渠務署及城市規劃委員會:

有關 A/YL-KTN/989 的擬議渠務建議詳細

在申請地點北面是規劃申請編號 A/YL-KTN/891 的申請範圍，基準水平高本申請範圍約 1 米，並設有鐵絲網。申請地點東面是道路。申請地點南面為耕種用地，申請地點北面為金屬實心的圍板，沒有留有去水位，因此沒有流水從北、南及西面進入申請地點。

總集水面積約 11,819 平方米，集水區主要分為兩部分：申請地點外上流的水流及申請地點內。集水區主要是由草地及混凝土作表面面層，請參考 Appendix 5.2。

申請地點計劃鋪設 375mm 及 450mmUC 引導及收集雨水及地面水，根據 STORMWATER DRAINAGE MANUAL – Seation 7.5.2 Rational Method 計算，現時的渠道有足夠的容量處理集水區內的水流量。

現場相片請參考文件尾端。

R to C:

	渠務署意見	申請人回覆
(1)	*The proposed UC appears to be undersized. Please review the hydraulic calculations. Please clarify why rainfall intensity equals to 71.*	請參考本文件尾端，已修正該錯誤。
(2)	*Please provide proposed catchment areas for comment.*	請參考 Appendix 5.2。
(3)	*Please submit calculation demonstrating the downstream drainage system receiving the discharge from the development has adequate spare capacity to accommodate the runoff.*	請參考本文件尾端，已修正該錯誤。現場觀察點及現有自然溪流評估位置請參考 Appendix 5.3。

(4)	*The level difference of invert levels of catchpit are consistently to be 0.1m while the distance of UC is varying which is not logically. Please review all catchpit invert levels accordingly.*	已依照　　貴署的意見更改。
(5)	*Please indicate clearly the full alignment of the discharge path from the application site all the way down to the ultimate discharge point (e.g. a well-established stream course/public drainage system).*	請參考 Appendix 5 及 5.3。
(6)	*The existing drainage facilities, to which the stormwater of the development from the subject site would discharge, are not maintained by this office. The applicant should identify the owner of the existing drainage facilities to which the proposed connection will be made. Also, DSD noticed that the proposed drainage connection(s) to the surrounding/downstream area(s) will run through other private lot(s). The applicant shall demonstrate that the proposed drainage construction / improvement / modification works and the operation of the drainage can be practicably implemented.*	本人了解現有的渠道設施不是由貴署所興建及保護。如興建及接駁到其他私人或其他有關政府部門的渠道，會向有關持分者或部分了解及取得同意後才會進行相關工程。
(7)	*Please justify the size of existing 600mm UC. Also, the existing 600mm UC is full of debris and leaves so the condition is considered not acceptable.*	本人會在申請後安排清理及維護有關渠道。
(8)	*Please indicate clearly on plan that the proposed size of discharge outlets.*	請參考 Appendix 5。
(9)	*Please clarify whether any walls or hoarding would be erected along the site boundary. Where walls or hoarding are erected are laid along the site boundary, adequate opening should be provided to intercept the existing overland flow passing through the site.*	申請地點未有圍封的地方將會以實心金屬板圍起，並會留有不少過10cm 的空間讓水流通過。

(10)	*Please provide more cross sections including adjacent areas for reference. All proposed/ existing drainage facilities should be indicated on section drawings.*	請參考 Appendix 5.1。
(11)	*The development should neither obstruct overland flow nor adversely affect existing natural streams, village drains, ditches and the adjacent areas, etc.*	本申請不會影響水流。
(12)	*The applicant(s) shall resolve any conflict/disagreement with relevant lot owner(s) and seek LandsD's permission for laying new drains/channels and/or modifying/upgrading existing ones in other private lots or on Government land (where required) outside the application site(s).*	如興建及接駁到其他私人或其他有關政府部門的渠道，會向有關持分者或部分了解及取得同意後才會進行相關工程。
(14)	*According to our record, the drainage proposal of A/YL-KTN/891 has not been submitted and approved, so this application should also consider all external catchment areas in the assessment as appropriate.*	現已將相關的水流納入，請參考 Appendix 5.2。

希望此附加文件能釋除　　貴署的隱憂。

二零二四年六月三日

Calculation of Peak Runoff, Q_p (Rational Method)

Rainfall Intensity, *i*

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

Where *i* = extreme mean intensity in mm/hr,
t_d = duration in minutes ($t_d \leq 240$), and
a, b, c = storm constants given in Table 3 of SMD, as shown below

for 50 year Design Return Period (Using Table 3a – Storm Constants for Different Return Periods of HKO Headquarters on SDM)

a=	451.3
b=	2.46
c=	0.337

Calculation of Peak Runoff, Q_p (Rational Method)

According to Section 7.5.2(b) of the Stormwater Drainage Manual (SDM), Fifth Edition January 2018

Surface Characteristics	Runoff coefficient, C
Asphalt	0.70-0.95
Concrete	0.80-0.95
Brick	0.70-0.85
Grassland (heavy soil)	
Flat	0.13-0.25
Steep	0.25-0.35
Grassland (sandy soil)	
Flat	0.05-0.15
Steep	0.15-0.20

For catchment area of the site at the proposed development, the Concrete runoff coefficient is taken as 0.95, Grassland (heavy soil) with flat surface as 0.25 and Asphalt (small rock) as 0.95.

Peak Runoff, Q_P

$Q_P = 0.278\ C\ i\ A$

Where Q_P = Peak runoff in km^3/s
C = Runoff coefficient (dimensionless)
i = Rainfall intensity in mm/hr
A = Catchment area in km^2

The total design runoff of the catchment area (upstream) is 0.261 m^3/s, which is around 14,040 liter/min.

According to GEO Technical Guidance Note No. 43 (TGN 43),
For gradient 1:200, a 450UC will be suitable.

The total design runoff of the catchment area (application) is 0.121 m^3/s, which is around 7,260 liter/min.

According to GEO Technical Guidance Note No. 43 (TGN 43),
For gradient 1:200, a 375UC will be suitable.

本申請會採用 375mm 及 450mmUC。

Check The Capacity of Existing Natural Stream

Manning Equation is used in hydraulic design and analysis. The cross-sectional mean velocity is given in the following expression:

$$V = \frac{R^{1/6}}{n}\sqrt{RS_f}$$

Where R = hydraulic radius (m)
N = Manning coefficient (s/m1/3), refer Table 13 of SDM
Sf = friction gradient (dimensionless)

Using Manning's Equation

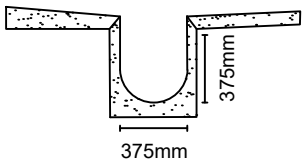
$V = R^{2/3} * S_f^{0.5}/n$

Where R = A/P = 0.362 m A = 1.05 m^2
P = 2.9 m
n = 0.03775 $s/m^{1/3}$ (Table 13 of Stormwater Drainage Manual)
S_f = 0.013

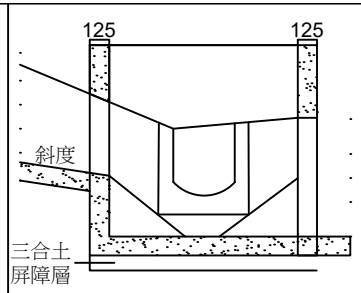
Therefor V = $0.362^{2/3} * 0.013^{0.5}/0.03775$
= 3.12 m/sec

Maximum Capacity (Qmax)
= V*A
= 3.28 m^3/sec
> Q_{total}

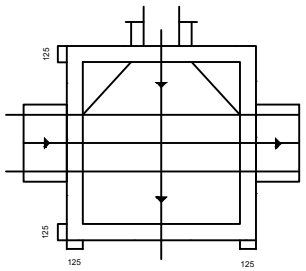
The Existing Natural Stream has enough capacity.



