規 劃 署

沙田、大埔及北區規劃處
香港新界沙田上禾輋路一號
沙田政府合署
十三樓 1301-1314 室

Planning Department

Sha Tin, Tai Po & North District Planning Office
Rooms 1301-1314, 13/F.,
Shatin Government Offices,
1 Sheung Wo Che Road, Sha Tin ,
N.T., Hong Kong

來函檔號 Your Reference:
本署檔號 Our Reference: ( ) in TPB/A/NE-FTA/201
電話號碼 Tel. No. : 2158 6220
傳真機號碼 Fax No. : 2691 2806

By Post and Fax

1 September 2022

(Attn.: Thomas LUK)

Dear Sir/Madam,

Proposed Temporary Cold Storage for Poultry and Distribution Centre for a Period of 3 Years with Filling of Land in "Agriculture" Zone, Lots 471 S.B RP (Part), 472, 473, 474, 475, 476, 482 RP, 483, 484, 486, 487 RP, 497 S.A RP, 501, 502, 504 S.B, 505 and 506 S.B RP in D.D. 89 and Adjoining Government Land, Man Kam To Road, Sha Ling (Compliance with Approval Condition (o) for Planning Application No. A/NE- FTA/201)

I refer to your submission dated 19.7.2022 for compliance with approval condition (o) in relation to the submission of a revised drainage impact assessment under the captioned planning application.

Chief Engineer/Mainland North, Drainage Services Department (Contact person: Mr. CHENG Man-wai, Marcus; Tel.: 2300 1407) has been consulted and considered that approval condition (o) has been complied with. His advisory comments are attached at **Appendix I** for your reference.

Should you have any queries, please feel free to contact Mr. CHENG Man-wai, Marcus of Drainage Services Department at 2300 1407 or Ms. Amy Y. T. CHONG of this department at 2158 6241.

Yours faithfully,

(Margaret CHAN)
for Director of Planning

Appendix I

Comments of the Chief Engineer/Mainland North, Drainage Services Department (Contact person: Mr. CHENG Man-wai, Marcus; Tel.: 2300 1407):

(i) the "existing watercourse" to which the applicant proposed to discharge the storm water from the subject site is not maintained by this office. The applicant should identify the owner of the 'existing watercourse" to which the proposed connection will be made and obtain consent from the owner prior to commencement of proposed works. In the case that it is a local village drains, DO/N should be consulted;

(ii) the applicant is required to construct and maintain the proposed drainage works properly and rectify the drainage systems if they are found to be inadequate or ineffective during operation. The applicant shall establish and implement an operation and maintenance procedure, including 24-hour attendant staff for responding to emergency situations and contingency plan for pump and power failure. The applicant shall also be liable for and shall indemnify claims and demands arising out of damage or nuisance caused by a failure of the systems. For works undertaken outside the lot boundary, prior consent and agreement from DLO/N and/or relevant private lot owners should be sought;

(iii) the applicant is reminded that all existing flow paths as well as the run-off falling onto and passing through the site should be intercepted and disposed of via proper discharge points. The applicant shall also ensure that no works, including any site formation works, shall be carried out as may adversely interfere with the free flow condition of the existing drain, channels and watercourses on or in the vicinity of the subject site any time during or after the works;

(iv) the lot owner/developer shall take all precautionary measures to prevent any disturbance, damage and pollution from the development to any parts of the existing drainage facilities in the vicinity of the lots. In the event of any damage to the existing drainage facilities, the developer shall be held responsible for the cost of all necessary repair works, compensation and any other consequences arising there from; and

(v) the applicant shall allow all time free access for the Government and its agent to conduct site inspection on his completed drainage works, if necessary.

c.c.
CE/MN, DSD (Attn.: Mr. CHENG Man-wai, Marcus) (Fax No. 2770 4761)

Internal
CTP/TPB(1)
Site record

HYC/MC/AC/NW/nw

Date : 19th July, 2022
Your Ref. : TPB/A/NE-FTA/201
Our Ref. : ADCL/PLG-10229/L012

District Planning Officer,
Sha Tin, Tai Po and North District Planning Office,
13/F, Sha Tin Government Offices,
1 Sheung Wo Che Road, Shatin,
New Territories
(Attn: Ms. Amy CHONG)

By Email and Post

Dear Amy,

Re: Section 16 Planning Application for Proposed Temporary Cold Storage for Poultry and Distribution Centre and Filling of Land for a Period of 3 Years at Lots 471 S.B RP (Part), 472, 473, 474, 475, 476, 482 RP, 483, 484, 486, 487 RP, 497 S.A RP, 501, 502, 504 S.B, 505 and 506 S.B RP in D.D. 89 and Adjoining Government Land, Man Kam To Road, Sha Ling, New Territories
(Approval Conditions (o) of Planning Application No. A/NE-FTA/201)

With reference to the letter of Town Planning Board (TPB) dated 11.06.2021 concerning the planning approval granted for the captioned planning application, please find attached *3 sets of revised drainage impact assessment* for consideration by the Director of Drainage Services or of the TPB, with a view to discharging approval conditions (o).

Thank you for your kind attention and should you have any queries, please do not hesitate to contact our Miss Isa YUEN or Mr. Thomas LUK at

Yours sincerely,
For and on behalf of
Aikon Development Consultancy Limited

Aikon Development Consultancy Limited 毅勤發展顧問有限公司

Encl.
c.c. Client

Responses-to-Comments

Item	Departmental Comments	Applicant's Responses
1. Comments from Drainage Service Department (received on 20 April 2022 via Planning Department)		
1	Table 3.3 – catchment areas are missing.	Table 3.3 has been updated.
2	Section 3.6 – for the proposed stormwater tank, design of water intake and discharge mechanism should be further detailed in order to achieve the expected hydraulic function.	Section 3.6 has been revised. An indicative schematic diagrams for aboveground and underground stormwater storage tank with water intake and discharge mechanism are provided in Appendix B.
3	Section 3.6.12 – details of the decking of the existing watercourse should be provided. The applicant should be clarify whether the future formation level of the site is formed by earth filling or by elevate structural platform.	The existing watercourse (about 1.5 m (W) x 0.9 m (D)) running in a northeast to southwest direction in the middle of the Site will be maintained and not encroached. The Application Site will be partly decked over (about 33.6% of the Site) and partly filled with a range from 0.5 m to 1.5 m in depth (about 28.3% of the Site) to facilitate the proposed development to be constructed on an elevated platform at similar site levels ranging from + 6.0 to + 6.9 mPD. There would be a 1.2m vertical gap between the proposed ground level and the structures (excluding an aboveground stormwater storage tank underneath Block 1) to allow clearing or maintenance of existing watercourse. Details of the proposal could refer to the enclosed Rural and New Town Planning Committee Paper - Planning Application No.

		A/NE-FTA/201. An indicative drawing is provided in Annex 1.
4	Section 3.6.13 – the applicant should check and ensure that the existing watercourse at the downstream of Lo Wu Station Road to which the proposed connection will be made adequate capacity and satisfactory condition to cater for the additional discharge from the captioned site. The applicant should also ensure that the flow from the site will not overload the existing drainage system.	Noted. The proposed drainage network has been checked as presented in Appendix D. There will be adequate capacity to accommodate the additional discharge from the Site. No adverse impact on the existing drainage system is anticipated.
5	Figure 3.1 – the applicant should review that Catchment A should be extended to further upstream.	Catchment A has been revised.
6	Figure 3.2 – the applicant is advised the following general requirements in the drainage proposal: (i) surface channel with grating covers should be provided along the site	(i) Grating covers will be provided.

		boundary;		
	(ii)	a drainage plan should be provided clearly showing the size, levels and routes of the proposed drainage. The details (invert level, gradient, general section etc.) of the proposed drain/ surface channel, catchpits and the discharge structure shall be provided;	(ii)	The proposed drainage layout is provided in Figure 3.2. Details of the proposed channel including the size, levels, gradient are presented in Appendix D. General section of the u-channel is presented in Appendix C.
	(iii)	the cover level of proposed channels should be flush with existing adjoining ground level;	(iii)	Noted.
	(iv)	a catchpit with covers should be provided where there is a change of direction of the channel/drain. The details of the catchpit with covers shall be provided;	(iv)	Noted. Catchpit with covers will be provided where there is change of direction. Typical detail of the catchpit with cover is provided in Appendix C.
	(v)	catchpits with sand trap shall be provided at the outlets of the proposed drainage	(v)	Noted. Catchpit with sand trap will be provided at the outlet of the proposed drainage. Typical detail of the catchpit with sand trap is

		system. The details of the catchpit with sand trap should be provided; and		provided in C.
	(vi)	the applicant is reminded that where walls are erected or kerbs are laid along the boundary of the same, peripheral channels should be provided on both sides of the walls or kerbs, and/or adequate openings should be provided at the walls/kerbs, to allow existing overland flow passing through the site to be intercepted by the drainage system of the site with details to be agreed by DSD, unless justified not necessary.	(vi)	Noted. The site boundary will be fenced with chaining fence. Noise barriers will be erected along a section of the Site boundary. Adequate opening will be provided as appropriate to allow existing overland flow passing through.

SMEC
Member of the Surbana Jurong Group

local people
global experience

D02 – Drainage Impact Assessment Report

Proposed Temporary Cold Storage for Poultry and Distribution Centre and Land Filling for Site Formation Works in “Agriculture” Zone for a Period of 3 Years at Various Lots in D.D. 89 and adjoining Government Land, Man Kam To Road, Sandy Ridge, NT

19 July 2022

SMEC INTERNAL REF. 7076840

Document Control

Document:	D02 – Drainage Impact Assessment Report
File Location:	Z:\Jobs\7076840 – Aikon - S16 Sandy Ridge Cold Store\08 Submission
Project Name:	Proposed Temporary Cold Storage for Poultry and Distribution Centre and Land Filling for Site Formation Works in "Agriculture" Zone for a Period of 3 Years at Various Lots in D.D. 89 and adjoining Government Land, Man Kam To Road, Sandy Ridge, NT
Project Number:	7076840
Revision Number:	2

Revision History

REVISION NO.	DATE	PREPARED BY	REVIEWED BY	APPROVED FOR ISSUE BY
0	31 August 2021	Tommy KONG	Kitty LEE	Antony Wong
1	16 May 2022	Tommy KONG	Kitty LEE	Antony Wong
2	19 July 2022	Tommy KONG	Kitty LEE	Antony Wong

Issue Register

DISTRIBUTION LIST	DATE ISSUED	NUMBER OF COPIES
Hong Kong Chilled Meat & Poultry Association	19 July 2022	1 electronic soft copy

SMEC Company Details

Approved by:	Alexi BHANJA		
Address:	27/F Ford Glory Plaza, 37-39 Wing Hong St, Cheung Sha Wan, Kowloon, Hong Kong		
Signature:			
Tel:	+852 3995 8100	Fax:	+852 3995 8101
Email:	alexi.bhanja@smec.com	Website:	www.smec.com

Important Notice

This report is confidential and is provided solely for the purposes of supporting Proposed Temporary Cold Storage for Poultry and Distribution Centre and Land Filling for Site Formation Works in "Agriculture" Zone for a Period of 3 Years at Various Lots in D.D. 89 and adjoining Government Land, Man Kam To Road, Sandy Ridge, NT. This report is provided pursuant to a Consultancy Agreement between SMEC Asia Limited ("SMEC") and Hong Kong Chilled Meat & Poultry Association, under which SMEC undertook to perform specific and limited tasks for Hong Kong Chilled Meat & Poultry Association. This report is strictly limited to the matters stated in it and subject to the various assumptions, qualifications and limitations in it and does not apply by implication to other matters. SMEC makes no representation that the scope, assumptions, qualifications and exclusions set out in this report will be suitable or sufficient for other purposes nor that the content of the report covers all matters which you may regard as material for your purposes.

This report must be read as a whole. Any subsequent report must be read in conjunction with this report.

The report supersedes all previous draft or interim reports, whether written or presented orally, before the date of this report. This report has not and will not be updated for events or transactions occurring after the date of the report or any other matters that might have a material effect on its contents or which come to light after the date of the report. SMEC is not obliged to inform you of any such event, transaction or matter nor to update the report for anything that occurs, or of which SMEC becomes aware, after the date of this report.

