

Drainage Impact Assessment for Proposed “Social Welfare Facilities” (Residential Care Homes for the Elderly) (RCHE) at Tai Wo, Tai Po, N.T.

C250511W-02-A

PREPARED FOR

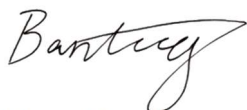
R LEE Architects Ltd

PREPARED BY

Eddy Ng

*BSc(Hons), MHKIOA, MIOA, MMOIA, MIET,
MAES, MASHRAE, MHKIEIA, REnv, BEAM Pro*

APPROVED BY



Wong Kam San

*MSc, CEng, MIOA,
MHKIOA, AFCHKRI, MHKIEIA, MHKIQEP*

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1. Background

The applicant, R Lee Architect, intends to develop one 9-storey building block situated at Tai Wo, Tai Po, New Territories for the Proposed Residential Care Home for the Elderly (RCHE) Development.

The purpose of this report is to conduct a Drainage Impact Assessment (DIA) to assess the potential drainage impact arising from the proposed development.

2. Objective

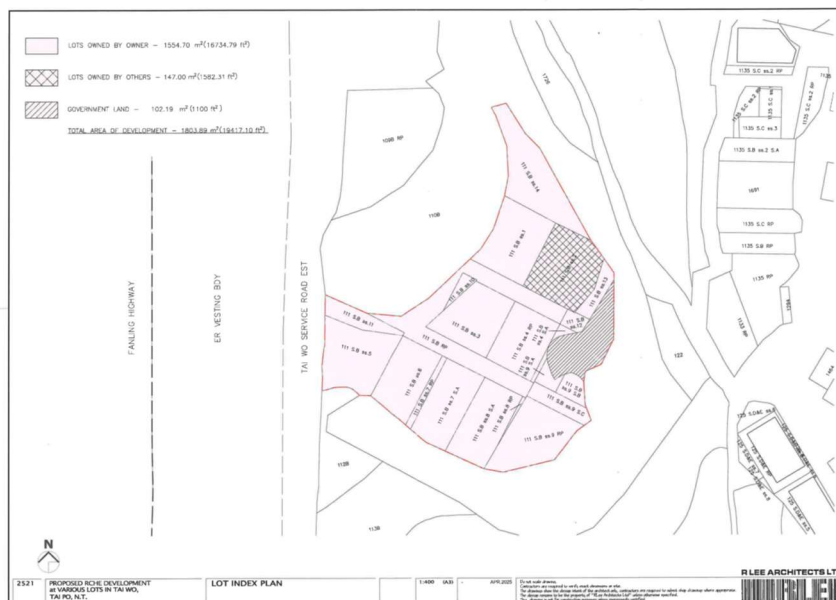
These DIA objectives are to assess the potential drainage impact arising from the proposed development and recommend mitigation measures, if necessary, to alleviate the impacts.

3. Site Information

The D.D.7, Lot 111S.B RP, 111 S.B ss.1 to 3, 111 S.B ss.4 RP, 111 S.B ss.4
Premise: S.A, 111 S.B ss.5 to 6, 111 S.B ss.7 RP, 111 S.B ss.7 S.A, 111 S.B ss.8
RP, 111 S.B ss.8 S.A, 111 S.B ss.9 RP, 111 S.B ss.9 S.A to S.C, 111 S.B
ss.10 to 14.

