Appendix E

Sewage Impact Assessment

ARUP

Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) to Rezone the Application Site from "Green Belt" to "Residential (Group C)1" for Proposed House Development at Various Lots in D.D. 244 and Adjoining Government Land, Nam Pin Wai, Sai Kung

Sewerage Impact Assessment

Reference:

1 | 11 October 2023

Job number 282344

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Contents

Appendices

1. Introduction

1.1 Background

Arup Hong Kong Limited was commissioned to conduct a Sewerage Impact Assessment (SIA) to support the Section 12A Planning Application for Proposed House Development at Various Lots in D.D. 244, Nam Pin Wai, Sai Kung.

The Application Site is located within a "Green Belt" ("GB") zone on the Approved Ho Chung Outline Zoning Plan No. S/SK-HC/11.

1.2 Objective

The objective of this report is to provide an assessment of the impact of wastewater flow generation as a result of the Proposed Development at the Application Site on the connecting the existing public sewerage system and to propose mitigation measures (if any).

1.3 Reference Materials

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

- Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (Version 1.0) - Report No.: EPD/TP 1/05 issued by Environmental Protection Department (EPD);
- Sewerage Manual – Key Planning Issues and Gravity Collection System (Third Edition) issued by Drainage Services Department in May 2013;
- Employment density shall refer to Commercial and Industrial Floor Space Utilization Survey published by PlanD; and
- Drainage Record Plans obtained from the GeoInfo Map services of the Lands Department (https://www.map.gov.hk/gm/?lg=en)

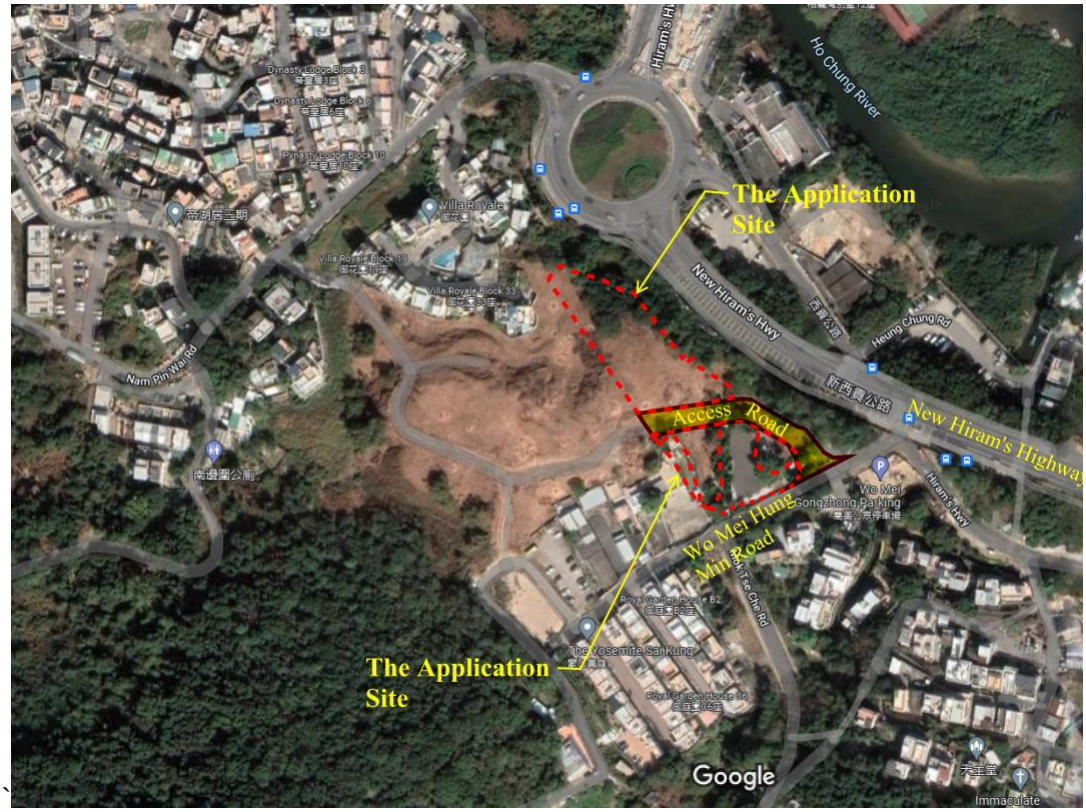
2. The Proposed Development

Master Layout Plan showing the proposed development is attached in **Appendix A – Plan 1**. A table showing the Proposed Development parameters is shown in table below:

Proposed Development	**Site Particulars**
Project	Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) to Rezone the Application Site from "Green Belt" to "Residential (Group C)1" for Proposed House Development at Various Lots in D.D. 244 and Adjoining Government Land, Nam Pin Wai, Sai Kung
Location	Nam Pin Wai Sai Kung
Land Use Zoning	"Green Belt" ("GB")
Development Site Area excluding Access Road (About)	5,355m^2
Domestic GFA (About)	4,016m^2

No. of House	17
Clubhouse GFA (About)	151 m^2

Below is an aerial photograph of the Application Site.



3. Sewerage Impact Assessment for the Proposed Development

3.1 Existing Sewerage Network

There is no existing public sewer in the vicinity of the Application Site as per Drainage Record Plan obtained from the GeoInfo Map services of the Lands Department.

3.2 Population of Proposed Development

The prediction for the Proposed Development sewage generation has been based on the information extracted from the development schedule in **Section 2** above. The quantity of sewage generated by the Proposed Development depends on the number of population with unit flow factor of Private R2 development.

For easy reference, a table showing the sewage generation of the Proposed Development is calculated based on the guideline set in EPD Guideline for Estimating Sewage Flows for planning catchment level sewage infrastructure and is shown in **Appendix B** – **Table T1** and summarized in below table.

Proposed Development	Parameters
Domestic GFA (About)	4,016
No. of Houses	17
No. of Residents	51
Unit Flow Factor (m^3/person/day) for Private R2	0.27
Average Dry Weather Flow for Residents (m^3/day)	13.77
Clubhouse GFA (m^2) (About)	151
Number of Employee	8
Unit Flow Factor for Restaurant (m^3/person/day)	1.58
Average Dry Weather Flow for Clubhouse (m^3/day)	12.14
Total Average Dry Weather Flow (m^3/day)	25.91
Contributing Population	96
Global Peaking Factor (including stormwater allowance) for Sewage Treatment Works	4.0
Global Peaking Factor (including stormwater allowance) for Sewers	8.0
Peak Flow for Sewage Treatment Works (L/s)	1.20
Peak Flow for Gravity Sewer (L/s)	2.40

3.3 Private Sewage Treatment Plant

In view of the lack of a public sewerage system in the vicinity of the Application Site, it is proposed to provide a private sewage treatment plant with treatment level reaching the secondary level plus disinfection as an alternative option and dispose treated effluent of a standard acceptable to EPD to the proposed drainage system along the access road. Design of the private sewage treatment plant will make reference to the "Guidelines for the Design of Small Sewage Treatment Plants (the Guidelines)" published by the EPD. A tentative location for the private sewage treatment plant is shown on the Master Layout Plan and is subject to detailed site planning. It is considered to be an acceptable alternative option prior to any future improvement to sewage infrastructure in the vicinity of the Application Site. The private sewage treatment plant should be designed in such a way that it is capable of handling the daily and peak sewage flow arising from the proposed development. Should public sewerage be available in future, we would modify the sewerage system to facilitate the sewerage connection.

Adopting the peaking factor of 8 in Table T-5 of EPD Report No. EPD/TP 1/05, the peak flow for sewers from the proposed development is estimated as 2.40 l/s. A 225mm diameter sewer of 1 in 100 minimum gradient is sufficient to convey the sewage from the proposed development to the private sewage treatment plant and the treated effluent from the private treatment plant to the proposed drainage along the future access road. **Appendix B** – **Table T2** shows the capacity checking of the proposed sewer from the proposed development to the private sewage treatment plant with the proposed sewerage plan shown in **Appendix A – Plan 2**.

As regards the standard of acceptance of the treated effluent to minimize pollution, Table 7 of the "Technical Memorandum Standards for Effluent Discharged into Drainage and Sewerage Systems, Inland and Coastal

Waters" for Port Shelter Area shall be followed. EPD will be consulted on the treatment proposals during the detailed site planning and the discharged effluent standard required.

4. Conclusion

In view of the lack of a public sewerage system in the vicinity of the Application Site, it is proposed to provide a private sewage treatment plant with treatment level reaching the secondary level plus disinfection as an alternative option and dispose treated effluent of a standard acceptable to EPD to the proposed drainage system along the access road.

Design of the private sewage treatment plant will make reference to the "Guidelines for the Design of Small Sewage Treatment Plants (the Guidelines)" published by the EPD.

The private sewage treatment plant should be designed in such a way that it is capable of handling the daily and peak sewage flow arising from the proposed development. Should public sewerage be available in future, we would modify the sewerage system to facilitate the sewerage connection.

As regards the standard of acceptance of the treated effluent to minimize pollution, Table 7 of the "Technical Memorandum Standards for Effluent Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters" for Port Shelter Area shall be followed. EPD will be consulted on the treatment proposals during the detailed site planning and the discharged effluent standard required.

Appendix A

Plan

-	26/1/2023	IP	F
MARK	DATE	BY	REV.

