Appendix H

Drainage Impact Assessment

Section 12A Planning Application for Proposed Amendments to the Tung Chung Valley Outline Zoning Plan to Rezone "Residential (Group C)2" Zone to "Residential (Group B)" Zone in Support of Private Residential Development at Various Lots in D.D. 1 Tung Chung and Adjoining Government Land, Tung Chung, Lantau Island

Drainage Impact Assessment

December 2024

Delivering a better world

Prepared by:

AECOM Asia Company Limited
11/F, Tower 2, Grand Central Plaza, 138 Shatin Rural Committee Road, Shatin
Hong Kong
aecom.com

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1. Introduction

1.1 Background

1.1.1 AECOM Asia Company Limited (AECOM) was commissioned by the project proponent to act as the engineering consultant to conduct a Drainage Impact Assessment (DIA) for a private residential development in Tung Chung, Lantau Island.

1.1.2 The Application Site, with a total site area of 33,808m^2, is mostly covered by vegetation and with some open space areas and car parking areas. The Site is located at the west side of Chung Mun Road, within Ngau Au. The Application Site is also next to the river outfall of Tung Chung Bay. The location of the Application Site is shown in **DIA/Figure 1**.

1.1.3 The Application Site is currently zoned "Residential (Group C)2" with a maximum plot ratio of 1 on the Approved Tung Chung Valley Outline Zoning Plan No. S/I-TCV/2. The Applicant now proposes to increase the domestic plot ratio to not more than 2.10 to optimise valuable land resources and infrastructural capacity.

1.1.4 This DIA report serves as a supporting document for rezoning the Site from "Residential (Group C)2" Zone to "Residential (Group B)" Zone.

1.2 Objective of this Submission

1.2.1 This report outlines the assessment results of the potential drainage impact caused by the Proposed Development at the Application Site. The main objectives of this assessment include the followings:

(i) Review the existing stormwater drainage condition;

(ii) Outline the methodology adopted in this assessment;

(iii) Outline changes to the drainage characteristics and potential drainage impacts which may arise from the Application Site;

(iv) Propose drainage mitigation measures where appropriate to mitigate the potential drainage impact.

1.3 Nomenclature

1.3.1 The following abbreviations and shortened expressions in **Table 1** are adopted in this report.

AECOM	AECOM Asia Company Limited
DSD	Drainage Services Department
GFA	Gross Floor Area
mPD	Metres above Principal Datum
PlanD	Planning Department
SDM	Stormwater Drainage Manual (5th edition, DSD)
DIA	Drainage Impact Assessment

Table 1 – Nomenclature

2. Development Proposal

2.1 The Proposed Development

2.1.1 The Application Site area is approximately 33,808m^2. The Application Site consists of 9 residential blocks, 1 covered private transport lay-by, 1 kindergarten and retail facilities. The residential blocks are ranging from 6 to 22 storeys above a 1 to 3-storey podium, providing about 1,783 units in total.

2.1.2 The anticipated population intake year of the Application Site is 2030.

2.1.3 The Master Layout Plan (MLP) of the Application Site is shown in **DIA/Figure 2**. The proposed development schedule is summarized in **Table 2** below.

Table 2 – Key Development Parameters

	Proposed Development
Site Area	About 33,808m^2
GFA - **Domestic Portion** - **Non-Domestic Portion**	About 78,292m^2 About 70,997m^2 About 7,295m^2
Plot Ratio - **Domestic Portion** - **Non-Domestic Portion**	Not more than 2.32 Not more than 2.10 Not more than 0.22
Maximum Site Coverage	Not more than 33.3%
Maximum Building Height (main roof level) - **Area (a)** - **Area (b)** - **Area (c)**	 Not more than 50mPD Not more than 80mPD Not more than 100mPD
No. of Storeys (1)	6 to 22 storeys above a 1 to 3 storey(s) podium
Domestic Portion	
Domestic GFA	About 70,997m^2
Domestic Plot Ratio	Not more than 2.10
No. of Blocks	9
No. of Units	About 1,783
Average Flat Size	About 39.8m^2
Anticipated Population (2)	About 5,171
Private Open Space (3)	Not less than 5,171m^2
Non-Domestic Portion – Commercial and Covered Private Transport Lay-by	
Commercial GFA (4)	About 4,145m^2
Covered Private Transport Lay-by GFA	About 3,150m^2
Maximum Building Height	Not more than 19mPD
Residents' Clubhouses (5)	
Clubhouse GFA	About 3,000m^2
No. of Storeys	1

