/2014 Site Formation and Infrastructure Works for Eight Housing Sites in Ma On Shan - Site 2&1

Drawing title: Illustration of Wind Flow from E Wind Direction

Drawing no.: Figure 3.2

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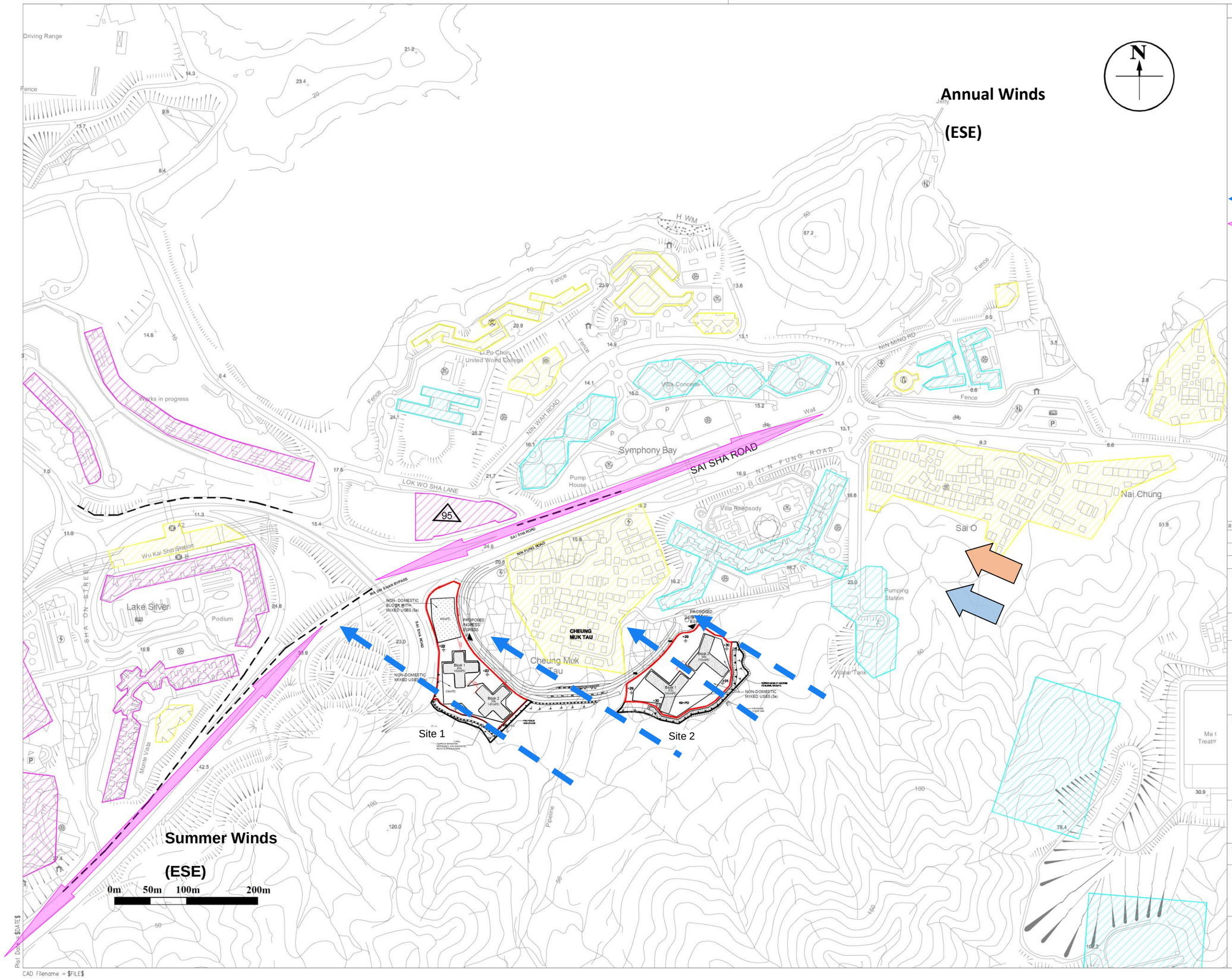

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Legend

- Low-rise Development
- Mid-rise Development
- High-rise Development
- Noise Barrier
- **Expected Wind flow**
- **Existing Breezeways**

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Contract title
Agreement No. CE 80/2014
Site Formation and Infrastructure Works for Eight Housing Sites in Ma On Shan - Site 2&1

Drawing title
Illustration of Wind Flow from ESE Wind Direction

Drawing no.
Figure 3.3

Revision

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Legend

- Low-rise Development
- Mid-rise Development
- High-rise Development
- Noise Barrier
- **Expected Wind flow**
- **Existing Breezeways**