JOB TITLE
Proposed Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D. 244, Nam Pin Wai, Sai Kung

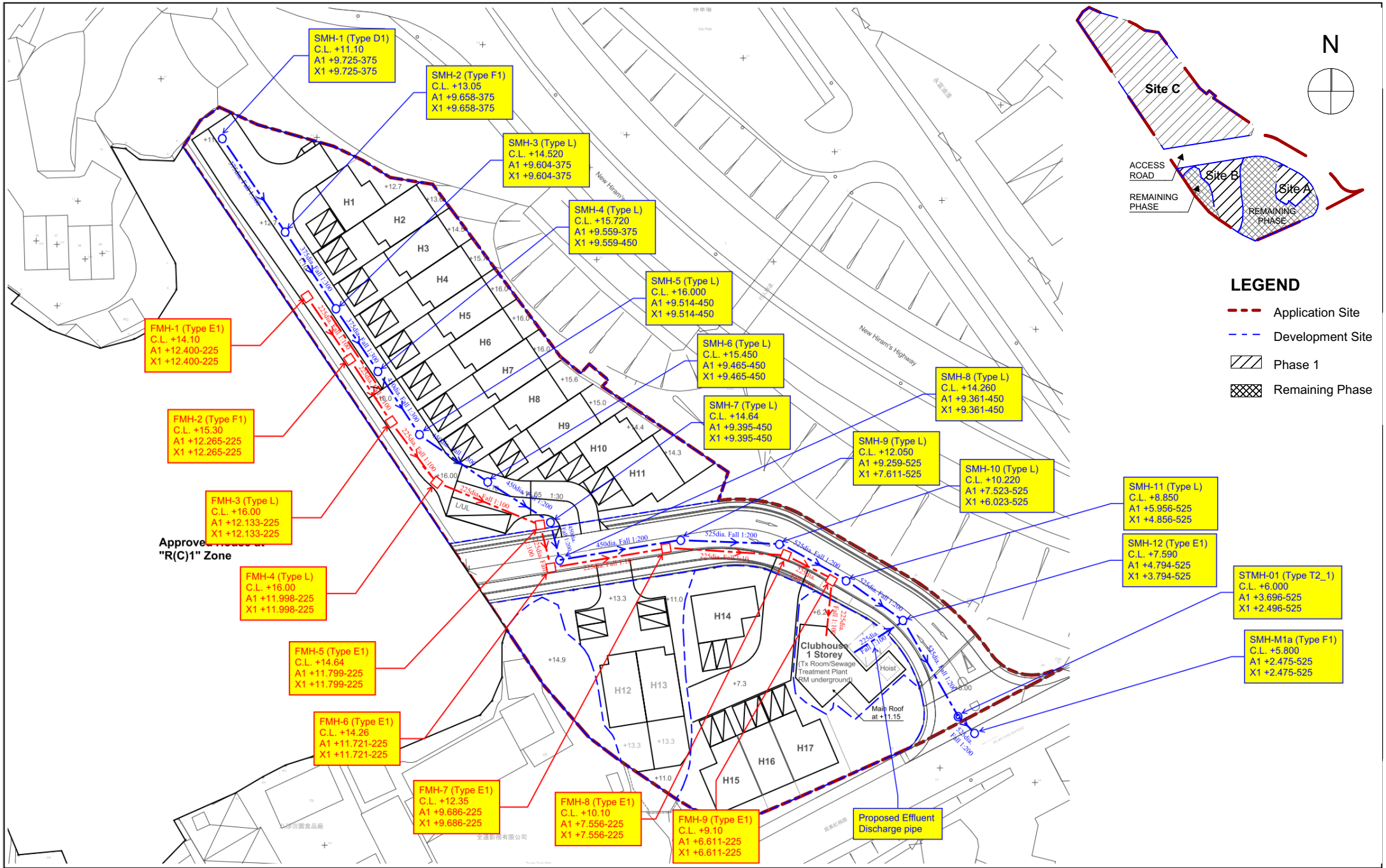
DRAWING TITLE
Master Layout Plan

DRAWING STATUS
FOR INFORMATION

ARUP

SCALE 1:600@A3
DRN. IP DATE 17/1/2023 CHD. CC PASSED. CC

JOB NO. 282344
DRAWING NO. PLAN 1
REV.



JOB TITLE: Proposed Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D. 244, Nam Pin Wai, Sai Kung	DRAWING TITLE: Proposed Drainage and Sewerage Layout within Site	ARUP	
	DRAWING STATUS: FOR INFORMATION	SCALE 1:600@A3	
		DRN. IP DATE 17/1/2023 CHD. CC PASSED. CC	
		JOB NO. 282344	DRAWING NO. PLAN 2
			REV.

MARK	DATE	BY	REV.
-	26/1/2023	IP	F

Appendix B

Calculation

TABLE B1
Estimation of Sewage Flows Estimation for Proposed Development

Design Code
1. Based on EPD Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning.
2. Plumbing Engineering Services Design Guide by The Institute of Plumbing.

Design Assumption:
Global Peaking Factor, P (Including Stormwater Allowance) as per Table T-5
Global Unit Flow Factors as per Tables T-2 and T-3
Catchment Inflow Factor for Sai Kung (PCIF = 1.30) as per Table T-4

Development Schedule		
Sewage Flow Estimates	**Estimation**	**Remark**
Proposed Development		
Domestic		
Number of Houses	17	Based on Development Schedule
Number of Residents (3-storey @ 3 persons for each storey)	51	
Unit flow factor (m^3/person/day)	0.27	Table T-1 of GESF - Private R2
ADWF, (m^3/day)	13.77	
Clubhouse		
GFA (m^2)	151	Based on Development Schedule
Worker Density (Number of Worker per 100m^2 GFA)	5.1	Restaurant
Number of Employee	8	
Unit flow factor (m^3/person/day)	1.58	Table T-2 of GESF - J10 Restaurant and Hotel
ADWF, (m^3/day)	12.14	
Total ADWF, (m^3/day)	25.91	
Contributing Population	96	
Global Peaking Factor (including stormwater allowance) for Sewage Treatment Works	4	Table T-5 of GESF
Global Peaking Factor (including stormwater allowance) for Sewers	8	Table T-5 of GESF
Peak Flow (L/s) for Sewage Treatment Works	1.20	
Peak Flow (L/s) for Gravity Sewers	2.40	

Notes:
Employment density shall refer to Commercial and Industrial Floor Space Utilization Survey published by PlanD.
Restaurant = 5.1 employee per 100m^2 of GFA

Table B2 - Capacity Performance of Proposed Sewer

Notes:
(1) Calculate by Colebrook-White Equation

$$\overline{V} = -\sqrt{32gRS_f}\log\left[\frac{k_s}{14.8R} + \frac{1.255\nu}{R\sqrt{32gRS_f}}\right]$$

where ks is roughness value is 3mm for sewer.
ν is kinematic viscosity of fluid = 1.14 x 10-6 m2/s and g is the gravity = 9.81m/s2
V is the velocity, D is the diameter of the sewer and S is the gradient of the sewer.

Abbreviation:

UP_MAN	Upstream Manhole	CON_POP	Contributing Population	DN_GL	Downstream Ground Level	CAP	Peak Pipe Capacity
DN_MAN	Downstream Manhole	DIA	Diameter	UP_INV	Upstream Invert Level	F/C	Peak Flow/Capacity
ADWF	Average Dry Weather Flow	LEN	Length	DN_INV	Downstream Invert Level		
ACC_ADWF	Accumulated Average Dry Weather Flow	UP_GL	Upstream Ground Level	VEL	Peak Pipe Velocity		

Proposed Development

Manhole		Catchment	CON_POP	PEAKING FACTOR	ACC_ADWF (L/s)	Peak Flow (L/s)	Proposd Sewer										
UP_MAN No.	DN_MAN No.						DIA (D) (mm)	LEN (m)	UP_GL (mPD)	DN_GL (mPD)	UP_INV (mPD)	DN_INV (mPD)	Gradient (S)	VEL (m/s)	CAP (L/s)	F/C (%)	Adequate Capacity?
FMH-1	FMH-2	Proposed Development	96	8	0.30	2.40	225	13.5	13.90	15.30	12.400	12.265	100	1.02	40.68	5.9%	YES
FMH-2	FMH-3		96	8	0.30	2.40	225	13.2	15.30	16.00	12.265	12.133	100	1.02	40.68	5.9%	YES
FMH-3	FMH-4		96	8	0.30	2.40	225	13.5	16.00	15.60	12.133	11.998	100	1.02	40.68	5.9%	YES
FMH-4	FMH-5		96	8	0.30	2.40	225	19.9	15.60	14.40	11.998	11.799	100	1.02	40.68	5.9%	YES
FMH-5	FMH-6		96	8	0.30	2.40	225	7.8	14.40	14.26	11.799	11.721	100	1.02	40.68	5.9%	YES
FMH-6	FMH-7		96	8	0.30	2.40	225	20.4	14.26	12.35	11.721	9.686	10	3.24	128.90	1.9%	YES
FMH-7	FMH-8		96	8	0.30	2.40	225	21.3	12.35	10.10	9.686	7.556	10	3.24	128.90	1.9%	YES
FMH-8	FMH-9		96	8	0.30	2.40	225	9.5	10.10	9.10	7.556	6.611	10	3.24	128.90	1.9%	YES
FMH-9	On-site Sewage Treatment Plant		96	8	0.30	2.40	225	10.2	9.10	9.10	6.611	6.509	100	1.02	40.68	5.9%	YES

Appendix D

Drainage Impact Assessment

ARUP

Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) to Rezone the Application Site from "Green Belt" to "Residential (Group C)1" for Proposed House Development at Various Lots in D.D. 244 and Adjoining Government Land, Nam Pin Wai, Sai Kung

Drainage Impact Assessment

Reference:

1 | 13 October 2023

Job number 282344

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Contents

Appendices

1. Introduction

1.1 Background

Arup Hong Kong Limited was commissioned to conduct a Drainage Impact Assessment (DIA) to support the Section 12A Planning Application for Proposed House Development at Various Lots in D.D. 244, Nam Pin Wai, Sai Kung. The Application Site is located within a "Green Belt" ("GB") zone on the Approved Ho Chung Outline Zoning Plan No. S/SK-HC/11.

1.2 Objective

The objective of this report is to provide an assessment of the impact of storm water flow generation as a result of the proposed house development at the Application Site on the connecting public drainage system adjacent to the Application Site and to propose mitigation measures as necessary such that the Application Site will not impose any adverse drainage impacts in areas upstream of, adjacent to, and downstream of the Application Site.

