

DRAINAGE IMPACT ASSESSMENT AND PROPOSAL

**Temporary Shop and Services (Sales Office for Sale of Goods Vehicles)
in Various Lots in DD 102, Ngau Tam Mei, Yuen Long, NT**

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DRAINAGE IMPACT ASSESSMENT

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1.0 INTRODUCTION

1.1 This site is located at **Various Lot in D.D. 102**, Ngau Tam Mei, Yuen Long. The site is accessed from Kwu Tung Road. The total **Site Area** is about **820m²**.

The enclosed **Plan no. D-01-revB** is a **drainage proposal** for the application site which also shows the condition of its surrounding areas.

1.2 The proposed use of the site is **Temporary Shop and Services (Sales Office for Sale of Goods Vehicles)** for a Period of 3 years .

2.0 THE DRAINAGE PROPOSAL

2.1 Main access of the site is from the east via shared access road connecting with Kwu Tung Road. The site is formed into two portions with a village shared access road in the middle.

2.2 There is an existing village channel DH running along south-east of the site, along KwuTung Road collecting the runoff of from surrounding areas. Such channel DH discharges to main government nullah at about 50m east of the site through various existing underground pipes.

2.2 The west portion of Site (Catchment area 1) is paved with concrete and formed with ground level slightly higher than the peripheral lands. Catchment area 1 mainly has a fall towards north as shown.

There is an existing system of drainage serving the Site - DB flowing from south of site via CP2, and collect at CP1 ; and DA flowing along north site boundary, and collect at CP1;

CP1 discharge to existing village chaneel DD through existing underground pipe DC.

Per request of DSD, a new 300m U-channel DK will be formed along the higher east site boundary. There is an existing boundary wall of 1m high to prevent infiltration and outflow of rain water to and from Kwu Tung Road at east side.

2.3 Various temporary storage sheds were erected on the site.

2.4 Catchment areas formed, and flow pattern is summarized as follows:

2.5 Site - Catchment Area 1 – Temporary shop and services, Goods Vehicles Park. Paved with concrete, runoff to discharge from south to north to **channel DB and DA**.

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Adjacent Catchment Area 3 – shared access road, public space. Paved with concrete, runoff mainly collected by **channel DA**.

Adjacent Catchment Area 4 – shared access road, public space. Paved with concrete, runoff mainly collected by **channel DB**.

Adjacent Catchment Area 5 – Paved with concrete, public space. Runoff mainly collected by **channel DD**

Adjacent Catchment Area 6 – Paved with concrete, public space. Runoff mainly collected by **channel DD**

2.6 Schedule of storm water channels / channels formed / used on site:

Existing DA - 450mm width x 450mm depth rectangular open concrete channel.
Existing DB - 450mm width x 450mm depth rectangular open concrete channel.
Existing DC – 450mm diameter concrete pipe.
Existing DD - 300mm width x 500mm depth rectangular open concrete channel.
New DK - 300mm shallow surface channel

Existing DH – Dredged open channel of 2.5m / 1m Width x 1.0m Depth.

2.7 By calculation, drainage **DA**, **DB** and **DC** will adequately handle outfall from **Catchment area 1 (Site) and adjacent catchment area 3, 4**. Where new surface channel DK will have minimum flow (fall mainly towards DA, DB only).

Drainage **DD** will adequately handle outfall from **Catchment area 1, adjacent catchment area 3, 4, 5 and 6**.

2.8 Outfall from **Application Site (Catchment area 1)**, **adjacent catchment area 3, 4, 5 and 6** will only occupy **3.377%** of **Village Channel DH**'s current capacity. Village Channel will adequately handle outfall from Application Site and adjacent catchment area 3, 4, 5 and 6.

2.9 Village Channel DH will discharge all outfall to government nullah at east of the Site / DH.

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3.0 MAINTENANCE OF THE PROPOSED STORMWATER DRAINAGE SYSTEMS

- 3.1 The applicant of the Application Site will undertake the following construction / maintenance works for the proposed drainage system at his own costs.
- 3.2 The Applicant would identify the owner of the existing drainage facilities (Portion of Village Channel DH) and obtain consent from the owner prior to commencement of the proposal works. In the case that it is a local village drain, District Officer (Yuen Long East) would be consulted.
- 3.3 Inspection, cleansing and desilting will be carried out regularly and before / after the rainy season each year to ensure the drainage facilities function efficiently. Since the system is designed to operate under gravity, the maintenance will be straightforward.

4.0 CONCLUSION

- 4.1 This drainage impact assessment is primarily based on existing drainage system provided and peripheral drainage system of the site. This report aims to record and report the actual site condition and audit the soundness of the provisions. The stormwater drainage system is in a simple manner without jeopardizing the neighboring drainage system and environment. All assumptions made were on conservative side of uniform flow in size and gradient.
- 4.2 The drainage assessment has also considered future temporary structure / storage shed to be erected, and we have already advised the drainage handling pattern of the discharge (storage shed to discharge to the open channel according to the fall pattern / split of catchment of the site. From calculation, the site drainage and the existing channels are adequate to handle these run off.
- 4.3 From this assessment, it can be concluded that the proposed drainage will have no adverse impacts to the site and surrounding areas -- upstream, downstream and adjacent catchment of the site. Flooding susceptibility will not be increased to the downstream and the peripherals of the site.

