Appendix G –

Drainage and Sewerage Impact Assessment

Prepared by

Ramboll Hong Kong Limited

SECTION 16 PLANNING APPLICATION FOR PROPOSED COMPREHENSIVE RESIDENTIAL DEVELOPMENT WITH COMMERIAL UESE AND SOCIAL WELFARE FACILITY AND MINOR RELAXATION OF MAXIMUM PLOT RATIO AND BUILDING HEIGHT RESTRICTIONS IN “COMPREHENSIVE DEVELOPMENT AREA (5)” ZONE FACILITY AT YEUNG UK ROAD / KWU HANG ROAD / WANG WO TSAI STREET, TSUEN WAN

DRAINAGE AND SEWERAGE IMPACT ASSESSMENT

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1. INTRODUCTION

1.1 Project Background

1.1.1 The Application Site is zoned as "Comprehensive Development Area (5)" [CDA (5)] site under Approved Tsuen Wan Outline Zoning Plan (OZP no. S/TW/37). A comprehensive development under application consists of different phases, i.e. Phase 1 in Site A at Lot No. 476 in D.D.443 Jumbo iAdvantage, 145-159 Yeung Uk Road and it will be implemented by the Applicant; while the remaining areas (i.e. Tsuen Wan Town Lot 11 for Phase 2A in Site B, Lot No. 475 in D.D. 443 for Phase 2B in Site C, and Lot No. 461, 469 & 459 in D.D. 443 for Phase 2C-E in Site D-F) will be implemented in later stage. This S16 application is submitted to the Town Planning Board for the proposed comprehensive residential development at the Application Site.

1.1.2 This application is submitted to seek permission from the Town Planning Board for proposed residential redevelopment and minor relaxation of maximum plot ratio and building height restrictions. The current maximum plot ratio is 5.0 with minimum 4.5 shall be for domestic use under OZP. On the other hand, the maximum building height is 100 mPD. Under this application, one 29-storey residential tower (above 1 level of basement carpark and excluding 3 levels of lobby/ club house/E&M/ social welfare facility) with building height not exceeding 120 mPD to the main roof is proposed in Phase 1 (i.e. Site A). Another 5 residential buildings with a maximum building height at 120 mPD are proposed in the remaining areas.

1.1.3 Ramboll Hong Kong Limited has been appointed to conduct the drainage and sewerage impact assessment based on the proposed scheme.

1.2 Application Site and its Environs

1.2.1 Figure 1 shows the location of the Application site and its environs. The Application Site is bounded by Wang Wo Tsai Street to the north and Kwu Hang Road to the west, and Yeung Uk Road to the south. Asia Tone i-Centre are located immediate north and northwest of the site. A public open space and mid-rise Ever Gain Centre are located to the immediate northeast with Wang Wo Tsai Street. High-rise Sheung Chui Court is located further northeast of the site. Medium to high rise industrial buildings are located and packed along the Wang Wo Tsai Street. High rise residential development (H Cube and Indi Home) and industrial building (Goodman Global Gateway) are located to the south of Yeung Uk Road.

1.2.2 Two (2) approved comprehensive residential development (Application No. A/TW/527 & Application No. A/TW/537) are located to the north and east of the Application Site (hereinafter to be referred as the Approved No. A/TW/527 Development and Approved No. A/TW/537 Development).

1.2.3 For Approved Application No.527 Development, it comprises of 2 phases and consists of a total of 5 residential towers with building height of 120 mPD. Phase 1, which is currently in construction, is a residential tower that occupies the previous Edward Wong Industrial Centre (i.e., the previous building has already been demolished). Phase 2 consists of 3 existing towers including Asia Tone i-Centre, Bonsun Industrial Building and Tetra.

1.2.4 For Approved Application No. A/TW/537 Development, it also comprises 2 phases and consists of a total of 4 residential towers with a building height of 120 mPD, which are currently occupied by Leahander Centre, Bonjour Tower, Harrington Building Block A and B, Tung Cheong Factory Building, and Wing Ming Industrial Building.

1.3 Proposed Development

1.3.1 According to the latest development scheme, the Application Site comprises of 2 phases and consists of 6 residential blocks as shown in Table 1.1 below. The indicative master layout plan is shown in Appendix 1. There are altogether 886 number of residential units. A social work service team for pre-primary institutions is provided at G/F of Site A. Each of the residential blocks at Site A to Site F are provided with a club house. Detailed development parameters can be referred to Table 1.1 below.

Table 1.1 Development Parameters of the Application Site

Development Phase	Phase 1	Phase 2A	Phase 2B	Phase 2C	Phase 2D	Phase 2E
Site ID.	Site A (the Subject Site of the Application)	Site B	Site C	Site D	Site E	Site F
Ancillary Facilities	Club house, Social Work Service Team for Pre-primary Institutions, Retail use	Club house, Retail	Club house, Retail	Club house	Club house	Club house
Non-domestic GFA	1016 m^2	419 m^2	431 m^2	317 m^2	209 m^2	399 m^2
No. of Residential Units	277	116	116	145	87	145
Total no. of Residential Units	886					

1.3.2 The target completion year for Phase 1 is Year 2030. The Phase 2 would replace the existing industrial buildings. The assumed completion year of the Phase 2 developments is also year 2030.

2. DRAINAGE IMPACT ASSESSMENT

2.1 Discussion

2.1.1 Surface runoff is mainly from rainfall, and it will be directed to existing public storm drains. As the existing site is currently on hard-paved ground, it is anticipated that the Application Site will not affect the drainage path or lead to any changes in the runoff behaviour.

2.1.2 The surface runoff generated from the Application Site (i.e., Site A to Site F) will be collected by the same drainage pipe tentatively so that there is no change of flow regime.

2.1.3 There is no change or abandonment of existing drains and hence no extra stormwater discharge is imposed. Therefore, significant impact on the existing drainage system is not anticipated and a detailed drainage impact assessment is therefore unnecessary.