1.3 Reference Materials

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

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

2. The Project Outlines

2.1 The Proposed Development

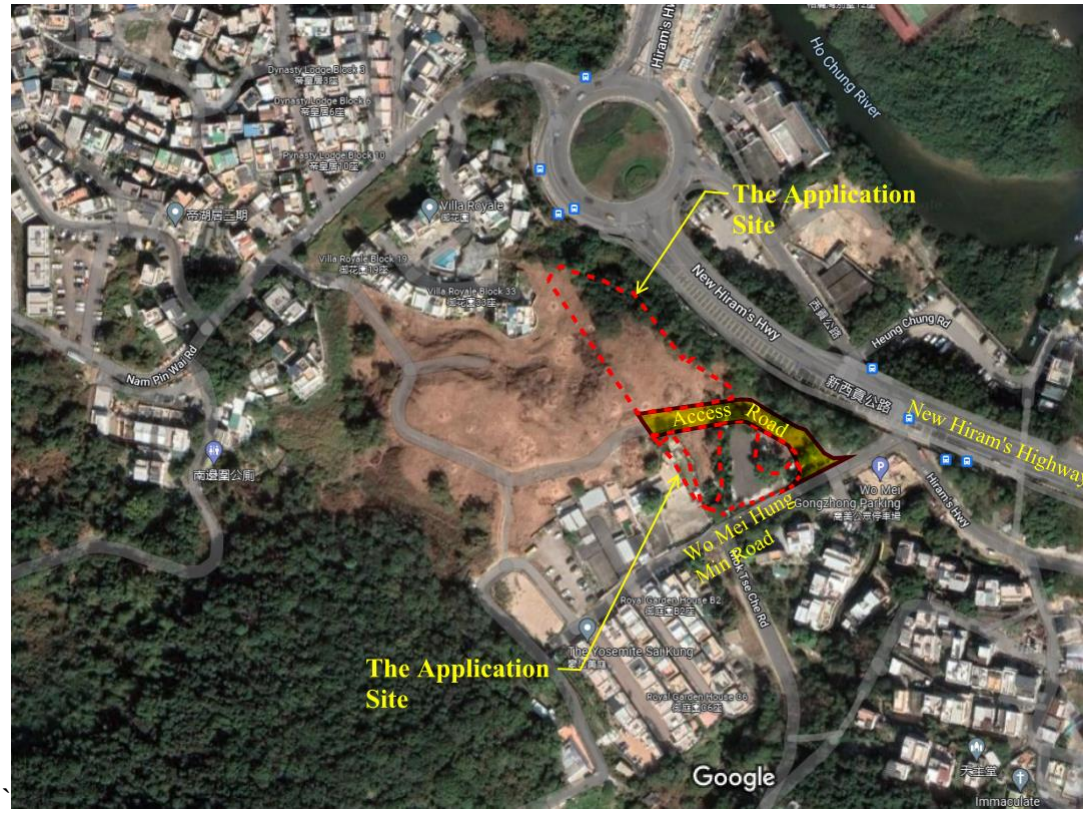
Master Layout Plan showing the proposed development is attached in **Appendix A – Plan 1**. **Table 1** showing the Proposed Development parameters is shown in table below:

Proposed Development	**Site Particulars**	
Project	Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) to Rezone the Application Site from "Green Belt" to "Residential (Group C)1" for Proposed House Development at Various Lots in D.D. 244 and Adjoining Government Land, Nam Pin Wai, Sai Kung	
Location	Nam Pin Wai Sai Kung	
Land Use Zoning	"Green Belt" ("GB")	
Development Site Area excluding Access Road	About 5,355m^2	
% of Hard-paved Area / Unpaved Area	Existing Site Hard-paved Area = 0%	Proposed Development Hard-paved Area = 100%

	Unpaved Area = 100%	Unpaved Area = 0%

Table 1 Recommended Design Return Period

Below is an aerial photograph of the Application Site.



2.2 Project Interface

There is another Drainage Impact Assessment for Residential Development at Lot Nos. 738, 877 (Portion), 878 (Portion), 879 RP (Portion), 887, 931, 932, 1939 sA, 1939 sB (Portion), 1939 sC, 1939 RP (Portion), 1941 sA (Portion), 1942, 1943, 1944 sA, 1945 sI and adjoining Government Land in DD 244 at Nam Pin Wai, Sai Kung, N. T. (New Lot to Be Lot 2189 in DD 244), carried out for the adjoining upstream "R(C)1" Site at the west of the Application Site. This approved DIA report of "R(C)1" should be considered as a separate submission.

3. Assessment Methodology

3.1 Design Criteria

The design criteria for this DIA are based on the Stormwater Drainage Manual (SDM) Table 10 of the SDM. The recommended design return periods for the various drainage system are shown in below **Table 2**.

Description	Design Return Period
Intensively Used Agricultural Land	2 to 5 years
Village Drainage including Internal Drainage System under a polder scheme	10 years
Main Rural Catchment Drainage Channel	50 years

Urban Drainage Trunk System	200 years
Urban Drainage Branch System	50 years

Table 2 Recommended Design Return Period

The proposed drainage system within/outside the development is classified as village (rural) drainage system, hence 10-year flood level return period is adopted as the design criteria.

3.1.1 Determination of Flood Level

The design criteria for flood level depends on the combination of rainstorm event and tidal level under different return period. The flood level is selected referring to SDM Table 11, shown in below **Table 3**:

Flood Level Return Period Scenarios	Rainfall Return Period	Sea Level Return Period
10-years A (10A)	10	2
10-years B (10B)	2	10

Table 3 Determination of Flood Level

3.1.2 Roughness

The Colebrook-White roughness (ks) adopted for concrete pipe is 0.6mm.

3.1.3 Freeboard

Referring to Section 6.5 of SDM, a 300mm minimum freeboard margin of safety is recommended to account for inaccuracies in flood level computations. Therefore, a 300mm freeboard is recommended.

3.1.4 Climate Change

Climate change is taken into account in existing drainage system capacity check calculation. 16.0% Rainfall intensity increase for end 21st century (2081-2100) is included referring to SDM, Table 28.

3.1.5 Sea Level Rise

Climate change is taken into account in existing drainage system back water analysis calculation. 0.20m Sea level rise for end 21st century (2090) is included referring to SDM, Table 29.

3.1.6 Storm Surge Increase

Climate change is taken into account in existing drainage system back water analysis calculation. Storm surge increase for end 21st century (2090) is included referring to SDM, Table 30b.

4. Existing Drainage

4.1 Existing Drainage Network

The Application Site is divided into 5 nos. of individual parcels which are next to the planned access road to be constructed under the residential development in R(C)1 zone. There is a proposed 825ø stormwater drain to be laid along the R(C)1 access road to collect the surface runoff from R(C)1 site and will be connected to an existing triple 1800ø pipe and finally discharge to Pak Sha Wan via an existing twin cell box culvert (2 x 2m x 2m) according to the approved R(C)1 Residential Development DIA.

Surface run-off from the Application Site will be collected by a separate new drainage system to be constructed by the Applicant other than the proposed 825ø stormwater drain to be constructed along

the R(C)1 access road by R(C)1 Residential Development and finally discharges to Ho Chung River directly.

5. Drainage Impact Assessment for the Proposed Development

5.1 Catchment Area Changes

Comparing the existing and the proposed catchment area, it can be found that the proposed house development will be assumed fully paved for conservative analysis.

The catchment area change is summarized in **Table 4** and **Table 5** below:

	Existing Catchment Area		**Proposed Catchment Area**	
	Hard-paved	Unpaved	Hard-paved	Unpaved
Surface run-off discharges to the proposed 825ø	R(C)1 Site and R(C)1 Access Road	0	R(C)1 Site and R(C)1 Access Road	0
Surface run-off discharges to the proposed 525ø	0	Site A, Site B, Site C and the Remaining Phase	Site A, Site B, Site C and the Remaining Phase	0

Table 4 Summary of Catchment Area Change

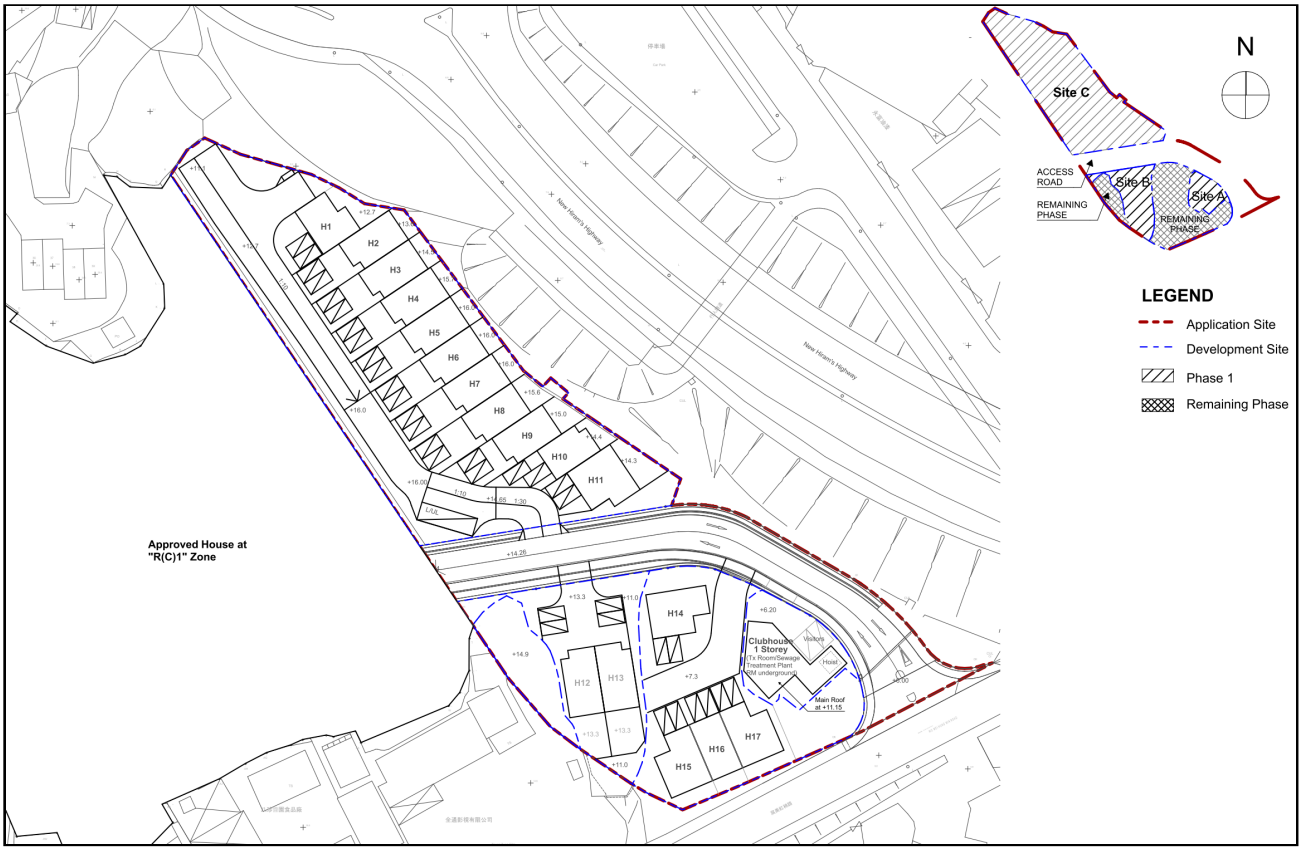


Figure 4-1 Catchment Plan

Catchment Area Distribution			
Catchment Area	Area (m^2)		
	paved	natural slope	grassland
Site A+B+C (About)	4,020	0	0
Remaining Site (About)	1,335	0	0
Access Road under Approved Planning Application No. A/SK-HC/223 (About)	1246	0	0