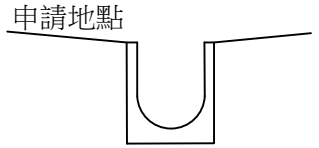
U型明渠切面圖



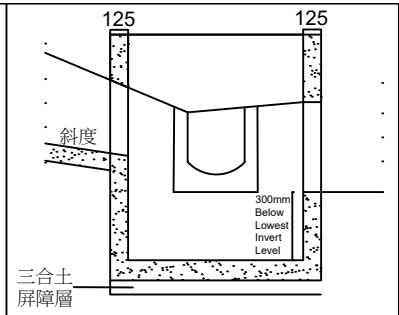
沙井切面圖



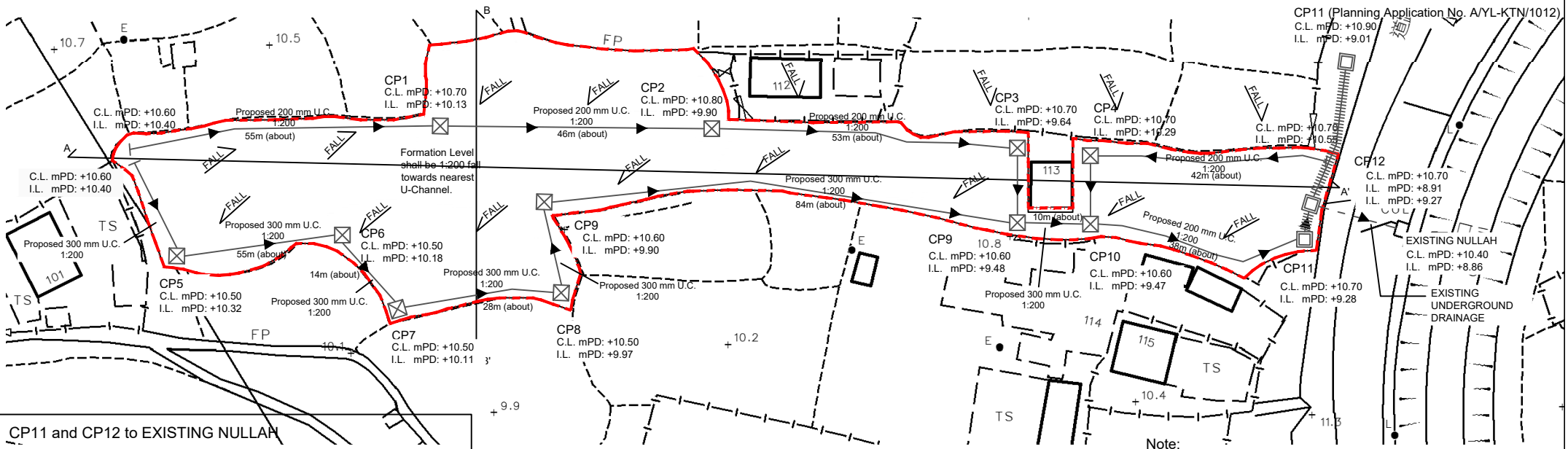
沙井俯視圖



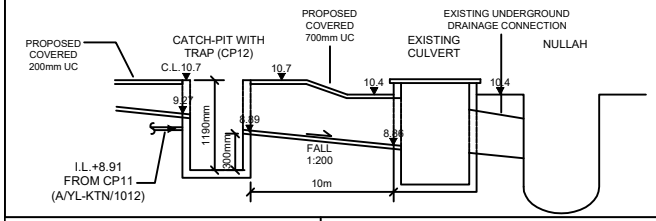
U型明渠切面略圖



沙井切面圖 (CP4 and CP11 Design)



CP11 and CP12 to EXISTING NULLAH



Scale: 1:750 @A4

Note:

1. Adequate opening will be provided around the application site.
2. Catchpit design shall follow CEDD standard drawing No. C2406I.
3. All proposed U-channel and Catchpit must maintain in good shape (i.e. Inspection and maintenance regularly).
4. Grating Cover is provided to reduce the irregular road surface from entering the site.
5. The discharge point is on the top of the natural stream, no extra work is needed outside the application site.

Appendix 5

Proposed Drainage Plan

擬議渠務建議

Location:
D.D. 109 Lot 1051 RP (Part), 1052 and 1057

OZP: S/YL-KTN/11
District: Kam Tin North
Zoning: Agriculture

擬議臨時貨倉（危險品倉庫除外）連附屬設施(為期3年)及填土工程

Proposed Temporary Warehouse (excluding Dangerous Goods Godown) with Ancillary Facilities for a Period of 3 Years and Filling of Land

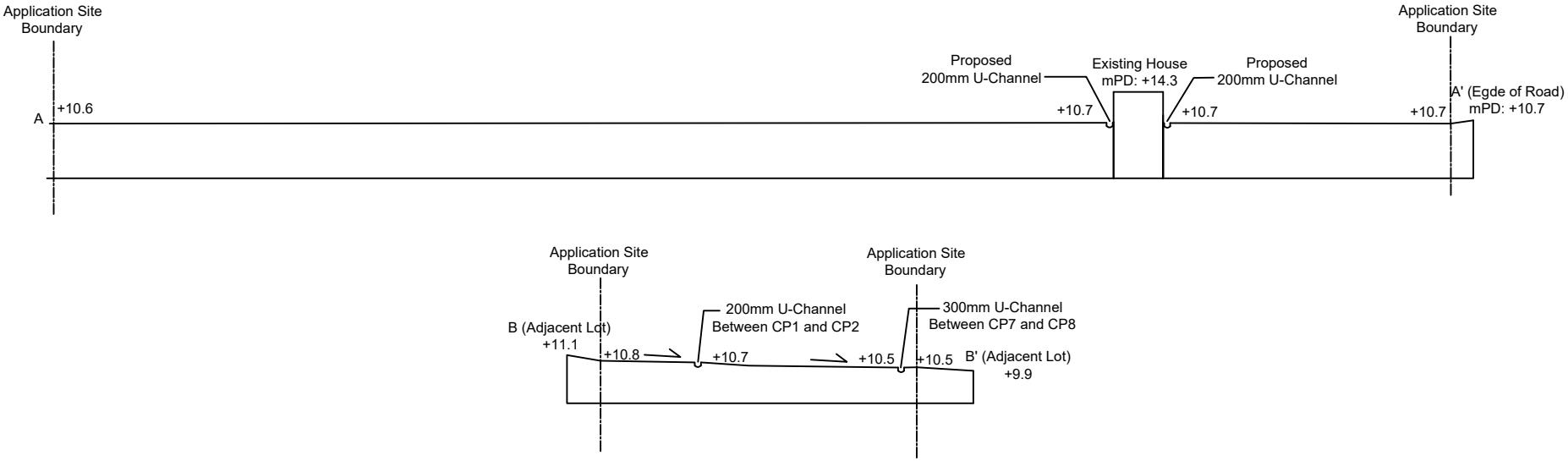
Legend:

- Proposed Catchpit
- Proposed U-Channel
- Proposed U-Channel with C.I. Cover
- Water Flow Direction
- Existing Channel

