

Appendix F

Revised Sewerage Impact Assessment

Application for Planning Permission Under Section 16 of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development in Area Shown as 'Road', Various Lots in D.D. 221 and Adjoining Government Land, Sha Ha, Sai Kung

Sewerage Impact Assessment Report

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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 302260

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1. Introduction

1.1 Project Background

- 1.1.1 This Sewerage Impact Assessment (“SIA”), appended to the Supporting Planning Statement, is prepared in support of the Planning Application under Section 16 of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D. 221 and adjoining Government Land, Sha Ha, Sai Kung (“the Application Site”).

1.2 Proposed Development

- 1.2.1 The Proposed Development is located in the existing temporary open storage area within Sha Ha. There would be 3 blocks of residential buildings and an access road adjoining Tai Mong Tsai Road.
- 1.2.2 The Proposed Development comprises private housing and clubhouse. The Application Site area is approximately 9,038 m², while the design parameters are shown in **Table 1.1** below.

Table 1.1 Key development Parameters

Parameter	Proposed Scheme
District Location	Sai Kung
Site Location	Sha Ha
Application Site Area ⁽¹⁾	About 9,038m ²
Development Site Area	About 7,614m ²
Plot Ratio ⁽²⁾	About 1.5
Domestic Gross Floor Area (GFA)	About 11,421m ²
Building Height (No. of Storeys) ⁽³⁾	10 storeys
Site Coverage	Not more than 42%
No. of Residential Blocks	3
No. of Units (about)	280
Average Unit Size	About 40.79m ²
Anticipated Population ⁽⁴⁾	Domestic: About 756 Clubhouse: 19 ⁽⁶⁾
Local Open Space	Not less than 756m ²
Target Completion Year	2032
Residents’ Clubhouse ⁽⁵⁾	GFA of about 571m ²

- (1) The Application Site includes the Development Site and empty area within the limit of works area of the planned Hiram’s Highway Improvement Stage 2 adjoining the Development Site for better rationalisation of boundary.
- (2) Plot ratio calculation is based on the area of Development Site.
- (3) The number of storeys excludes 1-storey basement carpark.

- (4) Person per flat (PPF) ratio of 2.7 is assumed, with reference to the average household size in the District Council Constituency Area Q01 Sai Kung Central in 2021 Population Census.
- (5) According to APP-104, a maximum 5% of total Domestic GFA can be applied for GFA concession for a development with Domestic GFA up to 25,000m². The clubhouse GFA is proposed to be exempted from GFA calculation.
- (6) Community, Social & Personal Services = 3.3 employee per 100m² of GFA based on PlanD's Commercial and Industrial Floor Space Utilization Survey "CIFSUS" Table 8.

1.3 Purpose of this Report

- 1.3.1 The aim of this Sewerage Impact Assessment (SIA) is to define the sewerage network arising from proposed development. The impacts on the existing sewerage network are assessed and mitigation measures (if found necessary) are formulated.
- 1.3.2 The scope of the Project comprises private housing development with a clubhouse in Sha Ha.
- 1.3.3 This SIA Report has been prepared to:
 - (a) fully satisfy the requirements of this Scope in respect of the prediction and assessment of impacts, the identification of sewerage impact mitigation measures and the associated residual impacts;
 - (b) provide assessment and evaluation of the sewerage impact and cumulative effects arising from the Project sufficient to identify those issues of key concern during the construction and operation of the Project;
 - (c) define measurable sewerage parameters and features likely to be affected by the Project;
 - (d) recommend optimum sewerage scheme for the Project;
 - (e) prescribe the specification for detailed design, construction and operation requirements of the recommended sewerage scheme;
 - (f) provide the assessment findings, conclusions, recommendations and a mechanism for implementation; and
 - (g) include any revisions or supplements to the above as might be required by the EPD and DSD.
- 1.3.4 The SIA Report shall be submitted for approval by EPD and DSD on the methodologies, findings, proposals, recommendations and conclusions of the SIA.
- 1.3.5 This Sewerage Impact Assessment Report is structured as follows:
 - Section 1 – Introduction**, introduces the Project Background, Objectives and Scope of the Project.
 - Section 2 – Methodology and Design Criteria**, presents the Methodology and Design Criteria.
 - Section 3 – Sewerage Impact Assessment**, presents the Sewerage Impact Assessment.
 - Section 4 – Construction, Operation and Maintenance of New Sewerage Facilities**, presents Construction, Operation and Maintenance of New Sewerage Facilities.
 - Section 5 – Conclusion**, summarises the Conclusions.

2. Methodology and Design Criteria

2.1 Methodology

2.1.1 The following methodology is adopted in carrying out the SIA:

- Identify the scope, parameters and programme of the development;
- Estimate the sewage flow generation of the development;
- Identify the existing and planned sewerage systems within and near the proposed development boundary;
- Examine the impact arising from new sewage generation from the proposed development on the existing sewerage network; and
- Identify new and upgrading sewerage works to support the proposed development.

2.1.2 The SIA has been carried out in accordance with the following guidelines set out in EPD Report No. EPD/TP1/05 “*Guidelines for Estimating Sewage Flows (GESF) for Sewerage Infrastructure Planning Version 1.0*” and DSD’s Sewerage Manual.

2.2 Parameters and Assumptions

2.2.1 The key parameters used for flow estimation in this SIA are: the unit flow factor; the peak flow factor; and the population/ employee density.

Unit Flow Factor – Domestic Flows

2.2.2 The Unit flow factors (UFF) for domestic sewage flow due to residential population of the proposed development and the existing sewerage catchment are shown in **Table 2.1** based on the Table T-1 of GESF.

Table 2.1 Unit Flow Factor for Domestic Flows

Residential Type	Unit Flow Factor (m ³ /person/day) ⁽¹⁾
Private R3	0.37
Private R4	0.37
Modern Village	0.27

⁽¹⁾ GESF Table T-1 values for “Planning for Future” have conservatively been adopted.

Unit Flow Factor – Commercial Flows

2.2.3 The UFFs for commercial sewage flows due to employed population of the proposed development and the existing sewerage catchment are shown in **Table 2.2** based on the Table T-2 of GESF.

2.2.4 The total unit flow generated from an employee in a particular trade is the sum of the UFF of the employee and the UFF of commercial activities of a particular trade under consideration.