Table 5 Summary of Catchment Area Distribution for Proposed Development and the Adjacent developments

5.2 Assessment Result

The peak runoff generated from the proposed development is 0.292m^3/s under 10-year return period. Surface run-off from the Application Site will be collected by a separate new drainage system of 375ø to 525ø to be constructed by the Applicant along the R(C)1 access road and finally discharges to Ho Chung River directly (see **Appendix A** – **Plan 2** and **3**).

The proposed stormwater drainage system is aligned within a single lane as shown in drawing in **Appendix A – Plan 2** and **3** to avoid difficulty in approval and implementation of TTA. It is observed that the existing ground level of the public carpark is too low for catering the design tidal level and therefore the design manhole cover level of the proposed manhole SMH-M4a located at the amenity area in Heung Chung public carpark will be raised to +4.15, around 450mm above the ground. The proposed manhole SMH-M4a is located away from the dripline of the existing tree and will be located at the back of the parking space which will not affect the departure of driver/passenger from the vehicle. Consent from relevant departments regarding the proposed upstand design of manhole SMH-M4a from safety point of view will be seek. To facilitate the future maintenance works at any time and at high tide, installation of stoplog will be provided within manhole in the detailed design of proposed manhole SMH-M4a for submission to DSD for comment prior to the commencement of the works.

The assessment result of adopting a proposed 375ø to 525ø stormwater drain has been appended in **Appendix B**. Referring to the backwater checking, by adopting a proposed 375ø to 525ø stormwater drain along Wo Mei Hung Min Road and Hiram's Road, 300mm freeboard can be achieved.

Considering the assessment result and the conservative approach adopted in estimation of the freeboard, there will be negligible impact on the existing drainage system as a result of the proposed house development.

5.3 Flooding Susceptibility

The proposed site ground level is varying from around +6.0mPD to + 16.0mPD which is much higher than the design extreme sea level of 1 in 200 return period which is +4.19mPD referring to DSD Storm Drainage Manual Table 8. On the other hand, there is no record of flood blackspot found for the Application Site or adjacent area. In general, foreseeing there is slim chance of the Application Site been affected by backwater effect under extreme weather.

5.4 Maintenance Responsibility

The management and maintenance responsibilities for the proposed 375ø to 525ø inside the Application site will be maintained by the developer or the management of the development after completion. The proposed drainage system of 525ø outside the Application Site will be handed over to DSD upon completion of the construction works.

5.5 An Outline of the Changes to the Drainage Characteristics and Potential Drainage Impacts Which Might Arise from the Proposed Project

According to the topographical survey included in **Appendix C**, the Application Site is at high point in the central region of the site that grades down in all directions with overland flows towards existing surface channel outside the Application Site. The proposed development will keep all the existing ground levels or drainage or land use adjacent to but outside the project site intact and they will be unaffected by the proposed development.

During construction, the Application Site should be fenced off by hoarding boards with temporary drainage, comprising perimeter channels and catchpits with desilting trap, towards the existing surface channel outside site following the existing catchment overland flow paths. No change to the drainage path during construction but after the completion of the proposed drainage in Wo Mei Hung Min Road, the drainage path of the Application Site after completion will be altered by discharging to the newly proposed drainage system in Wo Mei Hung Min Road.

No potential adverse impact and impact on the land users which might arise as a result of changes to the drainage characteristics caused by the proposed development. As all the existing ground levels or drainage or land use adjacent to but outside the project site will kept intact. The Application Site drainage will be discharge to the new stormwater drainage system in Wo Mei Hung Min Road directly.

5.6 Details of Proposed Temporary Drainage System

The existing catchment of the Application Site and the proposed temporary drainage system during construction period with hydraulic capacity checking is included in **Appendix C**. During construction, the Application Site should be fenced off by hoarding boards with temporary drainage, comprising perimeter channels and catchpits with desilting trap, towards the existing surface channel outside site following the existing catchment overland flow paths.

The temporary drainage should be designed in accordance with standards and recommendations established in DSD Stormwater Drainage Manual (SDM), DSD Technical Circular No. 14/2000 – 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.

Proper measures shall be taken to maintain the existing drainage characteristic 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:

- Erosion of ground material;
- Sediment transportation to existing downstream drainage system, and
- Obstruction to drainage systems.

Excavated slopes for the Application Site shall be well-compacted and protected to prevent any loose material being washed out during rainfall. Temporary protection may be in the form of placing layers of granular material and rockfill material or hard surface cover on the sloping faces of channel or tarpaulin covering.

Regular inspection shall be carried out to ensure integrity of the works. These inspections shall cover works under construction as well as the existing area in the vicinity of the Application Site.

No excavated materials should be left on site. If it is not possible to transport away the excavated material within the same day, the material should be covered by tarpaulin/impervious sheets. Measures shall be taken to ensure that runoff from the Application Site is managed so that silts and other pollution are properly intercepted.

In the event of extreme weather including landslip warning, issuance of amber/red/black rainstorm warning signal, Typhoon Signal No. 3 or above and the like, site inspections shall be carried out by the contractor's emergency team as deemed practical and safe before and after the events to ascertain if there has been any siltation or erosion. If it is determined that any unacceptable siltation or erosion has occurred, the contractor shall rectify it immediately.

Silt removal facilities, channels and manholes should be checked and maintained to ensure satisfactory working conditions. The deposited silt and grit should be removed regularly, at the onset of and after each rainstorm to ensure that these facilities are functioning properly at all times.

As the preliminary temporary drainage scheme and monitoring requirements included in this submission are subject to changes based on actual site constraints encountered on site and the method statement for each phase of construction works. As such, a detailed temporary drainage management plan, including but not limited to the proposed temporary drainage plan, associated hydraulic calculation, method statement for each phase of works, and the monitoring requirement and programme which should be endorsed by AP of the project should be submitted to DSD for agreement prior to the commencement of the works.

5.7 Details of Monitoring Requirement During Construction Stage

The contractor should include below drainage monitoring requirements during construction stage for agreement with RSS and DSD:

- Monitoring points should be set at catchpits, inlets to existing channels, manholes etc of the temporary drainage system and the existing drainage system in the vicinity of the Application Site;
- Drainage performance requirement: (i.e. no blockage, no flooding, no damage of drainage system; no mud/silty water discharge to monitoring points);
- General inspection should be carried out by contractor for the temporary drainage system (i.e. sump pit, sedimentation tank, wastewater treatment facilities and surface channel etc.) within the site and the existing drainage facilities in the vicinity of the Application Site;
- Monitoring frequency at monitoring points: Weekly basis & appropriate time after lowering of amber/red/black rainstorm warning signal and typhoon signal no. 3 or above hoisted by Hong Kong Observatory;
- Requirement of Remedial works: Timely complete the remedial works if non-conformity found after inspection, to ensure the drainage performance during construction;
- Provide an inspection checklist and rectification record (certified by the RSS with signature) together with the site photos at the monitoring points; and
- Keep the monitoring record and rectification record properly and submit to DSD upon requested.

6. Conclusion

This DIA has been prepared to assess the potential drainage impact as a result of the proposed house development.

Surface run-off from the Application Site will be collected by a separate new drainage system of 375ø to 525ø to be constructed by the Applicant along the R(C)1 access road and finally discharges to Ho Chung River directly.

10-year design return period of design criteria is adopted for the impact assessment on the proposed stormwater drain. Based on the hydraulic assessment, the proposed drainage system has sufficient capacity for the proposed house development.

Regarding the proposed upstand design of manhole SMH-M4a located at the amenity area in Heung Chung public carpark, consent from relevant departments from safety point of view will be seek. To facilitate the future maintenance works at any time and at high tide, installation of stoplog will be provided within the proposed manhole SMH-M4a in the detailed design for submission to DSD for comment prior to the commencement of the works. A flap valve is also proposed at the downstream to prevent backwater effect for mitigation measure.

In conclusion, no adverse drainage impact is expected to the surrounding drainage system arising from the proposed development and the proposed drainage system has sufficient capacity to convey the additional surface runoff arising from the proposed development.

Appendix A

Plan

-	26/1/2023	IP	F
MARK	DATE	BY	REV.

