
Appendix A
Sewerage Impact Assessment

Section 16 Planning Application for Proposed Mixed-Use Development (Proposed Flat with Permitted Commercial Uses) in Planning Area 32B, Hung Shui Kiu, New Territories (Application No.: A/HSK/619)

Sewerage Impact Assessment

August 2026

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1. Introduction

1.1 Background

- 1.1.1 AECOM Asia Company Limited (AECOM) has been commissioned by the project proponent to act as the engineering consultant to conduct a Sewerage Impact Assessment (SIA) for a private mixed-use development in Hung Shui Kiu, New Territories.
- 1.1.2 The S16 Planning Application involves Area 32B with total area of 13,601 m²; referred as the "Application Site". The Site is located next to the Kong Sham Western Highway. Location plan of the Application Site refers to figure no. **AREA 32B/SIA/Figure 1**.
- 1.1.3 The Application Site falls within "C(1)" zone on the Draft Hung Shui Kiu and Ha Tsuen OZP No. S/HSK/3. and lies within Hung Shui Kiu / Ha Tsuen (HSK/HT) New Development Area (NDA). According to the OZP, commercial uses including 'Hotel', 'Office', 'Eating Place', 'Shop and Services', etc. are always permitted in "C(1)" zone; while 'Flat' use is under Column 2, planning permission is therefore required for the proposed residential use in Site A of the Application Site.
- 1.1.4 This SIA report reviews the sewerage impact of the proposed development and serves as a supporting document for the S16 Planning Application.

1.2 Objective of this Submission

- 1.2.1 This report outlines the assessment results of the potential sewerage impacts caused by the Proposed Development at the Application Site. The main objectives of this assessment include the followings:
 - (i) Identify any increase in sewage flow due to the Proposed Development.
 - (ii) Review the existing sewerage condition of the Application Site based on available information.
 - (iii) Outline the methodology adopted in this assessment.
 - (iv) Assess any potential impact on the existing or planned sewerage facilities nearby due to the Proposed Development.
 - (v) Propose mitigation measures and/or improvement works to minimize any potential sewerage impact from the Proposed Development.
 - (vi) Discuss the responsibility of the construction and maintenance aspects of the proposed sewerage system.

1.3 Nomenclature

1.3.1 The following abbreviations and shortened expressions in **Table 1** are adopted in this report.

ADWF	Average Dry Weather Flow
AECOM	AECOM Asia Company Limited
CIF	Catchment Inflow Factor
CIFSUS	Commercial and Industrial Floor Space Utilization Survey (PlanD)
DSD	Drainage Services Department
EIA	Environmental Impact Assessment
EPD	Environmental Protection Department
F&B	Food and Beverage
GESF	Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0 (EPD)
GFA	Gross Floor Area
mPD	Metres above Principal Datum
PlanD	Planning Department
SWSTW	San Wai Sewage Treatment Works
HSKEPP	Hung Shui Kiu Effluent Polishing Plant
SIA	Sewerage Impact Assessment
UFF	Unit Flow Factor

Table 1 – Nomenclature

2. Development Proposal

2.1 The Indicative Development Proposal

- 2.1.1 The Application Site area is approximately 13,601m². Under the Proposed Development, the total plot ratio is not more than 9.5. (i.e. the total GFA is not more than 129,210m²) The Applicant proposed 71,066m² as non-domestic GFA for the permitted commercial use as of right, whereas the remaining 58,144m² GFA would be used for the proposed residential development.
- 2.1.2 The Proposed Development consists of Site A and Site B. Site A will be developed with 1,240 residential units, recreational facilities, and some permitted commercial use (e.g. retail). Site B will be developed with retail and office development, as well as a hotel which provides 924 rooms. The anticipated completion year of the Application Site (except for the remaining non-domestic GFA to be implemented at a later stage under the arrangement of “Pay for What You Build” Pilot Scheme) is 2033. Details refers to **Remark (3) of Table 2**.

