

Appendix 4

Sewerage Impact Assessment

PROPOSED RCHE AND RESIDENTIAL DEVELOPMENT AT 42 GRAMPIAN ROAD, KOWLOON CITY

SEWERAGE IMPACT ASSESSMENT

10 July 2026

Report No: RT25382-SIA-03r1

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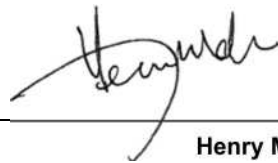
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TABLE OF CONTENTS

1	INTRODUCTION.....	4
1.1	PROJECT BACKGROUND.....	4
1.2	PROJECT LOCATION	4
1.3	DESCRIPTION OF THE SUBJECT SITE AND PROPOSED DEVELOPMENT	4
2	SEWERAGE IMPACT ASSESSMENT	5
2.1	SCOPE OF WORKS.....	5
2.2	EXISTING SEWERAGE FACILITIES.....	5
2.3	ASSESSMENT CRITERIA, METHODOLOGY AND ASSUMPTIONS	5
2.4	RESULTS AND DISCUSSION	8
3	CONCLUSION	8

APPENDIX A MASTER LAYOUT PLAN

APPENDIX B EXISTING SEWERAGE SYSTEM

APPENDIX C PROPOSED SEWERAGE CONNECTION AND CATCHMENT AREA

APPENDIX D SEWAGE CALCULATION AND HYDRAULIC CAPACITY CHECK

1 INTRODUCTION

1.1 PROJECT BACKGROUND

BeeXergy Consulting Limited was commissioned by KLS International Architects and Planners Limited to conduct a Sewerage Impact Assessment (SIA) for the Proposed Development. Latest architectural drawings and technical information on the Project Site were provided by the Project Architect.

1.2 PROJECT LOCATION

The Project Site is located at 42 Grampian Road, Kowloon City, and it is bounded by Gar Fook Court to the north, J17 to the east, and Grampian Road Substation to the south. **Figure 1.1** shows the location of Project Site and its environs.

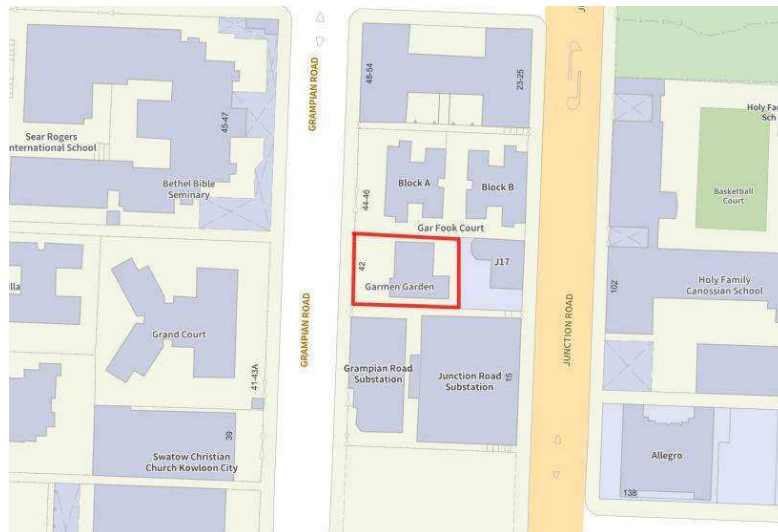


Figure 1.1 Location of the Project Site (Source: Geoinfo map)

1.3 DESCRIPTION OF THE SUBJECT SITE AND PROPOSED DEVELOPMENT

The Project Site covers an area of approximately 345.13m², and comprises a **14-storey residential tower and 4-storey podium**. The master layout plan provided by Project Architect is enclosed in **Appendix A**. The tentative population intake year is 2030.

2 SEWERAGE IMPACT ASSESSMENT

2.1 SCOPE OF WORKS

The objective of this SIA is to assess whether the existing capacity of the sewerage networking is sufficient to cope with the peak sewage flow arising from the Proposed Development during its operation stage and to recommend appropriate mitigation measure(s) to alleviate unacceptable sewerage impact, if any.

2.2 EXISTING SEWERAGE FACILITIES

The existing sewerage record from the GeoInfo Map of the Lands Department (LandsD) and Drainage Services Department (DSD) are obtained for this SIA and attached in **Appendix B**.

The foul manhole (FMH4048796) collected the sewage discharge from upstream to FMH4048798 via a 525mm sewer along Grampian Road. The foul water will further flow to FMH4048801 through two 300mm sewer.

The Project Proponent would like to construct a foul terminal manhole (FTMH-01) connect to FMH4048796 via a 225mm sewer. Location of the terminal manhole, proposed sewer connection and catchments are shown in **Appendix B**.

2.3 ASSESSMENT CRITERIA, METHODOLOGY AND ASSUMPTIONS

The Unit Flow Factors and Global Peaking Factor are adopted from the figures in the Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (Version 1.0)¹ (GESF) issued by the Environmental Protection Department (EPD) in March 2005 to estimate the sewage flows generated from the Subject Site.

The Unit Flow Factors and Catchment Inflow Factors as shown in **Table 2.1** below are adopted in the assessment. Relevant catchment can be found in **Appendix C**.

¹ http://www.epd.gov.hk/epd/sites/default/files/epd/english/environmentinhk/water/guide_ref/files/gesf.pdf

Table 2.1 Unit Flow Factors and Catchment Inflow Factors extracted from GESF

Parameter	Value	Justification
<i>Population</i>		
Proposed Development (Residential)	84 people	As advised by Project Proponent
Catchment A (Residential)	5104 people	2.7 and 3.7 Number of persons in average domestic household size for "Wong Tai Sin - Lok Fu" and "Kowloon City - Kowloon Tong" based on 2021 Population Census's Main Table D304, subject to the location of the building.
Catchment A (Student)	4762 people	Various online sources as stated in Appendix C. Assumed 1 class has 30 students if not specified.
Catchment A (Teacher)	324 people	Various online sources as stated in Appendix C.
Catchment A (Institution – Visitor & Staff)	626 people	3.3 employee per 100m2 GFA for 'Community, Social & Personal Services' based on CIFSUS published by PlanD
Catchment B (Residential)	10262 people	2.7 Number of persons in average domestic household size for "Wong Tai Sin - Lok Fu" and "Wong Tai Sin - Tung Mei" based on 2021 Population Census's Main Table D304
Catchment B (Student)	720 people	Various online sources as stated in Appendix C. Assumed 1 class has 30 students if not specified.
Catchment B (Teacher)	49 people	Various online sources as stated in Appendix C.
Catchment B (Institution – Visitor & Staff)	52 people	3.3 employee per 100m2 GFA for 'Community, Social & Personal Services' based on CIFSUS published by PlanD
Catchment C (Residential)	464 people	3.6 Number of persons in average domestic household size for "Kowloon City - Prince" based on 2021 Population Census's Main Table D304
Catchment C (Student)	31 people	Various online sources as stated in Appendix C. Assumed 1 class has 30 students if not specified.
Catchment C (Teacher)	6 people	Various online sources as stated in Appendix C.
Catchment C (Institution – Visitor & Staff)	172 people	3.3 employee per 100m2 GFA for 'Community, Social & Personal Services' based on CIFSUS published by PlanD
Catchment D (Residential)	302 people	3.6 Number of persons in average domestic household size for "Kowloon City - Prince" based on 2021 Population Census's Main Table D304.