Remarks:

(1) Excluding basement floor(s) for car park and transfer plate; including above ground floors for commercial / covered private transport lay-by / ramp / E&M facilities / clubhouse / residential lobby / residential floors. The indicative typical floor-to-floor height is 3.25m which is subject to refinement at detailed design stage.
(2) Adopting a person per flat ratio of 2.9 as per Tertiary Planning Units 950 – 951 under 2021 Population Census covering the Application Site
(3) Not less than 1m^2 per person in accordance with Hong Kong Planning Standards and Guidelines (HKPSG) requirement
(4) Commercial GFA refers to commercial uses ('Eating Place' and 'Shop and Services'), 'School' (kindergarten, nursery, language, computer, commercial and tutorial schools, art school, ballet and other types of schools providing interest / hobby related courses), 'Place of Entertainment' and 'Place of Recreation, Sports or Culture'. A kindergarten with a GFA of about 930m^2 is proposed.
(5) Residents' clubhouse GFA is based on the maximum GFA concession for clubhouse according to Buildings Department's Practice Note APP-104 and shall be disregarded from the total GFA calculation

3. Assessment Methodology

3.1 Drainage Impact Assessment Methodology

3.1.1 This assessment is carried out to assess the possible drainage impact arising from the Application Site on the drainage system. The Assessment is carried out in accordance with the requirements stated in "Advice Note No.1 – Application of the Drainage Impact Assessment Process to Private Sector Projects" issued by Drainage Services Department (DSD). Design parameters adopted are referenced to DSD's 5th Edition of Stormwater Drainage Manual (SDM) 2018 and SDM Corrigendum No. 1/2022, which are summarised in **Table 3**.

Design Standard	1 in 50-year storm event
Rainfall Zone	West Lantau Area
Design Storm Parameters	a = 1107.2; b = 13.01; c = 0.484
Rainfall Intensity	$i = \frac{a}{(t_d + b)^c}$
Peak Runoff Estimation	Rational Method
Runoff Coefficient	0.95 for paved area; 0.35 for unpaved area
Pipe Sediment	10% reduction in pipe area
Pipe Roughness	ks=0.003mm for PE100 pipes
Rainfall increases due to Climate Change	16%
Design Allowance	12.1%

Table 3 – Adopted Parameters in Drainage Impact Assessment

3.2 Climate Change

3.2.1 Design consideration on rainfall due to climate change has been incorporated into the 5th Edition of Stormwater Drainage Manual and Stormwater Drainage Manual Corrigendum No. 1/2022.

3.2.2 According to Section 6.8 replacement mentioned in Stormwater Drainage Manual Corrigendum No. 1/2022- In general, drainage provision in new development areas should consider the climate change effects up to the end of 21st century plus design allowance.

3.2.3 According to DSD's SDM, rainfall allowance due to the effect of climate change should be considered in drainage impact assessments. With reference to the SDM Corrigendum No. 1/2022, a 16% increase in rainfall intensity by the end of the 21st century and a 12.1% design allowance has been considered for this assessment.

4. Review on Existing Drainage System

4.1 Existing Drainage System

4.1.1 The Application Site is situated between Tung Chung Stream and Chung Mun Road adjacent to Tung Chung Bay. The Application Site is currently comprising with village houses, open space and unpaved area covered with vegetation.

4.1.2 The Application Site generally falls towards Tung Chung Bay, surface runoff of the site relies on overland flow discharge to the sea. The road level of existing Chung Mun Road was constructed at a higher level than the site.

4.1.3 An existing 5-cell 4500mm(W) x 3400mm(H) box culvert is identified under Chung Mun Road at the east of the Application Site. Whereas a corner of this box culvert falls within the Application Site boundary. According to information received from DSD, there is no proposed stormwater drainage connection to the concerned 5-cell box culvert under CEDD's Tung Chung New Town Extension (West) project, therefore DSD advised Drainage Reserve (DR) is not necessary for the concerned 5-cell box culvert at this juncture. The location of the existing 5-cell box culvert can be referred to Figure 3, adjacent to the proposed residential Tower 7.