JOB TITLE
Proposed Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D. 244, Nam Pin Wai, Sai Kung

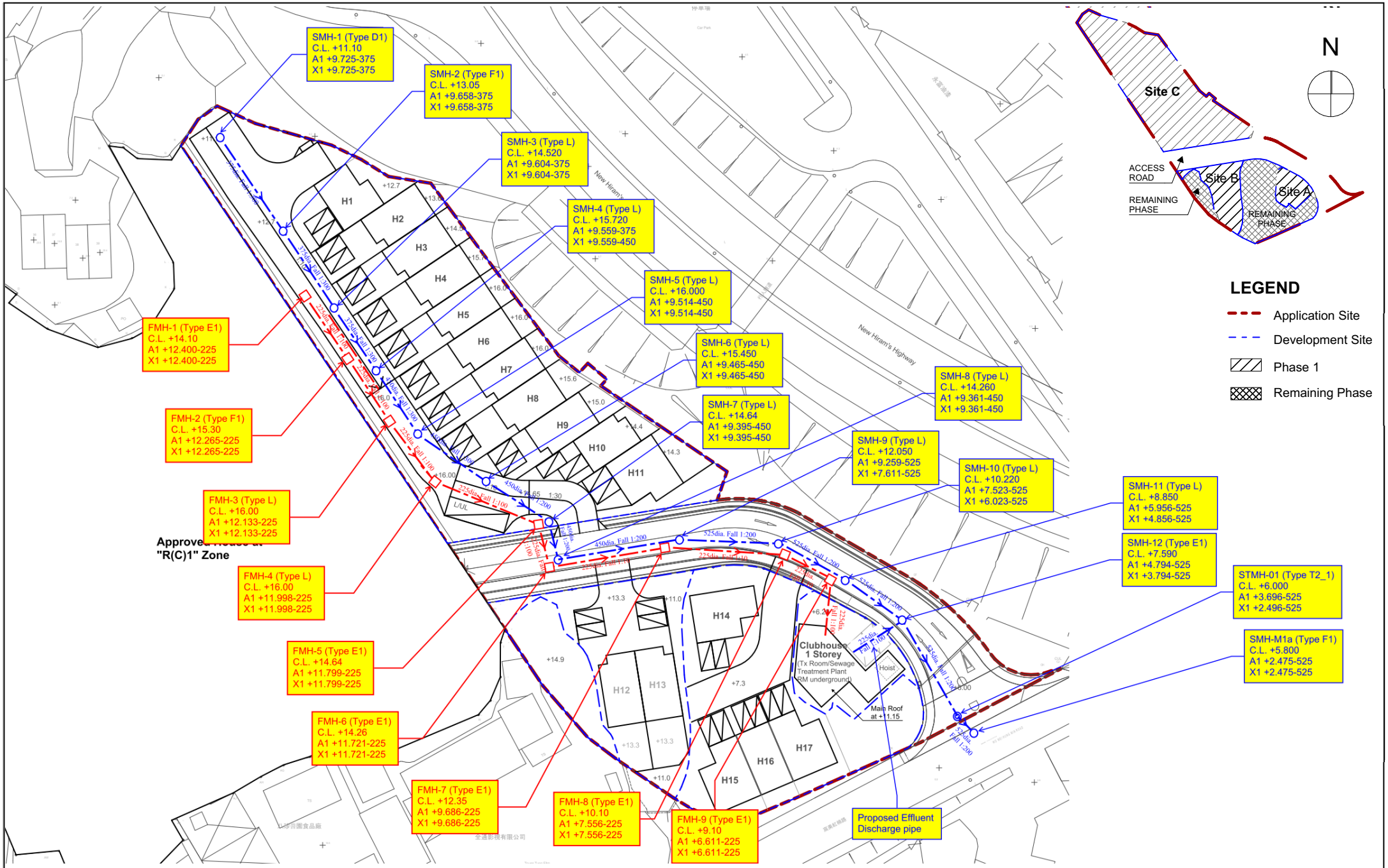
DRAWING TITLE
Master Layout Plan

DRAWING STATUS
FOR INFORMATION

ARUP

SCALE 1:600@A3
DRN. IP DATE 17/1/2023 CHD. CC PASSED. CC

JOB NO. 282344
DRAWING NO. PLAN 1
REV.



MARK	DATE	BY	REV.
-	26/1/2023	IP	F

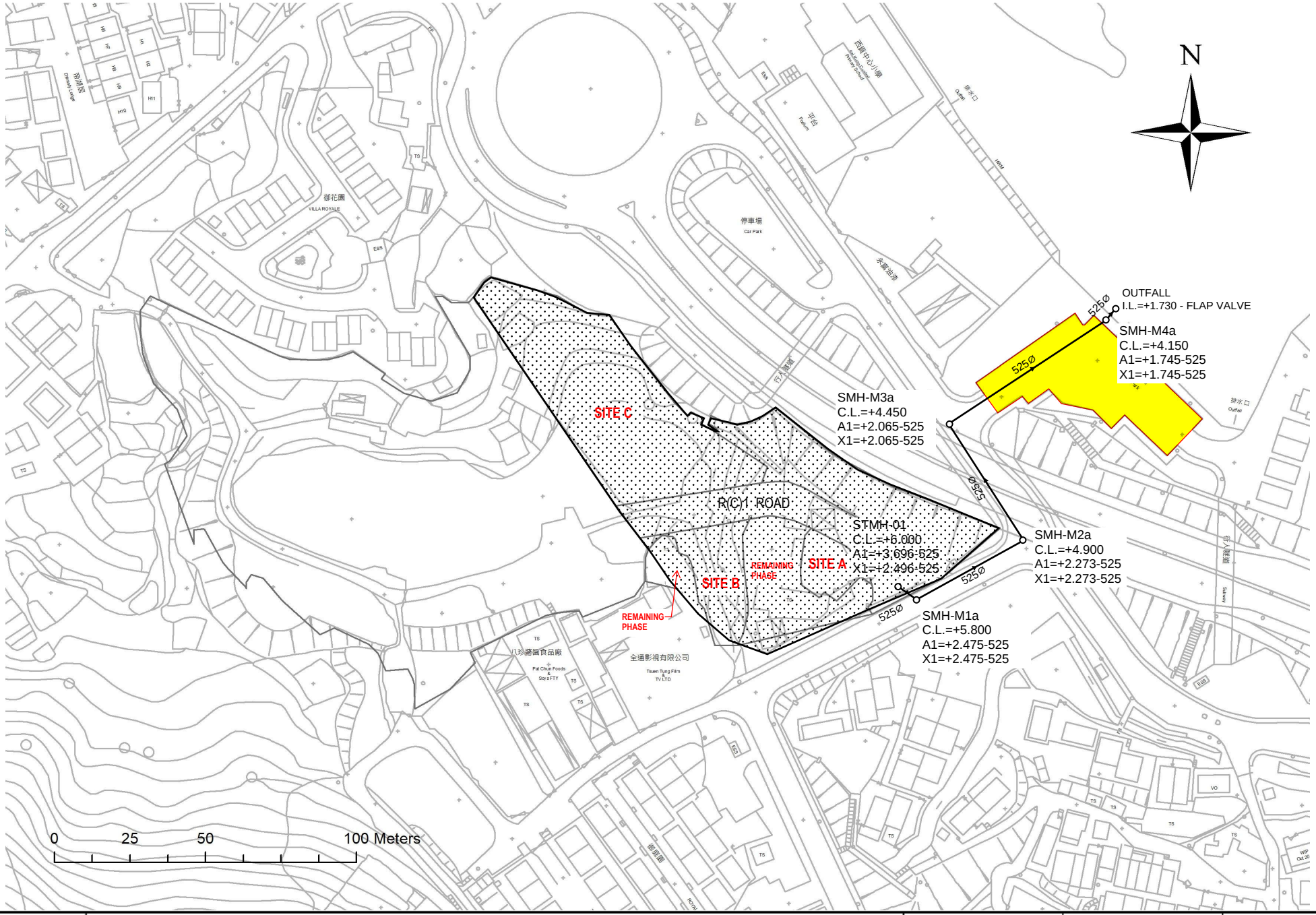
JOB TITLE
Proposed Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D. 244, Nam Pin Wai, Sai Kung

DRAWING TITLE
Proposed Drainage and Sewerage Layout within Site

DRAWING STATUS
FOR INFORMATION

ARUP

SCALE 1:600@A3
DRN. IP DATE 17/1/2023 CHD. CC PASSED. CC
JOB NO. 282344
DRAWING NO. PLAN 2
REV.



NOTE:
THE PROPOSED DRAINAGE ALIGNMENTS SHOWN IN THE DRAWINGS ARE INDICATIVE ONLY. THE EXACT ALIGNMENTS SHALL BE DETERMINED ON SITE AND AFGREED BY THE PROJECT MANAGER AND HIS REPRESENTATIVE.

LEGEND:

PROPOSED CATCHMENT AREA

PROPOSED DRAINAGE MANHOLE

1050Ø PROPOSED STORMWATER DRAIN

MARK	DATE	BY	REV.
-	25/1/2022	IP	F

JOB TITLE
Proposed Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D. 244, Nam Pin Wai, Sai Kung

DRAWING TITLE
Proposed Drainage Layout Plan outside Site

DRAWING STATUS
FOR INFORMATION

ARUP

SCALE	AS SHOWN				
DRN.	IP	DATE	CHD.	CC	PASSED. CC

JOB NO.	DRAWING NO.	REV.
282344	PLAN 3	

Appendix B

Calculation

ARUP

Job Title

Ove Arup & Partners Hong Kong
Proposed Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D. 244, Nam Pin Wai, Sai Kung

Job No. 288253 Sheet No. Rev. 1
Made by CC Date 17/10/2023 Checked CC

Table A - Backwater Checking of the proposed drainage system after completion of the Proposed Development

Proposed Stormwater Drain (10 year rain + 2 year sea level)