Unless expressly agreed otherwise in writing, SMEC does not accept a duty of care or any other legal responsibility whatsoever in relation to this report, or any related enquiries, advice or other work, nor does SMEC make any representation in connection with this report, to any person other than Hong Kong Chilled Meat & Poultry Association. Any other person who receives a draft or a copy of this report (or any part of it) or discusses it (or any part of it) or any related matter with SMEC, does so on the basis that he or she acknowledges and accepts that he or she may not rely on this report nor on any related information or advice given by SMEC for any purpose whatsoever.

Table of Contents

Appendices

List of Tables

List of Figures

1 PROJECT BACKGROUND

1.1 Introduction

1.1.1 Hong Kong Chilled Meat & Poultry Association ("HKCMA" or "the Applicant") plans to construct and operate a Temporary Cold Storage and Distribution Centre ("the Centre" or "the Proposed Development") for a period of three years at various lots in D.D.89 and adjoining Government Land, Man Kam To Road, Sandy Ridge in New Territories ("the Site").

1.1.2 HKCMA members are the chilled poultry importers who sell chilled poultry such as chickens, ducks, geese and squabs (unfledged pigeons), etc. With reference to the "Import Control and Food Safety Guidelines" published by the Centre for Food Safety of Food and Environmental Department ("FEHD"), "chilled" refers to "the pre-chilling process of food with subsequent storage at a temperature between 0°C and 4°C".

1.1.3 The absence of a proper cold storage and distribution centre has been a prolonged issue since the outbreak of Avian Influenza in 2003. In view of this, the Government has laid down instructions to slaughter live poultry to prevent the situation from worsening. Hence, the supply of live poultry was severely affected and led to an increased demand for chilled poultry in Hong Kong. Currently, there is a lack of central processing centre for HKCMA to handle the surging demand for chilled poultry.

1.1.4 The purpose of the Centre is for storage of chilled meat / poultry delivered from the Mainland to the Centre. Goods vehicles from the Mainland will stop at the Site and unload the chilled poultry. The chilled poultry will then be stored temporarily at the Site and delivered to different places in Hong Kong. No selling of poultry to individuals, retailers or wholesalers as well as no slaughtering or cleaning of chilled meat / poultry will be involved in the Centre. The Centre is of great importance since it will handle about 95% of the imported chilled poultry from the Mainland serving the Hong Kong.

1.1.5 The Site is currently zoned "Agriculture" (AGR) under the Approved Fu Tei Au and Sha Ling Outline Zoning Plan ("OZP") No. S/NE-FTA/16. In accordance with paragraph 10(a) of the Explanatory Note of the OZP, temporary use or development of any land or building not exceeding a period of three years would require planning permission from the Town Planning Board ("TPB"). Therefore, a Section 16 Planning Application with an application number A/NE-FTA/201 was made and approved with conditions on 28 May2021. One of the approval conditions is:

(o) The submission of a revised drainage impact assessment, as proposed by the applicant, within 6 months from the date of planning approval to the satisfaction of the Director of Drainage Services or of the TPB by 28.11.2021;

1.1.6 SMEC Asia Limited ("SMEC") has been commissioned by the Applicant to prepare this revised Drainage Impact Assessment ("DIA") Report to discharge the aforementioned Approval Condition (o).

1.2 Site Description

1.2.1 The Site is an elongated strip of land bounded by Man Kam To Road to the east and Lo Wu Station Road to the south with a total area of about 20,506m^2 in Sandy Ridge, which is close to the border between the Lo Wu Boundary Control Point ("BCP") and Man Kam To BCP in the North District. The Site is currently a vacant land overgrown with weeds and different tree groups. There is a watercourse cutting middle of the site running from the northeast to southeast direction, separating the Site into two halves.

1.2.2 The Site location and its environs are shown on ***Figure 1-1*** which the uses surrounding the Site include:

- To the north, northwest and west: dwellings and residential temporary structures, Sandy Ridge Cemetery and the planned Sandy Ridge Columbarium.
- To the east and southeast: The pipelines of the Dongjiang Water, Man Kam To Road, temporary structures, Boarder District Police Headquarter and Police Dog Unit and Force Search Unit Training School.
- To the south: Sha Ling Playground and Lo Wu Station Road.

1.3 Project Description

1.3.1 The Centre will be built upon a site area of about 20,506m^2 with a Gross Floor Area ("GFA") of about 12,736m^2 and a plot ratio of about 0.621, comprising the following major components:

- One two-storey building (Block 1) for cold storage area with a total GFA of about 6,701m^2 within the south portion of the Site.
- One two-storey building (Block 2) for cold storage area with a total GFA of about 5,850m^2 within the north portion of the Site.
- A transformer room with a total GFA of about 180m^2 within the southwestern portion of the Site.
- A guard house with a total GFA of about 6m^2 adjacent to the site ingress / egress at the southern boundary of the Site.
- A junction improvement works at the junction of the Man Kam To Road and Lo Wu Station Road.

1.3.2 The existing watercourse running through the Site from northeast to southwest direction will be decked over underneath the proposed development.

1.3.3 The indicative layout and sectional plans of the Proposed Development can be referred to the Planning Statement.

1.4 Objectives of this Report

1.4.1 The objectives of this DIA Report are to:

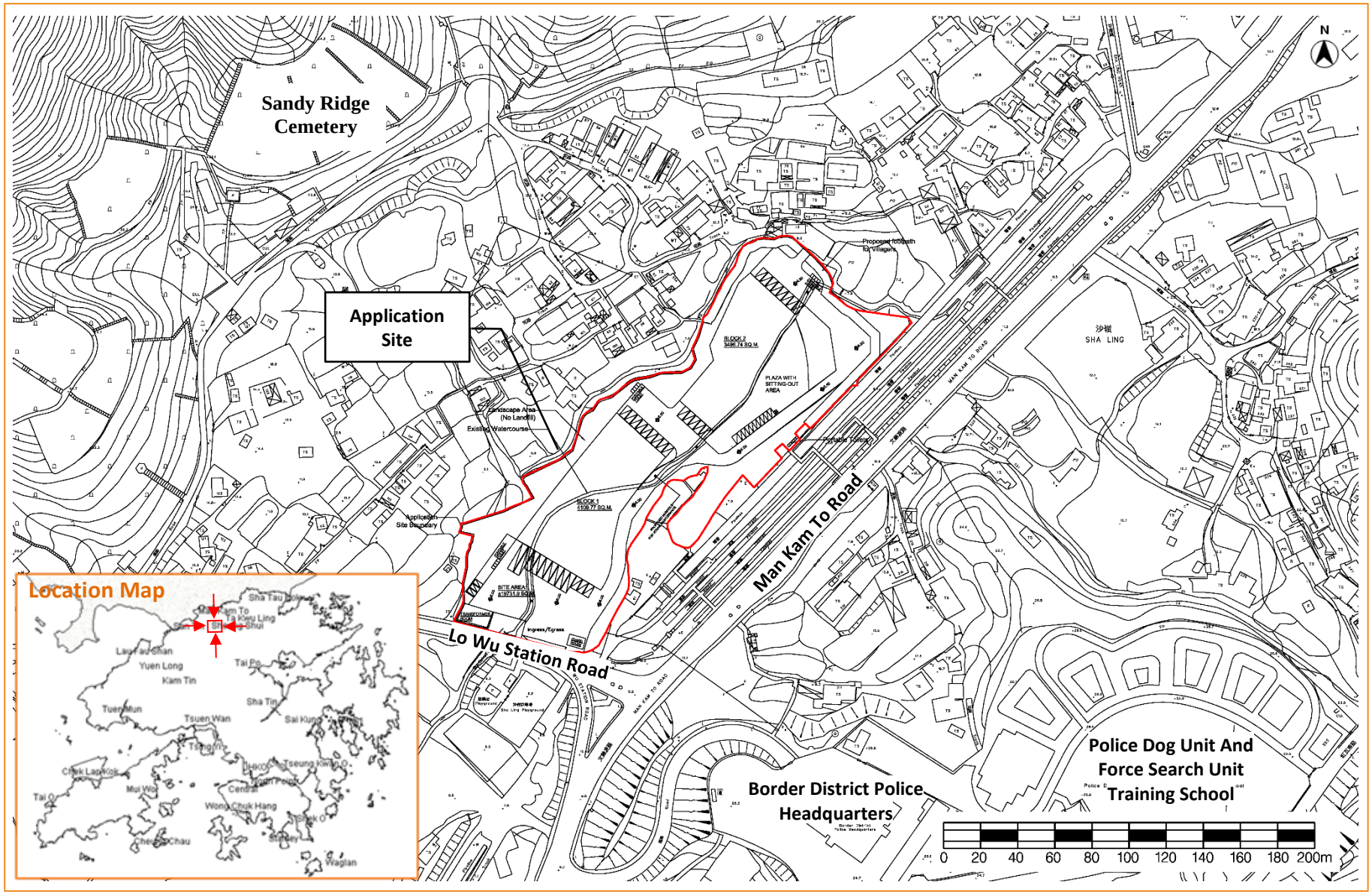
- Assess the potential drainage impacts arising from the Site.
- Recommend the necessary mitigation measures to alleviate any impacts.

1.5 Reference Materials

1.5.1 In evaluating the drainage impact arising from the Proposed Development, the following materials have been referred to:

- Drainage Services Department ("DSD") publication Stormwater Drainage Manual (with Eurocodes incorporated) – Planning, Design and Management (2018 Edition).
- DSD Advice Note No. 1 – Application of the Drainage Impact Assessment Process to Private Sector Projects.
- GeoInfo Map reviewed on 16 August 2021
- Slope Information System of CEDD on 16 August 2021

Figure 1-1: Site Location and its Environs



2 DESCRIPTION OF EXISTING ENVIRONMENT AND DRAINAGE CONDITIONS

2.1 Site Location and Topography

2.1.1 The area of the application site is about 20,506m^2 and is located at North District range from +4.5mPD to +8.0mPD.

2.1.2 As illustrated on ***Figure 1-1***, the Site is situated in Sandy Ridge that is an elongated strip land bounded by Man Kam To Road to the east and Lo Wu Station Road to the south. It is adjacent to the Sandy Ridge Cemetery that is bounded by Lo Wo Station Road and Shenzhen River.

2.1.3 Based on desktop study, there is an existing watercourse running from the surround of Sha Ling passing underneath the pipelines at Man Kam To Road and bisecting the whole site. It is connected to the existing box culvert at Lo Wo Station Road adjacent to the Sha Ling Playground which leads further downstream to connect to Ng Tung River.

2.2 Existing Baseline Conditions

2.2.1 According to the site inspection conducted on 17 August 2021, the Site is currently a vacant land overgrown with weeds and different tree groups. Moreover, several ditches/watercourses were observed inside the Site, which are connected to surrounding catchments.

2.2.2 There is continuous flow observed in the watercourse downstream of the box culvert, but relatively low level comparing to the height of the box-culvert.

2.2.3 During the site inspection, it was observed there is an on-going construction near the concrete batching plant that is upstream of the Site near the Sha Ling Road and the flow collected will eventually discharge into this box culvert.

3 DRAINAGE ANALYSIS

3.1 Assumptions and Methodology

3.1.1 Peak instantaneous runoff before and after the Proposed Development was calculated based on the Rational Method. The recommended physical parameters, including runoff coefficient (C) and storm constants for different return periods, are as per the *Stormwater Drainage Manual*.