Parameter	Value	Justification
Catchment D (Institution – Visitor & Staff)	103 people	3.3 employee per 100m ² GFA for 'Community, Social & Personal Services' based on CIFSUS published by PlanD
Catchment E (Residential)	325 people	3.6 Number of persons in average domestic household size for "Kowloon City - Prince" based on 2021 Population Census's Main Table D304.
Catchment F (Residential)	65 people	
Catchment G (Student)	180 people	Various online sources as stated in Appendix C. Assumed 1 class has 30 students if not specified.
Catchment G (Teacher)	24 people	Various online sources as stated in Appendix C.
Catchment H (Residential)	11 people	3.6 Number of persons in average domestic household size for "Kowloon City - Prince" based on 2021 Population Census's Main Table D304.
<i>Unit Flow Factors</i>		
Residents in residential buildings	0.27 m ³ /day	"Domestic Private R2" based on EPD's GESF Table T-1
Employees in clubhouse & school	0.28 m ³ /day	"J11 Community, Social & Personal Services" based on EPD's GESF Table T-2
Residents in public rental housing	0.19 m ³ /day	"Public Rental" based on EPD's GESF Table T-1
Student	0.04 m ³ /day	'School Student' based on EPD's GESF Table T-2
<i>Catchment Inflow Factor (P_{CIF})</i>		
Discharge from Project Site	1.0	Catchment based on EPD's GESF Table T-4

With reference to Table 5 in the Sewerage Manual (Part 1)² issued by the DSD in May 2013, k_s of 0.6mm is used for clayware and 0.3mm is used for PE pipe for both the sewers from the Subject Site and existing sewerage system. The Colebrook-White Equation will be used to analyse the flow conditions. Equation (ii) for circular pipes flowing partially full is adopted to estimate the sewage flow for the Subject Site and following sewers.

² http://www.dsd.gov.hk/EN/Files/Technical_Manual/technical_manuals/Sewerage_Manual_1_Eurocodes.pdf

2.4 RESULTS AND DISCUSSION

The estimated average flow rate and total peak flow of the Proposed Development are 22.68 m³/day and 2.10 L/s respectively. Sewage generated from the Proposed Development and surrounding catchment areas will be connected at the downstream of sewage network. The cumulative flow is generally no more than 61.1% of sewer capacity which no adverse sewerage impacts to the existing sewerage system are identified. Therefore, no upgrading or improvement works of the sewerage system are required. Details of the sewage calculation are included in **Appendix D**.

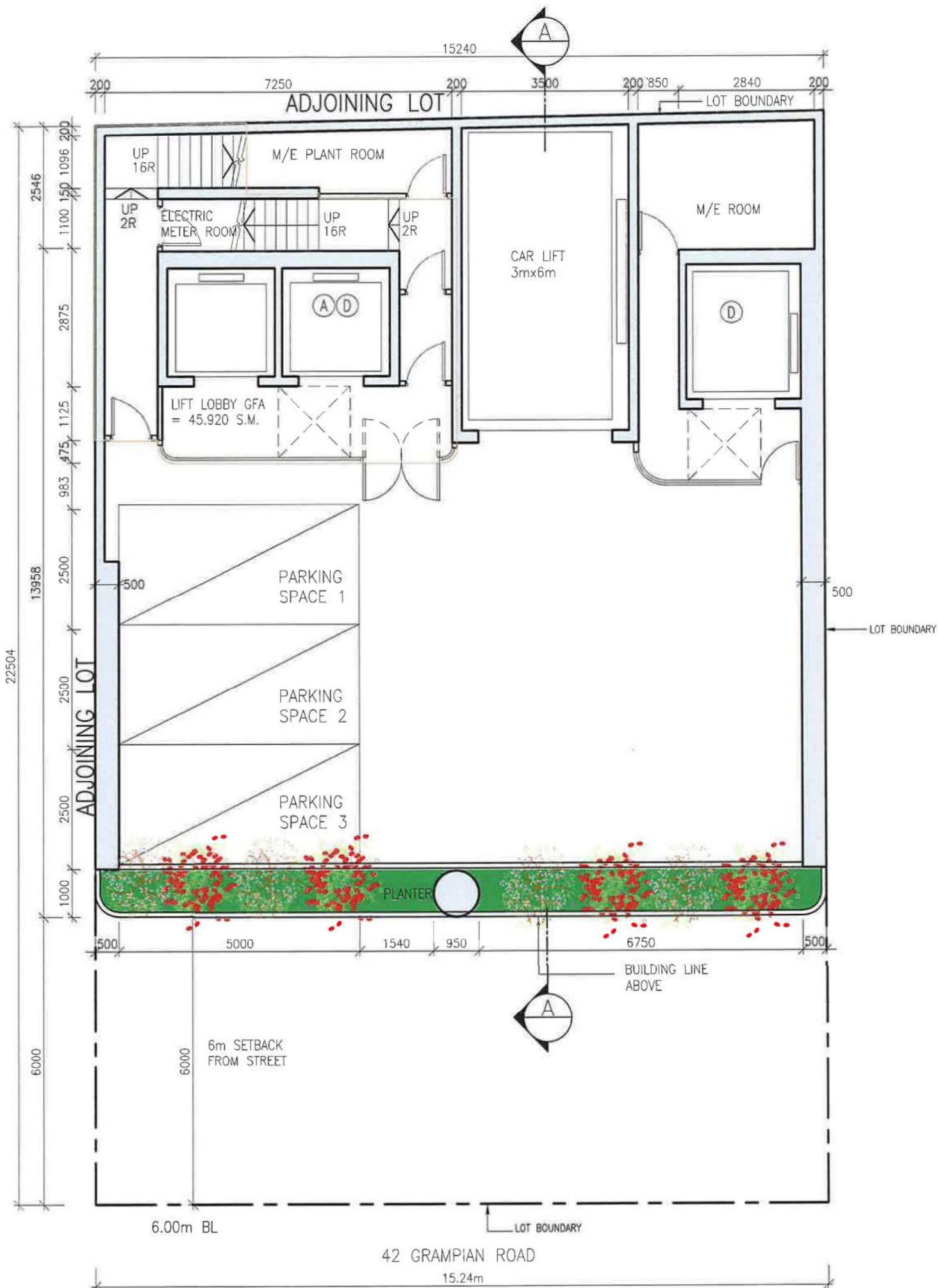
3 CONCLUSION

A composite development comprised of an 14-storey residential tower and 4-storey podium is proposed at 42 Grampian Road, Kowloon City. This is the SIA to assess whether the existing capacity of the sewerage networking is sufficient to cope with the peak sewage flow arising from the Proposed Development during its operation stage and to recommend appropriate mitigation measure(s) to alleviate unacceptable sewerage impact, if any.

