URBAN GREEN

Section 12A Application for Proposed Rezoning from "Government, Institution or Community" to "Government, Institution or Community (6)" at Tuen Mun, New Territories and to Amend the Notes of the Zone Applicable to the Site for the Proposed Social Welfare Facility (Residential Care Home for the Elderly) at Section C of Lot No. 496 in D.D 132 and the adjoining Government Land, Tuen Mun, New Territories

Drainage Impact Assessment Report

Reference: P166-DIA-I1
Date: 16 June 2026
Confidential

Section 12A Application for Proposed Rezoning from "Government, Institution or Community" to "Government, Institution or Community (6)" at Tuen Mun, New Territories and to Amend the Notes of the Zone Applicable to the Site for the Proposed Social Welfare Facility (Residential Care Home for the Elderly) at Section C of Lot No. 496 in D.D 132 and the adjoining Government Land, Tuen Mun, New Territories

Drainage Impact Assessment Report

Checked and Approved by:

Joan Choi
Director

Reference: P166-DIA-I1

Date: 16 June 2026

Issue	Prepared By	Date	Checked by	Date	Approved By	Date
1	Cheryl Chan	16 Jun 26	Joan Choi	16 Jun 26	Joan Choi	16 Jun 26

23/F Wui Tat Centre, 55 Connaught Road West, Hong Kong
Tel: (852) 3114 1144

Contents

1 Introduction 1

1.1 Background 1

1.2 Study Objectives 1

1.3 Report Structure 1

2 Site Context 2

2.1 Site Characteristic and Proposed Uses 2

2.2 Operation Year 2

2.3 Existing Drainage Condition 2

3 Drainage Analysis 4

3.1 Identified Catchments 4

3.2 Surface Characteristics of the Proposed Development 4

3.3 Proposed Drainage System 4

3.4 Assessment Methodology and Assumptions 5

3.5 Assessment Results 5

3.6 Climate Change 7

3.7 Proposed Upgrading Works 1

4 Conclusion 2

List of Figures

Figure 2.1	Site Location and its Environs
Figure 3.1	Identified Catchment Areas
Figure 3.2	Existing and Proposed Drainage System
Figure 3.3	Proposed Upgrading Works

List of Tables

Table 2.1	Development Parameters
Table 3.1	Surface Characteristics
Table 3.2	Percentage of Utilized Capacity of Existing Drainage System
Table 3.3	Percentage of Utilized Capacity of Proposed Drainage System
Table 3.4	Percentage of Utilized Capacity of Existing Drainage System with 11.1% and 16% of Rainfall Increase
Table 3.5	Percentage of Utilized Capacity of Proposed Drainage System with 11.1% and 16% of Rainfall Increase
Table 3.6	Percentage of Utilized Capacity of the Upgrading Work at Pipe between SMH1024712 to SMH1024709

List of Appendices

Appendix A	Proposed Layout Plan
Appendix B	Detailed Drainage Analysis
Appendix C	Detailed Drainage Analysis with 11.1% of Rainfall Increase
Appendix D	Detailed Drainage Analysis with 16% of Rainfall Increase
Appendix E	DIA of Planning Application no. A/TM/422
Appendix F	BRAVO Record of Tuen Mun North Offtake and Pigging Station

1 Introduction

1.1 Background

This Drainage Impact Assessment Report is prepared in support of the Section 12A Application for Proposed Rezoning from "Government, Institution or Community" to "Government, Institution or Community (6)" at Tuen Mun, New Territories and to Amend the Notes of the Zone Applicable to the Site for the Proposed Social Welfare Facility (Residential Care Home for the Elderly) at Section C of Lot No. 496 in D.D 132 and the adjoining Government Land, Tuen Mun, New Territories (hereafter "the Proposed Development). The Application Site falls within an area zoned "Government, Institution or Community" (G/IC) on the Approved Tuen Mun Outline Zoning Plan (OZP) No. S/TM/41.

Due to the concerns of possible drainage impact arising from the change of uses, Urban Green Consultants Limited (UGC) has been commissioned by the Project Proponent to conduct a Drainage Impact Assessment to demonstrate the acceptability of drainage impact upon the surrounding environment.

1.2 Study Objectives

The objectives of this DIA are to assess the possible drainage impacts that may cause and to recommend mitigation measures to alleviate such impacts if necessary.

1.3 Report Structure

The remaining chapters of this report are shown below:

Chapter 2 – Site Context

Chapter 3 – Drainage Analysis

Chapter 4 – Conclusion

2 Site Context

2.1 Site Characteristic and Proposed Uses

The Site intends to develop a social welfare facility with site area of approximately 1,770 m^2. Table 2.1 shows the development parameters. The layout plan is provided in Appendix A.

Currently, the Site is fenced off by some temporary structure. Tuen Fu Road Disciplined Services Quarters is located to the south of the Site. Ching Leung Nunnery is located to the north. Gig Lok Monastery is located to the east. Tuen Mun Road and MTR Tuen Ma Line are located to the west. Figure 2.1 shows the Site location and its environs.

Table 2.1 Development Parameters

Development Parameters	
Site Area	1,770 m^2
Gross Floor Area	Not more than 12,000 m^2
Zoning under OZP	Government, Institution or Community (G/IC)
No. of Block	1
No. of Storeys	13
Height of Building	Not more than 52 mPD
No. of Rooms	252
No. of Beds	504
Expected Completion Year	2032
Use	G/F: Lobby and Carpark 2/F – 7/F: RCHE 8/F: Refuge Floor 9/F – 13/F: RCHE

2.2 Operation Year

According to the latest programme, the operation year of the Proposed Development is expected to be in Year 2032.

2.3 Existing Drainage Condition

Drainage plans (plan no.: 6_NW_21D_1, 6_NW_21D_3 and 6_SW_1B_1) were obtained from Drainage Services Department (DSD) on 13 November 2025 to gather the background information on drainage infrastructure in the vicinity of the Site. Based on the drainage plans, the site is currently served by the public

government drainage system located at Tuen Fu Road. Surface runoff from the Site will be discharged into the existing drainage system via the proposed terminal manhole P1.

3 Drainage Analysis

3.1 Identified Catchments

Based on the geographic characteristics of the site and its surroundings, 13 catchments (Catchments A to H and R1 to R5) were identified and shown in Figure 3.1.

The runoff from catchments I, J and K will flow towards the existing drainage system along Tuen Fu Road to the west of the Site. It is assumed that all the runoff from Catchments I, J and K will be discharged at SMH1024709.

The runoff from catchments A and R1 to R5 will flow towards the existing drainage system along Tuen Fu Road to the south of the Site and discharge at SMH1024712.

For the runoff from catchment C, based on the DIA of planning application no. A/TM/422, there are 2 options for the proposed terminal manhole. Option 1 will be discharged at SMH1024712 at Tuen Fu Road and Option 2 will be discharged at SWD1035859 at the ramp to Castle Peak Road – San Hui Section. However, the report did not mention the final options adopted. Therefore, option 1 is adopted for worse case scenario. The planning application no. A/TM/422 was approved with condition(s) on 6/12/2011, is provided in Appendix E.

The runoff from catchment B, G and H will flow along Tuen Lok Lane and it is assumed to discharge at SMH1024711.

For the runoff from catchment D – Tuen Mun North Offtake and Pigging Station, the terminal manhole is located at the bottom left of the Site and it is connected at SMH1024710 based on the record obtain from BRAVO. The BRAVO record is provided in Appendix F.

The runoff from catchments E and F is assumed to discharge at SMH1024710.

3.2 Surface Characteristics of the Proposed Development

The surface characteristics before and after the Proposed Development are both 20% of grassland and 80% of concrete.

Table 3.1 Surface Characteristics

Catchment	Before Development		After Development	
	Grassland	Concrete	Grassland	Concrete
A	20%	80%	20%	80%

3.3 Proposed Drainage System

The surface runoff from the Site will be collected by the proposed terminal manhole P1 and discharged into the existing public drainage manhole (SMH1024712). The

surface runoff from the site and the surrounding area will then be finally discharged to the existing box culvert located to the south of the site. Figure 3.2 shows the proposed terminal manhole of the Site.

3.4 Assessment Methodology and Assumptions

This DIA has adopted the Rational Method for runoff estimation:

$$Q_p = 0.278\ i \sum C_j\ A_j$$

where
Q_p is peak runoff (m^3/s);
i is rainfall intensity (mm/hr);
A_j is the j^{th} catchment (km^2);
C_j is the runoff coefficient of the j^{th} catchment (dimensionless).

The details of the Rational Method can be referred to the *Stormwater Drainage Manual (SDM) (DSD, 2018)* and *Stormwater Drainage Manual Corrigendum No. 1/2022 and 1/2024*.

Based on a 1:50 year flood protection standard in the SDM and the estimated time of concentration, the appropriate rainfall intensities were calculated based on linear interpolation of the intermediate table values.

The assumptions of this DIA are summarised below:

- Rainstorm return period – 1 in 50 years
- Runoff coefficient for concrete-paved area – 0.95
- Runoff coefficient for flatted grassland (heavy soil) – 0.25
- Manning's roughness coefficient for u-channels (concrete-lined channels) n= 0.016
- Roughness coefficient for the existing circular pipe (precast concrete pipe) ks= 0.15mm
- Roughness coefficient for the proposed circular pipe (uPVC) ks= 0.006mm

Manning's equation and Colebrook-White equation are applied for u-channel and circular pipes respectively.

3.5 Assessment Results

The peak flow generated from the Proposed Development is 0.108m^3/s. Hydraulic calculations are conducted to check the capacity of the existing and proposed drainage system. Detailed calculations are provided in Appendix B. The summary of the existing and proposed drainage system is shown in Table 3.2 and Table 3.3, respectively.

Table 3.2 Percentage of Utilized Capacity of Existing Drainage System

Manhole No.		Diameter, m	Capacity, m^3/s	Runoff, m^3/s	Capacity Flow, %
SMH1024712	SMH1024709	0.450	0.300	0.463	**154%**
SMH1024708	SMH1024709	1.350	1.428	1.428	100% [1]
SMH1024709	SMH1024710	1.650	2.134	1.710	80%
SMH1024710	SMH1024711	1.650	2.134	1.981	93%
SMH1024711	Box culvert	3 x 0.750	- [2]	- [2]	- [2]

Note:
[1] Full-bore flow is applied between SMH1024708 and SMH1024709.
[2] Circular pipe between SMH1024711 and box culvert is rising main.

Table 3.3 Percentage of Utilized Capacity of Proposed Drainage System

Manhole No.		Diameter, m	Capacity, m^3/s	Runoff, m^3/s	Capacity Flow, %
C1	C3	0.375	0.201	0.108	54%
C3	C4	0.375	0.140	0.108	77%
C4	C5	0.375	0.144	0.108	75%
C5	P1	0.375	0.145	0.108	74%
C1	C2	0.375	0.204	0.108	53%
C2	P1	0.375	0.142	0.108	76%
P1	P2	0.375	0.272	0.108	40%
P2	SMH1024712	0.375	0.257	0.108	42%

Notes:
[1] C1-C3, C3-C4, C4-C5, C5-P1, C1-C2, C2-P1 are u-channels. P1-P2, P2- SMH1024712 are circular pipes.

Based on Table 3.2, pipe between SMH1024712 to SMH1024709 do not have sufficient capacity to cater the additional runoff generated from the Proposed Development. Therefore, upgrading work is required. The detail of upgrading work is provided in Section 3.7.

3.6 Climate Change

Climate change projections for Hong Kong estimate increases in rainfall intensity of 11.1% and 16% for the Mid-21st Century (2041-2060) and End of 21st Century (2081-2100) respectively. To assess the impact to the existing and proposed drainage system, both uplift percentages were applied to the rainfall intensity to estimate the increase runoff and quantify any projected capacity requirement. The results are summarised in Table 3.4 and Table 3.5. The assessment results are presented in Appendix C and Appendix D.

Table 3.4 Percentage of Utilized Capacity of Existing Drainage System with 11.1% and 16% of Rainfall Increase

Manhole No.		Diameter, m	Capacity, m^3/s	11.1% of rainfall increase		16% of rainfall increase	
				Runoff, m^3/s	Capacity Flow, %	Runoff, m^3/s	Capacity Flow, %
SMH1024712	SMH1024709	0.450	0.300	0.514	**171%**	0.537	**179%**
SMH1024708	SMH1024709	1.350	1.428	1.428	100% [1]	1.428	100% [1]
SMH1024709	SMH1024710	1.650	2.134	1.741	82%	1.755	82%
SMH1024710	SMH1024711	1.650	2.134	2.042	96%	2.070	97%
SMH1024711	Box culvert	3 x 0.750	- [2]	- [2]	- [2]	- [2]	- [2]

Note:
[1] Full-bore flow is applied between SMH1024708 and SMH1024709.
[2] Circular pipe between SMH1024711 and box culvert is rising main.