Table 2.2 Unit Flow Factor for Commercial Flows

Commercial Type	UFF (m ³ /employee/day)
Commercial Employee ⁽¹⁾	0.080
Commercial Activities	
(a) Specific trades:	
J11 – Community, Social & Personal Services	0.200

⁽¹⁾ Commercial employees refer to sewage generation arising from the staff of the clubhouse ancillary to the residential development.

Peaking Factors

2.2.5 The peaking factors to cater for seasonal/diurnal flow variations, and infiltration and inflow due to storm events are referenced to EPD's GESF and shown in **Table 2.3**.

Table 2.3 Peaking Factors for Various Population Ranges

Population Range	Peaking Factor (Including Stormwater Allowance) for Facility with Existing Upstream Sewerage	Peaking Factor (Excluding Stormwater Allowance) for Facility with Existing Upstream Sewerage
<i>Sewers</i>		
< 1,000	8	6
1,000 – 5,000	6	5
5,000 – 10,000	5	4
10,000 – 50,000	4	3
> 50,000	Max (7.3/N ^{0.15} , 2.4) ^[1]	Max (6/N ^{0.175} , 1.6) ^[1]
<i>Sewage Treatment Works, Preliminary Treatment Works and Pumping Stations</i>		
< 10,000	4	3
10,000 – 25,000	3.5	2.5
25,000 – 50,000	3	2
> 50,000	Max (3.9/N ^{0.065} , 2.4) ^[1]	Max (2.6/N ^{0.065} , 1.6) ^[1]
Note: [1] N = Contributing population in thousands		

2.2.6 With consideration of the reduced hydraulic performance due to the deterioration of sewer pipes with time, peaking factors (including stormwater allowance) is adopted in this Study.

Population Density

- 2.2.7 A person per flat (PPF) ratio of 2.9 is adopted for the estimating the existing population based on the average household size in Sai Kung District Council in “*Table 130-06806: Average household size and median monthly household income of households by District Council district*” of General Household Survey (GHS) from January to December of the year 2023¹.
- 2.2.8 The employment population density has been referenced to Table 8 of PlanD's Commercial and Industrial Floor Space Utilization Survey "CIFSUS":
- Community, Social & Personal Services: Assume 3.3 employee per 100m² of GFA

Hydraulic Analysis

- 2.2.9 Colebrook-White equation is applied for pipe hydraulic analysis. The design roughness coefficients (Ks) for existing pipeline system are assumed to be 0.3mm (Slimed sewer slimed to about half depth; velocity when flowing half full approximately 1.2 m/s, uPVC, under normal condition). The design roughness coefficients (Ks) for proposed pipeline system are 0.3mm in consideration of its reduced hydraulic performance in future due to degradation of material.
- 2.2.10 For small diameter sewers of diameter less than 300mm, the flow velocity of at least 0.7m/s shall occur daily, or that a gradient of at least 1:DN (i.e. Nominal diameter of the sewer in mm) is provided, provided that a flow of 2 times of Average Dry Weather Flow (ADWF) is assumed to occur at least once daily. For larger diameter sewers of diameter up to 900mm, a self-cleansing velocity of 1.0m/s in full pipe condition shall be achieved. The maximum flow velocity at peak flow shall be 3m/s.

¹ https://www.censtatd.gov.hk/en/web_table.html?id=130-06806

3. Sewerage Impact Assessment

3.1 Existing and Planned Sewerage Infrastructure

Existing Sewerage System

- 3.1.1 Based on the DSD Drainage records, there is an existing sewerage network with sewers with 300mm dia. along Tai Mong Tsai Road which discharges to SKSPS2 and flows ultimately to SKSTW.
- 3.1.2 SKSTW is a secondary treatment works facility for Sai Kung District. The ADWF received at the facility is approximately 8,000 m³/day².

Planned Sewerage System

- 3.1.3 SKSTW is under plan for an upgrade in order to cater for the increased demand from projected ultimate population and planned developments in Sai Kung.
- 3.1.4 Under PWP Item No. 4226DS³, the followings are included as planned improvement:
- (i) The project will increase the treatment capacity of the existing SKSTW from 8,000 m³/day to 22,000 m³/day.
- 3.1.5 Under PWP Item No. 4431DS⁴, the followings are included as planned improvement:
- (i) Construction of about 4.2 km of gravity sewers for 3 unsewered areas (including Wong Chuk Wan, Wo Mei and Heung Chung), one sewage treatment works, one sewage pumping station, about 1.2 km of rising mains and ancillary works in Sai Kung.

3.2 Sewage Generation from the Existing Development

- 3.2.1 The sewage flow generated from the existing development (upstream of proposed development) is about 629.8m³/day (ADWF), while the peak flow is 43.7L/s (peak factor = 6). The detailed calculations for sewage flow estimation are included in **Appendix A** and summarised in **Table 3.1**.

Table 3.1 Sewage Flow Estimation for the Existing Development

Existing Development ⁽¹⁾	Estimated ADWF (m ³ /day) ⁽³⁾
Sea View Villa	45.1
Shinji Shumeikai Hong Kong Church	16.0
Lotus Villas	16.3
Hilldon	3.3
Arcadia	8.9

² <https://www.dsd.gov.hk/others/saikungstwtocaverns/en/existing-sai-kung-sewage-treatment-facilities.html>

³ <https://www.epd.gov.hk/eia/register/profile/latest/esb067.pdf>

⁴ https://www.dsd.gov.hk/EN/Our_Projects/All_Projects/4431DS.html

Existing Development ⁽¹⁾	Estimated ADWF (m ³ /day) ⁽³⁾
Hillock	10.0
Burlingame Garden	16.3
Hunlicar Garden	3.3
Remaining discrete houses along Chuk Yeung Road	22.6
Tai Wan Village	286.7
Luna House	2.2
Violet Garden	8.9
Sha Ha Village	42.4
Peak Catchment Inflow Factor	1.30 ⁽⁴⁾
Total ADWF (m³/day)	482.0
Total ADWF including Catchment Inflow Factor (m³/day)	626.6
Contributing population	2321
Peaking Factor ⁽²⁾	6
Peak Flow (L/s)	43.5
Additional Flow from Wong Chuk Wan SPS (PWP Item No. 4431 DS) (m ³ /day) ⁽⁵⁾	1350.0
Peaking Factor for the flow from Wong Chuk Wan SPS ⁽⁶⁾	4
Additional Flow from Wong Chuk Wan SPS (L/s)	62.5
Additional Flow from Swimming Pools Backwashes (m³/day)	2.5