4.2 Impact on Existing Drainage System

4.2.1 Rational Method is adopted for estimation of the runoff from the pre-development and post-development scenarios. About 30% greenery area will be provided for the Application Site according to the minimum site coverage of Greenery from Buildings Department.

4.2.2 The Pre-development and Post-development surface runoff have been compared, pre-development surface runoff is 1.64m^3/s and post-development runoff is 2.54m^3/s. About 0.9m^3/s increase in surface runoff is expected after the Application Site due to the change of land use. Details of runoff estimation refer to **Annex 1.** A summary of the surface runoff calculation is shown in **Table 4** below.

	Paved area (m^2)(2)	Unpaved area (m^2)(2)	Rainfall intensity (mm/hr)(1)(3)	Total surface runoff (m^3/s)
Application Site				
Pre-Development	8,452	25,356	350	1.64
Post-Development	23,666	10,142	350	2.54
			Net Increase	**0.90**

Table 4 – Summary of Surface Runoff

Notes:

1) Please refer to Annex 1 for estimation of rainfall intensity.
2) According to satellite image, percentages of paved area and unpaved area adopted for pre-development are:
   Pre-development: 25% paved and 75% unpaved
   Post-development: 70% paved and 30% unpaved
3) 16% rainfall increase + 12.1% design allowance for climate change has been considered.

5. Proposed Drainage System

5.1 Proposed Stormwater Attenuation and Treatment Pond by CEDD

5.1.1 With reference to information provided by CEDD, 7 nos. of stormwater attenuation and treatment ponds are being constructed under CEDD Contract No. NL/2020/06 Tung Chung New Town Extension – Site Formation and Infrastructure Works at Tung Chung Valley, Phase 1.

5.1.2 The Application Site is within the drainage catchment of one of the stormwater attenuation and treatment ponds (i.e. Pond A07). According to CEDD's information provided, the Pond A07 is to collect the surface runoff of drainage catchments between Chung Mun Road and Yu Tung Road. The location of the Pond A07 refers to **DIA/Figure 4**.

5.2 Proposed Drainage Arrangement

5.2.1 Further to Section 5.1, a series of DN1200 and 3 x DN900 public drainage pipe (i.e. STMH7.1.05a to Pond A07) are constructed by CEDD for Area 60 drainage connection and handed over to DSD's maintenance. The proposed public drainage arrangement constructed by CEDD refers to **DIA/Figure 4**.

5.2.2 Proposed terminal manhole no. STMH1 of the Application Site would collect and convey the surface runoff via a DN1200 public drainage pipe to public drainage manhole no. STMH7.1.05b and finally discharge to Pond A07 which is constructed by CEDD and maintained by DSD.

5.2.3 Part of the public drainage pipe (i.e. manhole no. STMH7.1.05a to manhole no. STMH1) and manhole no. STMH7.1.05a are located within Area 60 and proposed be demolished.

5.2.4 Surface runoff generated from the development will be collected by internal drainage system and conveyed to terminal manhole no. STMH1 for discharge to public drainage system. The size and detailed arrangement of the internal drainage system and perimeter drains for the development will be further reviewed in the detailed design stage.

5.2.5 With the proposed drainage arrangement, no adverse impact is anticipated on drainage aspect. The hydraulic checking of the proposed DN1200 public drainage pipe by CEDD refers to **Annex 2**.

5.3 Review of Drainage Impact by other planned developments and planned drainage improvement works

5.3.1 Refer to DSD Advice Note No.1, to assess the possible flooding susceptibility of existing Area 60, CEDD has been consulted to acquire the boundary condition in the vicinity of Pond A07. According to CEDD's information provided, the water level of worst-case scenario under 50-year and 200-year (i.e. 50B and 200B) return period is +5.55 mPD and +5.99 mPD respectively. The Applicant will raise the formation level of proposed development higher than the flood level with provision of perimeter drains for the development as mentioned in Section 5.2.2. With the mitigation measures mentioned above, no adverse drainage impact to Area 60 is anticipated.

6. Maintenance Responsibility

6.1.1 The Applicant will be responsible for construction and maintenance of all necessary drainage system for the development within the development site, including the proposed site formation drainage channels and internal drainage networks within the private development portion.