Table 3.5 Percentage of Utilized Capacity of Proposed Drainage System with 11.1% and 16% of Rainfall Increase

Manhole No.		Diameter, m	Capacity, m^3/s	11.1% of rainfall increase		16% of rainfall increase	
				Runoff, m^3/s	Capacity Flow, %	Runoff, m^3/s	Capacity Flow, %
C1	C3	0.375	0.201	0.108	54%	0.125	62%
C3	C4	0.375	0.140	0.108	77%	0.125	89%
C4	C5	0.375	0.144	0.108	75%	0.125	87%
C5	P1	0.375	0.145	0.108	74%	0.125	86%
C1	C2	0.375	0.204	0.108	53%	0.125	61%
C2	P1	0.375	0.142	0.108	76%	0.125	88%
P1	P2	0.375	0.272	0.108	40%	0.125	46%
P2	SMH1024712	0.375	0.257	0.108	42%	0.125	49%

Notes:
[1] C1-C3, C3-C4, C4-C5, C5-P1, C1-C2, C2-P1 are u-channels. P1-P2, P2- SMH1024712 are circular pipes.

Based on the result, all the existing drainage system would have sufficient capacity for the additional runoff from the Proposed Development with a 11.1% and 16% increase in rainfall intensity due to Climate Change, except drainage pipe between SMH1024712 to SMH1024709.

Therefore, upgrading work at pipe between SMH1024712 to SMH1024709 is required.

3.7 Proposed Upgrading Works

The diameter of the drainage pipes between SMH1024712 to SMH1024709 will be upgraded from 450mm to 600mm with the adoption of precast concrete pipes. The percentage of utilized capacity for all the scenarios is shown in Table 3.6. Details of information of the upgrading pipe are presented in Figure 3.3 and Table D of Appendix B.

Table 3.6 Percentage of Utilized Capacity of the Upgrading Work at Pipe between SMH1024712 to SMH1024709

Scenario	Diameter, m	Capacity, m^3/s	Runoff, m^3/s	Capacity Flow, %
Baseline Condition	0.600	0.638	0.463	73%
11.1% of Rainfall Increase	0.600	0.638	0.514	81%
16% of Rainfall Increase	0.600	0.638	0.537	84%

The project proponent should implement the required drainage work at the cost of the project. With the proposed upgrading works, the Proposed Development would not cause adverse drainage impacts nor increase in flooding susceptibility to the surrounding areas.

4 Conclusion

A Drainage Impact Assessment (DIA) has been conducted for the Proposed Development in Area 6, Tuen Mun.

The peak surface runoff was calculated based on a 50-year return period, as well as projected increases in rainfall intensity attributed to both the Mid-21st Century and End of 21st Century climate change horizons.

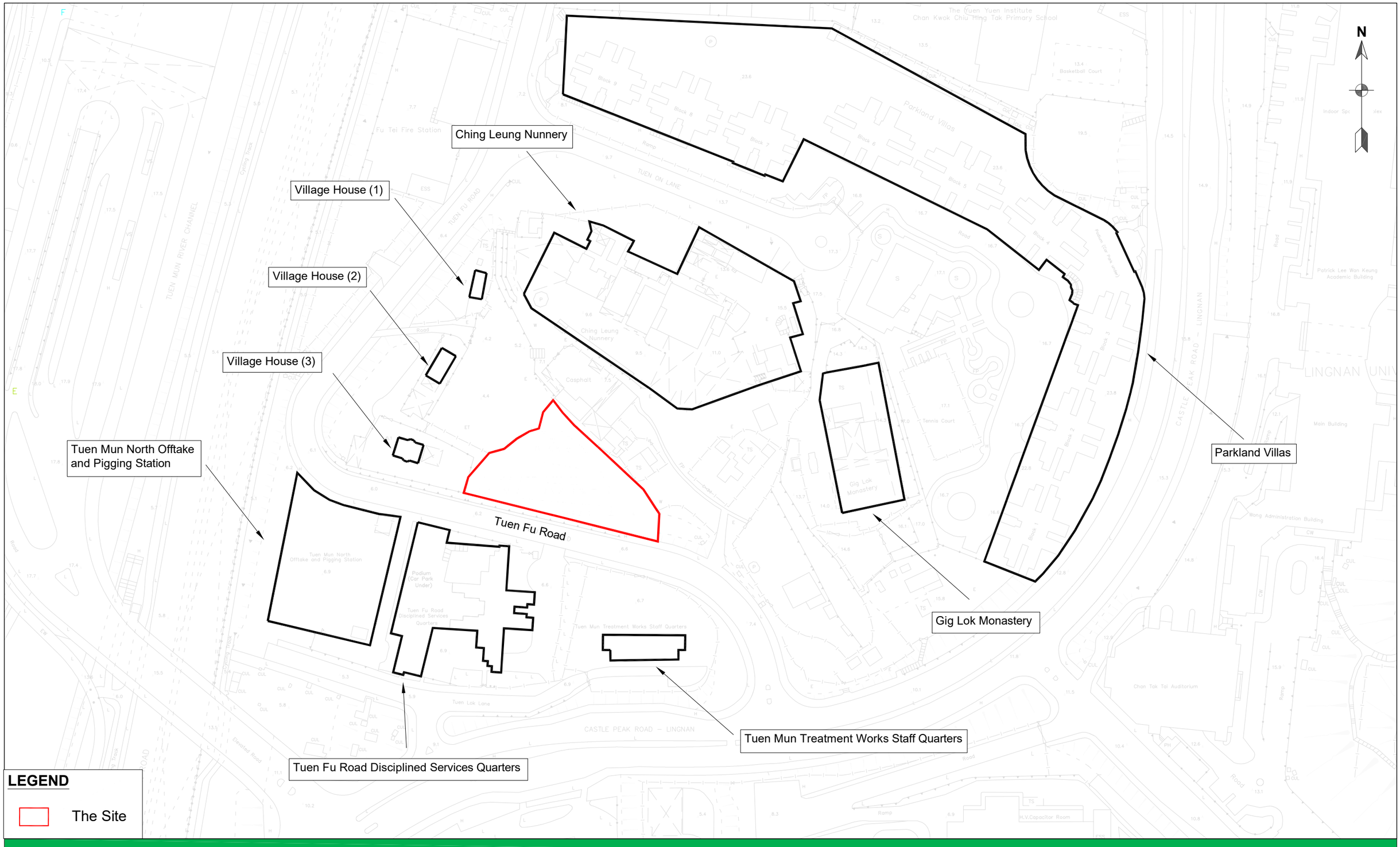
To cater the estimated peak surface runoff, upgrading of pipe between SMH1024712 to SMH1024709 from 450mm to 600mm are proposed. Based on the aforementioned upgrading works of the drainage segments, the assessment results have demonstrated that there shall be no adverse impacts due to the Proposed Development. The project proponent will be responsible for the design and construction of the proposed drainage system.

Upon completion of the upgrading works, the upgraded pipe will handover to DSD for maintenance.

In addition, with reference to the flooding blackspots available on the DSD website, the Site is not located within the flooding blackspots locations/ regions.

Based on the above, it is concluded that the Proposed Development shall not result in any adverse drainage impacts.

Figures



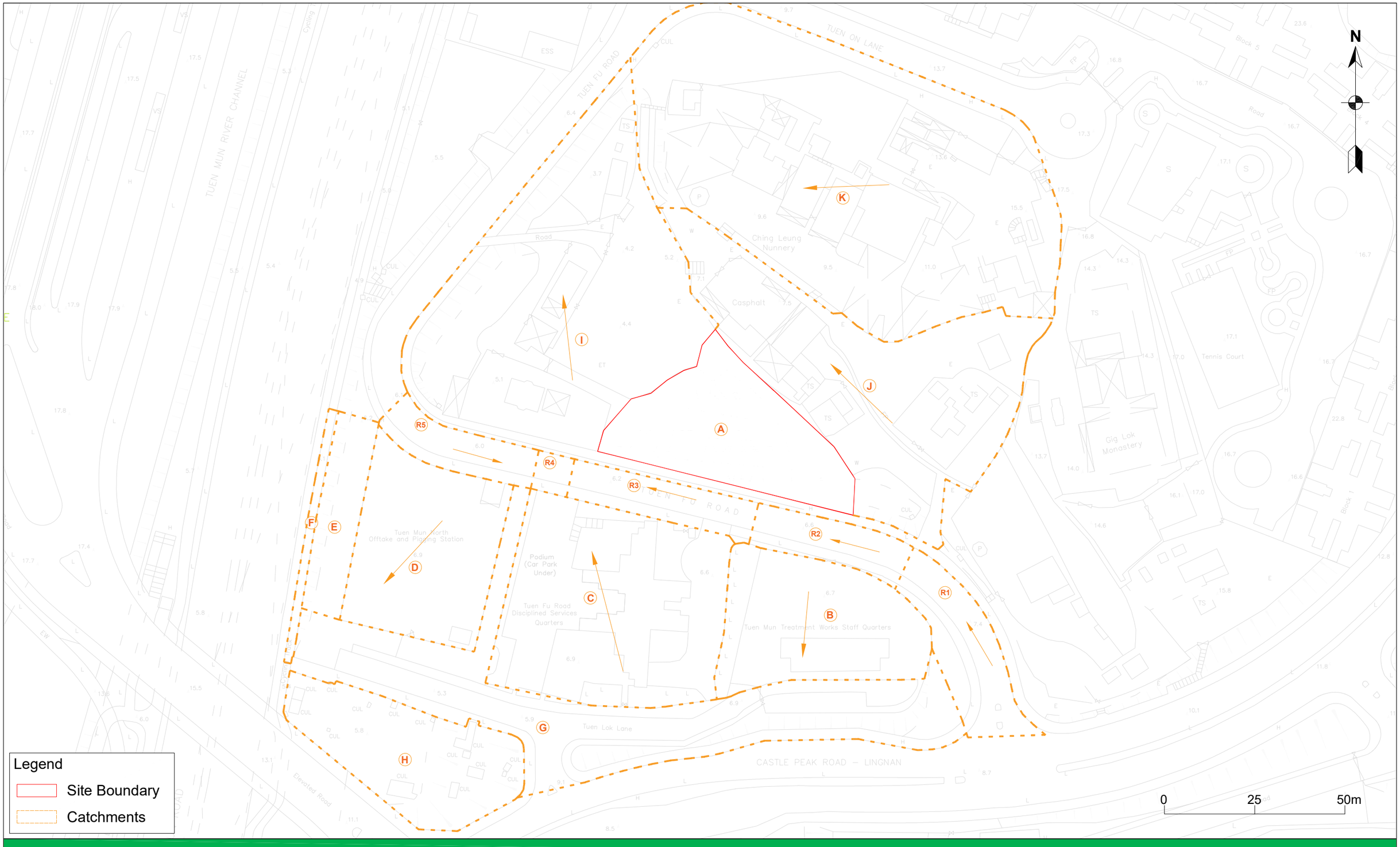
URBAN GREEN

Section 12A Application for Proposed Rezoning from "Government, Institution or Community" to "Government, Institution or Community (6)" at Tuen Mun, New Territories and to Amend the Notes of the Zone Applicable to the Site for the Proposed Social Welfare Facility (Residential Care Home for the Elderly) at Section C of Lot No. 496 in D.D 132 and the adjoining Government Land, Tuen Mun, New Territories

