

Prepared for

Fruit Design and Build Limited

Prepared by

Ramboll Hong Kong Limited

**PLANNING APPLICATION FOR PROPOSED COMPREHENSIVE
DEVELOPMENT SCHEME TO INCLUDE WETLAND
RESTORATION PROPOSAL AND PROPOSED FILLING OF
PONDS/LAND AND EXCAVATION OF LAND IN "OU(CDWRA)"
ZONE AT VARIOUS LOTS IN D.D. 104, NORTH OF KAM POK
ROAD EAST, POK WAI, YUEN LONG, NEW TERRITORIES**

DRAINAGE IMPACT ASSESSMENT

Date **13 September 2023**

Prepared by **Crystal Lui et. al**
Assistant Environmental Consultant

Signed 

Approved by **Henry Ng**
Principal Consultant

Signed 

Project Reference **FDBNPWWREA00**

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Ramboll Hong Kong Limited

21/F, BEA Harbour View Centre
56 Gloucester Road, Wan Chai, Hong Kong

Tel: (852) 3465 2888
Fax: (852) 3465 2899

Email: hkinfo@ramboll.com

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1. INTRODUCTION

- 1.1.1 The applicant proposes to develop the Application Site at various lots in DD104, north of Kam Pok Road East, Yuen Long, into a residential development cum wetland restoration area. The zoning of the Application Site is "Other Specified Uses – Comprehensive Development to include Wetland Restoration Area" (OU(CDWRA)) on the approved Nam Sang Wai Outline Zoning Plan S/YL-NSW/8. A S16 application is required for the proposed development.
- 1.1.2 Ramboll Hong Kong Limited has been commissioned by the Project Proponent to conduct the said Drainage Impact Assessment (DIA) for the proposed development under this application. Architectural drawings and technical information of the Development Site were largely provided respectively by the project architect and other project team members.
- 1.1.3 The Application Site is also the subject of a previous planning application under the application no. A/YL-NSW/290 and a DIA report (R7192) was previously submitted in support of that planning application (Previous DIA). Since then, the layout plan of proposed development has been further reviewed taking into account the concerns of AFCD with respect to the layout of proposed wetland restoration area. Compared to the previous scheme in Previous DIA, the application boundary in current application remains the same. Thus, this DIA serves as an update to the above-mentioned previous submitted DIA report based on the current proposed development.

1.2 Application Site and its Environs

- 1.2.1 The Application Site is about 51,073 m², and it is immediate southeast of an existing low-rise residential development, Man Yuen Chuen and north of the Kam Pok Road East. The Application Site is partly occupied by abandoned ponds and partly by soil ground.
- 1.2.2 **Figure 1.1** shows the location of the Application Site and the environs.

1.3 Proposed Development

- 1.3.1 The proposed development comprises a total of 114 units in 108 housing blocks of 3- to 5-storey high (i.e. 89 in the form of 2- to 4-storey on top of 1-level of communal basement carpark and 25 in 2-storey on top of 1-level of carport), two 2-storeys clubhouses, an underground sewage pumping station (SPS) and a proposed wetland restoration area (WRA).
- 1.3.2 The indicative Master Layout Plan (MLP) and sections of the Proposed Development are included in **Appendix 1.1**.

2. DRAINAGE IMPACT ASSESSMENT ("DIA")

2.1 Scope of Work

2.1.1 The aim of this study is to assess the changes to runoff from the Application Site as a result of the proposed development and the potential impacts on the existing drainage system and surrounding areas. Drainage Record Plans from the Drainage Services Department (DSD) were obtained for the information of drainage impact assessment.

2.2 Assessment Criteria and Methodology

2.2.1 The assessment standard complies with the Stormwater Drainage Manual (2022 Edition) published by DSD (DSD SDM). The Site is located within an urban drainage branch system and a 1 in 50 years return storm has therefore been adopted for the DIA.

2.2.2 The catchment runoff has been calculated using the "Rational Method", as outlined in the DSD SDM:

$$Q = 0.278 C i A$$

Where	Q	=	peak runoff in m ³ /s
	C	=	runoff coefficient (dimensionless)
	i	=	rainfall intensity in mm/hr
	A	=	catchment area in km

2.2.3 The existing Site consists of a group of abandoned ponds of around 4.9 ha in total. According to the latest development layout, the proposed development comprises houses. In the site inspection, it has been noted that parts of the Application Site have been paved concrete and pantry, unpaved soft landscape around intermixed among fishponds. Runoff coefficient of 0.95 has been adopted for the paved areas and 0.35 has been adopted for unpaved areas (i.e. soft landscape). A runoff coefficient of 0.35 has been adopted for fishponds in the existing scenario and a coefficient of 1.0 has been adopted for fishponds and the proposed WRA in the proposed scenario. A summary of catchment characteristics is provided in **Appendix 2.1**.

2.2.4 The design criteria for flood level depends on a combination of rainstorm event and tidal level, as well as the catchment characteristics. With reference to the Table 11 of DSD SDM, the determination of flood level is provided in **Table 2.1**.

Table 2.1 Determination of Flood Level

Flood Level Return Period Scenarios	Rainfall Return Period (year)	Sea Level Return Period (year)
50-years A (Case I)	50	10
50-years B (Case II)	10	50

- 2.2.5 With the reference to Table 28 of DSD SDM, as extracted in **Table 2.2** below, rainfall increase and sea level rise due to climate change has been considered in the calculations. As 1 in 50 years return storm is adopted for the assessment, the mid-21st century value has been considered.

Table 2.2 Rainfall Increase and Sea Level Rise due to Climate Change

	Rainfall Increase	Sea Level Rise (m)
Mid-21 st Century (2041 – 2060)	11.1%	0.20

2.3 Existing Drainage and Condition of the Application Site

- 2.3.1 According to the Drainage Record Plans obtained from DSD, there is no public drainage in the immediate vicinity of the Site. There is a drainage ditch to the west of the site, which runs northwards along the eastern perimeter of Man Yuen Chuen. The drainage ditch turns westward before discharging into Ngau Tam Mei Drainage Channel.
- 2.3.2 Based on the ground levels shown on the basemaps, surface runoff within the Site runs westwards, entering the abovementioned drainage ditch. For the ponds outside Site to the north and northeast of the Site, and the construction site and open storage area to the east of the site, the existing ground level indicates that surface runoff would run westwards as well then enter the above-mentioned drainage ditch. For the Hong Kong and China Gas Company Limited Yuen Long Open Yard to the south of the Site, runoff runs towards the east and south into another drainage ditch, which discharges to Ngau Tam Mei Drainage Channel. For Ma Yuen Chuen and the open storage area to the west of the Site, based on site observation, there are gullies along Kam Pok Road collecting runoff from these areas. The runoff then discharges to Ngau Tam Mei Drainage Channel as well.
- 2.3.3 The existing drainage system in the vicinity of the Application Site and the direction of runoff flow are shown in **Figure 2.1**. Sections of the existing drainage ditch to the west of the Site are shown in **Appendix 5.1**.

2.4 Proposed Development and Drainage System

- 2.4.1 The proposed site formation of the proposed development is about +5.1mPD. The proposed site will be formed at a level higher than the adjacent areas (Catchments C2 and C3) after the proposed development is completed. It may block the original surface runoff (from east to west) of Catchments C2 and C3. Thus, a set of 800mm peripheral drain is proposed along the east of the application site boundary to divert the surface runoff from Catchments C2 and C3 and to maintain the flow as its original flow direction.
- 2.4.2 A set of peripheral drains are proposed across the Site to collect stormwater runoff from the Proposed Development, Catchment C2 and Catchment C3. It runs to the proposed 1350mm drains (at section S10 in **Appendix 5.1**) and then runs to the existing drainage ditch immediate downstream of the Subject Site.
- 2.4.3 Based on the hydraulic calculations, a section of existing drainage ditch should be modified/upgraded to 1350mm and 1600mm drains to convey surface runoff from the Subject Site, the surrounding areas and the area further upstream. The runoff would be conveyed by the modified/upgraded 1350mm drain to the west of the Site then to the modified/upgraded 1600mm drain and eventually enter Ngau Tam Mei Drainage Channel.

- 2.4.4 However, with reference to related comments from DSD previously received during the Previous DIA and having considered various uncertainties with the existing drainage conditions in and around the Site, to be conservative, it is proposed the section of existing ditch to the west of the Site should be upgraded to a 1800mm drain or maintain the width of the existing ditch (whichever is greater). The upgraded drainage ditch will be an open channel design with a view to take into account the capacity of existing surface runoff from surrounding areas and capacity of the concerned drainage ditch. Details will be subject to later detailed design stage.
- 2.4.5 Details of the internal drainage facilities will be provided at detailed design and implementation stages. The indicative location of peripheral drains within the Application Site, and the reprofiled drain are indicated in **Figure 3.1**.
- 2.4.6 The boundary conditions of the application site provided by DSD is shown in **Appendix 4.1**.
- 2.4.7 Upon the completion of the Proposed Development, the Site would consist of residential blocks, clubhouse, driveways/EVAs, and a WRA. Except the WRA, the other areas will be paved. With the adoption of Rational Method, the WRA is considered as paved area under a conservative perspective in the hydraulic analysis/calculation. Consideration has been given to the rainfall intensity and sea level rise due to climate change effect when calculating the drainage discharge under backwater effect, which are demonstrated in **Appendix 2.1, Appendices 2.2, 2.3 and 3.1**.
- 2.4.8 Based on the result shown in **Appendix 3.1**, the water level of some segments is above the ground level. The ground level of these segments are existing ground levels and are consistent with the existing ground level of nearby catchments. However, as these existing levels are lower than the downstream boundary water level of Ngau Tam Mei Drainage Channel under both conditions of 50A and 50B, as shown in **Appendix 4.1**, the unfavourable condition is not due to the Proposed Development. Thus, no mitigation is proposed. However, with the presence of existing flap valve at the outlet pipe to Ngau Tam Mei Drainage Channel, backflow of river water through the drains is not anticipated. Thus, flooding due to backflow is not anticipated for the Application Site and the nearby catchments.
- 2.4.9 There will be a basement for a communal carpark. The carpark will be at about +1.7 mPD. The entrance of the communal carpark will be at the south-eastern corner of the Site near the clubhouses. A section of 5.5m tall fence wall (noise barrier) is also proposed along eastern site boundary line. In case of heavy rain, flooding of the basement may occur due to the lower ground level. In order to avoid flooding of the basement, the following precautionary measures will be adopted during detailed design of the Proposed Development:
- The level of the entrance of the basement carpark will be raised; and
 - A flood gate will be installed at the entrance of the basement carpark. The gate will be closed in case of potential flooding condition. The flood gate will be regularly inspected and maintained to ensure normal function in case of emergency.

2.5 Proposed Drainage System (Alternative Route)

- 2.5.1 For contingency purpose, an alternative discharge route including provision of a drainage pipe along the east of the application site boundary to Kam Pok Road East and a set of 800mm peripheral drain has also been considered and reviewed. The proposed alternative route is to divert the surface runoff from Catchments C2 and C3

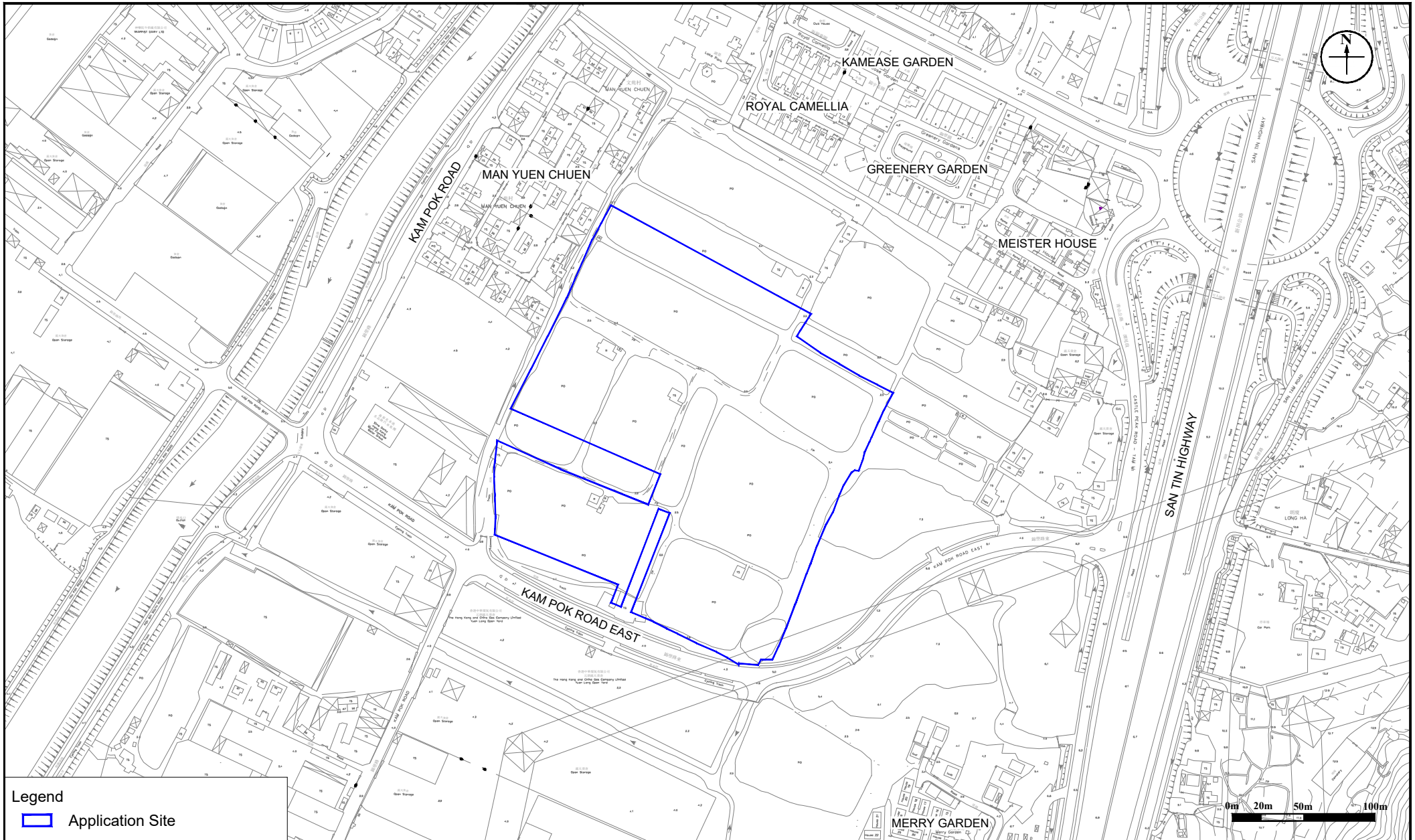
and to maintain the flow as its original flow direction (**Figure 3.2** refers). A detailed DIA will be submitted during later detailed design stage and will confirm the exact discharge route.

