

## **Annex C**

# **Revised Sewerage Impact Assessment**



# 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:

2 | 9 January 2024

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 282344

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# 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>)

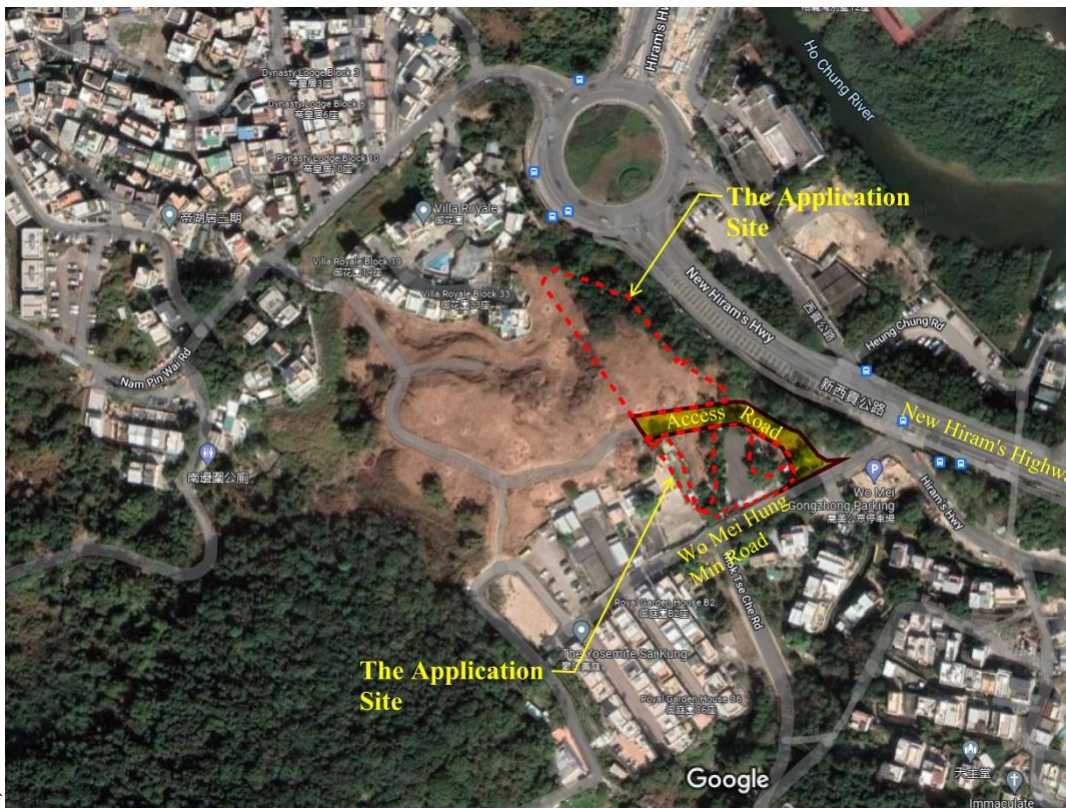
# 2. The Proposed Development

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 <sup>2</sup>
Domestic GFA (About)	4,016m <sup>2</sup>

No. of House	17
Clubhouse GFA (About)	151 m <sup>2</sup>

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 R3 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, **Guidelines for the Design of Small Sewage Treatment Plants** and is shown in **Appendix B – Table T1** and summarized in below table.

Proposed Development	Parameters
<b>Domestic GFA (About)</b>	4,016
No. of Houses	17
No. of Residents	51
Unit Flow Factor (m <sup>3</sup> /person/day) for <b>Private R3</b>	<b>0.37</b>
Average Dry Weather Flow for Residents (m <sup>3</sup> /day)	<b>18.87</b>
Clubhouse GFA (m <sup>2</sup> ) (About)	151
Number of Employee	8
Unit Flow Factor for Restaurant (m <sup>3</sup> /person/day)	1.58
Average Dry Weather Flow for Clubhouse (m <sup>3</sup> /day)	<b>12.64</b>
Total Average Dry Weather Flow (m <sup>3</sup> /day)	<b>31.51</b>
Contributing Population	<b>117</b>
<b>Global Peaking Factor for Private Sewage Treatment Works</b>	<b>6.0</b>
<b>Global Peaking Factor (excluding stormwater allowance) for Private Sewerage System within the Subject Site</b>	<b>6.0</b>
<b>Peak Flow for Sewage Treatment Works (L/s)</b>	<b>2.19</b>
<b>Peak Flow for Gravity Sewer (L/s)</b>	<b>2.19</b>

### 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 **subject to submission of a separate Sewerage Impact Assessment to EPD and DSD for approval prior to the connection.**

Adopting the peaking factor of **6** in Table T-5 of EPD Report No. EPD/TP 1/05, the peak flow for sewers from the proposed development is estimated as **2.19** 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.