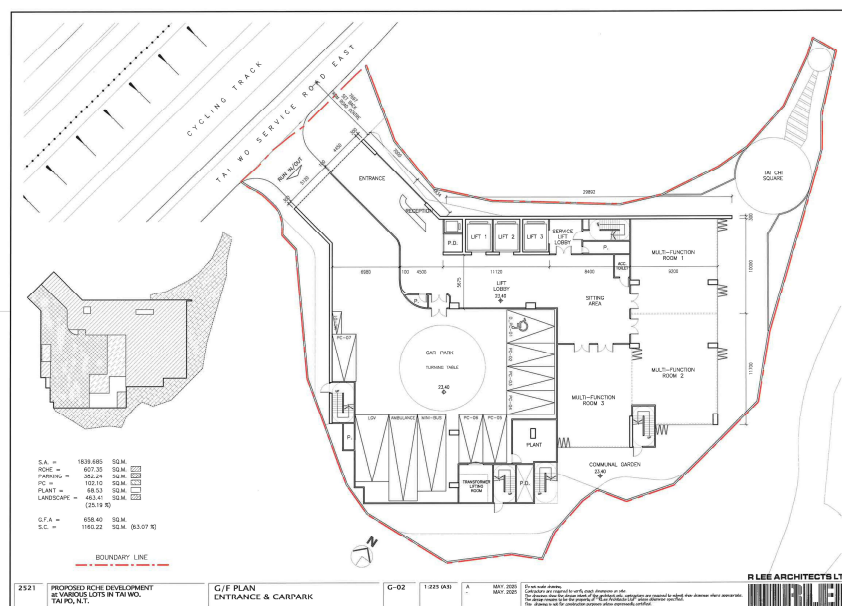
Address: Tai Wo, Tai Po

Location Plan:



Drainage Impact Assessment for Proposed “Social Welfare Facilities” (Residential Care Home for the Elderly) (RCHE) at Tai Wo, Tai Po, N.T.

Development Plan:



Development Schedule: Proposed Residential Care Home for the Elderly (RCHE) Development

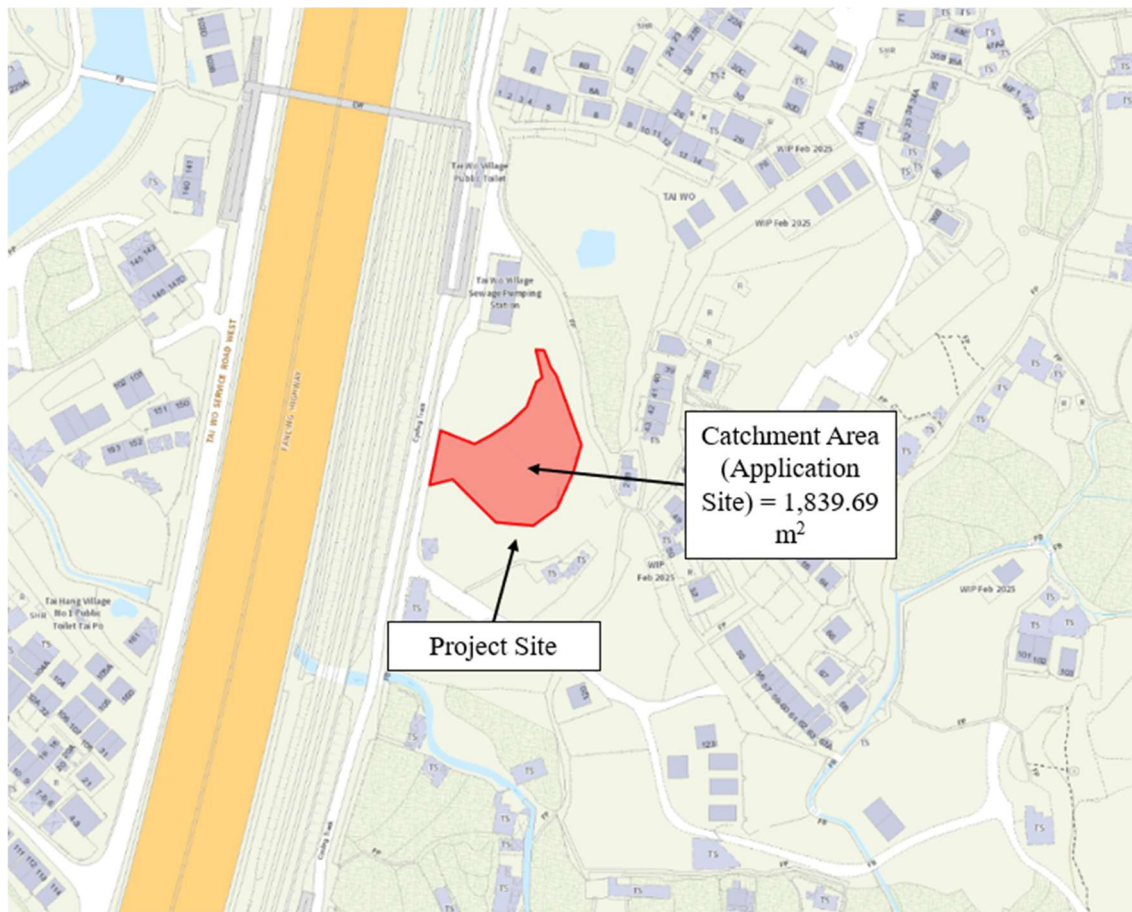
Site Area:	1,839.69m ²
Class of Site:	A
Proposed Plot Ratio for Non-domestic:	4.543 < 9.5
Proposed Site Coverage above for Non-domestic (Above 15m):	63.35% < 80%
Proposed Building Height:	54.40mPD
Absolute Height:	31.0m
Proposed No. of storey:	9 storeys