3. SEWERAGE IMPACT ASSESSMENT

3.1 Scope of Work

3.1.1 The aim of this study is to compare the sewage flow generated from the Application Site with the sewage flow from the existing usage, and to determine whether significant sewerage impact is anticipated.

3.2 Assessment Criteria and Methodology

3.2.1 According to the Drainage Record obtained from the Drainage Services Department, there is public sewer network serving the Application Site and the surrounding environment. Figure 2 shows the location of the sewer sections concerned.

3.2.2 The Environmental Protection Department's (EPD's) Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning, Version 1 (GESF) is referred to estimate the quantity of the sewage generated from the Application Site and the existing development. Sewage flow parameters and global peaking factors in this document are adopted.

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

3.2.4 In order to represent worst-case scenario, the sewerage impact assessment was conducted based on the assumption that all phases of the Application Site have been completed.

3.3 Sewerage Impact Assessment

3.3.1 Wastewater arising from the Application Site will be primarily contributed by residents, with some additional flows from the users and employees from the club houses at Sites A to F as well as the social work service team for pre-primary Institutions and retail use at Site A. The estimated peak discharge from the Application Site can be referred to Appendix 2.

3.3.2 The assumed parameters of gross floor areas (GFAs) are based on the Planning Department's Land Use Plan, rental listings, building directories and surveys of the assessment area.

3.3.3 Furthermore, the Approved Application No. A/TW/527 Development and Approved Application No. A/TW/537 Development to the north and east of the Application Sites, of which developments share the same sewerage network with the Application Site. The sewage generated by these two approved developments would be included in the assessment.

3.4 Discussion

<u>Wastewater Generated by the Existing Industrial Buildings and Proposed Development</u>

3.4.1 The Application Site currently comprises six (6) industrial buildings, Wing Wah Industrial Building, Shui Cheong Factory Building, Wing Kwai Factory Building, Wing Yu Factory Building, Sunwise Industrial Building, and Jumbo iAdvantage. Sewage flow from the existing buildings is primary contributed by the industrial activities, with additional flow from the industrial employee.

Table 3.1 Existing Sewage Flow arising from the Existing Industrial Buildings

Activities	ADWF (m^3/day)
Wing Yu Factory Building	53.3
Wing Wah Factory Building	149.7
Shui Cheong Industrial Building	92.7
Sunwise Industrial Building	452.6
Wing Kwai Factory Building	145.3
Jumbo iAdvantage	174.6
Total	922.8

3.4.2 For the Future Scenario, the flow from the Application Site will be primarily contributed by residents, with some additional flows from the users and employees from the retails and club houses at Sites A to F as well as the social work service team for pre-primary Institutions at Site A.

Table 3.2 Future Sewage Flow arising from the Proposed Development

Activities	ADWF (m^3/day)
Site A	211.5
Site B	88.5
Site C	88.6
Site D	108.8
Site E	65.4
Site F	109.5
Total	672.3

3.4.3 When compared with the result, there will be a decrease of discharge (equivalent to 250.6m^3/day) after development with the proposed residential use. The capacity of the existing and future sewerage system under concern and contribution from the Application Site is estimated and shown in Appendix 2 for reference.

3.4.4 According to the hydraulic calculation and estimated flow, no adverse sewerage impact is anticipated from the Proposed Development to the public sewerage network and STW/ pumping station.

3.4.5 The overall sewage generation and estimated peak flow of the Application Site has been summarised in Table 3.3 below.

Table 3.3 Sewage Generation and Estimated Peak Flow of the Application Site

Development Phase	Phase 1	Phase 2A	Phase 2B	Phase 2C	Phase 2D	Phase 2E
Site ID.	Site A	Site B	Site C	Site D	Site E	Site F
Peak Flow (m^3/day)	232.7	97.3	97.4	119.6	71.9	120.5
L/s	21.5	9.0	9.0	11.1	6.7	11.2

3.4.6 The assessment results have been summarised in Table 3.4 below.

Table 3.4 The Summary of the Assessment Result

Segment	Estimated Capacity (L/s)	Peak Flow from the Proposed Development and Catchment Areas (L/s) (with Swimming Pool and Public Toilet)	Contribution from the Proposed Development and the Surrounding Catchment Areas (%)
S1-S2	151	51.3	34.0
S2-S3	502	130.7	23.1
S3-S4	761	130.7	17.2
S4-S5	670	130.7	19.5
S5-S6	1066	205.4	19.3

3.4.7 Sewage generated from Sites A-F would be discharged from the existing terminal manholes, namely FMH4007099 (S1) and conveyed to the public manholes FMH4007100 (S2), FMH4007092 (S3), FMH4007084 (S4), FMH4007086(S5) and FMH4007087(S6) via the existing pipes. The sewage disposal arrangement of Proposed Development is shown in Figure 4.

3.4.8 For any future sewer which may have crossing the existing stormwater drains, a 300mm clearance as far as possible would be adopted during the detailed design.

4. OVERALL CONCLUSION

4.1.1 Since there is no change in stormwater runoff or discharge, no significant drainage impact is anticipated for the Application Site. The surface runoff generated from the Application Site (i.e., Site A to Site F) will be collected by the same drainage pipe tentatively so that there is no change of flow regime.

4.1.2 Based on the sewerage impact assessment calculations, it is considered that the capacity of the nearby existing sewers would be adequate to cater for the Application Site as well as the surrounding existing buildings and nearby approved planning application. The Proposed Development would therefore be acceptable in sewerage terms.