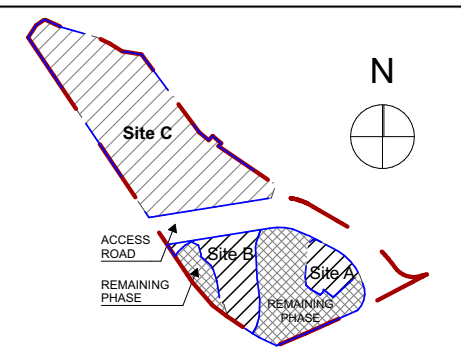
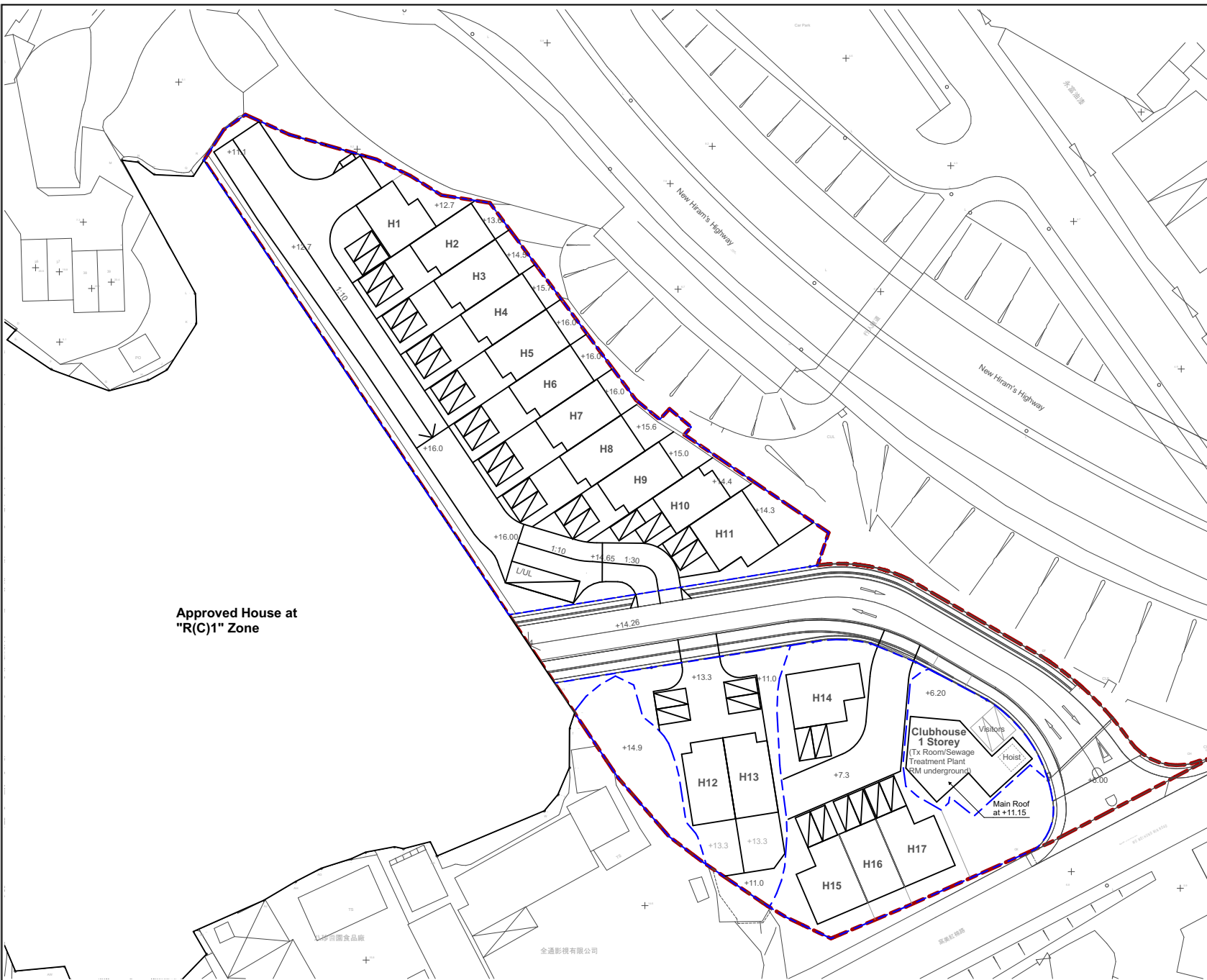
The private sewage treatment plant should be designed in such a way that it is capable of handling the daily and peak sewage flow arising from the proposed development. Should public sewerage be available in future, we would modify the sewerage system to facilitate the sewerage connection **subject to submission of a separate Sewerage Impact Assessment to EPD and DSD for approval prior to the 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