Proposed Gross Floor Area

G/F (ENTRANCE & CARPARK)	655.39 m ²	
1/F (RCHE)	885.91 m ²	
2/F-4/F (RCHE)	958.50 m ² x 3 storeys	
	=2,875.5 m ²	
5/F-7/F (RCHE)	958.50 m ² x 3 storeys	
	=2,875.5 m ²	
8/F (MANAGEMENT OFFICE)	961.38 m ²	
R/F (SKY GARDEN)	103.96 m ²	
TOTAL	8,357.64 m ²	21 no. of suites & 261 no. of beds

4. Drainage Impact Assessment

i) Catchment Areas



Catchment Area (Application Site, existing, concrete paved) = 1,839.69 m²

Catchment Area (Application Site, proposed to be paved with asphalt) = 1,839.69 m²

ii) Design Manual

In evaluating the drainage impact arising from the Proposed Development, the following sources of information have been specifically referred to:

- Stormwater Drainage Manual (SDM) Fifth Edition, January 2018
- Storm Drainage Manual (SDM) – Corrigendum No. 1/2022
- DSD’s Advice Note No. 1 – Application of the Drainage Impact Assessment Process to Private Sector Projects; and
- Drainage Record Plan obtained from the GeoInfo map Services of the Lands Department (<https://www.map.gov.hk/gm/?lg=en>)

iii) Design Method

a) Rational Method (DSD STORMWATER DRAINAGE MANUAL 7.5.2)

$$Q_p = 0.278CiA$$

Where

Q_p = peak runoff in m^3/s

C = runoff coefficient (dimensionless)

i = rainfall intensity in mm/hr

A = catchment area in km^2

b) Runoff Coefficient

In Hong Kong, a value of $C = 1.0$ is commonly used in developed urban areas. In less developed areas, appropriate C values in order to ensure that the design would be fully cost-effective.

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

The existing site has been concreted while majority of vegetations have been cleared, C of the existing site is taken as 0.8 conservatively.

The surface of the site will be covered by Asphalt, C of the proposed developed site is taken as 0.95 conservatively.

c) Village Drainage and Main Rural Catchment Drainage Channels

‘Village Drainage’ refers to the local stormwater drainage system within a village. A stormwater drain conveying stormwater runoff from an upstream catchment but happens to pass through a village may need to be considered as either a ‘Main Rural Catchment Drainage Channel’ or ‘Village Drainage’, depending on the nature and size of the upstream catchment. In any case, the impact of a 50-year event should be assessed in the planning and design of village drainage system to check whether a higher standard than 10 years is justified. (50 Years is used.)

d) Rainfall Intensity

Table 2d – Intensity-Duration-Frequency (IDF) Relationship of North District Area for durations not exceeding 240 minutes

Duration (min)	Extreme Intensity (mm/h) for various Return Periods T (year)						
	2	5	10	20	50	100	200
240	29.0	38.2	44.5	50.7	59.1	65.6	72.3
120	42.4	54.9	63.2	71.2	81.8	89.8	97.8
60	62.0	77.1	86.1	94.3	104	111	118
30	85.7	103	113	122	133	141	148
15	108	129	141	151	164	173	182
10	120	141	155	168	187	203	219
5	139	162	177	192	214	231	251

Notes:

1. based on continuous rainfall recorded at GEO rain gauges N05 (40 years), N34 (24 years), N46 (24 years), N33 (24 years), N35 (24 years), N36 (24 years), N45 (24 years) and HKO rain gauges EPC (31 years), SSH (20 years), TKL (38 years), R24 (40 years), R29 (39 years), R30_KAT (34 years), SEK (27 years) up to 2023.
2. rainfall IDF relationships are derived from regional frequency analysis of extreme rainfall of local rain gauges.
3. the trends of the extreme rainfalls observed at HKO Headquarters are used to infer the trends at other locations.

i (rainfall intensity) = 214mm/hr (Duration of 5 min is adopted as conservative approach)

e) Climate Change

Climate change is taken into account in drainage system capacity check calculation.