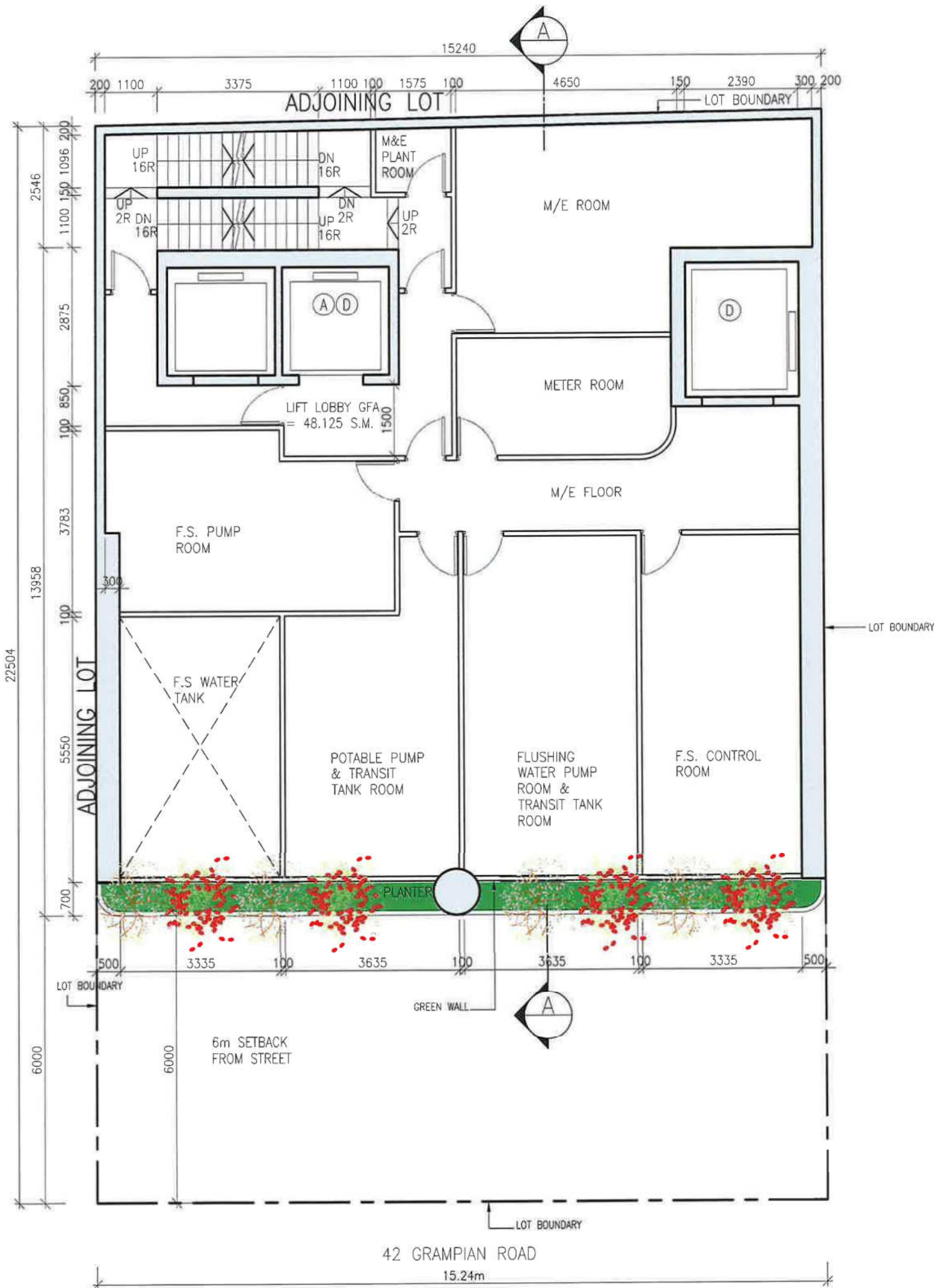
Based on the SIA results, it is found that the proposed and existing sewage system serving the area have sufficient capacity to cater for the sewage generated from the Proposed Development and the surrounding catchment areas. Adverse sewerage impacts are not anticipated, and thus no upgrading or improvement works are required.