3.1.2 The Rational Method has been adopted for hydraulic analysis and the peak runoff is given by the following expression:

$$\mathbf{Q_p = 0.278\ C\ i\ A} \qquad \textit{--- Equation 1}$$

where Q_p = peak runoff in m^3/s
C = runoff coefficient
i = rainfall intensity in mm/hr
A = catchment area in km^2

3.1.3 Rainfall intensity is calculated using the following expression:

$$\mathbf{i = \frac{a}{(t_d + b)^c}} \qquad \textit{--- Equation 2}$$

where i = rainfall intensity in mm/hr
t_d = duration in minutes ($t_d \leq 240$)
a, b, c = storm constants given in Table 3 of SDM

3.1.4 For a single catchment, duration (t_d) can be assumed equal to the time of concentration (t_c) which is calculated as follows:

$$\mathbf{t_c = t_0 + t_f} \qquad \textit{--- Equation 3}$$

where t_c = time of concentration
t_0 = inlet time (time taken for flow from the remotest point to reach the most upstream point of the urban drainage system)
t_f = flow time

3.1.5 Generally, t_0 is much larger than t_f. As shown in Equation 2, t_d is the divisor. Therefore, larger t_d will result in smaller rainfall intensity (i) as well as smaller Q_p. For the worst case scenario, t_f is assumed to be negligible and so:

$$\mathbf{t_d = t_c = t_0}$$

$$\mathbf{t_0 = \frac{0.14465\ L}{H^{0.2}\ A^{0.1}}} \qquad \textit{--- Equation 4}$$

where A = catchment area (m^2)
H = average slope (m per 100 m), measured along the line of natural flow, from the summit of the catchment to the point under consideration
L = distance (on plan) measured on the line of natural flow between the summit and the point under consideration (m)

3.1.6 The capacities of the drainage pipes have been calculated using the Colebrook-White Equation, assuming full bore flow with no surcharge, as follows, the calculation of drainage flow capacity in accordance with the *Stormwater Drainage Manual*:

$$V = -\sqrt{32gRs} \times \log\left(\frac{k_s}{14.8R} + \frac{1.25\upsilon}{R\sqrt{32gRs}}\right) \qquad \textbf{--- Equation 5}$$

where
- V = mean velocity (m/s)
- g = gravitational acceleration (m/s^2)
- R = hydraulic radius (m)
- k_s = hydraulic pipeline roughness (m)
- υ = kinematic viscosity of fluid (m^2/s)
- s = hydraulic gradient (energy loss per unit length due to friction)

3.1.7 On the other hand, the capacity of open channel has been calculated using the Manning's Equation:

$$V = \frac{R^{1/6}}{n} \times \sqrt{Rs} \qquad \textbf{--- Equation 6}$$

where
- V = mean velocity (m/s)
- R = hydraulic radius (m)
- n = Manning coefficient (s/m$^{1/3}$)
- s = hydraulic gradient (energy loss per unit length due to friction)

3.2 Assessment Assumptions

Identification of Catchments

3.2.1 Based on desktop study and site observation, although the Site is adjacent to the Sandy Ridge Cemetery, majority of the surface runoff from the Sandy Ridge Cemetery mainly flows to Shen Zhen River and partially to Ng Tung River via separate drainage system that is along a road which leads the Lo Wu Station Road and eventually discharge into Ng Tung River, and therefore not included as upstream catchments of the Site.

3.2.2 Catchments A to D were identified to be the catchments to be most relevant for this Site based on the topographical data available on Slope Information System of CEDD and the surveys map obtained from Lands Department. The indicative catchment plan is shown on ***Figure 3-1*** and briefly described below:

- Catchments A: covered by natural slope and village houses/ temporary structure Sha Ling area.
- Catchment B: near the pipeline area that accommodate the fresh water mains alongside the Man Kam To Road
- Catchment C: composed of farmland/ grassland and village houses/ temporary structure comprises of Sub-Catchments C1 and C2 ("the Site").
- Catchment D: occupied by a concrete batching plant.

3.2.3 The surface runoff from Catchments A, B, C1, D will pass through the Site (Catchment C2) and collected into the watercourse that gather at the box culvert underneath Lo Wu Station Road that eventually conveyed to Ng Tung River. Details of the catchments are described in paragraphs below.

Surface Runoff from Catchments

3.2.4 As shown on ***Figure 3-1***, runoff from Catchment A will pass underneath Man Kam To Road and run into the Site underneath the superstructures and then further drain to the existing box culvert via the existing watercourse. As such, runoff arising from Catchment A should be taken into account in this DIA. The runoff from Catchment A was estimated by Rational Method.

3.2.5 Runoff from Catchment B will flow along the pipeline area and collected into a U-channel that eventually leads to the existing box culvert downstream.

3.2.6 According to the topographical data, the runoff from Catchments C1 would flow toward the stream that is along the north of site boundary. The flow will pass through the Site connecting the existing watercourse and eventually discharge to downstream via the box culvert.

3.2.7 Runoff from Catchment D will flow towards the Sha Ling Road and collected into the existing watercourse, therefore it will be taken into account in this DIA.

3.2.8 The calculation methods of corresponding catchments are summarised in ***Table 3.1*** and the photos of relevant watercourse and watercourse will be shown on ***Figure 3-1***.

Table 3.1: Method for Estimating the Surface Runoff from Surrounding Catchments

Catchment	Estimating Method for Surface Runoff
Catchment A	Rational Method
Catchment B	Rational Method
Catchment C	Rational Method
Catchment D	Rational Method

3.2.9 As the runoff from Catchments A, B, C1, and D were calculated by Rational Method, information of the catchment area and runoff coefficients are necessary.

Site Surface Characteristics and Runoff Coefficient of the Site

3.2.10 The Site is located in Catchment C2. An elevated platform will be constructed above the ground of the Site and the Site including its facilities will mainly be on the platform.

3.2.11 The Site is currently a vacant land overgrown with weeds and different tree groups. As such, for conservative approach, it is assumed that the Site is currently 99% grassland and 1% concrete paved area.

3.2.12 For the Proposed Development, at least 30% site coverage of greenery will be provided in order to maintain the ratio of unpaved area. Therefore, it was assumed that the paving condition of the Proposed Development will comprise approximately 30% soft landscape and 70% paved area.

3.2.13 The Site is relatively flat, with reference to the DSD's Stormwater Drainage Manual, the runoff coefficients of paved surface and grassland at existing site are 0.95 and 0.25, respectively. As a result, the respective average runoff coefficients of 0.26 and 0.74 were adopted for the Site before and after the Proposed Development, respectively, as summarised in ***Table 3.2***.

Table 3.2: Surface Characteristics and Runoff Coefficients of the Site

SCENARIO OF PROJECT	AREA	SURFACE CHARACTERISTICS	RUNOFF COEFFICIENT
Before Development	20,506m^2	1%paved+99% grassland	0.26

SCENARIO OF PROJECT	AREA	SURFACE CHARACTERISTICS	RUNOFF COEFFICIENT
After Development		70% paved + 30% soft landscape	0.74

Site Surface Characteristics and Runoff Coefficient of Surrounding Catchments

3.2.14 Areas of farmland, grassland and natural slope are assumed to be soft landscape, while the remaining areas of village houses, temporary structure and fresh water mains are assumed to be paved area. The paving conditions are summarised in ***Table 3.3***.

3.2.15 With reference to the Stormwater Drainage Manual, the runoff coefficients for Catchments A are assumed are 0.95 for paved surface and 0.35 for soft landscape, respectively. On the other hand, as Catchments B, C1 and D are relatively flat, the runoff coefficients of paved surface and soft landscape are 0.95 and 0.25, respectively. The runoff coefficients of related catchments are summarised in ***Table 3.3***.

Table 3.3: Surface Characteristics and Runoff Coefficients of Surrounding Catchments

CATCHMENT	AREA, m^2	SURFACE CHARACTERISTICS	OVERALL RUNOFF COEFFICIENT
Catchment A	63,483	59% paved + 41% soft landscape	0.63
Catchment B	11,345	100% paved	0.95
Catchment C1	87,892	23% paved + 77% soft landscape	0.41
Catchment D	9,212	100% paved	0.95

3.3 Estimated Existing and Future Runoff

Peak Runoff from the Site

3.3.1 Based on the assumption as described in ***paragraphs 3.2.1*** to ***3.2.13***, the runoff from the Site (Catchment C2) before and after development was estimated based on the return periods of 2, 10 and 50 years.

3.3.2 As shown in ***Table 3.4***, the estimated peak runoff generated from the Site before development is $0.33m^3/s$ and after development is $0.896m^3/s$ under 50 years return period. There will be around 170% of change in the estimated peak runoff after the proposed development under all assessed return periods. Detailed calculations are provided in ***Appendix A***.

Table 3.4: Estimated Peak Runoff of the Site (Catchment C2)

RETURN PERIOD	ESTIMATED PEAK RUNOFF (m^3/s)		
	BEFORE DEVELOPMENT	AFTER DEVELOPMENT	INCREMENT
2 Years	0.198	0.581	170%
10 Years	0.276	0.752	170%
50 Years	0.332	0.896	170%

3.4 Peak Runoff from Other Sub-Catchment

3.4.1 The runoff generated from other surrounding sub-catchments has been evaluated and are summarised at ***Table 3.5***. Detailed calculations are provided in ***Appendix A***.

Table 3.5: Estimated Runoff from Other Catchments

RETURN PERIOD	ESTIMATED PEAK RUNOFF FROM SUB-CATCHMENTS (m^3/s)				
	CATCHMENT				
	A	B	C1	D	SUB – TOTAL
2 Years	1.211	0.368	1.415	0.359	3.35
10 Years	1.588	0.475	1.788	0.451	4.30
50 Years	1.891	0.567	2.141	0.541	5.14

3.5 Total Peak Runoff

3.5.1 Under 50 years return period, the estimated peak runoff generated from the surround sub-catchments A, B, C1 and D is 5.14m^3/s; and the estimated total peak runoff from Catchment A, B, C1, C2 and D from upstream to the box culvert downstream is approximately 6 m^3/s. However, it should be noted to avoid adverse impact to the downstream box culvert due to the additional flow from C2, it is proposed to include a stormwater storage tank on-site for collecting stormwater generated from C2. Details are discussed in ***Section 3.6***.

3.6 Proposed Drainage Layout

On-site Storage Facility

3.6.1 It is understood that the drainage facilities at the downstream might not be capable of receiving additional flow from the Site. In order to avoid additional drainage impact on the municipal drainage system, an on-site underground stormwater storage tank is proposed to store the additional runoff due to the Site.

3.6.2 Underground storage tank is more favourable for hydraulic flow and flow can be directly collected into the storage tank by gravity. The flow from the Site will be collected by the periphery U-channel drainage network and conveyed to the underground storage tank by gravity. Level sensors will be installed to trigger the pump start/stop and activate the valve to open/ close so that the water in the storage tank can be discharged under a controlled manner. The indicative cross-section of storage tank and with water intake and discharge mechanism is provided in ***Appendix B***.

3.6.3 The stored stormwater will either be reused on-site as much as practicable (e.g. floor mopping, toilet flush, etc.) or transported to the nearby active farmlands for irrigation (i.e. the farmland to the southwest of the Site).

3.6.4 In case of power failure, emergency generator will be used as the power supplier of the pump. Regular maintenance of the equipment will be carried out, spare pump will be used to maintain the operation when there is equipment failure.

On-site Storage Tank Sizing

3.6.5 Since Rational Method is not based on a total storm duration, but rather a period of rain that produces the peak runoff rate. The method cannot compute the runoff volumes unless the total storm duration is assumed. Therefore, 4 hours storm duration is proposed to be used as to design the size of on-site storage tank. This duration is sufficient to cover the effective life of many rainstorms (Royal Observatory, 1981). With reference to the IDF relationship of North District Area stated in Table 2d of the Stormwater Drainage Manual (DSD, 2018), the rainfall intensity of 54.9mm/h was adopted, which is based on 4 hours rainfall duration for 50 years return period.

3.6.6 The runoff coefficients of 0.26 and 0.74, as mentioned in ***paragraph 3.2.15*** were adopted for the Site before and after the proposed development, respectively.

3.6.7 The sizing of stormwater storage Tank is summarised and calculated in ***Table 3.6***.

Table 3.6: Estimated stormwater storage tank size

SCENARIO UNDER 50 YEARS RETURN PERIOD	Area, m^2	Runoff Coefficient	Rainfall Intensity, mm/hr	Peak Runoff Rate, m^3/s	Duration, hours	Estimated Runoff Volume, m^3
Before Development	20,506	0.26	54.9	0.080	4	1,158
After Development		0.74		0.232	4	3,335
					Incremental Runoff	**2,177**

3.6.8 As shown in ***Table 3.6***, the incremental runoff volume is 2,177 m^3 under 50 years return period. Thus, the designed storage capacity should be at least 2,177 m^3. The tentative location of the storage tank is under the Cold Storage Block 1 as shown on ***Figure 3-2***.