- LEGEND**
- Application Site
  - Development Site
  - Phase 1
  - Remaining Phase

Approved House at "R(C)1" Zone

MARK	DATE	BY	REV.

全通影視有限公司

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

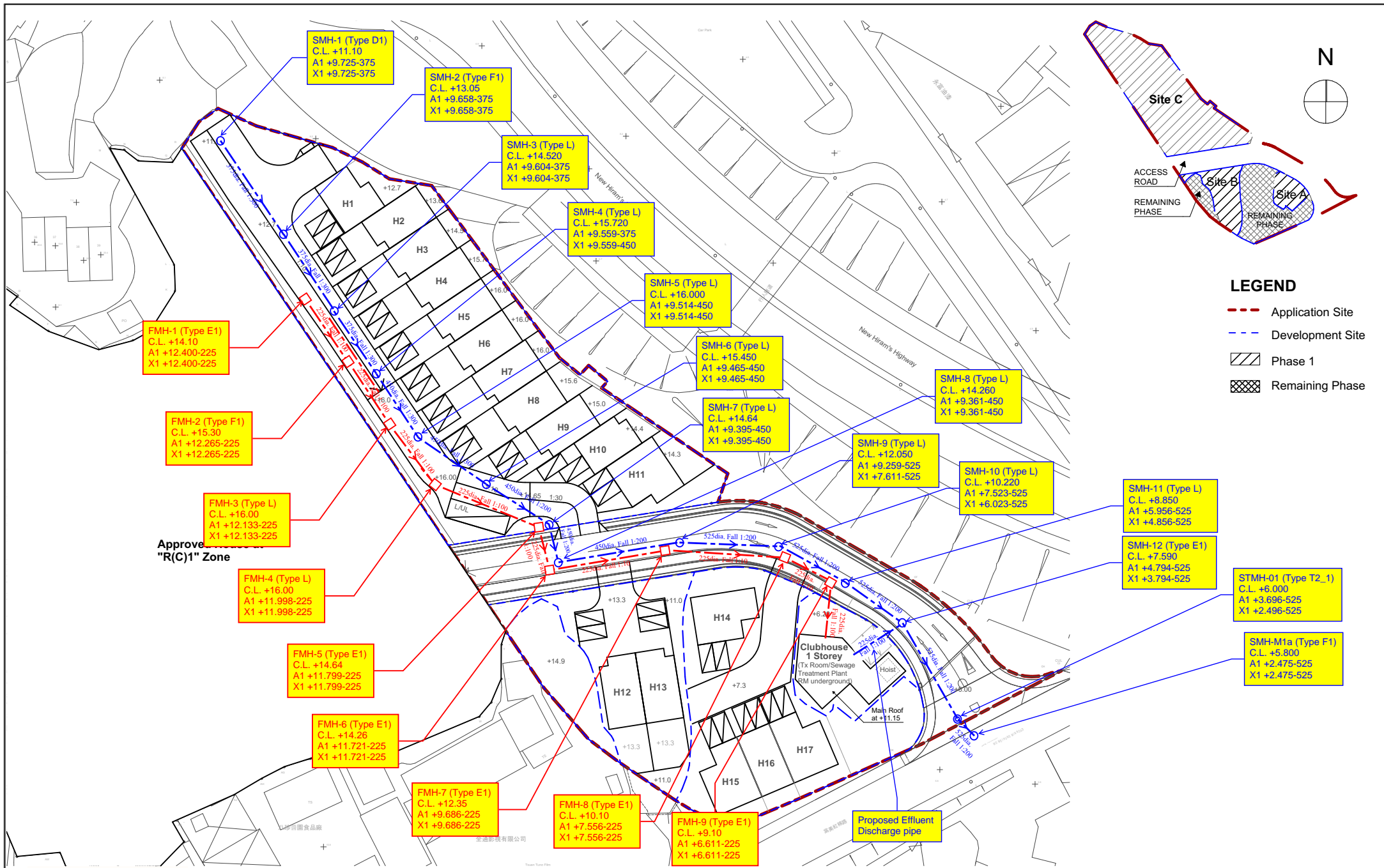
DRAWING STATUS  
FOR INFORMATION

**ARUP**

SCALE 1:6000/BA3

DRAWN BY DATE 17/11/2023 CHK. CC PASSED CC

JOB NO. 282344 DRAWING NO. PLAN 1 REV.



MARK	DATE	BY	REV.

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 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

DRAWN BY DATE 17/11/2023 CHK. CC PASSED CC

JOB NO. 282344 DRAWING NO. PLAN 2 REV.

# 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. Guidelines for the Design of Small Sewage Treatment Plants.

**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		
<b>Domestic</b>		
Number of Houses	17	Based on Development Schedule
Number of Residents (3-storey @ 3 persons for each storey)	51	
Unit flow factor (m <sup>3</sup> /person/day)	0.37	Table T-1 of GESF - Private R3
ADWF, (m <sup>3</sup> /day)	18.87	
<b>Clubhouse</b>		
GFA (m <sup>2</sup> )	151	Based on Development Schedule
Worker Density (Number of Worker per 100m <sup>2</sup> GFA)	5.1	Restaurant
Number of Employee	8	
Unit flow factor (m <sup>3</sup> /person/day)	1.58	Table T-2 of GESF - J10 Restaurant and Hotel
ADWF, (m <sup>3</sup> /day)	12.64	
Total ADWF, (m <sup>3</sup> /day)	31.51	
Contributing Population	117	
Global Peaking Factor for Sewage Treatment Works	6	Para 3.3 of the "Guidelines for the Design of Small Sewage Treatment Plants"
Global Peaking Factor (excluding stormwater allowance) for Sewers	6	Table T-5 of GESF