Site Location and Its Environs

Figure 2.1

Rev. 0



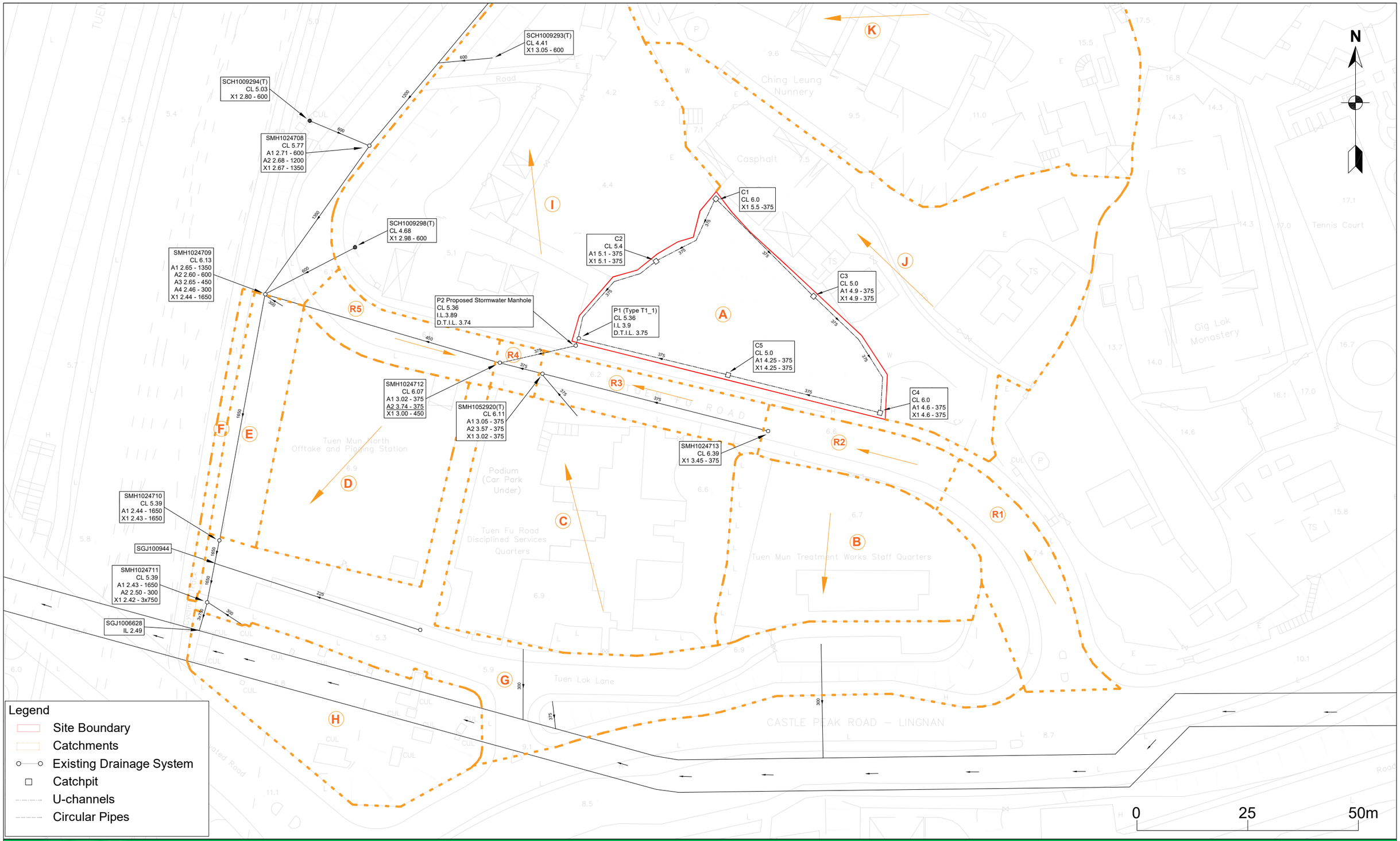
Section 12A Application for Proposed Rezoning from "Government, Institution or Community" to "Government, Institution or Community (6)" at Tuen Mun, New Territories and to Amend the Notes of the Zone Applicable to the Site for the Proposed Social Welfare Facility (Residential Care Home for the Elderly) at Section C of Lot No. 496 in D.D 132 and the adjoining Government Land, Tuen Mun, New Territories

Identified Catchment Area

URBAN GREEN

Figure 3.1

Rev. 0



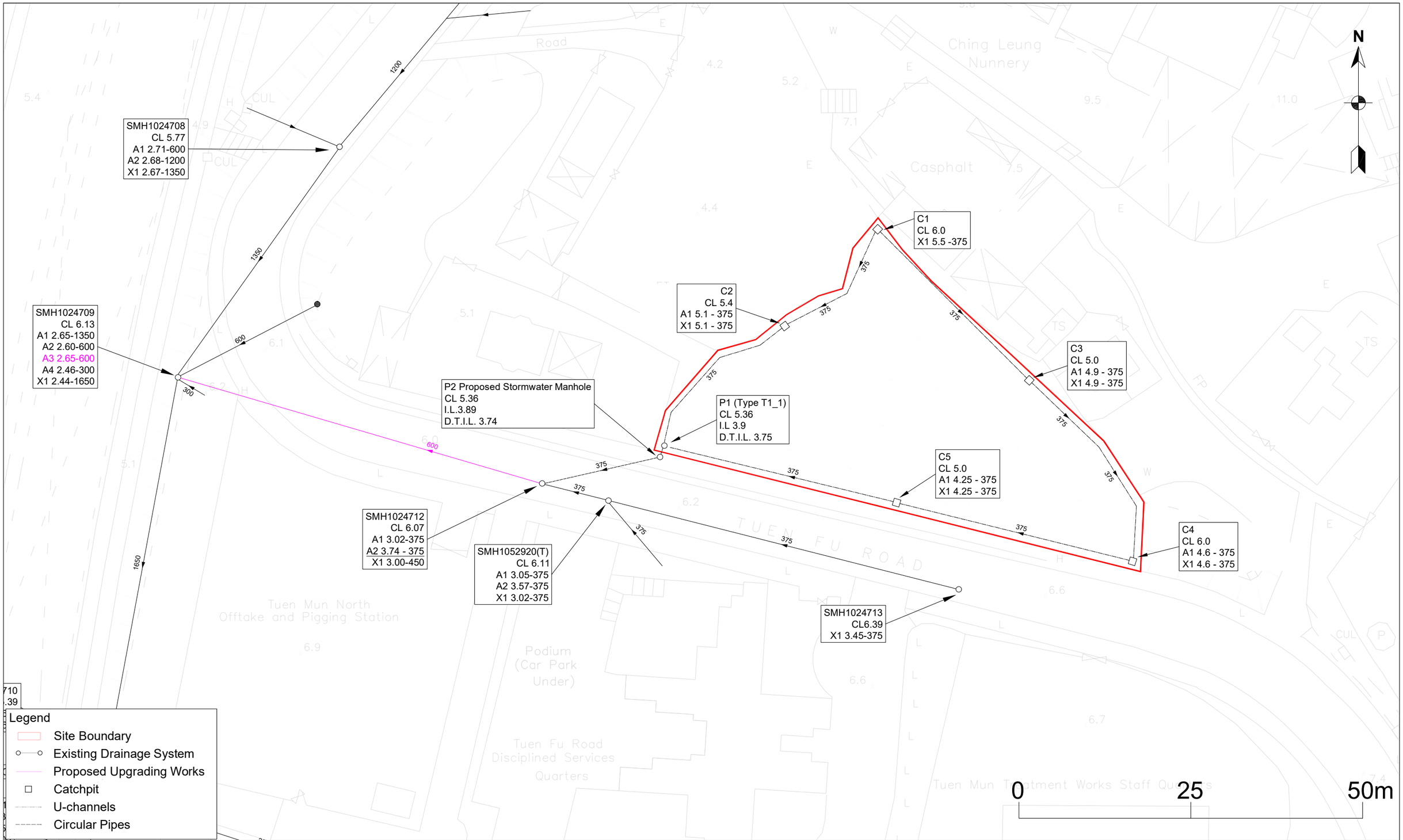
Section 12A Application for Proposed Rezoning from "Government, Institution or Community" to "Government, Institution or Community (6)" at Tuen Mun, New Territories and to Amend the Notes of the Zone Applicable to the Site for the Proposed Social Welfare Facility (Residential Care Home for the Elderly) at Section C of Lot No. 496 in D.D 132 and the adjoining Government Land, Tuen Mun, New Territories

Existing and Proposed Drainage System

URBAN GREEN

Figure 3.2

Rev. 0



Section 12A Application for Proposed Rezoning from "Government, Institution or Community" to "Government, Institution or Community (6)" at Tuen Mun, New Territories and to Amend the Notes of the Zone Applicable to the Site for the Proposed Social Welfare Facility (Residential Care Home for the Elderly) at Section C of Lot No. 496 in D.D 132 and the adjoining Government Land, Tuen Mun, New Territories

Proposed Upgrading Work

Figure 3.3

Rev. 0

Appendix A

Proposed Layout Plan

- LEVEL-1 FL. PLAN

SCALE: 1:250 (A3)

B.D. REF.

F.S.D. REF.

NOTES:

1. WORK FROM FIGURED DIMENSIONS ONLY.
2. ALL DIMENSIONS SHALL BE VERIFIED ON SITE BY THE CONTRACTOR.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH RELEVANT SPECIFICATIONS CONDITIONS OF CONTRACT AND ALL OTHER RELEVANT DRAWINGS. THE AUTHORIZED PERSON / REGISTERED STRUCTURAL ENGINEER SHALL BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCY FOUND THEREIN.
4. THIS IS DRAWING IS NOT VALID FOR CONSTRUCTION OR OTHER PURPOSES UNLESS IT HAS BEEN SIGNED BY THE AUTHORIZED PERSON / REGISTERED STRUCTURAL ENGINEER.
5. ALL WORKS SPECIFIED ON THIS DRAWING SHALL BE CARRIED OUT STRICTLY IN ACCORDANCE WITH PROVISIONS OF THE BUILDINGS ORDINANCE AND REGULATIONS.
6.
7. DRAWINGS DEVIATED FROM THE LATEST REVISION SHOULD BE CANCELLED.

Rev.	Description	Date	Checked

Project Title :

SECTION 12A APPLICATION FOR PROPOSED REZONING FROM "GOVERNMENT, INSTITUTION OR COMMUNITY" TO "GOVERNMENT, INSTITUTION OR COMMUNITY (6)" AT TUEN MUN, NEW TERRITORIES AND TO AMEND THE NOTES OF THE ZONE APPLICABLE TO THE SITE FOR THE PROPOSED SOCIAL WELFARE FACILITY (RESIDENTIAL CARE HOME FOR THE ELDERLY) AT SECTION C OF LOT NO. 496 IN D.D. 132 AND THE ADJOINING GOVERNMENT LAND, TUEN MUN, NEW TERRITORIES

Drawing Title :

LEVEL-1 FLOOR PLAN

CLIENT

PARK NATURE

DRAWN	DATE	CHECKED	SCALE
SY	JUN 2026	EK	

JOB NO. : -

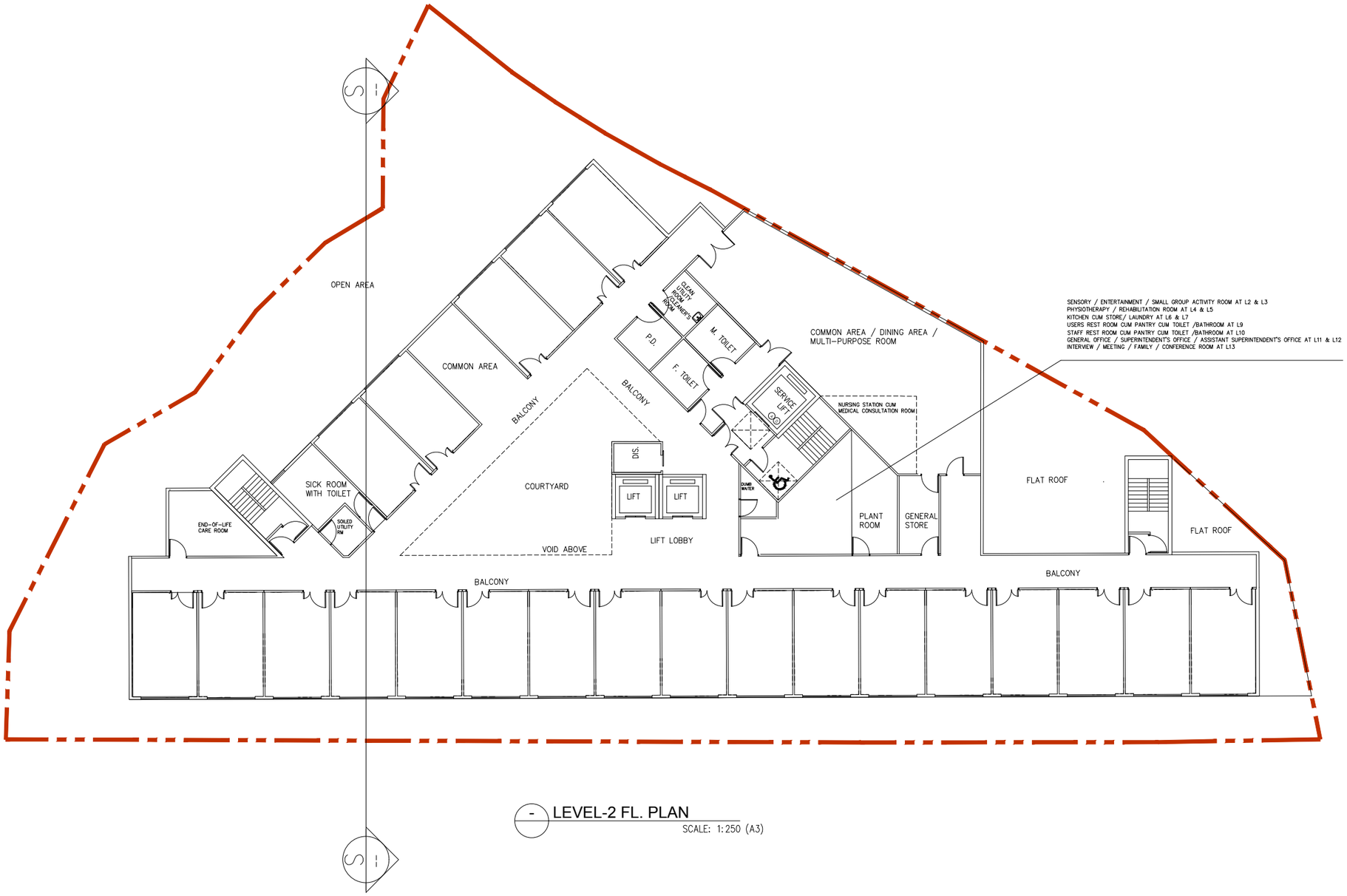
DRAWING NO. A-001

REVISION 2

AUTHORIZED PERSON :

KO B C

KO BUILDING CONSULTANCY LIMITED



- LEVEL-2 FL. PLAN

SCALE: 1:250 (A3)

B.D. REF.