- 2.5.2 With regard to the above, a set of peripheral drains are proposed across the Site to collect stormwater runoff from the Proposed Development, Catchment C2 and Catchment C3. It runs to the proposed standard sizes drains (at **Appendix 2.4**).
- 2.5.3 New drainage pipes are proposed along Kam Pok Road East towards west and then to Kam Pok Road. The storm water will be directly discharge to the Ngau Tam Mei Channel.
- 2.5.4 The designated location of the outlet has avoided the existing retaining walls and the cycle track underpass.
- 2.5.5 Upon the completion of the Proposed Development, the Site would consist of residential blocks, clubhouse, driveways/EVAs, and a WRA. Except the WRA, the other areas will be paved. With the adoption of Rational Method, the WRA is considered as paved area under a conservative perspective in the hydraulic analysis/calculation. Consideration has been given to the rainfall intensity and sea level rise due to climate change effect when calculating the drainage discharge under backwater effect, which are demonstrated in **Appendix 2.4** and **Appendix 3.2**. The drainage discharge still works under backwater effect.
- 2.5.6 The indicative location of peripheral drains within the Application Site, and the proposed drains are indicated in **Figure 3.2**.

3. OVERALL CONCLUSION

- 3.1.1 A residential development cum wetland restoration area is proposed for the Application Site at various lots in DD104, north of Kam Pok Road, Yuen Long. The potential drainage impact has been quantitatively addressed.
- 3.1.2 The Proposed Development will increase the runoff generated from the Application Site. Runoff from the Proposed Development and nearby Catchments to the east of the Site will be conveyed to the drainage ditch to the west of the Site, and then discharging into Ngau Tam Mei Drainage Channel.
- 3.1.3 Temporary drainage measures shall be implemented to ensure that the flooding conditions will not be worsened during construction. Periodic inspection by the Authorized Person or his representative will be carried out during construction.
- 3.1.4 With the implementation of the above proposed drainage measures and temporary drainage works during construction, if any, the Proposed Development at the Application Site is technically feasible; having no insurmountable impact from drainage point of view.

Figures



Legend
 Application Site

Figure: 1.1

Title: Application Site and Its Environs

Project: Planning Application for Proposed Comprehensive Development Scheme to include Wetland Restoration Proposal in "OU(CDWRA)" Zone at North of Kam Pok Road East, Pok Wai, Yuen Long, New Territories

RAMBOLL

Drawn by: SN

Checked by: HN

Rev.: 4.0

Date: Sep 2021

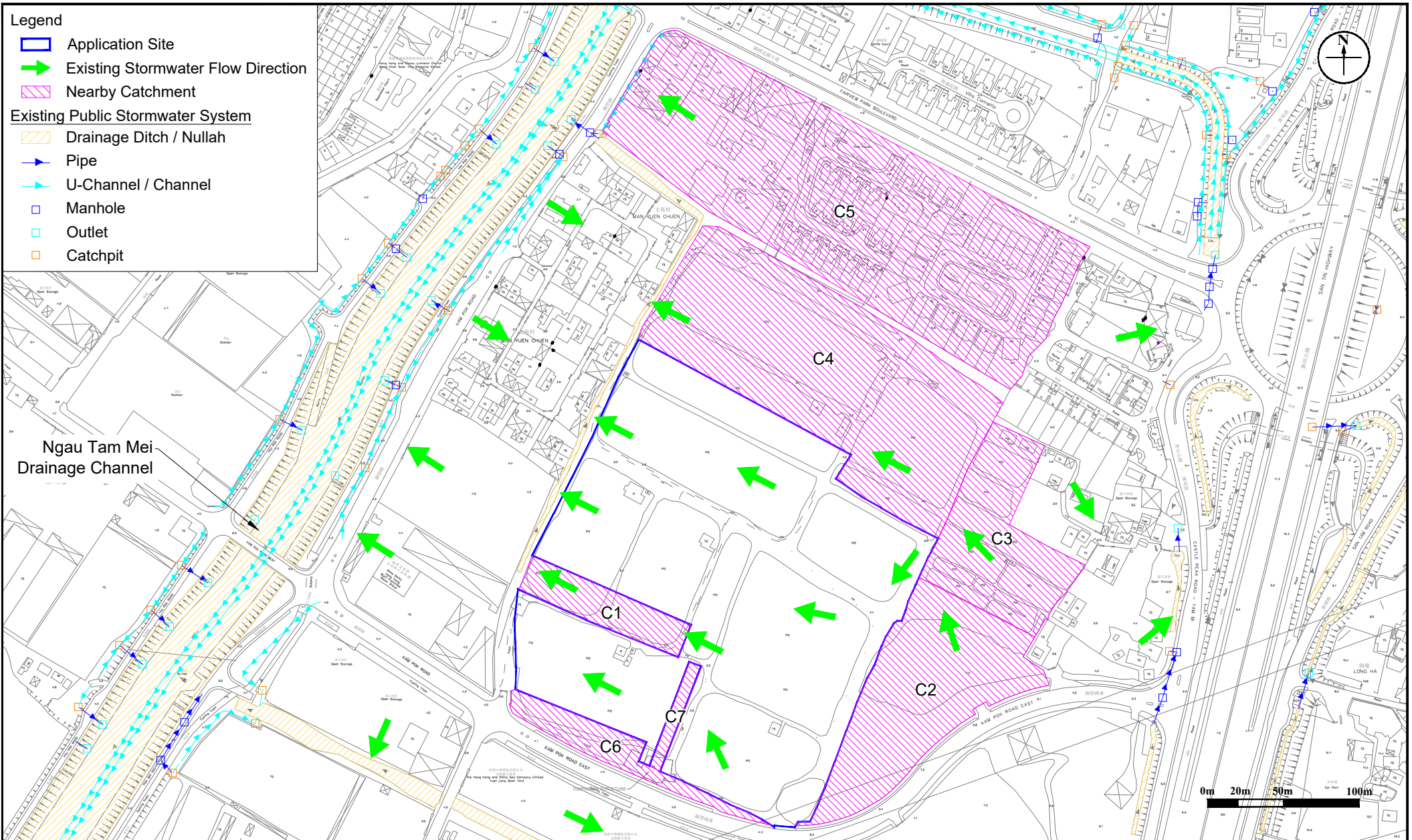


Figure: 2.1

Title: Existing Drainage System in the vicinity of the Application Site

Project: Planning Application for Proposed Comprehensive Development Scheme to include Wetland Restoration Proposal in "OU(CDWRA)" Zone at North of Kam Pok Road East, Pok Wai, Yuen Long, New Territories

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Drawn by: SN

Checked by: HN

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Date: Jan 2022

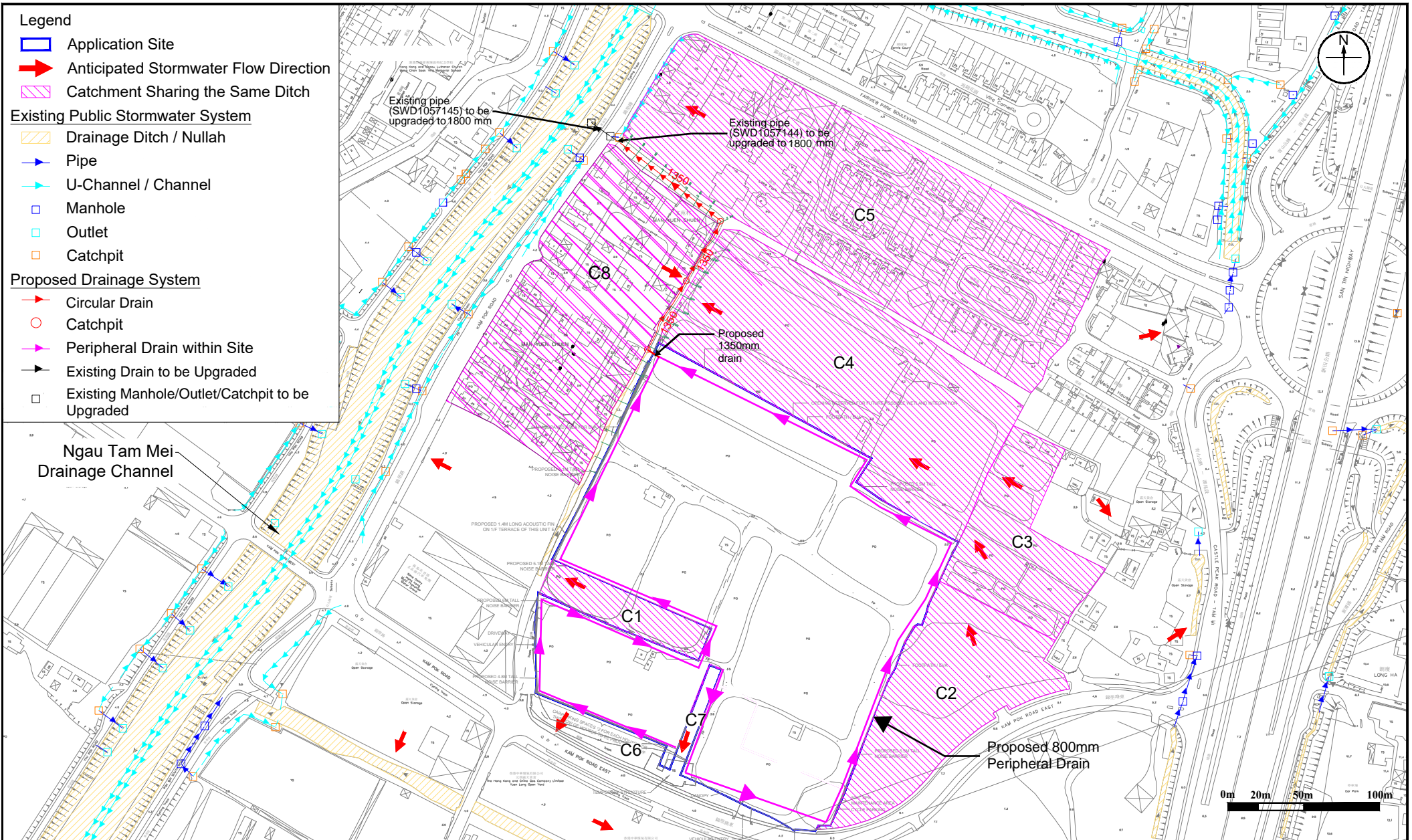


Figure: 3.1

Title: Proposed Drainage System for the Application Site

Project: Planning Application for Proposed Comprehensive Development Scheme to include Wetland Restoration Proposal in "OU(CDWRA)" Zone at North of Kam Pok Road East, Pok Wai, Yuen Long, New Territories

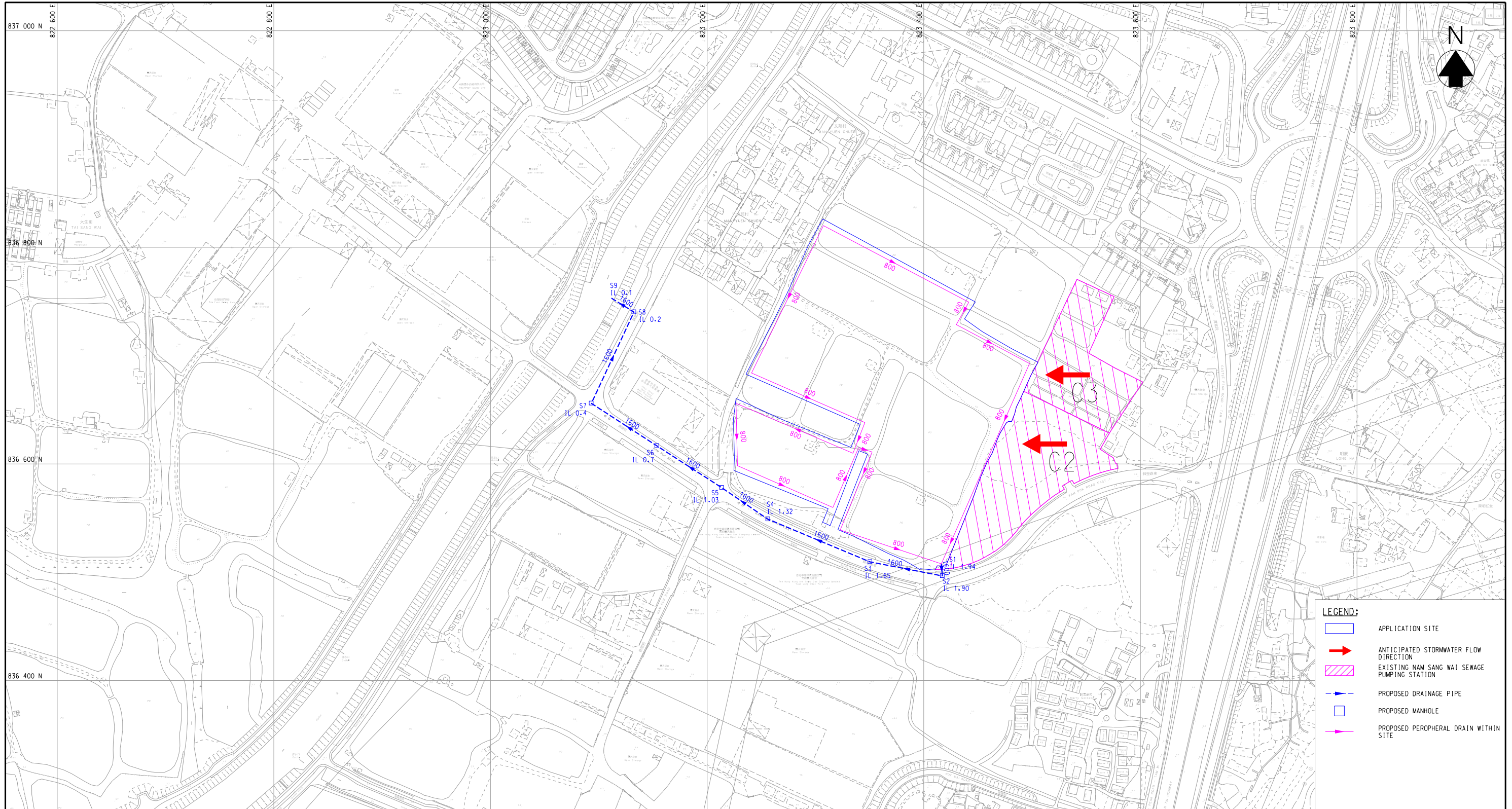
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Checked by: HN