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Appendix A

CALCULATION

DRAINAGE IMPACT ASSESSMENT

ASSUMPTIONS OF CALCULATION

Assessment is carried out in accordance with the guidelines given in the **Stormwater Drainage Manual** of the Drainage Service Department:

1. **Design Return Period** is 1 in 50 years for the proposed usage.

2. To determine **Rainfall Intensity (i)**

$$t_o = \text{Time of Concentration}$$

$$= 0.14465 L / (H^{0.2} A^{0.1})$$

$$L = \text{distance on plan of total fall}$$

$$H = \text{average slope (m per 100m) along total fall}$$

$$A = \text{Catchment Area}$$

$$i = \text{Rainfall Intensity} \quad \text{in mm/hr (based on Gumbel Solution)}$$

$$= a / (t_o + b)^c \quad \text{(a,b,c are storm constants from Table 3 of Manual)}$$

3. **Peak Runoff (Q_p)** is calculated from Rational Method.

$$Q_p = 0.278 C i A$$

$$C = \text{Runoff Coefficient}$$

$$= 1.0 \quad \text{(Concrete Paved)}$$

$$= 0.7 \quad \text{(Unpaved area - crush stone / sandy soil)}$$

$$= 0.25 \quad \text{(Grassland - heavy soil)}$$

(percentage may apply for mixed surface)

$$i = \text{Rainfall Intensity}$$

$$A = \text{Catchment Area}$$

4. For **Hydraulic Analysis**, uniform open channel flow is assumed and Manning's Equation is used.

$$V = R^{1/6} / n (RS i)^{1/2}$$

Where,

$$R = \text{Hydraulic Radius (m)}$$

$$= A/P$$

$$n = \text{Manning's Coefficient} \quad (m^{1/2}/s)$$

eg. 0.030 (for Dredged-earth Channels)

$$S_f = \text{Friction gradient} \quad (\text{dimensionless})$$

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Check Impact of Drainage on Channel DA, DB, DD, DE, DF and DG

Channel DA runs along the eastern edge of catchment area 1 (west portion of application site)
Channel DB runs along the northern edge of catchment area 1 (west portion of application site)
Underground pipe DC connects channel DA, DB to channel DD.
Channel DD runs along the southern edge of adjacent catchment area 6
Channel DG runs along the western edge of catchment area 1 (west portion of application site)

Runoff from channel DD will be discharged to Village Channel DH and finally be discharged to Government Nullah along Kwu Tung Road.

1) Calculation of Catchment Areas & Adjacent Catchment Areas

- Catchment Area 1, are paved by concrete (i.e. runoff coefficient C = 1)
- Adjacent Catchment Areas 3, 4, 5, 6 are paved by concrete. (i.e runoff coefficient C = 1)

Catchment Area 1 (Site) :

$$\begin{aligned} &= 820 \text{ m}^2 \text{ (approx.)} \\ &= 0.00082 \text{ km}^2 \end{aligned}$$

Time of Concentration

$$\begin{aligned} t_o &= 0.14465 L / (H^{0.2} A^{0.1}) \\ &= 0.14465 (35) / \\ &\quad [(1.143)^{0.2} (0.00082)^{0.1}] \\ &= 10.032 \text{ min.} \end{aligned}$$

$$\begin{aligned} i &= 687 / (t_o + 4.2)^{0.42} \\ &= 225.206 \text{ mm/h} \end{aligned}$$

Peak runoff

$$\begin{aligned} Q_p &= 0.278 C i A \\ &= 0.278(1)(225.206)(0.00082) \\ &= \mathbf{0.0513 \text{ m}^3 / \text{ sec}} \\ &= 3,080 \text{ L / min} \end{aligned}$$

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<p>Adjacent Catchment Area 3 (Shared access Road) :</p> <p>= 300m² (approx.) = 0.0003km²</p> <p>Time of Concentration $t_o = 0.14465 L / (H^{0.2} A^{0.1})$ = 0.14465 (17) / $[(1.176)^{0.2} (0.0003)^{0.1}]$ = 5.357min.</p> <p>$i = 687 / (t_o + 4.2)^{0.42}$ = 266.206 mm/h</p> <p>Peak runoff $Q_p = 0.278 C i A$ = 0.278(1)(266.206)(0.0003) = 0.0222m³/ sec = 1,332 L / min</p>	<p>Adjacent Catchment Area 4 (Shared access Road) ::</p> <p>= 207m² (approx.) = 0.00027 km²</p> <p>Time of Concentration $t_o = 0.14465 L / (H^{0.2} A^{0.1})$ = 0.14465 (17) / $[(1.176)^{0.2} (0.00019)^{0.1}]$ = 5.608min.</p> <p>$i = 687 / (t_o + 4.2)^{0.42}$ = 263.330 mm/h</p> <p>Peak runoff $Q_p = 0.278 C i A$ = 0.278(1)(263.330)(0.000207) = 0.0152m³/ sec = 911 L / min</p>
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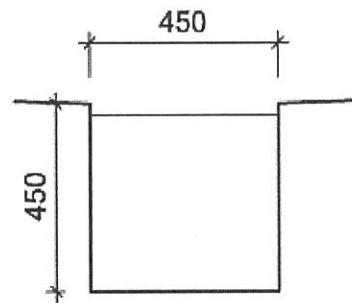
<p>Adjacent Catchment Area 5 (Site) :</p> <p>= 320m² (approx.) = 0.00032 km²</p> <p>Time of Concentration $t_o = 0.14465 L / (H^{0.2} A^{0.1})$ = 0.14465 (20) / $[(1)^{0.2} (0.00032)^{0.1}]$ = 6.489</p> <p>$i = 687 / (t_o + 4.2)^{0.42}$ = 254.183 mm/h</p> <p>Peak runoff $Q_p = 0.278 C i A$ = 0.278(1)(254.183)(0.00032) = 0.0226m³/ sec = 1,357 L / min</p>	<p>Adjacent Catchment Area 6 (Site) :</p> <p>= 510m² (approx.) = 0.00051 km²</p> <p>Time of Concentration $t_o = 0.14465 L / (H^{0.2} A^{0.1})$ = 0.14465 (22) / $[(0.909)^{0.2} (0.00032)^{0.1}]$ = 6.992</p> <p>$i = 687 / (t_o + 4.2)^{0.42}$ = 249.777 mm/h</p> <p>Peak runoff $Q_p = 0.278 C i A$ = 0.278(1)(249.777)(0.00051) = 0.0354m³/ sec = 2,125 L / min</p>
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2) Check Capacity of Drainage DA