- 16.0% Rainfall Increase for end of 21st century (2081 – 2100) is included referring to SDM, Table 28.
- 12.1% Rainfall Design Allowance for end of 21st century is included referring to SDM, Table 31.
- The tide level adopted in this assessment is referred to Table 9 in the SDM which is given in below:

Table 9 Mean
Higher High
Water
(MHHW)
Levels (in
mPD)

Replace the table with the following:

Table 9 – Mean Higher High Water (MHHW) Levels (in mPD)

North Point/ Quarry Bay (1954-2019)	Tai Po Kau (1963-2019)	Tsim Bei Tsui (1974-2019)	Tai O (1985-2019)
2.01	2.02	2.32	2.13

Notes: Data period for analysis at Tai O tide station does not cover 1998-2010 inclusive.

Given that the MHHW level of Tai Po Kau is 2.02mPD while the foundation level of ground level of the proposed development is about 23.40mPD, risk of flooding is not expected.

f) Calculations of Water Flow

Existing Situation

$$Q_p = 0.278 CiA$$

C = 0.8 (Concrete) (Existing Site)

i = 214 mm/hr

A = 1,839.69 m² (0.001840km²) (Existing Site)

$$Q_p = 0.278 \times 0.8 \times 214 \times 0.001840$$

$$Q_p = 0.0876 \text{ m}^3/\text{s} \text{ or } 5,253 \text{ l/min}$$

Proposed Development Situation

$$Q_p = 0.278 CiA$$

C = 0.95 (Asphalt) (Application Site)

i = 214 mm/hr

A = 1,839.69 m² (0.001840km²) (Existing Site)

$$Q_p = 0.278 \times 0.95 \times 214 \times 0.001840$$

$$Q_p = 0.1040 \text{ m}^3/\text{s} \text{ or } 6,238 \text{ l/min}$$

By considering Future Site Runoff with climate change increase to end of 21st Century and deposition of sediment, 28.1% and 10% of discharge is added respectively.

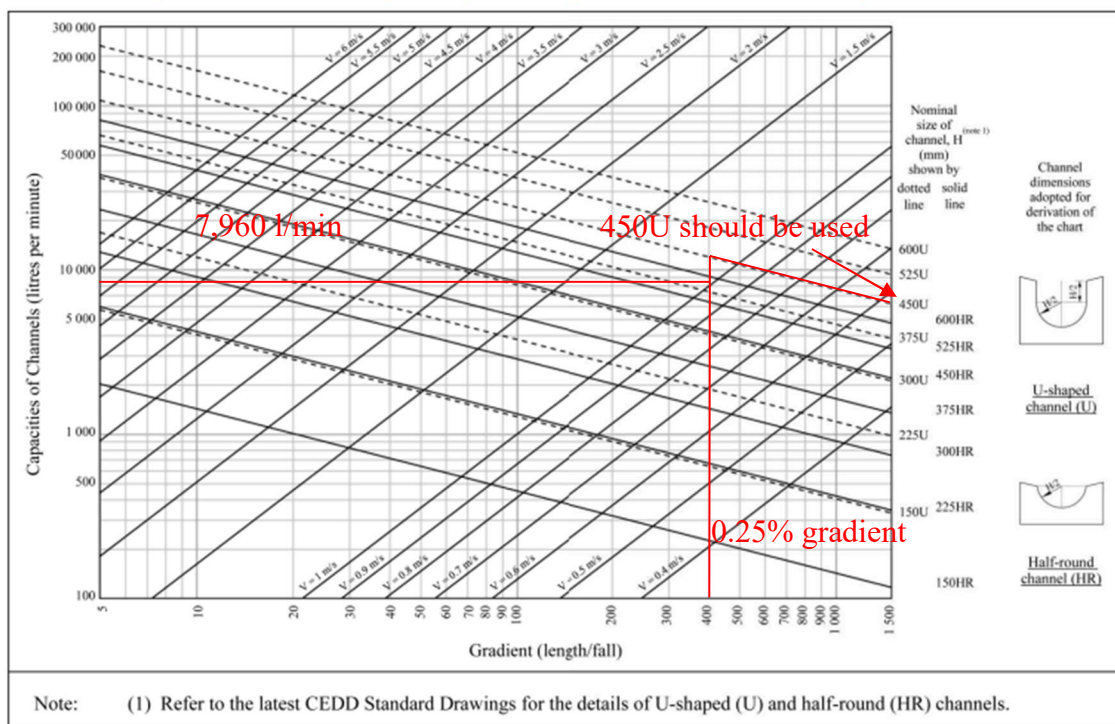
$$Q_{p(\text{Design})} = Q_p \times 128.1\% \times 110\% = 0.1465 \text{ m}^3/\text{s} \text{ or } 8,791 \text{ l/min}$$

