Appendix E

Updated Drainage & Sewerage Impact Assessment

SECTION 16 APPLICATION FOR PROPOSED FLATS, SHOP AND SERVICES, AND EATING PLACES WITH MINOR RELAXATION AND DOMESTIC AND NON-DOMESTIC PLOT RATIO AND BUILDING HEIGHT RESTRICTION IN "RESIDENTIAL (GROUP E)" ZONE AT NO.4 TUNG YUEN STREET, YAU TONG, KOWLOON

DRAINAGE & SEWERAGE IMPACT ASSESSMENT

Date	19 March 2025
Prepared by	Sally Chiu Assistant Environmental Consultant
Signed	
Approved by	Tony Cheng Senior Manager
Signed	
Project Reference	CRC_4TYSEI00
Document No.	R9291_v1.2

CHAPTERS

TABLES

FIGURES

APPENDICES AND DIAGRAMMATIC SECTION

1. INTRODUCTION

1.1 Background and Objectives

1.1.1 The Proposed Development is located at No. 4 Tung Yuen Street, Yau Tong ("Application Site"). It is zoned as "R(E)" site under OZP S/K15/27 Cha Kwo Ling, Yau Tong, Lei Yue Mun, gazetted on 18/11/2022.

1.1.2 This S16 application is submitted to the Town Planning Board for the Proposed Flat, Shop and Services, and Eating Places with Minor Relaxation of Plot Ratio and Building Height Restrictions at the Application Site.

1.1.3 Ramboll Hong Kong Limited is commissioned by the Applicants to prepare this Drainage and Sewerage Impact Assessment (DSIA) Mitigation measures will be identified if it is necessary. Development parameters of the Proposed Development are provided by project architect, P&T.

1.2 Application Site and its Environ

1.2.1 The Application Site has an area of about 2,419 m^2, which are situated in Yau Tong area. The Application Site is bounded by Yau Tong Sewage Pumping Station to the Northwest, Tung Yuen Street to the Northeast, The Coastline to the Southeast. Figure 1.1 shows the location of the Application Site and its environ.

1.3 Proposed Residential Development

1.3.1 The Proposed Development consist of 1 residential tower, providing not more than 342 residential units. The residential tower is situated atop a 3 storeys podium for shop and services, eating place, and clubhouse with two level of basements for carparking and loading/ unloading spaces.

1.3.2 The tentative completion year of the Proposed Development would be Years 2032.

1.3.3 The development parameters of the Proposed Development are shown in Appendix 1.1.

2. DRAINAGE IMPACT ASSESSMENT

2.1 Existing Drainage and Condition of the Application Site

2.1.1 The Application Site is consisting with an industrial building (i.e., ground level 4.40 mPD) and is almost 100% paved under existing conditions. As confirmed by the Project Proponent, there will be no change in the gradient of the Application Site after redevelopment.

2.1.2 According to APP-152, at least 20% of greenery will be provided after development. The provision of a greenery area of approximately 484 m^2 will further increase filtration of stormwater and minimize surface runoff. The paved / unpaved ratio of the Application Site before and after the Proposed Development were reviewed and summarized in Table 2.1.

Table 2.1 Estimated Peak Flow

	Before Development	After Development
Paved Area	2,419 m^2(99%)	1,935 m^2 (80%)
Unpaved Area	36 m^2 (1%)	484 m^2 (20%)

2.1.3 As change in land use would affect the amount of surface runoff flowing into the existing drainage system. Meanwhile, there is a slight increase in greenery area in the Proposed Development, peak runoff from the Application Site will slightly decrease as compared to existing site conditions. Adverse impact to the public drainage system is thus not anticipated. Upgrading works is considered not necessary.

2.2 Sea Level Rise due to Climate Change

Site Constraints

2.2.1 With reference to the Outline Zoning Plan (OZP) and confirmation from the Project Proponent, the design of the promenade within the Application Site should align directly with the design of the waterfront (i.e., at 4.40 mPD). Therefore, the current ground level of the proposed design is 4.40 mPD.

2.2.2 With reference the Table 8, and Table 29 in the *Stormwater Drainage Manual-Corrigendum No. 1/2022*. Based on the preliminary calculation, the design extreme sea level would be 4.39 mPD (i.e. 4.19+0.20 mPD) with reference the return period years 200 and the mean sea level rise in Mid-21st Century, compared with the the ground level (i.e., 4.40 mPD) of the Proposed Development, which is adequate to protect the Proposed Development from seawater inundation.

Table 8 Design Extreme Sea Levels (in mPD)

Return Period (Years)	North Point / Quarry Bay (1954- 2019)	Tai Po Kau (1962-2019)	Tsim Bei Tsui (1954-2019)	Tai O (1954-2019)
2	2.82	2.97	3.07	2.87
5	3.03	3.27	3.31	3.16
10	3.20	3.54	3.52	3.36
20	3.38	3.56	3.74	3.57
50	3.66	4.41	4.09	3.84

100	3.91	4.93	4.41	4.06
200	4.19	5.59	4.78	4.28

Note:

1. *The extreme sea levels at Tsim Bei Tsui and Tai O were based on the frequency analysis of instrumental data and correlated data from North Point/ Quarry Bay for an extended data set of 66 years (from 1954 to 2019).*
2. *For facilities which are vulnerable and sensitive to sea water level, e.g. E&M installations, where more stringent design is desirable, designers can make reference to the extreme sea levels as shown in Appendix 1. These extreme sea levels were derived with inclusion of significant storm surge events in Hong Kong before 1954.*

Table 29 Mean Sea Level Rise due to Climate Change

	Mean Sea Level Rise
Mid-21st Century	0.20 m
End of 21st Century	0.47 m

Notes:

1. *The mean sea level rise is relative to the average of 1995-2014.*
2. *Median projection values are adopted in the table.*
3. *Mid-21st century refers to period around 2050; end of 21st century refers to period around 2090.*

Mitigation Measures

2.2.3 For the Proposed Development design, the façade of the Proposed Development facing the waterfront on the ground floor primarily consists of blank walls with few entrances. Furthermore, there will be a basement for 2-story carpark and will be at about -4.6 mPD. The entrance of the basement carpark faces to Tung Yuen Street.

2.2.4 Apart from the scheme design, demountable flood barrier would be installed manually in front of the entrances of buildings, and carparks to prevent floodwater intrusion, and in open spaces to contain floodwater within the area. This type of barrier is widely used in Hong Kong to minimize flooding impact. Therefore, with proper mitigation measures there would be no adverse flooding impact.

3. SEWERAGE IMPACT ASSESSMENT

3.1 Scope of Work

3.1.1 The aim of this SIA is to assess whether the capacity of the sewerage network serving the Application Site is sufficient to cope with the sewage flow from the proposed development.