APPENDIX A

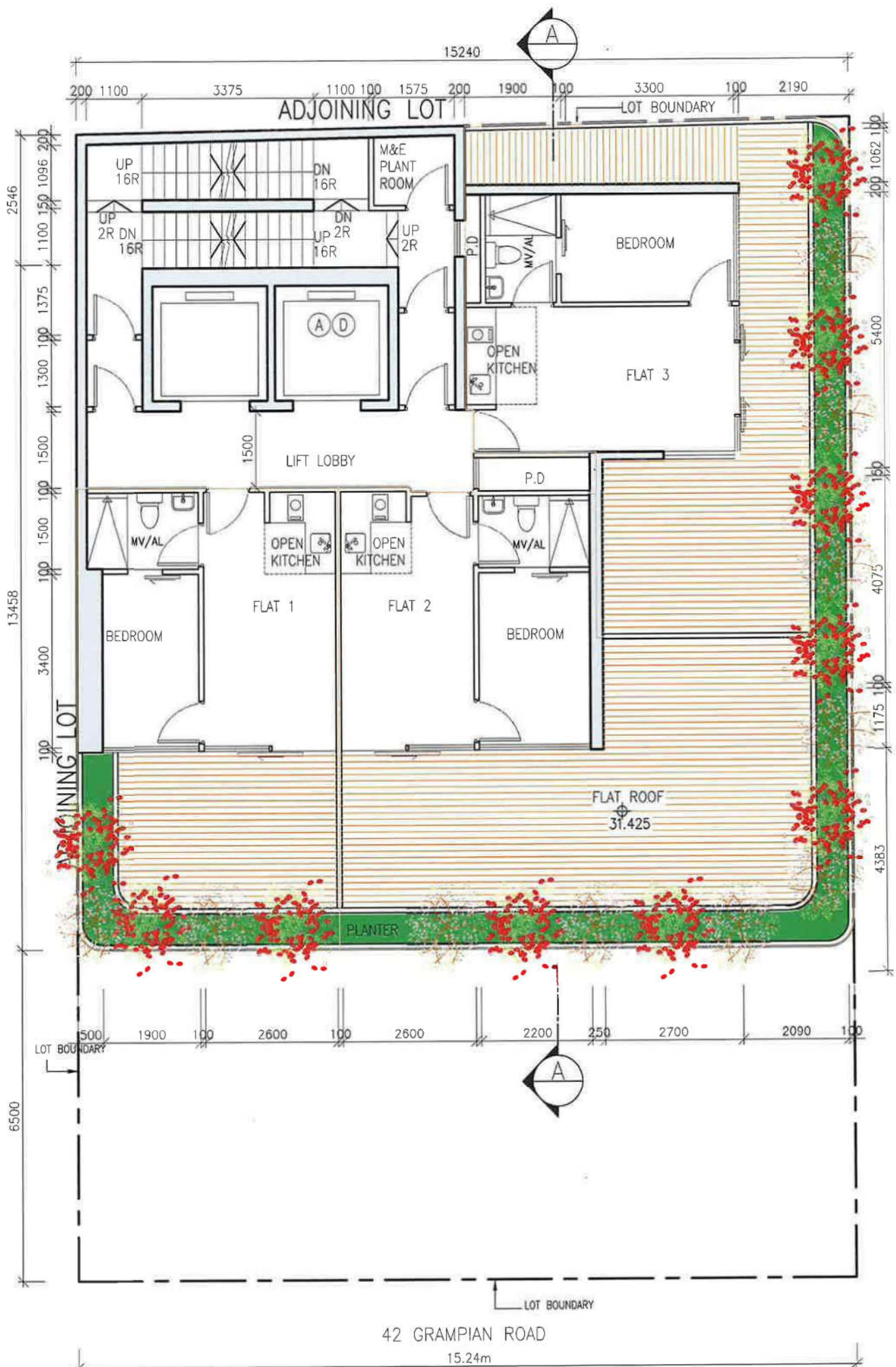
MASTER LAYOUT PLAN



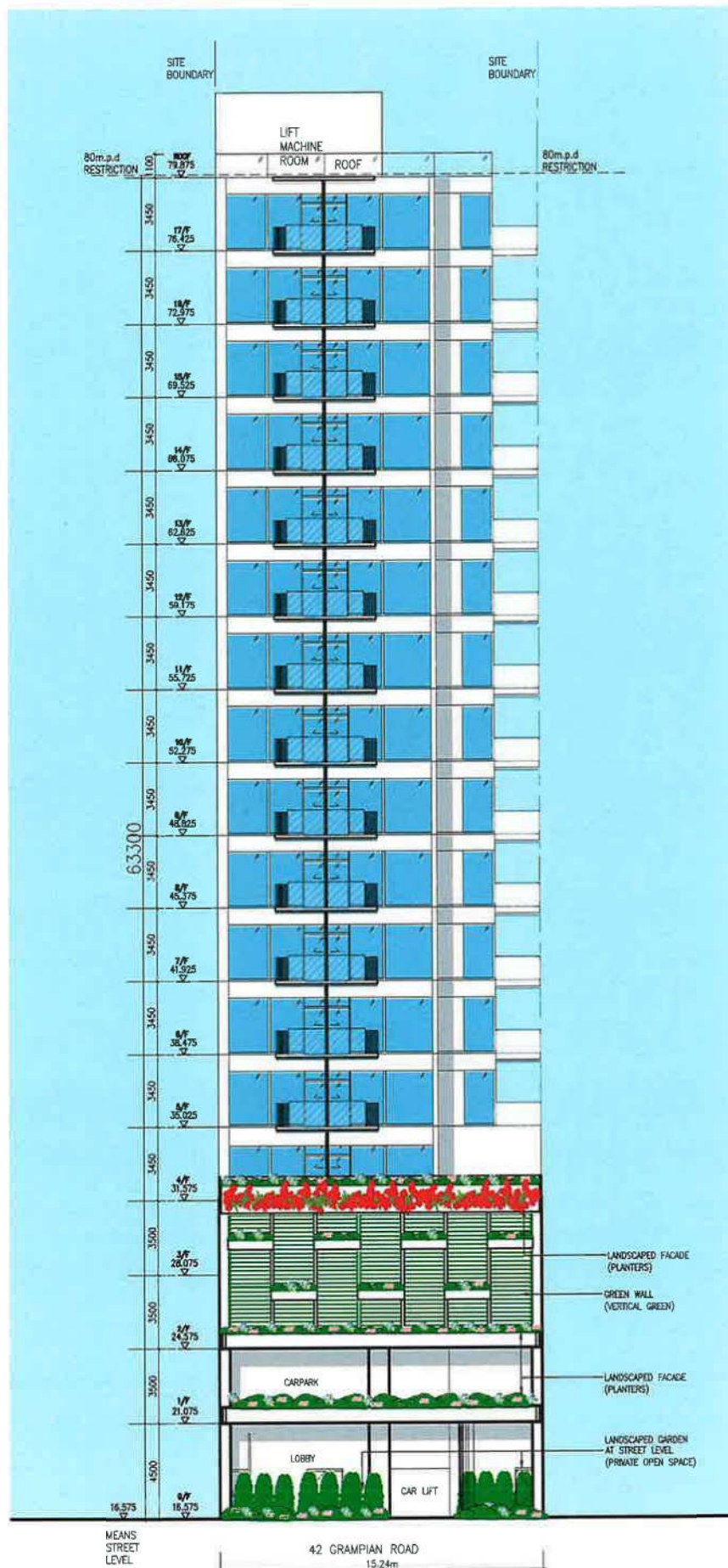
1ST FLOOR PLAN (A4 1:100)