Location		Sub-Catchment	Catchment Area						Drainage Character									Hydraulic parameter		Time			(i) Extreme mean intensity 10-year	Peak Runoff	Full Bore Capacity	Full Bore Velocity	Mean Velocity	k	k	H	H	Re	1/f^(1/2)	f	H	Total	Water level	Free board
US	DS	Reference	Impermeable		Permeable		Total		Drainage Shape	Drainage size			Ground level		Invert level		Slope			t_e	t_f	t_c															
			Sub-Catchment (m^2)	Accumulative Area (m^2)	Sub-Catchment (m^2)	Accumulative Area (m^2)	Sub-Catchment (m^2)	Accumulative Area (m^2)		width (mm)	height (mm)	length (m)	USG (mPD)	DSG (mPD)	US (mPD)	DS (mPD)	(S_f)	cross area (A) (m^2)	Pipe Dia. (D) (m)	(min)	(min)	(min)	(mm/h)	(m^3/s)	(m^3/s)	(m/s)	(m/s)			(m)	(m)	number)		(friction ceof)	(friction) (m)	H (m)	(mPD)	(m)
SMH-1	SMH-2	SITE C	619	619	0	0	619	619	375DIA.	375	375	20.2	11.100	12.720	9.725	9.658	0.003	0.11	0.375	5.00	0.32	5.32	235.80	0.036	0.115	1.041	0.330	0.500	1.000	0.003	0.006	1.0E+05	6.430	0.02418	0.0072	0.016	10.047	1.1
SMH-2	SMH-3		446	1,065	0	0	446	1,065	375DIA.	375	375	16.2	12.720	14.360	9.658	9.604	0.003	0.11	0.375	5.32	0.26	5.58	232.96	0.062	0.115	1.041	0.562	0.500	1.000	0.008	0.016	1.8E+05	6.531	0.02345	0.0163	0.040	10.032	2.7
SMH-3	SMH-4		459	1,524	0	0	459	1,524	375DIA.	375	375	13.4	14.360	15.680	9.604	9.559	0.003	0.11	0.375	5.58	0.21	5.80	230.69	0.088	0.115	1.041	0.796	0.500	1.000	0.016	0.032	2.5E+05	6.579	0.02310	0.0267	0.075	9.991	4.4
SMH-4	SMH-5		466	1,990	0	0	466	1,990	450DIA.	450	450	13.5	15.680	16.000	9.559	9.514	0.003	0.16	0.450	5.80	0.19	5.99	228.72	0.114	0.186	1.169	0.716	0.500	1.000	0.013	0.026	2.7E+05	6.721	0.02214	0.0173	0.056	9.916	5.8
SMH-5	SMH-6		516	2,506	0	0	516	2,506	450DIA.	450	450	14.6	16.000	15.000	9.514	9.465	0.003	0.16	0.450	5.99	0.21	6.20	226.65	0.142	0.186	1.169	0.893	0.500	1.000	0.020	0.041	3.3E+05	6.748	0.02196	0.0290	0.090	9.860	6.1
SMH-6	SMH-7		570	3,076	0	0	570	3,076	450DIA.	450	450	14.2	15.000	14.400	9.465	9.395	0.005	0.16	0.450	6.20	0.16	6.36	225.06	0.173	0.228	1.434	1.088	0.500	1.000	0.030	0.060	4.1E+05	6.769	0.02182	0.0415	0.132	9.770	5.2
SMH-7	SMH-8	-	0	3,076	0	0	0	3,076	450DIA.	450	450	6.8	14.400	14.260	9.395	9.361	0.005	0.16	0.450	6.36	0.08	6.44	224.31	0.172	0.228	1.434	1.085	0.500	1.000	0.030	0.060	4.1E+05	6.769	0.02182	0.0197	0.110	9.638	4.8
SMH-8	SMH-9	Remaining Area	216	3,292	0	0	216	3,292	450DIA.	450	450	20.3	14.260	12.050	9.361	9.259	0.005	0.16	0.450	6.44	0.24	6.68	222.13	0.183	0.228	1.434	1.149	0.500	1.000	0.034	0.067	4.3E+05	6.775	0.02179	0.0663	0.167	9.528	4.7
SMH-9	SMH-10	SITE B	637	3,929	0	0	637	3,929	525DIA.	525	525	17.6	12.050	10.220	7.611	7.523	0.005	0.22	0.525	6.68	0.19	6.86	220.47	0.217	0.342	1.580	1.000	0.500	1.000	0.026	0.051	4.4E+05	6.893	0.02105	0.0359	0.112	7.723	4.3
SMH-10	SMH-11	Remaining Area	1,110	5,039	0	0	1,110	5,039	525DIA.	525	525	13.4	10.220	8.850	6.023	5.956	0.005	0.22	0.525	6.86	0.14	7.00	219.23	0.276	0.342	1.580	1.276	0.500	1.000	0.041	0.083	5.6E+05	6.916	0.02091	0.0442	0.169	6.191	4.0
SMH-11	SMH-12	SITE A	315	5,354	0	0	315	5,354	525DIA.	525	525	12.4	8.850	7.590	4.856	4.794	0.005	0.22	0.525	7.00	0.13	7.13	218.10	0.292	0.342	1.580	1.349	0.500	1.000	0.046	0.093	5.9E+05	6.921	0.02088	0.0458	0.185	5.041	3.8
SMH-12	STMH-01	-	0	5,354	0	0	0	5,354	525DIA.	525	525	19.5	7.590	6.000	3.794	3.696	0.005	0.22	0.525	7.13	0.21	7.34	216.37	0.290	0.342	1.580	1.338	0.500	1.000	0.046	0.091	5.9E+05	6.920	0.02088	0.0709	0.208	4.704	2.9
STMH-01	SMH-M1a	-	0	5,354	0	0	0	5,354	525DIA.	525	525	4.3	6.000	5.800	2.496	2.475	0.005	0.22	0.525	7.34	0.04	7.39	216.00	0.289	0.342	1.580	1.336	0.500	1.000	0.045	0.091	5.8E+05	6.920	0.02088	0.0154	0.152	4.496	1.5
SMH-M1a	SMH-M2a	-	0	5,354	0	0	0	5,354	525DIA.	525	525	40.5	5.800	4.900	2.475	2.273	0.005	0.22	0.525	7.39	0.43	7.81	212.58	0.285	0.342	1.580	1.314	0.500	1.000	0.044	0.088	5.8E+05	6.919	0.02089	0.1419	0.274	4.344	1.5
SMH-M2a	SMH-M3a	-	0	5,354	0	0	0	5,354	525DIA.	525	525	41.5	4.900	4.500	2.273	2.065	0.005	0.22	0.525	7.81	0.44	8.25	209.26	0.280	0.342	1.580	1.294	0.500	1.000	0.043	0.085	5.7E+05	6.917	0.02090	0.1410	0.269	4.070	0.8
SMH-M3a	SMH-M4a	-	0	5,354	0	0	0	5,354	525DIA.	525	525	64.0	4.500	4.150	2.065	1.745	0.005	0.22	0.525	8.25	0.68	8.93	204.48	0.274	0.342	1.580	1.264	0.500	1.000	0.041	0.081	5.5E+05	6.915	0.02091	0.2077	0.330	3.801	0.7
SMH-M4a	OUTFALL	-	0	5,138	0	0	0	5,354	525DIA.	525	525	3.0	4.150	4.150	1.745	1.730	0.005	0.22	0.525	8.93	0.03	8.96	204.27	0.262	0.342	1.580	1.212	0.500	1.000	0.037	0.075	5.3E+05	6.912	0.02093	0.0090	0.121	3.471	0.7

2.820 2-year sea level at North Point
3.350 Climate Change end 21st Century

Proposed Stormwater Drain (2 year rain + 10 year sea level)