Remarks:

- (1) Existing upstream development have been estimated based on the sewerage network information available on government website <https://www.map.gov.hk/gm/>
- (2) Peaking Factor =6 for contributing population >1000 and <5000 based on EPD's Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0 (GESF) Table T-5.
- (3) Numbers are rounded to 1 decimal place.
- (4) Catchment Inflow Factor = 1.3 based on Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0 Table T-4 Sai Kung catchment.
- (5) The flow from Wong Chuk Wan SPS is taken from:
https://www.gld.gov.hk/egazette/tc_chi/gazette/file.php?year=2020&vol=24&no=13&extra=0&type=0&number=1498
- (6) Peaking Factor = 4 for contributing population <10000 (including stormwater allowance) based on EPD's Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0 Table T-5.

3.3 Sewage Generation from the Proposed Development

- 3.3.1 The sewage flow generated from the proposed development is about 285.0 m³/day (ADWF), while the peak flow is 19.8 L/s (peaking factor = 6 ⁽³⁾), while the additional flow from outdoor swimming pool is 9.8 m³/day. The detailed calculations for sewage flow estimation are included in **Appendix A** and summarised in **Table 3.2**.

Table 3.2 Sewage Flow Estimation for the Proposed Development

Proposed Development	Estimated ADWF (m ³ /day) ⁽⁴⁾
Residential	279.7
Clubhouse	5.3
Total ADWF(m³/day)⁽¹⁾	285.0
Contributing population ⁽²⁾	1,056
Peaking Factor ⁽³⁾	6
Peak Flow (L/s)	19.8
Additional Flow from Outdoor Swimming Pool (m³/day)	9.8⁽⁵⁾

Remarks:

- (1) Catchment Inflow Factor = 1.0, for new catchments which are deemed to be free from misconnections and pipe defects based on EPD's GESF Section 10.1.
- (2) From GESF section 12, contributing population is calculated as ADWF/0.27
- (3) Peaking Factor (including stormwater allowance) = 6 for contributing population = 1,000 – 5,000 based on EPD's GESF Table T-5 for facilities with existing upstream sewerage.
- (4) Numbers are rounded to 1 decimal place
- (5) Refer to Appendix A Sheet No. 2 Estimation of Sewerage Discharge from Proposed Development

3.4 Proposed Development Sewerage System

Sewerage Connection Proposal

- 3.4.1 To accommodate the sewage generation from Proposed Development, a new 225mm dia. sewage branch is proposed laying along the access road and connect to the existing manhole on Tai Mong Tsai Road. The proposed sewers are shown in **Table 3.3**, from the proposed terminal manhole (TMH) to the existing manhole ID (FMH4042114). Proposed connection drawing is in **Appendix B**.

Table 3.3 Proposed Sewage pipe connection from Terminal Manhole to Existing Sewerage Network

Location	Upstream Manhole	Downstream Manhole	Sewer size (mm)	Upstream Invert Level (mPD)	Downstream Invert Level (mPD)
Proposed Development	TMH	FMH4042114	225	8.30	8.20

Hydraulic Check

3.4.2

Hydraulic capacity check has been undertaken for the downstream sewerage system and results are presented in **Table 3.4**. The network under existing condition already exceeds its own capacity. Detailed calculations are included in **Appendix A**.

Table 3.4 Sewers Capacity Check

Location option	Upstream Manhole	Downstream Manhole	Sewer size (mm)	Upstream Invert Level (mPD)	Downstream Invert Level (mPD)	% of Max. Peak flow to sewer capacity
Existing Scheme	FMH4042114	FMH4042126	300	8.01	7.78	123%
	FMH4042126	FMH4042115	300	7.76	7.45	114%
	FMH4042115	FMH4042116	300	7.42	7.16	121%
	FMH4042116	FMH4042117	300	7.15	7.03	121%
	FMH4042117	FMH4042118	300	7.02	6.85	87%
	FMH4042118	FMH4042119	300	6.83	6.75	116%
	FMH4042119	FMH4042120	300	6.72	6.57	115%
	FMH4042120	FMH4042121	300	6.55	6.39	121%
	FMH4042121	FMH4042122	300	6.28	5.72	63%
	FMH4042122	FMH4042123	300	5.66	5.10	57%
	FMH4042123	FMH4042124	300	4.98	4.87	67%
Proposed Development	TM	FMH4042114	225	8.30	8.20	52%
	FMH4042114	FMH4042126	300	8.01	7.78	153%
	FMH4042126	FMH4042115	300	7.76	7.45	142%
	FMH4042115	FMH4042116	300	7.42	7.16	151%
	FMH4042116	FMH4042117	300	7.15	7.03	151%
	FMH4042117	FMH4042118	300	7.02	6.85	108%
	FMH4042118	FMH4042119	300	6.83	6.75	144%
	FMH4042119	FMH4042120	300	6.72	6.57	144%
	FMH4042120	FMH4042121	300	6.55	6.39	150%
	FMH4042121	FMH4042122	300	6.28	5.72	78%
	FMH4042122	FMH4042123	300	5.66	5.10	71%
	FMH4042123	FMH4042124	300	4.98	4.87	83%

3.4.3

Parts of the sewerage system along Tai Mong Tsai Road are under surcharge condition. Freeboard calculation was also conducted to check whether there are sufficient freeboards for the sewage flow from Subject Site. Detailed calculations are included in **Appendix A**.