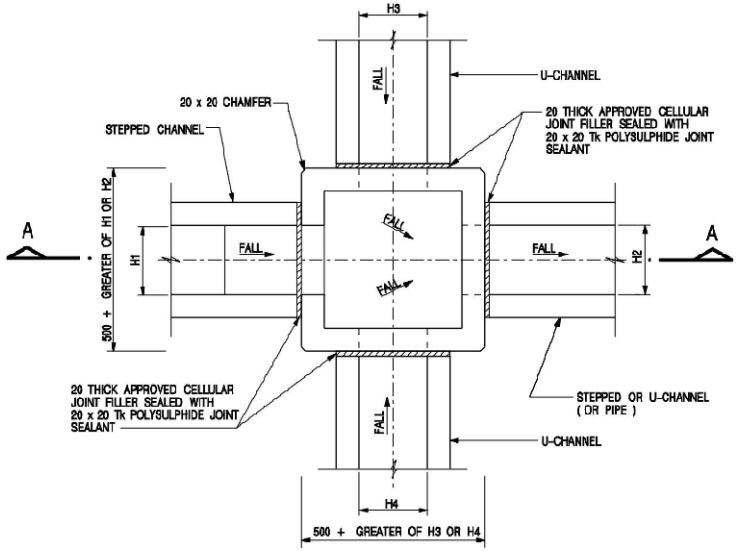
Drawing No.:
5-01

For Identification Only

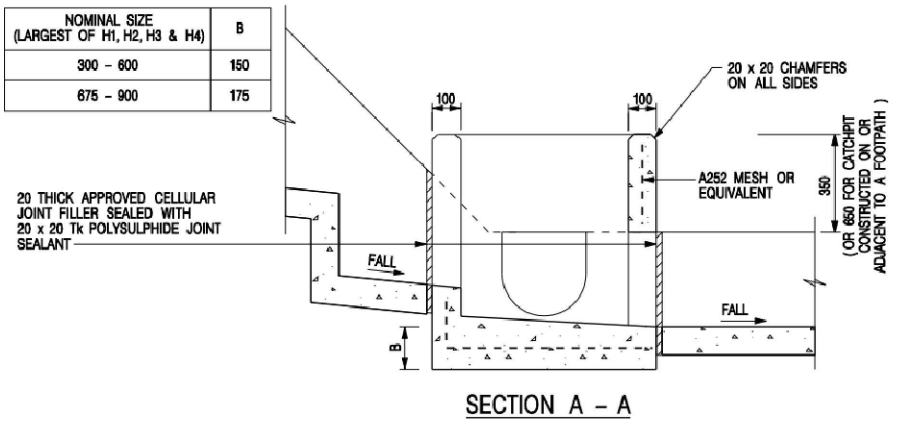
Date: 03/06/2024



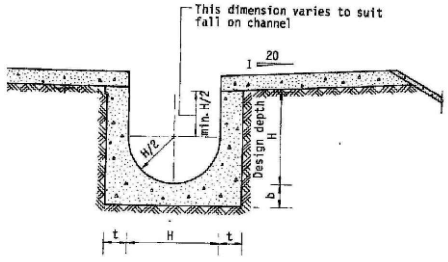
Appendix 5.1 Cross-Section A-A' B-B'	Location: D.D. 109 Lot 1051 RP (Part), 1052 and 1057 OZP: S/YL-KTN/11 District: Kam Tin North Zoning: Agriculture	擬議臨時貨倉（危險品倉庫除外）連附屬設施(為期3年)及填土工程 Proposed Temporary Warehouse (excluding Dangerous Goods Godown) with Ancillary Facilities for a Period of 3 Years and Filling of Land	Scale: 1:750 @A4	Drawing No.: 5.1-1 For Identification Only Date: 03/06/2024



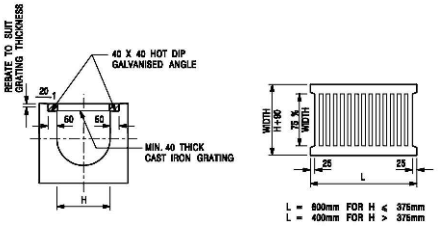
NOMINAL SIZE (LARGEST OF H1, H2, H3 & H4)	B
300 – 600	150
675 – 900	175



SECTION A – A



TYPICAL DETAILS OF U CHANNEL

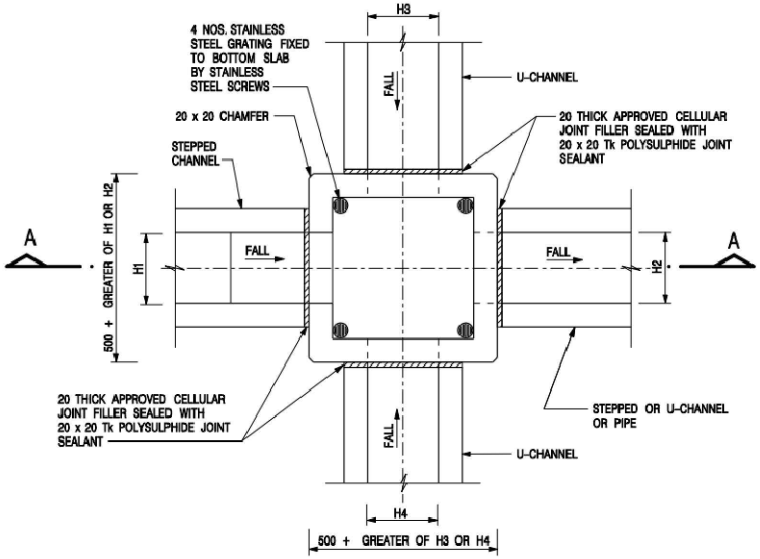


TYPICAL SECTION CAST IRON GRATING

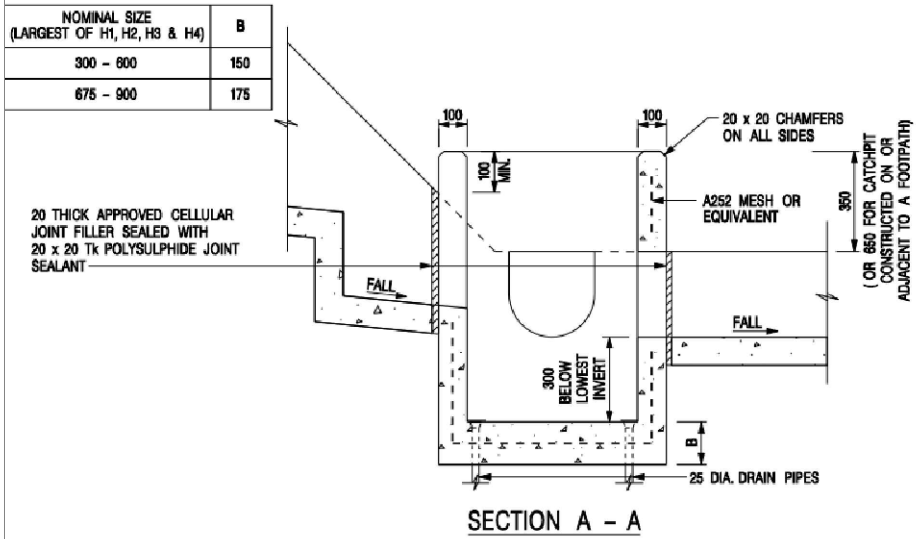
(DIMENSIONS ARE FOR GUIDANCE ONLY, CONTRACTOR MAY SUBMIT EQUIVALENT TYPE)

U-CHANNEL WITH CAST IRON GRATING

TYPICAL DETAILS OF CATCHPIT



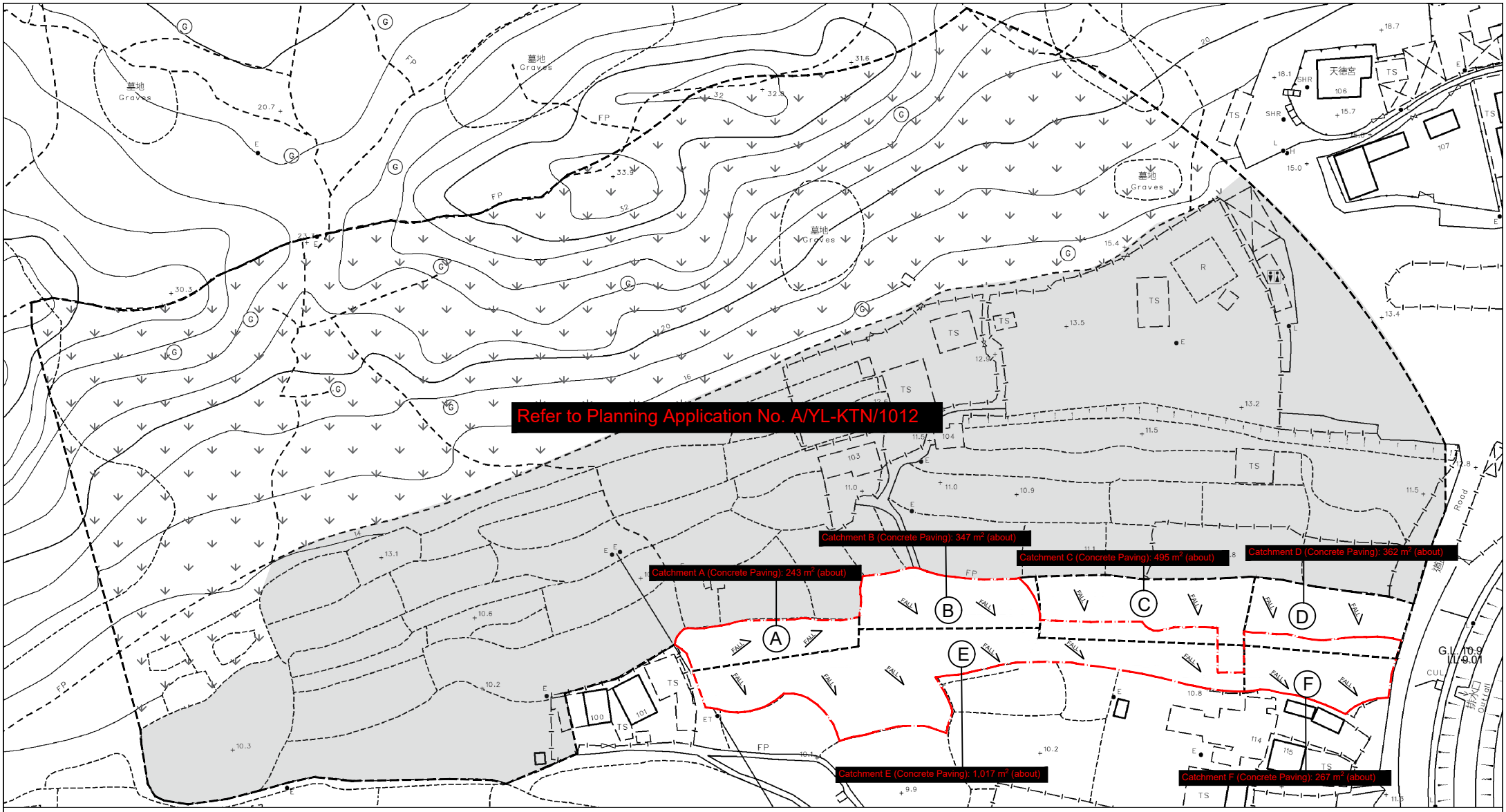
NOMINAL SIZE (LARGEST OF H1, H2, H3 & H4)	B
300 – 600	150
675 – 900	175