3.2 Assessment Criteria and Methodology

3.2.1 The Commercial and Industrial Floor Space Utilization Survey (CIFSUS) conducted by the Planning Department has been used to determine the worker density for various economic activities and planned usage types.

3.2.2 Environmental Protection Department's (EPD's) Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning, Version 1 (GESF) has been referred to for the purposes of estimating the quantity of the sewage generated from the Proposed Development and the existing catchment area. Sewage flow parameters and global peaking factors in this document have been adopted for this SIA.

3.2.3 According to the GESF, the overall unit flow is composed of flows due to employees and the associated activities. The following unit flow factors have been adopted in the SIA calculation in accordance with Tables T-1, T-2 and T-3 of the GESF:

- Residential housing: 0.27m^3/day (Private RR)
- Restaurant & Hotel: 1.58m^3/day (Commercial Employee and J10 – Restaurant & Hotel)
- Wholesale & Retail: 0.28m^3/day (Commercial Employee and J4 – Wholesale & Retail)
- Industrial: 1.08m^3/day (Industrial Employee and J1 – Yau Tong)

3.2.4 The catchment inflow factor, PCIF of 1.1 (East Kowloon), is adopted in catchment calculations.

3.3 Existing and Future Sewerage System

3.3.1 With reference to the sewerage system shown in Geo-info Map, all the sewage generated from the proposed development will be discharged to the terminal manhole (T0) which is located at the eastern side of the proposed development. The terminal manhole TMH-01 (S0) is connected to the exciting manhole FMH4034524 (S1) outside the proposed development via a new Ø300mm polyethylene pipe. The sewer eventually discharges the collected sewage to Yau Tong Sewage Pumping Station.

3.3.2 The Yau Tong Sewage Pumping Station (YTSPS) is located at the junction of Ko Fai Road and Tung Yuen Street which is next to the Application Site. Based on the information for DSD, The YTSPS currently has a design capacity with 28,800m^3/day.

3.3.3 The existing sewers and catchment areas in the vicinity of Application Site are shown in Figure 3.1.

3.4 Wastewater Generated by the Proposed Development

3.4.1 The sewage generated by the proposed development will be mainly contributed by the residential units, club house, retail and F&B facilities. Detailed calculation of sewage generation from the proposed development is given in Table 3.1 below and in Appendix 3.1.

Table 3.1 Estimated Peak Flow

Calculation for Sewage Generation Rate of the Proposed Development at the Application Site			
1. Proposed Residential Development			
Total number of residential units	=	342	units
Total number of residents	=	855	residents (refer to Census and Statistics Department 2021 data - average household size of 2.5 in Yau Tong West)
Design flow	=	0.27	m^3/person/day -- (Private R2 in Table T-1 of GESF)
Sewage generation rate	=	230.9	m^3/day
2. Club House			
Assumed Area	=	725	m^2 (refer to Appendix 1.1)
Assumed floor area per employee	=	30.3	m^2 per employee -- (refer to Table 8 of CIFSUS – Community, Social & Personal Services)
Total number of employees	=	24	employees
Design flow	=	200	litre/employee/day -- (refer to Table T-2 of GESF - J11 Community, Social & Personal Services)
Sewage generation rate	=	6.7	m^3/day
3. Swimming Pool			
Assumed Area of Swimming Pool	=	250	m^2
Average Depth of Water	=	1.5	m
Volume of Swimming Pool	=	375	m^3
Turnover Rate	=	6	hr (CAP132, Section 42 Swimming Pools Regulation (open air pool))
Surface Loading Rate of Filter	=	50	$m^3/m^2/hr$
Filter Areas required	=	1.3	m^2
Backwash flow rate	=	30	$m^3/m^2/hr$
Design flow for Swimming Pool Backwashing	=	37.5	m^3/hr
Backwash Duration	=	7	min/day (With reference to Section B8.5.5 of General Specification for Swimming Pool Water Treatment Installation in Government Buildings of the HKSAR published by the ArchSD)
Backwash generation rate	=	3.75	m^3/day
Design flow for Swimming Pool Backwashing	=	10.4	litre/sec
4. Retail			
Assumed area	=	1306.3	m^2
Assumed floor area per employee	=	28.6	m^2 per employee – (refer to Table 8 of CIFSUS – Retail Trade)
Total number of employees	=	46	employees
Design flow	=	200	litre/employee/day -- (refer to Table T-2 of GESF – J4 Wholesale & Retail)
Sewage generation rate	=	12.9	m^3/day
5. F&B			
Assumed used area	=	870.8	m^2
Assumed floor area per employee	=	19.6	m^2 per employee -- (refer to Table 8 of CIFSUS - Restaurant)
Total number of employees	=	44	employees
Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-2 of GESF)
Design flow for commercial activities	=	1500	litre/employee/day -- (refer to Table T-2 of GESF Job Type J10)
Sewage generation rate	=	69.5	m^3/day
Flow rate (without swimming pool)	=	320.0	m^3/day
Flow rate with P_{CIF} (without swimming pool)	=	352.0	m^3/day (refer to Table T-4 of GESF – East Kowloon - 1.0)
Contributing population	=	1304	people
Peaking factor	=	6	(refer to Table T-5 of GESF for a population between 1000-5000 incl. stormwater allowance)
Peak flow (without swimming pool)	=	22.2	litre/sec
Peak flow (with swimming pool)	=	32.6	litre/sec

3.5 Assessment of Sewerage Impact

3.5.1 The potential sewerage impact due to the Proposed Development has been quantitatively addressed. Total sewage generation rate from the Proposed Development is estimated to be 320.0 m^3/day (i.e. peak flow 22.2 litre/sec).

3.5.2 Based on the assessment results, it is found that the capacity of sewers FWD4036746, and FWD4036747 are not sufficient for the sewerage generated from the Proposed Development and the surrounding catchment. Therefore, sewers FWD4036746, and FWD4036747 are proposed to upgrade. The proposed upgrading works are summarized in Table 3.2 and Figure 3.2.

Table 3.2 Proposed Upgrading Works

Segment	Manhole Reference	Manhole Reference	Length (m)	Original Size (Ø)	Upgraded Size (Ø)
S1-S2	FMH4034524	FMH4034525	41.7	675	825
S2-S3	FMH4034525	FMH4034509	8.0	675	825

3.5.3 Hence, upgrading works on the public sewers FWD4036746, and FWD4036747 by the project proponent are required.

3.5.4 The estimated sewage generated including existing development and Proposed Development is about 7166.5m^3/day, which the flow is occupied about 25% of the current capacity of YTSPS. It is unlikely that the YTSPS will be overloaded. Detailed calculation for the capacities of YTSPS is given in Appendix 3.1.