F.S.D. REF.

NOTES:

1. WORK FROM FIGURED DIMENSIONS ONLY.
2. ALL DIMENSIONS SHALL BE VERIFIED ON SITE BY THE CONTRACTOR.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH RELEVANT SPECIFICATIONS CONDITIONS OF CONTRACT AND ALL OTHER RELEVANT DRAWINGS. THE AUTHORIZED PERSON / REGISTERED STRUCTURAL ENGINEER SHALL BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCY FOUND THEREIN.
4. THIS IS DRAWING IS NOT VALID FOR CONSTRUCTION OR OTHER PURPOSES UNLESS IT HAS BEEN SIGNED BY THE AUTHORIZED PERSON / REGISTERED STRUCTURAL ENGINEER.
5. ALL WORKS SPECIFIED ON THIS DRAWING SHALL BE CARRIED OUT STRICTLY IN ACCORDANCE WITH PROVISIONS OF THE BUILDINGS ORDINANCE AND REGULATIONS.
6.
7. DRAWINGS DEVIATED FROM THE LATEST REVISION SHOULD BE CANCELLED.

Rev.	Description	Date	Checked

Project Title :

SECTION 12A APPLICATION FOR PROPOSED REZONING FROM "GOVERNMENT, INSTITUTION OR COMMUNITY" TO "GOVERNMENT, INSTITUTION OR COMMUNITY (6)" AT TUEN MUN, NEW TERRITORIES AND TO AMEND THE NOTES OF THE ZONE APPLICABLE TO THE SITE FOR THE PROPOSED SOCIAL WELFARE FACILITY (RESIDENTIAL CARE HOME FOR THE ELDERLY) AT SECTION C OF LOT NO. 496 IN D.D. 132 AND THE ADJOINING GOVERNMENT LAND, TUEN MUN, NEW TERRITORIES

Drawing Title :

LEVEL-2 FLOOR PLAN

CLIENT

PARK NATURE

DRAWN	DATE	CHECKED	SCALE
SY	JUN 2026	EK	

JOB NO. : -

DRAWING NO. A-002A

REVISION 1

AUTHORIZED PERSON :

KO BUILDING CONSULTANCY LIMITED

- TYP FL. PLAN

SCALE: 1:250 (A3)

B.D. REF.

F.S.D. REF.

NOTES:

1. WORK FROM FIGURED DIMENSIONS ONLY.
2. ALL DIMENSIONS SHALL BE VERIFIED ON SITE BY THE CONTRACTOR.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH RELEVANT SPECIFICATIONS CONDITIONS OF CONTRACT AND ALL OTHER RELEVANT DRAWINGS. THE AUTHORIZED PERSON / REGISTERED STRUCTURAL ENGINEER SHALL BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCY FOUND THEREIN.
4. THIS IS DRAWING IS NOT VALID FOR CONSTRUCTION OR OTHER PURPOSES UNLESS IT HAS BEEN SIGNED BY THE AUTHORIZED PERSON / REGISTERED STRUCTURAL ENGINEER.
5. ALL WORKS SPECIFIED ON THIS DRAWING SHALL BE CARRIED OUT STRICTLY IN ACCORDANCE WITH PROVISIONS OF THE BUILDINGS ORDINANCE AND REGULATIONS.
6.
7. DRAWINGS DEVIATED FROM THE LATEST REVISION SHOULD BE CANCELLED.

Rev.	Description	Date	Checked

Project Title :

SECTION 12A APPLICATION FOR PROPOSED REZONING FROM "GOVERNMENT, INSTITUTION OR COMMUNITY" TO "GOVERNMENT, INSTITUTION OR COMMUNITY (6)" AT TUEN MUN, NEW TERRITORIES AND TO AMEND THE NOTES OF THE ZONE APPLICABLE TO THE SITE FOR THE PROPOSED SOCIAL WELFARE FACILITY (RESIDENTIAL CARE HOME FOR THE ELDERLY) AT SECTION C OF LOT NO. 496 IN D.D. 132 AND THE ADJOINING GOVERNMENT LAND, TUEN MUN, NEW TERRITORIES

Drawing Title :

TYPICAL FLOOR PLAN

CLIENT

PARK NATURE

DRAWN	DATE	CHECKED	SCALE
SY	JUN 2026	EK	

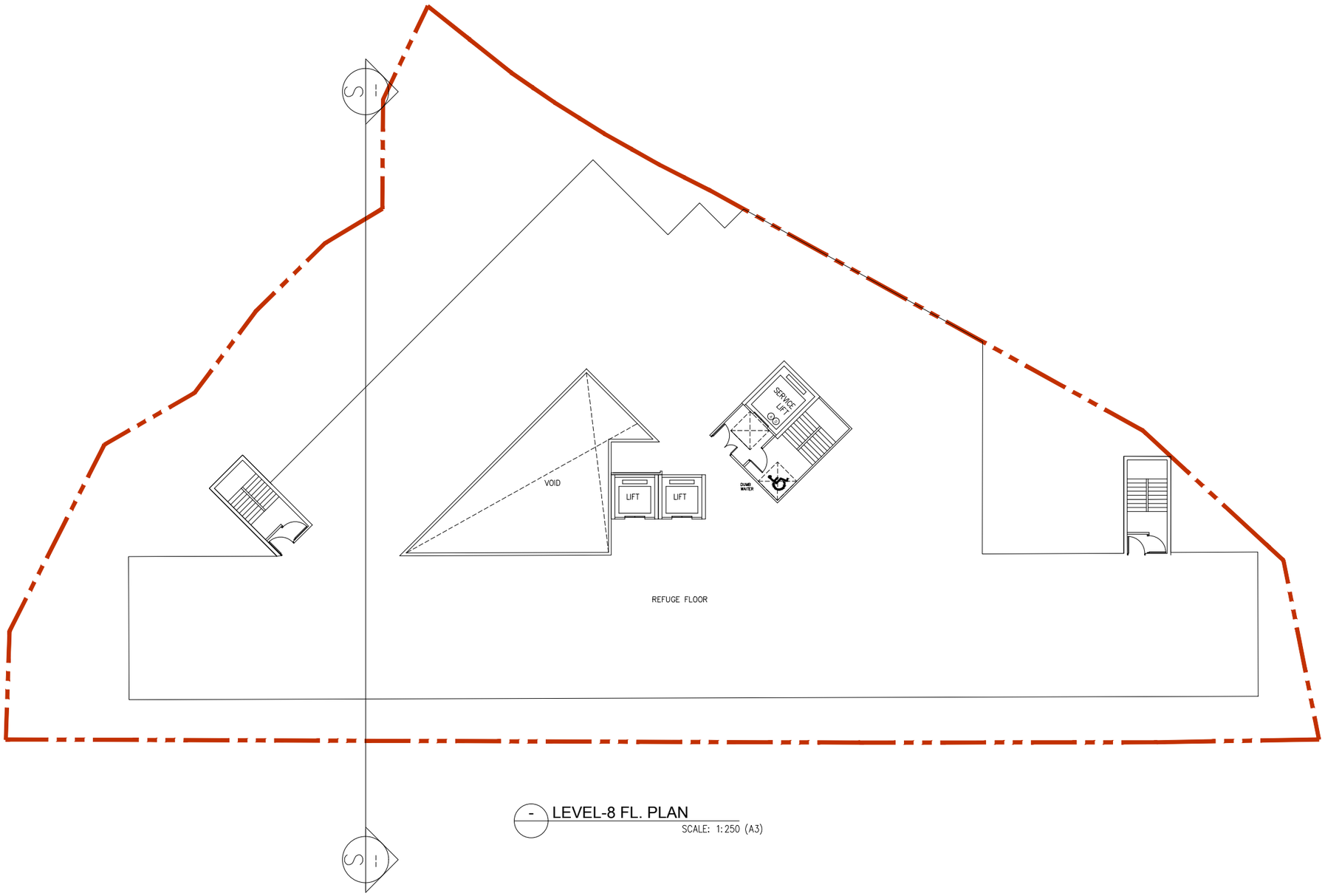
JOB NO. : -

DRAWING NO. A-002

REVISION 3

AUTHORIZED PERSON :

KO BUILDING CONSULTANCY LIMITED



- LEVEL-8 FL. PLAN

SCALE: 1:250 (A3)

B.D. REF.

F.S.D. REF.

NOTES:

1. WORK FROM FIGURED DIMENSIONS ONLY.
2. ALL DIMENSIONS SHALL BE VERIFIED ON SITE BY THE CONTRACTOR.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH RELEVANT SPECIFICATIONS CONDITIONS OF CONTRACT AND ALL OTHER RELEVANT DRAWINGS. THE AUTHORIZED PERSON / REGISTERED STRUCTURAL ENGINEER SHALL BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCY FOUND THEREIN.
4. THIS IS DRAWING IS NOT VALID FOR CONSTRUCTION OR OTHER PURPOSES UNLESS IT HAS BEEN SIGNED BY THE AUTHORIZED PERSON / REGISTERED STRUCTURAL ENGINEER.
5. ALL WORKS SPECIFIED ON THIS DRAWING SHALL BE CARRIED OUT STRICTLY IN ACCORDANCE WITH PROVISIONS OF THE BUILDINGS ORDINANCE AND REGULATIONS.
6. COPYRIGHT OF THIS DRAWING IS RESERVED BY THE AUTHORIZED PERSON / REGISTERED STRUCTURAL ENGINEER. NO PORTION OF THIS DRAWING MAY BE REPRODUCED WITHOUT HIS WRITTEN CONSENT.
7. DRAWINGS DEVIATED FROM THE LATEST REVISION SHOULD BE CANCELLED.