2.2 Base Case for Area 32B

- 2.2.1 With reference to the OZP, the allowed maximum plot ratio is PR 9.5 and the total GFA is not more than 129,210m². As specified in the Outline Development Plan (ODP) No. D/HSK/1, the development mix for Area 32B is: 45% GFA for office use, 20% GFA for hotel use and 35% for retail use. Based on this mix, a hypothetical base case scenario is formed for sewage generation estimation.

2.2.2 The comparison table of development parameters between the base case and proposed development is summarized in **Table 2** below.

	Base Case	Proposed Development (Site A)	Proposed Development (Site B)
Site Area	13,601m ²	8,967m ²	4,634m ²
Total PR (not more than)	9.5	7.1	14.2
		9.5 (Site A + Site B)	
Total GFA (not more than)	129,210m ²	63,365m ²	65,845m ²
		129,210m ² (Site A + Site B)	
Domestic Portion			
Total Domestic GFA (not more than)	-	58,144m ²	-
No. of Units	-	1,240	-
Population ⁽¹⁾	-	3,348	-
Domestic Portion – Resident’s Recreational Facilities ⁽²⁾	-	2,325m ²	-
Non-Domestic Portion – Retail			
Total Non-Domestic GFA	45,223.5m ²	5,221m ² ⁽³⁾	354m ² ⁽³⁾
Non-Domestic Portion – Hotel			
Total Non-Domestic GFA	25,842m ²	-	27,871m ² ⁽³⁾
No. of Hotel Rooms	-	-	924
Non-Domestic Portion – Office			
Total Non-Domestic GFA	58,144.5m ²	-	37,620m ²
Non-Domestic Portion – Office (Completed in 2033)			
Total Non-Domestic GFA	-	-	9,290m ² ⁽³⁾
Non-Domestic Portion – Office (Remaining)			
Total Non-Domestic GFA	-	-	28,330m ²

Table 2 – Key Development Parameters

Remarks:

- (1) A person per flat of 2.7 is assumed.
- (2) Or such other areas of clubhouse as may be approved by the Buildings Department based on the total permissible domestic GFA for individual land parcel (site under the Buildings Ordinance) at the future General Building Plans.
- (3) Drawing upon the spirit of the "Pay for What You Build" Pilot Scheme, about 60% of the non-domestic GFA in Area 32B (i.e. about 42,736m²) will be implemented first by the target completion year 2033. The GFA to be distributed in both Site A and Site B are 5,221m² and 37,515m² respectively.

3. Assessment Methodology

3.1 Overview of Methodology

- 3.1.1 This assessment is carried out to assess the sewerage impact arising from the Proposed Development on the sewerage system.
- 3.1.2 The sewage generated from the Proposed Development is estimated according to “Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning” (GESF) published by Environmental Protection Department (EPD). The sewage calculation is in accordance with the Sewerage Manual published by Drainage Services Department (DSD).

3.2 Methodology and Assumptions

- 3.2.1 The adopted sewage unit flow factors for sewage estimation and calculation are summarized in **Table 3**.

Development Type	Flow Type	Unit Flow Factor (UFF) (m ³ /head/day)
Residential	R2	0.27
Retail Trade	J4	0.28
Finance, Insurance, Real Estate & Business Services	J6	0.08
Restaurants & Hotels	J10	1.58
Community, Social & Personal Services (Clubhouse)	J11	0.28

Table 3 – Unit Flow Factors

- 3.2.2 For the non-domestic population, the worker density adopted for business use is referred to Commercial and Industrial Floor Space Utilization Survey (CIFSUS). The adopted worker density is summarised in **Table 4**.