6.1.2 The Applicant will be responsible for construction and maintenance of proposed terminal manhole no. STMH1. The connected 1200mm dia. public drainage pipe after proposed terminal manhole no. STMH1 are constructed by CEDD and handed over to DSD for future maintenance.

6.1.3 There is a twin 900mm diameter drainage outfall pipe crossing the northern part of the Application Site as shown in **Figure 4**. This outfall is public drainage system to release storm water from Pond A07 to Tung Chung Bay. Drainage Reserve would be provided following Stormwater Design Manual's advisory requirement and sufficient headroom will be provided for the entire section of outfall within the Application Site to facilitate future maintenance by DSD. Drainage Reserve details will be discussed with DSD during detail design stage.

7. Conclusion

7.1.1 The Application Site is designated for residential use under the current OZP with a plot ratio of 1. The Applicant proposes to have a domestic plot ratio of 2.1 for the site by rezoning the site from "R(C)2" to "R(B)". The DIA has been carried out to assess the potential drainage impact due to the proposed development.

7.1.2 The pre-development surface runoff is 1.64m^3/s and post-development runoff is 2.54m^3/s. About 0.9m^3/s increase in surface runoff is expected after the Application Site with optimization of development intensity.

7.1.3 Proposed terminal manhole no. STMH1 of the Application Site would collect and convey the surface runoff via a DN1200 and finally discharge to Pond A07 which is constructed by CEDD and maintained by DSD.

7.1.4 Based on the hydraulic assessment, it is envisaged that the Application Site will not have an adverse impact on the existing drainage system.

End of Report

Figures

ISO A1 594mm x 841mm

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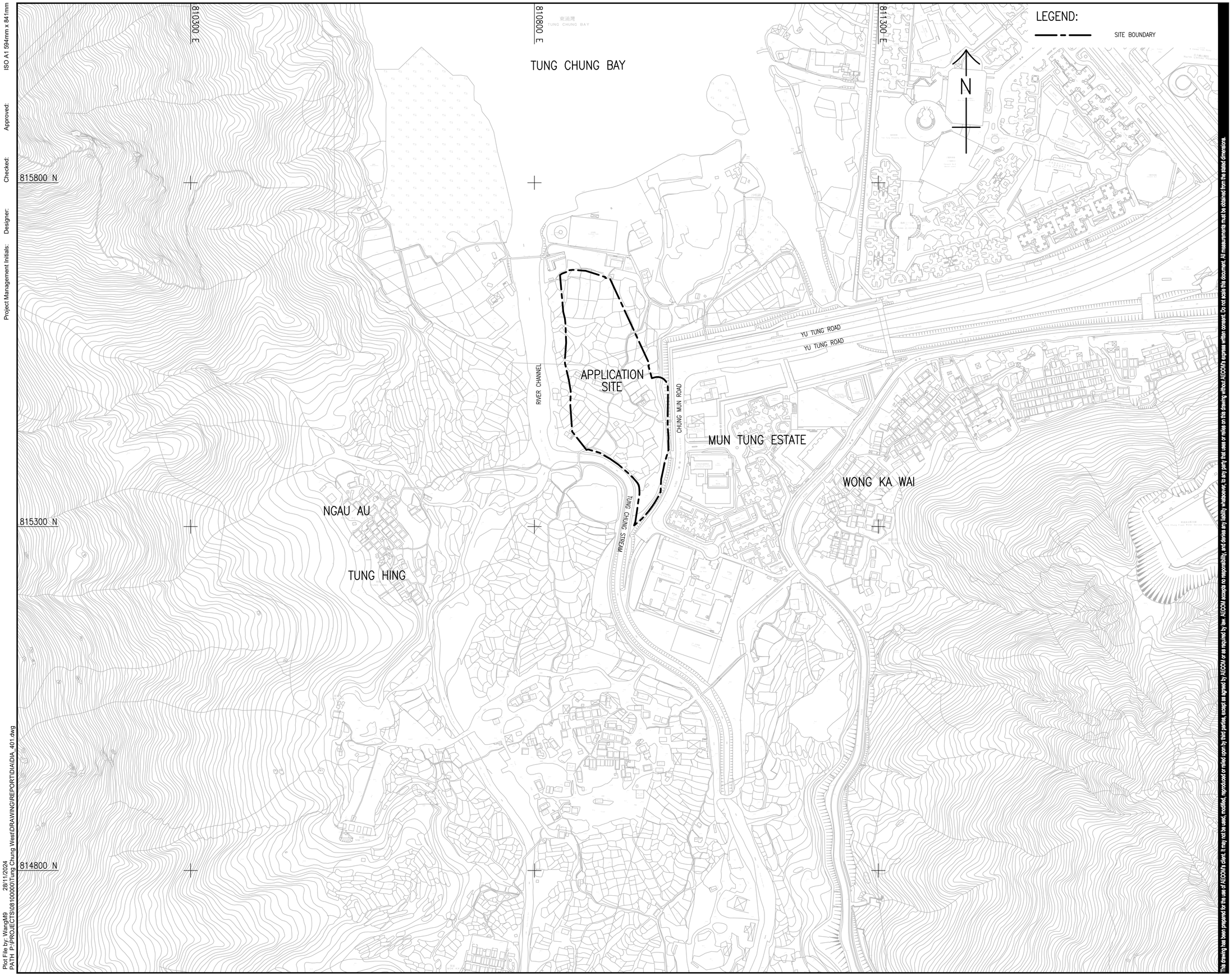
Designer:

Project Management Initials:



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SUN HUNG KAI REAL ESTATE AGENCY LTD. 新鴻基地產代理有限公司

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工程顧問公司

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AGREEMENT NO. 協議編號

TUNG CHUNG WEST

SHEET TITLE
圖紙名稱

LOCATION PLAN

SHEET NUMBER
圖紙編號

TUNG CHUNG WEST/DIA/FIGURE 1

ISO A1 594mm x 841mm

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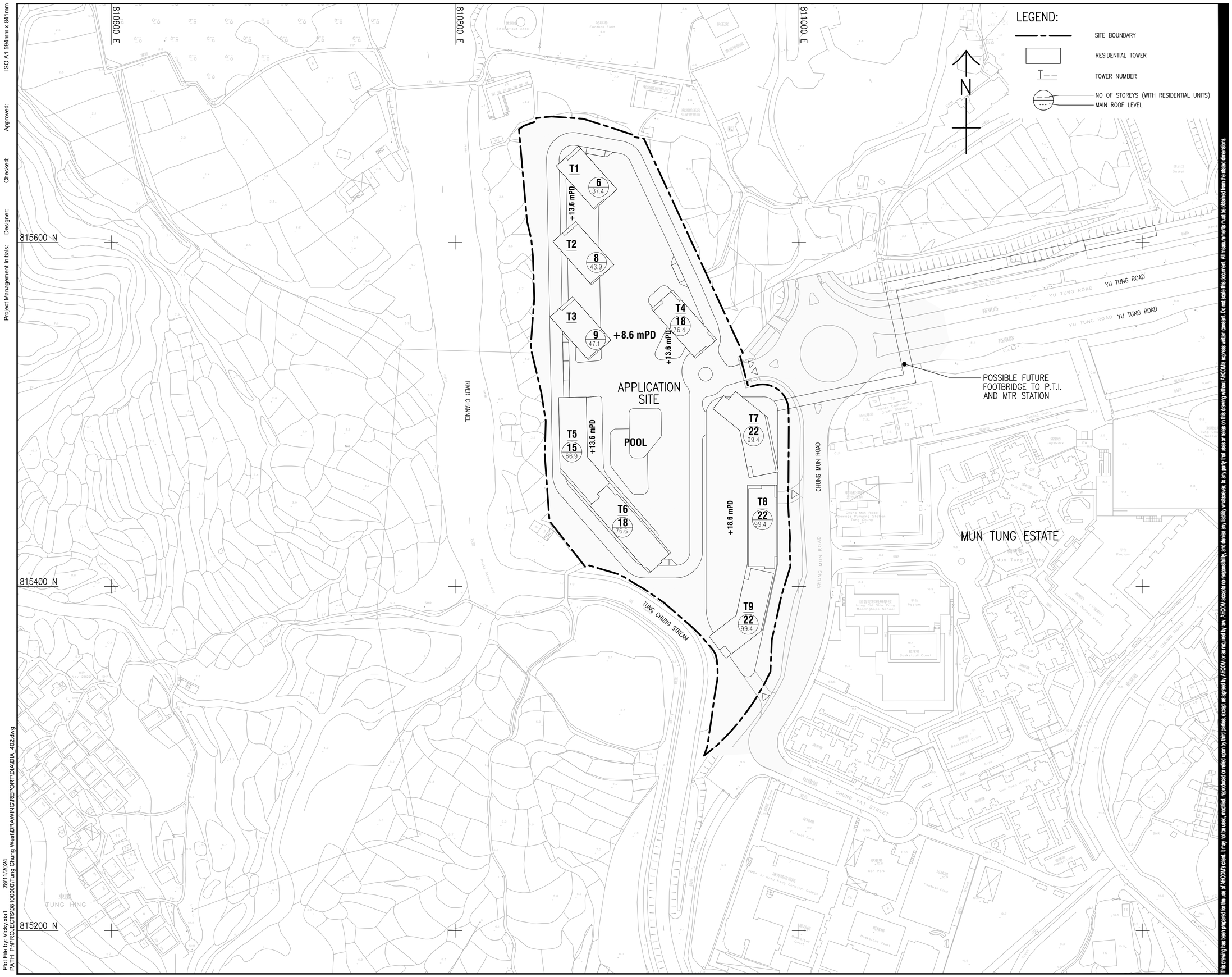