- Drainage DA will take 30% of the runoff from catchment area 1 and runoff from Adjacent Catchment Area 3
- Drainage DA is made of concrete and thus has a manning coefficient (n) of 0.013
- runoff from DK is minimal since site has fall towards west and DK is a highest point, and that edge of site is bounded by a 1m height fence wall, stopping runoff from neighbouring village land

$$\begin{aligned}
 \text{Total Distance of drainage DA} &= 40 \text{ m} \\
 \text{Invert Level Difference} &= 4.8 - 4.4 \\
 &= 0.4 \text{ m} \\
 \text{Sf} &= \text{gradient} \\
 &= 0.4 / 40 \\
 &= \mathbf{0.01} \\
 &= 1: 100
 \end{aligned}$$



$$\begin{aligned}
 A &= \text{Cross sectional area of channel (minimum)} \\
 &= 0.45 \times 0.45 \\
 &= 0.2025 \text{ m}^2
 \end{aligned}$$

$$\begin{aligned}
 R &= \text{Hydraulic Radius} \\
 &= A/P \\
 &= 0.2025 / [0.45 + 0.45 + 0.45] \\
 &= 0.150 \text{ m}^2
 \end{aligned}$$

$$\begin{aligned}
 V &= R^{1/6} / n (RSf)^{1/2} \\
 &= [(0.150)^{1/6} / (0.013)] [(0.150)(0.01)]^{1/2} \\
 &= 2.171 \text{ m/sec}
 \end{aligned}$$

$$\begin{aligned}
 \text{Total Flow capacity of Drainage DA} & \\
 &= A \times V \\
 &= 0.2025 \times 2.171 \\
 &= \mathbf{0.440 \text{ m}^3/\text{sec}}
 \end{aligned}$$

$$\begin{aligned}
 \text{Total Peak Run off from 30\% of Catchment Area 1 and Adjacent Catchment Area 3} & \\
 &= 0.0513 \times 30\% + 0.0222 \\
 &= \mathbf{0.0376 \text{ m}^3/\text{sec} < 0.440 \text{ m}^3/\text{sec} \text{ OK}}
 \end{aligned}$$

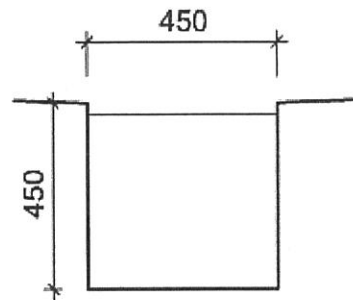
Note: Capacity of this Drainage Channel DA is **adequate** to handle flow from **30% of Catchment Area 1 plus Adjacent Catchment Area 3**.

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5) Check Capacity of Drainage DB

- Drainage DB will take 70% of the runoff from catchment area 1 and runoff from Adjacent Catchment Area 4
- Drainage DB is made of concrete and thus has a manning coefficient (n) of 0.013

$$\begin{aligned}
 \text{Total Distance of drainage DB} &= 64 \text{ m} \\
 \text{Invert Level Difference} &= 4.9 - 4.4 \\
 &= 0.5 \text{ m} \\
 \text{Sf} &= \text{gradient} \\
 &= 0.5 / 64 \\
 &= \mathbf{0.00781} \\
 &= 1 : 128
 \end{aligned}$$



$$\begin{aligned}
 A &= \text{Cross sectional area of channel (minimum)} \\
 &= 0.45 \times 0.45 \\
 &= 0.2025 \text{ m}^2
 \end{aligned}$$

$$\begin{aligned}
 R &= \text{Hydraulic Radius} \\
 &= A/P \\
 &= 0.2025 / [0.45 + 0.45 + 0.45] \\
 &= 0.150 \text{ m}
 \end{aligned}$$

$$\begin{aligned}
 V &= R^{1/6} / n (RSf)^{1/2} \\
 &= [(0.150)^{1/6} / (0.013)] [(0.150)(0.00781)]^{1/2} \\
 &= 1.919 \text{ m/sec}
 \end{aligned}$$