Figures

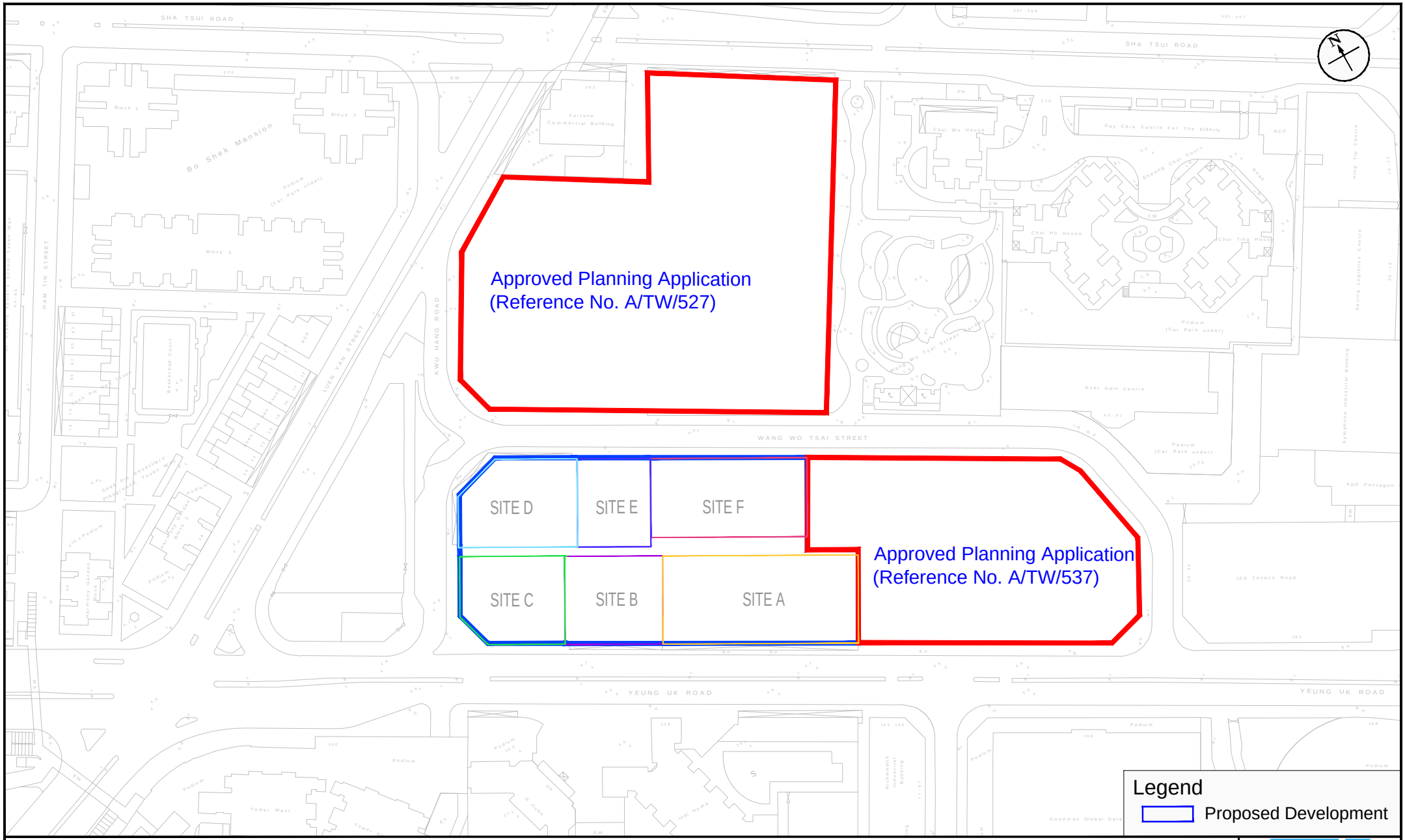

Figure: 1

Title: Location of the Proposed Development and its Environs

Project: Section 16 Planning Application for Proposed Comprehensive Residential Development with Commercial Uses and Social Welfare Facility and Minor Relaxation of Maximum Plot Ratio and Building Height Restrictions in "Comprehensive Development Area (5)" Zone at Yeung Uk Road / Kwu Hang Road / Wang Wo Tsai Street, Tsuen Wan

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Checked by:	TC
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Date:	Aug 2024

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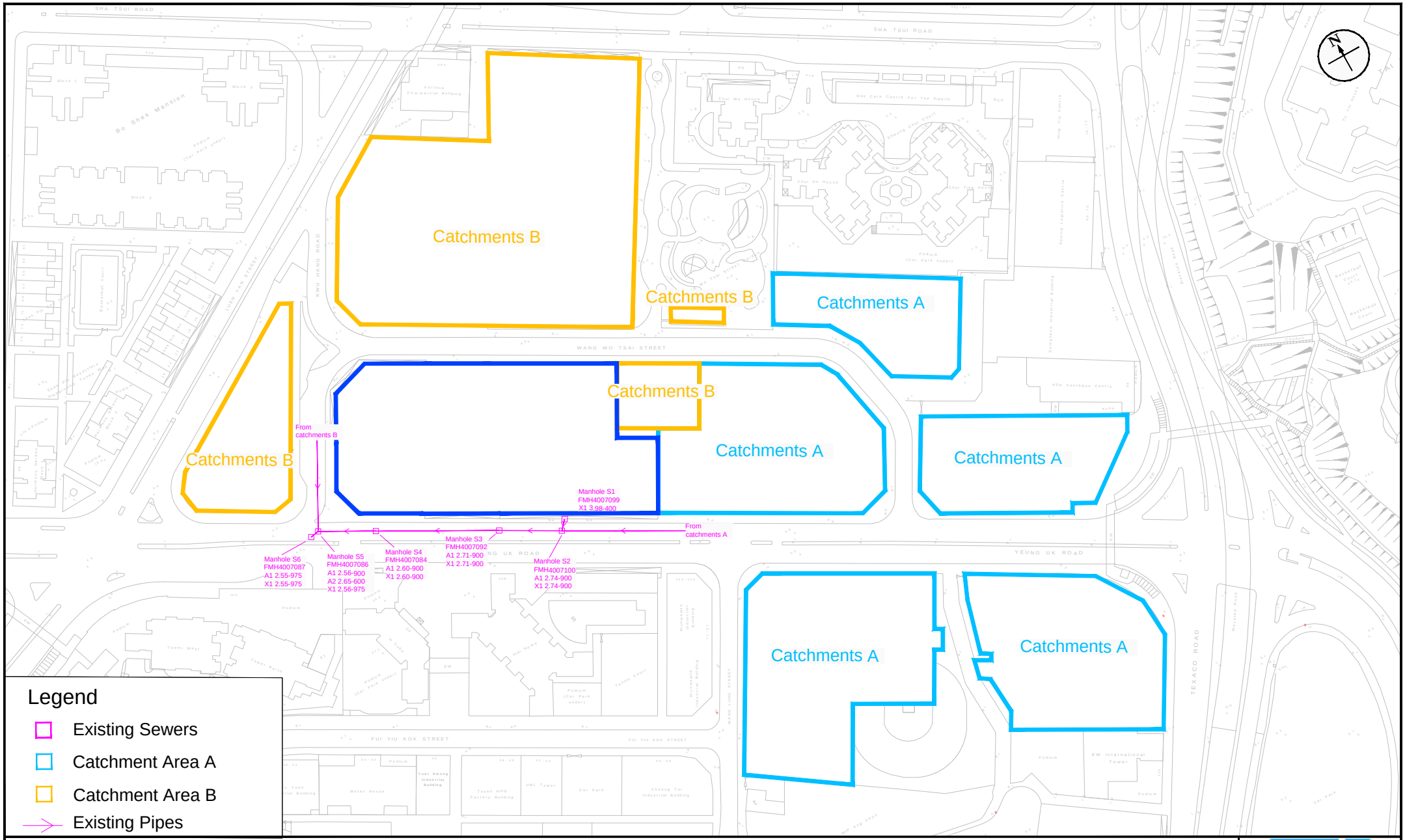