3.6.9 The tank volume of 2400m^3 with dimensions of approximately 80m(L) x 30(W) x 1(m) is proposed to be provided. it will be sufficient to meet the storage volume required. Proposed Arrangement for Stormwater Collection

3.6.10 Two peripheral U- channels with grating covers are proposed to be running at the perimeter of the Site. The U shape channels will be in a combination of size ranging from Ø450-600mm at an average gradient 1 in 250 to collect the runoff from the Site. Each of the two peripheral U- channels will eventually connect to catchpit pit that can connect to the storage tank mentioned in *paragraph 3.6.8*. Catchpit with sand trap and cover will also be provided on-site to minimise sand/silt go into the drainage system. The indicative location and path of proposed parameter drain was shown on ***Figure 3-2***. The typical drawing of the U-Channel and catchpit with sand trap and cover is provided in ***Appendix C***

3.6.11 During low intensity rainfall, flow will be collected to the peripheral U-channel and continue to flow to discharge at a flow rate no more than 0.332m^3/s to downstream box culvert. During heavy rainfall, flow will be collected to the peripheral U-channel, flow will continue to run along the U-channel; whilst part of the flow will adopt another arrangement at the catchpits CP5, CP9, CP12 and CP14 where partial stormwater will bypass the proposed U-channel and overflow into the tank. Thus, the additional runoff flow from the Site and nearby related catchments will be stored in the on-site storage tank and will not flow to downstream during heavy rainstorm. Hence, there is no additional flooding risk caused by the Proposed Development.

3.6.12 An indicative drawing of the catchpit with sandtrap design is provided in ***Appendix C***. The typical design of the peripheral U- Channel is presented in **Table 3.7.** Detailed calculations for impact assessment of proposed drainage channels and the design of on-site storage tank are provided in ***Appendix D.***

Table 3.7: Drainage Capacity of Proposed Peripheral Channels

Description	Size, mm	Related Catchment	Runoff, m^3/s	Capacity, m^3/s	% of Capacity Used	Sufficient Capacity?
U- Channel from Start 1 to MH9	Ø 450-600	Catchment C2(the Site)	0.14-0.30	0.18-0.40	57-73%	YES
U- Channel from Start 2 to MH14	Ø450-600	Catchment C2(the Site)	0.11-0.31	0.18-0.40	40-78%	YES

Description	Size, mm	Related Catchment	Runoff, m^3/s	Capacity, m^3/s	% of Capacity Used	Sufficient Capacity?
Pipe from CP5 to Tank	Ø 500	Catchment C2(the Site)	0.15	0.32	46%	YES
Pipe from CP9 to Tank	Ø 500	Catchment C2(the Site)	0.14	0.32	43%	YES
Pipe from CP12 to Tank	Ø 500	Catchment C2(the Site)	0.15	0.32	46%	YES
Pipe from CP14 to Tank	Ø 500	Catchment C2(the Site)	0.13	0.32	39%	YES

Maintenance of Existing Watercourse

3.6.13 The existing watercourse passing through the Site is proposed to be decked over to minimise disturbance to it. To support regular maintenance, manholes for watercourse are proposed to be installed along the existing watercourse with an interval of 60m in which the indicative location of maintenance manholes can be referred to ***Figure 3-2***.

Drainage Point

3.6.14 The runoff from the surrounding catchments run into the existing stream which located underneath the proposed platform inside the Site as before the proposed development. The collected runoff from the existing watercourse would be diverted to southwest of the Site and discharged to downstream through a box culvert with 5000mm (W) x 1550mm (H) with 1% fall laid under the Lo Wo Station Road, as shown on ***Figure 3-2*** and the detail drawing of the box culvert underneath Lo Wu Station is shown on ***Appendix E***.

Figure 3-1: Identification of Surrounding Catchments

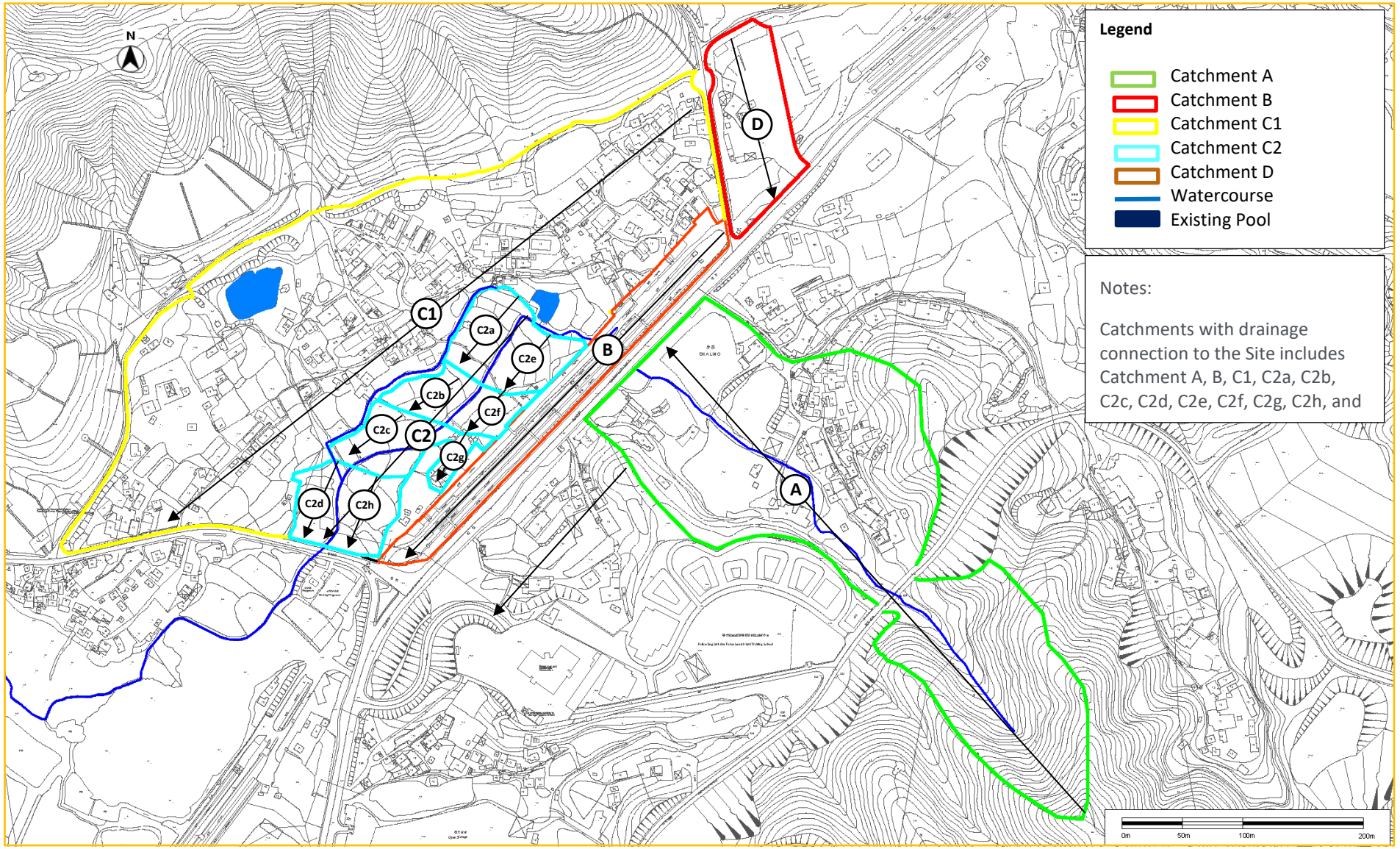
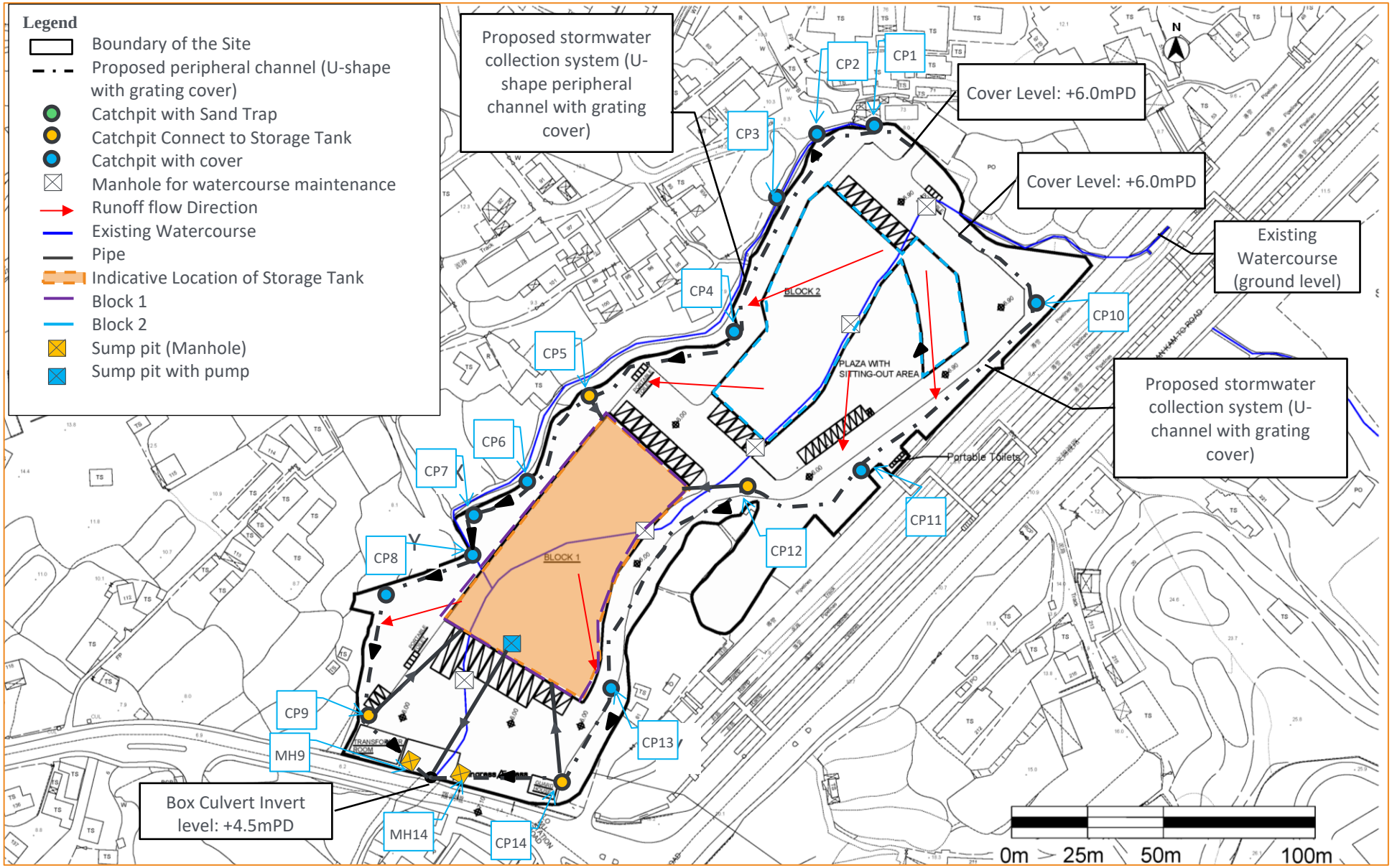


Figure 3-2: Indicative Proposed Drainage Layout



4 CONCLUSION

4.1.1 Potential drainage impacts that may arise from the Site after construction of the Proposed Development have been assessed.

4.1.2 The peak runoff before and after the development of the Site were estimated using Rational Method and based on the catchment surface characteristics for the existing environment and the Proposed Development. The paving area of the Site will increase to 70%, additional surface runoff will be generated from the site. The estimated peak runoff generated from the Site and the surrounding catchments are 0.896m^3/s and 5.14^3/s under 50 years return period, and the total estimated peak flow from the Site and surrounding catchments to the box culvert downstream is about 6m^3/s.

4.1.3 U-shape peripheral channels has been proposed to be installed at the boundary of the Site to collect surface runoff from the Site (Catchment C2). The U- channel of size 450-600 mm dia. has been proposed. Based on the calculation, the utilisation rate of the capacity is about 42-73% under the 50 years return period, which shows there is sufficient capacity to accommodate flow from the Site.

4.1.4 The incremental runoff before and after the development were estimated using the rainfall duration of 4 hours based on a return period of 50 years. Regarding to the additional runoff, on-site storage tank was proposed. The capacity of storage tank should not be less than 2,177m^3 to prevent generating additional runoff to the downstream. As a result, no adverse drainage impact to the existing drainage system is anticipated after the development of the Site, subject to the following condition:

(a) At least 30% of the Site area shall be soft landscape.

4.1.5 This DIA Report indicates the initial findings regarding drainage impact and indicative drainage layout. A qualified engineer should be engaged by the Architect/Contractor of the Proposed Development to review and provide detailed designs for the internal Site drainage layout, including the water storage tank. A “Drainage Proposal” including detailed designs based on calculations and quantitative assessments, as well as hydraulic model if necessary, shall be prepared by the qualified engineer and submitted to the drainage Authority, EPD and DSD, for their review and approval prior to the commencement of work. The Applicant shall obtain the consent from the owner of the existing watercourse for discharging of storm water prior to commencement of the proposed works. All the relevant government departments shall also be consulted with when necessary.