Location		Sub-Catchment	Catchment Area						Drainage Character									Hydraulic parameter		Time			(i) Extreme mean intensity 2-year	Peak Runoff	Full Bore Capacity	Full Bore Velocity	Mean Velocity	k	k	H	H	Re	1/f^(1/2)	f	H	Total	Water level	Free board
US	DS	Reference	Impermeable		Permeable		Total		Drainage Shape	Drainage size			Ground level		Invert level		Slope			t_e	t_f	t_c															
			Sub-Catchment (m^2)	Accumulative Area (m^2)	Sub-Catchment (m^2)	Accumulative Area (m^2)	Sub-Catchment (m^2)	Accumulative Area (m^2)		width (mm)	height (mm)	length (m)	USG (mPD)	DSG (mPD)	US (mPD)	DS (mPD)	(S_f)	cross area (A) (m^2)	Pipe Dia. (D) (m)	(min)	(min)	(min)	(mm/h)	(m^3/s)	(m^3/s)	(m/s)	(m/s)			(m)	(m)	number)		(friction ceof)	(friction) (m)	H (m)	(mPD)	(m)
SMH-1	SMH-2	SITE C	619	619	0	0	619	619	375DIA.	375	375	20.2	11.100	12.720	9.725	9.658	0.003	0.11	0.375	5.00	0.32	5.32	189.85	0.029	0.115	1.041	0.266	0.500	1.000	0.002	0.004	8.3E+04	6.378	0.02458	0.0048	0.010	9.803	1.30
SMH-2	SMH-3		446	1,065	0	0	446	1,065	375DIA.	375	375	16.2	12.720	14.360	9.658	9.604	0.003	0.11	0.375	5.32	0.26	5.58	187.36	0.050	0.115	1.041	0.452	0.500	1.000	0.005	0.010	1.4E+05	6.494	0.02371	0.0106	0.026	9.793	2.93
SMH-3	SMH-4		459	1,524	0	0	459	1,524	375DIA.	375	375	13.4	14.360	15.680	9.604	9.559	0.003	0.11	0.375	5.58	0.21	5.80	185.37	0.071	0.115	1.041	0.640	0.500	1.000	0.010	0.021	2.0E+05	6.550	0.02331	0.0174	0.049	9.767	4.59
SMH-4	SMH-5		466	1,990	0	0	466	1,990	450DIA.	450	450	13.5	15.680	16.000	9.559	9.514	0.003	0.16	0.450	5.80	0.19	5.99	183.64	0.091	0.186	1.169	0.575	0.500	1.000	0.008	0.017	2.2E+05	6.689	0.02235	0.0113	0.037	9.718	5.96
SMH-5	SMH-6		516	2,506	0	0	516	2,506	450DIA.	450	450	14.6	16.000	15.000	9.514	9.465	0.003	0.16	0.450	5.99	0.21	6.20	181.83	0.114	0.186	1.169	0.716	0.500	1.000	0.013	0.026	2.7E+05	6.721	0.02214	0.0188	0.058	9.682	6.32
SMH-6	SMH-7		570	3,076	0	0	570	3,076	450DIA.	450	450	14.2	15.000	14.400	9.465	9.395	0.005	0.16	0.450	6.20	0.16	6.36	180.43	0.139	0.228	1.434	0.872	0.500	1.000	0.019	0.039	3.3E+05	6.746	0.02198	0.0268	0.085	9.624	5.38
SMH-7	SMH-8	-	0	3,076	0	0	0	3,076	450DIA.	450	450	6.8	14.400	14.260	9.395	9.361	0.005	0.16	0.450	6.36	0.08	6.44	179.77	0.138	0.228	1.434	0.869	0.500	1.000	0.019	0.039	3.3E+05	6.745	0.02198	0.0128	0.071	9.539	4.86
SMH-8	SMH-9	Remaining Area	216	3,292	0	0	216	3,292	450DIA.	450	450	20.3	14.260	12.050	9.361	9.259	0.005	0.16	0.450	6.44	0.24	6.68	177.84	0.146	0.228	1.434	0.920	0.500	1.000	0.022	0.043	3.5E+05	6.752	0.02194	0.0428	0.108	9.468	4.79
SMH-9	SMH-10	SITE B	637	3,929	0	0	637	3,929	525DIA.	525	525	17.6	12.050	10.220	7.611	7.523	0.005	0.22	0.525	6.68	0.19	6.86	176.37	0.173	0.342	1.580	0.800	0.500	1.000	0.016	0.033	3.5E+05	6.867	0.02121	0.0231	0.072	7.683	4.37
SMH-10	SMH-11	Remaining Area	1,110	5,039	0	0	1,110	5,039	525DIA.	525	525	13.4	10.220	8.850	6.023	5.956	0.005	0.22	0.525	6.86	0.14	7.00	175.28	0.221	0.342	1.580	1.020	0.500	1.000	0.027	0.053	4.5E+05	6.895	0.02104	0.0284	0.108	6.131	4.09
SMH-11	SMH-12	SITE A	315	5,354	0	0	315	5,354	525DIA.	525	525	12.4	8.850	7.590	4.856	4.794	0.005	0.22	0.525	7.00	0.13	7.13	174.28	0.233	0.342	1.580	1.078	0.500	1.000	0.030	0.059	4.7E+05	6.900	0.02100	0.0294	0.118	4.974	3.88
SMH-12	STMH-01	-	0	5,354	0	0	0	5,354	525DIA.	525	525	19.5	7.590	6.000	3.794	3.696	0.005	0.22	0.525	7.13	0.21	7.34	172.74	0.231	0.342	1.580	1.068	0.500	1.000	0.029	0.058	4.7E+05	6.899	0.02101	0.0454	0.133	4.629	2.96
STMH-01	SMH-M1a	-	0	5,354	0	0	0	5,354	525DIA.	525	525	4.3	6.000	5.800	2.496	2.475	0.005	0.22	0.525	7.34	0.04	7.39	172.41	0.231	0.342	1.580	1.066	0.500	1.000	0.029	0.058	4.7E+05	6.899	0.02101	0.0099	0.097	4.496	1.50
SMH-M1a	SMH-M2a	-	0	5,354	0	0	0	5,354	525DIA.	525	525	40.5	5.800	4.900	2.475	2.273	0.005	0.22	0.525	7.39	0.43	7.81	169.37	0.227	0.342	1.580	1.047	0.500	1.000	0.028	0.056	4.6E+05	6.898	0.02102	0.0906	0.174	4.400	1.40
SMH-M2a	SMH-M3a	-	0	5,354	0	0	0	5,354	525DIA.	525	525	41.5	4.900	4.500	2.273	2.065	0.005	0.22	0.525	7.81	0.44	8.25	166.42	0.223	0.342	1.580	1.029	0.500	1.000	0.027	0.054	4.5E+05	6.896	0.02103	0.0897	0.171	4.225	0.67
SMH-M3a	SMH-M4a	-	0	5,354	0	0	0	5,354	525DIA.	525	525	64.0	4.500	4.150	2.065	1.745	0.005	0.22	0.525	8.25	0.68	8.93	162.15	0.217	0.342	1.580	1.003	0.500	1.000	0.026	0.051	4.4E+05	6.893	0.02105	0.1315	0.208	4.055	0.45
SMH-M4a	OUTFALL	-	0	5,138	0	0	0	5,354	525DIA.	525	525	3.0	4.150	4.150	1.745	1.730	0.005	0.22	0.525	8.93	0.03	8.96	161.96	0.208	0.342	1.580	0.961	0.500	1.000	0.024	0.047	4.2E+05	6.888	0.02107	0.0057	0.076	3.846	0.30

3.200 10-year sea level at North Point
3.770 Climate Change end 21st Century

Notes:

Rational Method is adopted for the peak runoff estimate i.e. Qp = 0.278 C I A.
The time of entry (te) is assumed to be 5.0 minutes.
The Colebrook White's Equation was used for hydraulic analysis of the drainage system.
The roughness value (ks) of 0.6mm has been taken in the hydraulic calculation for concrete pipes.
The runoff coefficient of 0.90 for paved area and 0.35 for unpaved area has been adopted.
The inlet and outlet headloss coefficients of 0.5 and 1.0 respectively for the drainage system have been assumed in the hydraulic calculations.
Sea level rise due to Climate Change refers to Table 29 of 0.47m for End 21st Century.
Storm surge Increase in End 21st Century refer to Table 30b.
Rainfall increase due to Climate Change refers to Table 28 of 16.0% for End 21st Century.

Appendix C

Temporary Drainage During Construction Stage

Existing 300UC
Existing 300UC
Existing 300UC
200 sq m
G4
G3
2,526 sq m
G1
875 sq m
324 sq m
G2
F2
Existing 300UC
99 sq m
Existing 300UC
Existing 450UC
1,754 sq m
F1
955 sq m
E1
E4
E2
573 sq m
E3
684 sq m
625 sq m
NEW HIRAM'S HIGHWAY
WO MEI HUNG MIN ROAD
WOK TSE CHE ROAD
PAT CHAN FOOD & SOYS FACTORY
VILLA ROYALE

EXISTING CATCHMENT PLAN

LEGEND:

- ARTIFICIAL SLOPE
- CHANNEL WITH FLOW DIRECTION (UR: SIDE OF CHANNEL)
- STEP CHANNEL WITH FLOW DIRECTION (UR: SIDE OF STEP CHANNEL)
- BOUNDARY LINE & BOUNDARY POINT
- GATE
- PERMANENT BUILDING AND CANOPY
- TREE WITH TREE NO.
- VERTICAL MASONRY / CUTTING
- GRAVE
- CONTOURS
- TS TEMPORARY STRUCTURE
- PB PILLAR BOX
- HR HAND RAILING
- HO HOARDING
- KL KERB LINE
- ST SLOPE TOP
- SB SLOPE BOTTOM
- FX FENCE
- BARRIERS
- BN BENCH
- E ELECTRIC POLE
- SB SIGN BOARD
- SP SIGN POLE
- L LAMP POST
- TP TELEPHONE POLE
- TL TRAFFIC LIGHT
- H FIRE HYDRANT
- PM PARKING METER
- BOLLARD AT ROAD
- GULLY
- GRATING
- VALVE FIRE
- VALVE GAS
- VALVE WATER WORKS
- MANHOLE
- ATC MANHOLE, ATC
- CATV MANHOLE, CABLE TV
- E&M MANHOLE, ELECTRIC & MECHANICAL SERVICES DEPARTMENT
- HKTA MANHOLE, PCCW-HKT TELEPHONE LIMITED
- DSD MANHOLE, DRAINAGE SERVICES DEPARTMENT
- HKT MANHOLE, HUTCHISON COMMUNICATION LIMITED
- HGC MANHOLE, HUTCHISON GLOBAL CROSSING LIMITED BROADBAND
- CP CATCH PIT
- MF MANHOLE, FOUL WATER/SEWER
- MS MANHOLE, STORM WATER
- PCW MANHOLE, PACIFIC CENTURY CABLE & WIRELESS
- NWT MANHOLE, NEW WORLD TELEPHONE
- CLP MANHOLE, CLP POWER
- W&T MANHOLE, WHAFT T & T
- TGT MANHOLE, TOWNGAS TELECOM

ABBREVIATION:

BD	BOULDER
BE	BERM
BS	BOUNDARY STONE
CUL	CULVERT
CO	COLUMN
CONC	CONCRETE
EB	ELECTIC BOX
END	END OF OBJECT
FB	FLOWER BED
FP	FOOTPATH
IL	INVERT LEVEL
NU	NULLAH
OH	OVERHANG
PL	PLATFORM
PO	POND
PZ	PIEZOMETER TUBE
RP	RAMP
RU	RUIN
SS	SHRINE
VB	VEHICLE BARRIERS
WE	WELL
WIP	WORK IN PROGRESS
WT	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: NOVEMBER 2014