Figure: 2

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

Project: Section 16 Planning Application for Proposed Comprehensive Residential Development with Commercial Uses and Social Welfare Facility and Minor Relaxation of Maximum Plot Ratio and Building Height Restrictions in "Comprehensive Development Area (5)" Zone at Yeung Uk Road / Kwu Hang Road / Wang Wo Tsai Street, Tsuen Wan

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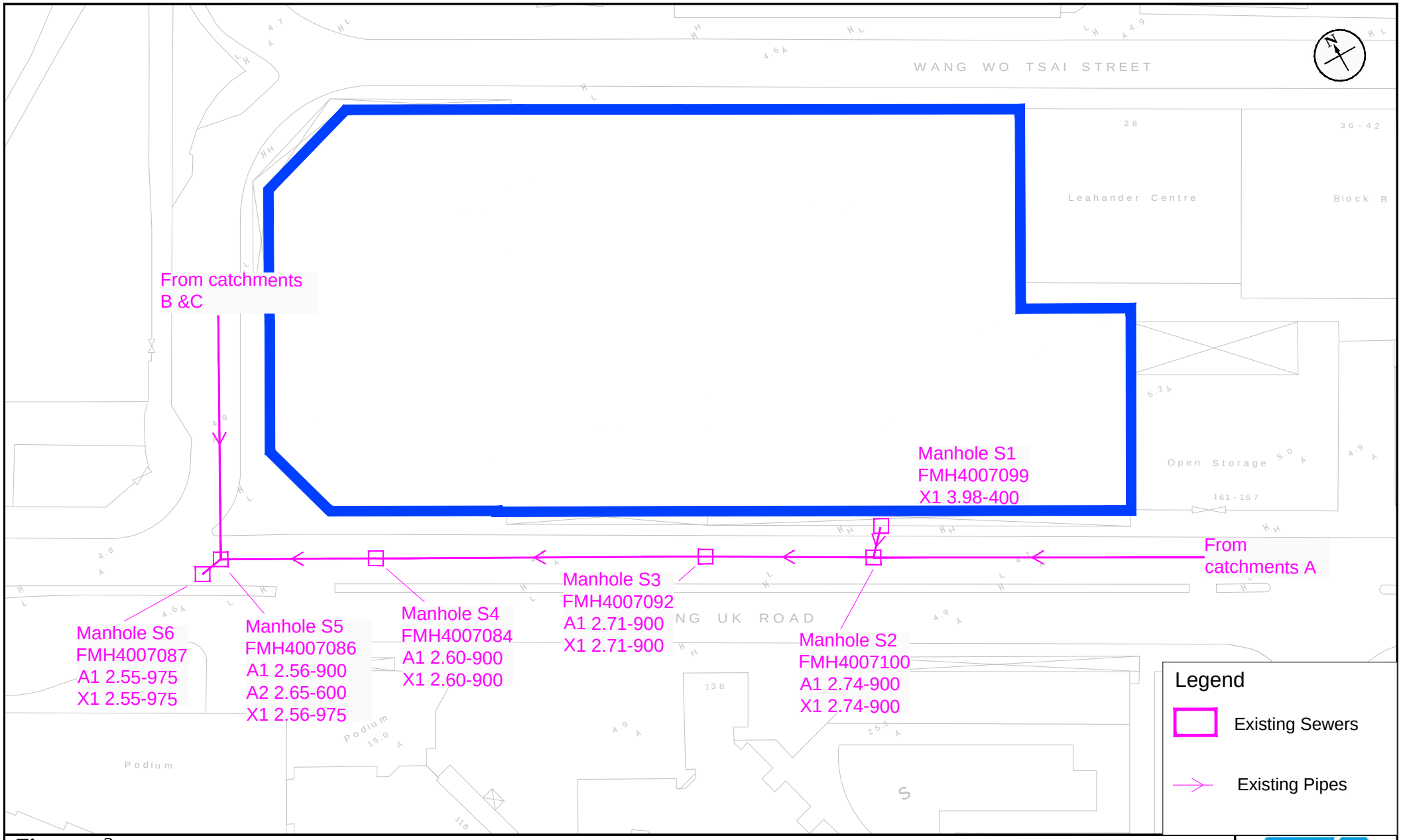

Figure: 3	RAMBOLL
Title: Sewerage System in the vicinity of the Application Site and Invert Levels adopted for Sewerage Impact Assessment	Drawn by: KK Checked by: TC
Project: Section 16 Planning Application for Proposed Comprehensive Residential Development with Commercial Uses and Social Welfare Facility and Minor Relaxation of Maximum Plot Ratio and Building Height Restrictions in "Comprehensive Development Area (5)" Zone at Yeung Uk Road / Kwu Hang Road / Wang Wo Tsai Street, Tsuen Wan	Rev.: 1.1 Date: Dec 2024