4. OVERALL CONCLUSION

4.1.1 With a slight increase in greenery area in the Proposed Development, peak runoff from the Application Site will slightly decrease as compared to existing site conditions. The proposed development can be completed without aggravating the flooding conditions within, upstream, or downstream of the Application Site. Therefore, it is anticipated that there will not be any impact on the existing drainage system. As such, upgrading work on the drainage system is NOT required.

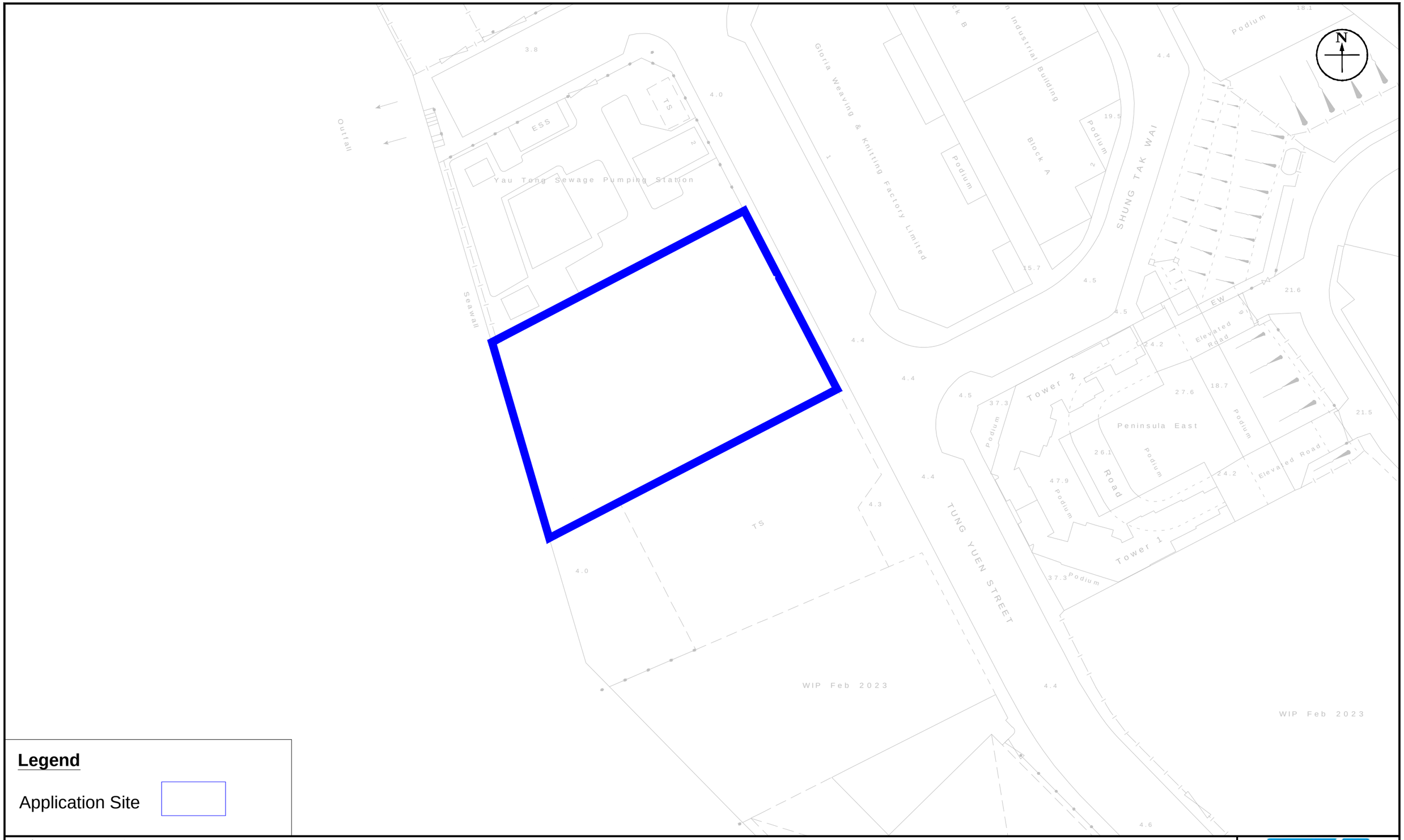
4.1.2 The potential sewerage impact arisen from the Proposed Development has been quantitatively assessed. Two of existing Ø675mm sewerage pipe (S2-S3 and S3-S1) will be upgraded to Ø825mm sewerage pipes. New Ø300mm sewerage pipes and manhole will be proposed to connect the existing pipe.

4.1.3 The TYSPS that the sewerage system would be connecting to has adequate capacity for the expected daily flows from the Proposed Development based on the assessment results.

4.1.4 With the proposed new connection and upgrading works in place, this SIA confirms the feasibility of the Proposed Development with no adverse impacts imposed to the public sewerage system.