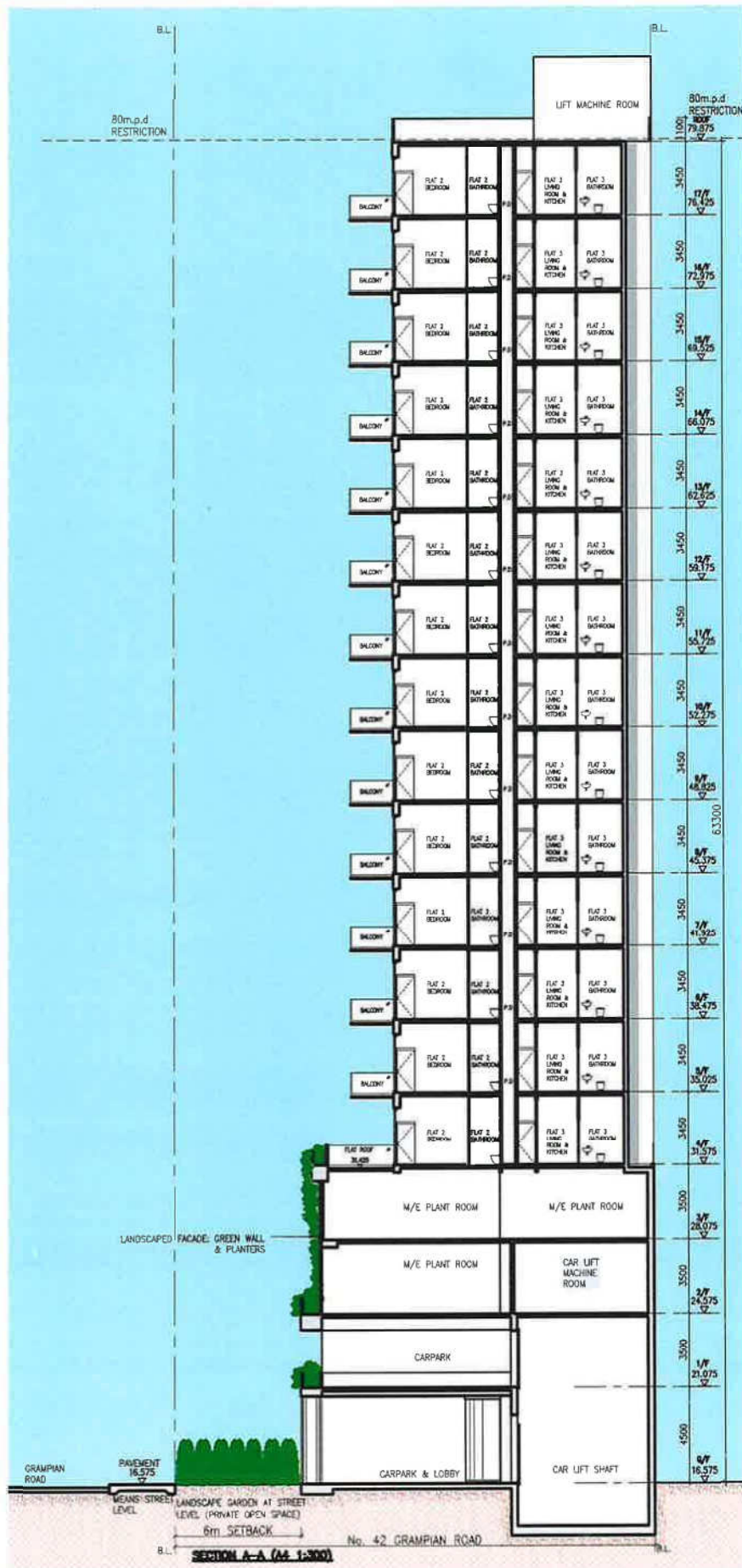


3RD FLOOR PLAN (A4 1:100)



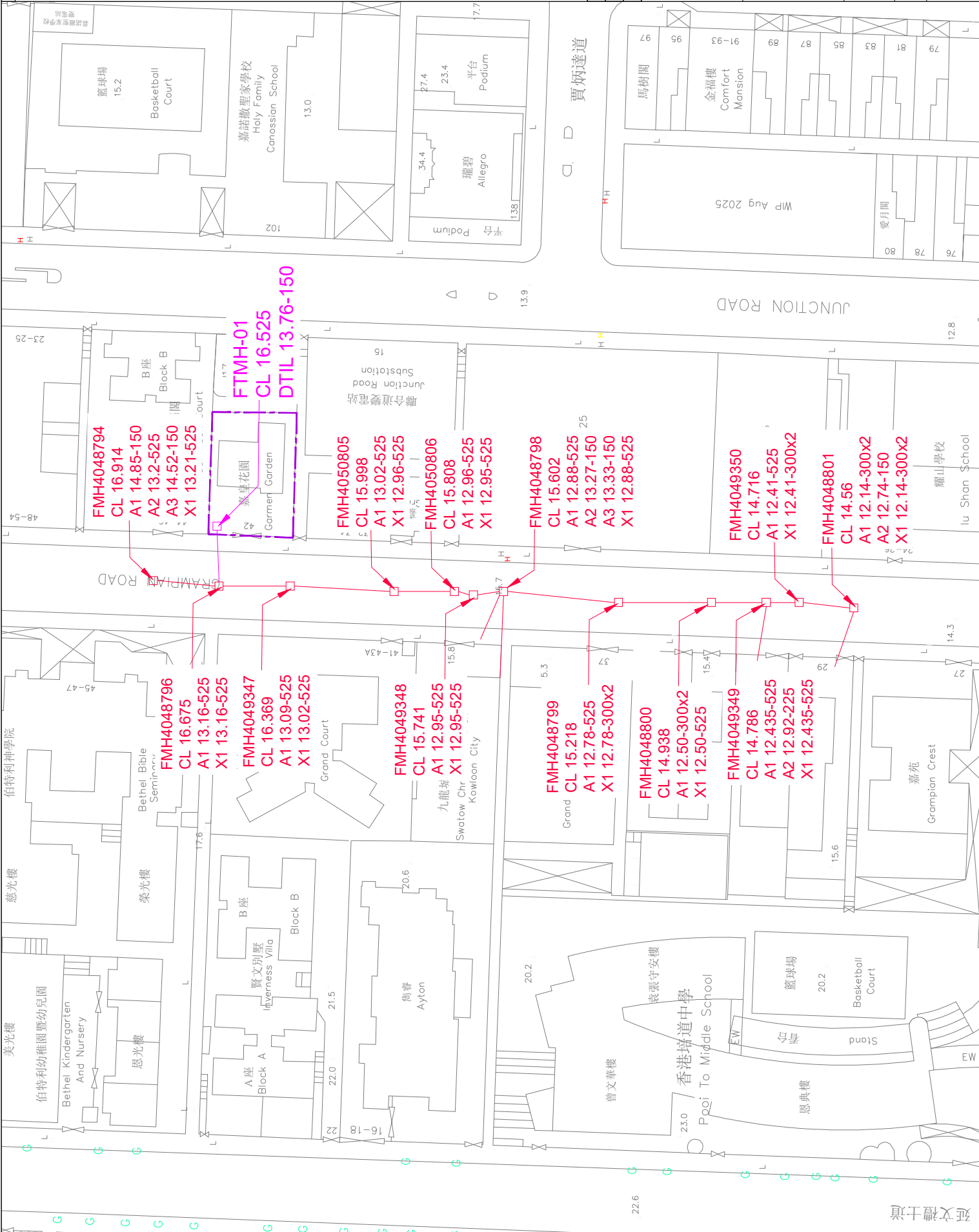
4 FLOOR PLAN (A4 1:100)





APPENDIX B

EXISTING AND PROPOSED SEWERAGE SYSTEM CONNECTION



- Project Site
- Existing Sewage Connection
- Proposed Sewage Connection

Prepared	Checked	Approved
Initial	Various	TL
Date	20260112	20260112

Project Title

PROPOSED RCHE AND
RESIDENTIAL DEVELOPMENT
AT 42 GRAMPIAN ROAD,
KOWLOON CITY

Drawing Title

Sewage Connection

Drawing No.

Appendix B

Rev.