Peak Flow (L/s) for Sewage Treatment Works	2.19	
Peak Flow (L/s) for Gravity Sewers	2.19	

Notes:

Employment density shall refer to Commercial and Industrial Floor Space Utilization Survey published by PlanD.

Restaurant = 5.1 employee per 100m<sup>2</sup> of GFA

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Job Title

**Table B2 - Capacity Performance of Proposed Sewer**

Notes:

(1) Calculate by Colebrook-White Equation

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

where ks is roughness value is 3mm for sewer.

v is kinematic viscosity of fluid = 1.14 x 10<sup>-6</sup> m<sup>2</sup>/s and g is the gravity = 9.81m/s<sup>2</sup>

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)	Proposed 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	117	6	0.36	2.19	225	13.5	13.90	15.30	12.400	12.265	100	1.02	40.68	5.4%	YES
FMH-2	FMH-3		117	6	0.36	2.19	225	13.2	15.30	16.00	12.265	12.133	100	1.02	40.68	5.4%	YES
FMH-3	FMH-4		117	6	0.36	2.19	225	13.5	16.00	15.60	12.133	11.998	100	1.02	40.68	5.4%	YES
FMH-4	FMH-5		117	6	0.36	2.19	225	19.9	15.60	14.40	11.998	11.799	100	1.02	40.68	5.4%	YES
FMH-5	FMH-6		117	6	0.36	2.19	225	7.8	14.40	14.26	11.799	11.721	100	1.02	40.68	5.4%	YES
FMH-6	FMH-7		117	6	0.36	2.19	225	20.4	14.26	12.35	11.721	9.686	10	3.24	128.90	1.7%	YES
FMH-7	FMH-8		117	6	0.36	2.19	225	21.3	12.35	10.10	9.686	7.556	10	3.24	128.90	1.7%	YES
FMH-8	FMH-9		117	6	0.36	2.19	225	9.5	10.10	9.10	7.556	6.611	10	3.24	128.90	1.7%	YES
FMH-9	On-site Sewage Treatment Plant		117	6	0.36	2.19	225	10.2	9.10	9.10	6.611	6.509	100	1.02	40.68	5.4%	YES