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PROJECT NO. 項目編號

AGREEMENT NO. 協議編號

TUNG CHUNG WEST

SHEET TITLE
圖紙名稱

MASTER LAYOUT PLAN

SHEET NUMBER
圖紙編號

TUNG CHUNG WEST/DIA/FIGURE 2

ISO A1 594mm x 841mm

Approved:

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Project Management Initials:

LEGEND:

- SITE BOUNDARY
- EXISTING STORM WATER MANHOLE
- 450 EXISTING STORM DRAIN
- 300UC EXISTING U CHANNEL
- RESIDENTIAL TOWER
- T-- TOWER NUMBER
- NO OF STOREYS (WITH RESIDENTIAL UNITS)
- MAIN ROOF LEVEL

810800 E

811000 E

811200 E

815600 N

815400 N

815200 N

N

T1 6 (37.4) +13.6 mPD

T2 8 (43.9)

T3 9 (47.1) +8.6 mPD

T4 18 (76.4) +13.6 mPD

APPLICATION SITE

T5 15 (66.9) +13.6 mPD

POOL

T6 18 (76.6)

T7 22 (99.4)

T8 22 (99.4) +18.6 mPD

T9 22 (99.4)

RIVER CHANNEL

TUNG CHUNG STREAM

CHUNG MUN ROAD

YU TUNG ROAD

POSSIBLE FUTURE FOOTBRIDGE TO P.T.I. AND MTR STATION

MUN TUNG ESTATE

CHUNG YAT STREET

TUNG HING

AECOM

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TUNG CHUNG WEST

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EXISTING DRAINAGE LAYOUT PLAN

SHEET NUMBER 圖紙編號

TUNG CHUNG WEST/DIA/FIGURE 3

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Project Management Initials:

LEGEND:

- SITE BOUNDARY
- STORM WATER DRAIN TO BE CONSTRUCTED BY CEDD
- STORM WATER DRAIN TO BE CONSTRUCTED BY APPLICANT
- STORM WATER MANHOLE TO BE CONSTRUCTED BY CEDD
- STORM WATER MANHOLE TO BE CONSTRUCTED BY APPLICANT
- EXISTING STORM WATER MANHOLE
- 450 EXISTING STORM DRAIN
- 300UC EXISTING U CHANNEL
- RESIDENTIAL TOWER
- T-- TOWER NUMBER
- NO OF STOREYS (WITH RESIDENTIAL UNITS)
- MAIN ROOF LEVEL
- STORM WATER DRAIN TO BE DEMOLISHED BY APPLICANT
- STORM WATER MANHOLE TO BE DEMOLISHED BY APPLICANT

810800 E
811000 E
811200 E
815600 N
815400 N
815200 N

SMHA07.02.02
2x900ø
2x900ø
DISCHARGE TO TUNG CHUNG BAY
STORMWATER ATTENUATION AND TREATMENT POND A07 TO BE CONSTRUCTED BY CEDD
CONNECTION TO STORMWATER ATTENUATION AND TREATMENT POND A07
3x900ø
1200ø
1200ø
STMH7.1.05b
STMH7.1.05a
STMH-1
POSSIBLE FUTURE FOOTBRIDGE TO P.T.I. AND MTR STATION