Table 3.5 Freeboard Checking

Scenario	Upstream Manhole	Downstream Manhole	Sewer size (mm)	Upstream Invert Level (mPD)	Downstream Invert Level (mPD)	Freeboard at upstream manhole (m)
Peak flow x 1.0 while	FMH4042114	FMH4042126	300	8.01	7.78	-3.46
	FMH4042126	FMH4042115	300	7.76	7.45	-2.56

Scenario	Upstream Manhole	Downstream Manhole	Sewer size (mm)	Upstream Invert Level (mPD)	Downstream Invert Level (mPD)	Freeboard at upstream manhole (m)
freeboard >= 1m	FMH4042115	FMH4042116	300	7.42	7.16	-1.62
	FMH4042116	FMH4042117	300	7.15	7.03	-0.69
	FMH4042117	FMH4042118	300	7.02	6.85	-0.10
	FMH4042118	FMH4042119	300	6.83	6.75	0.40
	FMH4042119	FMH4042120	300	6.72	6.57	0.91
	FMH4042120	FMH4042121	300	6.55	6.39	1.27
Peak flow x 1.15 FOS while Freeboard >= 0m	FMH4042114	FMH4042126	300	8.01	7.78	-5.92
	FMH4042126	FMH4042115	300	7.76	7.45	-4.64
	FMH4042115	FMH4042116	300	7.42	7.16	-3.29
	FMH4042116	FMH4042117	300	7.15	7.03	-1.96
	FMH4042117	FMH4042118	300	7.02	6.85	-1.11
	FMH4042118	FMH4042119	300	6.83	6.75	-0.38
	FMH4042119	FMH4042120	300	6.72	6.57	0.34
	FMH4042120	FMH4042121	300	6.55	6.39	0.97

3.4.4 As there are no sufficient freeboard in the concerned manholes, sewerage upgrade is proposed by upgrading the sewers from manhole FMH4042114 to FMH4042124, from 300mm dia. to 375mm dia. HDPE pipes. As the maximum velocity of the sewerage from manhole FMH4042121 to FMH4042124 exceed 3 m/s, new invert levels are proposed to keep the maximum within 3 m/s. Detailed calculation is supplemented in **Appendix A**.

Table 3.6 Sewerage Capacity Checking after Proposed Upgrading Works

Location option	Upstream Manhole	Downstream Manhole	Sewer size (mm)	Upstream Invert Level (mPD)	Downstream Invert Level (mPD)	% of Max. Peak flow to sewer capacity
Proposed Sewerage Upgrading Works	FMH4042114	FMH4042126	375	8.01	7.78	85%
	FMH4042126	FMH4042115	375	7.76	7.45	79%
	FMH4042115	FMH4042116	375	7.42	7.16	84%
	FMH4042116	FMH4042117	375	7.15	7.03	84%
	FMH4042117	FMH4042118	375	7.02	6.85	60%
	FMH4042118	FMH4042119	375	6.83	6.75	80%
	FMH4042119	FMH4042120	375	6.72	6.57	80%
	FMH4042120	FMH4042121	375	6.55	6.39	84%
	FMH4042121	FMH4042122	375	6.18	5.72	48%
	FMH4042122	FMH4042123	375	5.52	5.10	46%
	FMH4042123	FMH4042124	375	4.91	4.87	77%

3.5 Potential Sewerage Impact

3.5.1 The sewerage network will discharge to the SKSPS2 located downstream and finally will be treated at SKSTW located at Wa Fuk Street. In addition to the verification of the existing sewer downstream of the connection location also the impacts on SKSPS2 and SKSTW have been assessed. The further downstream the assessed infrastructure, the less the proposed development will generate any impact as the additional flow will become progressively a smaller portion of the overall sewage flows.

3.5.2 The SKSPS2 has sufficient capacity to accommodate the additional sewage flows from the proposed development as shown in **Table 3.5** and **Appendix A**. No capacity upgrade of sewage pumping station no.2 is required.

Table 3.7 SKSPS2 Capacity Check

	ADWF (m ³ /day)	SKSPS2 Capacity (m ³ /day)	SKSPS2 Utilisation (%)	SKSPS2 Spare Capacity (m ³ /day)	SKSPS2 Spare Capacity (%)
Existing Sewage Flow	1,776.0	6,480	27%	4,704	73%
Proposed Sewage Flow	2,061.0		32%	4,419	68%

3.5.3 The SKSTW is planned to be upgraded, increasing its treatment capacity from the existing 8,000 m³/day to 22,000 m³/day. The increase in utilisation rate due to the additional sewage flow generated by the proposed development has been assessed against both conditions. As shown in **Table 3.6** and **Appendix A**, the utilisation increase is insignificant compared the treatment works capacity. No capacity upgrade of sewage treatment works is required.

Table 3.8 TPSTW Capacity Check

	Capacity (m ³ /day)	Development Proposed Sewage Flow (m ³ /day)	Utilisation Increase of SKSTW
Existing SKSTW	8,000	285	3.6%
Upgraded SKSTW	22,000		1.3%

3.5.4 The SKSPS2 and SKSTW are designed to cater for the regional sewage generation, thus no adverse impact to SKSPS2 and SKSTW is caused by the proposed development.

4. Construction, Operation and Maintenance of New Sewerage Facilities

- 4.1.1 The proposed sewerage works within the development boundary including the construction of new sewers connection and the proposed terminal manhole (TMH) will be constructed, operated and maintained by the future management agent.
- 4.1.2 The proposed sewerage connection mentioned in **Section 3.4** will be undertaken by the project proponent. The portion of sewers downstream of terminal manhole will be handed over to DSD upon completion of construction works for future maintenance as part of the public network.

5. Conclusion

- 5.1.1 A sewerage impact assessment has been carried out for the proposed development of at Sai Kung.
- 5.1.2 The sewage flows under existing and proposed conditions have been assessed. To discharge sewage generated from the proposed location, a new sewerage branch is proposed. Sewage from the Proposed Development will be discharged through a 225 mm dia. sewer from a new terminal manhole (i.e. TMH) into the existing sewerage network at manhole FMH4042114. The existing sewerage network is proposed to be upgraded to 375mm dia. to provide sufficient capacity to cater for the proposed additional flow. The proposed upgrading works extend from existing sewer manhole FMH4042114 to existing sewer manhole FMH4042124.
- 5.1.3 The SKSPS2 and SKSTW are deemed to be designed to cater for the regional sewage generation, thus it is not anticipated for any adverse impact on SKSPS2 and SKSTW due to the proposed development.