For conservative calculations, all catchment areas are combined for all U-Channels.

g) Design of U-channel

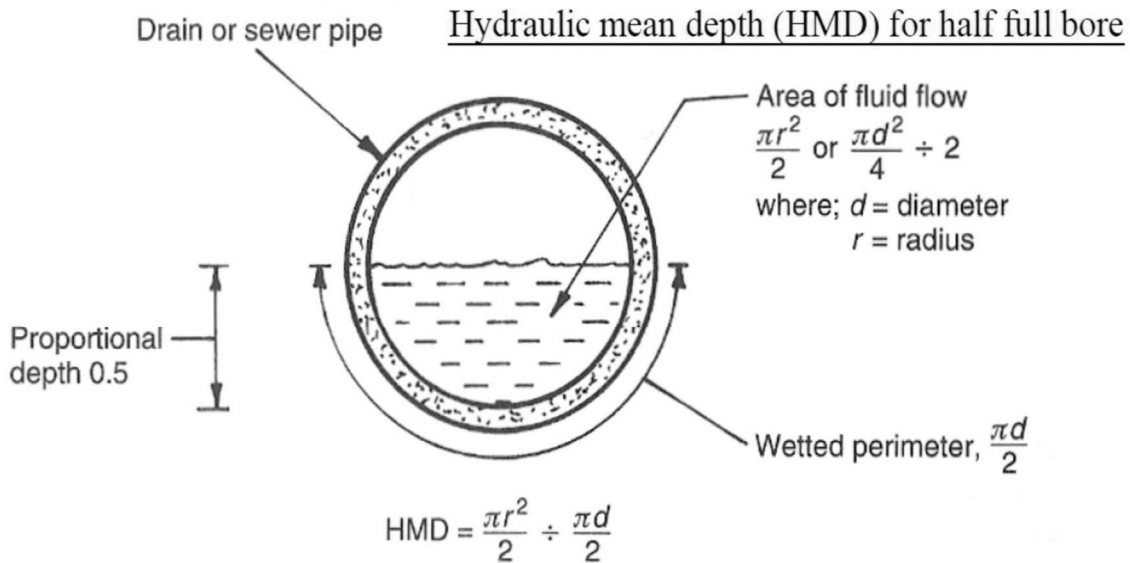
GEO Technical Guidance Note No. 43 (TGN 43) Guidelines on Hydraulic

Figure 1 - Chart for the rapid design of U-shaped and half-round channels up to 600 mm



For 8,791 l/min, 450 U-channel with no less than 0.25% gradient will be used

h) Design of Pipe



Depth of flow	HMD
0.25	Pipe dia. (m) / 6.67
0.33	Pipe dia. (m) / 5.26
0.50	Pipe dia. (m) / 4.00
0.66	Pipe dia. (m) / 3.45
0.75	Pipe dia. (m) / 3.33
Full	Pipe dia. (m) / 4.00

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The 0.5 full bore, a self-cleansing velocity of 1.7m/s and 500mm pipe is used.

The capacity of the pipe:

$$Q = V \times A = (1.7) \times \pi \times (0.500/2)^2 \times 0.5 = 0.1669 \text{ m}^3/\text{s} > 0.1465 \text{ m}^3/\text{s}, \text{ OK}$$

Chezy's formula:

$$V = C\sqrt{(m \times i)}$$

where

V = velocity of flow = 1.7m/s

m = hydraulic mean depth (HMD) $\rightarrow$ $\text{HMD} = 0.500 / 4.00 = 0.125$

C = Chezy coefficient = $(0.125)^{1/6} / (0.015(\text{concrete pipe})) = 47.14$

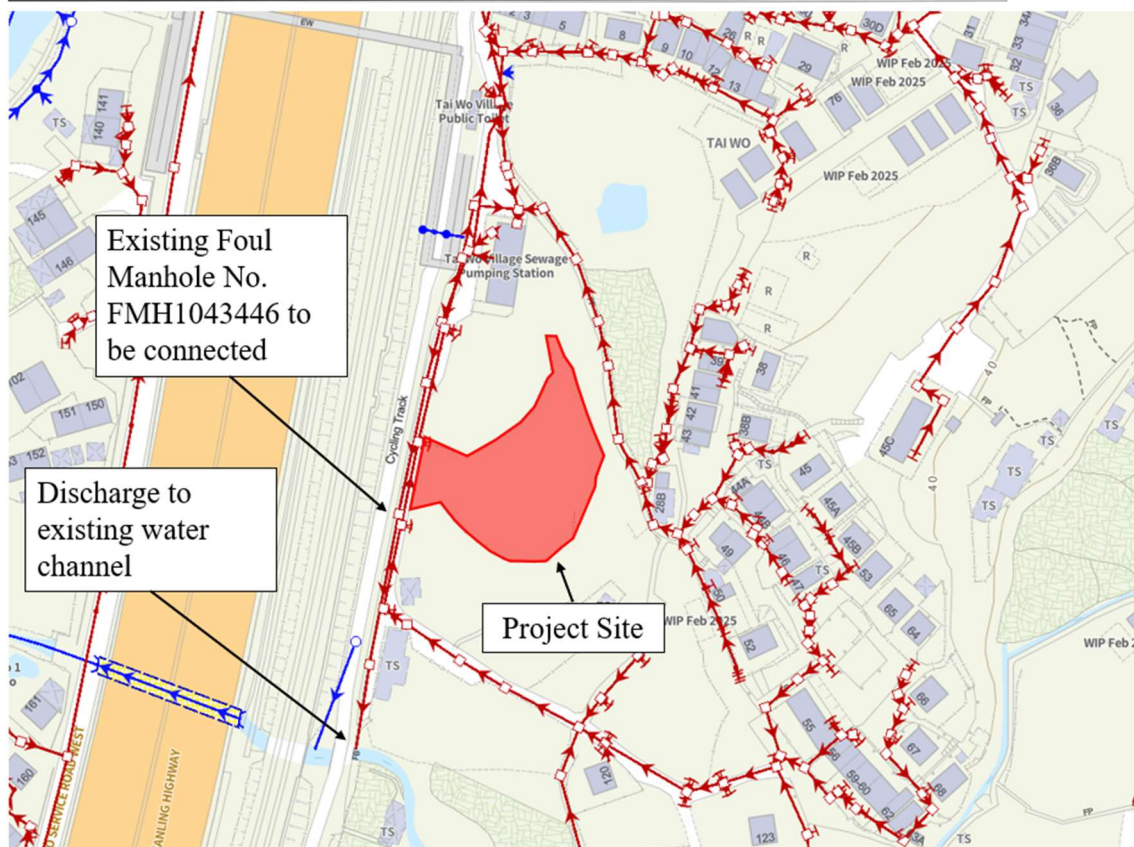
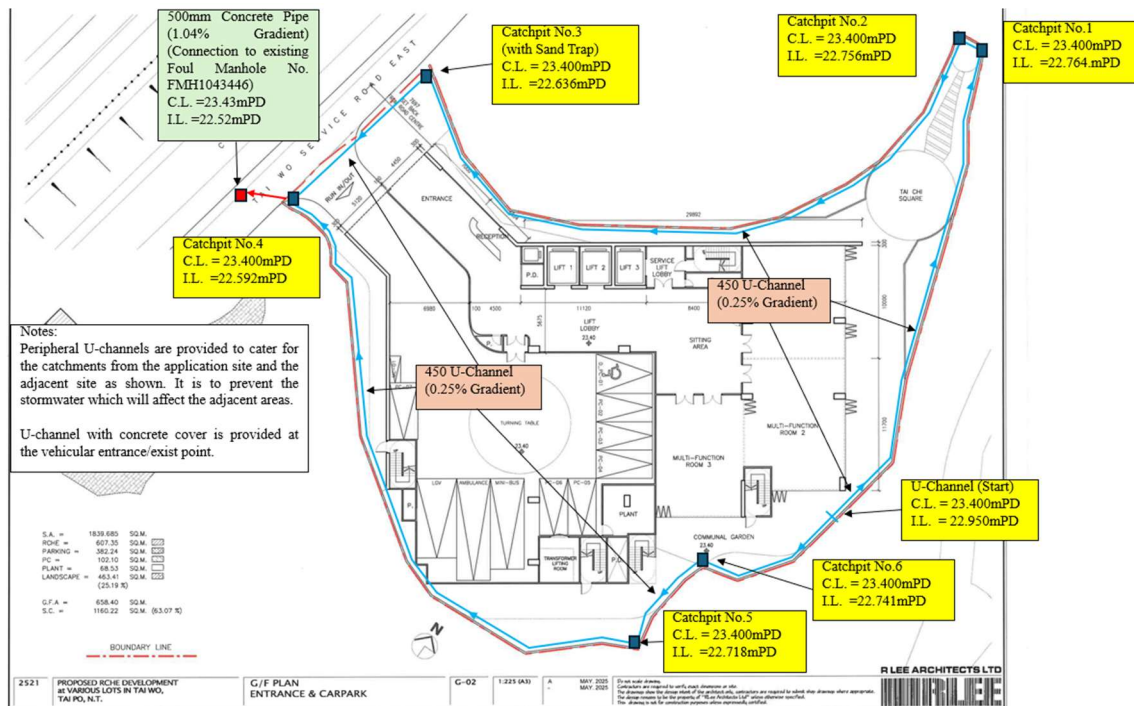
$$1.7 = 47.14 \times (0.125 \times i)^{0.5}$$