REVISION	DATE	DESCRIPTION
INITIAL	05/12/2014	---

Topographical Survey
Lot 2189 in DD244, Sai Kung
New Territories

SAM MAK & ASSOCIATES SURVEYORS (HK) LTD.
CONSULTANTS IN LAND, ENGINEERING, MARINE & AERIAL SURVEYS
ROOM 703-705, MARINA HOUSE, NO.68 HING MAN STREET, SHAUKEIWAN, HONG KONG.
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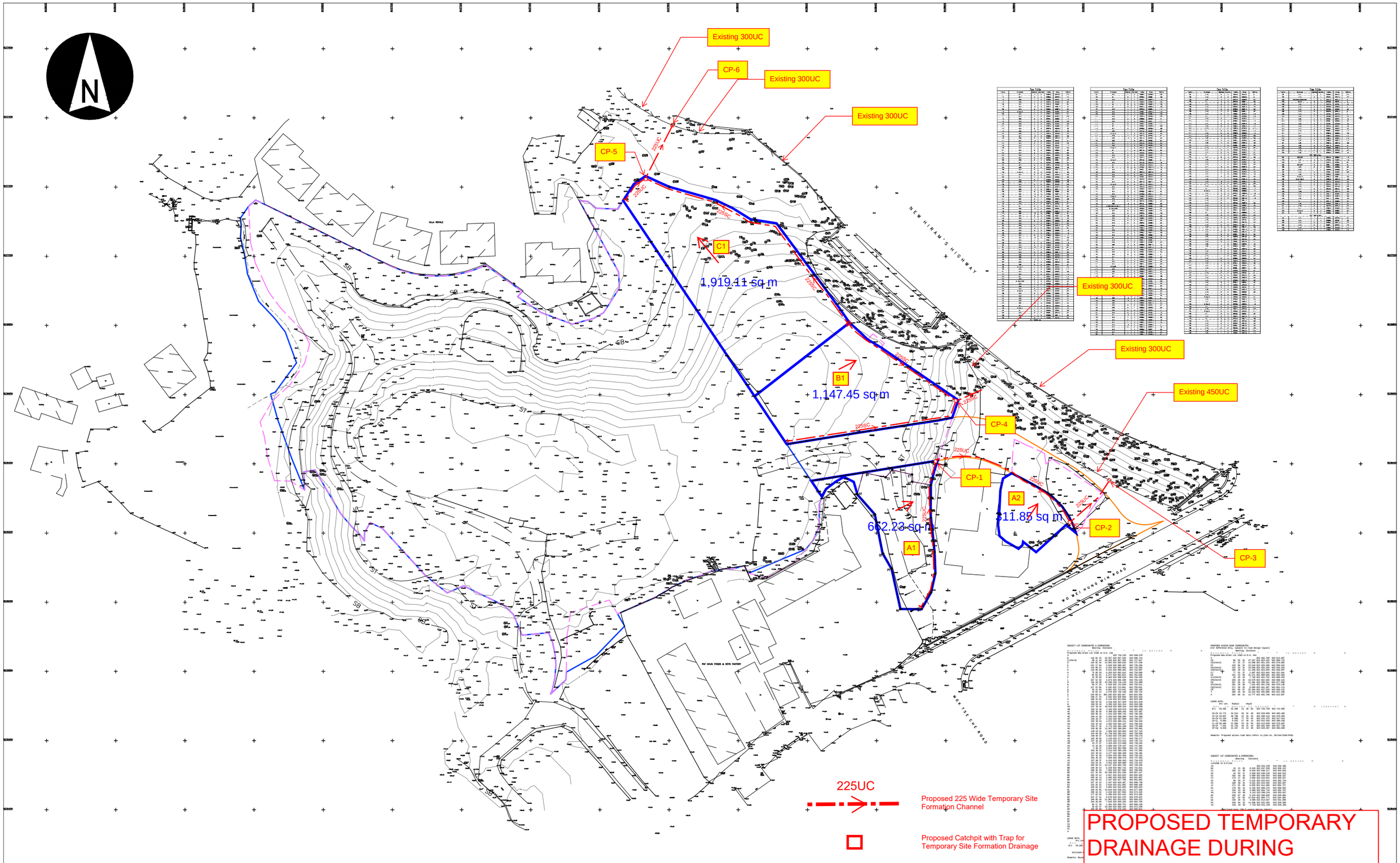
PRELIMINARY
(27/02/2015)
JESSICA LEUNG MRICS MHKIS RPS(LS)
CHARTERED SURVEYOR

PLAN NO. 8877/01



LEGEND:

- ARTIFICIAL SLOPE
- CHANNEL WITH FLOW DIRECTION 0.00 WIDE OF CHANNEL
- STEP CHANNEL WITH FLOW DIRECTION 0.00 WIDE OF STEP CHANNEL
- BOUNDARY LINE & BOUNDARY POINT
- GATE
- PERMANENT BUILDING AND CANOPY
- TREE WITH TREE NO.
- VERTICAL MASONRY / CUTTING
- GRAVE
- CONTOURS
- TS TEMPORARY STRUCTURE
- PB PILLAR BOX
- HR HAND RAILING
- HO HOARDING
- KL KERB LINE
- ST SLOPE TOP
- SB SLOPE BOTTOM
- FX FENCE
- BARRIERS
- BEN BENCH
- E ELECTIC POLE
- SB SIGN BOARD
- SP SIGN POLE
- L LAMP POST
- TP TELEPHONE POLE
- TL TRAFFIC LIGHT
- H FIRE HYDRANT
- PM PARKING METER
- BOLLARD AT ROAD
- GULLY
- GRATING
- VALVE FIRE
- VALVE GAS
- VALVE WATER WORKS
- MANHOLE
- ATC MANHOLE, ATC
- CATV MANHOLE, CABLE TV
- E&M MANHOLE, ELECTRIC & MECHANICAL SERVICES DEPARTMENT
- HKT MANHOLE, PCCW–HKT TELEPHONE LIMITED
- DSD MANHOLE, DRAINAGE SERVICES DEPARTMENT
- HEL MANHOLE, HUTCHISON COMMUNICATION LIMITED
- HBC MANHOLE, HUTCHISON GLOBAL CROSSING LIMITED BROADBAND
- CI CATCH PIT
- MF MANHOLE, FOUL WATER/SEWER
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TABLE 1 Temporary Drainage Design During Construction Stage

Runoff Coeff., C = 0.35 (Unpaved)
= 0.95 (Paved)

Return Period = 10 years

Rainfall Intensity, $I = a / (Tc + b)^c$ 10-year (Gumbel solution)
where : a = 471.9 (Table 3a, Stormwater Drainage Manual)
b = 3.02
c = 0.397

Time of Concentration,To = 2.0 min

Rainfall Increase due to Climate Change = 16.00% (End 21st Century, Table 28)

By Colebrook-White Equation

$$\overline{V} = -\sqrt{32gRS_f}\,\log\left[\frac{k_s}{14.8R} + \frac{1.255\nu}{R\sqrt{32gRS_f}}\right]$$

where ks is equivalent roughness with value equals 1.5mm for channels
ν is kinematic viscosity of fluid = 1.14 x 10-6 m2/s and g is the gravity = 9.81m/s2
V is the velocity, R is the hydraulic radius of the drain and S is the gradient of the drain

Proposed Temporary Drainage Design

Manhole/Catchpit Ref		Contributing	Area (m^2)			T_o	T_f	T_c	I	Peak Flow,	Existing / Proposed Stepped Channel and Drain															
Upstream Manhole/ Catchpit	Downstream Manhole/ Catchpit	Catchment Ref.	Unpaved	Paved	Factored Area A, (m^2)	(min.)	(min.)	(min.)	(mm/hr)	Q (m^3/s)	Channel / Drain	Width (mm)	Depth (mm)	Wetted Area A (m^2)	Wetted Perimeter P (m)	Hydraulic Radius R (m)	Length (m)	UP_GL (mPD)	DN_GL (mPD)	UP_INV (mPD)	DN_INV (mPD)	Gradient (S)	VEL (m/s)	CAP (m^3/s)	F/C (%)	Adequate Capacity?
U/S U/C	CP-1	A1	662	0	232	1.00	0.23	1.23	308.10	0.020	225UC	225	225	0.045	0.578	0.08	43.1	11.000	9.000	10.775	8.775	0.046	3.07	0.139	14%	Y
CP-1	CP-2	A1 + A2	974	0	341	1.23	0.19	1.43	302.71	0.029	225UC	225	225	0.045	0.578	0.08	45.8	9.000	5.500	8.775	5.275	0.076	3.95	0.178	16%	Y
CP-2	CP-3	A1 + A2	974	0	341	1.43	0.09	1.52	300.30	0.028	225UC	225	225	0.045	0.578	0.08	16.1	5.500	4.800	5.275	4.575	0.043	2.98	0.134	21%	Y
U/S U/C	CP-4	B1	1147	0	402	1.00	0.17	1.17	309.85	0.035	225SC	225	225	0.045	0.578	0.08	52.0	18.000	9.000	17.775	8.775	0.173	5.00	0.226	15%	Y
U/S U/C	CP-4	B1	1147	0	402	1.00	0.13	1.13	311.24	0.035	225SC	225	225	0.045	0.578	0.08	37.9	16.000	9.000	15.775	8.775	0.185	5.00	0.226	15%	Y
CP-4	EX OUTFALL	B1	1147	0	402	1.17	0.03	1.20	309.07	0.034	22SUC	225	225	0.045	0.578	0.08	8.0	9.000	7.000	8.775	6.775	0.251	5.00	0.226	15%	Y
U/S U/C	CP-5	C1	1919	0	672	1.00	0.06	1.06	313.12	0.058	22SUC	225	225	0.045	0.578	0.08	8.4	8.400	8.200	8.175	7.975	0.024	2.20	0.099	59%	Y
U/S U/C	CP-5	C1	1919	0	672	1.00	0.27	1.27	307.00	0.057	22SUC	225	225	0.045	0.578	0.08	75.1	16.000	8.200	15.775	7.975	0.104	4.60	0.208	28%	Y
CP-5	CP-6	C1	1919	0	672	1.06	0.10	1.16	310.17	0.058	22SUC	225	225	0.045	0.578	0.08	17.1	8.200	7.500	7.975	7.275	0.041	2.89	0.130	44%	Y

Existing Drainage Checking

Manhole/Catchpit Ref		Contributing	Area (m^2)			T_o	T_f	T_c	I	Peak Flow,	Existing / Proposed Stepped Channel and Drain															
Upstream Manhole/ Catchpit	Downstream Manhole/ Catchpit	Catchment Ref.	Unpaved	Paved	Factored Area A, (m^2)	(min.)	(min.)	(min.)	(mm/hr)	Q (m^3/s)	Channel / Drain	Width (mm)	Depth (mm)	Wetted Area A (m^2)	Wetted Perimeter P (m)	Hydraulic Radius R (m)	Length (m)	UP_GL (mPD)	DN_GL (mPD)	UP_INV (mPD)	DN_INV (mPD)	Gradient (S)	VEL (m/s)	CAP (m^3/s)	F/C (%)	Adequate Capacity?
Existing 450UC		E1, E2, E3, E4	2837	0	993	1.00	0.28	1.28	306.86	0.085	450UC	450	450	0.181	1.157	0.16	38.0	5.400	5.000	4.950	4.550	0.011	2.28	0.413	20%	Y
Existing 300UC		F1, F2	1853	0	649	1.00	0.09	1.09	312.41	0.056	300UC	300	300	0.080	0.771	0.10	9.0	8.000	8.000	7.700	7.610	0.010	1.72	0.138	41%	Y
Existing 300UC		G1, G2, G3, G4	3785	0	1325	1.00	0.20	1.20	309.13	0.114	300UC	300	300	0.080	0.771	0.10	36.2	8.000	4.800	7.300	6.160	0.031	3.05	0.245	46%	Y