Abbreviation List

Abbreviation	Definition
ADWF	Average Dry Weather Flow
DSD	Drainage Services Department
EPD	Environmental Protection Department
GESF	Guidelines for Estimating Sewage Flows
GFA	Gross Floor Area
PWP	Public Works Programme
PPF	Person Per Flat
SIA	Sewerage Impact Assessment
SKSPS2	Sai Kung Sewage Pumping Station No. 2
SKSTW	Sai Kung Sewage Treatment Works
UFF	Unit Flow Factor

Appendix A

Sewage Generation Estimation

ARUP Job Title: Application for Planning Permission Under Section 16 of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development in Area Shown as ‘Road’, Various Lots in D.D. 221 and Adjoining Government Land, Sha Ha, Sai Kung Calculation: Estimation of Sewage Discharge from Existing Development	Job No.		Sheet No.	Rev.
	302260		1	3
	Made by JP		Date 05/2025	Chd. NP

Exisiting Development along Chuk Yeung Road		
Sea View Villa 西沙小築 (Catchment 1)		
Number of Houses	42	
Number of Flats	42	Flats
Size of household/flat ⁽¹⁾	2.9	Persons/flat
Population	122	Persons
Per Capita Flow ⁽²⁾ - R4	0.37	m ³ /day/person
Estimated Dry Weather Flow	45.1	m ³ /day
Swimming Pool Flow Assume: - Pool size = 100m ² with 1.5m water depth. - Pool volume = 100 x 1.5 = 150 m ³ . - Turnover rate = 6 hours. - Filter loading rate = 48 m ³ /m ² /hr. - Filter area required = 150 / 6 / 48 = 0.521 m ² . - Backwash flow rate = 0.5 m ³ /m ² /min. - Backwash flow = 0.521 x 0.5 = 0.26 m ³ /min = 4.3 L/s	4.3	L/s
Shinji Shumeikai Hong Kong Church 香港神慈秀明會 (Catchment 1)		
Building Area (measured on GeoInfo Map)	1715	m ²
Employee per GFA (in 100 m ²) ⁽⁷⁾	3.3	Persons
Employee Population	57	Persons
Per Capita Flow ⁽⁵⁾ - J11 (commercial employees + J11)	0.28	m ³ /day
Estimated Dry Weather Flow	16.0	m ³ /day
Lotus Villas 樂濤居 (Catchment 1)		
Number of Houses	15	
Number of Flats	15	Flats
Size of household/flat ⁽¹⁾	2.9	Persons/flat
Population	44	Persons
Per Capita Flow ⁽²⁾ - R4	0.37	m ³ /day/person
Estimated Dry Weather Flow	16.3	m ³ /day
Swimming Pool Flow Assume: - Pool size = 80m ² with 1.5m water depth. - Pool volume = 80 x 1.5 = 120 m ³ . - Turnover rate = 6 hours. - Filter loading rate = 48 m ³ /m ² /hr. - Filter area required = 120 / 6 / 48 = 0.417 m ² . - Backwash flow rate = 0.5 m ³ /m ² /min. - Backwash flow = 0.417 x 0.5 = 0.21 m ³ /min = 4.3 L/s	3.5	L/s
Hildon 浩瀚臺 (Catchment 1)		
Number of Houses	3	
Number of Flats	3	Flats
Size of household/flat ⁽¹⁾	2.9	Persons/flat
Population	9	Persons
Per Capita Flow ⁽²⁾ - R4	0.37	m ³ /day/person
Estimated Dry Weather Flow	3.3	m ³ /day
Swimming Pool Flow Assume: - Pool size = 55m ² with 1.5m water depth. - Pool volume = 55 x 1.5 = 82.5 m ³ . - Turnover rate = 6 hours. - Filter loading rate = 48 m ³ /m ² /hr. - Filter area required = 82.5 / 6 / 48 = 0.286 m ² . - Backwash flow rate = 0.5 m ³ /m ² /min. - Backwash flow = 0.286 x 0.5 = 0.14 m ³ /min = 2.4 L/s	2.4	L/s
Arcadia 龍嶺 (Catchment 1)		
Number of Houses	8	
Number of Flats	8	Flats

ARUP Job Title: Application for Planning Permission Under Section 16 of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development in Area Shown as ‘Road’, Various Lots in D.D. 221 and Adjoining Government Land, Sha Ha, Sai Kung Calculation: Estimation of Sewage Discharge from Existing Development	Job No.		Sheet No.		Rev.	
	302260		1		3	
	Made by JP		Date 05/2025		Chd. NP	

Size of household/flat ⁽¹⁾	2.9	Persons/flat
Population	24	Persons
Per Capita Flow ⁽²⁾ - R4	0.37	m ³ /day/person
Estimated Dry Weather Flow	8.9	m ³ /day
Swimming Pool Flow		
Assume:		
- Pool size = 85m ² with 1.5m water depth.		
- Pool volume = 85 x 1.5 = 127.5 m ³ .		
- Turnover rate = 6 hours.		
- Filter loading rate = 48 m ³ /m ² /hr.		
- Filter area required = 127.5 / 6 / 48 = 0.443 m ² .		
- Backwash flow rate = 0.5 m ³ /m ² /min.		
- Backwash flow = 0.443 x 0.5 = 0.22 m ³ /min = 3.7 L/s	3.7	L/s
Hillock 樂居 (Catchment1)		
Number of Houses	9	
Number of Flats	9	Flats
Size of household/flat ⁽¹⁾	2.9	Persons/flat
Population	27	Persons
Per Capita Flow ⁽²⁾ - R4	0.37	m ³ /day/person
Estimated Dry Weather Flow	10.0	m ³ /day
Burlingame Garden 柏寧頓花園 (Catchment 2)		
Number of Houses	15	
Number of Flats	15	
Size of household/flat ⁽¹⁾	2.9	Persons
Population	44	
Per Capita Flow ⁽²⁾ - R4	0.37	m ³ /day
Estimated Dry Weather Flow	16.3	m ³ /day
Hunlicar Garden 雄愉花園 (Catchment 2)		
Number of Houses	3	
Number of Flats	3	Flats
Size of household/flat ⁽¹⁾	2.9	Persons/flat
Population	9	Persons
Per Capita Flow ⁽²⁾ - R4	0.37	m ³ /day/person
Estimated Dry Weather Flow	3.3	m ³ /day
Remaining discrete houses along Chuk Yeung Road (till 109 Chuk Yeung Road) (Catchment 2)		
Number of Houses	7	
Number of Storeys per Houses (Assueming 3 Storeys per Houses)	3	
Number of Flats (assueming 1 flat per storey)	21	Flats
Size of household/flat ⁽¹⁾	2.9	Persons/flat
Population	61	Persons
Per Capita Flow ⁽²⁾ - R4	0.37	m ³ /day/person
Estimated Dry Weather Flow	22.6	m ³ /day