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Appendix 1 Indicative Master Layout Plan


KEY PLAN:
SITE D
SITE E
SITE F
SITE C
SITE B
SITE A
N
LEGEND:
Boundary of Application Site
Phase 1 (Site A)
Phase 2a (Site B)
Phase 2b (Site C)
Phase 2c (Site D)
Phase 2d (Site E)
Phase 2e (Site F)
Residential
Landscape / Uncovered Area
EVA / Driveway
Uncovered Walkway
Management Facility
WANG WO TSAI STREET
KWU HANG ROAD
YEUNG UK ROAD
PUBLIC LANE
B
A
SITE D INDICATIVE LAYOUT
SITE E INDICATIVE LAYOUT
SITE F INDICATIVE LAYOUT
SITE C INDICATIVE LAYOUT
SITE B INDICATIVE LAYOUT
SITE A LAYOUT FOR THIS APPLICATION
TOWER
120.00mPD
LANDSCAPE AREA
PEDESTRIAN ACCESS
VEHICULAR ACCESS
11.05mPD
4.70
4.60
4.65
4.60
14.25
14.30
4.80
14.35
21.85
4.85

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Title

INDICATIVE MASTER LAYOUT PLAN

Rev.	Date
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Scale	Figure
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Appendix 2 Detailed Sewerage Impact Assessment Calculations

Table 1 Calculation for Sewage Generation Rate of the Application Site (Site A)

Residential			
Total number of residential units	=	277	units
Total number of residents	=	748	residents (refer to Census and Statistics Department 2023 data - average household size of 2.7 in Tsuen Wan)
Design flow	=	270	litre/person/day -- (Private R2 in Table T-1 of GESF)
Sewage generation rate	=	202.0	m^3/day
Retail			
Assumed Area	=	280	m^2 (refer to Building Floor Layout Plan)
Assumed floor area per employee	=	28.6	m^2 per employee -- (refer to Table 8 of CIFSUS - Retail Trade)
Total number of employees	=	10	employees
Design flow	=	280	litre/employee/day -- (refer to Table T-2 of GESF - J4 Wholesale & Retail)
Sewage generation rate	=	2.7	m^3/day
Club House			
Assumed area	=	557	m^2 (refer to Building Floor Layout Plan)
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	=	18	employees
Design flow	=	280	litre/employee/day -- (refer to Table T-2 of GESF - J11 Community, Social & Personal Services)
Sewage generation rate	=	5.1	m^3/day
Social Welfare Facilities			
Assumed area	=	179	m^2 (refer to Building Floor Layout Plan)
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	=	6	employees
Design flow	=	280	litre/employee/day -- (refer to Table T-2 of GESF - J11 Community, Social & Personal Services)
Sewage generation rate	=	1.7	m^3/day
Total Flow from the Application Site (Site A)			
Flow rate	=	211.5	m^3/day
Flow rate with P_{CIF}	=	232.7	m^3/day (refer to Table T-4 of GESF - Kwai Chung - 1.1)
Contributing population	=	862	people (refer to Section 12 of GESF -- Contributing population is the Flow rate with PCIF ÷ 0.27, while 0.27 is the average unit flow factor of all typical residents plus employees)
Peaking factor	=	8	(refer to Table T-5 of GESF for a population < 1000 incl. stormwater allowance)
Peak flow	=	1861	m^3/day
	=	21.5	litre/sec

Remarks:

(1) For job type J11, the “per-employee” unit flow factor takes into account the flows of customers and tenants.

Table 1 Calculation for Sewage Generation Rate of the Application Site (Site B)

Residential			
Total number of residential units	=	116	units
Total number of residents	=	313	residents (refer to Census and Statistics Department 2023 data - average household size of 2.7 in Tsuen Wan)
Design flow	=	270	litre/person/day -- (Private R2 in Table T-1 of GESF)
Sewage generation rate	=	84.5	m^3/day
Retail			
Assumed Area	=	140	m^2 (refer to Building Floor Layout Plan)
Assumed floor area per employee	=	28.6	m^2 per employee -- (refer to Table 8 of CIFSUS - Retail Trade)
Total number of employees	=	5	employees
Design flow	=	280	litre/employee/day -- (refer to Table T-2 of GESF - J4 Wholesale & Retail)
Sewage generation rate	=	1.4	m^3/day
Club House			
Assumed area	=	279	m^2 (refer to Building Floor Layout Plan)
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	=	9	employees
Design flow	=	280	litre/employee/day -- (refer to Table T-2 of GESF - J11 Community, Social & Personal Services)
Sewage generation rate	=	2.6	m^3/day
Total Flow from the Application Site (Site B)			
Flow rate	=	88.5	m^3/day
Flow rate with P_{CIF}	=	97.3	m^3/day (refer to Table T-4 of GESF - Kwai Chung - 1.1)
Contributing population	=	360	people (refer to Section 12 of GESF -- Contributing population is the Flow rate with PCIF ÷ 0.27, while 0.27 is the average unit flow factor of all typical residents plus employees)
Peaking factor	=	8	(refer to Table T-5 of GESF for a population < 1000 incl. stormwater allowance)
Peak flow	=	778	m^3/day
	=	9.0	litre/sec

Remarks:

(1) For job type J11, the “per-employee” unit flow factor takes into account the flows of customers and tenants.