Commercial Activities	Workers per GFA (in 100 m ²)
Restaurants & Hotels	5.1
Retail Trade	3.5
Financial, Insurance, Real Estate & Business Services	5.5
Community, Social & Personal Services (Clubhouse)	3.3

Table 4 – Worker Density

3.2.3 The peaking factor is referred to Table T-5 of GESF. The adopted worker density are summarized in **Table 5**.

Population Range	Peaking Factor (including stormwater allowance) for facility with existing upstream sewerage	Peaking Factor (excluding stormwater allowance) for facility with new upstream sewerage
5,000 – 10,000	5	4

Table 5 – Peaking Factor

4. Review on Existing and Planned Sewerage System

4.1 Existing and Planned Sewerage System

- 4.1.1 The Application Site is currently unsewered and it is within the sewerage catchments for Hong Shui Kiu/ Ha Tsuen New Development Area (HSK/HT NDA). It is noted new sewerage network (including pumping stations) is proposed under CEDD consultancy Agreement No. CE 1/2020(CE) HSK/HT NDA Package A Works for Second Phase Development – Design and Construction to cater for sewage flows due to population intensification of HSK/HT NDA. The Proposed Development will rely on the proposed sewerage infrastructure proposed by CEDD.
- 4.1.2 With reference to Planning Application No.: A/HSK/452, the design capacity of the Sewage Pumping Station No.1 (SPS1) and the Sewage Pumping Station No.2 (SPS2) is 28,874m³/day and 42,255m³/day respectively. The sewage would be ultimately conveyed to the planned Hung Shui Kiu Effluent Polishing Plant (HSKEPP). With reference to HSKEPP website, the treatment capacity (i.e. ADWF) of HSKEPP is 90,000m³/day.
- 4.1.3 Under DSD project PWP No. 4463DS, the HSKEPP is currently under Phase 1 construction to provide a sewage treatment capacity of 60,000m³/day and is anticipated to be completed in mid-2031. Under DSD project PWP No. 4428DS, the HSKEPP will increase the sewage treatment capacity from 60 000m³/day to 90 000 m³/day. It is currently under planning and design stage.

4.2 Base Case Sewage Estimation

- 4.2.1 A base case scenario of sewage estimation for Area 32B is calculated based on ODP development mix aforementioned in Para 2.2.1 to predict the sewage estimation under HSK/HT NDA. The total estimated ADWF of Area 32B is approximately 2,389.4m³/day. Detailed calculation refers to **Annex 4. Table 6** below presents the summary of sewage flow estimation of the base case scenario.

Flow Type	Average Dry Weather Flow (ADWF) (m ³ /day)
Base Case	
Hotel	730.0
Office	255.8
Retail – Retail Trade	310.2
Retail – Restaurant	1,093.4
Total ADWF	2,389.4

Table 6 – Sewage Estimation for the Base Case Scenario

4.3 Impact on Sewerage System

- 4.3.1 With reference to approved EIA for HSK/HT NDA, the Proposed Development is within the sewerage catchment of proposed SPS1 under HSK/HT NDA.
- 4.3.2 The estimated ADWF generated from the Proposed Development is about 2088.6m³/d. The peak flow generated from the Proposed Development including the backwash for swimming pool is 0.135m³/s. Detailed calculation refers to **Annex 1**. The swimming pool backwash calculation refers to **Annex 2**. **Table 7** below presents the summary of sewage flow estimation of the Proposed Development.

Flow Type	Average Dry Weather Flow (ADWF) (m ³ /day)
Site A	
Residential	903.96
Clubhouse	21.56
F&B	211.72
Retail	25.76
Site B	
Hotel	729.96
Office (completed in 2033)	40.88
Office (Remaining)	124.72
F&B	30.02
Total ADWF (excl. Backwash)	2,088.58
Outdoor Swimming Pool Backwash	0.023m ³ /s
Indoor Swimming Pool Backwash	0.016m ³ /s

Table 7 – Sewage Estimation for the Proposed Development

Note:

(1) Swimming pool backwash will last 3 minutes per day

4.4 Sewage Discharge Comparison between Base Case and Proposed Development

- 4.4.1 Sewage estimation results show that the sewage discharge (i.e. ADWF) from Proposed Development is less than the base case scenario. (i.e. 2088.6m³/d < 2389.4m³/d) It is anticipated the planned sewerage infrastructure under HSK/HT NDA is sufficient to cater for the Proposed Development for Area 32B.