Rev.	Description	Date	Checked

Project Title :

SECTION 12A APPLICATION FOR PROPOSED REZONING FROM "GOVERNMENT, INSTITUTION OR COMMUNITY" TO "GOVERNMENT, INSTITUTION OR COMMUNITY (6)" AT TUEN MUN, NEW TERRITORIES AND TO AMEND THE NOTES OF THE ZONE APPLICABLE TO THE SITE FOR THE PROPOSED SOCIAL WELFARE RE FACILITY (RESIDENTIAL CARE HOME FOR THE ELDERLY) AT SECTION C OF LOT NO. 496 IN D.D. 132 AND THE ADJOINING GOVERNMENT LAND, TUEN MUN, NEW TERRITORIES

Drawing Title :

LEVEL-8 FLOOR PLAN

CLIENT

PARK NATURE

DRAWN	DATE	CHECKED	SCALE
SY	JUN 2026	EK	

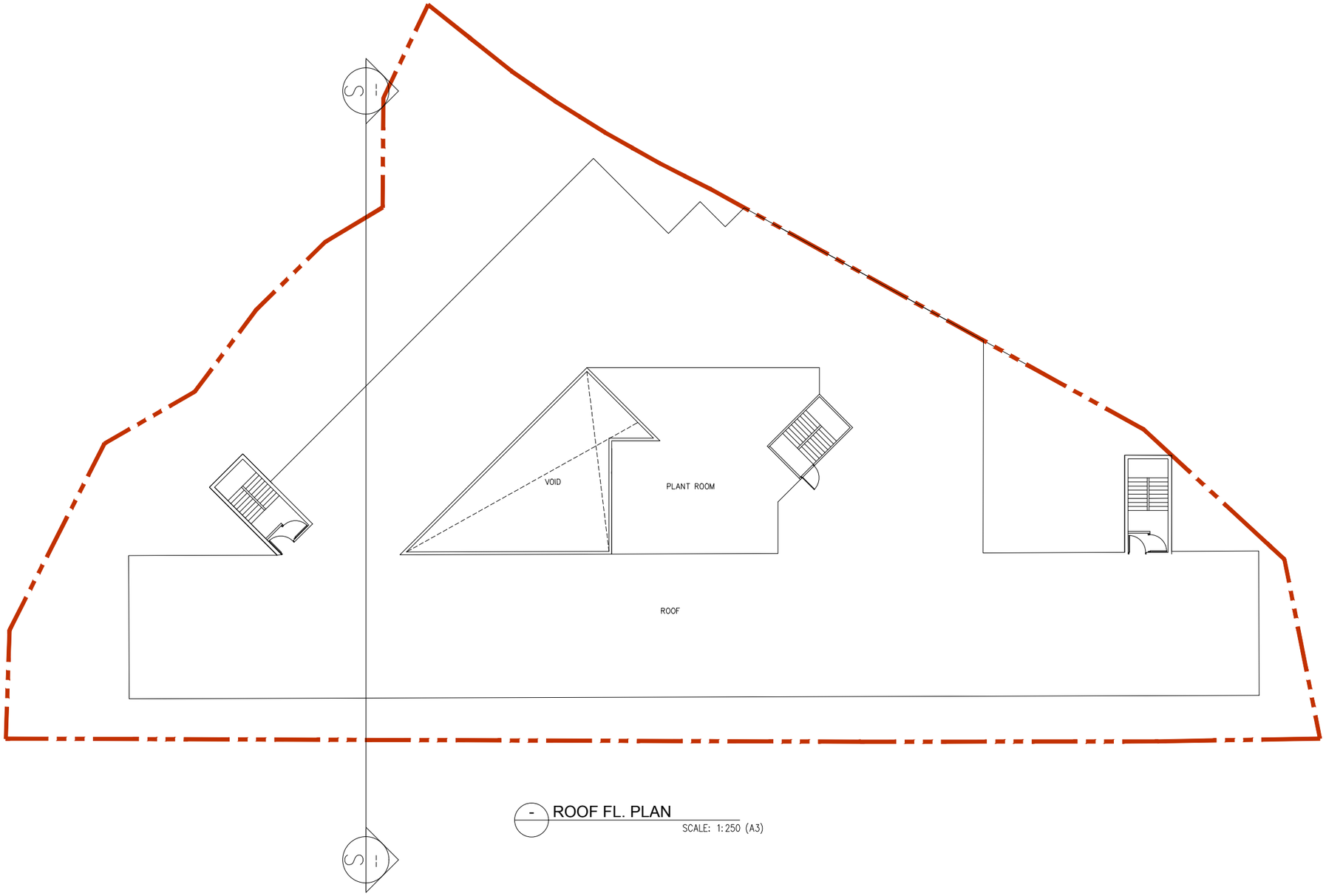
JOB NO. : -

DRAWING NO. A-003

REVISION 2

AUTHORIZED PERSON :

KO BUILDING CONSULTANCY LIMITED



- ROOF FL. PLAN
SCALE: 1:250 (A3)

B.D. REF.

F.S.D. REF.

NOTES:

1. WORK FROM FIGURED DIMENSIONS ONLY.
2. ALL DIMENSIONS SHALL BE VERIFIED ON SITE BY THE CONTRACTOR.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH RELEVANT SPECIFICATIONS CONDITIONS OF CONTRACT AND ALL OTHER RELEVANT DRAWINGS. THE AUTHORIZED PERSON / REGISTERED STRUCTURAL ENGINEER SHALL BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCY FOUND THEREIN.
4. THIS IS DRAWING IS NOT VALID FOR CONSTRUCTION OR OTHER PURPOSES UNLESS IT HAS BEEN SIGNED BY THE AUTHORIZED PERSON / REGISTERED STRUCTURAL ENGINEER.
5. ALL WORKS SPECIFIED ON THIS DRAWING SHALL BE CARRIED OUT STRICTLY IN ACCORDANCE WITH PROVISIONS OF THE BUILDINGS ORDINANCE AND REGULATIONS.
6.
7. DRAWINGS DEVIATED FROM THE LATEST REVISION SHOULD BE CANCELLED.

Rev.	Description	Date	Checked

Project Title :

SECTION 12A APPLICATION FOR PROPOSED REZONING FROM "GOVERNMENT, INSTITUTION OR COMMUNITY" TO "GOVERNMENT, INSTITUTION OR COMMUNITY (6)" AT TUEN MUN, NEW TERRITORIES AND TO AMEND THE NOTES OF THE ZONE APPLICABLE TO THE SITE FOR THE PROPOSED SOCIAL WELFARE FACILITY (RESIDENTIAL CARE HOME FOR THE ELDERLY) AT SECTION C OF LOT NO. 496 IN D.D. 132 AND THE ADJOINING GOVERNMENT LAND, TUEN MUN, NEW TERRITORIES

Drawing Title :

ROOF FLOOR PLAN

CLIENT

PARK NATURE

DRAWN	DATE	CHECKED	SCALE
SY	JUN 2026	EK	

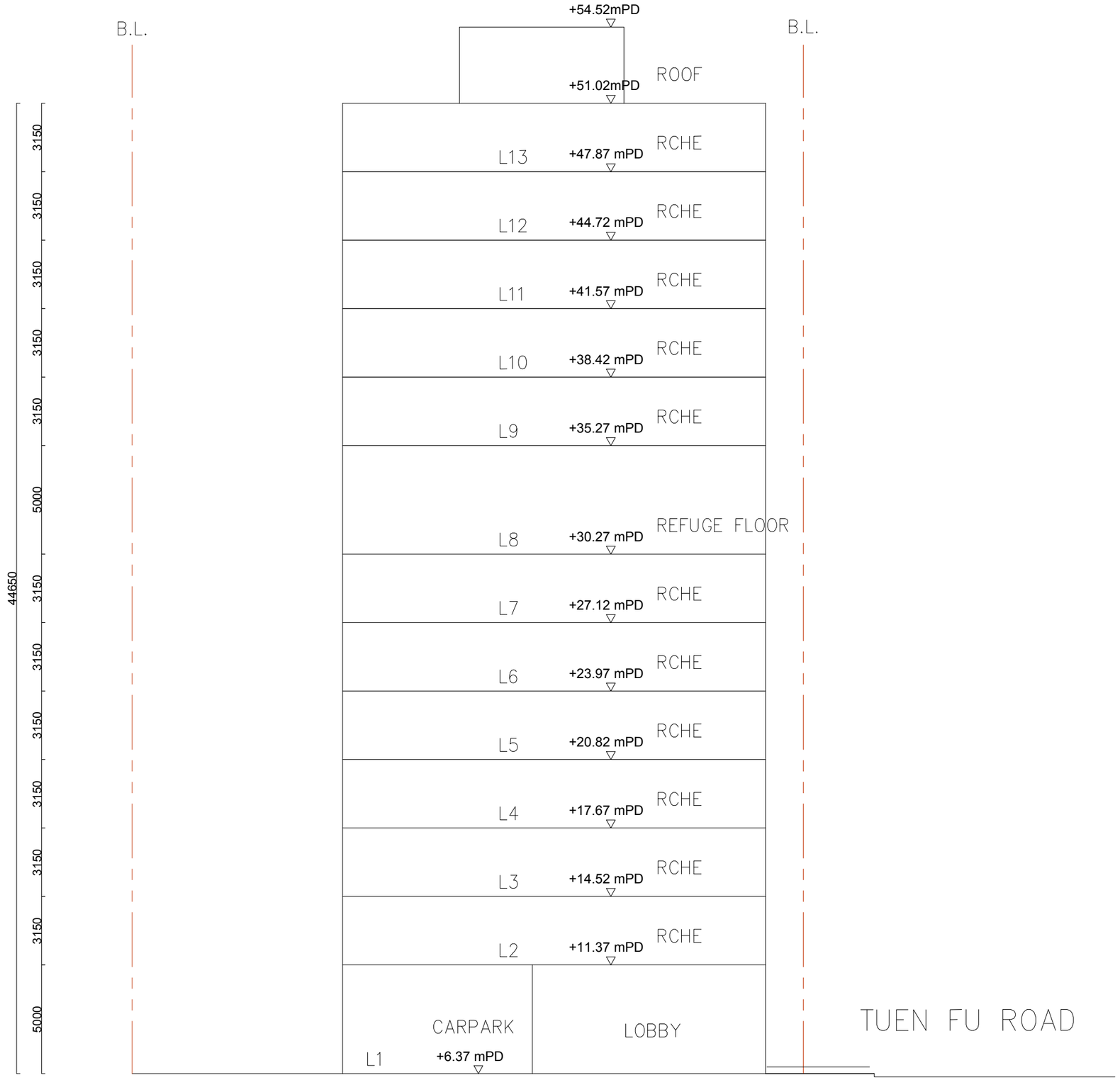
JOB NO. :
-

DRAWING NO.
A-004

REVISION
2

AUTHORIZED PERSON :

KO BUILDING CONSULTANCY LIMITED



- SECTIONAL DIAGRAM

SCALE: 1:200 (A3)

B.D. REF.

F.S.D. REF.

NOTES:

1. WORK FROM FIGURED DIMENSIONS ONLY.
2. ALL DIMENSIONS SHALL BE VERIFIED ON SITE BY THE CONTRACTOR.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH RELEVANT SPECIFICATIONS CONDITIONS OF CONTRACT AND ALL OTHER RELEVANT DRAWINGS. THE AUTHORIZED PERSON / REGISTERED STRUCTURAL ENGINEER SHALL BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCY FOUND THEREIN.
4. THIS IS DRAWING IS NOT VALID FOR CONSTRUCTION OR OTHER PURPOSES UNLESS IT HAS BEEN SIGNED BY THE AUTHORIZED PERSON / REGISTERED STRUCTURAL ENGINEER.
5. ALL WORKS SPECIFIED ON THIS DRAWING SHALL BE CARRIED OUT STRICTLY IN ACCORDANCE WITH PROVISIONS OF THE BUILDINGS ORDINANCE AND REGULATIONS.
6.
7. DRAWINGS DEVIATED FROM THE LATEST REVISION SHOULD BE CANCELLED.

Rev.	Description	Date	Checked

Project Title :

SECTION 12A APPLICATION FOR PROPOSED REZONING FROM "GOVERNMENT, INSTITUTION OR COMMUNITY" TO "GOVERNMENT, INSTITUTION OR COMMUNITY (6)" AT TUEN MUN, NEW TERRITORIES AND TO AMEND THE NOTES OF THE ZONE APPLICABLE TO THE SITE FOR THE PROPOSED SOCIAL WELFARE FACILITY (RESIDENTIAL CARE HOME FOR THE ELDERLY) AT SECTION C OF LOT NO. 496 IN D.D. 132 AND THE ADJOINING GOVERNMENT LAND, TUEN MUN, NEW TERRITORIES

Drawing Title :

SECTIONAL DIAGRAM

CLIENT

PARK NATURE

DRAWN	DATE	CHECKED	SCALE
SY	JUN 2026	EK	

JOB NO. : -

DRAWING NO. A-005

REVISION 2

AUTHORIZED PERSON :

KO BC
KO BUILDING CONSULTANCY LIMITED

Appendix B

Detailed Drainage Analysis

Capacity Flow Estimation for Proposed Catchments and Drainage System with 50 Year Return Period