Rev.: 1.0

Date: Jan 2022



- LEGEND:**
- APPLICATION SITE
 - ANTICIPATED STORMWATER FLOW DIRECTION
 - EXISTING NAM SANG WAI SEWAGE PUMPING STATION
 - PROPOSED DRAINAGE PIPE
 - PROPOSED MANHOLE
 - PROPOSED PERIPHERAL DRAIN WITHIN SITE

Figure: 3.2

Title: PROPOSED SEWERAGE SYSTEM FOR THE APPLICATION SITE

Project: PLANNING APPLICATION FOR PROPOSED COMPREHENSIVE DEVELOPMENT SCHEME TO INCLUDE WETLAND RESTORATION PROPOSAL IN "OU(CDWRA)" ZONE AT NORTH OF KAM POK ROAD EAST, POK WAI, YUEN LONG, NEW TERRITORIES



Drawn by: CL

Checked by: NH

Rev: 6.1

Date: Aug 2023

Appendix 1.1 Indicative Master Layout Plan of the Proposed Development

Please refer to the Planning Statement

Appendix 2.1 Summary of Catchment Characteristic

Summary of Catchment Characteristic

Catchment		Area	Coverage	Runoff Coefficient
		(m ²)		
Existing (Site)	Pond	49,000.0	96%	0.35
	Unpaved pond bund / footpath	2,073.3	4%	0.35
	Total	51,073.3		
Future (Site)	Paved area	18,189.9	35%	0.95
	Wetland Restoration Area (WRA)	20,202.4	40%	1.00
	Uncovered horizontal PA, Reed Zone and Grass Paver	12,681.0	25%	0.35
	Total	51,073.3		
C1	Pond	2191.3	79%	1.00
	Unpaved pond bund / footpath	593.5	21%	0.35
	Total	2,784.8		
C2	Construction site for village houses	4365.1	40%	0.95
	Open storage area	6,547.6	60%	0.35
	Total	10,912.7		
C3	Pond	5,954.1	81%	1.00
	Unpaved pond bund / footpath	942.4	13%	0.35
	Village houses	497.7	7%	0.95
	Total	7,394.2		
C4	Pond	15,359.8	70%	1.00
	Unpaved pond bund / footpath	6,657.0	30%	0.35
	Total	22,016.8		
C5	Pond	626.5	2%	1.00
	Village houses / paved area	30,333.1	96%	0.95
	Landscaping area	660.0	2%	0.35
	Total	31,619.6		
C6	Pond	734.0	29%	1.00
	Temporary structure / paved area	1,824.5	71%	0.95
	Total	2,558.5		
C7	Pond	537.2	86%	1.00
	Temporary structure / paved area	86.2	14%	0.95
	Total	623.4		
C8	Unpaved area	340.3	20%	0.35
	Paved area	1,355.0	80%	0.95
	Total	1,695.3		

Appendix 2.2 Drainage Impact Assessment Calculations under Existing Condition

Appendix 2.2 Drainage Impact Assessment Calculations under Existing Condition

Note:

1) Colebrook-White's equation is adopted for full-bore pipe velocity calculation; Manning's equation is adopted for non-circular features.

From	To	US I.L. (mPD)	DS I.L. (mPD)	No. of pipe	Shape	Bottom Width (m)	Height (m)	Top Width (m)	Side Slope (m/m)	Inflow Catchment	Runoff from Catchment (m ³ /s)	Full Flow Velocity (m/s)	Full Flow Capacity (m ³ /s)	Cumulative Runoff (m ³ /s)	Utilization
S1	S2	2.96	2.55	1	Trapezoidal	1.47	0.70	2.54	1.53	C1, C6, C7	0.293	7.221	8.771	8.771	3.3%
S2	S3	2.55	2.48	1	Trapezoidal	2.38	1.27	4.64	1.78	-	0.000	4.207	14.878	14.878	2.0%
S3	S4	2.48	2.54	1	Trapezoidal	2.40	1.17	3.89	1.27	-	0.000	4.106	14.349	14.349	2.0%
S4	S5	2.54	2.41	1	Trapezoidal	0.61	0.91	5.15	2.49	C8	0.104	3.405	2.718	2.718	14.6%
S5	S6	2.41	2.49	1	Trapezoidal	1.44	1.16	5.08	1.57	-	0.000	3.971	9.035	9.035	4.4%
S6	S7	2.49	2.44	1	Trapezoidal	1.06	1.13	4.51	1.53	-	0.000	2.974	5.445	5.445	7.3%
S7	S8	2.44	2.41	1	Trapezoidal	1.02	1.01	3.87	1.41	-	0.000	2.022	3.191	3.191	12.4%
S8	S9	2.41	2.40	1	Trapezoidal	1.03	0.53	2.92	1.78	-	0.000	0.929	0.588	0.588	67.4%
S9	S10	2.40	2.39	1	Trapezoidal	1.44	0.68	4.63	2.35	-	0.000	1.055	1.117	1.117	35.5%
S10	S11	2.39	2.37	1	Trapezoidal	1.49	0.72	4.63	2.18	C2, C3, Site	1.800	1.599	1.886	1.886	116.5%
S11	S12	2.37	2.27	1	Trapezoidal	1.60	0.76	3.90	1.51	-	0.000	3.715	5.343	5.343	41.1%
S12	S13	2.27	2.28	1	Trapezoidal	0.98	1.10	5.26	1.95	-	0.000	1.227	1.878	1.878	117.0%
S13	S14	2.28	2.26	1	Trapezoidal	1.44	1.67	7.06	1.68	-	0.000	2.332	8.527	8.527	25.8%
S14	S15	2.26	2.25	1	Trapezoidal	0.44	0.32	0.76	0.50	C4	0.178	0.646	0.201	0.201	1183.0%
S15	S16	2.25	2.20	1	Trapezoidal	0.40	0.36	0.70	0.42	-	0.000	1.502	0.615	0.615	386.3%
S16	S17	2.20	2.00	1	Trapezoidal	0.50	0.48	2.44	2.02	-	0.000	3.188	1.016	1.016	233.9%
S17	S18	2.00	1.73	1	Trapezoidal	0.61	0.54	3.03	2.24	-	0.000	4.075	1.686	1.686	140.9%
S18	S19	1.73	1.61	1	Trapezoidal	0.62	0.94	5.32	2.50	-	0.000	2.855	2.406	2.406	98.7%
S19	S20	1.61	1.59	1	Trapezoidal	2.24	1.09	6.94	2.16	-	0.000	1.972	5.313	5.313	44.7%
S20	S21	1.59	1.60	1	Trapezoidal	1.84	0.99	6.08	2.14	-	0.000	1.328	2.725	2.725	87.2%
S21	S22	1.60	1.54	1	Trapezoidal	1.13	0.63	6.55	4.30	-	0.000	2.345	1.697	1.697	140.0%
S22	S23	1.54	1.46	1	Trapezoidal	2.05	0.98	7.16	2.61	-	0.000	3.781	8.091	8.091	29.4%
S23	S24	1.46	1.23	1	Trapezoidal	0.60	1.11	6.23	2.54	-	0.000	5.153	5.342	5.342	44.5%
S24	S25	1.23	1.87	1	Trapezoidal	1.64	1.22	6.82	2.12	-	0.000	11.207	27.253	27.253	8.7%
S25	S26	1.87	1.98	1	Trapezoidal	2.61	1.17	5.01	1.03	-	0.000	5.357	21.158	21.158	11.2%
S26	S27	1.98	1.32	1	Trapezoidal	1.89	1.57	9.32	2.37	-	0.000	14.301	51.600	51.600	4.6%
S27	Outlet	1.32	1.58	1	Trapezoidal	3.23	2.96	8.49	0.89	C5	2.087	19.690	344.174	344.174	1.3%

Appendix 2.3 Drainage Impact Assessment Calculations under Proposed Condition

Appendix 2.3 Drainage Impact Assessment Calculations under Proposed Condition

Note:

1) Colebrook-White's equation is adopted for full-bore pipe velocity calculation; Manning's equation is adopted for non-circular features.

From	To	US I.L. (mPD)	DS I.L. (mPD)	No. of pipe	Shape	Bottom Width (m)	Height (m)	Top Width (m)	Side Slope (m/m)	Pipe Size (m)	Inflow Catchment	Runoff from Catchment (m ³ /s)	Full Flow Velocity (m/s)	Full Flow Capacity (m ³ /s)	Cumulative Runoff (m ³ /s)	Utilization
S1	S2	2.96	2.55	1	Trapezoidal	1.47	0.70	2.54	1.53	-	C1, C6, C7	0.325	4.941	1.945	0.325	16.7%
S2	S3	2.55	2.48	1	Trapezoidal	2.38	1.27	4.64	1.78	-	-	0.000	1.999	0.787	0.325	41.4%
S3	S4	2.48	2.54	1	Trapezoidal	2.40	1.17	3.89	1.27	-	-	0.000	1.986	0.782	0.325	41.6%
S4	S5	2.54	2.41	1	Trapezoidal	0.61	0.91	5.15	2.49	-	C8	0.115	2.696	1.061	0.440	41.5%
S5	S6	2.41	2.49	1	Trapezoidal	1.44	1.16	5.08	1.57	-	-	0.000	2.166	0.853	0.440	51.6%
S6	S7	2.49	2.44	1	Trapezoidal	1.06	1.13	4.51	1.53	-	-	0.000	1.745	0.687	0.440	64.1%
S7	S8	2.44	2.41	1	Trapezoidal	1.02	1.01	3.87	1.41	-	-	0.000	1.248	0.491	0.440	89.7%
S8	S9	2.41	2.40	1	Trapezoidal	1.03	0.53	2.92	1.78	-	-	0.000	1.053	0.486	0.440	90.6%
S9	S10	2.40	2.39	1	Trapezoidal	1.44	0.68	4.63	2.35	-	-	0.000	1.003	0.452	0.440	97.4%
S10	S11	2.39	2.35	1	Circular	-	-	-	-	1.35	C2, C3, Site	2.000	2.234	2.669	2.441	91.4%
S11	S12	2.35	2.31	1	Circular	-	-	-	-	1.35	-	0.000	2.234	2.669	2.441	91.4%
S12	S13	2.31	2.27	1	Circular	-	-	-	-	1.35	-	0.000	2.234	2.669	2.441	91.4%
S13	S14	2.27	2.23	1	Circular	-	-	-	-	1.35	-	0.000	2.234	2.669	2.441	91.4%
S14	S15	2.23	2.19	1	Circular	-	-	-	-	1.35	C4	0.198	2.234	2.669	2.639	98.9%
S15	S16	2.19	2.15	1	Circular	-	-	-	-	1.35	-	0.000	2.234	2.669	2.639	98.9%
S16	S17	2.15	2.11	1	Circular	-	-	-	-	1.35	-	0.000	2.234	2.669	2.639	98.9%
S17	S18	2.11	2.07	1	Circular	-	-	-	-	1.35	-	0.000	2.234	2.669	2.639	98.9%
S18	S19	2.07	2.01	1	Circular	-	-	-	-	1.35	-	0.000	2.234	2.669	2.639	98.9%
S19	S20	2.01	1.95	1	Circular	-	-	-	-	1.35	-	0.000	2.499	2.985	2.639	88.4%
S20	S21	1.95	1.90	1	Circular	-	-	-	-	1.35	-	0.000	2.499	2.985	2.639	88.4%
S21	S22	1.90	1.85	1	Circular	-	-	-	-	1.35	-	0.000	2.499	2.985	2.639	88.4%
S22	S23	1.85	1.80	1	Circular	-	-	-	-	1.35	-	0.000	2.499	2.985	2.639	88.4%
S23	S24	1.80	1.75	1	Circular	-	-	-	-	1.35	-	0.000	2.499	2.985	2.639	88.4%
S24	S25	1.75	1.70	1	Circular	-	-	-	-	1.35	-	0.000	2.499	2.985	2.639	88.4%
S25	S26	1.70	1.65	1	Circular	-	-	-	-	1.35	-	0.000	2.499	2.985	2.639	88.4%
S26	S27	1.65	1.60	1	Circular	-	-	-	-	1.35	-	0.000	2.499	2.985	2.639	88.4%
S27	Outlet	1.60	1.58	1	Circular	-	-	-	-	1.60	C5	2.318	2.844	5.147	4.957	96.3%

Appendix 2.4 Drainage Impact Assessment Calculations under Proposed Condition (Alternative Route)

Appendix 2.4 Drainage Impact Assessment Calculations under Proposed Condition (Alternative Method)

Note:

1) Colebrook-White's equation is adopted for full-bore pipe velocity calculation; Manning's equation is adopted for non-circular features.