4.1.5 This DIA and SIA confirm the feasibility of the proposed development in terms of its drainage and sewerage impact.

Figures

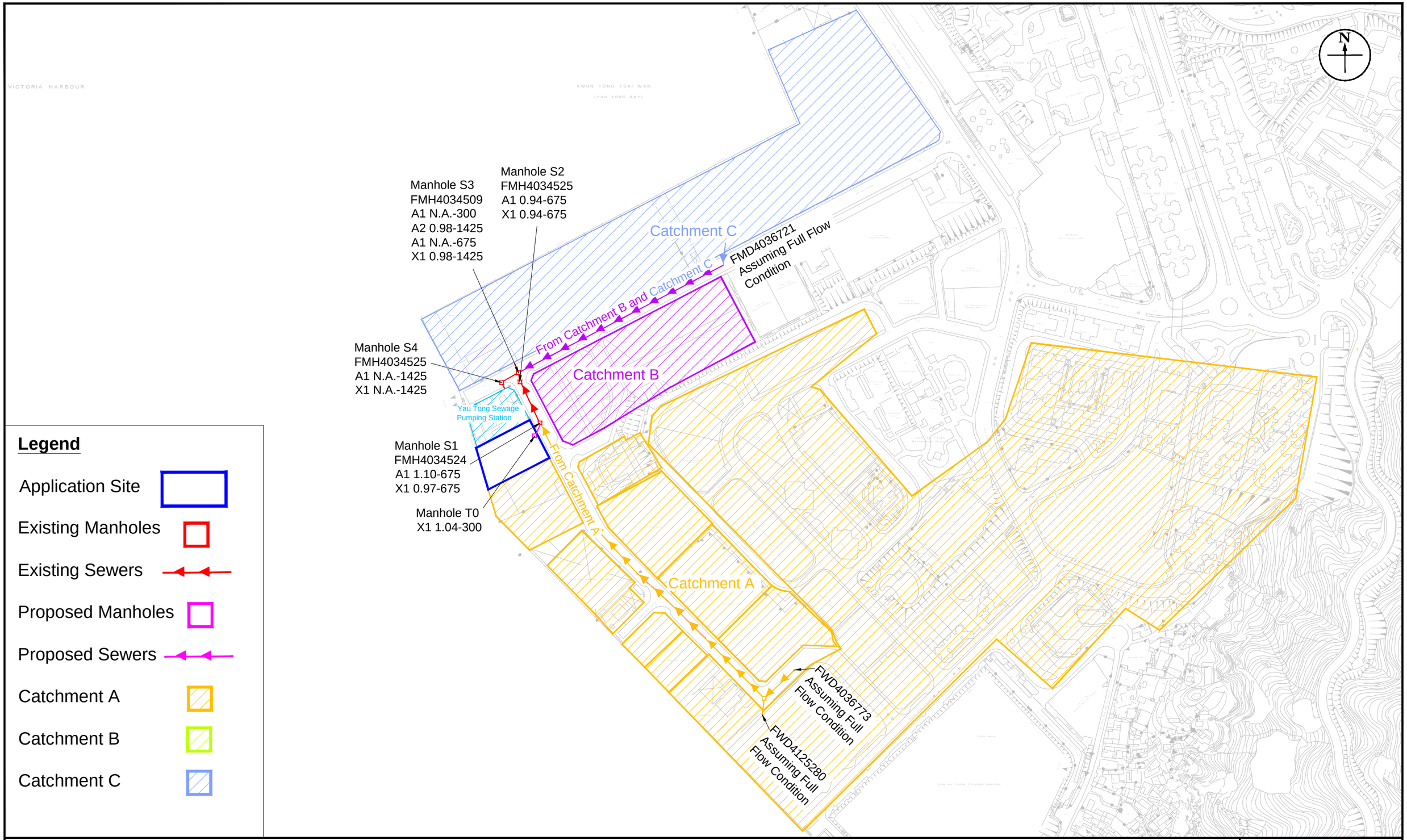


Legend

Application Site

Figure: 1.1	RAMBOLL
Title: Location of the Application Site and its Environ	Drawn by: SC Checked by: TC
Project: Proposed Flats, Shop and Services, and Eating Places with Minor Relaxation and Domestic and Non-domestic Plot Ratio and Building Height Restriction in "Residential (Group E)" Zone at Nos.4 Tung Yuen Street, Yau Tong, Kowloon	Rev.: 1.1 Date: Mar 2025

Q:\Projects\CRC_4TYSEI00\05 Assessments\05 SIA\240410\SIA - 241107.dwg



Legend

- Application Site
- Existing Manholes
- Existing Sewers
- Proposed Manholes
- Proposed Sewers
- Catchment A
- Catchment B
- Catchment C

Figure: 3.1

Title: Sewerage System and Catchment Areas in the Vicinity of the Application Site

Project: Proposed Flats, Shop and Services, and Eating Places with Minor Relaxation and Domestic and Non-domestic Plot Ratio and Building Height Restriction in "Residential (Group E)" Zone at Nos.4 Tung Yuen Street, Yau Tong, Kowloon

RAMBOLL

Drawn by:	SC
Checked by:	TC
Rev.:	1.1
Date:	Mar 2025

Q:\Projects\CRC_4TYSEI00\05 Assessments\05 SIA\240410\SIA - 241107.dwg

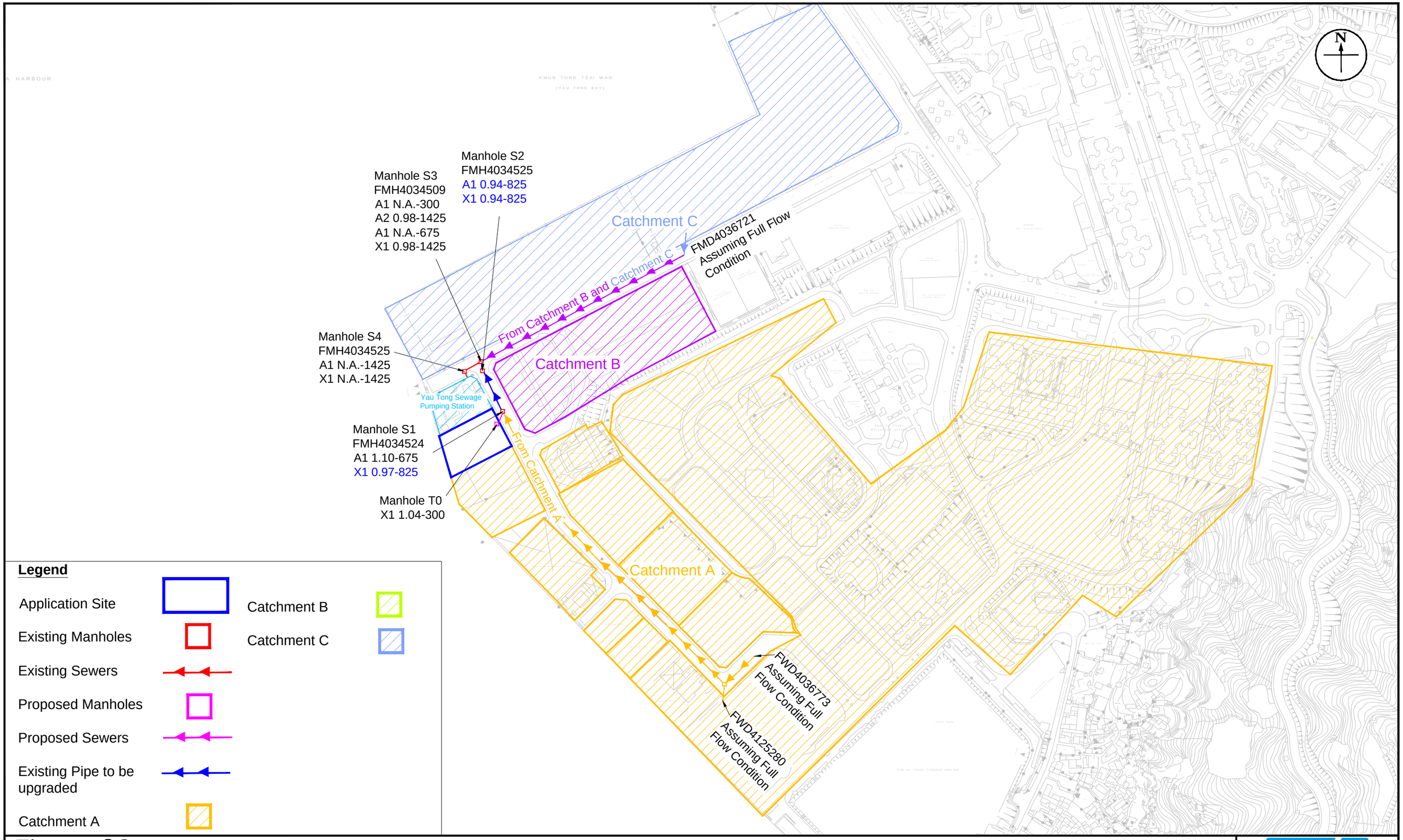


Figure: 3.2

Title: Proposed Sewerage System

Project: Proposed Flats, Shop and Services, and Eating Places with Minor Relaxation and Domestic and Non-domestic Plot Ratio and Building Height Restriction in "Residential (Group E)" Zone at Nos.4 Tung Yuen Street, Yau Tong, Kowloon