A.Calculation of Catchment Runoff

Catchment ID	Surface Type	Catchment Area (A), m^2	Catchment Area (A), km^2	Average Slope (H), m/100m	Flow Path Length (L), m	Inlet Time (t_0), min	Time of Concentration (t_c), min	Duration (t_d), min	a (50 year return period) [2]	b (50 year return period) [2]	c (50 year return period) [2]	Runoff Intensity mm/hr	Runoff Coefficient (C)	C x A	Peak Runoff (Q_p), m^3/s
A	80% Concrete + 20% Grassland (heavysoil), flat	1,770	0.0018	4.78	51.00	2.55	2.55	2.55	505.5	3.29	0.355	270	0.81	0.0014	0.108
B	70% Concrete + 30% Grassland (heavysoil), flat	1,821	0.0018	0.38	53.00	4.40	4.40	4.40	505.5	3.29	0.355	245	0.74	0.0013	0.092
C	80% Concrete + 20% Grassland (heavysoil), flat	3,197	0.0032	1.17	60.00	3.75	3.75	3.75	505.5	3.29	0.355	253	0.81	0.0026	0.182
D	100% Concrete	1,903	0.0019	1.21	58.00	3.80	3.80	3.80	505.5	3.29	0.355	252	0.95	0.0018	0.127
E	100% Grassland (heavysoil), flat	642	0.0006	1.54	52.00	3.62	3.62	3.62	505.5	3.29	0.355	255	0.25	0.0002	0.011
F	100% Concrete	182	0.0002	1.47	68.00	5.41	5.41	5.41	505.5	3.29	0.355	235	0.95	0.0002	0.011
G	50% Concrete + 50% Grassland (heavysoil), flat	3,567	0.0036	1.96	168.00	9.37	9.37	9.37	505.5	3.29	0.355	205	0.6	0.0021	0.122
H	100% Grassland (heavysoil), flat	1,633	0.0016	5.22	67.00	3.32	3.32	3.32	505.5	3.29	0.355	259	0.25	0.0004	0.029
R1	100% Concrete	858	0.0009	2.38	42.00	2.60	2.60	2.60	505.5	3.29	0.355	269	0.95	0.0008	0.061
R2	100% Concrete	517	0.0005	1.32	38.00	2.79	2.79	2.79	505.5	3.29	0.355	266	0.95	0.0005	0.036
R3	100% Concrete	568	0.0006	0.59	51.00	4.35	4.35	4.35	505.5	3.29	0.355	246	0.95	0.0005	0.037
R4	100% Concrete	110	0.0001	2.22	9.00	0.69	0.69	0.69	505.5	3.29	0.355	309	0.95	0.0001	0.009
R5	100% Concrete	498	0.0005	0.19	53.00	5.75	5.75	5.75	505.5	3.29	0.355	231	0.95	0.0005	0.030

B. Capacity Flow Estimation and Adequacy Check for Existing Drainage System (Colebrook-White Equation)

Pipe Segment		Shape	Diameter, m	Initial mPD,X(m)	Ending mPD, A(m)	Length, m	Aw, m2	ks, m [3]	v, m2/s	s	g, m/s2	V, m/s	Capacity Flow, m3/s	Catchment Served	Runoff, m^3/s	% of capacity	Sufficient Capacity? (Y/N)	
SMH1024712	SMH1024709	Circular Pipe	0.450	3.00	2.65	54.00	0.159	0.00015	1E-06	0.0065	9.810	1.888	0.300	A, C, R1-R5	0.463	154%	N	
SMH1024708	SMH1024709	Circular Pipe	1.350	2.67	2.65	40.00	1.431	0.00015	1E-06	0.0005	9.810	0.998	1.428	Full-bore flow	1.428	100%	-	
SMH1024709	SMH1024710	Circular Pipe	1.650	2.44	2.44	56.00	2.138	0.00015	1E-06	-	9.810	0.998	2.134	A,R1-R5, Full-bore flow of SMH1024708 to SMH1024709	1.710	80%	Y	
SMH1024710	SMH1024711	Circular Pipe	1.650	2.43	2.43	13.40	2.138	0.00015	1E-06	-	9.810	0.998	2.134	A,D,E,F,G,R1-R5, Full-bore flow of SMH1024708 to SMH1024709	1.981	93%	Y	
SMH1024711	Box culvert	Circular Pipe	2.250	2.42	2.49	6.23	3.976	0.00015	1E-06	-	-	-	-	-	-	-	-	*rising main

* As there is no slope from SMH1024709 to SMH1024711, the velocity between SMH1024708 to SMH1024709 is adopted.

C1. Capacity Flow Estimation and Adequacy Check for Proposed Drainage System (Manning's Equation)

Manhole/Catchpit No.		Shape	Diameter, m	Initial mPD,X(m)	Ending mPD, A(m)	Length, m	Slope	Manning's Roughness Coefficient [4]	Cross Section Area, m^2	Wetted Perimeter, m	Hydraulic Radius, m	Mean Velocity, m/s	Capacity Flow, m^3/s	Catchments Served	Runoff, m^3/s	% of Capacity Flow	Sufficient Capacity? (Y/N)
C1	C3	U-channel	0.375	5.50	4.90	30.14	0.02	0.016	0.110	1.178	0.094	1.820	0.201	A	0.108	54%	Y
C3	C4	U-channel	0.375	4.90	4.60	31.25	0.01	0.016	0.110	1.178	0.094	1.264	0.140	A	0.108	77%	Y
C4	C5	U-channel	0.375	4.60	4.25	34.38	0.01	0.016	0.110	1.178	0.094	1.301	0.144	A	0.108	75%	Y
C5	P1	U-channel	0.375	4.25	3.90	33.94	0.01	0.016	0.110	1.178	0.094	1.310	0.145	A	0.108	74%	Y
C1	C2	U-channel	0.375	5.50	5.10	19.59	0.02	0.016	0.110	1.178	0.094	1.843	0.204	A	0.108	53%	Y
C2	P1	U-channel	0.375	5.10	4.85	25.28	0.01	0.016	0.110	1.178	0.094	1.283	0.142	A	0.108	76%	Y

C2. Capacity Flow Estimation and Adequacy Check for Proposed Drainage System (Colebrook-White Equation)

Pipe Segment		Shape	Diameter, m	Initial mPD,X(m)	Ending mPD, A(m)	Length, m	Aw, m2	ks, m [5]	v, m2/s	s	g, m/s2	V, m/s	Capacity Flow, m3/s	Catchment Served	Runoff, m^3/s	% of capacity	Sufficient Capacity? (Y/N)
P1	P2	Circular Pipe	0.375	3.90	3.89	1.00	0.1104	0.000006	1E-06	0.01	9.810	2.462	0.272	A	0.108	40%	Y
P2	SMH1024712	Circular Pipe	0.375	3.89	3.74	16.70	0.1104	0.000006	1E-06	0.01	9.810	2.323	0.257	A	0.108	42%	Y

D. Capacity Flow Estimation and Adequacy Check for Upgrading Works at the Existing Drainage System (Colebrook-White Equation)

Pipe Segment		Shape	Diameter, m	Initial mPD,X(m)	Ending mPD, A(m)	Length, m	Aw, m2	ks, m [3]	v, m2/s	s	g, m/s2	V, m/s	Capacity Flow, m3/s	Catchment Served	Runoff, m^3/s	% of capacity	Sufficient Capacity? (Y/N)
SMH1024712	SMH1024709	Circular Pipe	0.600	3.00	2.65	54.00	0.283	0.00015	1E-06	0.0065	9.810	2.255	0.638	A, C, R1-R5	0.463	73%	Y

Note:
[1] Runoff is calculated in accordance with DSD's "Stormwater Drainage Manual - Planning, Design and Management" (SDM), fifth edition, January 2018..
[2] 50 years return period of HKO Headquarters is adopted in the calculation.
[3 For the existing circular pipes, value of ks for precast concrete pipe under fair condition (i.e. ks = 0.15mm) is adopted in the calculation.
[4] For the proposed u-channel, value of n for concrete-lined channels under fair condition (i.e. n = 0.016) is adopted in the calculation.
[5] For the proposed connection pipe, value of ks for uPVC under fair condition (i.e. ks = 0.006mm) is adopted in the calculation.

Equation used:

Peak runoff

$$Q_p = 0.278\,C\,i\,A$$

Rainfall intensity

$$i = \frac{a}{(t_d + b)^c}$$

Time of concentration

$$t_0 = \frac{0.14465L}{H^{0.2}A^{0.1}} \qquad t_c = t_0 + t_f$$

Capacity flow = Aw x V

Appendix C

Detailed Drainage Analysis with 11.1 % of Rainfall Increased

Capacity Flow Estimation for Proposed Catchments and Drainage System with 50 Year Return Period (with 11.1% of rainfall increase)

A.Calculation of Catchment Runoff

Catchment ID	Surface Type	Catchment Area (A), m^2	Catchment Area (A), km^2	Average Slope (H), m/100m	Flow Path Length (L), m	Inlet Time (t_0), min	Time of Concentration (t_c), min	Duration (t_d), min	a (50 year return period) [2]	b (50 year return period) [2]	c (50 year return period) [2]	Runoff Intensity mm/hr	Runoff Coefficient (C)	C x A	Peak Runoff (with 11.1% of rainfall increase) (Q_p), m^3/s
A	80% Concrete + 20% Grassland (heavysoil), flat	1,770	0.0018	4.78	51.00	2.55	2.55	2.55	505.5	3.29	0.355	270	0.81	0.0014	0.120
B	70% Concrete + 30% Grassland (heavysoil), flat	1,821	0.0018	0.38	53.00	4.40	4.40	4.40	505.5	3.29	0.355	245	0.74	0.0013	0.102
C	80% Concrete + 20% Grassland (heavysoil), flat	3,197	0.0032	1.17	60.00	3.75	3.75	3.75	505.5	3.29	0.355	253	0.81	0.0026	0.202
D	100% Concrete	1,903	0.0019	1.21	58.00	3.80	3.80	3.80	505.5	3.29	0.355	252	0.95	0.0018	0.141
E	100% Grassland (heavysoil), flat	642	0.0006	1.54	52.00	3.62	3.62	3.62	505.5	3.29	0.355	255	0.25	0.0002	0.013
F	100% Concrete	182	0.0002	1.47	68.00	5.41	5.41	5.41	505.5	3.29	0.355	235	0.95	0.0002	0.013
G	50% Concrete + 50% Grassland (heavysoil), flat	3,567	0.0036	1.96	168.00	9.37	9.37	9.37	505.5	3.29	0.355	205	0.6	0.0021	0.136
H	100% Grassland (heavysoil), flat	1,633	0.0016	5.22	67.00	3.32	3.32	3.32	505.5	3.29	0.355	259	0.25	0.0004	0.033
R1	100% Concrete	858	0.0009	2.38	42.00	2.60	2.60	2.60	505.5	3.29	0.355	269	0.95	0.0008	0.068
R2	100% Concrete	517	0.0005	1.32	38.00	2.79	2.79	2.79	505.5	3.29	0.355	266	0.95	0.0005	0.040
R3	100% Concrete	568	0.0006	0.59	51.00	4.35	4.35	4.35	505.5	3.29	0.355	246	0.95	0.0005	0.041
R4	100% Concrete	110	0.0001	2.22	9.00	0.69	0.69	0.69	505.5	3.29	0.355	309	0.95	0.0001	0.010
R5	100% Concrete	498	0.0005	0.19	53.00	5.75	5.75	5.75	505.5	3.29	0.355	231	0.95	0.0005	0.034

B. Capacity Flow Estimation and Adequacy Check for Existing Drainage System (Colebrook-White Equation)

Pipe Segment		Shape	Diameter, m	Initial mPD,X(m)	Ending mPD, A(m)	Length, m	Aw, m2	ks, m [3]	v, m2/s	s	g, m/s2	V, m/s	Capacity Flow, m3/s	Catchment Served	Runoff, m^3/s	% of capacity	Sufficient Capacity? (Y/N)	
SMH1024712	SMH1024709	Circular Pipe	0.450	3.00	2.65	54.00	0.159	0.00015	1E-06	0.0065	9.810	1.888	0.300	A, C, R1-R5	0.514	171%	N	
SMH1024708	SMH1024709	Circular Pipe	1.350	2.67	2.65	40.00	1.431	0.00015	1E-06	0.0005	9.810	0.998	1.428	Full-bore flow	1.428	100%	-	
SMH1024709	SMH1024710	Circular Pipe	1.650	2.44	2.44	56.00	2.138	0.00015	1E-06	-	9.810	0.998	2.134	A,R1-R5, Full-bore flow of SMH1024708 to SMH1024709	1.741	82%	Y	
SMH1024710	SMH1024711	Circular Pipe	1.650	2.43	2.43	13.40	2.138	0.00015	1E-06	-	9.810	0.998	2.134	A,D,E,F,G,R1-R5, Full-bore flow of SMH1024708 to SMH1024709	2.042	96%	Y	
SMH1024711	Box culvert	Circular Pipe	2.250	2.42	2.49	6.23	3.976	0.00015	1E-06	-	-	-	-	-	-	-	-	*rising main

* As there is no slope from SMH1024709 to SMH1024711, the velocity between SMH1024708 to SMH1024709 is adopted.