Total Flow capacity of Drainage DB

$$\begin{aligned}
 &= A \times V \\
 &= 0.2025 \times 1.919 \\
 &= \mathbf{0.389 \text{ m}^3/\text{sec}}
 \end{aligned}$$

Total Peak Run off from 70% of Catchment Area 1 and Adjacent Catchment Area 4

$$\begin{aligned}
 &= 0.0513 \times 70\% + 0.0152 \\
 &= \mathbf{0.0511 \text{ m}^3/\text{sec} < 0.389 \text{ m}^3/\text{sec} \text{ OK}}
 \end{aligned}$$

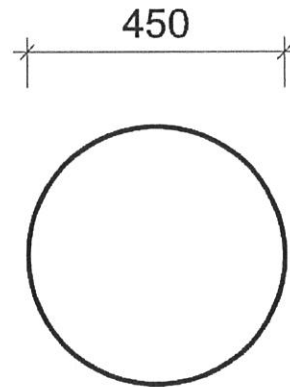
Note: Capacity of this Drainage Channel DA is **adequate** to handle flow from **70% of Catchment Area 1 plus Adjacent Catchment Area 4.**

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Check Capacity of Drainage DC

- Drainage DC will take the runoff from catchment area 1, Adjacent Catchment Area 3 and 4.
- Drainage DC is a circular concrete pipe (underground) (i.e. Manning coefficient = 0.013)

$$\begin{aligned}
 \text{Total Distance of drainage DC} &= 13 \text{ m} \\
 \text{Invert Level Difference} &= 4.3 - 4.1 \\
 &= 0.4 \text{ m} \\
 S_f &= \text{gradient} \\
 &= 0.4 / 13 \\
 &= 0.308 \\
 &= 1:65
 \end{aligned}$$



$$\text{Diameter } D = 0.450 \text{ m}$$

$$\begin{aligned}
 \text{Hydraulic Mean Depth } HMD &= 0.291 \times D \\
 &= 0.291 \times 0.45 \\
 &= 0.13095
 \end{aligned}$$

$$\begin{aligned}
 \text{Area of Flow, } A \text{ (m}^2\text{)} &= 3.1416 \times (D/2)^2 \\
 &= 3.1416 \times (0.45/2)^2 \\
 &= 0.159
 \end{aligned}$$

$$\begin{aligned}
 \text{Velocity } V \text{ (m/s)} &= 1/n \times HMD^{2/3} \times S_f^{1/2} \\
 &= 1/0.013 \times (0.13095)^{2/3} \times (0.308)^{1/2} \\
 &= 2.460
 \end{aligned}$$

$$\begin{aligned}
 \text{Total flow Capacity of D5} &= A \times V \\
 &= 0.159 \times 2.460 \\
 &= \mathbf{0.391 \text{ m}^3/\text{sec}}
 \end{aligned}$$

$$\begin{aligned}
 \text{Total peak run off from Catchment Area 1, Adjacent Catchment Area 3 and 4} \\
 &= 0.0513 + 0.0222 + 0.0152 \\
 &= \mathbf{0.0887 \text{ m}^3/\text{sec}} < \mathbf{0.391 \text{ m}^3/\text{sec}} \text{ OK}
 \end{aligned}$$

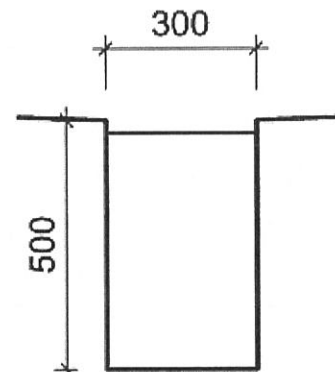
Note: Capacity of this Drainage Channel DC is **adequate** to handle flow from **Catchment Area 1, Adjacent Catchment Area 3 and 4.**

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5) Check Capacity of Drainage DD

- Drainage DD will take the runoff from drainage DC (Catchment area 1, Adjacent Catchment Area 3, 4) and Adjacent Catchment Area 5, 6.
- Drainage DD is made of concrete and thus has a manning coefficient (n) of 0.013

Total Distance of drainage DD = 31 m
 Invert Level Difference = 4.1 – 3.7
 = 0.4 m
 Sf = gradient
 = 0.4 / 31
 = **0.0129**
 = 1: 77.5



A = Cross sectional area of channel (minimum)
 = 0.3 x 0.5
 = 0.15 m²

R = Hydraulic Radius
 = A/P
 = 0.15 / [0.5 + 0.3 + 0.5]
 = 0.115m²

V = $R^{1/6} / n (RSf)^{1/2}$
 = $[(0.115)^{1/6} / (0.013)] [(0.115)(0.00129)]^{1/2}$
 = 2.071m/sec

Total Flow capacity of Drainage DD
 = A x V
 = 0.15 x 2.071
 = **0.371m³/sec**

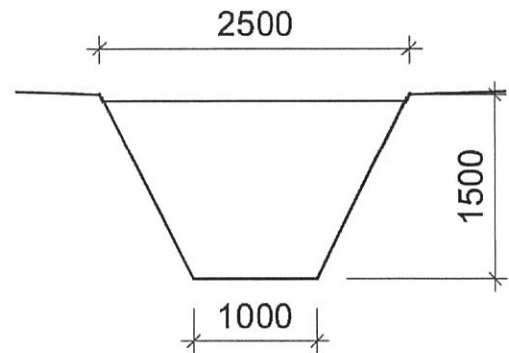
Total Peak Run off from Catchment Area 1 and Adjacent Catchment Area 3, 4, 5 and 6
 = 0.0513 + 0.0222 + 0.0152 + 0.0226 + 0.0354
 = **0.147m³/sec < 0.371m³/sec OK**