SECTION A – A

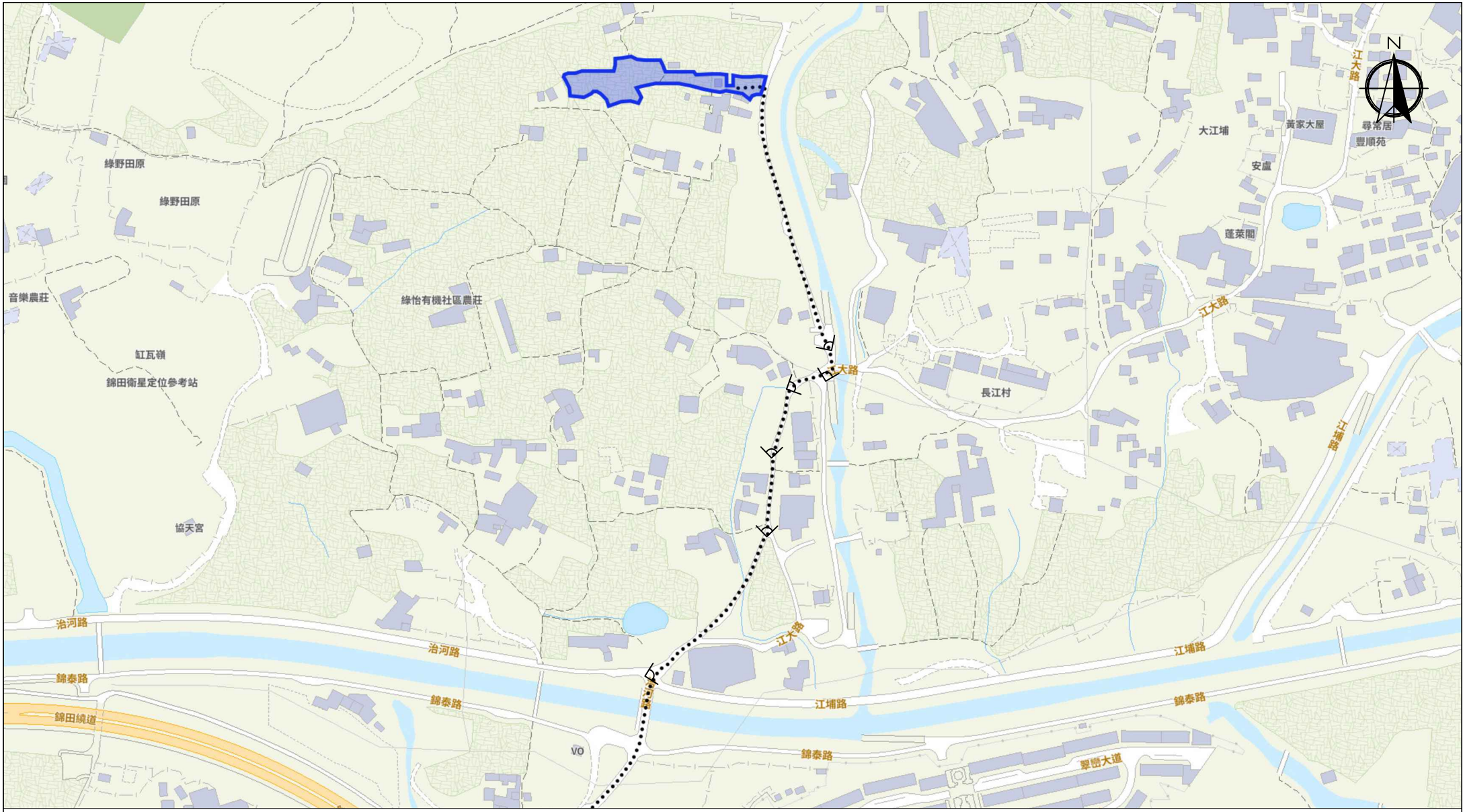
TYPICAL DETAILS OF CATCHPIT WITH TRAP

Appendix 5.1.1 TYPICAL DETAILS	Location: D.D. 109 Lot 1051 RP (Part), 1052 and 1057 OZP: S/YL-KTN/11 District: Kam Tin North Zoning: Agriculture	擬議臨時貨倉（危險品倉庫除外）連附屬設施(為期3年)及填土工程 Proposed Temporary Warehouse (excluding Dangerous Goods Godown) with Ancillary Facilities for a Period of 3 Years and Filling of Land	Scale: N.T.S.	Drawing No.: 5.1-2 For Identification Only Date: 03/06/2024



Catchment Area (Outside): 33,309m^2, Catchment Area (Application Site): About 2,557 m^2.

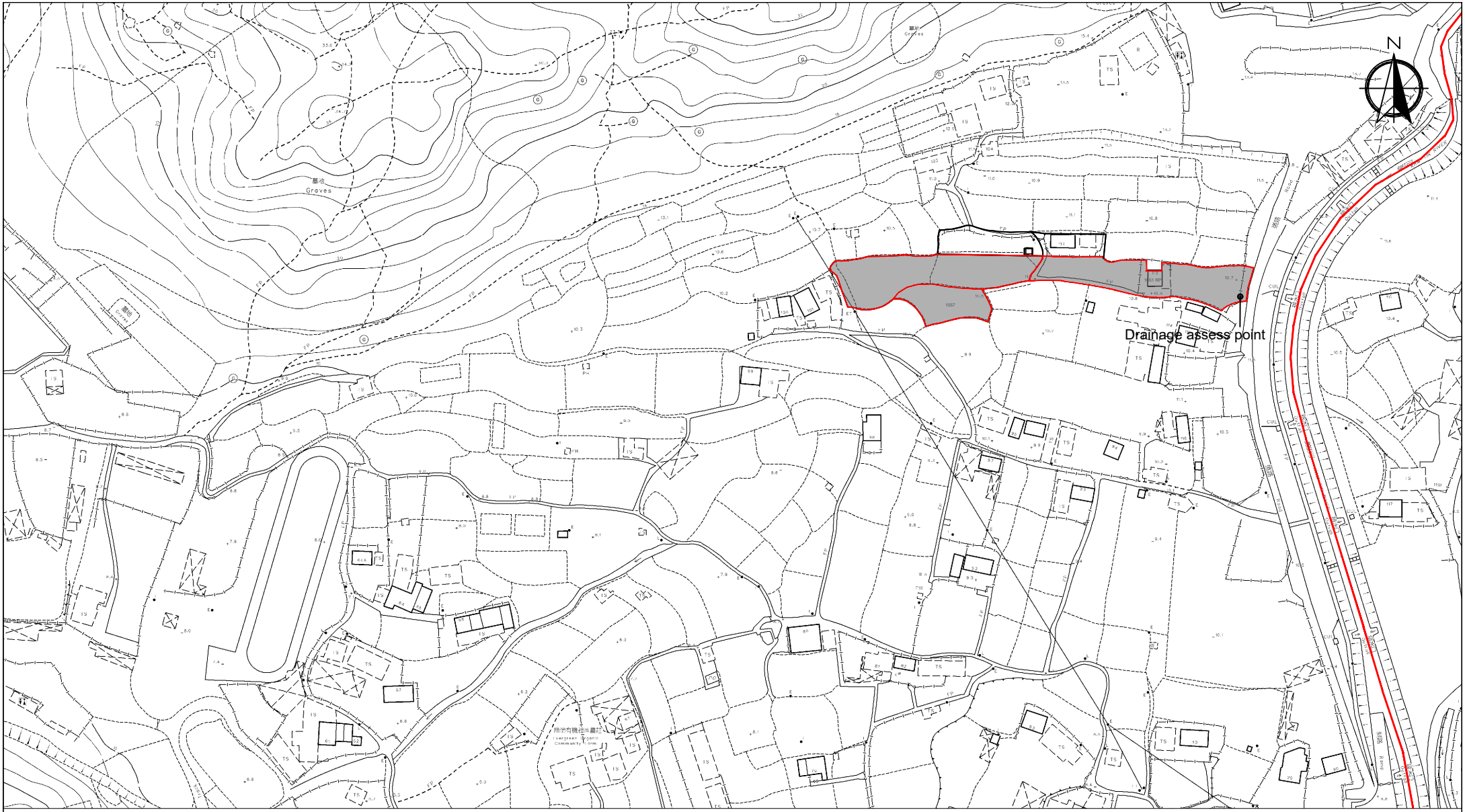
Appendix 5.2 Catchment Area	Location: D.D. 109 Lot 1051 RP (Part), 1052 and 1057 OZP: S/YL-KTN/11 District: Kam Tin North Zoning: Agriculture	擬議臨時貨倉（危險品倉庫除外）連附屬設施(為期3年)及填土工程 Proposed Temporary Warehouse (excluding Dangerous Goods Godown) with Ancillary Facilities for a Period of 3 Years and Filling of Land	Scale: 1:1200 @A4 Legend: Catchment Area (Steep Glassland) Catchment Area (Concrete Paving) Catchment Area (Application Site - Concrete Paving)	Drawing No.: 5.2-1 For Identification Only Date: 30/05/2024