Summer Winds

(SE)

0m 50m 100m 200m

Site 1

Site 2

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Site Formation and Infrastructure Works for
Eight Housing Sites in Ma On Shan - Site 2&1

Drawing title
Illustration of Wind Flow from
SE Wind Direction

Drawing no.
Figure 3.4

Revision

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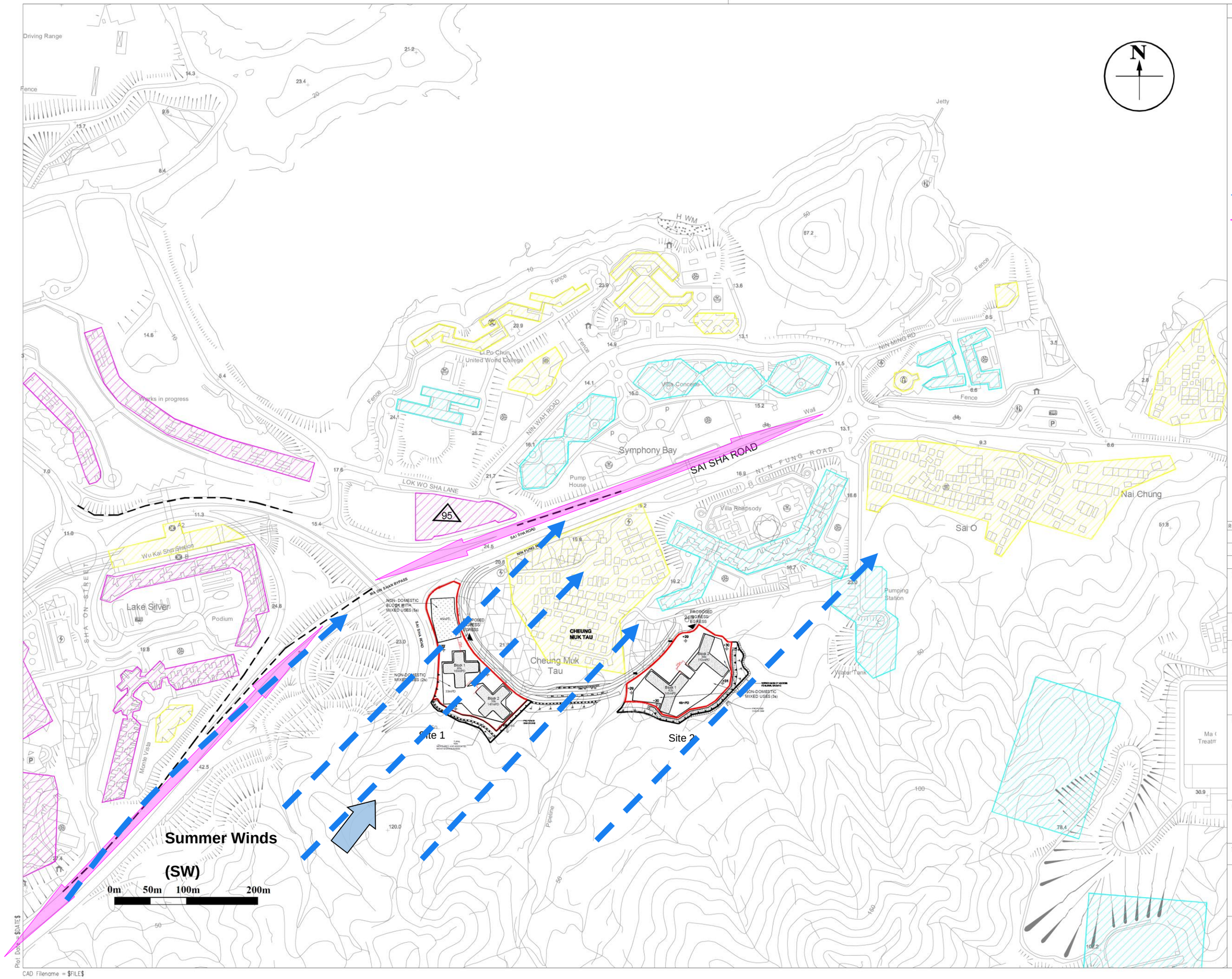

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Legend

- Low-rise Development
- Mid-rise Development
- High-rise Development
- Noise Barrier
- **Expected Wind flow**
- **Existing Breezeways**