FMH4042115	FMH4042116	10.24	9.92	7.42	7.16	2.52	2.46	38.3	0.007	147.3	300	0.071	10%	0.064	0.400	0.942	0.075	0.300	1.402	0.099	0.0	911.6	3,376	6	0.063	0.0862	151%	0.2700	0.5	1	0.1860	0.3721	6.40E+05	7	0.02	1.09E+00	1.65	0.27	13.53	8.08	YES	-3.29	review						
FMH4042116	FMH4042117	9.92	9.70	7.15	7.03	2.47	2.37	17.8	0.007	148.3	300	0.071	10%	0.064	0.398	0.942	0.075	0.300	1.397	0.099	0.0	911.6	3,376	6	0.063	0.0862	151%	0.2700	0.5	1	0.1860	0.3721	6.40E+05	7	0.02	5.08E-01	1.07	0.27	11.88	7.75	YES	-1.96	review						
FMH4042117	FMH4042118	9.70	9.50	7.02	6.85	2.38	2.35	13.0	0.013	76.5	300	0.071	10%	0.064	0.555	0.942	0.075	0.300	1.954	0.138	0.0	911.6	3,376	6	0.063	0.0862	108%	0.2700	0.5	1	0.1860	0.3721	6.40E+05	7	0.02	3.71E-01	0.93	0.27	10.81	7.46	YES	-1.11	review						
FMH4042118	FMH4042119	9.50	9.36	6.83	6.75	2.37	2.31	10.8	0.007	135.0	300	0.071	10%	0.064	0.418	0.942	0.075	0.300	1.465	0.104	0.0	911.6	3,376	6	0.063	0.0862	144%	0.2700	0.5	1	0.1860	0.3721	6.40E+05	7	0.02	3.08E-01	0.87	0.27	9.88	7.33	YES	-0.38	review						
FMH4042119	FMH4042120	9.36	8.86	6.72	6.57	2.34	1.99	20.1	0.007	134.0	300	0.071	10%	0.064	0.419	0.942	0.075	0.300	1.471	0.104	0.0	911.6	3,376	6	0.063	0.0862	144%	0.2700	0.5	1	0.1860	0.3721	6.40E+05	7	0.02	5.74E-01	1.13	0.27	9.02	7.15	YES	0.34	freeboard >0, OK						
FMH4042120	FMH4042121	8.86	8.32	6.55	6.39	2.01	1.63	23.4	0.007	146.3	300	0.071	10%	0.064	0.401	0.942	0.075	0.300	1.407	0.099	0.0	911.6	3,376	6	0.063	0.0862	150%	0.2700	0.5	1	0.1860	0.3721	6.40E+05	7	0.02	6.68E-01	1.23	0.27	7.89	7.05	YES	0.97	freeboard >0, OK						
FMH4042121	FMH4042122	8.32	7.84	6.28	5.72	1.74	1.82	22.4	0.025	40.0	300	0.071	10%	0.064	0.767	0.942	0.075	0.300	2.712	0.192	0.0	911.6	3,376	6	0.063	0.0862	78%																						
FMH4042122	FMH4042123	7.84	7.52	5.66	5.1	1.88	2.12	18.7	0.030	33.4	300	0.071	10%	0.064	0.840	0.942	0.075	0.300	2.970	0.210	0.0	911.6	3,376	6	0.063	0.0862	71%																						
FMH4042123	FMH4042124	7.52	7.35	4.98	4.87	2.24	2.18	5.0	0.022	45.5	300	0.071	10%	0.064	0.720	0.942	0.075	0.300	2.542	0.180	0.0	911.6	3,376	6	0.063	0.0862	83%																						
Proposed Sewerage Upgrading																																																	
TM	FMH4042114	11.00	10.88	8.30	8.20	2.48	2.46	10.0	0.010	100.0	225	0.040	10%	0.036	0.420	0.707	0.056	0.300	1.422	0.057	285.0	285.0	1,056	6	0.020	0.0098	52%																						
FMH4042114	FMH4042126	10.88	10.60	8.01	7.78	2.50	2.45	35.0	0.007	152.2	375	0.110	10%	0.099	0.440	1.178	0.094	0.300	1.587	0.175	626.6	911.6	3,376	6	0.063	0.0862	85%																						
FMH4042126	FMH4042115	10.60	10.24	7.76	7.45	2.47	2.42	40.4	0.008	130.3	375	0.110	10%	0.099	0.475	1.178	0.094	0.300	1.716	0.190	0.0	911.6	3,376	6	0.063	0.0862	79%																						
FMH4042115	FMH4042116	10.24	9.92	7.42	7.16	2.45	2.39	38.3	0.007	147.3	375	0.110	10%	0.099	0.447	1.178	0.094	0.300	1.613	0.178	0.0	911.6	3,376	6	0.063	0.0862	84%																						
FMH4042116	FMH4042117	9.92	9.70	7.15	7.03	2.40	2.30	17.8	0.007	148.3	375	0.110	10%	0.099	0.445	1.178	0.094	0.300	1.607	0.178	0.0	911.6	3,376	6	0.063	0.0862	84%																						
FMH4042117	FMH4042118	9.70	9.50	7.02	6.85	2.31	2.28	13.0	0.013	76.5	375	0.110	10%	0.099	0.620	1.178	0.094	0.300	2.248	0.248	0.0	911.6	3,376	6	0.063	0.0862	60%																						
FMH4042118	FMH4042119	9.50	9.36	6.83	6.75	2.30	2.24	10.8	0.007	135.0	375	0.110	10%	0.099	0.467	1.178	0.094	0.300	1.686	0.186	0.0	911.6	3,376	6	0.063	0.0862	80%																						
FMH4042119	FMH4042120	9.36	8.86	6.72	6.57	2.27	1.92	20.1	0.007	134.0	375	0.110	10%	0.099	0.469	1.178	0.094	0.300	1.692	0.187	0.0	911.6	3,376	6	0.063	0.0862	80%																						
FMH4042120	FMH4042121	8.86	8.32	6.55	6.39	1.94	1.56	23.4	0.007	146.3	375	0.110	10%	0.099	0.449	1.178	0.094	0.300	1.619	0.179	0.0	911.6	3,376	6	0.063	0.0862	84%																						
FMH4042121	FMH4042122	8.32	7.84	6.18	5.72	1.77	1.75	22.4	0.021	48.7	375	0.110	10%	0.099	0.777	1.178	0.094	0.300	2.823	0.312	0.0	911.6	3,376	6	0.063	0.0862	48%																						
FMH4042122	FMH4042123	7.84	7.52	5.52	5.1	1.95	2.05	18.7	0.022	44.5	375	0.110	10%	0.099	0.813	1.178	0.094	0.300	2.954	0.326	0.0	911.6	3,376	6	0.063	0.0862	46%																						
FMH4042123	FMH4042124	7.52	7.35	4.91	4.87	2.24	2.11	5.0	0.008	125.0	375	0.110	10%	0.099	0.485	1.178	0.094	0.300	1.753	0.194	0.0	911.6	3,376	6	0.063	0.0862	77%																						