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2) Check Capacity of Village Channel DH

- Village Channel DH is dredged and thus has a manning coefficient of 0.03

Total Distance of drainage DH = 124m
 Invert Level Difference = 3.3- 2.7
 = 0.6 m
 Sf = gradient
 = 0.6 / 124
 = 0.00484
 = 1: 207



A = Cross sectional area of channel
 = $(2.5 + 1) \times (1.5) / 2$
 = 2.625 m²

R = Hydraulic Radius
 = A/P
 = $2.625 / [((2.5-1)/2)^2 + (1.5)^2]^{1/2} \times 2 + 1$
 = 0.603m²

V = $R^{1/6} / n (RSf)^{1/2}$
 = $[(0.603)^{1/6} / (0.03)] [(0.603)(0.00484)]^{1/2}$
 = 1.655 m/sec

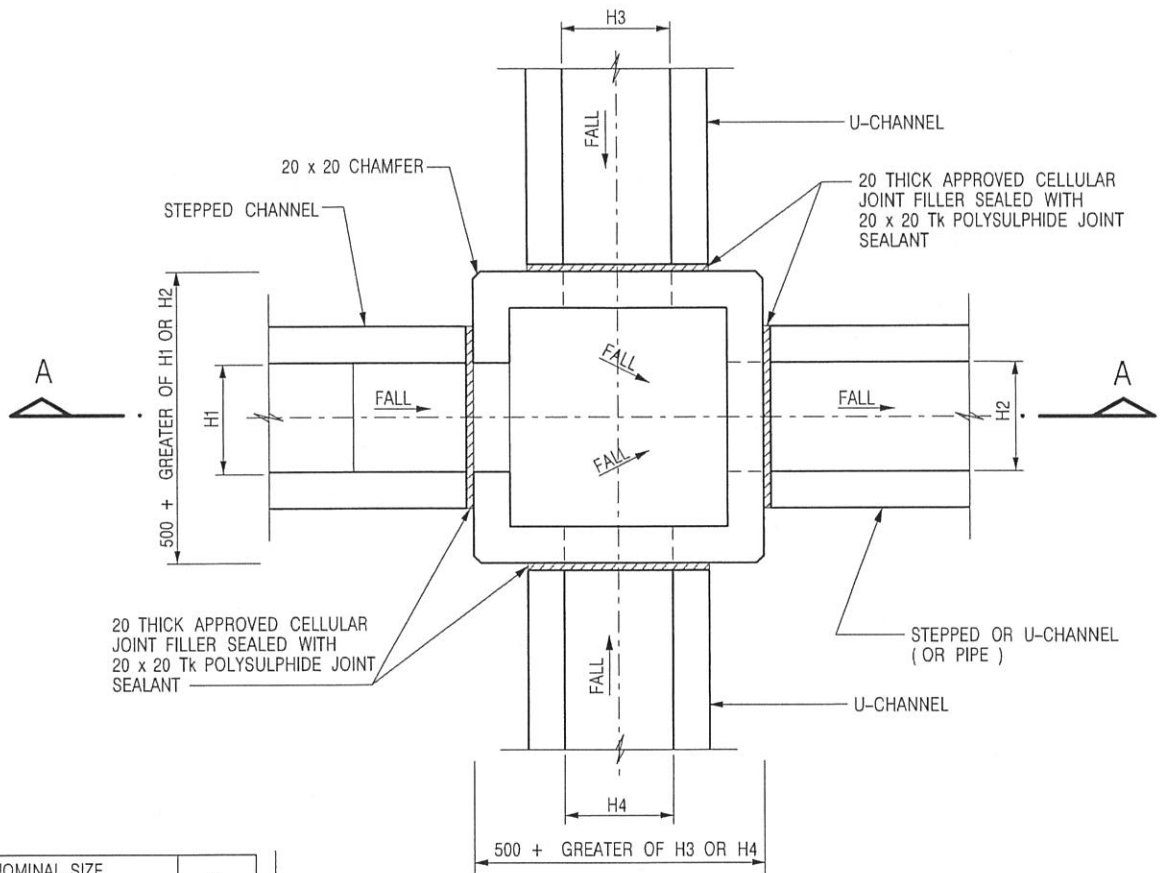
Total Flow capacity of Drainage DH
 = A x V
 = 2.625 x 1.655
 = **4.344 m³/sec**

Total peak run off from Catchment Area 1, 2 and Adjacent Catchment Area 3, 4, 5, 6
 = 0.0513 + 0.0222 + 0.0152 + 0.0226 + 0.0354 =
0.147m³/ sec

Total peak run off from Catchment Area 1, 2 and Adjacent Catchment Area 3, 4, 5, 6 /
 Total flow capacity of Village Channel DH