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Contract title
Agreement No. CE 80/2014
Site Formation and Infrastructure Works for Eight Housing Sites in Ma On Shan - Site 2&1

Drawing title
Illustration of Wind Flow from SW Wind Direction

Drawing no.
Figure 3.5

Revision

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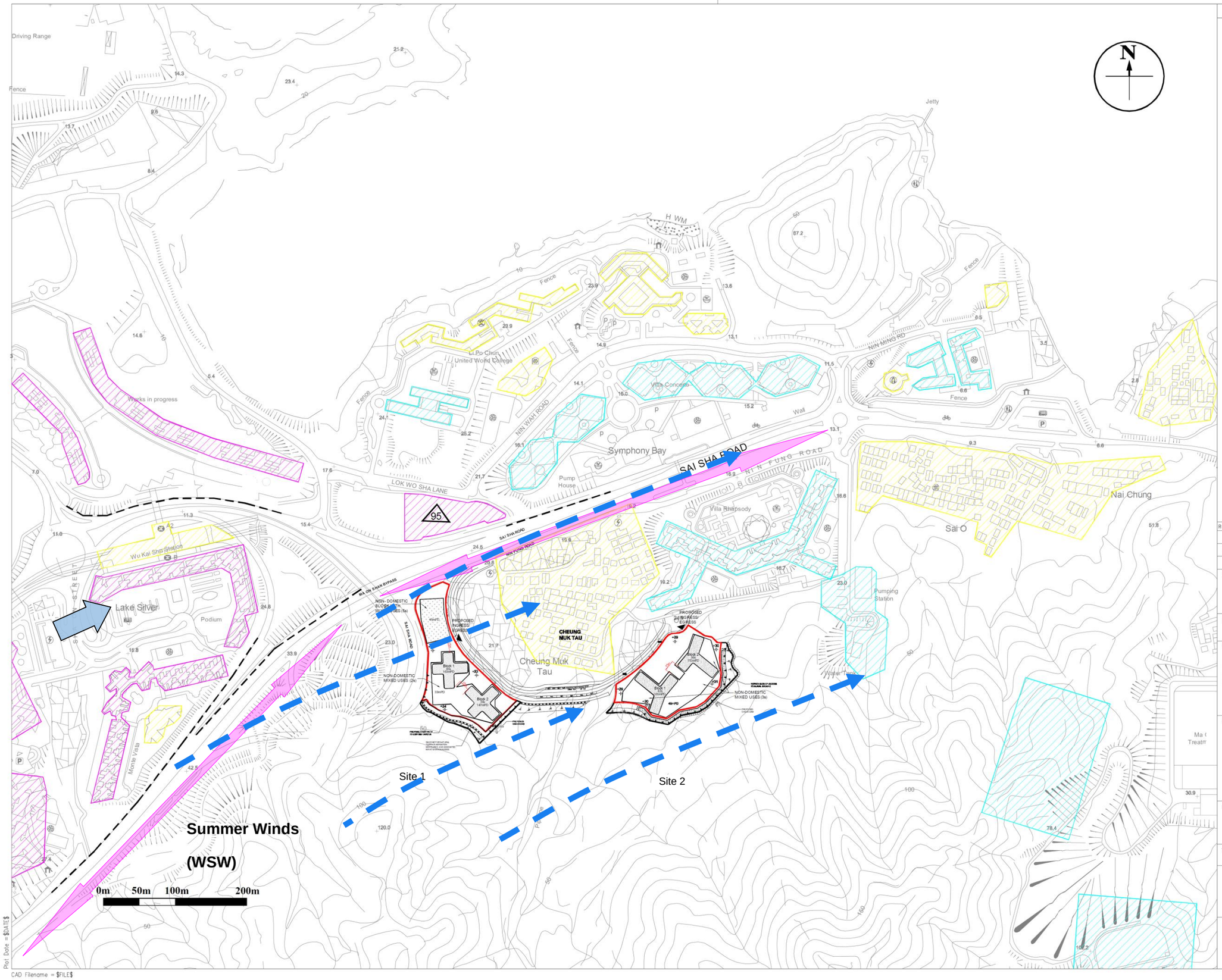

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Legend

- Low-rise Development
- Mid-rise Development
- High-rise Development
- Noise Barrier
- **Expected Wind flow**
- **Existing Breezeways**

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CE 80/2014 (CE)

Contract title
Agreement No. CE 80/2014
Site Formation and Infrastructure Works for Eight Housing Sites in Ma On Shan - Site 2&1

Drawing title
Illustration of Wind Flow from WSW Wind Direction

Drawing no.
Figure 3.6

Revision

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