5. Proposed Sewerage System

5.1 Proposed Sewerage Connection

- 5.1.1 The sewage generated from the Application Site would be discharged via internal sewerage network leading to the proposed terminal manhole no. FTMH01 located close to the site boundary and connected to proposed sewer manhole no. FMH01 to be constructed by CEDD under HSK/HT NDA project via proposed 375mm diameter sewer by this Application. The proposed sewerage layout refers to figure no. **Area 32B/SIA/Figure 3**.
- 5.1.2 The sewage will be conveyed to the proposed SPS1 through planned gravity sewers, and then to the proposed SPS2 through planned rising mains and gravity sewers constructed by CEDD under HSK/HT NDA. The sewage will subsequently be discharged to the CEDD planned HSKEPP. The location of the proposed sewerage facilities and indicative sewerage alignment constructed by CEDD refers to figure no. **Area 32B/SIA/Figure 4**.
- 5.1.3 Hydraulic calculation as shown in **Annex 3** shows that sewage discharged from the Proposed Development utilises about 76% of the capacity of the proposed 375mm diameter sewer connected from FTMH01 to CEDD proposed sewer manhole FMH01.
- 5.1.4 Sewage discharged from the Application Site contribute to about 7.2% of the capacity of the SPS1. Hence, the sewerage impact is considered insignificant.

6. Maintenance Responsibility

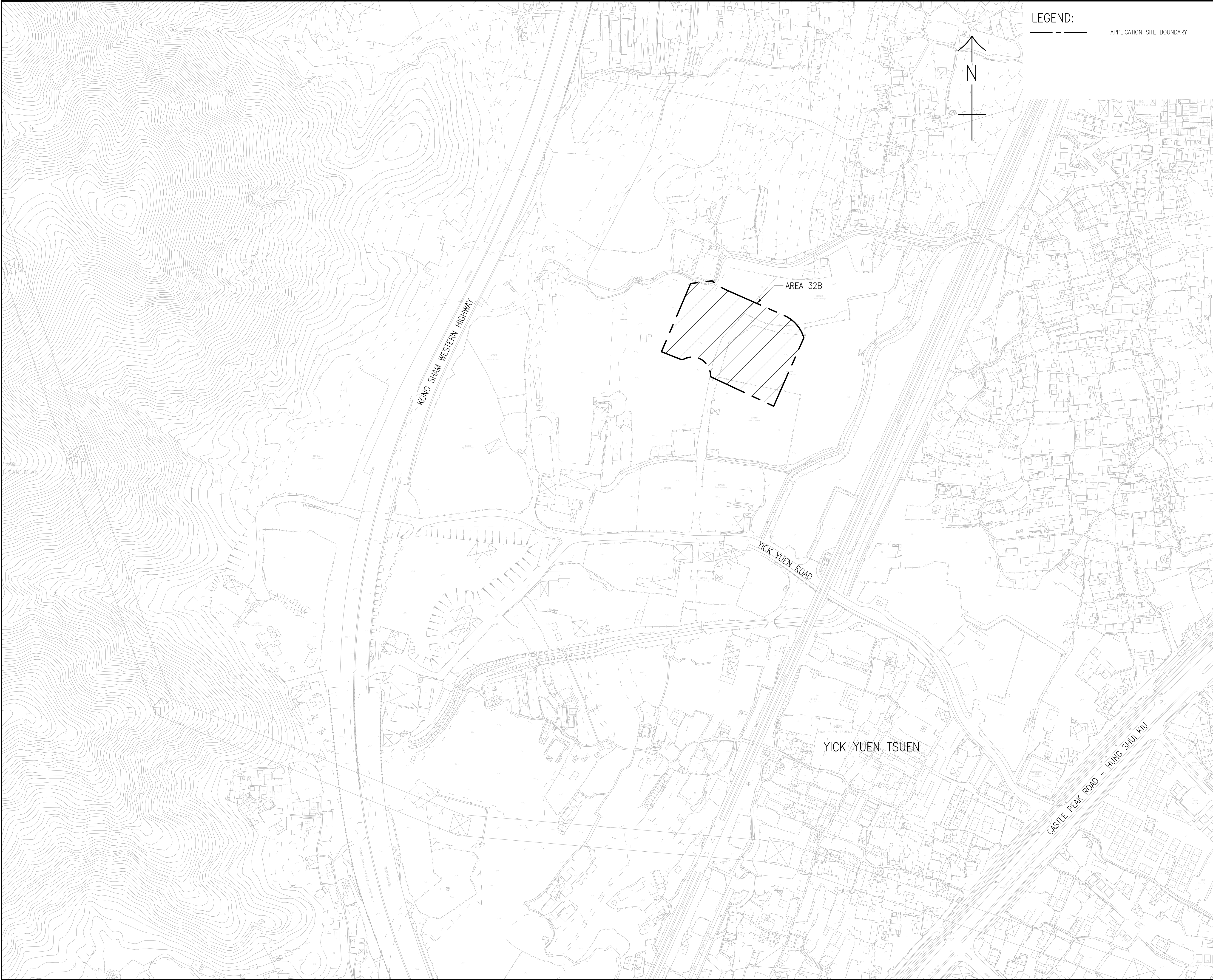
- 6.1.1 The development will be responsible for construction of the internal sewer and sewerage manholes within the Application Site. The development will be responsible for the maintenance of the internal sewer and manholes within the Application Site.
- 6.1.2 The Proposed Development will be responsible for construction of all necessary sewerage connection works to the public sewerage system. The sewerage systems outside the site boundary are proposed to be handed over to relevant government department for future maintenance.