T1 6 37.4 +13.6 mPD
T2 8 43.9
T3 9 47.1 +8.6 mPD
T4 18 76.4 +13.6 mPD
T5 15 66.9 +13.6 mPD
T6 18 76.6
T7 22 99.4
T8 22 99.4 +18.6 mPD
T9 22 99.4

POOL
APPLICATION SITE
RIVER CHANNEL
TUNG CHUNG STREAM
CHUNG MUN ROAD
MUN TUNG ESTATE
YU TUNG ROAD
YU TUNG ROAD YU TUNG ROAD
CHUNG YAT STREET
TUNG HING

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TUNG CHUNG WEST

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DRAINAGE LAYOUT PLAN

SHEET NUMBER 圖紙編號

TUNG CHUNG WEST/DIA/FIGURE 4

Annex 1

Surface Runoff Estimation

Application Site: Area 60 in Tung Chung

Annex 1: Surface Runoff Estimation - Rational Method

Rainfall Return Period : 1 in 50

Return Period 50-year

Rainfall Intensity $i = \frac{a}{(t_d + b)^c}$ SDM Table 3a

a =	1107.2	
b =	13.01	
c =	0.484	(West Lantau Area)
t_d =	Duration in minutes	Assumed
=	**5**	min
i =	273	
Climate Change (End of 21 st Century) =	16.0%	Table 28 Corrigendum No.1/2022
Design Allowance =	12.1%	Table 31 Corrigendum No.1/2022

The design rainfall intensity with climate change allowance is 350mm/hr.

Using Rational Method to calculate the runoff for Pre / Post Development:

Q_p = 0.278CiA

C = runoff coefficient

i = rainfall intensity in mm/hr

A = catchment area in km^2

Pre-Development

	Application Site		Total Runoff (m^3/s)
	Paved	Unpaved	
Site Area (m^2)	8,452	25,356	
Runoff coefficient (c)	0.95	0.35	
Rainfall intensity (i)	273	273	
Rainfall intensity including climate change	350	350	
Runoff (Q)	0.78	0.86	**1.64**

Post-Development

	Application Site		Total Runoff (m^3/s)	
	Paved	Unpaved		
Site Area (m^2)	23,666	10,142		
Runoff coefficient (c)	0.95	0.35		
Rainfall intensity (i)	273	273		
Rainfall intensity including climate change	350	350		Net Increase
Runoff (Q)	2.19	0.35	**2.54**	0.90

(1) The following paved/unpaved ratio is adopted for existing scenario according to satellite image, Pre-development: 25% paved and 75% unpaved

(2) The 70% paved and 30% unpaved ratio is assumed for proposed scenario in accordance with Section 18, APP-152 (Practical Notes for AP/RSE/RGE), Buildings Department.

Annex 2

Hydraulic Checking for Proposed DN1200 Stormwater Pipe by CEDD

Application Site: Area 60 in Tung Chung

Annex 2: Hydraulic Check for Proposed DN1200 Stormwater Pipe by CEDD

Post-development

The full-bore capacity of the pipe is calculated using the Colebrook-White Equation:

$$V = -\sqrt{8gDs}\log\left[\frac{k_s}{3.7D} + \frac{2.51v}{D\sqrt{2gDs}}\right]$$

where	V =	velocity of the pipe flow	m/s	
	s =	proposed pipe gradient	m/m	
	=	0.006451613		(1 in 155)
	k_s =	pipe roughness value		SDM Table 14
	=	0.15	x 10^{-3} m	Precast concrete pipe with 'O' joints in normal condition
	v =	kinematic viscosity of fluid		
	=	0.000001	m^2/s	
	D =	Proposed pipe diameter		
	=	**1200**	mm	
	=	1.2	m	
	V =	3.44	m/s	
		Assume 10% reduction in pipe area for siltation effect		
	A =	1.02	m^2	
	Available Pipe capacity Q_a =	V x A		
	=	3.50	m^3/s	
	Number of Pipe Provided =	2		
	Total Available Pipe Capacity Q_T =	6.99	m^3/s	
		Peak runoff generated from the proposed development,		50-year
	Q_p =	2.54	m^3/s	
	>	Q_p		
	Capacity Check =	36.3%		
	=>	**OK**		

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