Notes:
(1) Refer to Catchment calculations.

ARUP		Job No.		Sheet No.		Rev.	
		302260		4		3	
		Member/Location					
		Drg. Ref.					
Job Title	Application for Planning Permission Under Section 16 of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development in Area Shown as ‘Road’, Various Lots in D.D. 221 and Adjoining Government Land, Sha Ha, Sai Kung						
Calculation	Estimation of Sewerage Discharge from Proposed Development					Made by JP Date 05/2025 Chd. NP	

Proposed downstream sewage facilities capacity check:

a) Change in Maximum Sewer Utilisation ⁽¹⁾

	ADWF (m ³ /day)	Peak Flow (L/s)	Existing/Proposed Sewer Size (mm)	Max. Utilisation at Downstream Pipeline
Existing Sewage Flow (Sewage Estimation of Existing Catchment)	1,976.6	119.9	225	/
			300	123.0%
Proposed Sewage Flow + Existing Sewage Flow (Sewage Estimation of Existing Catchment)	2,261.6	149.5	225	52.3%
			375	85.3%

b) Change in Maximum SKSPS2 Utilisation ⁽²⁾

	ADWF (m ³ /day)	SKSPS2 Capacity (m ³ /day)	SKSPS2 Utilisation (%)	SKSPS2 Spare Capacity (m ³ /day)	SKSPS2 Spare Capacity (%)
Existing Sewage Flow	1,776.0	6,480	27%	4,704	73%
Proposed Sewage Flow + Existing Sewage Flow	2,061.0		32%	4,419	68%

c) Change in SKSTW Utilisation

	Capacity (m ³ /day)	Development Proposed Sewage Flow (m ³ /day)	Utilisation Increase of SKSTW
Existing SKSTW	8,000	285	3.6%
Upgraded SKSTW	22,000		1.3%

Note:

1. The existing sewage flow ADWF and peak flow adopted are from the sewage estimation calculation (with WCWSPS flow).
2. The existing sewage flow and design capacity of SKSPS2 adopted here were provided by DSD/ST via email conversation.

Appendix B

Existing and Proposed Sewerage Network Plan

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828000 N

LONG MEI

WANG KONG TSUEN

MUK MIN SHAN

CHUK YEUNG ROAD

TAI MONG TSAI ROAD

SHA KOK MEI

WAI MAN ROAD

MEI YUEN STREET

西貢海
INNER PORT SHELTER
(SAI KUNG HOI)

INNER PORT SHELTER

西貢海
INNER PORT SHELTER
(SAI KUNG HOI)

LEGEND

-  PROPOSED DEVELOPMENT
-  APPLICATION SITE

Job Title

APPLICATION FOR PLANNING PERMISSION UNDER SECTION 16
OF THE TOWN PLANNING ORDINANCE (CAP. 131) FOR PROPOSED
RESIDENTIAL DEVELOPMENT IN AREA SHOWN AS 'ROAD', VARIOUS
LOTS IN D.D. 221 AND ADJOINING GOVERNMENT LAND, SHA HA,
SAI KUNG

Drawing Title

MASTER LOCATION PLAN

ARUP

Scale 1:2000 @ A1
Drn. RY Date 06/24 Chd. JW Passed KK

Drawing Status

SUBMISSION

Job No.

302260

Drawing No.

C/001

Rev.

B

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A	06/24	JP	FIRST ISSUE

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827800 N

橫江村
WANG KONG TSUEN

846000 E

CHUK YEUNG ROAD

TAI MONG TSAI ROAD

INCOMING SEWERAGE
FLOW FROM UPSTREAM
CATCHMENTS

FMH402300
AT 8.85-300

FMH402314
AT 8.85-300

FMH402326
AT 7.78-300

FMH402316
AT 7.42-300

FMH402316
AT 7.78-300

FMH402317
AT 7.02-300

FMH402318
AT 6.95-300

FMH402319
AT 6.72-300

FMH402320
AT 6.52-300

FMH402321
AT 6.28-300

FMH402322
AT 5.84-300

FMH402323
AT 4.95-300

FMH402324
AT 4.27-300

DISCHARGES TO
EXISTING MANHOLE
FMH402125

沙角尾
SHA KOK MEI

WAI MAN ROAD

MEI YUEN STREET

LEGEND



PROPOSED DEVELOPMENT



APPLICATION SITE



EXISTING SEWER AND MANHOLE

Job Title

APPLICATION FOR PLANNING PERMISSION UNDER SECTION 16
OF THE TOWN PLANNING ORDINANCE (CAP. 131) FOR PROPOSED
RESIDENTIAL DEVELOPMENT IN AREA SHOWN AS 'ROAD', VARIOUS
LOTS IN D.D. 221 AND ADJOINING GOVERNMENT LAND, SHA HA,
SAI KUNG

Drawing Title

EXISTING SEWERAGE
NETWORK

Drawing Status

SUBMISSION

ARUP

Scale 1:1000 @ A1

Drn. RY Date 06/24 Chd. JW Passed KK

Job No. 302260

Drawing No. C/SIA/001

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Filename :
Mark Date By Rev.