7. Conclusion

- 7.1.1 This SIA report serves as a supporting document for proposing a mixed-use development with residential and commercial uses. The SIA has been carried out to assess the potential sewerage impact due to the Proposed Development.
- 7.1.2 The ADWF generated from the Application Site is about 2088.6m³/d (excluding the backwash for swimming pool). The peak flow generated from the Proposed Development including the backwash for swimming pool is 0.135 m³/s.
- 7.1.3 The sewage will be conveyed to the proposed SPS1 and then to the proposed SPS2. The sewage will subsequently be discharged to the planned HSKEPP. With the implementation of the proposed sewerage arrangement, no adverse impact from sewerage aspect is anticipated.

End of Report

Figure



LEGEND:

--- APPLICATION SITE

--- BOUNDARY

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PROJECT NO.
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協議編號

HUNG SHUI KIU

SHEET TITLE
圖紙名稱

LOCATION PLAN

SHEET NUMBER
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AREA 32B/SIA/FIGURE 1

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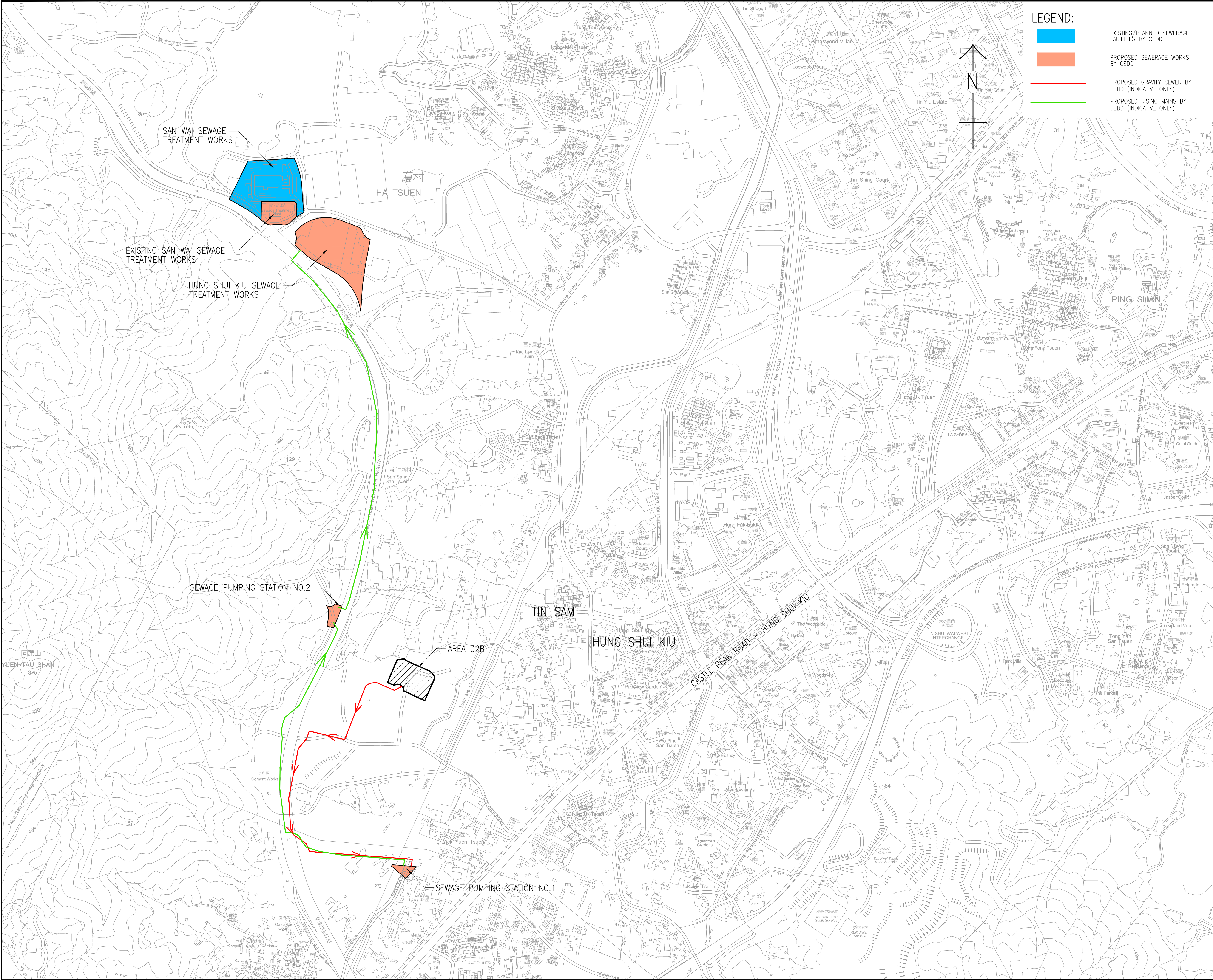
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SHEET TITLE
圖紙名稱
MASTER LAYOUT PLAN