1

Scale:

A3

APPENDIX C

PROPOSED SEWERAGE CONNECTION AND CATCHMENT AREA

- Project Site
- Existing Sewage Connection
- Proposed Sewage connection
- Catchment

Prepared	Checked	Approved
Initial	Various	TL
Date	20260112	20260112

Project Title

PROPOSED RCHE AND
RESIDENTIAL DEVELOPMENT
AT 42 GRAMPAN ROAD,
KOWLOON CITY

Drawing Title

Proposed Sewage Connection &
Catchment

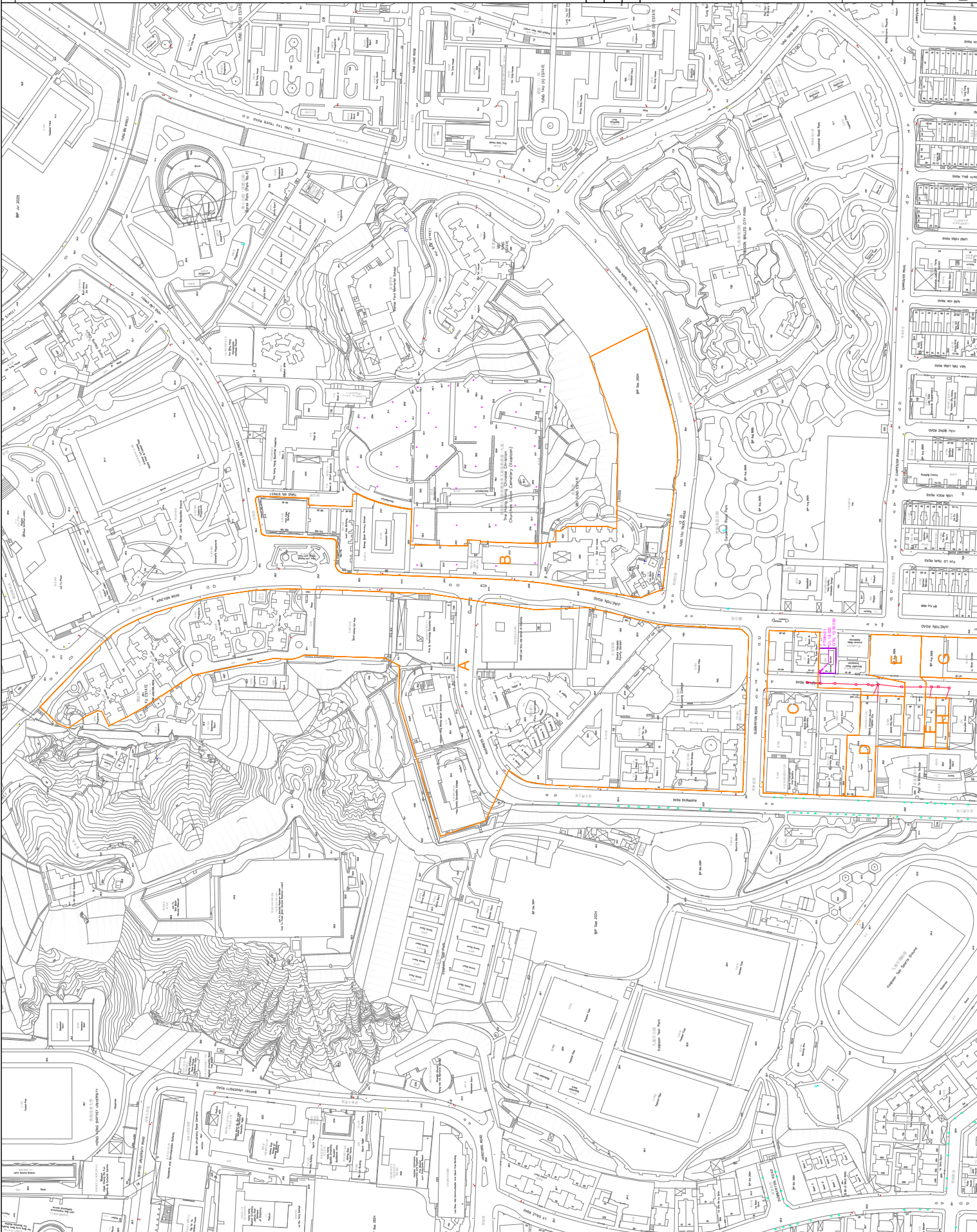
Drawing No.
Appendix C

Rev.
1

Scale:
A3



Bee Xergy Consulting Limited



APPENDIX C - CALCULATION OF SEWAGE FLOW

1) Proposed Development									
Development	GFA (m ²)	No. of Flat	Occupancy Density ^{(a), (b)} (Number of Persons) (Workers per GFA in 100m ²)	Estimated Population	Unit Flow Factor (m ³ /day)	Estimated Average Dry Weather Flow (m ³ /day)	Catchment Inflow Factor	Estimated Average Dry Weather Flow X Catchment Inflow Factor (m ³ /day)	Remarks
Proposed Development (Resident)	-	-	-	84	0.27	22.680	1.00	22.680	Occupancy as advised by project proponent. Unit Flow Factor: 0.270m3/day for 'Private R2' based on EPD's GESF Table T-1
Total Average Daily Dry Weather Flow of Proposed Development (m ³ /day)								22.680	