Scale: Undefined @A4

Captured from map.gov.hk on 17th January 2024

Appendix 3 Existing Vehicular Access	Location: D.D. 109 Lot 1051 RP (Part), 1052 and 1057 OZP: S/YL-KTN/11 District: Kam Tin North Zoning: Agriculture	Project: Proposed Temporary Warehouse (excluding Dangerous Goods Godown) with Ancillary Facilities for a Period of 3 Years and Filling of Land	Width of Chi Ho Road: 3-6m (About) with passing space Map Legend: Road Path Site Boundary Viewing Point	Drawing No.: 3-01 For Identification Only Date: 01/03/2024



Scale: Undefined @A4

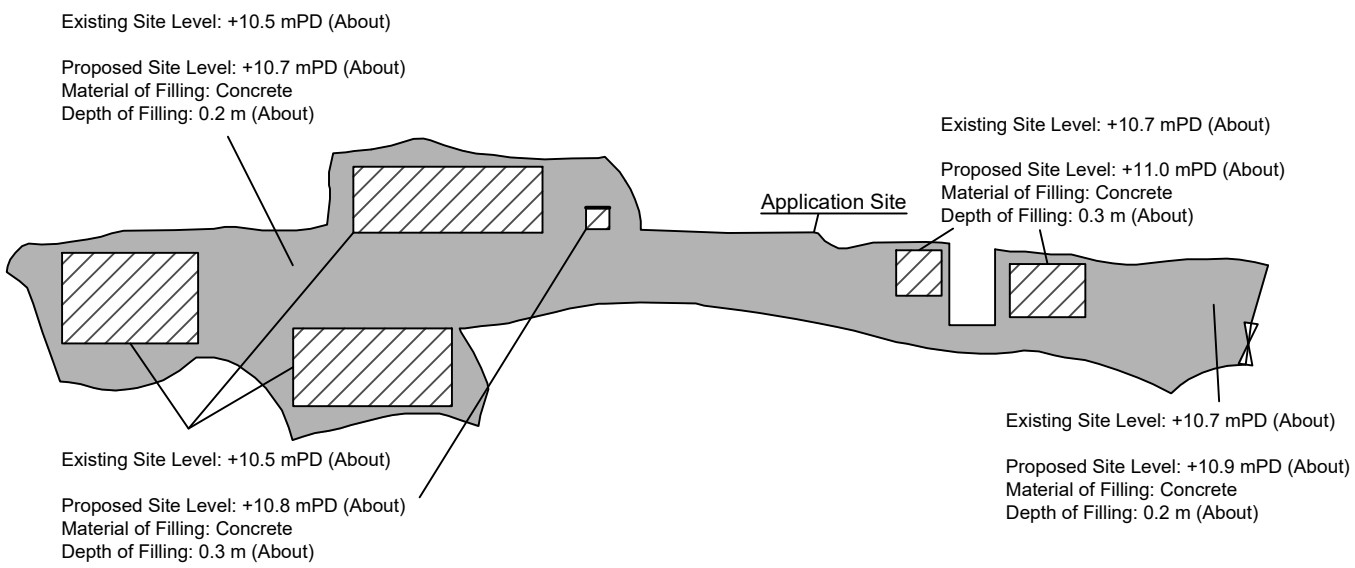
Captured from hkmapservices iB1000 6-NE-7D on 30th May 2024

Appendix 5.3 Ultimate Discharge Point with Viewing Point	Location: D.D. 109 Lot 1051 RP (Part), 1052 and 1057 OZP: S/YL-KTN/11 District: Kam Tin North Zoning: Agriculture	Project: Proposed Temporary Warehouse (excluding Dangerous Goods Godown) with Ancillary Facilities for a Period of 3 Years and Filling of Land	Map Legend: Viewing Point Discharge Path	Drawing No.: 5.3-1 For Identification Only Date: 03/06/2024

Scale: Undefined @A4

Captured from map.gov.hk on 17th January 2024

Appendix 5.4 Viewing Point	Location: D.D. 109 Lot 1051 RP (Part), 1052 and 1057 OZP: S/YL-KTN/11 District: Kam Tin North Zoning: Agriculture	Project: Proposed Temporary Warehouse (excluding Dangerous Goods Godown) with Ancillary Facilities for a Period of 3 Years and Filling of Land	Map Legend: Viewing Point	Drawing No.: 5.4-1 For Identification Only Date: 30/05/2024

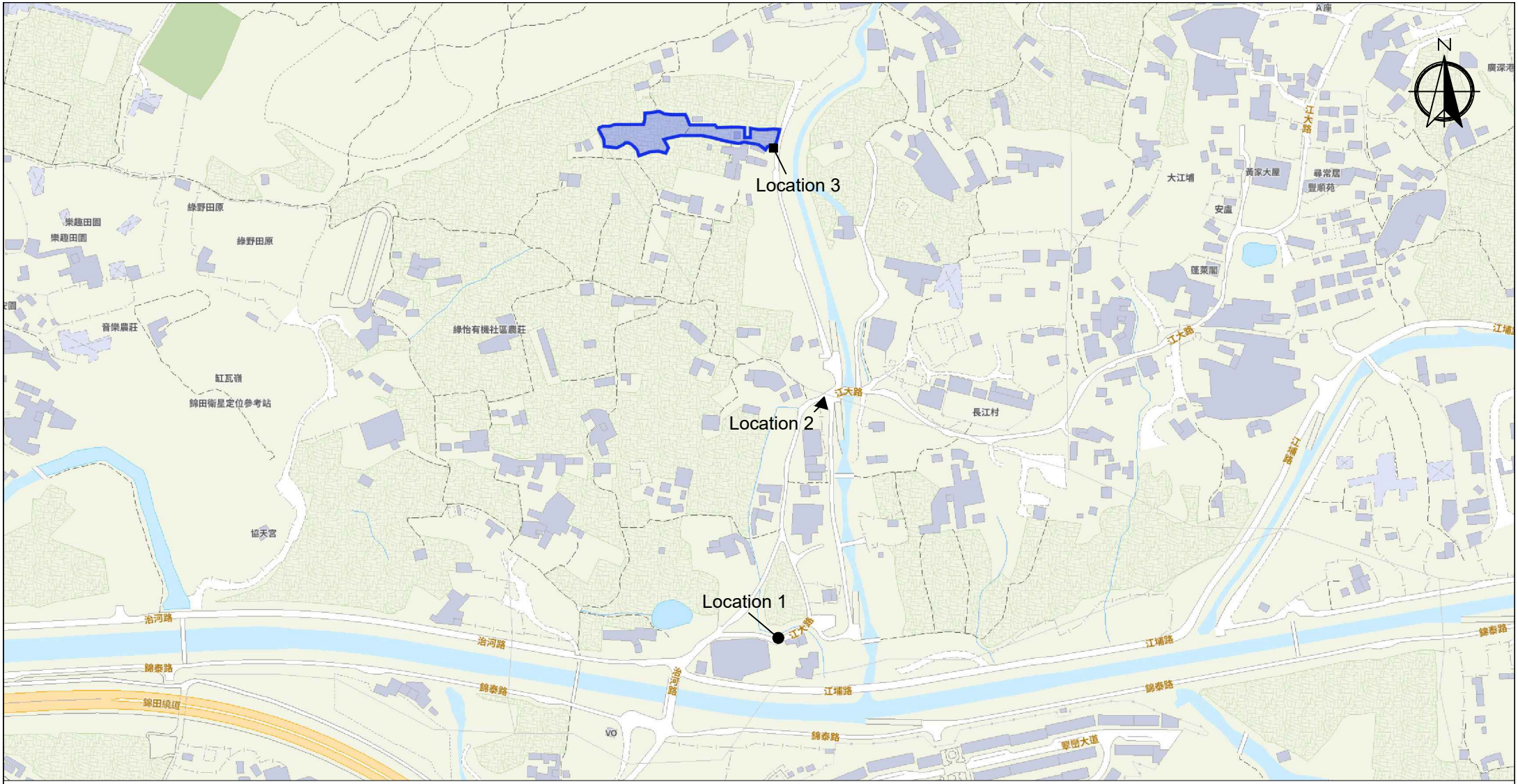


Paved Area: About 2,899.2 m^2

Legend:

Paved Area 平整範圍

Appendix 4 Location: DD 109 Lot 1051 RP (Part) DD 109 Lot 1052 DD 109 Lot 1057 OZP: S/YL-KTN/11 District: Kam Tin North Zoning: Agriculture Date: 17 January 2024	Paved Area 平整位置圖 擬議臨時貨倉（危險品倉庫除外）連附屬設施(為期3年)及填土工程 Proposed Temporary Warehouse (excluding Dangerous Goods Godown) with Ancillary Facilities for a Period of 3 Years and Filling of Land	SCALE 1:1000 @A4 For Identification Only Drawing No.: 4-01



Scale: Undefined @A4

Captured from map.gov.hk on 17th January 2024

Appendix 5 On-Site Notice Location	Location: D.D. 109 Lot 1051 RP (Part), 1052 and 1057 OZP: S/YL-KTN/11 District: Kam Tin North Zoning: Agriculture	Project: Proposed Temporary Warehouse (excluding Dangerous Goods Godown) with Ancillary Facilities for a Period of 3 Years and Filling of Land	Map Legend: Site Boundary On-site Notice Location 1 On-site Notice Location 2 On-site Notice Location 3	Drawing No.: 5-01 For Identification Only Date: 18/01/2024

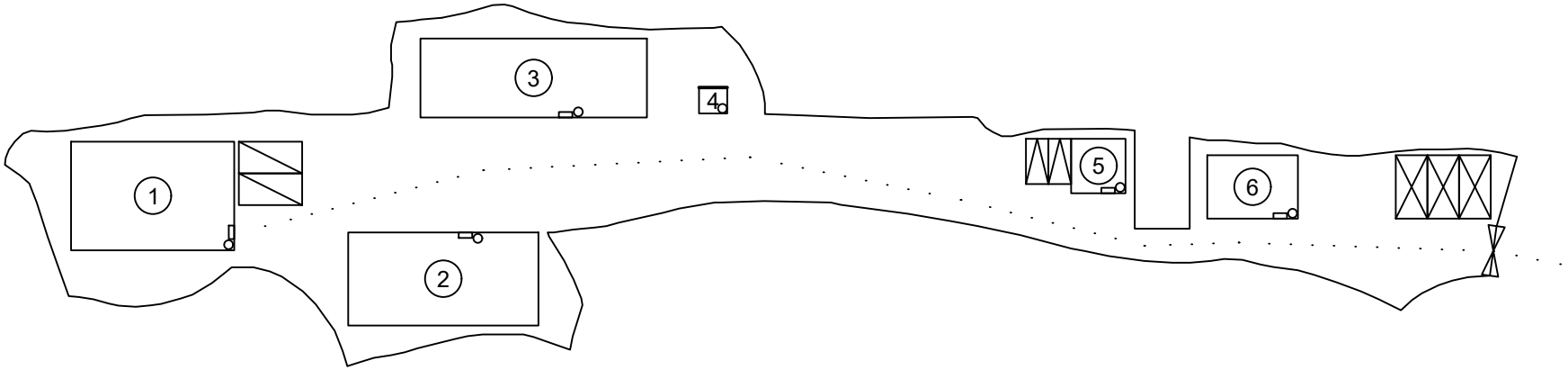
Proposed Structures Details

	Structures	Gross Floor Area (GFA)	Height (Not Exceeding)	No. of Storey
1	Warehouse (Excluding D.G.G.)	About 18m x 12m = 216 m^2	8m	1
2	Warehouse (Excluding D.G.G.)	About 21m x 10m = 210 m^2	8m	1
3	Warehouse (Excluding D.G.G.)	About 25m x 8.7m = 217.5 m^2	8m	1
4	Electric Meter Room	About 2.8m x 3m = 8.4 m^2	3.5m	1
5	Ancillary Office	About 6m x 6m = 36 m^2	3.5m	1
6	Warehouse (Excluding D.G.G.)	About 10m x 7m = 70 m^2	4m	1
	Total	About 757.9 m^2		
	Private Car Parking Space	Unit(s): 2		
	LGV L/UL Space	Unit(s): 2		
	LGV Parking Space	Unit(s): 3		

Legend:

- ●●●●● Emergency Vehicular Access Route
- ○ 5 kg Portable Dry Powder Type Fire Extinguisher (6 in Total)
- ▭ Emergency Lighting (5 in Total) (in accordance with BS 5266-1:2016, BS EN 1838:2013 and the FSD Circular Letter No. 4/2021)

N



*All FSI (includes installation/maintenance/modification/repair work) will be completed by RFSIC.
For Emergency Vehicular Access, Please see Appendix 6.1
*All the enclosed structures are provided with access for emergency vehicles to reach within 30m travel distance from the structures.

Scale: 1:750 @A4

Appendix 6

Proposed Fire Service Installation Plan

Location:
D.D. 109 Lot 1051 RP (Part), 1052 and 1057

OZP: S/YL-KTN/11
District: Kam Tin North
Zoning: Agriculture

擬議臨時貨倉（危險品倉庫除外）連附屬設施(為期3年)及填土工程

Proposed Temporary Warehouse (excluding Dangerous Goods Godown) with Ancillary Facilities for a Period of 3 Years and Filling of Land

Legend:
- Ingress/egress (About 5.5m)
- Proposed Structures
- Private Car Parking Space
- LGV L/UL Space
- LGV Parking Space

Drawing No.: 6-01

For Identification Only

Date: 01/03/2024

1 For Catchment Area A — **Ref.**

Area,	A	=	243		
Average slope,	H	=	0.1	per 100m	
Distance on the line of natural flow,	L	=	32	m	
Time of concentration,	t_o	=	$0.14465L/(H^{0.2}A^{0.2})$	= 0.14465(32) / (0.1^0.2*243^0.1)	SDM 7.5.2 (d)
		=	4.2	min	

2 For Proposed U-Channel in catchment area A

	From	To
Ground level (mPD)	10.60	10.70
Invert level (mPD)	10.40	10.13

Width of u-channel,	w	=	200	mm		
Radius of u-channel,	r	=	100	mm		
Length of u-channel,	L_c	=	55	m		
Depth of vertical part of u-channel,	d	=	200	mm		
Gradient of u-channel,	S_f	=	(10.40-10.13)/55	=	0.005	
Cross-Section Area,	a	=	$0.5\ \pi r^2 + w\ d$	=	0.5 x 3.14 x 100^2 + 200 x 200	
		=	0.056	m^2		
Wetted Perimeter,	p	=	$\pi r+2d$	=	3.14 x 100 + 2 x 200	
		=	0.714	m		
Hydralic radius,	R	=	a / p			SDM 8.2.1
		=	0.078	m		

3 Use Manning Equation for estimating velocity of stormwater

Take	n	=	0.016	for concrete lined channels:-		SDM Table 13
Allowable velcoity,	v	=	$R^{1/6}x\ (RS_f)^{1/2}/n$	=	0.078^1/6 x (0.078 x 0.005)^1/2 / 0.016	SDM Table 12
		=	0.80	m/s		
Time of flow,	t_f	=	0.9	min		

4 Use "Rational Method" for calculation of design flow

Design intensity,	i	=	$a / (t_o + t_f + b)^c$		SDM 4.3.2
		=	451.3 / (4.2+0+2.46)^9.337	for return period T = 50 years	SDM Table 3(a)
		=	228		

Type of surface	Runoff Coefficient C	Catchment Area A (m2)	CxA
Steep Grassland (heavy soil)	0.35	0.0	0
Concrete Paving	0.95	243.0	230.85
		SUM=	230.85

s — SDM 7.5.2 (d)