From	To	US I.L. (mPD)	DS I.L. (mPD)	No. of pipe	Shape	Bottom Width (m)	Height (m)	Top Width (m)	Side Slope (m/m)	Pipe Size (m)	Inflow Catchment	Runoff from Catchment (m ³ /s)	Full Flow Velocity (m/s)	Full Flow Capacity (m ³ /s)	Cumulative Runoff (m ³ /s)	Utilization
S1	S2	1.94	1.90	1	Circular	-	-	-	-	1.60	C2, C3, Site	4.443	2.342	4.709	4.443	94.4%
S2	S3	1.90	1.65	1	Circular	-	-	-	-	1.60	-	0.000	2.256	4.535	4.443	98.0%
S3	S4	1.65	1.32	1	Circular	-	-	-	-	1.60	-	0.000	2.316	4.657	4.443	95.4%
S4	S5	1.32	1.03	1	Circular	-	-	-	-	1.60	-	0.000	2.370	4.764	4.443	93.3%
S5	S6	1.03	0.70	1	Circular	-	-	-	-	1.60	-	0.000	2.532	5.091	4.443	87.3%
S6	S7	0.70	0.40	1	Circular	-	-	-	-	1.60	-	0.000	2.386	4.798	4.443	92.6%
S7	S8	0.40	0.20	1	Circular	-	-	-	-	1.60	-	0.000	2.481	4.989	4.443	89.1%
S8	Outlet	0.20	0.10	1	Circular	-	-	-	-	1.60	-	0.000	2.310	4.645	4.443	95.7%

Appendix 3.1 Calculation of Backwater Effect

Backwater Analysis for the Proposed Application Site

Appendix 3.1

Type	Size			Upstream Invert Level (mPD)	Downstream Invert Level (mPD)	Hydraulics				Friction Loss	Inlet/Outlet		Water Level ⁽¹⁾ (mPD)	Ground Level (mPD)	Check ⁽²⁾
	Width (m)	Height (m)	Length (m)			Radius (m)	Flow (m ³ /s)	Velocity (m/s)	Friction slope (S _f)		K	Loss			
Circular Drain	1.60	1.60	5.00	1.40	0.98	0.40	0.296666667	0.147549895	0.000016621	0.000	1	0.0011	4.563		
Circular Pipe	1.60	1.60	2.17	1.58	1.40	0.40	0.296666667	0.147549895	0.000016621	0.000			4.56	4.0	
Proposed Circular Drain	1.30	1.30	84.46		1.56	0.33	0.296666667	0.223507533	0.000050302	0.004			4.57	4.0	NOT OK
Proposed Circular Drain	1.30	1.30	109.00			0.33	0.890000000	0.670522600	0.000452722	0.049			4.62	3.1	NOT OK
Proposed Circular Drain	1.30	1.30	7.81			0.33	0.840000000	0.632852791	0.000403283	0.003	0.5	0.0013	4.57	3.1	NOT OK
													4.57	5.1	OK

Remark:

(1) With reference to the Appendix 4, flood level of 50B (PP with climate change) provided by DSD, the maximum water level of the Ngau Tam Mei Drainage Channel at the outlet is +4.563 mPD.

(2) According to Appendix 4, the boundary water level of Ngau Tam Mei River is already higher than the ground level, hence, the unfavourable condition is not a result of the Proposed Development. Thus, no mitigation works is proposed under this project.

Appendix 3.2 Calculation of Backwater Effect (Alternative Route)

Appendix 3.2 Backwater Analysis for the Proposed Application Site (Alternative Method)

Appendix 3.2

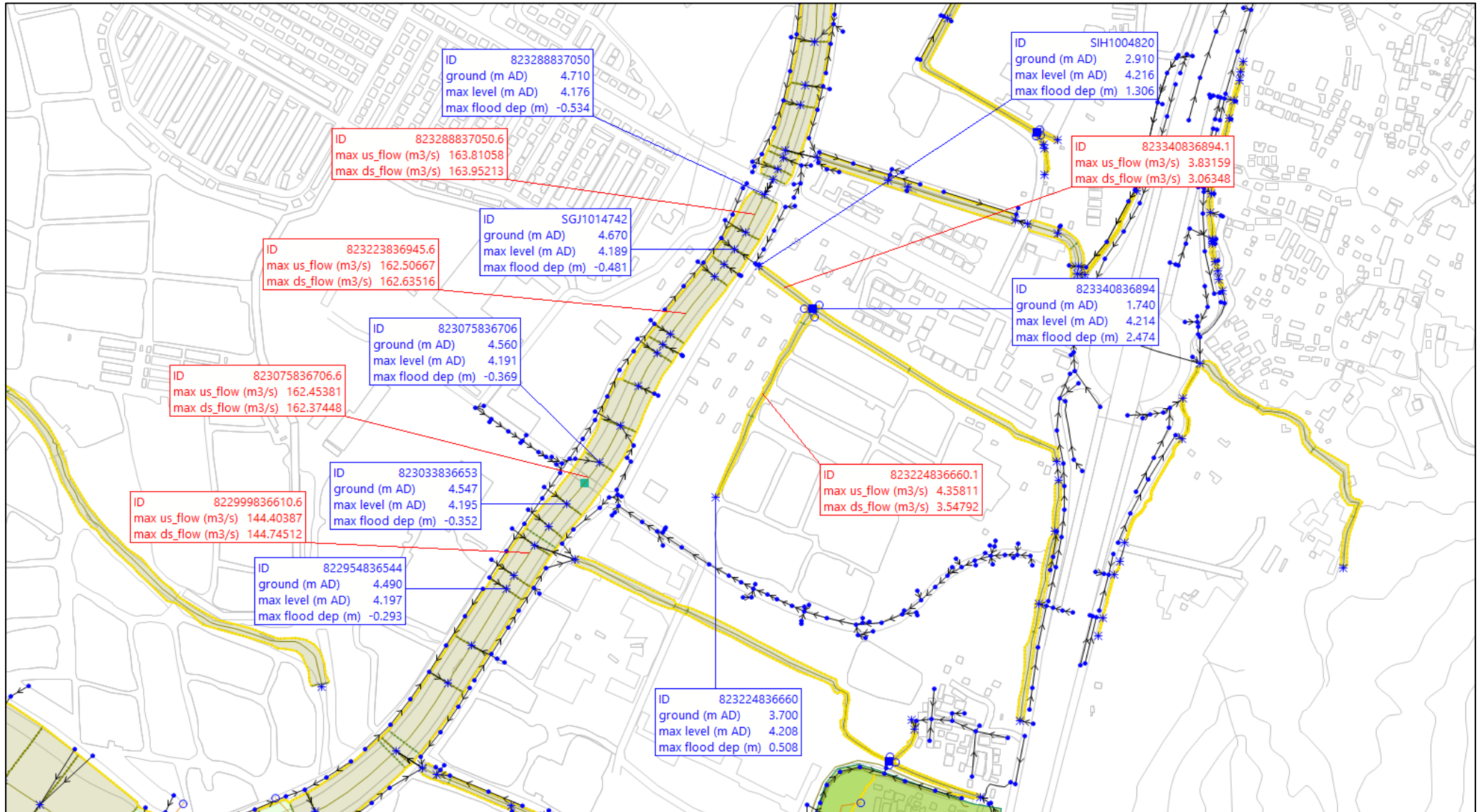
Type	Size		Length (m)	Hydraulics			Friction Loss	Inlet/Outlet		Water Level ⁽¹⁾ (mPD)	Ground Level (mPD)	Check ⁽²⁾	
	Width (m)	Height (m)		Radius (m)	Flow (m ³ /s)	Velocity (m/s)		Friction slope (S _f)	K				Loss
Proposed Circular Drain	1.60	1.60	9.92	0.40	0.296666667	0.147549895	0.000016621	0.000	1	0.0011	4.563 4.56	4.0	
Proposed Circular Drain	1.60	1.60	66.84	0.40	0.296666667	0.147549895	0.000016621	0.001			4.56	4.0	
Proposed Circular Drain	1.60	1.60	83.68	0.40	0.296666667	0.147549895	0.000016621	0.001			4.57	4.0	
Proposed Circular Drain	1.60	1.60	70.26	0.40	0.296666667	0.147549895	0.000016621	0.001			4.57	4.0	NOT OK
Proposed Circular Drain	1.60	1.60	70.04	0.40	0.296666667	0.147549895	0.000016621	0.001			4.57	4.0	NOT OK
Proposed Circular Drain	1.60	1.60	71.67	0.40	0.890000000	0.442649685	0.000149586	0.011			4.58	3.1	NOT OK
Proposed Circular Drain	1.60	1.60	44.20	0.40	0.840000000	0.417781726	0.000133250	0.006			4.57	3.1	NOT OK
Proposed Circular Drain	1.60	1.60	25.49	0.40	0.840000000	0.417781726	0.000133250	0.003	0.5	0.0006	4.57 4.57	5.1	NOT OK OK

Remark:

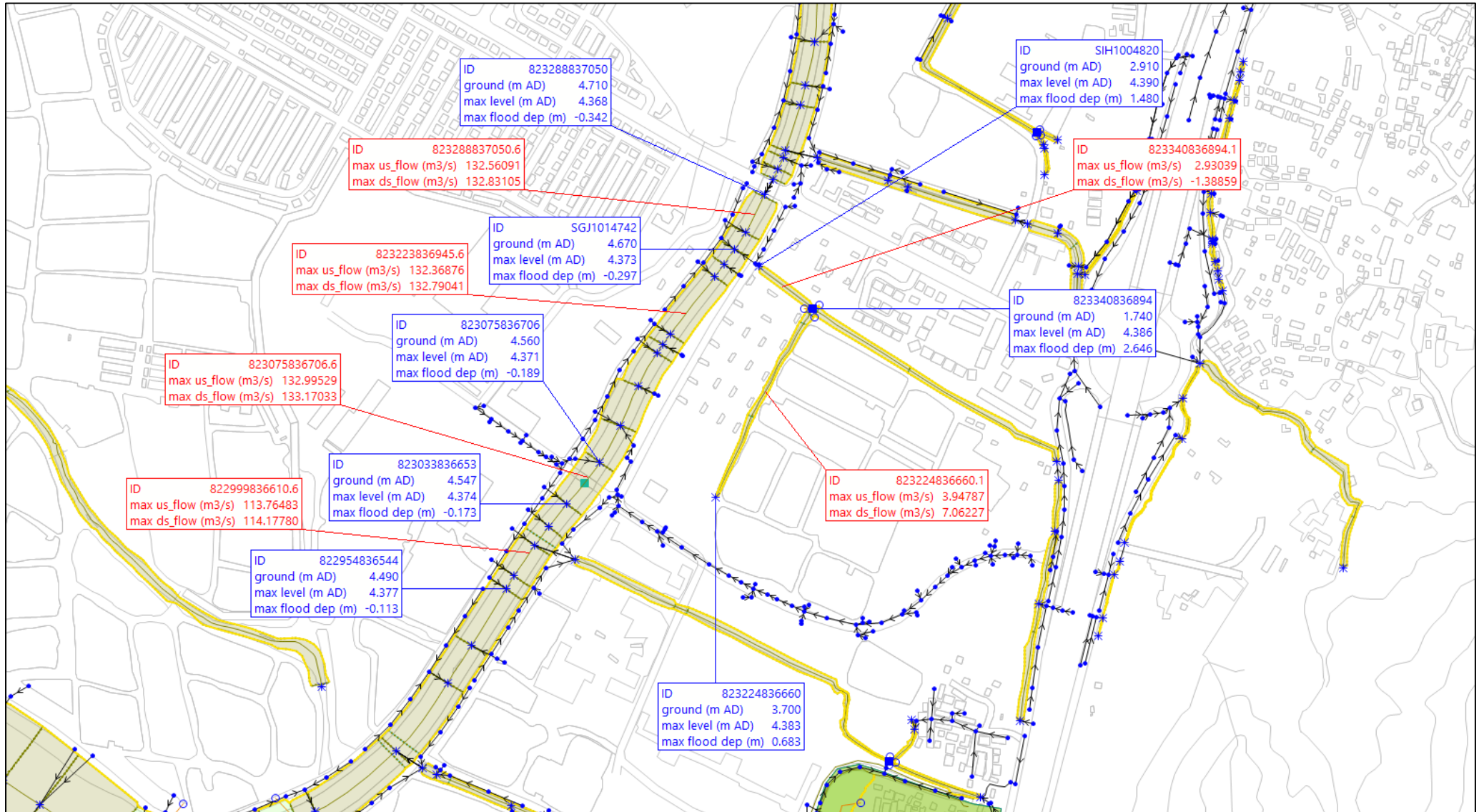
(1) With reference to the Appendix 4, flood level of 50B (PP with climate change) provided by DSD, the maximum water level of the Ngau Tam Mei Drainage Channel at the outlet is +4.563 mPD.

(2) According to Appendix 4, the boundary water level of Ngau Tam Mei River is already higher than the ground level, hence, the unfavourable condition is not a result of the Proposed Development. Thus, no mitigation works is proposed under this project.