Appendix A RUNOFF CALCULATIONS

Calculation of Runoff for Return Period of 2 Years

Catchment ID	Catchment Area (A), km^2	Average slope (H), m/100m	Flow path length (L), m	Inlet time (t_0), min	Duration (t_d), min	Storm Constants			Runoff intensity (i), mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s
						a	b	c				
Before the Proposed Development												
Catchment A	0.063483	16.29	526.24	14.42	14.42	1004.5	17.24	0.644	108.55	0.63	0.0401	1.211
Catchment B	0.011345	1.28	164.20	8.89	8.89	1004.5	17.24	0.644	122.84	0.95	0.0108	0.368
Catchment C1	0.087892	3.94	110.00	3.88	3.88	1004.5	17.24	0.644	140.90	0.41	0.0361	1.415
Catchment C2	0.020506	1.19	110.00	5.69	5.69	1004.5	17.24	0.644	133.61	0.26	0.0053	0.196
Catchment D	0.009212	4.98	58.00	2.44	2.44	1004.5	17.24	0.644	147.42	0.95	0.0088	0.359
											Total (General Scenario)	**3.549**
After the Proposed Development												
Catchment A	0.0635	16.29	526.2	14.42	14.42	1004.5	17.24	0.644	108.55	0.63	0.0401	1.211
Catchment B	0.0113	1.28	164.20	8.89	8.89	1004.5	17.24	0.644	122.84	0.95	0.0108	0.368
Catchment C1	0.087892	3.94	110.00	3.88	3.88	1004.5	17.24	0.644	140.90	0.41	0.0360	1.412
Catchment C2a	0.00306	0.01	23.0	3.75	3.75	1004.5	17.24	0.644	141.46	0.74	0.0023	0.089
Catchment C2b	0.00309	0.01	11.8	1.92	1.92	1004.5	17.24	0.644	150.00	0.74	0.0023	0.095
Catchment C2c	0.00231	0.01	31.9	5.34	5.34	1004.5	17.24	0.644	134.93	0.74	0.0017	0.064
Catchment C2d	0.00182	0.01	31.9	5.47	5.47	1004.5	17.24	0.644	134.44	0.74	0.0013	0.050
Catchment C2e	0.00252	0.01	31.9	5.30	5.30	1004.5	17.24	0.644	135.12	0.74	0.0019	0.070
Catchment C2f	0.00221	0.01	31.9	5.37	5.37	1004.5	17.24	0.644	134.84	0.74	0.0016	0.061
Catchment C2g	0.00234	0.01	31.9	5.34	5.34	1004.5	17.24	0.644	134.96	0.74	0.0017	0.065
Catchment C2h	0.00316	0.01	34.5	5.60	5.60	1004.5	17.24	0.644	133.95	0.74	0.0023	0.087
Catchment D	0.0092	4.98	58.00	2.44	2.44	1004.5	17.24	0.644	147.42	0.95	0.0088	0.359
											Total (General Scenario)	**3.931**

Note:

1) Runoff is calculated in accordance with DSD's "*Stormwater Drainage Manual (with Eurocodes incorporated) - Planning, Design and Managemen* t" (SDM), fifth edition, January 2018.

Calculation of Runoff for Return Period of 10 Years

Catchment ID	Catchment Area (A), km^2	Average slope (H), m/100m	Flow path length (L), m	Inlet time (t_0), min	Duration (t_d), min	Storm Constants			Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s
						a	b	c				
Before the Proposed Development												
Catchment A	0.063483	16.29	526.24	14.42	14.42	1157.7	19.04	0.597	142.39	0.63	0.0401	1.588
Catchment B	0.011345	1.28	164.20	8.89	8.89	1157.7	19.04	0.597	158.60	0.95	0.0108	0.475
Catchment C1	0.087892	3.94	110.00	3.88	3.88	1157.7	19.04	0.597	178.49	0.41	0.0360	1.788
Catchment C2	0.020506	4.98	58.00	2.25	2.25	1157.7	19.04	0.597	186.47	0.26	0.0053	0.276
Catchment D	0.009212	4.98	58.00	2.44	2.44	1157.7	19.04	0.597	185.50	0.95	0.0088	0.451
											Total (General Scenario)	**4.578**
After the Proposed Development												
Catchment A	0.0635	16.29	526.2	14.42	14.42	1157.7	19.04	0.597	142.39	0.63	0.0401	1.588
Catchment B	0.0113	1.28	164.2	8.89	8.89	1157.7	19.04	0.597	158.60	0.95	0.0108	0.475
Catchment C1	0.087892	3.94	110.00	3.88	3.88	1157.7	19.04	0.597	178.49	0.41	0.0360	1.788
Catchment C2a	0.00306	0.01	23.0	3.75	3.75	1157.7	19.04	0.597	179.09	0.74	0.0023	0.113
Catchment C2b	0.00309	0.01	11.8	1.92	1.92	1157.7	19.04	0.597	188.25	0.74	0.0023	0.120
Catchment C2c	0.00231	0.01	31.9	5.34	5.34	1157.7	19.04	0.597	171.99	0.74	0.0017	0.082
Catchment C2d	0.00182	0.01	31.9	5.47	5.47	1157.7	19.04	0.597	171.45	0.74	0.0013	0.064
Catchment C2e	0.00252	0.01	31.9	5.30	5.30	1157.7	19.04	0.597	172.19	0.74	0.0019	0.089
Catchment C2f	0.00221	0.01	23.0	3.87	3.87	1157.7	19.04	0.597	178.51	0.74	0.0016	0.081
Catchment C2g	0.00234	0.01	11.8	1.97	1.97	1157.7	19.04	0.597	187.96	0.74	0.0017	0.091
Catchment C2h	0.00316	0.01	31.9	5.18	5.18	1157.7	19.04	0.597	172.69	0.74	0.0023	0.112
Catchment D	0.0092	4.98	58.00	2.44	2.44	1004.5	17.24	0.644	147.42	0.95	0.0088	0.359
											Total (General Scenario)	**4.962**

Note:
1) Runoff is calculated in accordance with DSD's "*Stormwater Drainage Manual (with Eurocodes incorporated) - Planning, Design and Managemen* t" (SDM), fifth edition, January 2018.

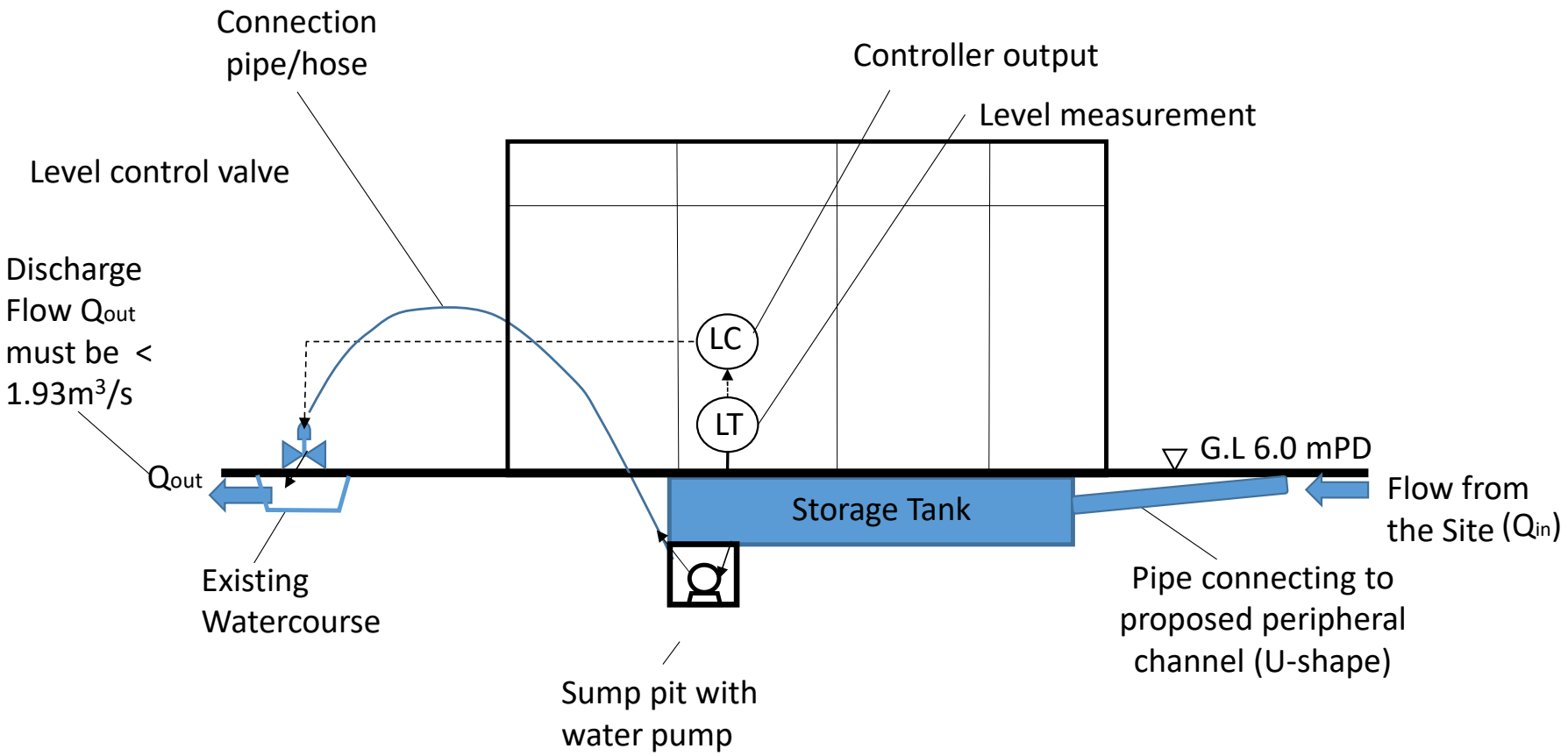
Calculation of Runoff for Return Period of 50 Years

Catchment ID	Catchment Area (A), km^2	Average slope (H), m/100m	Flow path length (L), m	Inlet time (t_0), min	Duration (t_d), min	Storm Constants			Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s
						a	b	c				
Before the Proposed Development												
Catchment A	0.063483	16.29	526.24	14.42	14.42	1167.6	16.76	0.561	169.53	0.63	0.0401	1.891
Catchment B	0.011345	1.28	164.20	8.89	8.89	1167.6	16.76	0.561	189.15	0.95	0.0108	0.567
Catchment C1	0.087892	3.94	110.00	3.88	3.88	1167.6	16.76	0.561	213.70	0.41	0.0360	2.141
Catchment C2	0.020506	4.98	58.00	2.25	2.25	1167.6	16.76	0.561	223.73	0.26	0.0053	0.332
Catchment D	0.009212	4.98	58.00	2.44	2.44	1167.6	16.76	0.561	222.50	0.95	0.0088	0.541
											Total (General Scenario)	**5.472**
After the Proposed Development												
Catchment A	0.0635	16.29	526.2	14.42	14.42	1167.6	16.76	0.561	169.53	0.63	0.0401	1.891
Catchment B	0.0113	1.28	164.2	8.89	8.89	1167.6	16.76	0.561	189.15	0.95	0.0108	0.567
Catchment C1	0.087892	3.94	110.00	3.88	3.88	1167.6	16.76	0.561	213.70	0.41	0.0360	2.141
Catchment C2a	0.00306	0.01	23.0	3.75	3.75	1167.6	16.76	0.561	214.46	0.74	0.0023	0.135
Catchment C2b	0.00309	0.01	11.8	1.92	1.92	1167.6	16.76	0.561	225.97	0.74	0.0023	0.144
Catchment C2c	0.00231	0.01	31.9	5.34	5.34	1167.6	16.76	0.561	205.61	0.74	0.0017	0.098
Catchment C2d	0.00182	0.01	31.9	5.47	5.47	1167.6	16.76	0.561	204.94	0.74	0.0013	0.077
Catchment C2e	0.00252	0.01	31.9	5.30	5.30	1167.6	16.76	0.561	205.87	0.74	0.0019	0.107
Catchment C2f	0.00221	0.01	11.8	2.02	2.02	1167.6	16.76	0.561	225.27	0.74	0.0016	0.102
Catchment C2g	0.00234	0.01	31.9	5.30	5.30	1167.6	16.76	0.561	205.87	0.74	0.0017	0.099
Catchment C2h	0.00316	0.01	31.9	5.18	5.18	1167.6	16.76	0.561	206.48	0.74	0.0023	0.134
Catchment D	0.0092	4.98	58.0	2.44	2.44	1167.6	16.76	0.561	222.50	0.95	0.0088	0.541
											Total (General Scenario)	**6.036**

Note:
1) Runoff is calculated in accordance with DSD's "*Stormwater Drainage Manual (with Eurocodes incorporated) - Planning, Design and Managemen* t" (SDM), fifth edition, January 2018.