Upstream flow,	Q_u	=	0	m^3/s	
Design flow,	Q_d	=	$0.278i\ \Sigma C_j A_j + Q_u$	where A_j is in km_2	SDM 7.5.2 (a)
		=	0.278 x 228 x 230.85 /1000000 + 0		
		=	0.015	m^3/s	
Allowable flow,	Q_a	=	a x v		
		=	0.06 x 0.80		
		=	0.045	m^3/s	
		>	Q_d		

Reference was made to Stormwater Drainage Manual (SDM) by DSD

1 For Catchment Area B — **Ref.**

Area,	A	=	347		
Average slope,	H	=	0.1	per 100m	
Distance on the line of natural flow,	L	=	35	m	
Time of concentraction,	t_o	=	$0.14465L/(H^{0.2}A^{0.2})$	= 0.14465(35) / (0.1^0.2*347^0.1)	SDM 7.5.2 (d)
		=	4.5	min	

2 For Proposed U-Channel in catchment area B

	From	To
Ground level (mPD)	10.70	10.80
Invert level (mPD)	10.13	9.90

Width of u-channel,	w	=	200	mm		
Radius of u-channel,	r	=	100	mm		
Length of u-channel,	L_c	=	46	m		
Depth of vertical part of u-channel,	d	=	200	mm		
Gradient of u-channel,	S_f	=	(10.13-9.90)/46	=	0.005	
Cross-Section Area,	a	=	$0.5\ \pi r^2 + w\ d$	=	0.5 x 3.14 x 100^2 + 200 x 200	
		=	0.056	m^2		
Wetted Perimeter,	p	=	$\pi r+2d$	=	3.14 x 100 + 2 x 200	
		=	0.714	m		
Hydralic radius,	R	=	a / p			SDM 8.2.1
		=	0.078	m		

3 Use Manning Equation for estimating velocity of stormwater

Take	n	=	0.016	for concrete lined channels:-		SDM Table 13
Allowable velcoity,	v	=	$R^{1/6}x\ (RS_f)^{1/2}/n$	=	0.078^1/6 x (0.078 x 0.005)^1/2 / 0.016	SDM Table 12
		=	0.81	m/s		
Time of flow,	t_f	=	1.1	min		

4 Use "Rational Method" for calculation of design flow

Design intensity,	i	=	$a / (t_o + t_f + b)^c$		SDM 4.3.2
		=	451.3 / (4.5+1+2.46)^1.337	for return period T = 50 years	SDM Table 3(a)
		=	224		

Type of surface	Runoff Coefficient C	Catchment Area A (m2)	CxA	SDM 7.5.2 (d)
Steep Grassland (heavy soil)	0.35	0.0	0	
Concrete Paving	0.95	347.0	329.65	
		SUM=	329.65	

Upstream flow,	Q_u	=	0.015	m^3/s	
Design flow,	Q_d	=	$0.278i\ \Sigma C_j A_j + Q_u$	where A_j is in km_2	SDM 7.5.2 (a)
		=	0.278 x 224 x 329.65 /1000000 + 0.015		
		=	0.036	m^3/s	
Allowable flow,	Q_a	=	a x v		
		=	0.06 x 0.81		
		=	0.045	m^3/s	
		>	Q_d		

Reference was made to Stormwater Drainage Manual (SDM) by DSD

1 For Catchment Area C — **Ref.**

Area,	A	=	495		
Average slope,	H	=	0.2	per 100m	
Distance on the line of natural flow,	L	=	42	m	
Time of concentration,	t_o	=	$0.14465L/(H^{0.2}A^{0.2})$	= 0.14465(42) / (0.2^0.2*495^0.1)	SDM 7.5.2 (d)
		=	4.5	min	

2 For Proposed U-Channel in catchment area C

	From	To
Ground level (mPD)	10.80	10.70
Invert level (mPD)	9.90	9.64

Width of u-channel,	w	=	200	mm		
Radius of u-channel,	r	=	100	mm		
Length of u-channel,	L_c	=	53	m		
Depth of vertical part of u-channel,	d	=	400	mm		
Gradient of u-channel,	S_f	=	(9.90-9.64)/53	=	0.005	
Cross-Section Area,	a	=	$0.5\ \pi r^2 + w\ d$	=	0.5 x 3.14 x 100^2 + 200 x 400	
		=	0.096	m^2		
Wetted Perimeter,	p	=	$\pi r+2d$	=	3.14 x 100 + 2 x 400	
		=	1.114	m		
Hydralic radius,	R	=	a / p			SDM 8.2.1
		=	0.086	m		

3 Use Manning Equation for estimating velocity of stormwater

Take	n	=	0.016	for concrete lined channels:-		SDM Table 13
Allowable velcoity,	v	=	$R^{1/6}x\ (RS_f)^{1/2}/n$	=	0.086^1/6 x (0.086 x 0.005)^1/2 / 0.016	SDM Table 12
		=	0.85	m/s		
Time of flow,	t_f	=	1.0	min		

4 Use "Rational Method" for calculation of design flow

Design intensity,	i	=	$a / (t_o + t_f + b)^c$		SDM 4.3.2
		=	451.3 / (4.5+1+2.46)^0.337	for return period T = 50 years	SDM Table 3(a)
		=	225		

Type of surface	Runoff Coefficient C	Catchment Area A (m2)	CxA	SDM 7.5.2 (d)
Steep Grassland (heavy soil)	0.35	0.0	0	
Concrete Paving	0.95	495.0	470.25	
		SUM=	470.25	

Upstream flow,	Q_u	=	0.036	m^3/s	
Design flow,	Q_d	=	$0.278i\ \Sigma C_j A_j + Q_u$	where A_j is in km_2	SDM 7.5.2 (a)
		=	0.278 x 225 x 470.25 /1000000 + 0.036		
		=	0.065	m^3/s	
Allowable flow,	Q_a	=	a x v		
		=	0.10 x 0.85		
		=	0.082	m^3/s	
		>	Q_d		

Reference was made to Stormwater Drainage Manual (SDM) by DSD

1 For Catchment Area D — **Ref.**

Area,	A	=	362		
Average slope,	H	=	0.1	per 100m	
Distance on the line of natural flow,	L	=	31	m	
Time of concentraction,	t_o	=	$0.14465L/(H^{0.2}A^{0.2})$	= 0.14465(31) / (0.1^0.2*362^0.1)	SDM 7.5.2 (d)
		=	3.9	min	

2 For Proposed U-Channel in catchment area D

	From	To
Ground level (mPD)	10.70	10.70
Invert level (mPD)	10.50	10.29

Width of u-channel,	w	=	200	mm		
Radius of u-channel,	r	=	100	mm		
Length of u-channel,	L_c	=	42	m		
Depth of vertical part of u-channel,	d	=	200	mm		
Gradient of u-channel,	S_f	=	(10.50-10.29)/42	=	0.005	
Cross-Section Area,	a	=	$0.5\ \pi r^2 + w\ d$	=	0.5 x 3.14 x 100^2 + 200 x 200	
		=	0.056	m^2		
Wetted Perimeter,	p	=	$\pi r+2d$	=	3.14 x 100 + 2 x 200	
		=	0.714	m		
Hydralic radius,	R	=	a / p			SDM 8.2.1
		=	0.078	m		

3 Use Manning Equation for estimating velocity of stormwater

Take	n	=	0.016	for concrete lined channels:-		SDM Table 13
Allowable velcoity,	v	=	$R^{1/6}x\ (RS_f)^{1/2}/n$	=	0.078^1/6 x (0.078 x 0.005)^1/2 / 0.016	SDM Table 12
		=	0.81	m/s		
Time of flow,	t_f	=	1.2	min		

4 Use "Rational Method" for calculation of design flow

Design intensity,	i	=	$a / (t_o + t_f + b)^c$		SDM 4.3.2
		=	451.3 / (3.9+1+2.46)^2.337	for return period T = 50 years	SDM Table 3(a)
		=	228		

Type of surface	Runoff Coefficient C	Catchment Area A (m2)	CxA
Steep Grassland (heavy soil)	0.35	0.0	0
Concrete Paving	0.95	362.0	343.9
		SUM=	343.9

s — SDM 7.5.2 (d)

Upstream flow,	Q_u	=	0	m^3/s		
Design flow,	Q_d	=	$0.278i\ \Sigma C_j A_j + Q_u$	where A_j is in km_2		SDM 7.5.2 (a)
		=	0.278 x 228 x 343.9 /1000000 + 0			
		=	0.022	m^3/s		
Allowable flow,	Q_a	=	a x v			
		=	0.06 x 0.81			
		=	0.045	m^3/s		
		>	Q_d			