2) Catchment A									
Development	GFA (m ²)	No. of Flat	Occupancy Density ^{(A), (B)} (Number of Persons) (Workers per GFA in 100m ²)	Estimated Population	Unit Flow Factor (m ³ /day)	Estimated Average Dry Weather Flow (m ³ /day)	Catchment Inflow Factor	Estimated Average Dry Weather Flow X Catchment Inflow Factor (m ³ /day)	Remarks
A1: Lok Tai House	-	460	2.7	1242	0.19	235.980	1.00	235.980	No of flat: https://zh.wikipedia.org/wiki/%E6%A8%82%E5%AF%8C%E9%82%A8 Occupancy Density: 2.7 Number of persons in average domestic household size for "Wong Tai Sin - Lok Fu" based on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.190m3/day for "Public rental" based on EPD's GESF Table T-1
A2: Lok Man House	-	469	2.7	1266	0.19	240.597	1.00	240.597	No of flat: https://zh.wikipedia.org/wiki/%E6%A8%82%E5%AF%8C%E9%82%A8 Occupancy Density: 2.7 Number of persons in average domestic household size for "Wong Tai Sin - Lok Fu" based on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.190m3/day for "Public rental" based on EPD's GESF Table T-1
A3: Lok Him House	-	360	2.7	972	0.19	184.680	1.00	184.680	No of flat: https://zh.wikipedia.org/wiki/%E6%A8%82%E5%AF%8C%E9%82%A8 Occupancy Density: 2.7 Number of persons in average domestic household size for "Wong Tai Sin - Lok Fu" based on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.190m3/day for "Public rental" based on EPD's GESF Table T-1
A4: Lok Tsui House	-	360	2.7	972	0.19	184.680	1.00	184.680	No of flat: https://zh.wikipedia.org/wiki/%E6%A8%82%E5%AF%8C%E9%82%A8 Occupancy Density: 2.7 Number of persons in average domestic household size for "Wong Tai Sin - Lok Fu" based on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.190m3/day for "Public rental" based on EPD's GESF Table T-1
A5: Arts & Technology Education Centre	5369.0	-	3.3	177	0.28	49.610	1.00	49.610	Site area = 767m3, 7-storey building Occupancy Density: 3.3 employee per 100m2 GFA for "Community, Social & Personal Services" based on Commercial and Industrial Floor Space Utilization Survey published by PlanD UFF: 0.280 m3/day for "J11 Community, Social & Personal Services" based on EPD's GESF Table T-2
A6: Kowloon Tong Bishop Walsh Catholic School (student)	-	-	-	720	0.04	28.800	1.00	28.800	Occupancy: https://www.schooland.hk/p/k/tw/cs Assumed 1 class has 30 students. Unit Flow Factor: 0.04m3/day for "School Student" based on EPD's GESF Table T-2
A6: Kowloon Tong Bishop Walsh Catholic School (teacher)	-	-	-	47	0.28	13.160	1.00	13.160	Occupancy: https://www.schooland.hk/p/k/tw/cs Unit Flow Factor: 0.28m3/day for "J11 Community, Social & Personal Services" based on EPD's GESF Table T-2
A7: Holy Family Canossian College (student)	-	-	-	720	0.04	28.800	1.00	28.800	Occupancy: https://www.schooland.hk/ss/hfcc Assumed 1 class has 30 students. Unit Flow Factor: 0.04m3/day for "School Student" based on EPD's GESF Table T-2
A7: Holy Family Canossian College (teacher)	-	-	-	54	0.28	15.120	1.00	15.120	Occupancy: https://www.schooland.hk/ss/hfcc Unit Flow Factor: 0.28m3/day for "J11 Community, Social & Personal Services" based on EPD's GESF Table T-2
A8: HKICC Lee Shau Kee School of Creativity	12970.0	-	3.3	428	0.28	119.843	1.00	119.843	GFA = planning application: AK/18/224 Occupancy Density: 3.3 employee per 100m2 GFA for "Community, Social & Personal Services" based on Commercial and Industrial Floor Space Utilization Survey published by PlanD UFF: 0.280 m3/day for "J11 Community, Social & Personal Services" based on EPD's GESF Table T-2
A9: Munsang College (student)	-	-	-	3322	0.04	132.880	1.00	132.880	Occupancy: https://zh-yue.wikipedia.org/wiki/%E6%B0%91%E7%94%9F%E6%9B%B8%E9%99%A2 Unit Flow Factor: 0.04m3/day for "School Student" based on EPD's GESF Table T-2
A9: Munsang College (teacher)	-	-	-	223	0.28	62.440	1.00	62.440	Occupancy: https://zh-yue.wikipedia.org/wiki/%E6%B0%91%E7%94%9F%E6%9B%B8%E9%99%A2 Unit Flow Factor: 0.28m3/day for "J11 Community, Social & Personal Services" based on EPD's GESF Table T-2
A10: Parc Inverness	-	134	3.7	496	0.27	133.866	1.00	133.866	No. of flat: https://hk.centanet.com/estate/en/Parc-Inverness/2-EDWPWWPHWS Occupancy Density: 3.7 Number of persons in average domestic household size for "Kowloon City - Kowloon Tong" based on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.270m3/day for "Private R2" based on EPD's GESF Table T-1
A11: Stone House Family Garden	638.6	-	3.3	21	0.28	5.901	1.00	5.901	GFA = planning application: AK/18/287 Occupancy Density: 3.3 employee per 100m2 GFA for "Community, Social & Personal Services" based on Commercial and Industrial Floor Space Utilization Survey published by PlanD UFF: 0.280 m3/day for "J11 Community, Social & Personal Services" based on EPD's GESF Table T-2
A12: Man Wah Heights	-	30	3.7	111	0.27	29.970	1.00	29.970	No. of flat: https://hk.centanet.com/estate/en/Man-Wah-Heights/2-MHITHZRH7 Occupancy Density: 3.7 Number of persons in average domestic household size for "Kowloon City - Kowloon Tong" based on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.270m3/day for "Private R2" based on EPD's GESF Table T-1
A13: Louise Garden	-	12	3.7	44	0.27	11.988	1.00	11.988	No. of flat: https://www.house730.com/estate-21639/%E4%B9%9D%E9%BE%8D%E5%A1%98-%E6%80%A1%E9%B9%91/ Occupancy Density: 3.7 Number of persons in average domestic household size for "Kowloon City - Kowloon Tong" based on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.270m3/day for "Private R2" based on EPD's GESF Table T-1
Total Average Daily Dry Weather Flow of Catchment A (m³/day)								1478.314	

3) Catchment B									
Development	GFA (m ²)	No. of Flat	Occupancy Density ^{(a), (b)} (Number of Persons) (Workers per GFA in 100m ²)	Estimated Population	Unit Flow Factor (m ³ /day)	Estimated Average Dry Weather Flow (m ³ /day)	Catchment Inflow Factor	Estimated Average Dry Weather Flow X Catchment Inflow Factor (m ³ /day)	Remarks
B1: Luen Hop Building	-	224	2.7	605	0.27	163.296	1.00	163.296	No of flat: https://hk.cenat.net/estate/en/Luen%20Hop%20Building%20EYEWPPDSPA Occupancy Density: 2.7 Number of persons in average domestic household size for "Wong Tai Sin - Lok Fu" based on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.270m3/day for "Private R2" based on EPD's GESF Table T-1
B2: Bishop Walsh Primary School (student)	-	-	-	720	0.04	28.800	1.00	28.800	Occupancy: https://www.schooland.hk/ps/bishopwalsh Assumed 1 class has 30 students. Unit Flow Factor: 0.04m3/day for "School Student" based on EPD's GESF Table T-2
B2: Bishop Walsh Primary School (teacher)	-	-	-	49	0.28	13.720	1.00	13.720	Occupancy: https://www.schooland.hk/ps/bishopwalsh Unit Flow Factor: 0.28m3/day for "J11 Community, Social & Personal Services" based on EPD's GESF Table T-2
B3: The Hong Kong Chinese Christian Churches Union Building	1584	-	3.3	52	0.28	14.636	1.00	14.636	Site area = 396m3, 4-storey building Occupancy Density: 3.3 employee per 100m2 GFA for "Community, Social & Personal Services" based on Commercial and Industrial Floor Space Utilization Survey published by PlanD UFF: 0.280 m3/day for "J11 Community, Social & Personal Services" based on EPD's GESF Table T-2
B4: Mei Yan House	-	799	2.7	2157	0.19	409.887	1.00	409.887	No of flat: https://zh.wikipedia.org/wiki/%E7%B6%B8%E6%9D%B1%E9%82%A8 Occupancy Density: 2.7 Number of persons in average domestic household size for "Wong Tai Sin - Tung Mei" based on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.190m3/day for "Public rental" based on EPD's GESF Table T-1
B5: Redevelopment of Mei Tung Estate	-	-	-	7500	0.19	1425.000	1.00	1425.000	Population: https://www.districtcouncils.gov.hk/nts/doc/2020_2023/en/committee_meetings_doc/HC/18124/HC_M1_007.pdf Unit Flow Factor: 0.190m3/day for "Public rental" based on EPD's GESF Table T-1
Total Average Daily Dry Weather Flow of Catchment D (m ³ /day)								2055.339	