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AREA 32B/SIA/FIGURE 2

AREA 32B/SIA/FIGURE 3

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HUNG SHUI KIU

SHEET TITLE
圖紙名稱

PROPOSED SEWERAGE LAYOUT
BY CEDD

SHEET NUMBER
圖紙編號

AREA 32B/SIA/FIGURE 4

Annex 1

Proposed Development Sewage Estimation

Proposed Development

Site A								
Residential								
No. of Units		1,240						
PPoF ⁽¹⁾		Development Type			Population	Unit Flow Factor	ADWF (m³/d)	
2.7		Private R2			3,348	0.27	903.96	
Workers	GFA (m²)	Worker's Type		Workers per GFA (in 100m²) ⁽²⁾	Employee	Unit Flow Factor	ADWF (m³/d)	
GFA for Clubhouse (m²)	2,325	J11 Community, Social & Personal Services		3.3	77	0.28	21.56	
						Sub-total	925.52	
Retail								
Workers	GFA (m²)	Worker's Type		Workers per GFA (in 100m²) ⁽²⁾	Employee	Unit Flow Factor	ADWF (m³/d)	
GFA for Restaurant (m²) ⁽²⁾	2,611	Restaurants		5.1	134	1.58	211.72	
		J10 Restaurants & Hotels						
GFA for Retail Trade (m²) ⁽³⁾	2,611	Retail Trade		3.5	92	0.28	25.76	
		J4 Wholesale & Retail						
						Sub-total	237.48	
Site B								
Hotel								
No. of Rooms	No. of Rooms							
	924							
Workers		Worker's Type		Employee		Unit Flow Factor	ADWF (m³/d)	
1 employee serves 2 rooms		J10 Restaurants & Hotels		462		1.58	729.96	
Office								
GFA for Office (m²)	Completed in 2033	9,290	J6 Finance, Insurance, Real Estate & Business Services	Workers per GFA (in 100m²) ⁽⁴⁾	Completed in 2033	511	0.08	40.88
	Remaining ⁽¹⁰⁾	28,330		5.5	Remaining ⁽¹⁰⁾	1559		124.72
GFA for Restaurant (m²)(5)	354	Restaurants		5.1	19		1.58	30.02
		J10 Restaurants & Hotels						
						Sub-total	925.58	

Total ADWF from the Proposed Development (Site A + Site B) (m ³ /day)	2,088.58
Contributing Population ⁽⁷⁾	7,735.48
Peaking Factor ⁽⁸⁾	4.00
Total Peak Flow from the Proposed Development (m ³ /s)	0.097
Total Peak Flow from the Proposed Development including swimming pools(m ³ /s) ⁽⁹⁾	0.135

Remarks:

⁽¹⁾ A person per flat of 2.7 is assumed.

⁽²⁾ Assume 50% of the Retail GFA at Site A is for restaurant use

⁽³⁾ Assume 50% of the Retail GFA at Site A is for retail use

⁽⁴⁾ Worker Density is in GFA per worker according to T-8 CIFSUS are assumed.

⁽⁵⁾ Assume all Retail GFA at Site B is for restaurant use

⁽⁶⁾ Catchment Inflow Factor P_{CF} = 1 is based on the catchment area in Yuen Long.

⁽⁷⁾ Contributing population = Projected Flow (ADWF in m³/day) / 0.27 (m³/person/day)

⁽⁸⁾ Worst case scenario (all swimming pools will undergo backwash at the same time) is assumed.

⁽⁹⁾ Peaking factor excluding stormwater allowance is adopted for hydraulic checking for proposed new constructed sewer.

⁽¹⁰⁾ Remaining indicates the non-domestic GFA to be implemented at a later stage under the arrangement of "Pay for What You Build"Pilot Scheme.

Annex 2

Swimming Pool Backwash Calculation

Estimation of Outdoor Pool Backwash

Pool area	=	438 m ²
Pool depth	=	1.5 m
Pool volume	=	657 m ³
Turnover rate	=	6 hrs
Flow rate	=	109.50 m ³ /hr
Surface loading rate of filter	=	20 m ³ /m ² /hr
Filter Areas Required	=	5.48 m ²
Assume backwash duration	=	3 min/day
Assume backwash flow rate	=	30 m ³ /m ² /hr
Volume of backwash	=	8.21 m ³ /day
Peak flow	=	0.023 m ³ /s

Note

(1)Swimming pool backwash will last for 3 minutes per day.