Reference was made to Stormwater Drainage Manual (SDM) by DSD

1 For Catchment Area E — **Ref.**

Area,	A	=	1017		
Average slope,	H	=	0.2	per 100m	
Distance on the line of natural flow,	L	=	105	m	
Time of concentration,	t_o	=	$0.14465L/(H^{0.2}A^{0.2})$	= 0.14465(105) / (0.2^0.2*1017^0.1)	SDM 7.5.2 (d)
		=	10.5	min	

2 For Proposed U-Channel in catchment area E

	From	To
Ground level (mPD)	10.60	10.60
Invert level (mPD)	10.40	9.47

Width of u-channel,	w	=	300	mm		
Radius of u-channel,	r	=	150	mm		
Length of u-channel,	L_c	=	211	m		
Depth of vertical part of u-channel,	d	=	300	mm		
Gradient of u-channel,	S_f	=	(10.40-9.47)/211	=	0.004	
Cross-Section Area,	a	=	$0.5\ \pi r^2 + w\ d$	=	0.5 x 3.14 x 150^2 + 300 x 300	
		=	0.125	m^2		
Wetted Perimeter,	p	=	$\pi r+2d$	=	3.14 x 150 + 2 x 300	
		=	1.071	m		
Hydralic radius,	R	=	a / p			SDM 8.2.1
		=	0.117	m		

3 Use Manning Equation for estimating velocity of stormwater

Take	n	=	0.016	for concrete lined channels:-		SDM Table 13
Allowable velcoity,	v	=	$R^{1/6}x\ (RS_f)^{1/2}/n$	=	0.117^1/6 x (0.117 x 0.004)^1/2 / 0.016	SDM Table 12
		=	0.99	m/s		
Time of flow,	t_f	=	0.3	min		

4 Use "Rational Method" for calculation of design flow

Design intensity,	i	=	$a / (t_o + t_f + b)^c$		SDM 4.3.2
		=	451.3 / (10.5+0+2.46)^3.337	for return period T = 50 years	SDM Table 3(a)
		=	189		

s

Type of surface	Runoff Coefficient C	Catchment Area A (m2)	CxA
Steep Grassland (heavy soil)	0.35	0.0	0
Concrete Paving	0.95	1017.0	966.15
		SUM=	966.15

SDM 7.5.2 (d)

Upstream flow,	Q_u	=	0.065	m^3/s	
Design flow,	Q_d	=	$0.278i\ \Sigma C_j A_j + Q_u$	where A_j is in km_2	SDM 7.5.2 (a)
		=	0.278 x 189 x 966.15 /1000000 + 0.065		
		=	0.116	m^3/s	
Allowable flow,	Q_a	=	a x v		
		=	0.13 x 0.99		
		=	0.124	m^3/s	
		>	Q_d		

Reference was made to Stormwater Drainage Manual (SDM) by DSD

1 For Catchment Area F — **Ref.**

Area,	A	=	267		
Average slope,	H	=	0.1	per 100m	
Distance on the line of natural flow,	L	=	29	m	
Time of concentraction,	t_o	=	$0.14465L/(H^{0.2}A^{0.2})$	= 0.14465(29) / (0.1^0.2*267^0.1)	SDM 7.5.2 (d)
		=	3.8	min	

2 For Proposed U-Channel in catchment area F

	From	To
Ground level (mPD)	10.60	10.90
Invert level (mPD)	9.47	9.28

Width of u-channel,	w	=	300	mm		
Radius of u-channel,	r	=	150	mm		
Length of u-channel,	L_c	=	41	m		
Depth of vertical part of u-channel,	d	=	400	mm		
Gradient of u-channel,	S_f	=	(9.47-9.28)/41	=	0.005	
Cross-Section Area,	a	=	$0.5\ \pi r^2 + w\ d$	=	0.5 x 3.14 x 150^2 + 300 x 400	
		=	0.155	m^2		
Wetted Perimeter,	p	=	$\pi r+2d$	=	3.14 x 150 + 2 x 400	
		=	1.271	m		
Hydralic radius,	R	=	a / p			SDM 8.2.1
		=	0.122	m		

3 Use Manning Equation for estimating velocity of stormwater

Take	n	=	0.016	for concrete lined channels:-		SDM Table 13
Allowable velcoity,	v	=	$R^{1/6}x\ (RS_f)^{1/2}/n$	=	0.122^1/6 x (0.122 x 0.005)^1/2 / 0.016	SDM Table 12
		=	1.05	m/s		
Time of flow,	t_f	=	1.5	min		

4 Use "Rational Method" for calculation of design flow

Design intensity,	i	=	$a / (t_o + t_f + b)^c$		SDM 4.3.2
		=	451.3 / (3.8+1+2.46)^5.337	for return period T = 50 years	SDM Table 3(a)
		=	226		

Type of surface	Runoff Coefficient C	Catchment Area A (m2)	CxA	s	SDM 7.5.2 (d)
Steep Grassland (heavy soil)	0.35	0.0	0		
Concrete Paving	0.95	267.0	253.65		
		SUM=	253.65		

Upstream flow,	Q_u	=	0.138	m^3/s	
Design flow,	Q_d	=	$0.278i\ \Sigma C_j A_j + Q_u$	where A_j is in km_2	SDM 7.5.2 (a)
		=	0.278 x 226 x 253.65 /1000000 + 0.138		
		=	0.154	m^3/s	
Allowable flow,	Q_a	=	a x v		
		=	0.16 x 1.05		
		=	0.163	m^3/s	
		>	Q_d		

Reference was made to Stormwater Drainage Manual (SDM) by DSD

1 For Connection between CP12 and Existing Culvert — **Ref.**

Area,	A	=	0		
Average slope,	H	=	0.1 per 100m		
Distance on the line of natural flow,	L	=	0 m		
Time of concentraction,	t_o	=	$0.14465L/(H^{0.2}A^{0.2})$	= 0.14465(0) / (0.1^0.2*0^0.1)	SDM 7.5.2 (d)
		=	0.0 min		

2 For Proposed U-Channel between CP12 and Existing Culvert

	From	To
Ground level (mPD)	10.90	10.40
Invert level (mPD)	9.01	8.86

Width of u-channel,	w	=	700 mm			
Radius of u-channel,	r	=	350 mm			
Length of u-channel,	L_c	=	30 m			
Depth of vertical part of u-channel,	d	=	1190 mm			
Gradient of u-channel,	S_f	=	(9.01-8.86)/30	=	0.005	
Cross-Section Area,	a	=	$0.5\ \pi r^2 + w\ d$	=	0.5 x 3.14 x 350^2 + 700 x 1190	
		=	1.025 m^2			
Wetted Perimeter,	p	=	$\pi r+2d$	=	3.14 x 350 + 2 x 1190	
		=	3.479 m			
Hydralic radius,	R	=	a / p			SDM 8.2.1
		=	0.295 m			

3 Use Manning Equation for estimating velocity of stormwater

Take	n	=	0.016	for concrete lined channels:-		SDM Table 13
Allowable velcoity,	v	=	$R^{1/6}x\ (RS_f)^{1/2}/n$	=	0.295^1/6 x (0.295 x 0.005)^1/2 / 0.016	SDM Table 12
		=	1.96 m/s			
Time of flow,	t_f	=	3.9 min			

4 Use "Rational Method" for calculation of design flow

Design intensity,	i	=	$a / (t_o + t_f + b)^c$		SDM 4.3.2
		=	451.3 / (0.0+3+2.46)^9.337	for return period T = 50 years	SDM Table 3(a)
		=	242		

s

Type of surface	Runoff Coefficient C	Catchment Area A (m2)	CxA	SDM 7.5.2 (d)
Steep Grassland (heavy soil)	0.35	0.0	0	
Concrete Paving	0.95	0.0	0	
		SUM=	0	

Upstream flow,	Q_u	=	1.785 (from Existing CP11) + 0.154 (From new CP11)		
		=	1.939		
Design flow,	Q_d	=	$0.278i\ \Sigma C_j A_j + Q_u$	where A_j is in km_2	SDM 7.5.2 (a)
		=	0.278 x 242 x 0 /1000000 + 1.785 (from Existing CP11) + 0.154 (From new CP11)		
		=	1.939 m^3/s		
Allowable flow,	Q_a	=	a x v		
		=	1.03 x 1.96		
		=	2.007 m^3/s		
		>	Q_d		

Reference was made to Stormwater Drainage Manual (SDM) by DSD