5) Catchment D									
Development	GFA (m ²)	No. of Flat	Occupancy Density ^(M, B) (Number of Persons) (Workers per GFA in 100m ²)	Estimated Population	Unit Flow Factor (m ³ /day)	Estimated Average Dry Weather Flow (m ³ /day)	Catchment Inflow Factor	Estimated Average Dry Weather Flow X Catchment Inflow Factor (m ³ /day)	Remarks
D1: Aylton	-	60	3.6	216	0.27	58.320	1.00	58.320	No. of flat: https://hk.cenitar.net/es/estate/%E9%9B%8E%E7%9D%B7%E2%80%A2EDPPWPPHPS Occupancy Density: 3.6 Number of persons in average domestic household size for "Kowloon City - Prince" based on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.270m3/day for "Private R2" based on EPD's GESF Table T-1
D2: Swatow Christian Church Kowloon City	3129	-	3.3	103	0.28	28.912	1.00	28.912	Site area = 447m3, 7-storey building Occupancy Density: 3.3 employee per 100m2 GFA for "Community, Social & Personal Services" based on Commercial and Industrial Floor Space Utilization Survey published by Pland UFF: 0.280 m3/day for "J11 Community, Social & Personal Services" based on EPD's GESF Table T-2
D3: Grand City Court	-	24	3.6	86	0.27	23.328	1.00	23.328	No. of flat: https://hk.cenitar.net/es/estate/undefined/1-MIZHDVHT Occupancy Density: 3.6 Number of persons in average domestic household size for "Kowloon City - Prince" based on 2021 Population Census's Main Table D304. Unit Flow Factor: 0.270m3/day for "Private R2" based on EPD's GESF Table T-1
Total Average Daily Dry Weather Flow of Catchment D (m ³ /day)								110.560	

APPENDIX D

SEWAGE CALCULATION AND HYDRAULIC CAPACITY CHECK

Appendix D - Hydraulic Capacity of the Proposed and Downstream Sewers

Manhole Reference	Cover Level mPD	Manhole Reference	Cover Level mPD	Pipe Dia. mm	Number of Pipe	Pipe Length m	Upstream Invert Level mPD	Downstream Invert Level mPD	g ⁽¹⁾ m/s ²	Pipe Material	K _s ^{(1),(3)} m	s ⁽¹⁾ s ⁽¹⁾	V ⁽¹⁾ m ² /s	V ^{(1),(2)} m/s	A m ²	Q ⁽⁴⁾ m ³ /s	Estimated Capacity L/s	ADWF m ³ /day	Contributing Population	Peaking Factor	Peak Flow L/s	Capacity %	Compliance	Remarks
FMH-01	+16.525	FMH-04-0796	+16.675	150	1	9.5	+13.76	+13.16	9.81	PE	0.0003	0.0035	1.306E-06	2.7906	0.0177	0.0463	46.31	22.66	84	8	2.10	4.3%	Yes	Catchment S (Project Site)
FMH-04-0794	+16.914	FMH-04-0796	+16.675	525	1	10.3	+13.21	+13.16	9.81	Clay	0.0006	0.0050	1.306E-06	1.5700	0.2165	0.3399	339.86	3708.99	13741	4	171.76	50.5%	Yes	Catchment A, B, C
FMH-04-0796	+16.675	FMH-04-0847	+16.369	525	1	12.9	+13.16	+13.09	9.81	Clay	0.0006	0.0053	1.306E-06	1.6390	0.2165	0.3528	352.85	3732.67	13625	4	172.81	49.0%	Yes	Catchment A, B, C, S
FMH-04-0847	+16.369	FMH-05-0805	+15.868	525	1	16.5	+13.09	+13.02	9.81	Clay	0.0006	0.0037	1.306E-06	1.3681	0.2165	0.2940	293.99	3732.67	13625	4	172.81	58.8%	Yes	Catchment A, B, C, S
FMH-05-0805	+15.868	FMH-05-0806	+15.868	525	1	9.4	+13.02	+12.96	9.81	Clay	0.0006	0.0059	1.306E-06	1.7776	0.2165	0.3718	371.82	3732.67	13625	4	172.81	46.5%	Yes	Catchment A, B, C, S
FMH-05-0806	+15.868	FMH-04-0848	+15.741	525	1	3.3	+12.86	+12.95	9.81	Clay	0.0006	0.0052	1.306E-06	1.6003	0.2165	0.3464	346.44	3732.67	13625	4	172.81	49.9%	Yes	Catchment A, B, C, S
FMH-04-0848	+15.741	FMH-04-0796	+15.602	525	1	5.0	+12.96	+12.88	9.81	Clay	0.0006	0.0133	1.306E-06	2.5782	0.2165	0.5583	558.33	3843.23	14234	4	177.93	31.9%	Yes	Catchment A, B, C, S, D
FMH-04-0798	+15.932	FMH-04-0796	+15.218	525	1	19.9	+12.88	+12.78	9.81	Clay	0.0006	0.0050	1.306E-06	1.5785	0.2165	0.3417	341.71	3843.23	14234	4	177.93	52.1%	Yes	Catchment A, B, C, S, D
FMH-04-0799	+15.218	FMH-04-0800	+14.938	300	2	16.9	+12.78	+12.50	9.81	Clay	0.0006	0.0180	1.306E-06	2.1071	0.0707	0.1469	207.88	3930.90	14559	4	181.99	61.1%	Yes	Catchment A, B, C, S, D, E
FMH-04-0800	+14.938	FMH-04-0848	+14.786	525	1	8.8	+12.50	+12.44	9.81	Clay	0.0006	0.0068	1.306E-06	1.8426	0.2165	0.3869	386.88	3948.40	14624	4	182.80	45.6%	Yes	Catchment A, B, C, S, D, E, F
FMH-04-0849	+14.786	FMH-04-0930	+14.716	525	1	4.8	+12.44	+12.41	9.81	Clay	0.0006	0.0062	1.306E-06	1.7577	0.2165	0.3805	380.50	3962.32	14675	4	183.44	46.2%	Yes	Catchment A, B, C, S, D, E, F, G
FMH-04-0930	+14.716	FMH-04-0801	+14.860	300	2	9.1	+12.41	+12.14	9.81	Clay	0.0006	0.0291	1.306E-06	2.6882	0.0707	0.1900	309.04	3965.23	14686	4	183.98	48.3%	Yes	Catchment A, B, C, S, D, E, F, G, H

Note:

- (1) g=gravitational acceleration, k_s=equivalent sand roughness, sg=dynamic viscosity of water, V=mean velocity
(2) The mean velocity (V) is calculated by the Colebrook-White Equation for circular pipes:

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

where

V = mean velocity (m/s)

g = gravitational acceleration (m/s²)

D = internal pipe diameter (m)

s = slope

k_s = roughness coefficient (m)

v = kinematic viscosity of fluid (m²/s)

- (3) For roughness value k_s, 0.6mm is used for aligned sewers with velocity > 1.2m/s and 3mm is used for aligned sewers with velocity < 1.2m/s based on DSD's "Sewerage Manual" Table 5: Recommended roughness values.

- (4) Peak flow (Q) is calculated by Q = V x A