RAMBOLL

Drawn by: SC

Checked by: TC

Rev.: 1.1

Date: Mar 2025

Q:\Projects\CRC_4TYSEI00\05 Assessments\05 SIA\240410\SIA - 241107.dwg

Appendix

Appendix 1.1 Key Development Parameters

4.3 Key Development Parameters

4.3.1 The key development parameters of the Proposed Scheme as compared with the OZP Scenario (i.e. Development Parameters of "R(E)" zone under the OZP) are summarised in **Table 4-1** below.

Table 4-1 Key Development Parameters of the Proposed Scheme

Key Development Parameters	OZP Scenario (i.e. Development Parameters of "R(E)" zone under the OZP) (a)	Proposed Scheme (b)	Differences/ Compliance (b) – (a)
Site Area (m^2)	About 2,419m^2	About 2,419m^2	-
Proposed Uses	'Flat' is Column 2 use; 'Shop and Services' and 'Eating Place' are always permitted on the lowest three floors of a building, taken to include basements., excluding floors containing wholly or mainly car parking, loading/unloading bays and/or plant room)	'Flat' is Column 2 use; 'Shop and Services' and 'Eating Place' are always permitted on the lowest three floors of a building, taken to include basements., excluding floors containing wholly or mainly car parking, loading/unloading bays and/or plant room)	Column 2 uses (S16 Application required)
Plot Ratio (PR)			
- Total PR	Not more than 6	Not more than 6.9 [1]	+ 15%
- Domestic PR	Not more than 5	Not more than 6	+ 20%
- Non-domestic PR	Not more than 1	Not more than 0.9 [2]	-
Gross Floor Area (GFA) (m^2) [1]			
- Total GFA (excluding Bonus GFA to be claimed)	Not more than 14,514m^2	Not more than 16,691.1m^2	+ 15%
- Domestic GFA (excluding Bonus GFA to be claimed)	Not more than 12,095m^2	Not more than 14,514m^2	+ 20%
- Non-domestic GFA	Not more than 2,419m^2	Not more than 2,177.1m^2 [2]	-
Bonus Plot Ratio (Bonus GFA)	Provision under Remark (5) of the Notes of "R(E)" zone	Not more than 0.081 [3] (to be included in Domestic PR) (Not more than 197.93m^2)	Provision under Remark (5) of the Notes of "R(E)" zone
Building Height (BH) (mPD)	Not more than 80mPD	80mPD to 100mPD (for inland portion only)	+25% (for inland portion only)
Floor-to-Floor Height	N/A	Basement: about 4.5m Retail: about 4.5-5.5m Clubhouse: about 3.9m Transfer Plate: about 1.85m	-

Key Development Parameters	OZP Scenario (i.e. Development Parameters of "R(E)" zone under the OZP) (a)	Proposed Scheme (b)	Differences/ Compliance (b) – (a)
		Typical Residential: about 3.15m	
No. of Storeys	N/A	22 - 28 storeys (for inland portion only), excluding 2 storeys of basement carpark	-
Site Coverage (SC) - Below 15m - Above 15m	 N/A N/A	 Not more than 70% Not more than 33.3%	 -
No. of Residential Block	N/A	1	-
No. of Flats	N/A	About 342	-
Average Flat Size	N/A	About 43m^2	-
Anticipated Population	N/A	About 855 [4]	-
Local Open Space	N/A	Total area of not less than 855m^2, which includes a voluntary waterfront promenade of not less than 608m^2 for public access and enjoyment	-
Greenery Provision	N/A	Not less than 20% [5]	-
Car Parking Spaces Private Car Parking Spaces - Residential - Visitor - Shop and Services/ Eating Place Motorcycle Parking Spaces	 N/A N/A N/A N/A N/A	 63 (incl. 2 accessible car parking spaces) 50 5 8 4	 - - -
Loading/ Unloading (L/UL) Bays	N/A	3 (1 Light Goods Vehicle Space and 2 Heavy Goods Vehicle Spaces)	-
Completion Year	N/A	2032	-

Notes:

[1] Proposed clubhouse GFA (5% of total domestic GFA) is exempted from GFA calculation.

[2] The area of the covered public passageway (about 223m^2) for public access from Tung Yuen Street to the waterfront promenade through our proposed building at ground level is not included in the non-domestic GFA of 2,177.1m^2. Considering the nature of serving the public and users of the proposed development with reference to PNAP APP-108, the 223m^2 is proposed as an exempted GFA.

[3] On top of the PR/GFA set out above, a bonus PR of not more than 0.081 (rounded down, equivalent to a GFA of not more than 197.93m^2) and SC of 0.257% will be claimed for the 39.586m^2 of ODP-required setback areas. While the bonus PR and SC will be subject to approval by the Building Authority under Building (Planning) Regulations (B(P)R) 22(2) at detailed design

stage, nevertheless, the bonus PR and SC have been incorporated in the building bulk (including BH) of the Proposed Scheme and adopted in the technical assessments.

[4] A person per flat (PPF) ratio of 2.5 is adopted with reference to the average domestic household size of the subject Yau Tong West District Council Constituency Area as reported in the 2021 Population Census results published by the Census and Statistics Department.

[5] The total greenery provision is located at Primary Zone, i.e. 15m vertical zone, of the Application Site which accounts for not less than 20% of SC of greenery.