= 0.147 / 4.344
 = **3.377%**

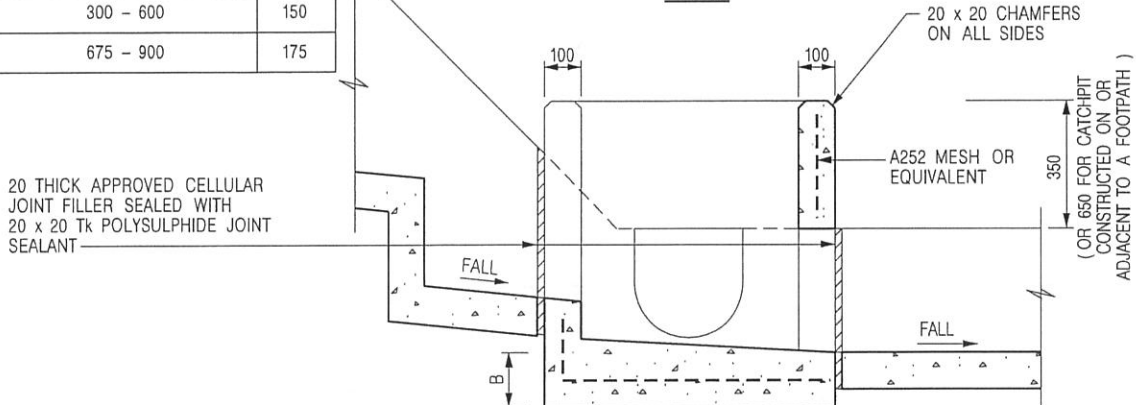
Note: Capacity of Application site (Catchment area 1) and Adjacent Catchment Area (3, 4, 5, 6) only occupy **3.377%** of Village Channel DH's capacity.



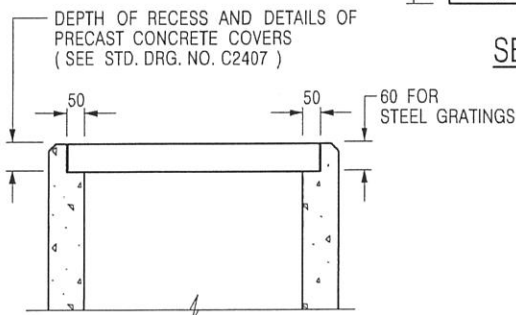
NOMINAL SIZE (LARGEST OF H1, H2, H3 & H4)	B
300 - 600	150
675 - 900	175

20 THICK APPROVED CELLULAR JOINT FILLER SEALED WITH 20 x 20 TK POLYSULPHIDE JOINT SEALANT

PLAN



SECTION A - A



ALTERNATIVE TOP SECTION FOR PRECAST CONCRETE COVERS / GRATINGS

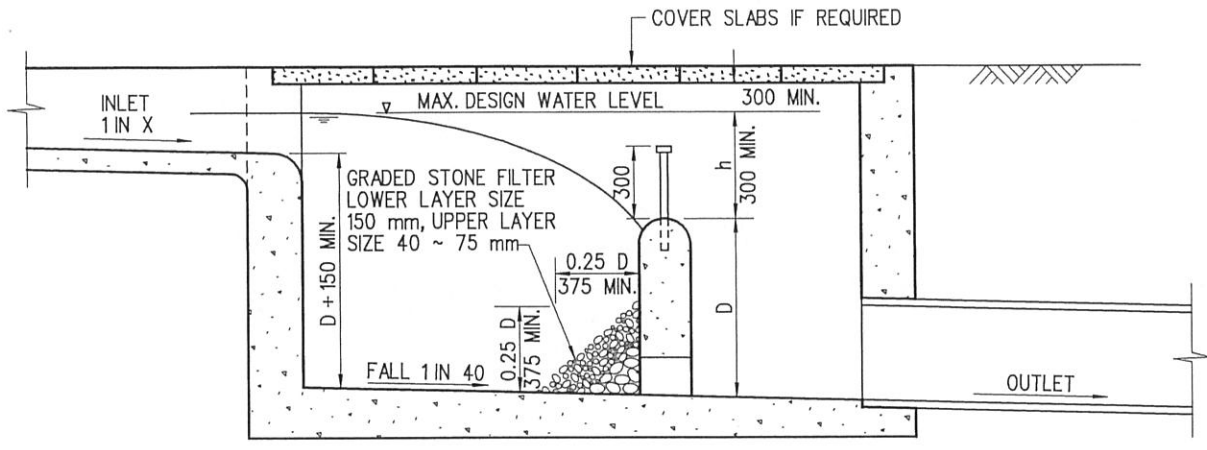
- NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES.
 2. REFER TO SHEET 5 FOR OTHER NOTES.