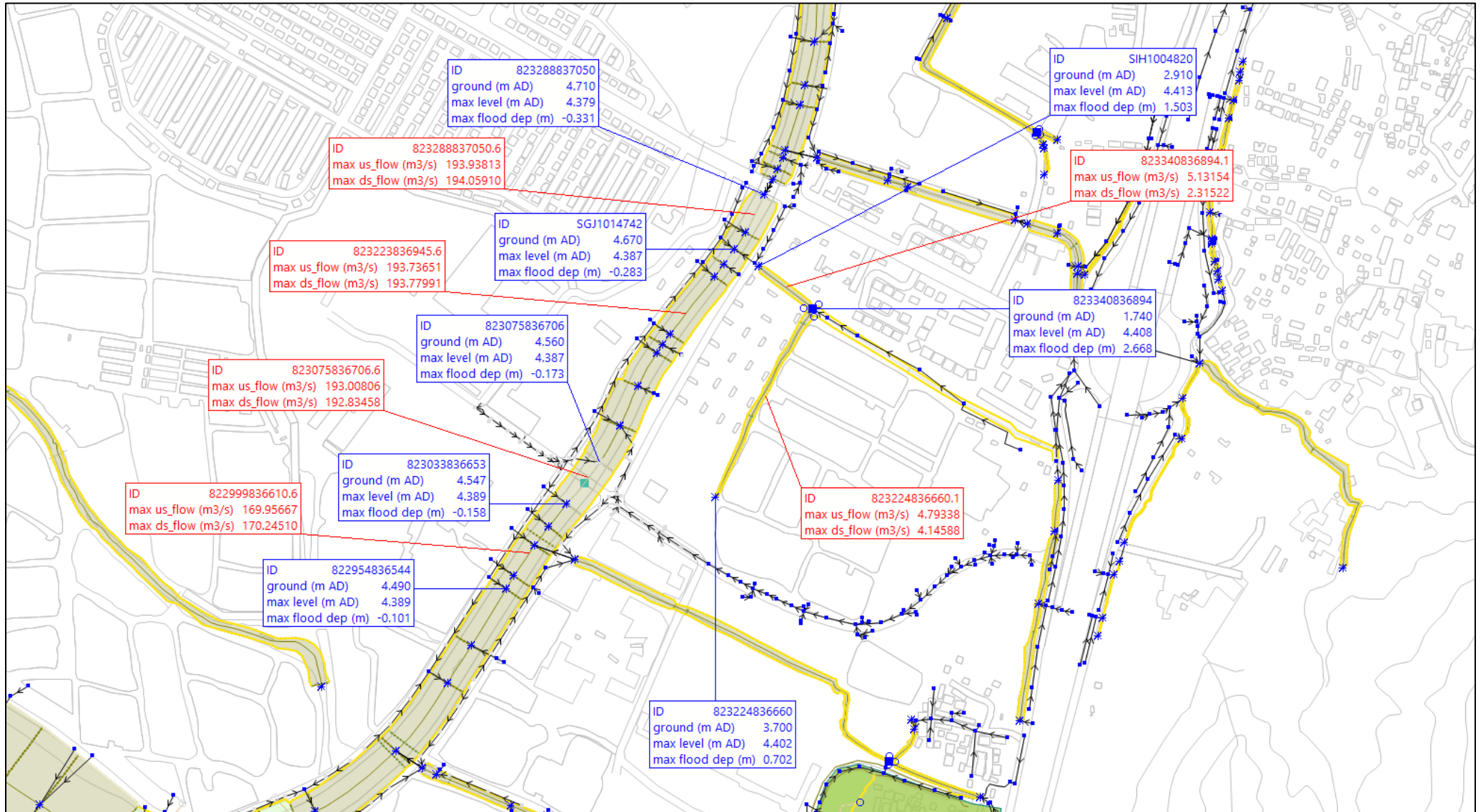
Appendix 4.1 Boundary Condition provided by DSD



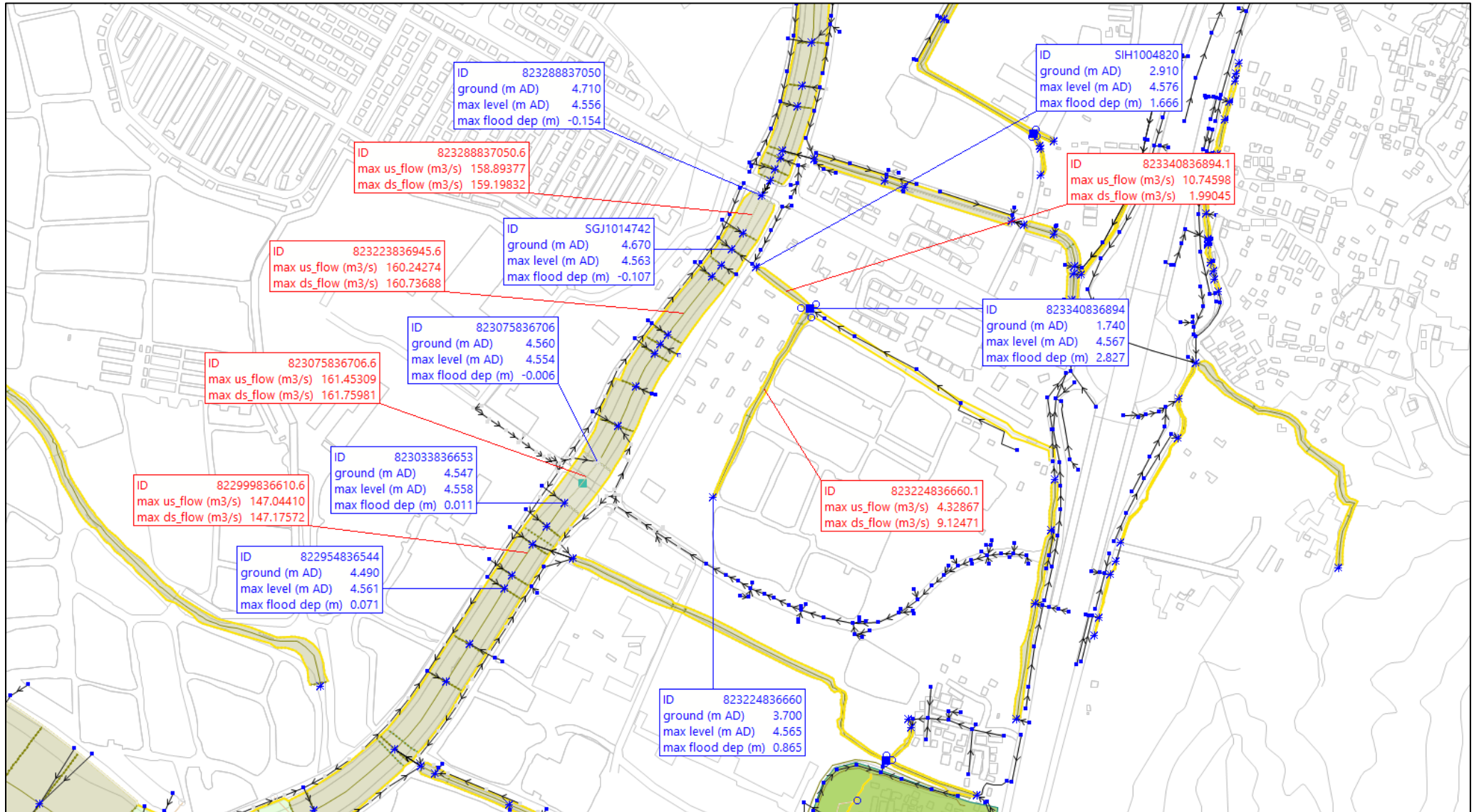
50A (EE)



50B (EE)



50A (PP with climate change)



50B (PP with climate change)

Appendix 5.1 Site Surveying of Existing Drainage Ditch



LEGEND:

	ARTIFICIAL SLOPE		TEMPORARY STRUCTURE
	CHANNEL WITH FLOW DIRECTION		PILLAR BOX
	STEP CHANNEL WITH FLOW DIRECTION		HAND RAILING
	BOUNDARY LINE & BOUNDARY POINT		HOARDING
	GATE		KERB LINE (BOTTOM)
	PERMANENT BUILDING AND CANOPY		SLOPE TOP
	TREE WITH TREE NO.		SLOPE BOTTOM
	INCLINED WALL		FIRE HYDRANT
	GRAVE		PARKING METER
			BOLLARD AT ROAD
			FENCE
			BARRIERS
			BENCH
	ELECTRIC POLE		MANHOLE, FIRE
	SIGN BOARD		MANHOLE, GAS
	SIGN POLE		MANHOLE, WATER WORKS
	LAMP POST		MANHOLE
	TELEPHONE POLE		MANHOLE, ATC
	TRAFFIC LIGHT		MANHOLE, CABLE TV
	FIRE HYDRANT		MANHOLE, ELECTRIC & MECHANICAL SERVICES DEPARTMENT
	PARKING METER		MANHOLE, PCW-HKT
	BOLLARD AT ROAD		MANHOLE, NEW WORLD TELEPHONE
	FENCE		MANHOLE, CLP POWER
	BARRIERS		MANHOLE, HKT 1 & T
	BENCH		MANHOLE, TOMKISS TELECOM
	MANHOLE, PUBLIC LIGHTING		

ABBREVIATION:

BE	BENCH	HLC	HONG KONG LIGHTING CONSULTANTS LIMITED
BS	BOUNDARY STONE	HMC	HONG KONG METRIC GRID
CA	CADOPUS	HR	HONG KONG ROAD DEPARTMENT
CL	CONCRETE	IS	IRIDIUM
CO	CONCRETE	ISB	IRIDIUM SERVICE BROADCAST
COB	CONCRETE BOX	ISD	IRIDIUM SERVICE DEPARTMENT
COB	CONCRETE BOX	ISL	IRIDIUM SERVICE LIMITED
END	END OF CABLE	ISM	IRIDIUM SERVICE METER
END	END OF CABLE	ISN	IRIDIUM SERVICE NETWORK
END	END OF CABLE	ISO	IRIDIUM SERVICE OFFICE
END	END OF CABLE	ISP	IRIDIUM SERVICE POINT
END	END OF CABLE	ISQ	IRIDIUM SERVICE QUARTERS
END	END OF CABLE	ISR	IRIDIUM SERVICE RECORD
END	END OF CABLE	ISS	IRIDIUM SERVICE SIGN
END	END OF CABLE	ISV	IRIDIUM SERVICE VEHICLE
END	END OF CABLE	ISW	IRIDIUM SERVICE WORKS
END	END OF CABLE	ISX	IRIDIUM SERVICE EXCHANGE
END	END OF CABLE	ISY	IRIDIUM SERVICE YARD
END	END OF CABLE	ISZ	IRIDIUM SERVICE ZONE
END	END OF CABLE	ITA	IRIDIUM TELECOMMUNICATIONS AUTHORITY
END	END OF CABLE	ITB	IRIDIUM TELECOMMUNICATIONS BOARD
END	END OF CABLE	ITC	IRIDIUM TELECOMMUNICATIONS CENTRE
END	END OF CABLE	ITD	IRIDIUM TELECOMMUNICATIONS DEVELOPMENT
END	END OF CABLE	ITE	IRIDIUM TELECOMMUNICATIONS ENGINEERING
END	END OF CABLE	ITF	IRIDIUM TELECOMMUNICATIONS FINANCE
END	END OF CABLE	ITG	IRIDIUM TELECOMMUNICATIONS GENERAL
END	END OF CABLE	ITH	IRIDIUM TELECOMMUNICATIONS HUMAN RESOURCES
END	END OF CABLE	ITI	IRIDIUM TELECOMMUNICATIONS INFORMATION TECHNOLOGY
END	END OF CABLE	ITJ	IRIDIUM TELECOMMUNICATIONS JAPAN
END	END OF CABLE	ITK	IRIDIUM TELECOMMUNICATIONS KOREA
END	END OF CABLE	ITL	IRIDIUM TELECOMMUNICATIONS LAW
END	END OF CABLE	ITM	IRIDIUM TELECOMMUNICATIONS MANAGEMENT
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END	END OF CABLE	ITP	IRIDIUM TELECOMMUNICATIONS PROJECT
END	END OF CABLE	ITQ	IRIDIUM TELECOMMUNICATIONS QUALITY
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END	END OF CABLE	ITS	IRIDIUM TELECOMMUNICATIONS SECURITY
END	END OF CABLE	ITU	IRIDIUM TELECOMMUNICATIONS UNION
END	END OF CABLE	ITV	IRIDIUM TELECOMMUNICATIONS VENDOR
END	END OF CABLE	ITW	IRIDIUM TELECOMMUNICATIONS WORKS
END	END OF CABLE	ITX	IRIDIUM TELECOMMUNICATIONS EXCHANGE
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END	END OF CABLE	ITZ	IRIDIUM TELECOMMUNICATIONS ZONE

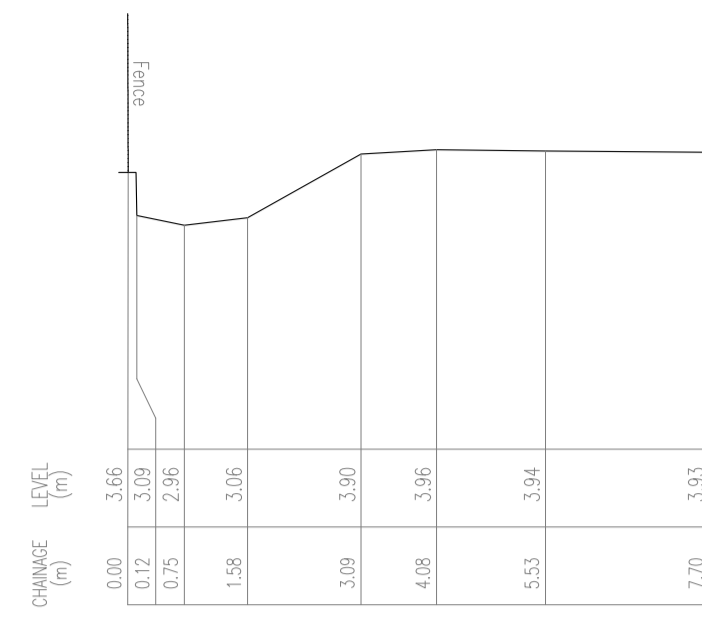
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HONG KONG METRIC GRID
PRINCIPAL DATUM HONG KONG
ALL UNITS IN METRES

NOTE:
ALL SPOT LEVEL POSITIONS ARE THE DECMAL POINT OF A CROSS

DATE OF SURVEY: DECEMBER 2022

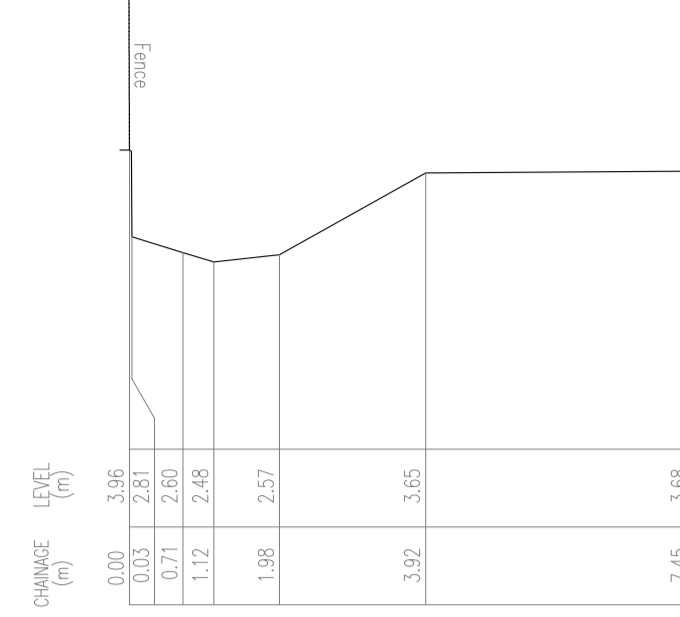
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			PRELIMINARY Cheung Chee Pak Authorized Land Surveyor