C1. Capacity Flow Estimation and Adequacy Check for Proposed Drainage System (Manning's Equation)

Manhole/Catchpit No.		Shape	Diameter, m	Initial mPD,X(m)	Ending mPD, A(m)	Length, m	Slope	Manning's Roughness Coefficient [4]	Cross Section Area, m^2	Wetted Perimeter, m	Hydraulic Radius, m	Mean Velocity, m/s	Capacity Flow, m^3/s	Catchments Served	Runoff, m^3/s	% of Capacity Flow	Sufficient Capacity? (Y/N)
C1	C3	U-channel	0.375	5.50	4.90	30.14	0.02	0.016	0.110	1.178	0.094	1.820	0.201	A	0.120	59%	Y
C3	C4	U-channel	0.375	4.90	4.60	31.25	0.01	0.016	0.110	1.178	0.094	1.264	0.140	A	0.120	86%	Y
C4	C5	U-channel	0.375	4.60	4.25	34.38	0.01	0.016	0.110	1.178	0.094	1.301	0.144	A	0.120	83%	Y
C5	P1	U-channel	0.375	4.25	3.90	33.94	0.01	0.016	0.110	1.178	0.094	1.310	0.145	A	0.120	83%	Y
C1	C2	U-channel	0.375	5.50	5.10	19.59	0.02	0.016	0.110	1.178	0.094	1.843	0.204	A	0.120	59%	Y
C2	P1	U-channel	0.375	5.10	4.85	25.28	0.01	0.016	0.110	1.178	0.094	1.283	0.142	A	0.120	84%	Y

C2. Capacity Flow Estimation and Adequacy Check for Proposed Drainage System (Colebrook-White Equation)

Pipe Segment		Shape	Diameter, m	Initial mPD,X(m)	Ending mPD, A(m)	Length, m	Aw, m2	ks, m [5]	v, m2/s	s	g, m/s2	V, m/s	Capacity Flow, m3/s	Catchment Served	Runoff, m^3/s	% of capacity	Sufficient Capacity? (Y/N)
P1	P2	Circular Pipe	0.375	3.90	3.89	1.00	0.1104	0.000006	1E-06	0.01	9.810	2.462	0.272	A	0.120	44%	Y
P2	SMH1024712	Circular Pipe	0.375	3.89	3.74	16.70	0.1104	0.000006	1E-06	0.01	9.810	2.323	0.257	A	0.120	47%	Y

D. Capacity Flow Estimation and Adequacy Check for Upgrading Works at the Existing Drainage System (Colebrook-White Equation)

Pipe Segment		Shape	Diameter, m	Initial mPD,X(m)	Ending mPD, A(m)	Length, m	Aw, m2	ks, m [3]	v, m2/s	s	g, m/s2	V, m/s	Capacity Flow, m3/s	Catchment Served	Runoff, m^3/s	% of capacity	Sufficient Capacity? (Y/N)
SMH1024712	SMH1024709	Circular Pipe	0.600	3.00	2.65	54.00	0.283	0.00015	1E-06	0.0065	9.810	2.255	0.638	A, C, R1-R5	0.514	81%	Y

Note:
[1] Runoff is calculated in accordance with DSD's "Stormwater Drainage Manual - Planning, Design and Management" (SDM), fifth edition, January 2018..
[2] 50 years return period of HKO Headquarters is adopted in the calculation.
[3 For the existing circular pipes, value of ks for precast concrete pipe under fair condition (i.e. ks = 0.15mm) is adopted in the calculation.
[4] For the proposed u-channel, value of n for concrete-lined channels under fair condition (i.e. n = 0.016) is adopted in the calculation.
[5] For the proposed connection pipe, value of ks for uPVC under fair condition (i.e. ks = 0.006mm) is adopted in the calculation.

Equation used:

Peak runoff

$$Q_p = 0.278\,C\,i\,A$$

Rainfall intensity

$$i = \frac{a}{(t_d + b)^c}$$

Time of concentration

$$t_0 = \frac{0.14465L}{H^{0.2}A^{0.1}} \qquad t_c = t_0 + t_f$$

Capacity flow = Aw x V

Appendix D

Detailed Drainage Analysis with 16 % of Rainfall Increase

Capacity Flow Estimation for Proposed Catchments and Drainage System with 50 Year Return Period (with 16% of rainfall increase)

A.Calculation of Catchment Runoff

Catchment ID	Surface Type	Catchment Area (A), m^2	Catchment Area (A), km^2	Average Slope (H), m/100m	Flow Path Length (L), m	Inlet Time (t_0), min	Time of Concentration (t_c), min	Duration (t_d), min	a (50 year return period) [2]	b (50 year return period) [2]	c (50 year return period) [2]	Runoff Intensity mm/hr	Runoff Coefficient (C)	C x A	Peak Runoff (with 16% of rainfall increase) (Q_p), m^3/s
A	80% Concrete + 20% Grassland (heavysoil), flat	1,770	0.0018	4.78	51.00	2.55	2.55	2.55	505.5	3.29	0.355	270	0.81	0.0014	0.125
B	70% Concrete + 30% Grassland (heavysoil), flat	1,821	0.0018	0.38	53.00	4.40	4.40	4.40	505.5	3.29	0.355	245	0.74	0.0013	0.106
C	80% Concrete + 20% Grassland (heavysoil), flat	3,197	0.0032	1.17	60.00	3.75	3.75	3.75	505.5	3.29	0.355	253	0.81	0.0026	0.211
D	100% Concrete	1,903	0.0019	1.21	58.00	3.80	3.80	3.80	505.5	3.29	0.355	252	0.95	0.0018	0.147
E	100% Grassland (heavysoil), flat	642	0.0006	1.54	52.00	3.62	3.62	3.62	505.5	3.29	0.355	255	0.25	0.0002	0.013
F	100% Concrete	182	0.0002	1.47	68.00	5.41	5.41	5.41	505.5	3.29	0.355	235	0.95	0.0002	0.013
G	50% Concrete + 50% Grassland (heavysoil), flat	3,567	0.0036	1.96	168.00	9.37	9.37	9.37	505.5	3.29	0.355	205	0.6	0.0021	0.142
H	100% Grassland (heavysoil), flat	1,633	0.0016	5.22	67.00	3.32	3.32	3.32	505.5	3.29	0.355	259	0.25	0.0004	0.034
R1	100% Concrete	858	0.0009	2.38	42.00	2.60	2.60	2.60	505.5	3.29	0.355	269	0.95	0.0008	0.071
R2	100% Concrete	517	0.0005	1.32	38.00	2.79	2.79	2.79	505.5	3.29	0.355	266	0.95	0.0005	0.042
R3	100% Concrete	568	0.0006	0.59	51.00	4.35	4.35	4.35	505.5	3.29	0.355	246	0.95	0.0005	0.043
R4	100% Concrete	110	0.0001	2.22	9.00	0.69	0.69	0.69	505.5	3.29	0.355	309	0.95	0.0001	0.010
R5	100% Concrete	498	0.0005	0.19	53.00	5.75	5.75	5.75	505.5	3.29	0.355	231	0.95	0.0005	0.035

B. Capacity Flow Estimation and Adequacy Check for Existing Drainage System (Colebrook-White Equation)

Pipe Segment		Shape	Diameter, m	Initial mPD,X(m)	Ending mPD, A(m)	Length, m	Aw, m2	ks, m [3]	v, m2/s	s	g, m/s2	V, m/s	Capacity Flow, m3/s	Catchment Served	Runoff, m^3/s	% of capacity	Sufficient Capacity? (Y/N)	
SMH1024712	SMH1024709	Circular Pipe	0.450	3.00	2.65	54.00	0.159	0.00015	1E-06	0.0065	9.810	1.888	0.300	A, C, R1-R5	0.537	179%	N	
SMH1024708	SMH1024709	Circular Pipe	1.350	2.67	2.65	40.00	1.431	0.00015	1E-06	0.0005	9.810	0.998	1.428	Full-bore flow	1.428	100%	-	
SMH1024709	SMH1024710	Circular Pipe	1.650	2.44	2.44	56.00	2.138	0.00015	1E-06	-	9.810	0.998	2.134	A,R1-R5, Full-bore flow of SMH1024708 to SMH1024709	1.755	82%	Y	
SMH1024710	SMH1024711	Circular Pipe	1.650	2.43	2.43	13.40	2.138	0.00015	1E-06	-	9.810	0.998	2.134	A,D,E,F,G,R1-R5, Full-bore flow of SMH1024708 to SMH1024709	2.070	97%	Y	
SMH1024711	Box culvert	Circular Pipe	2.250	2.42	2.49	6.23	3.976	0.00015	1E-06	-	-	-	-	-	-	-	-	*rising main

* As there is no slope from SMH1024709 to SMH1024711, the velocity between SMH1024708 to SMH1024709 is adopted.

C1. Capacity Flow Estimation and Adequacy Check for Proposed Drainage System (Manning's Equation)

Manhole/Catchpit No.		Shape	Diameter, m	Initial mPD,X(m)	Ending mPD, A(m)	Length, m	Slope	Manning's Roughness Coefficient [4]	Cross Section Area, m^2	Wetted Perimeter, m	Hydraulic Radius, m	Mean Velocity, m/s	Capacity Flow, m^3/s	Catchments Served	Runoff, m^3/s	% of Capacity Flow	Sufficient Capacity? (Y/N)
C1	C3	U-channel	0.375	5.50	4.90	30.14	0.02	0.016	0.110	1.178	0.094	1.820	0.201	A	0.125	62%	Y
C3	C4	U-channel	0.375	4.90	4.60	31.25	0.01	0.016	0.110	1.178	0.094	1.264	0.140	A	0.125	89%	Y
C4	C5	U-channel	0.375	4.60	4.25	34.38	0.01	0.016	0.110	1.178	0.094	1.301	0.144	A	0.125	87%	Y
C5	P1	U-channel	0.375	4.25	3.90	33.94	0.01	0.016	0.110	1.178	0.094	1.310	0.145	A	0.125	86%	Y
C1	C2	U-channel	0.375	5.50	5.10	19.59	0.02	0.016	0.110	1.178	0.094	1.843	0.204	A	0.125	61%	Y
C2	P1	U-channel	0.375	5.10	4.85	25.28	0.01	0.016	0.110	1.178	0.094	1.283	0.142	A	0.125	88%	Y

C2. Capacity Flow Estimation and Adequacy Check for Proposed Drainage System (Colebrook-White Equation)

Pipe Segment		Shape	Diameter, m	Initial mPD,X(m)	Ending mPD, A(m)	Length, m	Aw, m2	ks, m [5]	v, m2/s	s	g, m/s2	V, m/s	Capacity Flow, m3/s	Catchment Served	Runoff, m^3/s	% of capacity	Sufficient Capacity? (Y/N)
P1	P2	Circular Pipe	0.375	3.90	3.89	1.00	0.1104	0.000006	1E-06	0.01	9.810	2.462	0.272	A	0.125	46%	Y
P2	SMH1024712	Circular Pipe	0.375	3.89	3.74	16.70	0.1104	0.000006	1E-06	0.01	9.810	2.323	0.257	A	0.125	49%	Y

D. Capacity Flow Estimation and Adequacy Check for Upgrading Works at the Existing Drainage System (Colebrook-White Equation)

Pipe Segment		Shape	Diameter, m	Initial mPD,X(m)	Ending mPD, A(m)	Length, m	Aw, m2	ks, m [3]	v, m2/s	s	g, m/s2	V, m/s	Capacity Flow, m3/s	Catchment Served	Runoff, m^3/s	% of capacity	Sufficient Capacity? (Y/N)
SMH1024712	SMH1024709	Circular Pipe	0.600	3.00	2.65	54.00	0.283	0.00015	1E-06	0.0065	9.810	2.255	0.638	A, C, R1-R5	0.537	84%	Y

Note:
[1] Runoff is calculated in accordance with DSD's "Stormwater Drainage Manual - Planning, Design and Management" (SDM), fifth edition, January 2018..
[2] 50 years return period of HKO Headquarters is adopted in the calculation.
[3 For the existing circular pipes, value of ks for precast concrete pipe under fair condition (i.e. ks = 0.15mm) is adopted in the calculation.
[4] For the proposed u-channel, value of n for concrete-lined channels under fair condition (i.e. n = 0.016) is adopted in the calculation.
[5] For the proposed connection pipe, value of ks for uPVC under fair condition (i.e. ks = 0.006mm) is adopted in the calculation.