Appendix 3.1 Detailed Sewerage Impact Assessment Calculations

Table 1 Calculation for Sewage Generation Rate of the Proposed Residential Development at the Application Site

1. Proposed Residential Development			**Remarks**
1. Residential Towers (T1-T3)			
a. Total number of units	=	342	units
b. Total number of residents	=	855	people -- (average household size of 2.5 from Hong Kong 2021 Population Census -Yau Tong West)
c. Design flow	=	0.27	m^3/person/day -- (Private R1 in Table T-1 of GESF)
d. Sewage Generation rate	=	**230.9**	m^3/day
2. Club House			
a. Assumed used area	=	725	m^2
b. Assumed floor area per employee	=	30.3	m^2 per employee -- (refer to Table 8 of CIFSUS - Community, Social & Personal Services)
c. Total number of employees	=	24	employees
d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-2 of GESF)
e. Design flow for commercial activities	=	200	litre/employee/day -- (refer to Table T-2 of GESF Job Type J11)
f. Sewage generation rate	=	**6.7**	m^3/day
3. Swimming Pool			
a. Assumed Area of Swimming Pool	=	250	m2
b. Average Depth of Water	=	1.5	m
c. Volume of Swimming Pool	=	375	m3
d. Turnover Rate	=	6	hr (CAP132, Section 42 Swimming Pools Regulation (open air pool))
e. Surface Loading Rate of Filter	=	50	m3/m2/hr
f. Filter Areas required	=	1.3	m2
g. Backwash flow rate	=	30	$m^3/m^2/hr$
h. Design flow for Swimming Pool Backwashing	=	37.5	m^3/hr
i. Backwash Duration	=	7	min/day
j. Backwash generation rate	=	3.75	m^3/day
k. Design flow for Swimming Pool Backwashing	=	**10.4**	litre/sec
4. Retail			
a. Assumed used area	=	1306.2	m^2
b. Assumed floor area per employee	=	28.6	m^2 per employee -- (refer to Table 8 of CIFSUS - Retail Trade)
c. Total number of employees	=	46	employees
d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-2 of GESF)
e. Design flow for commercial activities	=	200	litre/employee/day -- (refer to Table T-2 of GESF Job Type J4)
f. Sewage generation rate	=	**12.9**	m^3/day
5. F&B			
a. Assumed used area	=	870.8	m^2
b. Assumed floor area per employee	=	19.6	m^2 per employee -- (refer to Table 8 of CIFSUS - Restaurant)
c. Total number of employees	=	44	employees
d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-2 of GESF)
e. Design flow for commercial activities	=	1500	litre/employee/day -- (refer to Table T-2 of GESF Job Type J10)
f. Sewage generation rate	=	**69.5**	m^3/day
Total Flow at Manhole T0			
Flow Rate (Without Swimming Pool)	=	320.0	m^3/day
Flow Rate with inflow factor (Without Swimming Pool)	=	352.0	m^3/day (Catchment Inflow Factor for East Kowloon = 1.1)
Population	=	1304	people
Peaking factor	=	6	Refer to Table T-5 of GESF for population 1,000 - 5,000 including stormwater allowance
Peak Flow (Without Swimming Pool)	=	22.2	litre/sec
Peak Flow (With Swimming Pool)	=	**32.6**	litre/sec

Table 2a Hydraulic Capacity at Sewers along Tung Yuen Street, Yau Tong

Segment	Manhole Reference	Manhole Reference	Pipe Dia.	Pipe Length	Invert Level 1	Invert Level 2	g	k_s	s	v	V	Area	Q	Estimated Capacity
			mm	m	mPD	mPD	m/s^2	m		m^2/s	m/s	m^2	m^3/s	L/s
T0-S1	Terminal Manhole	FMH4034524	300	9.5	1.04	0.97	9.81	0.0015	0.007	0.000001	1.19	0.07	0.08	84
S1-S2	FMH4034524	FMH4034525	675	41.7	0.97	0.94	9.81	0.0015	0.001	0.000001	0.62	0.36	0.22	223
S2-S3	FMH4034524	FMH4034509	675	8.0	-	-	9.81	0.0015	0.001	0.000001	0.62	0.36	0.22	223
S3-S4	FMH4034509	FMH4034510	1425	17.6	-	-	9.81	0.0015	0.002	0.000001	1.50	1.59	2.38	2385
S4-S5	FMH4034510	Yau Tong Sewage Puminp Station	1425	6.4	-	-	9.81	0.0015	0.002	0.000001	1.50	1.59	2.38	2385

Remarks: (1) g=gravitational acceleration; k_s=equivalent sand roughness; s=gradient; v=kinematic viscosity of water; V=mean velocity

(2) The value of k_s = 1.5 mm is used with reference to Slimed uPVC Sewers, poor example in Table 5 of Sewerage Manual Part 1.

(3) The value of velocity (V) is referred to the Tables for the hydraulic design of pipes, sewers and channels (8th edition)

(4) Equation used:

$$V = -\sqrt{(8gDs)}\log\left(\frac{k_s}{3.7D} + \frac{2.51\nu}{D\sqrt{(2gDs)}}\right)$$

(5) The pipe information in Table 2a is obtained from Sewerage Impact Assessment for Proposed Development at YTML No. 57 and YTILs 4 sB & 9, and Adjoining Government Land, Yau Tong (R7481_v1.3)

(6) According to DSD Drainage Records, the downstream invert level of manholes FMH4034525 is missing, as a conservative approach, the slope of the upstream Segment (i.e. S1-S2) is used instead.

(7) According to DSD Drainage Records, the invert level of manholes FMH4034509 and FMH4034510 are missing, as a conservative approach, the slope 0.002 is used .

The Invert Level 1 is reference the FWD4036916 downstream 1.22mPD and the Invert Level 2 is reference the FWD4036741 downstream 0.98mPD with length

Table 3a Hydraulic Capacity of Sewers (Catchment A)

1. Full Bore of Pipes FWD4036773 and FWD4125280 (Assumption)

Pipe Reference	Manhole Reference	Manhole Reference	Pipe Dia.	Pipe Length	Upstream Invert Level	Downstream Invert Level	g	k_s	s	v	V	Area	Q	Estimated Capacity
			mm	m	mPD	mPD	m/s^2	m		m^2/s	m/s	m^2	m^3/s	L/s
FWD4036773	FMH4034555	FMH4034556	600	38.9	1.89	1.86	9.81	0.006	0.001	0.000001	0.49	0.28	0.14	138
FWD4125280	FMH4099933	FMH4034556	225	6.1	2.15	2.10	9.81	0.006	0.008	0.000001	0.81	0.04	0.03	32
													Sub-total	170

Remarks:

(1) g=gravitational acceleration; k_s=equivalent sand roughness; s=gradient; v=kinematic viscosity of water; V=mean velocity

(2) The value of k_s = 6mm is used for the calculation of concrete sewer (based on Table 5: Recommended roughness values in Sewerage Manual)

(3) The value of velocity (V) is referred to the Tables for the hydraulic design of pipes, sewers and channels (8th edition)

(4) Equation used: $V=-\sqrt{(8gDs)}\log\left(\frac{k_s}{3.7D}+\frac{2.51v}{D\sqrt{(2gDs)}}\right)$

(5) The pipe information is obtained from Geoinfo Map.