I	DETAILS OF STEEL GRATINGS AMENDED. SHEET 5 ADDED.	Original Signed	03.2009
H	DIMENSIONS OF CATCHPIT AMENDED. NOTES ADDED. SHEETS 2 TO 4 ADDED.	Original Signed	10.2008
G	"FALL" ON BOTTOM OF CATCHPIT ADDED.	Original Signed	05.2008
F	DIMENSION B ADDED.	Original Signed	08.2007
E	NAME OF DEPARTMENT AMENDED.	Original Signed	01.2005
D	GENERAL REVISION.	Original Signed	12.2002
REF.	REVISION	SIGNATURE	DATE

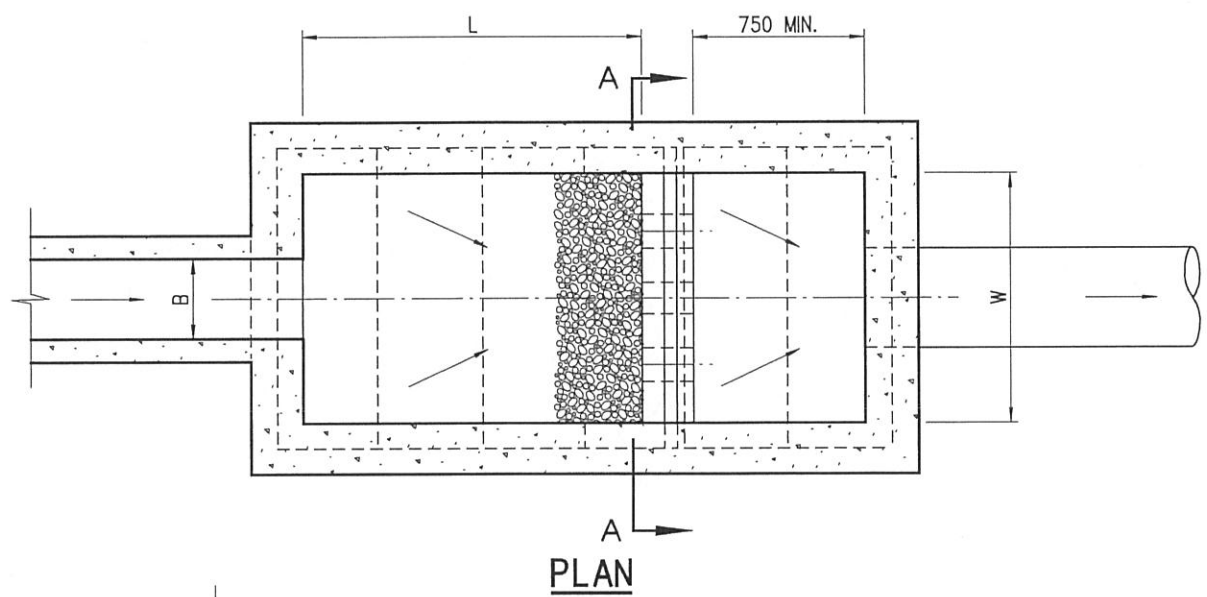
STANDARD CATCHPIT DETAILS

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

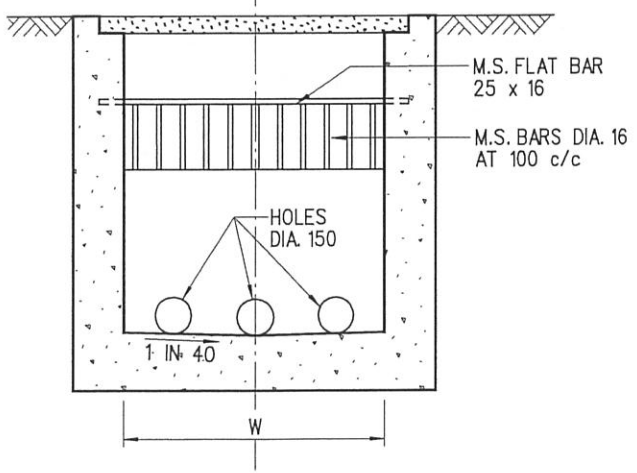
SCALE 1 : 20 DRAWING NO. C24051 SHEET 1 OF 5
 DATE JAN 1991