Equation used:

Peak runoff

$$Q_p = 0.278\,C\,i\,A$$

Rainfall intensity

$$i = \frac{a}{(t_d + b)^c}$$

Time of concentration

$$t_0 = \frac{0.14465L}{H^{0.2}A^{0.1}} \qquad t_c = t_0 + t_f$$

Capacity flow = Aw x V

Appendix E

DIA of Planning Application no. A/TM/422

Drainage and Sewage Impact Assessment for Proposed Redevelopment of Ex-fire Services Married Quarters, in Fu Tei, Tuen Mun

Prepared by:

Simon Lam
Environmental Consultant

Approved by:

David Yeung
Managing Director

ENVIRON Hong Kong Limited
Room 2310, China Resources Building
26 Harbour Road, Wan Chai, Hong Kong
Tel: (852) 3743 0788
Fax: (852) 35486988
E-mail: info.hk@environcorp.com

Q:\Projects\ALKTMFTQEI00\Report\DIA&SIA\V1.2\R1927_V1.2.doc

Contents

		Page
1.0	Introduction	1
1.1	Project Background	1
1.2	Project Location and Scope	1
2.0	Drainage Impact Assessment	2
2.1	Existing drainage conditions	2
2.2	Potential drainage impacts	2
2.3	Results and recommendations	4
3.0	Sewage Impact Assessment	5
3.1	Existing sewage conditions	5
3.2	Potential sewage impacts	5
3.3	Remedial and Mitigation Measures	7
3.4	Results and recommendations	7

List of Tables

Table 1 Parameters used in Estimation of Sewage within Catchment Area 6

List of Figures

Figure 1 Site Location Plan
Figure 2 Typical Floor Plan
Figure 3 Catchment of Site Stormwater Drainage
Figure 4 Proposed Drainage Layouts (Options 1 & 2)
Figure 5 Catchment of Existing Sewer from Tuen Fu Road to Siu Hong Sewage Pumping Station
Figure 6 Proposed Sewage Layout

List of Appendix

Appendix A Site Photographs
Appendix B Stormwater Drainage Estimation
Appendix C Sewage Estimation

1.0 Introduction

1.1 Project Background

1.1.1 Both Drainage Impact Assessment (DIA) and Sewage Impact Assessment (SIA) are performed to support the planning of the Proposed Redevelopment of Ex-fire Services Married at Fu Tei, Tuen Mun, N.T., hereinafter called the Site which is shown on **Figure1**.

1.1.2 This Report is based on the following information:

(i) Fig. 1 Location Plan,
(ii) Fig. 2 Layout Plans provided by the client,
(iii) Drainage information in Tuen Mun copied from DSD,
(iv) 1:5000 Survey maps,
(v) Stormwater Drainage Manual (SDM) by Drainage Services Department (2000),
(vi) EPD Technical Paper (EPD/TP 1/05) – Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0 (GESF)
(vii) Sewerage Manual – Part 1 (SM1) by Drainage Services Department (1995),
(viii) OZP Zoning from website of the Town Planning Board, Planning Department (OZP)
(ix) Tuen Mun Outline Zoning Plan No. S/TM/28,and;
(x) Site visit on 22 January 2011.

1.2 Project Location and Scope

1.2.1 The Site is located at Tuen Fu Road, Tuen Mun, N.T. with an area of about 3,390m^2, see Photo No. 2.

1.2.2 The Site is bounded by Tuen Fu Road on the North and a track road on the South. It is adjoining the WSD Tuen Mun Water Treatment Works Staff Quarters on the East and the Tuen Mun North Offtake & Pigging Station on the West; a 10m access road exists between the site and the offtake and pigging station, see **Figure 1**.

1.2.3 The track road at South is connected to the Castle Peak Road-San Hui Section via a 15m long ramp. The ground levels of Castle Peak Road-San Hui Section and the track road are 8.5mPD and 5.5mPD respectively.

1.2.4 The ground levels of the Site and Tuen Fu Road are 6.9mPD and 6.2mPD respectively.

2.0 Drainage Impact Assessment

2.1 Existing drainage conditions

2.1.1 According to the existing drainage layout extracted from DSD, see **Figure 3**, an existing 3,000 x 2,400 mm (H) twin box culvert is running underneath Castle Peak Road-San Hui Section and parallel to the track road at South of the Site.

2.1.2 A DN450 stormwater pipe (SWD1028346) downstream of a DN375 stormwater pipe (SWD1028347) are running at Tuen Fu Road and connecting to the twin box culvert via a series of DN750 and DN1650 stormwater pipes.

2.1.3 Another DN300 stormwater pipe (SWD1035859) underneath the ramp at South of the Site is connecting to the twin box culvert. However, upstream invert level of the pipe is not shown in the DSD information and stormwater manhole was not found at this location during the site visit.

2.2 Potential drainage impacts

2.2.1 The runoff from the Site could be discharged into the twin box culvert via the existing DN450 stormwater pipe at Tuen Fu Road (Option 1) or the existing DN300 stormwater pipe at the ramp (Option 2). The capacity of the twin box culvert and the stormwater pipes against additional runoff from the Site are checked below.

2.2.2 The runoff from the Site and capacities of the twin box culvert and the stormwater pipes are estimated based on the following parameters.

(i) Stormwater runoff estimated by rational method according to Bransby Williams' equation:

- Return period of storm, 1 in 50 years for Urban Drainage Branch Systems (para 6.6.2 and Table 10 of SDM refers)
- Runoff coefficient,

c = 0.8 for concrete surface before redevelopment, and

c = 0.95 for concrete surface after redevelopment

(para 7.5.2 (b) of SDM refers)

(ii) Capacity of twin box culvert 3,000 x 2,400 mm (H) by Manning's Formula, assuming Manning's n-value equals 0.016 (Fair Condition in Table 13 of SDM refers)

(iii) The Roughness Coefficient of the stormwater pipes is 0.15mm (Normal Condition of Precast concrete pipes with 'O' ring joints in Table 14 of SDM refers).

Detail estimations are included in **Appendix B**.

2.2.3 The runoff estimation and twin box culvert capacity are as follow:

(i) Total runoff from the Site

before redevelopment = 0.2m^3/sec
after redevelopment = 0.2376 m^3/sec

(ii) Additional runoff from the site = 0.038 m^3/sec

(iii) Full flow capacity of twin box culvert = 46.22m^3/sec.

(iv) Additional stormwater runoff after the redevelopment = 0.08% of the twin box culvert.

2.2.4 For Option 1, the stormwater runoff is discharged into the DN450 stormwater pipe and to the twin box culvert via the DN750 and DN1650 stormwater pipes.

(i) The full flow capacity of the DN450 stormwater pipe = 0.313m^3/sec

(ii) Additional stormwater runoff after the redevelopment is 11.98% of the stormwater pipe

(iii) Based on the DSD drainage record and the site visit, the drainage catchment areas of the DN450 stormwater pipe is regarded as consisting of the Site and a 85m road section of Tuen Fu Road in front of the Site. The catchment areas are shown in **Figure 3**. From the hydraulic calculation in **Appendix B**, the total design flow of the stormwater pipe including the road drainage runoff = 0.3081 m^3/sec which is about 98.4 % of the full flow capacity of the pipe.

2.2.5 For Option 2, the stormwater runoff is discharged into the DN300 stormwater pipe which is connected to the twin box culvert.

(i) Assuming a 1.9m cover at upstream of the pipe, the full flow capacity of the DN300 stormwater pipe = 0.245m^3/sec

(ii) Additional stormwater runoff after the redevelopment is 15.33% of the stormwater pipe

2.2.6 For both options, the DN450 and DN300 stormwater pipe are capable to discharge the runoff from the Site and the increase in stormwater flow is about 12% to 15% of the pipe capacity which is considered small. As the capacity of the twin box culvert and downstream nullah is larger than these pipes, the significance of such increase is diminishing, thus further hydraulic checking on the twin box culvert and beyond is therefore not required.

2.3 Results and recommendations

2.3.1 The proposed redevelopment will not have any adverse drainage impact to the downstream area as the percentage increase in surface water runoff is well below the capacity of the existing drainage system.

2.3.2 Proper stormwater drainage system within the lot boundary shall be designed to collect all stormwater runoff and transmitted to the existing DN450 stormwater pipe at Tuen Fu Road in Option 1 or alternatively to the existing DN300 stormwater pipe at the ramp to Castle Peak Road-San Hui Section in Option 2 in order to protect the proposed redevelopment, see **Figure 4**.

2.3.3 For Option 1, a stormwater terminal manhole close to north site boundary is proposed to connect to the existing stormwater manhole (SMH1024712) at Tuen Fu Road.

2.3.4 For Option 2, as mentioned in para 3.1.3 above, the upstream invert level and the location of the DN300 stormwater pipe are not certain, further site investigation is required to locate the pipe. A stormwater terminal manhole close to south site boundary is proposed to connect to the DN300 stormwater pipe at the ramp to the Castle Peak Road-San Hui Section.

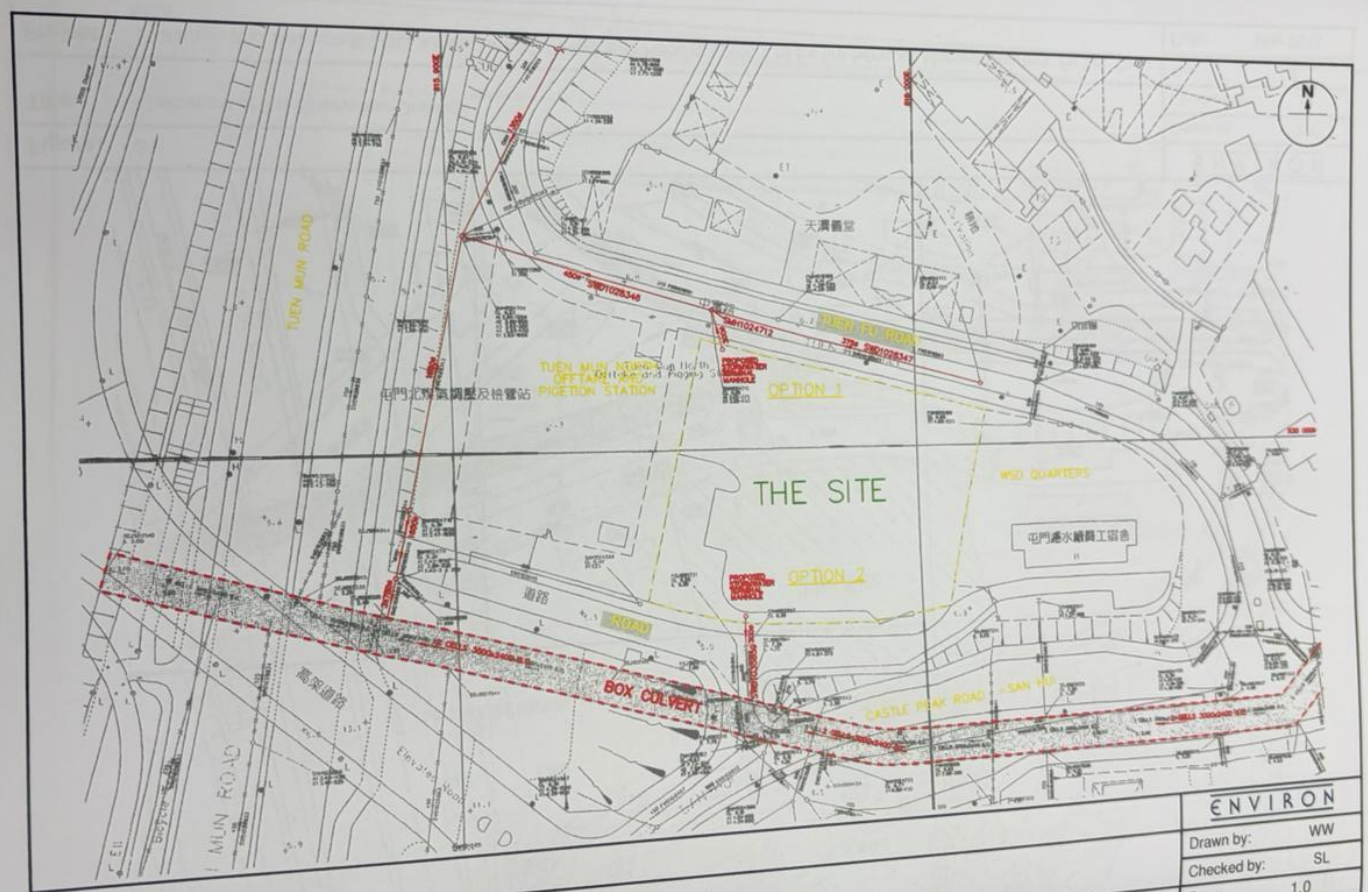


Figure:	4
Title:	Proposed Drainage Layouts (Options 1 & 2)
Project:	Drainage and Sewage Impact Assessment for Proposed Redevelopment of Ex-fire Services Married Quarters, Fu Tei, Tuen Mun

ENVIRON

Drawn by:	WW
Checked by:	SL
Rev.:	1.0
Date:	May 2011

Appendix F

BRAVO Record of Tuen Mun North Offtake and Pigging Station