$$(1.7/47.14)^2 = 0.125 \times i$$

Thus $i = 0.0104$ or 1.04% (i = inclination or gradient as 1/X)

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iv) Drainage Plan



Detail and method statement for connection of the proposed DN500 pipe to the existing foul manhole should be submitted for DSD’s approval before the connection works. CCTV inspection should be conducted before and after the connection works. DSD should be informed before commencement of the works.

5. Temporary Drainage Arrangements during Construction Stage

Proper measures shall be taken to maintain the existing drainage characteristics of the catchment areas and to minimize drainage impacts associated with the construction works. The principal drainage impacts which are associated with construction of the works have been identified as follows:

- (a) Erosion of ground materials;
- (b) Sediment transportation to existing downstream drainage system; and
- (c) Obstruction to drainage systems.

All proposed works should not obstruct any overland flow and all the existing flow paths, along with runoff directed towards the existing watercourse/drainage system, are to be intercepted and directed to the proposed drainage system. Temporary drainage system designed with sufficient capacity shall be provided to prevent flood risk within the Application Site before commencement of construction works. For example, perimeter channels should be provided at site boundary to intercept surface runoff from outside the Application Site so that overland flow across the Application Site can be avoided. Moreover, permanent U-channel shall be constructed prior to commencement of other construction works which can form part of temporary drainage system during construction stage.

To ensure proper operation of the site drainage channels and desilting facilities, inspection of the temporary drainage system shall be carried out on a weekly basis and the desilting facilities shall be cleaned on a daily basis.

If excavated materials are not possible to transport away the excavated materials within the same day, the materials should be covered by tarpaulin/ impervious sheets. Stockpiles of construction materials of more than 50m³ in an open area shall also be covered with tarpaulin or similar fabric during rainstorms.

All runoff discharge into the existing drainage system will be settled in a silt trap to ensure no sediment will be discharge into the existing system. Silt traps will normally be provided along the site drainage immediately upstream of the proposed discharge point to the existing Site. The silt traps shall be inspected daily and immediately after each rainstorm.

Liaison shall be carried out with relevant parties regarding temporary drainage arrangements to ensure that the drainage system is functioning adequately.

Further guidelines and site practices outlined in EPD’ s Practice Note ProPECC PN1/94, DSD Technical Circular No. 1/2017 – Temporary Flow Diversions and Temporary Works Affecting Capacity in Stormwater Drainage System, and DSD Practice Note No.

1/2004 – Design Rainfall Depth for Temporary Works within the Dry Season shall be followed as far as practicable to minimize the adverse drainage impact caused by the construction works.

6. Conclusion

U-channels with catchpits are proposed to convey runoff from the proposed Project site for collection. The collected runoff will be discharge to the existing water channel through connecting the existing foul manhole by drainage pipe.

The Project Proponent will be responsible for the construction and on-going maintenance of the drainage facilities.

No change of total catchment areas and the increase in stormwater flow is small (from 0.0876 m³/s to 0.1040 m³/s), there will be no unacceptable drainage impacts as a result of the proposed development.

The assessment reviews the U-channel and drainage pipe have the sufficient capacity to cater for the drainage flow from the proposed Project site.

Temporary drainage impact mitigation measures and monitoring and audit are proposed to ensure that the existing drainage system will not be affected during the construction stage.