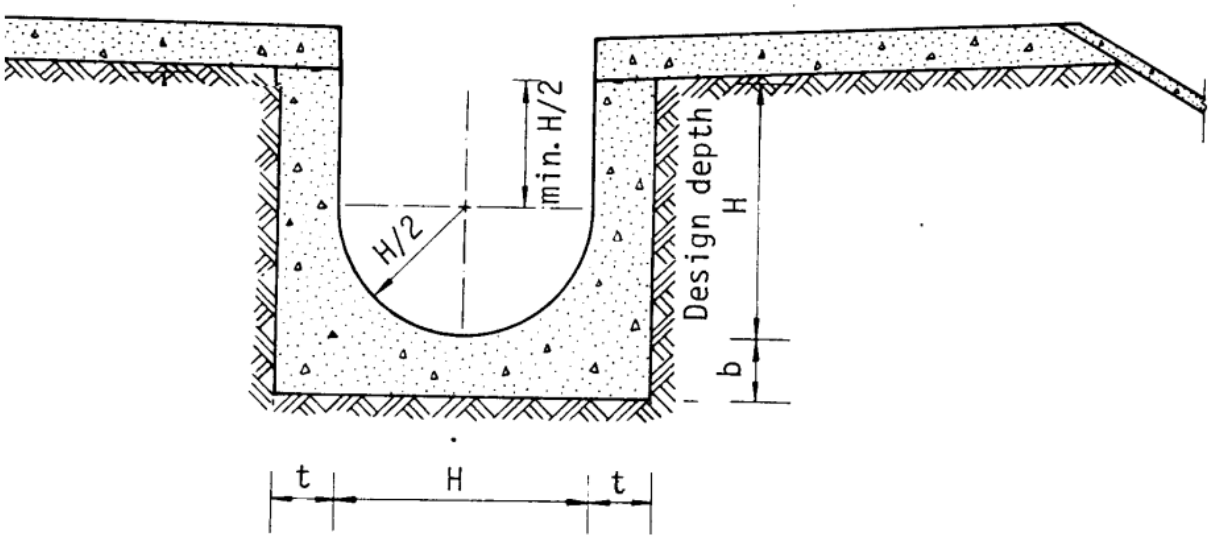
Appendix B INDICATIVE SCHEMATIC DIAGRAMS FOR STORAGE TANK

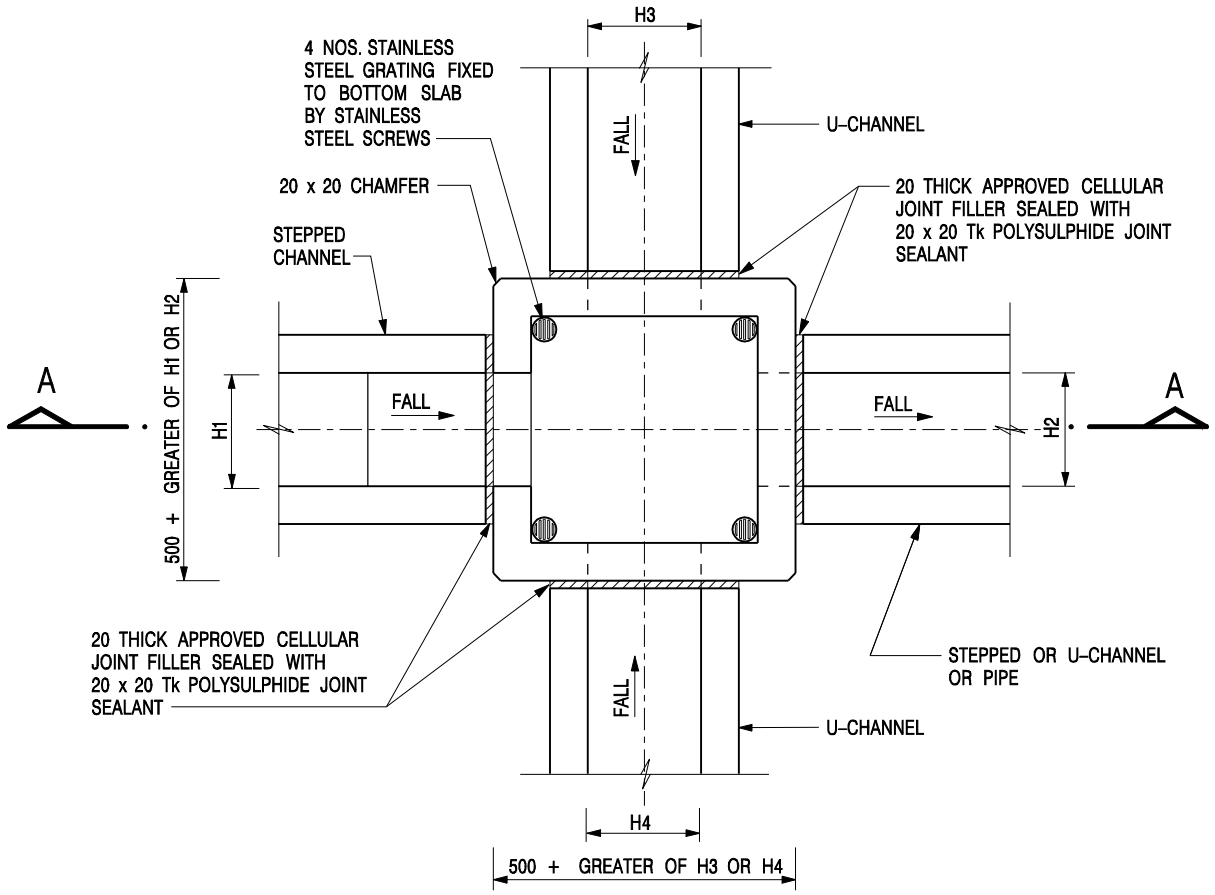
Water Intake and Discharge Mechanism with Storage Tank Underground



Appendix C DRAWINGS OF TYPICAL DETAILS OF U-CHANNEL AND CATCHPIT

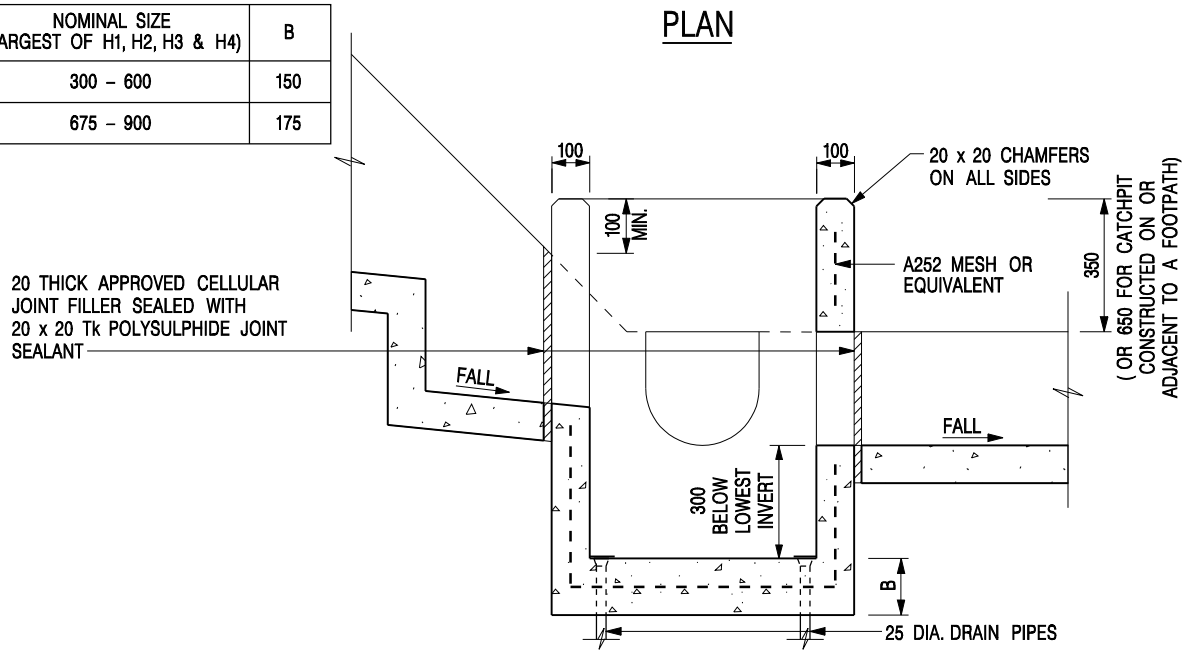
Typical Detail of the U-channel cross section





PLAN

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



SECTION A – A

NOTES:

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

REF.	REVISION	SIGNATURE	DATE
–	FORMER DRG. NO. C2406J.	Original Signed	03.2015

CATCHPIT WITH TRAP

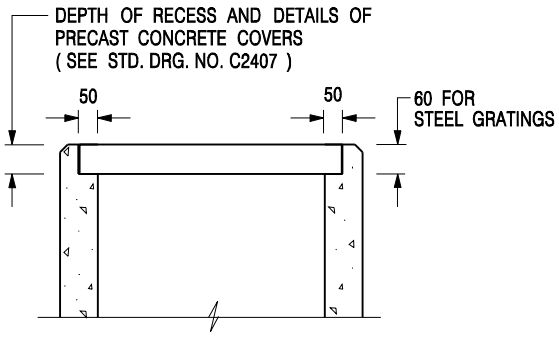
(SHEET 1 OF 2)

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

SCALE 1 : 20

DATE JAN 1991

DRAWING NO. C2406 /1



ALTERNATIVE TOP SECTION
FOR PRECAST CONCRETE COVERS / GRATINGS

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL CONCRETE SHALL BE GRADE 20 /20.
3. CONCRETE SURFACE FINISH SHALL BE CLASS U2 OR F2 AS APPROPRIATE.
4. FOR DETAILS OF JOINT, REFER TO STD. DRG. NO. C2413.
5. CONCRETE TO BE COLOURED AS SPECIFIED.
6. UNLESS REQUESTED BY THE MAINTENANCE PARTY AND AS DIRECTED BY THE ENGINEER, CATCHPIT WITH TRAP IS NORMALLY NOT PREFERRED DUE TO PONDING PROBLEM.
7. UPON THE REQUEST FROM MAINTENANCE PARTY, DRAIN PIPES AT CATCHPIT BASE CAN BE USED BUT THIS IS FOR CATCHPITS LOCATED AT SLOPE TOE ONLY AND AS DIRECTED BY THE ENGINEER.
8. FOR CATCHPITS CONSTRUCTED ON OR ADJACENT TO A FOOTPATH, STEEL GRATINGS (SEE DETAIL 'A' ON STD. DRG. NO. C2405 /2) OR CONCRETE COVERS (SEE STD. DRG. NO. C2407) SHALL BE PROVIDED AS DIRECTED BY THE ENGINEER.
9. IF INSTRUCTED BY THE ENGINEER, HANDRAILING (SEE DETAIL 'J' ON STD. DRG. NO. C2405 /5; EXCEPT ON THE UPSLOPE SIDE) IN LIEU OF STEEL GRATINGS OR CONCRETE COVERS CAN BE ACCEPTED AS AN ALTERNATIVE SAFETY MEASURE FOR CATCHPITS NOT ON A FOOTPATH NOR ADJACENT TO IT. TOP OF THE HANDRAILING SHALL BE 1 000 mm MIN. MEASURED FROM THE ADJACENT GROUND LEVEL.
10. MINIMUM INTERNAL CATCHPIT WIDTH SHALL BE 1 000 mm FOR CATCHPITS WITH A HEIGHT EXCEEDING 1 000 mm MEASURED FROM THE INVERT LEVEL TO THE ADJACENT GROUND LEVEL. AND, STEP IRONS (SEE DSD STD. DRG. NO. DS1043) AT 300 c/c STAGGERED SHALL BE PROVIDED. THICKNESS OF CATCHPIT WALL FOR INSTALLATION OF STEP IRONS SHALL BE INCREASED TO 150 mm.
11. FOR RETROFITTING AN EXISTING CATCHPIT WITH STEEL GRATING, SEE DETAIL 'G' ON STD. DRG. NO. C2405 /4.
12. SUBJECT TO THE APPROVAL OF THE ENGINEER, OTHER MATERIALS CAN ALSO BE USED AS COVERS / GRATINGS.