2. 18 Tung Yuen Street Application No A/K15/121

a. Sewage Generation rate at FMH4034557	=	91	m^3/day (from EPD)
b. Sewage Generation rate at FMH4034558	=	136	m^3/day (from EPD)
c. Total Dewerage Generate rate	=	227	m^3/day

3. With reference Planning Application No. A/K15/126 (https://www.tpb.gov.hk/tc/plan_application/Attachment/20200828/s16_A_K15_126_0_gist.pdf)

Residential

a. Total number of units	=	1393	units
b. Total number of residents	=	3483	people -- (average household size of 2.5 from Hong Kong 2021 Population Census -Yau Tong West)
c. Design flow	=	0.27	m^3/person/day -- (Private R1 in Table T-1 of GESF)
d. Sewage Generation rate	=	**940.3**	m^3/day

Club House

a. Assumed used area	=	950	m^2
b. Assumed floor area per employee	=	30.3	m^2 per employee -- (refer to Table 8 of CIFSUS - Community, Social & Personal Services)
c. Total number of employees	=	31	employees
d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-2 of GESF)
e. Design flow for commercial activities	=	200	litre/employee/day -- (refer to Table T-2 of GESF Job Type J11)
f. Sewage generation rate	=	**8.7**	m^3/day

Outdoor Swimming Pool

Assumed area	=	112.1	m^2
Assumed depth of water	=	1.5	m
Volume of water	=	168.2	m^3
Turnover Rate	=	6.0	hr (CAP132, Section 42 Swimming Pools Regulation (open air pool))
Surface loading rate of filter	=	50.0	$m^3/m^2/hr$
Filter areas required	=	0.6	m^2
Backwashing flow rate	=	30.0	$m^3/m^2/hr$
Design flow for backwashing	=	16.8	m^3/hr
Backwash duration	=	7.0	min/day
Backwash generation rate	=	1.96	m^3/day
Backwash generation rate	=	**4.67**	litre/sec

4. Residential (Other Proposed Residential Development ref. YTML No. 69 & YTIL No. 4RP) (From Sewerage Impact Assessment for Proposed Development at YTML No. 57 and YTILs 4 sB & 9, and Adjoining Government Land, Yau Tong (R7481_v1.3))

a. Sewage Generation rate	=	627	m^3/day (from EPD)

5. Commercial (Kwun Tong Wholesale Fish Market and Tung Yuen Street Cooked Food Market) (From Sewerage Impact Assessment for Proposed Development at YTML No. 57 and YTILs 4 sB & 9, and Adjoining Government Land, Yau Tong (R7481_v1.3))

a. Sewage Generation rate	=	30	m^3/day

6. Peninsula East (From Sewerage Impact Assessment for Proposed Development at YTML No. 57 and YTILs 4 sB & 9, and Adjoining Government Land, Yau Tong (R7481_v1.3))

a. Sewerage Generate rate	=	193.5	m^3/day

7. Industrial (Redland Concrete Limited) (From Sewerage Impact Assessment for Proposed Development at YTML No. 57 and YTILs 4 sB & 9, and Adjoining Government Land, Yau Tong (R7481_v1.3))

a. Sewerage Generate rate	=	27	m^3/day

Total Flow at Manhole S1 (FMH4034524), including Proposed Development and Catchment A

Flow Rate (Without Swimming Pool & Item 1 of Catchment A)	=	2373.4	m^3/day
Flow Rate with inflow factor (Without Swimming Pool)	=	2610.8	m^3/day (Catchment Inflow Factor for East Kowloon = 1.1)
Population	=	9670	people
Peaking factor	=	5	Refer to Table T-5 of GESF for population 5,000 - 10,000 including stormwater allowance)
Peak Flow (Without Swimming Pool)	=	307.7	litre/sec
Peak Flow (With Swimming Pool)	=	**322.8**	litre/sec

Table 3b Calculation for Sewage Generation Rate of the Existing Surrounding Building (Catchment B)

1. Yau Tongindustrial City Block A			
a. Assumed used area	=	47051	m^2
b. Assumed floor area per employee	=	43.5	m^2 per employee -- (refer to Table 8 of CIFSUS -Manufacturing)
c. Total number of employees	=	1082	employees
d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-3 of GESF)
e. Design flow for commercial activities	=	1000	litre/employee/day -- (refer to Table T-3 of GESF Yau Tong)
f. Sewage generation rate	=	**1168.6**	m^3/day
2. Yau Tongindustrial City Block B			
a. Assumed used area	=	36735	m^2
b. Assumed floor area per employee	=	43.5	m^2 per employee -- (refer to Table 8 of CIFSUS -Manufacturing)
c. Total number of employees	=	845	employees
d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-3 of GESF)
e. Design flow for commercial activities	=	1000	litre/employee/day -- (refer to Table T-3 of GESF Yau Tong)
f. Sewage generation rate	=	**912.6**	m^3/day
3. Union Industrial Building Blook A&B			
a. Assumed used area	=	9149	m^2
b. Assumed floor area per employee	=	43.5	m^2 per employee -- (refer to Table 8 of CIFSUS -Manufacturing)
c. Total number of employees	=	210	employees
d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-3 of GESF)
e. Design flow for commercial activities	=	1000	litre/employee/day -- (refer to Table T-3 of GESF Yau Tong)
f. Sewage generation rate	=	**226.8**	m^3/day
5. Gloria Weaving & Knitting Factory Limited			
a. Assumed used area	=	100052	m^2
b. Assumed floor area per employee	=	43.5	m^2 per employee -- (refer to Table 8 of CIFSUS -Manufacturing)
c. Total number of employees	=	2301	employees
d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-3 of GESF)
e. Design flow for commercial activities	=	1000	litre/employee/day -- (refer to Table T-3 of GESF Yau Tong)
f. Sewage generation rate	=	**2485.1**	m^3/day

Total Flow of Catchment B			
Flow Rate (Without Swimming Pool & Item 1 of Catchment A)	=	4793.0	m^3/day
Flow Rate with inflow factor (Without Swimming Pool)	=	5272.3	m^3/day (Catchment Inflow Factor for East Kowloon = 1.1)
Population	=	19527	people
Peaking factor	=	4	Refer to Table T-5 of GESF for population 10,000 - 50,000 including stormwater allowance)
Peak Flow (Without Swimming Pool)	=	221.9	litre/sec
Total Flow at Manhole S3 (FMH4034509), including Catchment A and Catchment B			
Flow Rate (Without Swimming Pool & Item 1 of Catchment A)	=	7166.5	m^3/day
Flow Rate with inflow factor (Without Swimming Pool)	=	7883.1	m^3/day (Catchment Inflow Factor for East Kowloon = 1.1)
Population	=	29197	people
Peaking factor	=	4	Refer to Table T-5 of GESF for population 10,000 - 50,000 including stormwater allowance)
Peak Flow (Without Swimming Pool)	=	331.8	litre/sec
Peak Flow (With Swimming Pool)	=	**346.2**	litre/sec

Table 3c Calculation for Sewage Generation Rate of the Existing Surrounding Building (Catchment C)