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A	06/24	JP	FIRST ISSUE

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827800 N

橫江村
WANG KONG TSUEN

846000 E

846200 E

846400 E

827600 N

沙角尾
SHA KOK MEI

INCOMING SEWERAGE
FLOW FROM UPSTREAM
CATCHMENTS

TM
CL 11.0
X1 8.30-225

TAI MONG TSAI ROAD

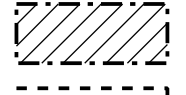
CHUK YEUNG ROAD

WAI MAN ROAD

MEI YUEN STREET

DISCHARGES TO
EXISTING MANHOLE
FMH4042125

LEGEND



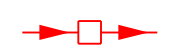
PROPOSED DEVELOPMENT



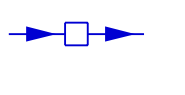
APPLICATION SITE



EXISTING SEWER AND MANHOLE



PROPOSED SEWER AND MANHOLE



EXISTING SEWER AND MANHOLE
TO BE UPGRADED

Job Title

APPLICATION FOR PLANNING PERMISSION UNDER SECTION 16
OF THE TOWN PLANNING ORDINANCE (CAP. 131) FOR PROPOSED
RESIDENTIAL DEVELOPMENT IN AREA SHOWN AS 'ROAD', VARIOUS
LOTS IN D.D. 221 AND ADJOINING GOVERNMENT LAND, SHA HA,
SAI KUNG

Drawing Title

PROPOSED SEWERAGE
NETWORK

Drawing Status

SUBMISSION

ARUP

Scale 1:1000 @ A1

Drn. RY Date 06/24 Chd. JW Passed KK

Job No.

302260

Drawing No.

C/SIA/002

Rev.

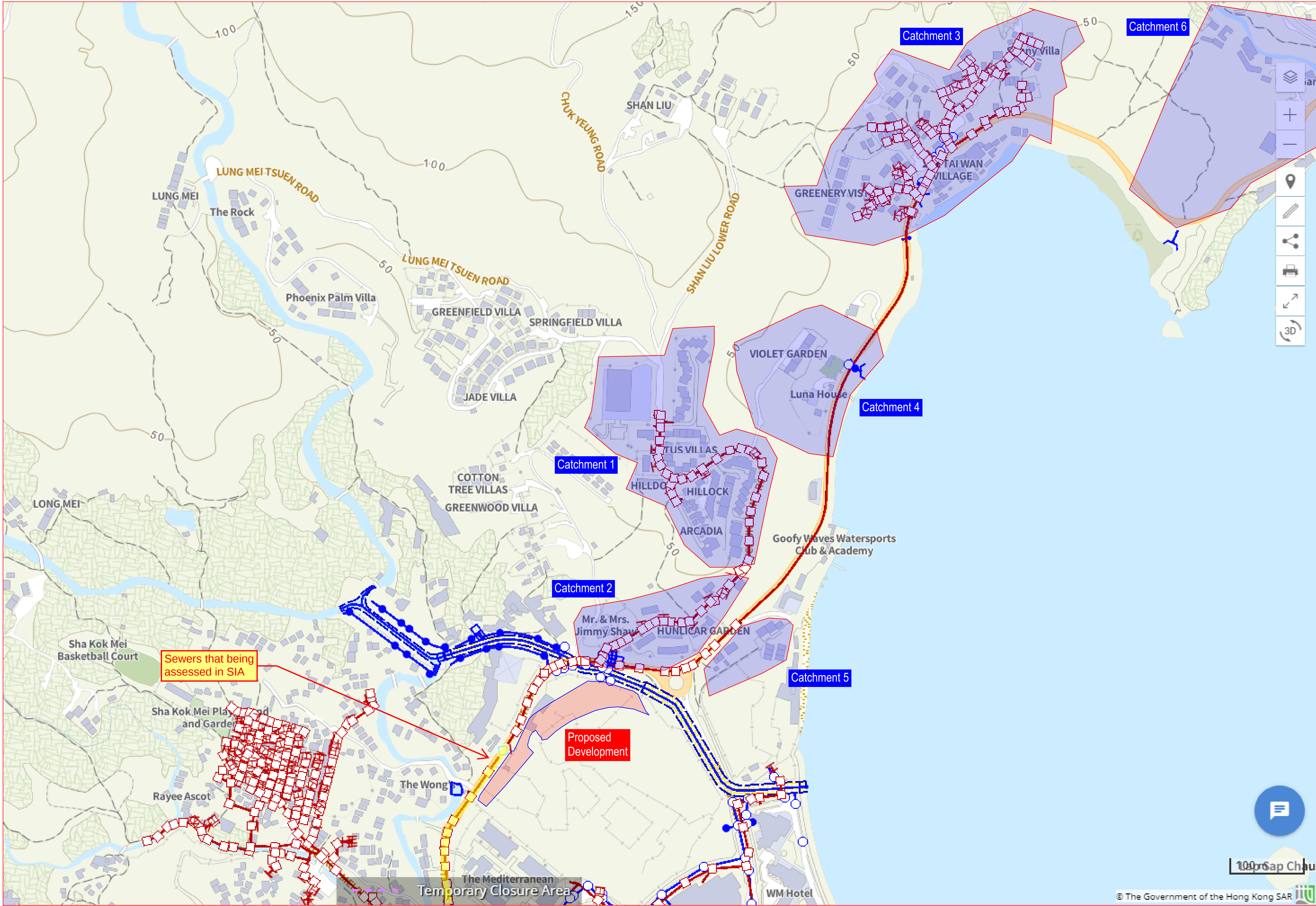
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A	06/24	JP	FIRST ISSUE



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A	06/24	JP	FIRST ISSUE

LEGEND

- PROPOSED DEVELOPMENT
- SEWERAGE CATCHMENT

Job Title
APPLICATION FOR PLANNING PERMISSION UNDER SECTION 16 OF THE TOWN PLANNING ORDINANCE (CAP. 131) FOR PROPOSED RESIDENTIAL DEVELOPMENT IN AREA SHOWN AS 'ROAD', VARIOUS LOTS IN D.D. 221 AND ADJOINING GOVERNMENT LAND, SHA HA, SAI KUNG

Drawing Title
SEWERAGE CATCHMENT PLAN

Drawing Status
SUBMISSION

ARUP			
Scale	1:1000 @ A1		
Drn.	RY	Date	06/24
Chd.	JW	Passed	KK
Job No.	302260	Drawing No.	C/SIA/003
Rev.	A		