REF.	REVISION	SIGNATURE	DATE
A	MINOR AMENDMENT.	Original Signed	04.2016
–	FORMER DRG. NO. C2406J.	Original Signed	03.2015

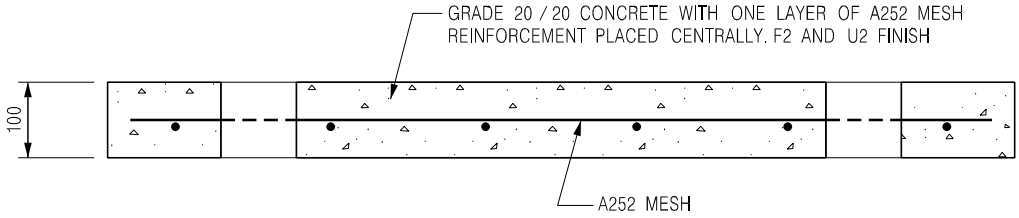
CATCHPIT WITH TRAP
(SHEET 2 OF 2)

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

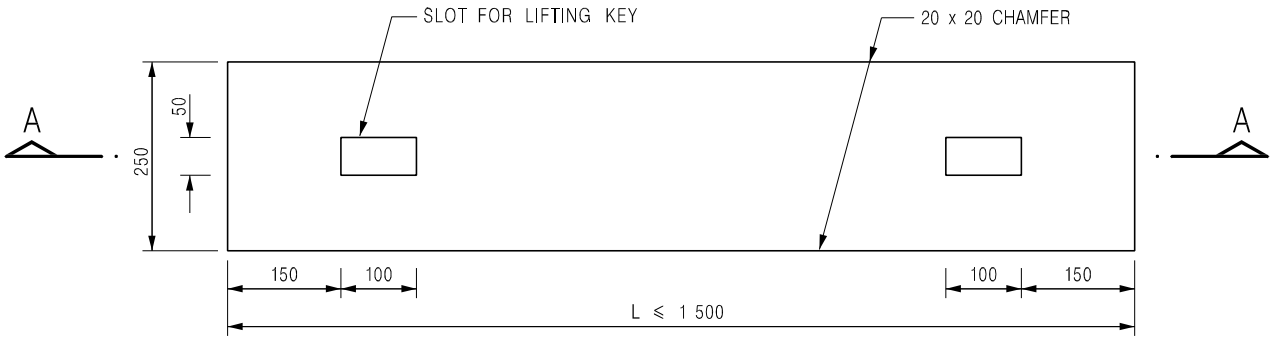
SCALE 1 : 20

DATE JAN 1991

DRAWING NO. C2406 /2A

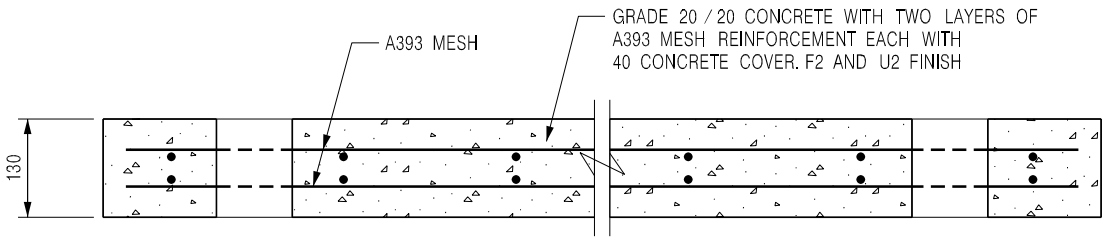


SECTION A – A

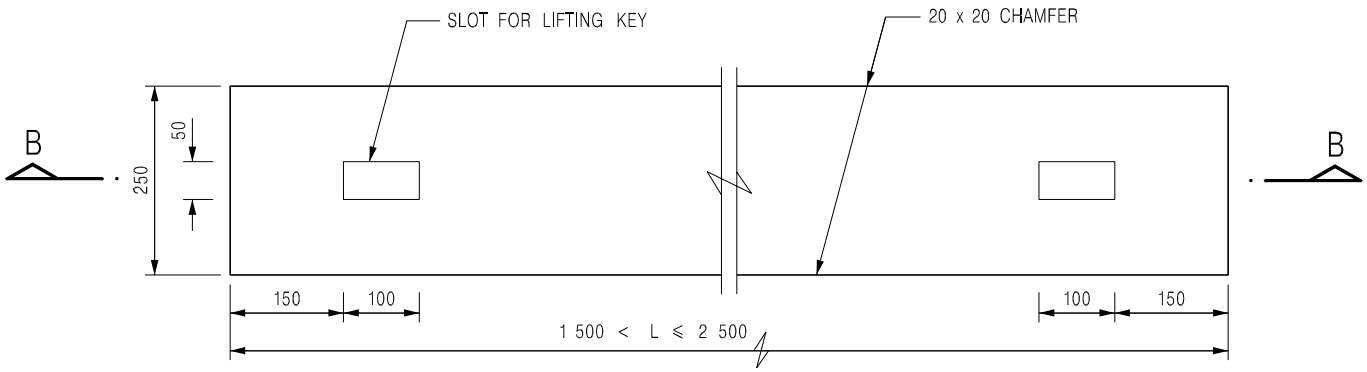


PLAN

TYPE 1 – FOR SPAN UP TO 1.5 m



SECTION B – B



PLAN

TYPE 2 – FOR SPANS 1.5 m TO 2.5 m

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL EXTERNAL EDGES OF THE COVERS SHALL BE 20mm CHAMFERED.

REF.	REVISION	SIGNATURE	DATE
B	NAME OF DEPARTMENT AMENDED.	Original Signed	01.2005
A	GENERAL REVISION	Original Signed	12.2002

PRECAST CONCRETE COVERS FOR CATCHPIT AND SAND TRAP

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

SCALE 1 : 10

DATE JAN 1991

DRAWING NO. C2407B

興土木 利民生 齊拓展 創明天

We bring the best engineering to life

Appendix D CALCULATION OF DRAINAGE CAPACITY

Calculation of Drainage Capacity for Return Period of 50 Years

Drainage Capacity of Proposed Stream Course

From	To	Description	U-Shape Channel / Pipe	Length	Diameter	Upstream Invert Level (mPD)	Downstream Invert Level (mPD)	Slope (s)	Cross Section Area, m2	Wetted Perimeter	Hydaralius Radius, m	Manning Roughness Coefficient	Roughness Coefficient	g m/s^2	Kinematic Viscosity m^2/s	Mean Velocity, m/s	Capacity Flow, m3/s	Total Runoff, m3/s	Flow go to Tank	% of capacity	Remark
Start 1	CP1	C2a	U-Shape Channel	26.4	0.45	5.89	5.78	0.0040	0.18	1.16	0.16	0.018				1.02	0.18	0.14		73%	OK
CP1	CP2	C2a	U-Shape Channel	26.4	0.45	5.78	5.68	0.0040	0.18	1.16	0.16	0.018				1.02	0.18	0.14		73%	OK
CP2	CP3	C2a	U-Shape Channel	43.7	0.45	5.68	5.50	0.0040	0.18	1.16	0.16	0.018				1.02	0.18	0.14		73%	OK
CP3	CP4	C2a	U-Shape Channel	32.7	0.45	5.50	5.37	0.0040	0.18	1.16	0.16	0.018				1.02	0.18	0.14		73%	OK
CP4	CP5	C2a+C2b	U-Shape Channel	37.8	0.6	5.37	5.22	0.0040	0.32	1.54	0.21	0.018				1.23	0.40	0.28		70%	OK
CP5	Tank	flow discharge to tank	pipe	37.5	0.5	5.42	5.23	0.0050	0.20	1.57	0.13		0.30	9.81	0.000001	1.65	0.32		0.15	46%	OK
CP5	CP6	C2a+C2b	U-Shape Channel	20.1	0.45	5.22	5.14	0.0040	0.18	1.16	0.16	0.018				1.02	0.18	0.13		70%	OK
CP6	CP7	C2a+C2b	U-Shape Channel	26.4	0.45	5.14	5.03	0.0040	0.18	1.16	0.16	0.018				1.02	0.18	0.13		70%	OK
CP7	CP8	C2a+C2b+C2c	U-Shape Channel	33.7	0.6	5.03	4.90	0.0040	0.32	1.54	0.21	0.018				1.23	0.40	0.23		57%	OK
CP8	CP9	C2a+C2b+C2c+2d	U-Shape Channel	42.9	0.6	4.90	4.73	0.0040	0.32	1.54	0.21	0.018				1.23	0.40	0.30			
CP9	Tank	flow discharge to tank	pipe	44.8	0.5	4.93	4.70	0.005	0.20	1.57	0.125		0.30	9.81	0.000001	1.65	0.32		0.14	43%	OK
CP9	MH9	C2a+C2b+C2c+2d	U-Shape Channel	49.4	0.6	4.73	4.53	0.0040	0.32	1.54	0.21	0.018				1.23	0.40	0.17		42%	OK
MH9	discharge	flow discharge to tank	U-Shape Channel	7.7	0.6	4.53	4.50	0.0040	0.32	1.54	0.21	0.018				1.23	0.40	0.17		42%	OK
Start 2	CP10	C2e	U-Shape Channel	13.3	0.45	5.45	5.39	0.0040	0.18	1.16	0.16	0.018				1.02	0.18	0.11		58%	OK
CP10	CP11	C2e	U-Shape Channel	75.6	0.45	5.39	5.09	0.0040	0.18	1.16	0.16	0.018				1.02	0.18	0.11		58%	OK
CP11	CP12	C2e+C2f	U-Shape Channel	27.8	0.60	5.09	4.98	0.0040	0.32	1.54	0.21	0.018				1.23	0.40	0.21		53%	OK
CP12	Tank	flow discharge to tank	pipe	23.2	0.5	5.18	5.06	0.0050	0.20	1.57	0.13		0.30	9.81	0.000001	1.65	0.32		0.15	46%	OK
CP12	CP13	C2e+C2f+2g	U-Shape Channel	38.2	0.60	4.98	4.83	0.0040	0.32	1.54	0.21	0.018				1.23	0.40	0.16		40%	OK
CP13	CP14	C2e+C2f+2g	U-Shape Channel	38.2	0.60	4.83	4.68	0.0040	0.32	1.54	0.21	0.018				1.23	0.40	0.16		40%	OK
CP14	Tank	flow discharge to tank	pipe	30.0	0.5	4.88	4.73	0.0050	0.20	1.57	0.13		0.30	9.81	0.000001	1.65	0.32		0.13	39%	OK
CP14	MH14	C2e+C2f+2g+2h	U-Shape Channel	33.0	0.6	4.68	4.54	0.0040	0.32	1.54	0.21	0.018				1.23	0.40	0.17		42%	OK
MH14	discharge	flow discharge to tank	U-Shape Channel	10.8	0.6	4.54	4.50	0.0040	0.32	1.54	0.21	0.018				1.23	0.40	0.17		42%	OK
Tank	discharge	Remaining flow for direct discharge	pipe	45.2	0.7	4.73	4.50	0.005	0.38	2.20	0.175	0.018				1.23	0.47	0.33		70%	OK

Legend

d = pipe diameter, m

r = pipe radius (m) = 0.5d

A_w = wetted area (m^2) = πr^2

P_w = wetted perimeter (m) = $2\pi r$

R = Hydraulic radius (m) = A_w/P_w

s = Slope of the total energy line

k_s = equivalent sand roughness, mm

V = Velocity of flow calculated based on Colebrook White Equation, m/s

Q_c = Flow Capacity (10% sedimentation incorporated), m^3/s

Q_p = Estimated total peak flow from the Site during peak season, m^3/s

Remarks

[1] The proposed U-channel is assumed to be concrete-lined channels under bad condition based on a conservative approach, therefore the manning coefficient of $0.018 s/m^{1/3}$ is assumed as per the SDM.

[2] The material of proposed drainage pipe is assumed to be galvanised iron with coated cast iron generally under bad condition based on a conservative approach, therefore pipelines roughness coefficient ks of 0.3mm is assumed as per the SDM.