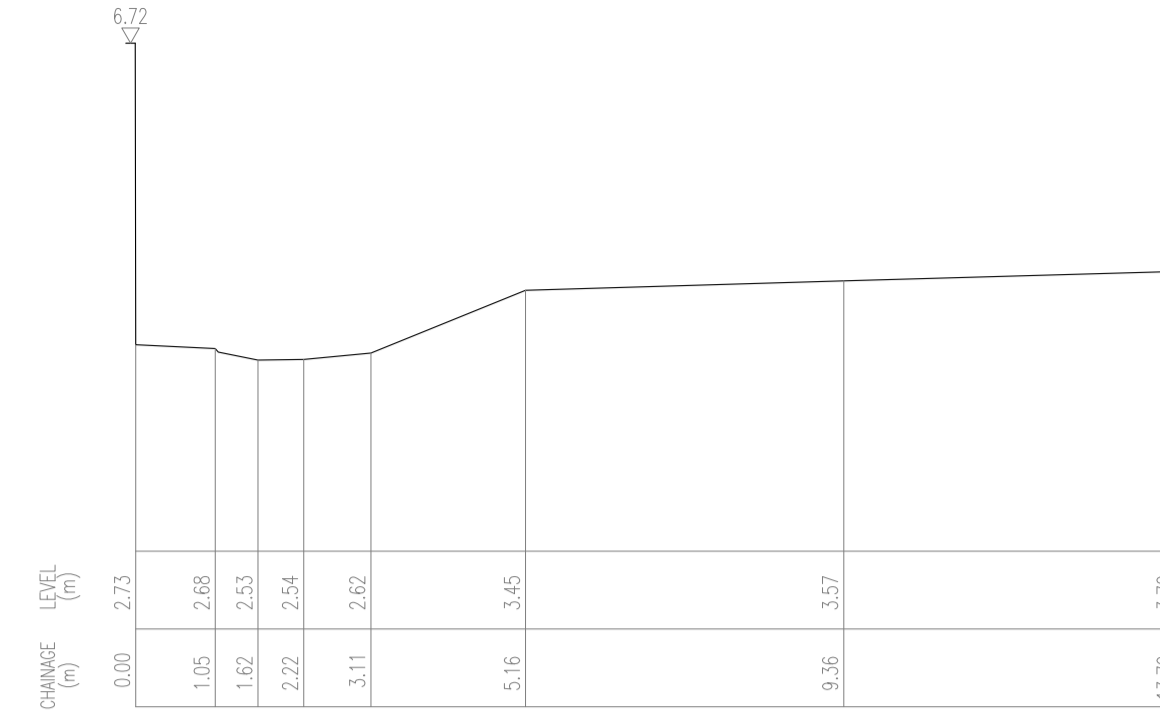
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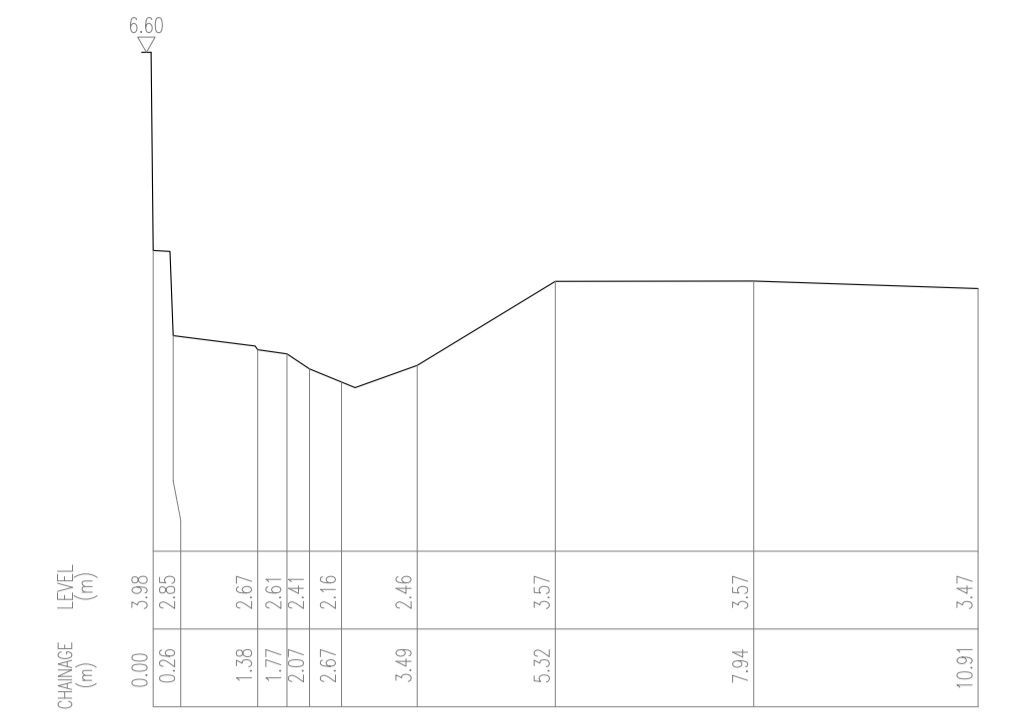
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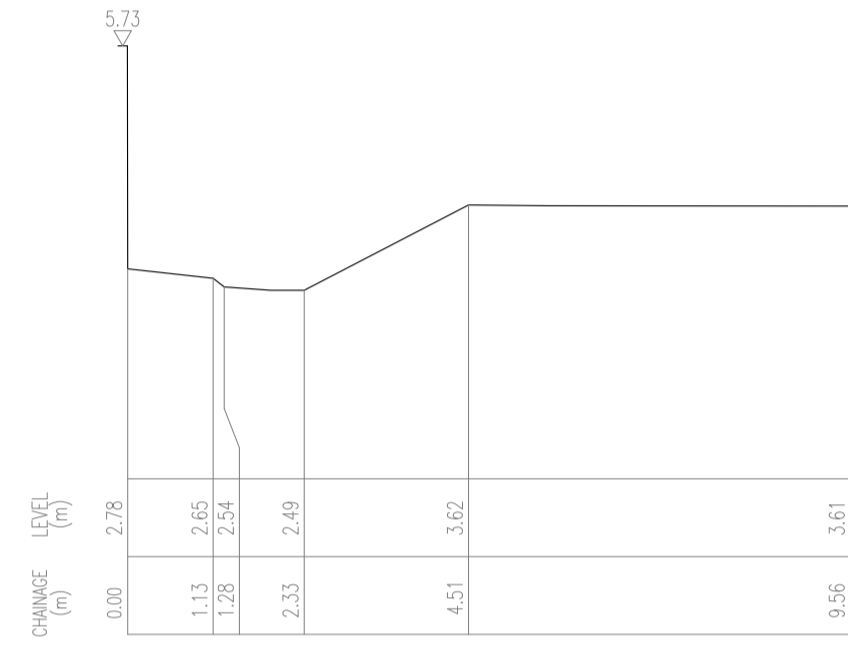
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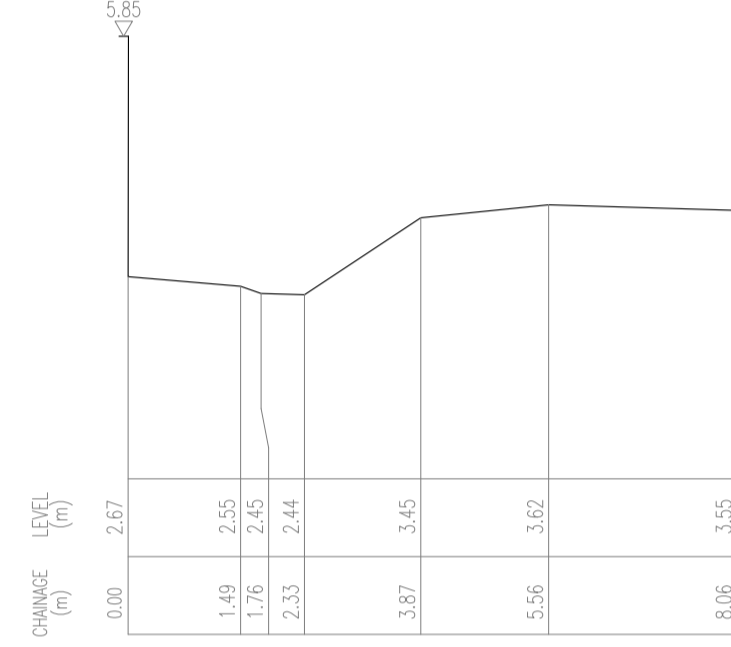
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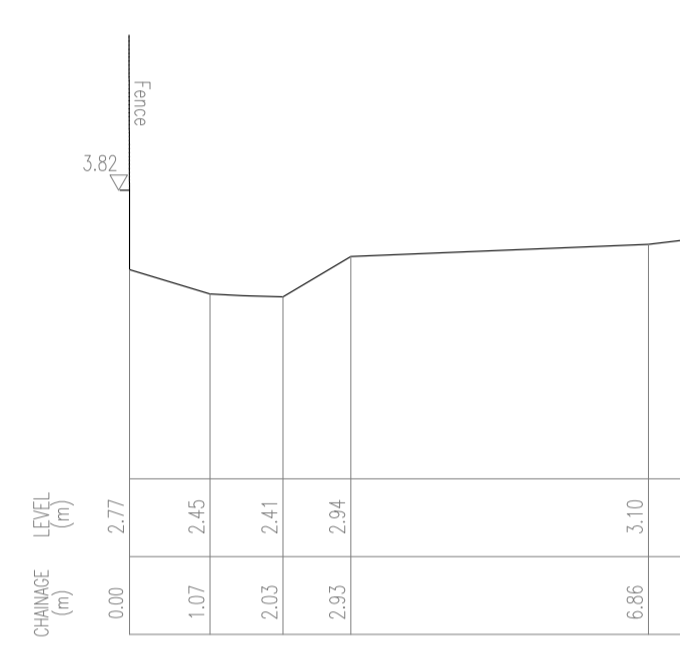
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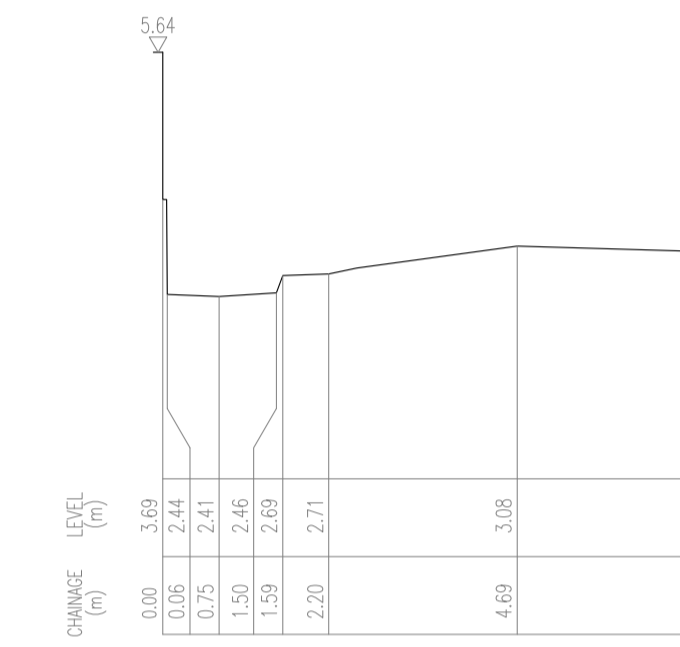
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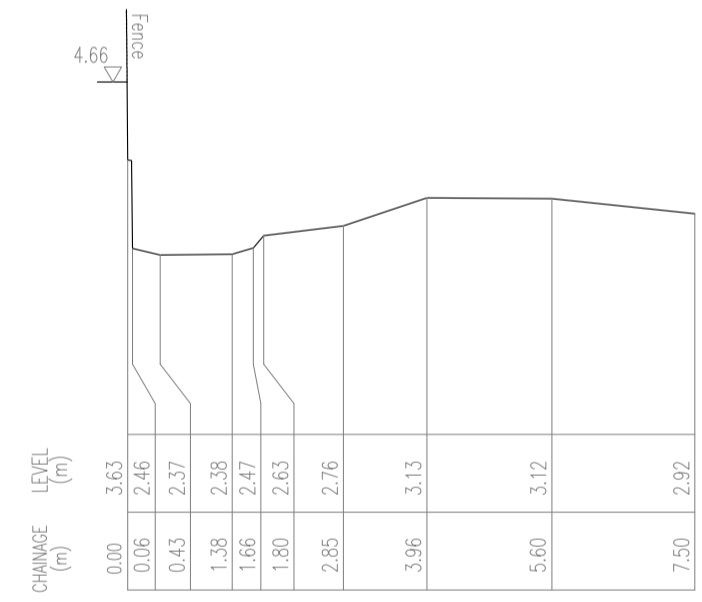
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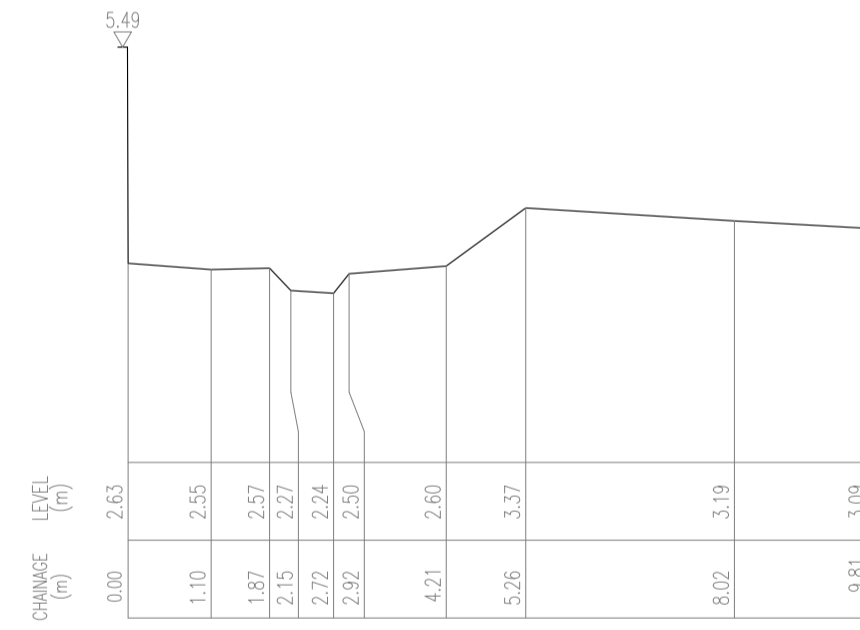
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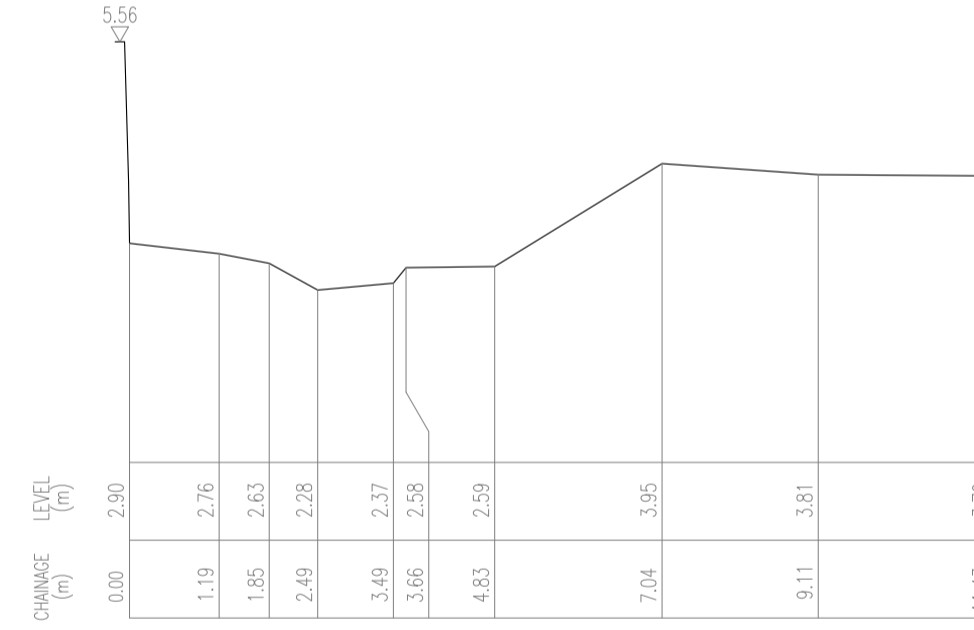
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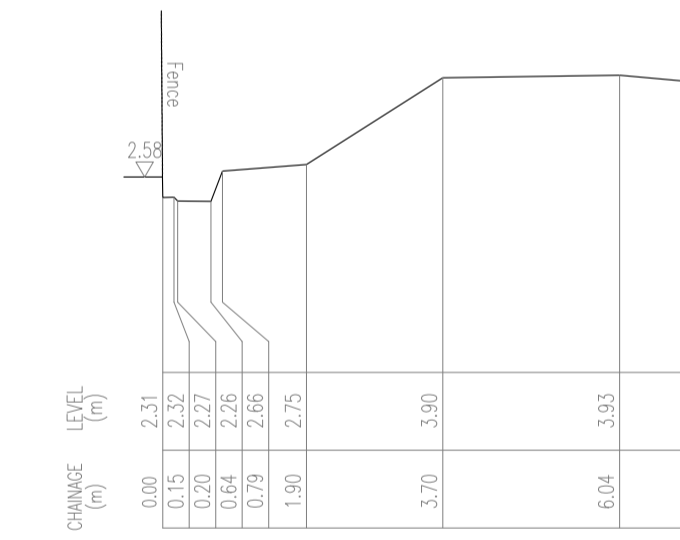
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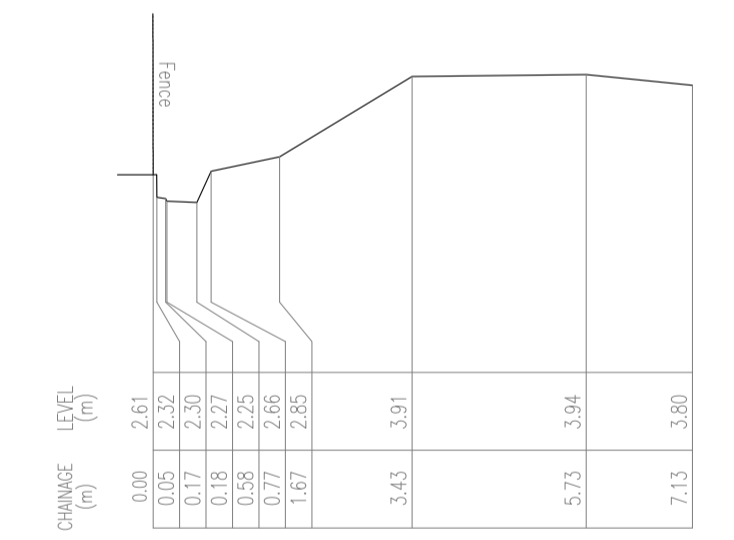
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SECTION S13