Estimation of Indoor Pool Backwash

Pool area	=	200 m ²
Pool depth	=	1.5 m
Pool volume	=	300 m ³
Turnover rate	=	4 hrs
Flow rate	=	75.00 m ³ /hr
Surface loading rate of filter	=	20 m ³ /m ² /hr
Filter Areas Required	=	3.75 m ²
Assume backwash duration	=	3 min/day
Assume backwash flow rate	=	30 m ³ /m ² /hr
Volume of backwash	=	5.63 m ³ /day
Peak flow	=	0.016 m ³ /s

Note

(1)Swimming pool backwash will last for 3 minutes per day.

Annex 3

Hydraulic Checking

Annex 3 - Hydraulic Check of Proposed Sewer

V of water = 0.000001

Manhle No.		Pipe												
U/S	D/S	Size	Hydraulic Radius	Flow Area	Pipe Gradient	Pipe Velocity	Capacity	Roughness	Accumulated ADWF	Contributing Population	Peaking Factor	Estimated Peak Discharge	Capacity Check	Remark
		mm	m	m ²	(1 in)	m/s	m ³ /s	mm	m ³ /d			m ³ /s	%	
FTMH01	FMH01	375	0.094	0.11	100	1.60	0.18	1.50 ⁽²⁾	2,088.58	7,736	4.00	0.135	76	

- Note
- (1) Assume the pipe flows under full-bore capacity.
 - (2) Assumed proposed slimed sewer is at normal condition, when flowing half full, velocity is about 1.2 m/s.
 - (3) Peaking factor excluding stormwater allowance is adopted for hydraulic checking for proposed sewer.
 - (4) FMH01 indicates CEDD proposed sewer manhole

Annex 4

Baseline Sewage Estimation

Appendix 4 Baseline for Area 32B

Estimated Sewage Flow from 32B Baseline Commercial Development		
Site Area	=	13,601.00
Plot Ratio	=	9.50
Non-domestic GFA(m2)	=	129,210
Retail Ratio	=	35%
Hotel Ratio	=	20%
Office Ratio	=	45%
Retail GFA (m ²)	=	45,223.5
		(1)
Retail GFA (m ²)	=	31,656
		(7)
Occupation Density (person/100m2 or person/room)	=	3.5
		(2)
Retail staff (no.)	=	1,108
Unit Flow Factor (m ³ /d/head)	=	0.28
DWF (m ³ /day)	=	310.2
Retail GFA (m ²)	=	13,567
		(7)
Occupation Density (person/100m2 or person/room)	=	5.1
		(4)
Restaurant staff (no.)	=	692
Unit Flow Factor (m ³ /d/head)	=	1.58
DWF (m ³ /day)	=	1093.4
Hotel GFA (m ²)	=	25,842
		(1)
Occupation Density (no. of rooms)	=	924
Hotel staff (no.)	=	462
		(5)
Unit Flow Factor (m ³ /d/head)	=	1.58
DWF (m ³ /day)	=	730.0
Office GFA (m ²)	=	58,144.5
		(1)
Occupation Density (person/100m2 or person/room)	=	5.5
		(3)
Office Staff (no.)	=	3,198
Unit Flow Factor (m3/d/head)	=	0.08
DWF (m ³ /day)	=	255.8
Total ADWF (m3/day)	=	2389.4

Notes:

1. Adopt retail = 35% of non-domestic GFA, hotel = 20% of non-domestic GFA, office = 45% of non-domestic GFA
2. According to CIFSUS, the worker density for retail trade is assumed as 3.5 workers per GFA (in 100 m²)
3. According to CIFSUS, the worker density for office is assumed as 5.5 workers per GFA (in 100 m²)
4. According to CIFSUS, the worker density for restaurants is assumed as 5.1 workers per GFA (in 100 m²)
5. Assumed 1 hotel staff serves 2 rooms
6. Catchment Inflow Factors (PCIF): Yuen Long = 1.00 is adopted.
7. For retail GFA, it is assumed 30% for F&B and 70% for retail trade usage.