Table 1 Calculation for Sewage Generation Rate of the Application Site (Site C)

Residential			
Total number of residential units	=	116	units
Total number of residents	=	313	residents (refer to Census and Statistics Department 2023 data - average household size of 2.7 in Tsuen Wan)
Design flow	=	270	litre/person/day -- (Private R2 in Table T-1 of GESF)
Sewage generation rate	=	84.5	m^3/day
Retail			
Assumed Area	=	143	m^2 (refer to Building Floor Layout Plan)
Assumed floor area per employee	=	28.6	m^2 per employee -- (refer to Table 8 of CIFSUS - Retail Trade)
Total number of employees	=	5	employees
Design flow	=	280	litre/employee/day -- (refer to Table T-2 of GESF - J4 Wholesale & Retail)
Sewage generation rate	=	1.4	m^3/day
Club House			
Assumed area	=	287	m^2 (refer to Building Floor Layout Plan)
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	=	9	employees
Design flow	=	280	litre/employee/day -- (refer to Table T-2 of GESF - J11 Community, Social & Personal Services)
Sewage generation rate	=	2.7	m^3/day
Total Flow from the Application Site (Site C)			
Flow rate	=	88.6	m^3/day
Flow rate with P_{CIF}	=	97.4	m^3/day (refer to Table T-4 of GESF - Kwai Chung - 1.1)
Contributing population	=	361	people (refer to Section 12 of GESF -- Contributing population is the Flow rate with PCIF ÷ 0.27, while 0.27 is the average unit flow factor of all typical residents plus employees)
Peaking factor	=	8	(refer to Table T-5 of GESF for a population < 1000 incl. stormwater allowance)
Peak flow	=	779	m^3/day
	=	9.0	litre/sec

Remarks:
(1) For job type J11, the “per-employee” unit flow factor takes into account the flows of customers and tenants.

Table 1 Calculation for Sewage Generation Rate of the Application Site (Site D)

Residential			
Total number of residential units	=	145	units
Total number of residents	=	392	residents (refer to Census and Statistics Department 2023 data - average household size of 2.7 in Tsuen Wan)
Design flow	=	270	litre/person/day -- (Private R2 in Table T-1 of GESF)
Sewage generation rate	=	105.8	m^3/day
Club House			
Assumed area	=	317	m^2 (refer to Building Floor Layout Plan)
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	=	10	employees
Design flow	=	280	litre/employee/day -- (refer to Table T-2 of GESF - J11 Community, Social & Personal Services)
Sewage generation rate	=	2.9	m^3/day
Total Flow from the Application Site (Site D)			
Flow rate	=	108.8	m^3/day
Flow rate with P_{CIF}	=	119.6	m^3/day (refer to Table T-4 of GESF - Kwai Chung - 1.1)
Contributing population	=	443	people (refer to Section 12 of GESF -- Contributing population is the Flow rate with PCIF ÷ 0.27, while 0.27 is the average unit flow factor of all typical residents plus employees)
Peaking factor	=	8	(refer to Table T-5 of GESF for a population < 1000 incl. stormwater allowance)
Peak flow	=	957	m^3/day
	=	11.1	litre/sec

Remarks:

(1) For job type J11, the “per-employee” unit flow factor takes into account the flows of customers and tenants.

Table 1 Calculation for Sewage Generation Rate of the Application Site (Site E)

Residential			
Total number of residential units	=	87	units
Total number of residents	=	235	residents (refer to Census and Statistics Department 2023 data - average household size of 2.7 in Tsuen Wan)
Design flow	=	270	litre/person/day -- (Private R2 in Table T-1 of GESF)
Sewage generation rate	=	63.5	m^3/day
Club House			
Assumed area	=	209	m^2 (refer to Building Floor Layout Plan)
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	=	7	employees
Design flow	=	280	litre/employee/day -- (refer to Table T-2 of GESF - J11 Community, Social & Personal Services)
Sewage generation rate	=	1.9	m^3/day
Total Flow from the Application Site (Site E)			
Flow rate	=	65.4	m^3/day
Flow rate with P_{CIF}	=	71.9	m^3/day (refer to Table T-4 of GESF - Kwai Chung - 1.1)
Contributing population	=	266	people (refer to Section 12 of GESF -- Contributing population is the Flow rate with PCIF ÷ 0.27, while 0.27 is the average unit flow factor of all typical residents plus employees)
Peaking factor	=	8	(refer to Table T-5 of GESF for a population < 1000 incl. stormwater allowance)
Peak flow	=	575	m^3/day
	=	6.7	litre/sec

Remarks:
(1) For job type J11, the “per-employee” unit flow factor takes into account the flows of customers and tenants.

Table 1 Calculation for Sewage Generation Rate of the Application Site (Site F)

Residential			
Total number of residential units	=	145	units
Total number of residents	=	392	residents (refer to Census and Statistics Department 2023 data - average household size of 2.7 in Tsuen Wan)
Design flow	=	270	litre/person/day -- (Private R2 in Table T-1 of GESF)
Sewage generation rate	=	105.8	m^3/day
Club House			
Assumed area	=	399	m^2 (refer to Building Floor Layout Plan)
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	=	13	employees
Design flow	=	280	litre/employee/day -- (refer to Table T-2 of GESF - J11 Community, Social & Personal Services)
Sewage generation rate	=	3.7	m^3/day
Total Flow from the Application Site (Site F)			
Flow rate	=	109.5	m^3/day
Flow rate with P_{CIF}	=	120.5	m^3/day (refer to Table T-4 of GESF - Kwai Chung - 1.1)
Contributing population	=	446	people (refer to Section 12 of GESF -- Contributing population is the Flow rate with PCIF ÷ 0.27, while 0.27 is the average unit flow factor of all typical residents plus employees)
Peaking factor	=	8	(refer to Table T-5 of GESF for a population < 1000 incl. stormwater allowance)
Peak flow	=	964	m^3/day
	=	11.2	litre/sec

Remarks:
(1) For job type J11, the “per-employee” unit flow factor takes into account the flows of customers and tenants.