1. Full Bore of Pipes FWD4036721 (Assumption)

Pipe Reference	Manhole Reference	Manhole Reference	Pipe Dia.	Pipe Length	Upstream Invert Level	Downstream Invert Level	g	k_s	s	v	V	Area	Q	Estimated Capacity
			mm	m	mPD	mPD	m/s^2	m		m^2/s	m/s	m^2	m^3/s	L/s
FWD4036721	FMH4034501	FMH4034502	1125	42.2	1.15	0.97	9.81	0.006	0.004	0.000001	1.74	0.99	1.73	1732
													Sub-total	1732

Remarks:
(1) g=gravitational acceleration; k_s=equivalent sand roughness; s=gradient; v=kinematic viscosity of water; V=mean velocity
(2) The value of k_s = 6mm is used for the calculation of concrete sewer (based on Table 5: Recommended roughness values in Sewerage Manual)
(3) The value of velocity (V) is referred to the Tables for the hydraulic design of pipes, sewers and channels (8th edition)
(4) Equation used: $$V = -\sqrt{(8gDs)}\log\left(\frac{k_s}{3.7D} + \frac{2.51v}{D\sqrt{(2gDs)}}\right)$$
(5) The pipe information is obtained from Geoinfo Map.
(6) Assumed sewage generated form Catchment C is discharged to FWD4036721 with full flow condition as a worst case scenario.

Total Flow at Manhole S1 (FMH4034524), including Proposed development, Cathment A, Catchment B and Catchment C

Peak Flow (Without Swimming Pool)	=	2063.6	litre/sec
Peak Flow (With Swimming Pool)	=	**2078.4**	litre/sec

Table 4 Hydraulic Capacity at Sewers After Upgrading

Segment	Manhole Reference	Manhole Reference	Pipe Dia.	Pipe Length	Invert Level 1	Invert Level 2	g	k_s	s	v	V	Area	Q	Estimated Capacity
			mm	m	mPD	mPD	m/s^2	m		m^2/s	m/s	m^2	m^3/s	L/s
T0-S1	Terminal Manhole	FMH4034524	300	9.5	1.04	0.97	9.81	0.0015	0.007	0.000001	1.19	0.07	0.08	84
S1-S2	FMH4034524	FMH4034525	825	41.7	0.97	0.94	9.81	0.0015	0.001	0.000001	0.71	0.53	0.38	379
S2-S3	FMH4034524	FMH4034509	825	8.0	-	-	9.81	0.0015	0.001	0.000001	0.71	0.53	0.38	379
S3-S4	FMH4034509	FMH4034510	1425	17.6	-	-	9.81	0.0015	0.002	0.000001	1.50	1.59	2.38	2385
S4-S5	FMH4034510	Yau Tong Sewage Puminp Station	1425	6.4	-	-	9.81	0.0015	0.002	0.000001	1.50	1.59	2.38	2385

Remarks:
(1) g=gravitational acceleration; k_s=equivalent sand roughness; s=gradient; v=kinematic viscosity of water; V=mean velocity
(2) The value of k_s = 1.5 mm is used with reference to Slimed uPVC Sewers, poor example in Table 5 of Sewerage Manual Part 1.
(3) The value of velocity (V) is referred to the Tables for the hydraulic design of pipes, sewers and channels (8th edition)
(4) Equation used:

$$V = -\sqrt{(8gDs)}\log\left(\frac{k_s}{3.7D} + \frac{2.51v}{D\sqrt{(2gDs)}}\right)$$

(5) The pipe information in Table 2a is obtained from Sewerage Impact Assessment for Proposed Development at YTML No. 57 and YTILs 4 sB & 9, and Adjoining Government Land, Yau Tong (R7481_v1.3)
(6) According to DSD Drainage Records, the downstream invert level of manholes FMH4034525 is missing, as a conservative approach, the slope of the upstream Segment (i.e. S1-S2) is used instead.
(7) According to DSD Drainage Records, the invert level of manholes FMH4034509 and FMH4034510 are missing, as a conservative approach, the slope 0.002 is used .
The Invert Level 1 is reference the FWD4036916 downstream 1.22mPD and the Invert Level 2 is reference the FWD4036741 downstream 0.98mPD with length

Table 4a Comparision of the Hydraulic Capacity of Existing Sewers for Sewerage generated from the Proposed Development and Surrounding Catchment Areas

Segment	Pipe Dia. (mm)	Pipe Length (m)	Gradient	Estimated Capacity (L/s)	Estimated Flow including the Proposed Development only (L/s)	Contributed by the Proposed Development only (%)	Status	Estimated Flow including the Proposed Development and Catchment Areas (L/s)	Contributed by the Proposed Development and the Surrounding Catchment Areas (%)	Status	Included Catchment Area
T0-S1	300	9.5	0.0074	84	32.6	38.8%	OK	32.6	38.8%	OK	A
S1-S2	675	41.7	0.0007	223	32.6	14.6%	OK	322.8	144.6%	Spill	A
S2-S3	675	8.0	0.0007	223	32.6	14.6%	OK	322.8	144.6%	Spill	A
S3-S4	1425	17.6	0.0016	2385	32.6	1.4%	OK	331.8	13.9%	OK	A+B
S4-S5	1425	6.4	0.0016	2385	32.6	1.4%	OK	331.8	13.9%	OK	A+B

Table 4a Comparision of the Hydraulic Capacity of Upgrading Sewers for Sewerage generated from the Proposed Development and Surrounding Catchment Areas

Segment	Pipe Dia. (mm)	Pipe Length (m)	Gradient	Estimated Capacity (L/s)	Estimated Flow including the Proposed Development only (L/s)	Contributed by the Proposed Development only (%)	Status	Estimated Flow including the Proposed Development and Catchment Areas (L/s)	Contributed by the Proposed Development and the Surrounding Catchment Areas (%)	Status	Included Catchment Area
T0-S1	300	9.5	0.0074	84	32.6	38.8%	OK	32.6	38.8%	OK	A
S1-S2	825	41.7	0.0007	379	32.6	8.6%	OK	322.8	85.2%	OK	A
S2-S3	825	8.0	0.0007	379	32.6	8.6%	OK	322.8	85.2%	OK	A
S3-S4	1425	17.6	0.0016	2385	32.6	1.4%	OK	2078.4	87.2%	OK	A+B+C
S4-S5	1425	6.4	0.0016	2385	32.6	1.4%	OK	2078.4	87.2%	OK	A+B+C

Table 5 Future Flows to Yau Tong Seage Pumping Station

Existing Designed Capacity	28800	m^3/day (DSD)
Estimated Flow including the Proposed Development and Catchment Area A, B and C	7166.5	m^3/day
Contribution	25%	(of designed capacity)