SECTION S14



SECTION S15

LEGEND:

- | | | | | |
|--|--|--|--|--|
| <ul style="list-style-type: none"> ARTIFICIAL SLOPE CHANNEL WITH FLOW DIRECTION STEP CHANNEL WITH FLOW DIRECTION BOUNDARY LINE & BOUNDARY POINT GATE PERMANENT BUILDING AND CANOPY TREE WITH TREE NO. INCLINED WALL GRAVE | <ul style="list-style-type: none"> CONTOURS TEMPORARY STRUCTURE PILLAR BOX HAND RAILING HOARDING KERB LINE (BOTTOM) SLOPE TOP SLOPE BOTTOM FENCE BARRIERS BENCH | <ul style="list-style-type: none"> ELECTRIC POLE SIGN BOARD SIGN POLE LAMP POST TELEPHONE POLE TRAFFIC LIGHT FIRE HYDRANT PARKING METER BOLLARD AT ROAD GULLY GRATING | <ul style="list-style-type: none"> VALVE FIRE VALVE GAS VALVE WATER WORKS MANHOLE MANHOLE, ATC MANHOLE, CABLE TV MANHOLE, ELECTRIC & MECHANICAL SERVICES DEPARTMENT MANHOLE, PCOW-HKT TELEPHONE LIMITED MANHOLE, DRAINAGE SERVICES DEPARTMENT MANHOLE, PUBLIC LIGHTING | <ul style="list-style-type: none"> MANHOLE, HUTCHISON COMMUNICATION LIMITED MANHOLE, HUTCHISON GLOBAL CROSSING LIMITED BROADBAND CATCH PIT MANHOLE, FOUL WATER/SEWER MANHOLE, STORM WATER MANHOLE, PACIFIC CENTURY CABLE & WIRELESS MANHOLE, NEW WORLD TELEPHONE MANHOLE, CLP POWER MANHOLE, WHAT T & T MANHOLE, TOWNGAS TELECOM |
|--|--|--|--|--|

ABBREVIATION:

- | | |
|---|---|
| <ul style="list-style-type: none"> BOULDER BERM BOUNDARY STONE CANOPY CULVERT COLUMN CONCRETE ELECTRIC BOX END OF OBJECT FLOWER BED FOOTPATH INVERT LEVEL NULLAH OVERBRIDGE PLATFORM PIEZOMETER TUBE RAMP RUIN SHRINE TEMPORARY STRUCTURE VEHICLE BARRIERS WELL WORK IN PROGRESS WATER TANK | <p>SCALE 1 : 100 (SIZE A1)</p> <p>HONG KONG METRIC GRID
PRINCIPAL DATUM HONG KONG
ALL UNITS IN METRES</p> <p>NOTE: ALL SPOT LEVEL POSITIONS ARE THE DECIMAL POINT OR A CROSS</p> <p>DATE OF SURVEY: DECEMBER 2022</p> |
|---|---|

INITIAL	10/01/2023	---
REVISION	DATE	DESCRIPTION

Fruit Design & Build Ltd.
Topographical Survey
Nam Sang Wai
New Territories

SAM MAK & ASSOCIATES SURVEYORS (HK) LTD.
CONSULTANTS IN LAND, ENGINEERING, MARINE & AERIAL SURVEYS
ROOM 901, MARINA HOUSE, NO.68 HING MAN STREET, SHAUKEIWAN, HONG KONG.
TEL : 28951918 FAX : 28901759 E-mail: tkoffice@sammak.com