Table 2a Hydraulic Capacity of Existing Sewers - Free Flow Condition

Segment	Manhole Reference	Manhole Reference	Material	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
S1-S2	FMH4007099	FMH4007100	Concrete	400	4.7	3.98	3.95	9.81	0.003	0.006	0.000001	1.20	0.13	0.15	151
S2-S3	FMH4007100	FMH4007092	Concrete	900	24.7	2.74	2.71	9.81	0.003	0.001	0.000001	0.89	0.64	0.57	566
S3-S4	FMH4007092	FMH4007084	Concrete	900	50.1	2.71	2.60	9.81	0.003	0.002	0.000001	1.20	0.64	0.76	761
S4-S5	FMH4007084	FMH4007086	Concrete	900	23.5	2.60	2.56	9.81	0.003	0.002	0.000001	1.05	0.64	0.67	670
S5-S6	FMH4007086	FMH4007087	Concrete	975	3.6	2.56	2.55	9.81	0.003	0.003	0.000001	1.43	0.75	1.07	1066

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

(2) The values of ks = 3mm and 0.6mm are used for the calculation of slimed clayware sewer, poor condition @mean velocity = approximately 0.75m/s and 1.2m/s (based on Table 5: Recommended Roughness Values in Sewerage Manual)

(3) The values of ks = 0.3mm is used for the calculation of slimed PE sewer, poor condition @mean velocity = approximately 1.2m/s (based on Table 5: Recommended Roughness Values in Sewerage Manual)

(4) The values of ks = 6mm and 3mm is used for the calculation of slimed Concrete sewer, poor condition @mean velocity = approximately 0.75m/s and 1.2m/s (based on Table 5: Recommended Roughness Values in Sewerage Manual)

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

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

(7) According to DSD Drainage Records, the incoming invert level of manhole S12 (FMH4007086) is missing. Therefore, the outgoing invert level of 2.56mPD is used instead.

Table 3 Calculation for Sewage generation rate of the Existing Surrounding Buildings

Catchment A, discharges to FMH4007100

1. Approved Planning Application A/TW/537 (without Phase 2A-Site B)

1a. Sewage generation rate from residential units, clubhouse & swimming pool	=	**390.1**	m^3/day

2. Ever Gain Centre

2a. Assumed used area	=	20884	m^2
2b. Assumed floor area per employee	=	43.48	m^2 per employee -- (refer to CIFSUS Table 8 - Manufacturing)
2c. Total number of employees	=	480	employees
2d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-3 of GESF Industrial employee)
2e. Design flow for commercial activities	=	650	litre/employee/day -- (refer to Table T-2 of GESF Job Type J1 Manufacturing - Tsuen Wan)
2f. Sewage generation rate	=	**350.4**	m^3/day

3. 100 Texaco Road

3a. Assumed used area	=	21760	m^2
3b. Assumed floor area per employee	=	43.48	m^2 per employee -- (refer to CIFSUS Table 8 - Manufacturing)
3c. Total number of employees	=	500	employees
3d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-3 of GESF Industrial employee)
3e. Design flow for commercial activities	=	650	litre/employee/day -- (refer to Table T-2 of GESF Job Type J1 Manufacturing - Tsuen Wan)
3f. Sewage generation rate	=	**365.0**	m^3/day

4. Goodman Dynamic Centre

4a. Assumed used area	=	79808	m^2
4b. Assumed floor area per employee	=	250	m^2 per employee -- (refer to CIFSUS Table 8 - Storage)
4c. Total number of employees	=	319	employees
4d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-2 of GESF Commercial employee)
4e. Design flow for commercial activities	=	100	litre/employee/day -- (refer to Table T-2 of GESF Job Type J3 - Transport, Storage & Communication)
4f. Sewage generation rate	=	**57.4**	m^3/day

5. Goodman Global Gateway

5a. Assumed used area	=	94915	m^2
5b. Assumed floor area per employee	=	250	m^2 per employee -- (refer to CIFSUS Table 8 - Storage)
5c. Total number of employees	=	380	employees
5d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-2 of GESF Commercial employee)
5e. Design flow for commercial activities	=	100	litre/employee/day -- (refer to Table T-2 of GESF Job Type J3 - Transport, Storage & Communication)
5f. Sewage generation rate	=	**68.4**	m^3/day

6. PetroChina Tsuen Wan (171 Yeung Uk Road)

6a. Assumed used area	=	311	m^2
6b. Assumed floor area per employee	=	100	m^2 per employee -- (refer to CIFSUS Table 8 - Retail)
6c. Total number of employees	=	3	employees
6d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-2 of GESF Commercial employee)
6e. Design flow for commercial activities	=	200	litre/employee/day -- (refer to Table T-2 of GESF Job Type J4 Wholesale & Retail)
6f. Sewage generation rate	=	**0.8**	m^3/day

Total Flow of Catchment A, discharges to FMH4007100	=	1,232.2 m^3/day

Table 3 Calculation for Sewage generation rate of the Existing Surrounding Buildings

Catchment B, discharges to FMH4007086

1. Approved Planning Application A/TW/527

1a. Sewage generation rate from residential units, clubhouse & swimming pool	=	**1010.3**	m^3/day
1b.Backwash generation rate	=	**9.5**	L/s

2. Approved Planning Application A/TW/537 (Phase 2A-Site B)

2a. Sewage generation rate from residential units, clubhouse & swimming pool	=	**102.4**	m^3/day
2b.Backwash generation rate	=	**32.1**	L/s

3. Public Toilet

3a. Discharge Unit (DU) from WC (Qty * DU)	=	16.2	L/s
3b. Discharge Unit (DU) from Single Urinal with Cistern (Qty * DU)	=	1.6	L/s
3c. Discharge Unit (DU) from Basin (Qty * DU)	=	2.7	L/s
3d. Sum of DUs	=	20.5	L/s
3e. Wastewater Flow Rate ($K\sqrt{\sum DU}$)	=	4.53	L/s

Remarks

1. Calculation of Wastewater Flow Rate is followed Plumbing Engineering Services Design Guide (PESDG)

2. Discharge Unit (DU) of WC = 1.8 L/s; DU of Basin = 0.3 L/s; DU of Single Urinal with Cistern = 0.4L/s, extracted from Table 5 of PESDG.

3. It is asumed that the total number of WC = 9; total number of Single Urinal with Cistern = 4; Total number of Basin = 9.