LONGITUDINAL SECTION



PLAN



SECTION A-A

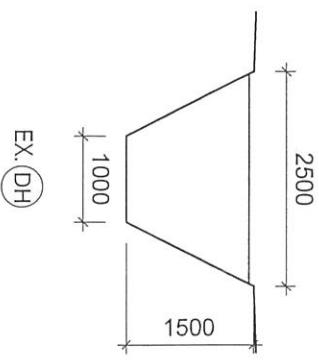
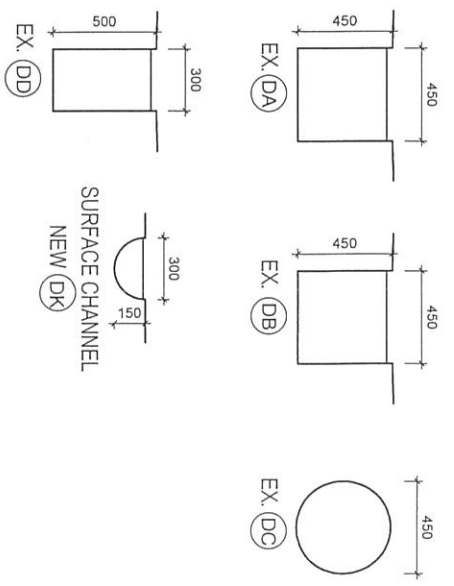
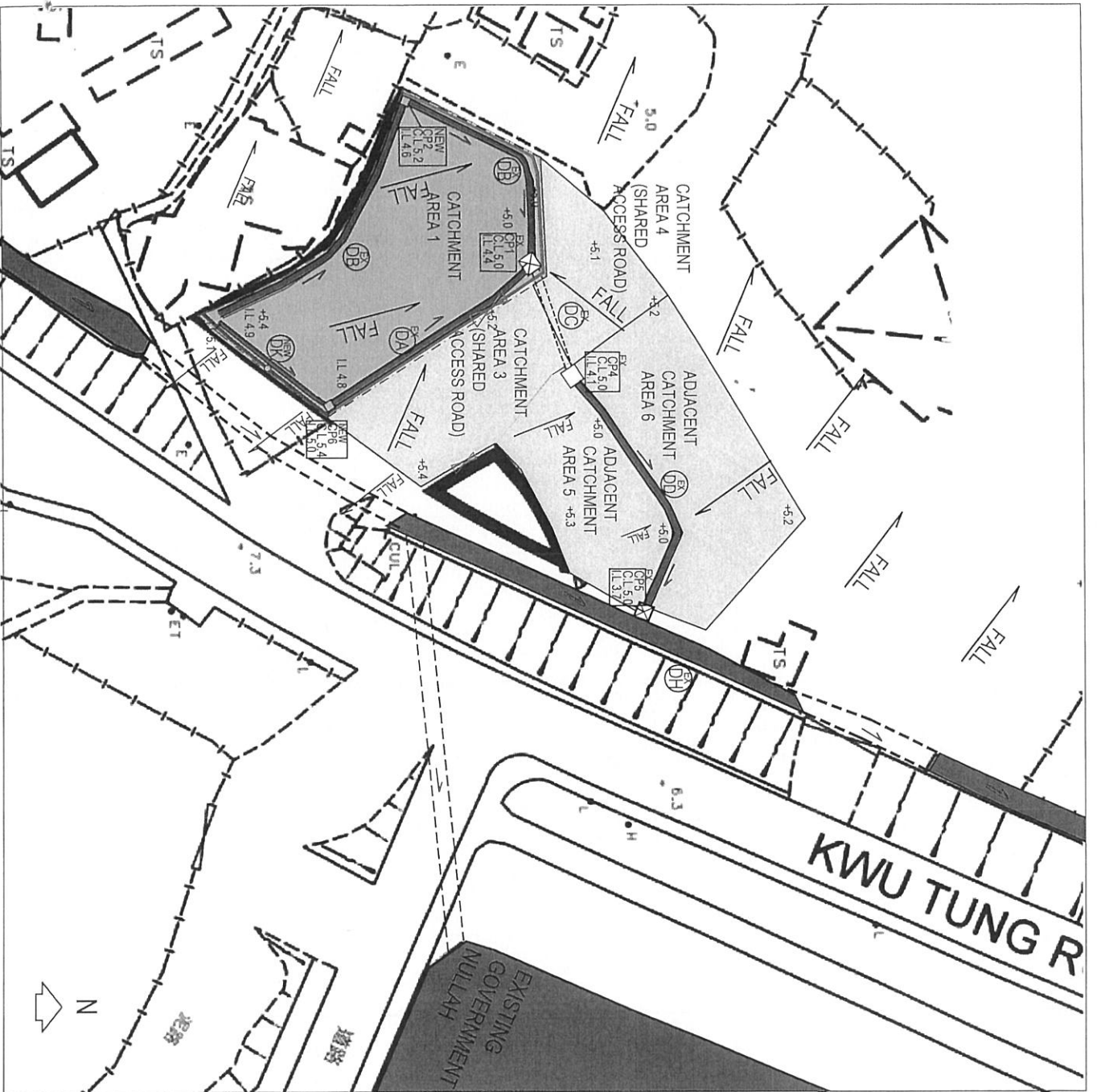
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. NORMALLY FOR DRAINS OF 900 mm DIA. AND BELOW. FOR BIGGER DRAINS AND STEEP TERRAIN, SAND TRAP SHOULD BE SPECIALLY DESIGNED.
3. SIZE
 DEPTH : $D \leq 750$
 WIDTH : $W \geq 3B$
 LENGTH : $4.8D^{0.67} h^{0.5} X^{0.5} \geq 4B$
4. GRADED STONE FILTER SHALL BE CRUSHER RUN GRANITE AGGREGATE.
5. CAPACITY D W L TO BE ACCORDING TO SIZE AND NATURE OF CATCHMENT, PROVIDING DETENTION TIME NOT LESS THAN 5 MINUTES FOR MAX. DESIGN FLOW OF INLET.

B	REDRAWN BY CAD	ORIGINAL SIGNED	8.8.2001
A	GENERAL REVIEW	ORIGINAL SIGNED	2.2.2001
REV.	DESCRIPTION	SIGNATURE	DATE

SAND TRAP

DRAINAGE SERVICES DEPARTMENT	
REFERENCE	DRAWING No.
SCALE	DS 1025B
DIAGRAMMATIC	



- APPLICATION SITE
- ADJACENT SITE
- SAND TRAP
- CATCHPIT
- OPEN CHANNEL
- COVERED CHANNEL
- FLOW DIRECTION
- EX. 1000H CONCRETE PLINTH
- PROPOSED FENCE
- SITE BOUNDARY

DRAWING NO. D-01

SCALE 1:500
DATE: 31/12/2020

TEMPORARY SHOP AND SERVICES
(SALES OFFICE FOR SALE OF GOODS VEHICLES)
IN VARIOUS LOTS IN DD 102, NGAU TAM MEI, YUEN LONG, NT