Tank Sizing for Stormwater Storage Tank

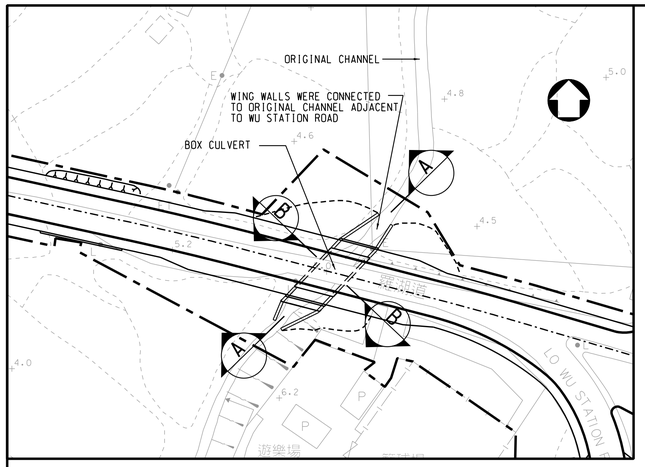
Catchment ID	Catchment Area (A), km^2	Runoff intensity (i), mm/hr [2]	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s	Duration of Storm, hours	Runoff Volume, m^3/s
C2 Before Proposed Development	0.0205	54.90	0.26	0.0053	0.080	4.000	1158.227
C2 After Proposed Development	0.0205	54.90	0.74	0.0152	0.232	4.000	3334.973
						Incremental Runoff	**2176.75**

Note:

1) Runoff is calculated in accordance with DSD's "*Stormwater Drainage Manual (with Eurocodes incorporated) - Planning, Design and Managemen* t" (SDM), fifth edition, January 2018.

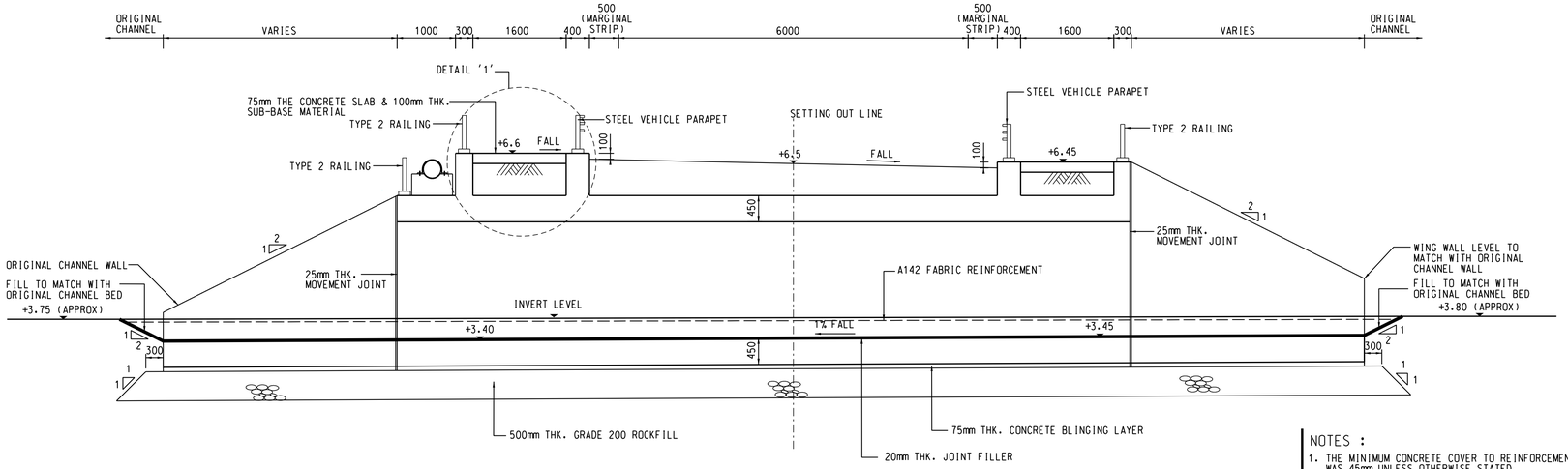
2) Extreme intensity under 50 years return period is based on Table 2a of SDM

Appendix E DRAWINGS OF BOX CULVERT UNDERNEATH LO WU STATION ROAD



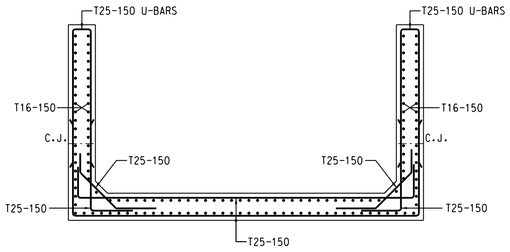
GENERAL LAYOUT OF BOX CULVERT

SCALE 1 : 500



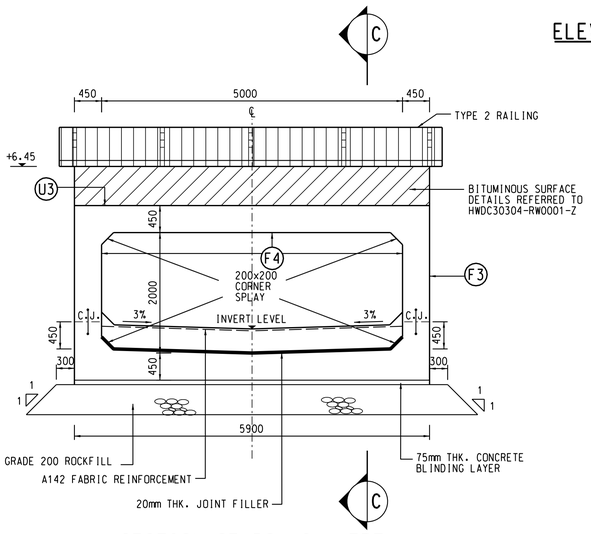
ELEVATION OF BOX CULVERT (SECTION A - A)

SCALE 1 : 50



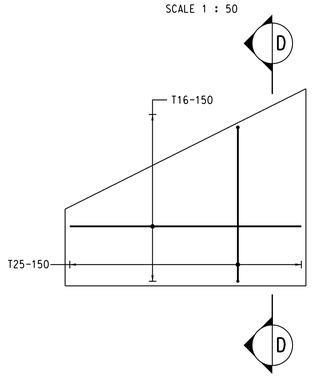
WING WALL REINFORCEMENT DETAIL (SECTION D - D)

SCALE 1 : 50



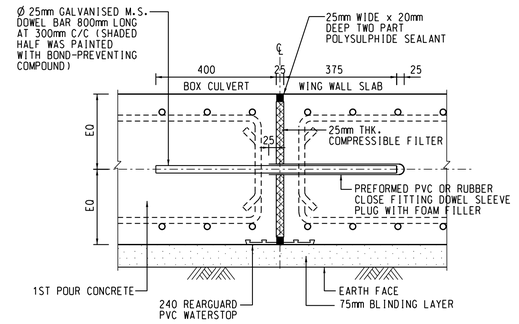
SECTION OF BOX CULVERT

SCALE 1 : 50



TYPICAL R.C. DETAILS OF WING WALL

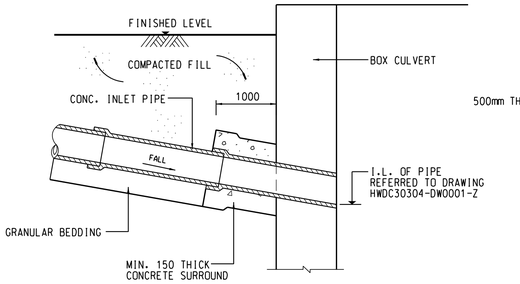
SCALE 1 : 50



MOVEMENT JOINT AT BASE SLAB WITH WATERSTOP

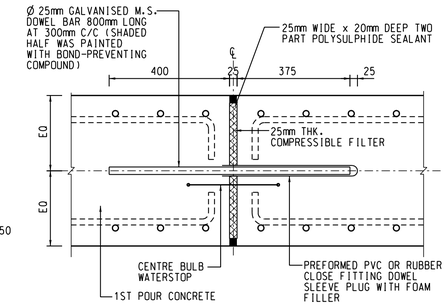
SCALE 1 : 10

NOTE : WATERSTOP ON WALL WAS EXTENDED TO 50mm BELOW FINISHING GROUND LEVEL.



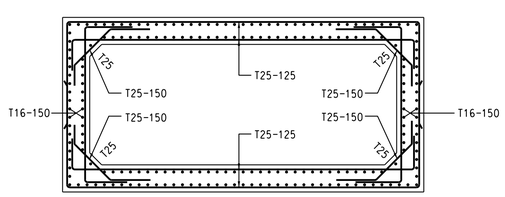
TYPICAL DETAIL OF PIPE CONNECTION TO BOX CULVERT

SCALE 1 : 5



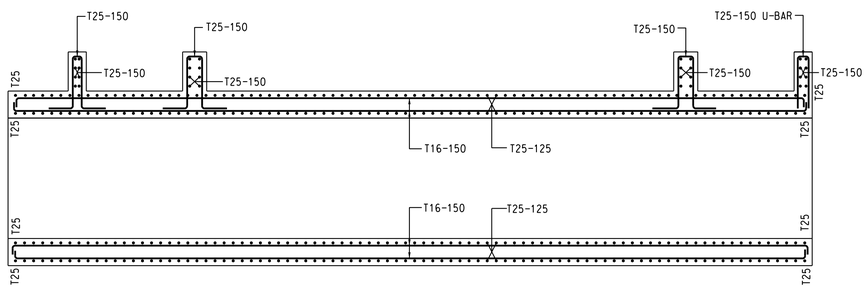
MOVEMENT JOINT AT WALL STEM WITH WATERSTOP

SCALE 1 : 10



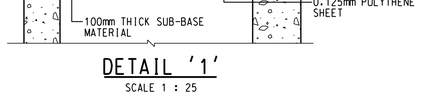
BOX CULVERT REINFORCEMENT DETAIL B - B (SECTION B - B)

SCALE 1 : 50



BOX CULVERT REINFORCEMENT DETAIL C - C (SECTION C - C)

SCALE 1 : 50



DETAIL '1'

SCALE 1 : 25

NOTES :

1. THE MINIMUM CONCRETE COVER TO REINFORCEMENT WAS 45mm UNLESS OTHERWISE STATED.
2. DETAILS STEEL VEHICLE PARAPET REFERRED TO HyD STD. DWG NO.SSD141-B.
3. ALL DIMENSIONS WERE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED.
4. CONCRETE GRADE WAS 40/20D AND CONFORMED TO CONSTRUCTION STANDARD CS1:1990.
5. 25 x 25 CHAMFER UNLESS STATED OTHERS WAS PROVIDED AT EXTERNAL CORNER OF CONCRETE SURFACE LESS THAN 120 DEGREES.
6. THE LEVELS SHOWN ON THE DRG WERE INDICATIVE ONLY THE EXACT LEVELS WERE DETERMINED ON SITE.
7. DETAILS OF THE DRAWING EXTRACTED FROM MCAL'S DRAWING No. 96802/14/01101C.

no.	date	description	initial
Z	22.01.14	AS CONSTRUCTED	SIGNED W.P. WONG (E/NT2-3)

REVISION

	post	name	initial	date
designed	ACE/NT2-1	C.Y. WONG	SIGNED	26.02.09
drawn	TO/3-1	S.C. CHAN	SIGNED	26.02.09
checked	SE/NT2	W.S. MAK	SIGNED	26.02.09

approved

SIGNED
S.W. CHU — 26.02.09
Chief Highway Engineer / Works — Date

contract no.

file no.

project no. 630G041X

project

IMPROVEMENT TO LO WU STATION ROAD

drawing title

BOX CULVERT DETAILS

drawing no. HWDC30304-MC0009-Z

scale A1 AS SHOWN

office

WORKS DIVISION

HIGHWAYS DEPARTMENT HONG KONG

A1 841x594

0 10 20 30 40 50 60 70 80 90 100 mm SCALE 1 : 1

local people
global experience

SMEC is recognised for providing technical excellence and consultancy expertise in urban, infrastructure and management advisory. From concept to completion, our core service offering covers the life-cycle of a project and maximises value to our clients and communities. We align global expertise with local knowledge and state-of-the-art processes and systems to deliver innovative solutions to a range of industry sectors.

www.smec.com