4. Frequency of use, K = 1, extracted from Table 6 of PESDG.

4.Tsuen Fook Kui

4a.Total number of residents	=	408	residents (refer to Census and Statistics Department 2023 data - average household size of 2.7 in Tsuen Wan)
4b.Design flow	=	270	litre/person/day -- (Private R2 in Table T-1 of GESF)
4c.Sewage generation rate	=	**110.2**	m^3/day

Total Flow of Catchment B, discharges to FMH4007086	=	1,222.8	m^3/day

Remarks:

(1) For job type J11, the “per-employee” unit flow factor takes into account the flows of customers and tenants.

Sub-total

Total Flow at S2 (including Catchment A & Application Site)	=	1,904.4	m^3/day
Total Flow at S5 (including Catchment A, B & Application Site)	=	3,127.2	m^3/day
Sub-total with Catchment Inflow Factor = 1.1 (Kwai Chung)			
Total Flow at S2 (including Catchment A & Application Site)	=	2,094.8	m^3/day
Total Flow at S5 (including Catchment A, B & Application Site)	=	3,439.9	m^3/day

Table 4a Calculation for Sewage Generation Rate of the Existing Industrial Buildings within the Application Site

1. Wing Yu Factory Building			
1a. Assumed used area	=	3179	m^2
1b. Assumed floor area per employee	=	43.5	m^2 per employee (refer to Table 8 of CIFSUS - Manufacturing)
1c. Total number of employees	=	73	employees
1d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-3 of GESF Industrial employee)
1e. Design flow for commercial activities	=	650	litre/employee/day -- (refer to Table T-3 of GESF Job Type J1 Manufacturing - Tsuen Wan)
1f. Sewage generation rate	=	53.3	m^3/day
2. Wing Wah Factory Building			
2a. Assumed used area	=	8903	m^2
2b. Assumed floor area per employee	=	43.5	m^2 per employee (refer to Table 8 of CIFSUS - Manufacturing)
2c. Total number of employees	=	205	employees
2d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-3 of GESF Industrial employee)
2e. Design flow for commercial activities	=	650	litre/employee/day -- (refer to Table T-3 of GESF Job Type J1 Manufacturing - Tsuen Wan)
2f. Sewage generation rate	=	149.7	m^3/day
3. Shui Cheong Industrial Building			
3a. Assumed used area	=	5527	m^2
3b. Assumed floor area per employee	=	43.5	m^2 per employee (refer to Table 8 of CIFSUS - Manufacturing)
3c. Total number of employees	=	127	employees
3d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-3 of GESF Industrial employee)
3e. Design flow for commercial activities	=	650	litre/employee/day -- (refer to Table T-3 of GESF Job Type J1 Manufacturing - Tsuen Wan)
3f. Sewage generation rate	=	92.7	m^3/day
4. Sunwise Industrial Building			
4a. Assumed used area	=	26952	m^2
4b. Assumed floor area per employee	=	43.5	m^2 per employee (refer to Table 8 of CIFSUS - Manufacturing)
4c. Total number of employees	=	620	employees
4d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-3 of GESF Industrial employee)
4e. Design flow for commercial activities	=	650	litre/employee/day -- (refer to Table T-3 of GESF Job Type J1 Manufacturing - Tsuen Wan)
4f. Sewage generation rate	=	452.6	m^3/day
5. Wing Kwai Factory Building			
5a. Assumed used area	=	8668	m^2
5b. Assumed floor area per employee	=	43.5	m^2 per employee (refer to Table 8 of CIFSUS - Manufacturing)
5c. Total number of employees	=	199	employees
5d. Design flow for commercial employee	=	80	litre/employee/day -- (refer to Table T-3 of GESF Industrial employee)
5e. Design flow for commercial activities	=	650	litre/employee/day -- (refer to Table T-3 of GESF Job Type J1 Manufacturing - Tsuen Wan)
5f. Sewage generation rate	=	145.3	m^3/day
1. Jumbo iAdvantage			
1a. Assumed used area	=	10396	m^2
1b. Assumed floor area per employee	=	43	m^2 per employee (refer to Table 8 of CIFSUS - Manufacturing)
1c. Total number of employees	=	239.1	employees
1d. Design flow for industrial employee	=	80.0	litre/employee/day -- (refer to Table T-3 of GESF Industrial employee)
1e. Design flow for industrial activities	=	650	litre/employee/day -- (refer to Table T-3 of GESF Job Type J1 Manufacturing - Tsuen Wan)
1f. Sewage generation rate	=	174.6	m^3/day
Total Flow from the Existing Industrial Buildings			
Flow rate	=	922.8	m^3/day

Table 5a Hydraulic Capacity of Existing Sewers for Sewerage Generated from the Proposed Development (Application Site) and Surrounding Catchment Areas

Segment	Manhole Reference	Manhole Reference	Pipe Dia. (mm)	Pipe Length (m)	Gradient	Estimated Capacity (L/s)	Daily Flow (m^3/day)	Contributing Population	Peaking Factor	Existing Swimming Pools Backwash (L/s)	Peak Flow from the Proposed Development and Catchment Areas (L/s)	Public Toilet (L/S)	Contribution from the Proposed Development and the Surrounding Catchment Areas (%)	Status
S1-S2	FMH4007099	FMH4007100	400	4.7	0.006	151	739.4	2,739	6		51.3	-	34.0%	OK
S2-S3	FMH4007100	FMH4007092	900	24.7	0.001	566	2094.8	7,759	5	9.5	130.7	-	23.1%	OK
S3-S4	FMH4007092	FMH4007084	900	50.1	0.002	761	2094.8	7,759	5	9.5	130.7	-	17.2%	OK
S4-S5	FMH4007084	FMH4007086	900	23.5	0.002	670	2094.8	7,759	5	9.5	130.7	-	19.5%	OK
S5-S6	FMH4007086	FMH4007087	975	3.6	0.003	1066	3439.9	12,740	4	41.63	205.4	4.5	19.3%	OK

Table 5a Comparsion of the Hydraulic Capacity of Existing Industrial Buildings and Proposed Developement

Activities	ADWF (m^3/day)
Existing Industiral Building	922.8
Proposed Development	672.2
Net decrease	250.6