PRELIMINARY
(10/01/2023)
Cheung Chee Pak
Authorized Land Surveyor

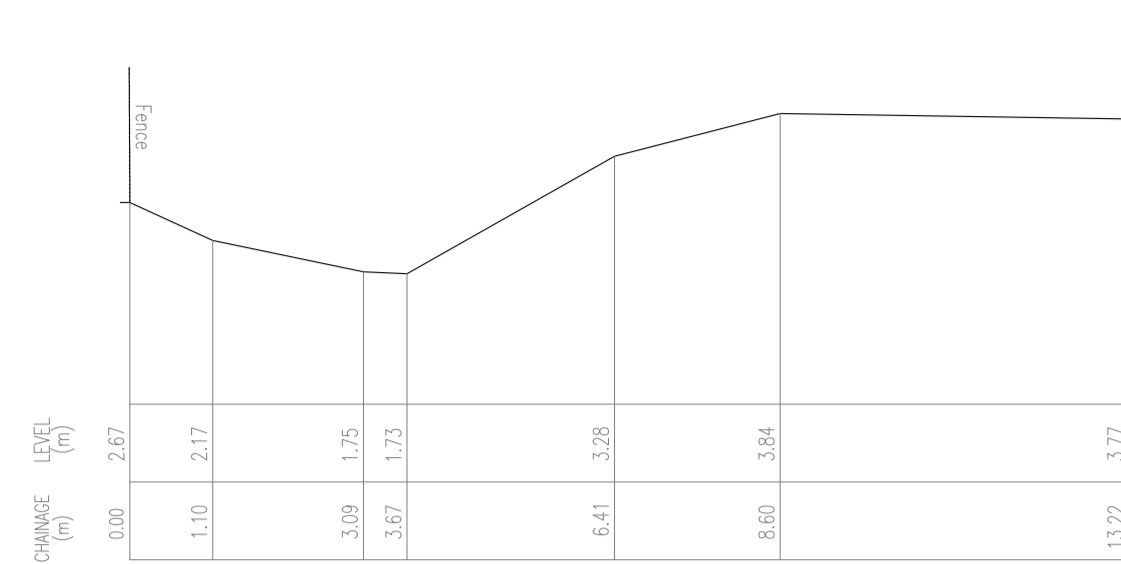
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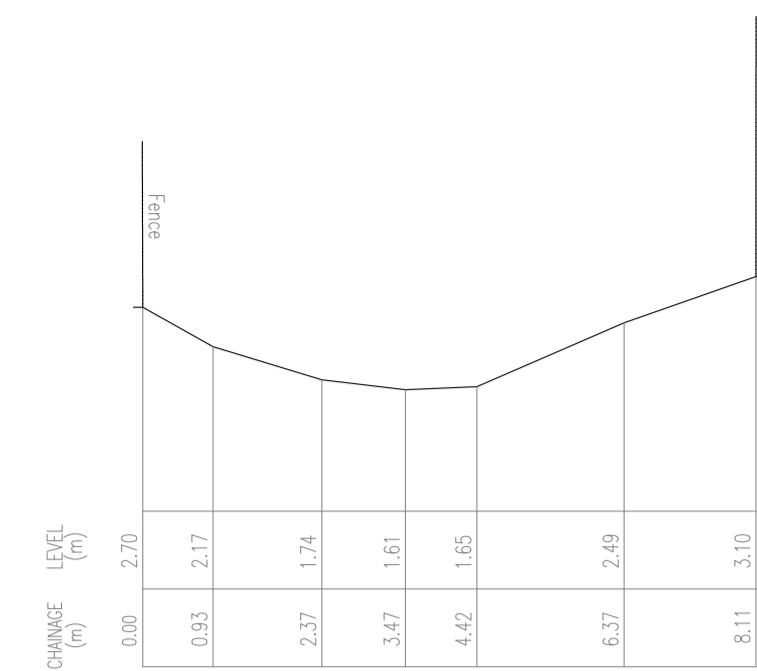
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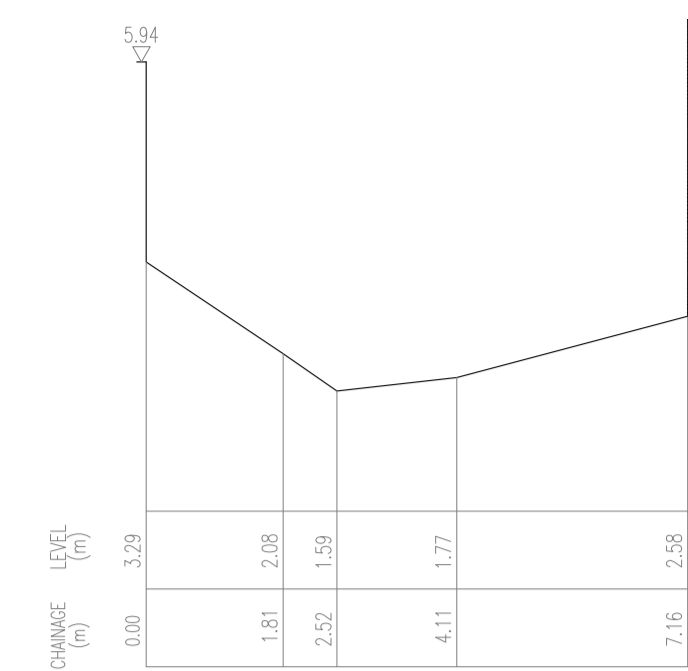
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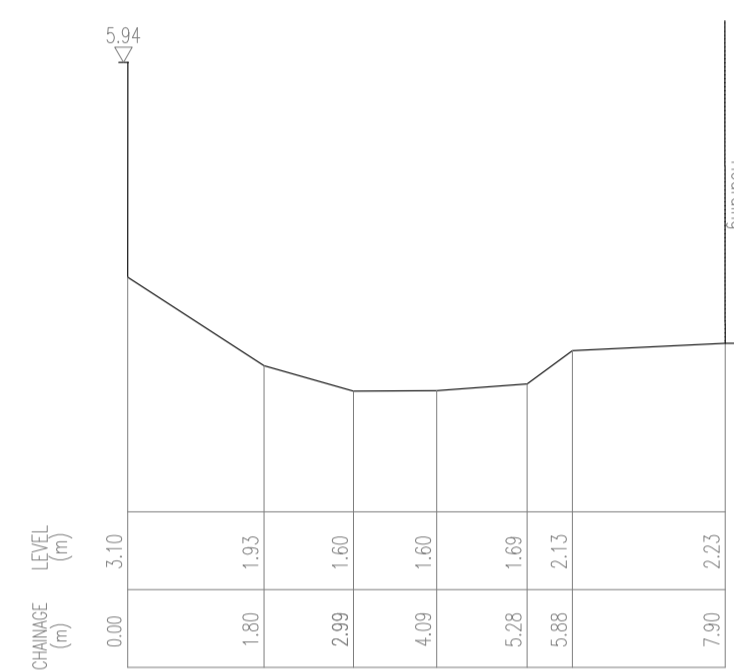
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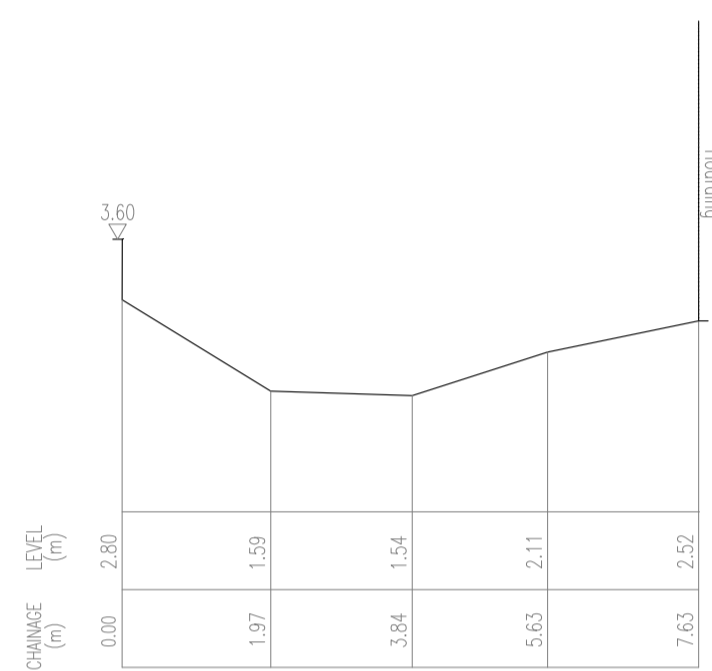
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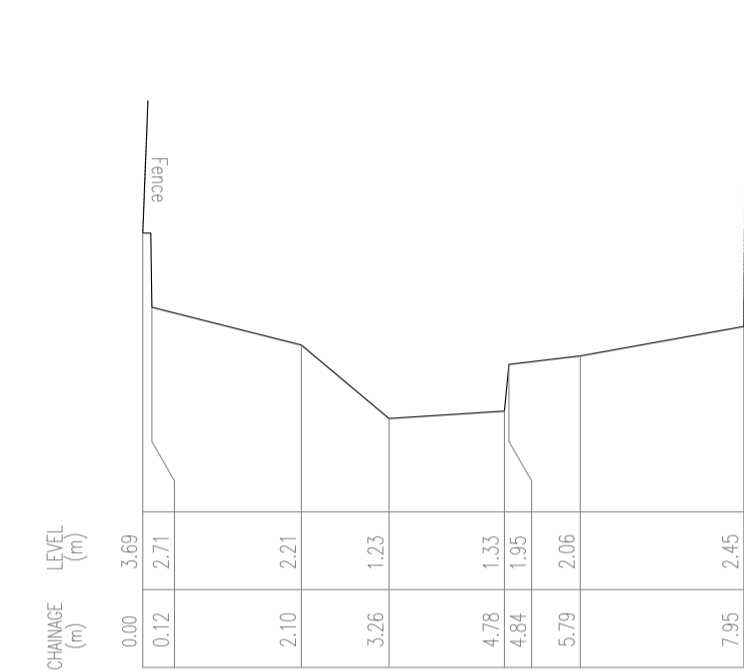
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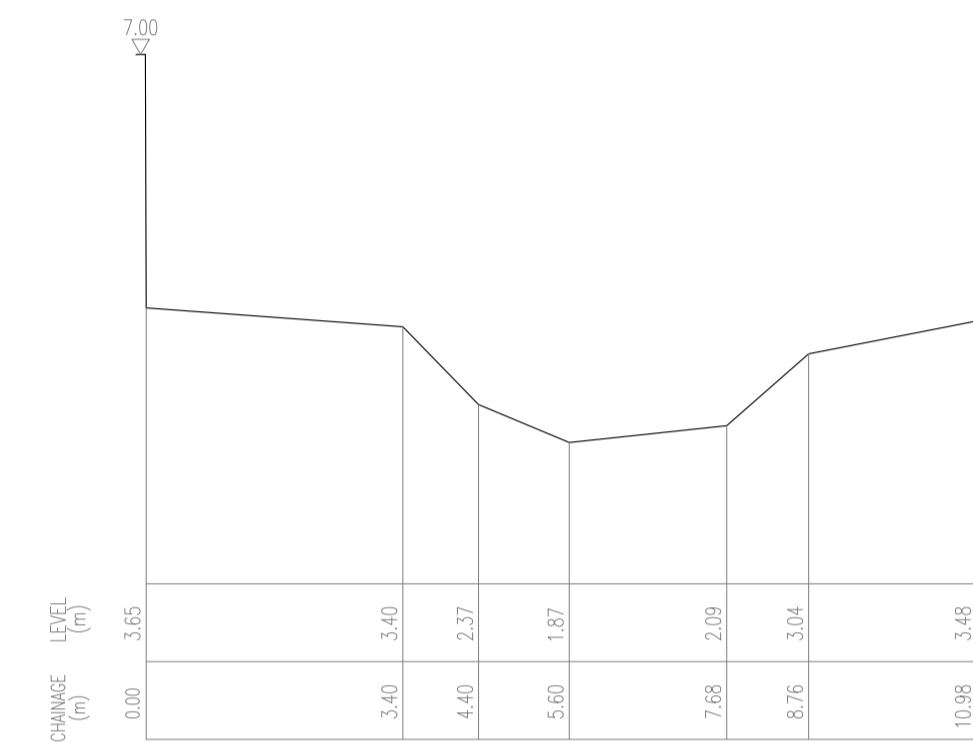
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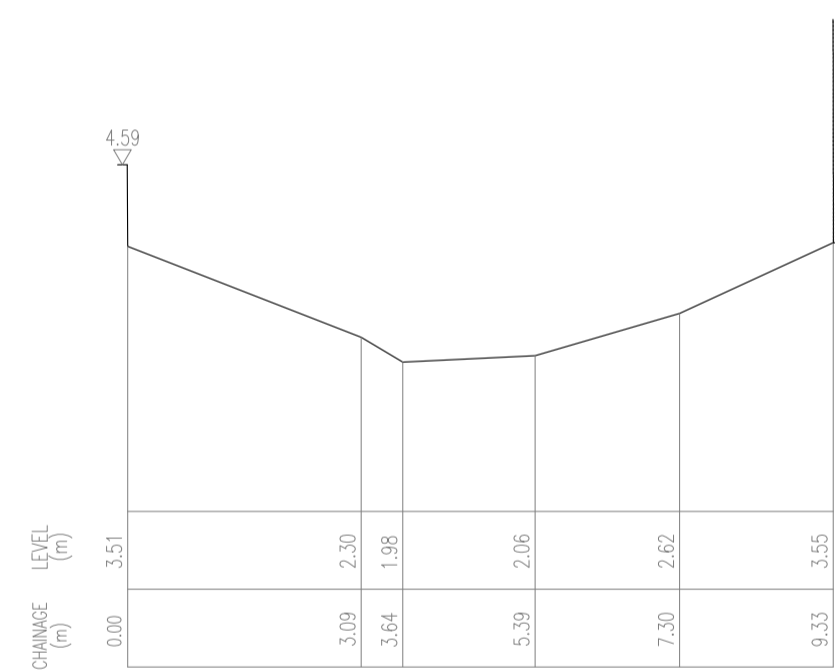
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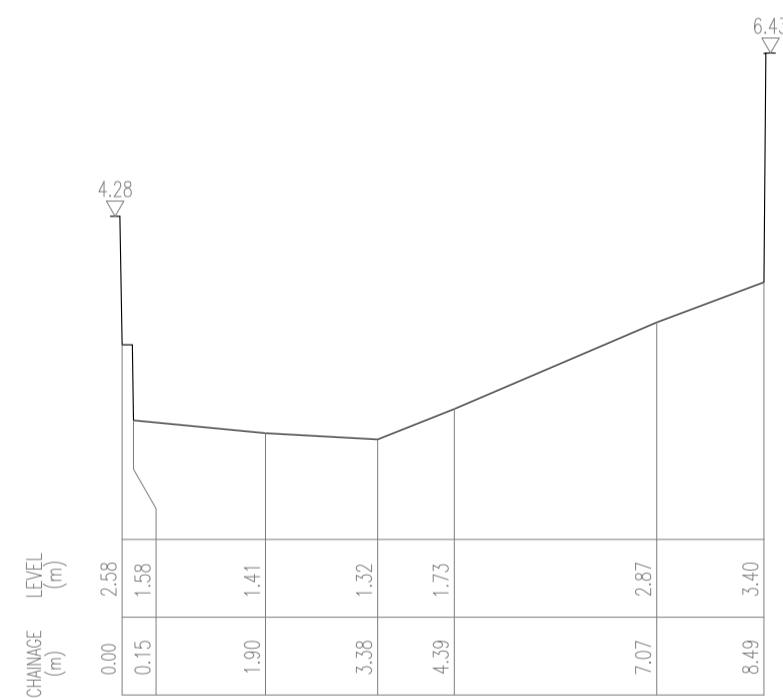
SECTION S24



SECTION S25



SECTION S26



SECTION S27

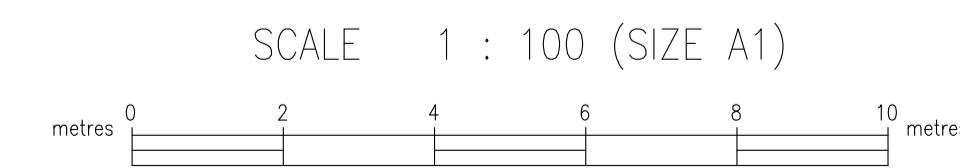
LEGEND:

- | | | | |
|--|--|--|---|
| <ul style="list-style-type: none"> ARTIFICIAL SLOPE CHANNEL WITH FLOW DIRECTION STEP CHANNEL WITH FLOW DIRECTION BOUNDARY LINE & BOUNDARY POINT GATE PERMANENT BUILDING AND CANOPY TREE WITH TREE NO. INCLINED WALL GRAVE | <ul style="list-style-type: none"> CONTOURS TEMPORARY STRUCTURE PILLAR BOX HAND RAILING HOARDING KERB LINE (BOTTOM) SLOPE TOP SLOPE BOTTOM FENCE BARRIERS BENCH | <ul style="list-style-type: none"> ELECTRIC POLE SIGN BOARD SIGN POLE LAMP POST TELEPHONE POLE TRAFFIC LIGHT FIRE HYDRANT PARKING METER BOLLARD AT ROAD GULLY GRATING | <ul style="list-style-type: none"> VALVE FIRE VALVE GAS VALVE WATER WORKS MANHOLE MANHOLE, ATC MANHOLE, CABLE TV MANHOLE, ELECTRIC & MECHANICAL SERVICES DEPARTMENT MANHOLE, PCW-HKT TELEPHONE LIMITED MANHOLE, DRAINAGE SERVICES DEPARTMENT MANHOLE, PUBLIC LIGHTING |
|--|--|--|---|

- | |
|---|
| <ul style="list-style-type: none"> MANHOLE, HUTCHISON COMMUNICATION LIMITED MANHOLE, HUTCHISON GLOBAL CROSSING LIMITED BROADBAND CATCH PIT MANHOLE, FOUL WATER/SEWER MANHOLE, STORM WATER MANHOLE, PACIFIC CENTURY CABLE & WIRELESS MANHOLE, NEW WORLD TELEPHONE MANHOLE, CLP POWER MANHOLE, WHAFT T & T MANHOLE, TOWNGAS TELECOM |
|---|

ABBREVIATION:

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|--|
| <ul style="list-style-type: none"> BOULDER BERM BOUNDARY STONE CANOPY CULVERT COLUMN CONCRETE ELECTRIC BOX OVERSILANG PLATFORM PIEZOMETER TUBE RAMP REIN SHRINE TEMPORARY STRUCTURE VEHICLE BARRIERS WELL WORK IN PROGRESS WATER TANK |
|--|



HONG KONG METRIC GRID
PRINCIPAL DATUM HONG KONG
ALL UNITS IN METRES

NOTE
ALL SPOT LEVEL POSITIONS ARE
THE DECIMAL POINT OR A CROSS

DATE OF SURVEY: DECEMBER 2022

INITIAL	10/01/2023	---
REVISION	DATE	DESCRIPTION

Fruit Design & Build Ltd.
Topographical Survey
Nam Sang Wai
New Territories

SAM MAK & ASSOCIATES SURVEYORS (HK) LTD.
CONSULTANTS IN LAND, ENGINEERING, MARINE & AERIAL SURVEYS
ROOM 901, MARINA HOUSE, NO.68 HING MAN STREET, SHAUKEIWAN, HONG KONG.
TEL : 28951918 FAX : 28901759 E-mail: hkoffice@sammak.com

PLAN NO. 9215/01/01 (Sheet 3 of 3)

PRELIMINARY
(10/01/2023)
Cheung Chee Pak
Authorized Land Surveyor