Annex D

Revised Drainage and Sewerage Impact Assessment

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DRAINAGE AND SEWERAGE IMPACT ASSESSMENT

FOR

APPLICATION FOR AMENDMENT OF PLAN UNDER SECTION 12A FOR PROPOSED REDEVELOPMENT OF POK OI HOSPITAL YEUNG CHUN PUI CARE AND ATTENTION HOME IN YUEN LONG

Prepared by

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COMMERCIAL-IN-CONFIDENCE

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1. Introduction

1.1. Background

1.1.1. The Applicant intends to redevelop Pok Oi Hospital Yeung Chun Pui Care and Attention Home at 58 Sha Chau Lei Tsuen, Ha Tsuen, Ping Ha Road, Yuen Long at Lot No. 2273 and the Extension thereto in Demarcation District 125 (hereafter as "the Project Site").

1.1.2. The Project Site is currently zoned as "G/IC" under approved Hung Shui Kiu and Ha Tsuen Outline Zoning Plan No.S/HSK/2. The Proposed Redevelopment will involve the demolition of the existing 3-storey building and the construction of a new block with 11-storey to cater for the increasing demand for elderly, rehabilitation and child care services (thereafter as "Proposed Redevelopment").

1.1.3. Allied Environmental Consultants Limited (AEC) is commissioned to conduct a drainage and sewage impact assessment (DSIA) in support of the Section 12(A) Planning Application for the proposed redevelopment.

1.2. Objectives of the DSIA

1.2.1. The objectives of this DSIA are to review the existing/proposed sewage and drainage facilities in the vicinity of the Proposed Redevelopment and to evaluate the potential impacts on the current sewage and drainage system due to the additional discharge from the proposed redevelopment, and proposed mitigation measures where appropriate to mitigate potential impacts.

1.3. Report Structure

1.3.1. The remaining chapters of this report are shown below:

Chapter 2 – Legislation, Standards and Guidelines
Chapter 3 – Proposed Redevelopment and Site Context
Chapter 4 – Sewage Impact Assessment
Chapter 5 – Drainage Impact Assessment
Chapter 6 – Overall Conclusion

2. Legislation, Standards and Guidelines

2.1.1. Water quality in Hong Kong is legislated by the provisions of Water Pollution Control Ordinance (Cap 358), 1980 ("WPCO"). Territorial Water has been subdivided into ten Water Control Zones ("WCZ") and four supplementary water control zones. The study area lies within the Deep Bay WCZ. A Technical Memorandum on Standards for Effluents discharged into Drainage and Sewerage Systems, Inland and Coastal Water (TMES) has been issued, which requires licensing of all discharges into all public sewers and drains. The water quality standards will have to be met during the construction and operation stages.

2.1.2. With reference to Table 7 of the Technical Memorandum, as the Proposed Redevelopment is located within Deep Bay WCZ, the pollutant loading for effluents discharged into coastal waters of the respective WCZ shall be considered. The standards of effluents discharge of Biochemical Oxygen Demand (BOD) and Suspended Solids (SS) are extracted below.

Table 2-1 Standards for Effluents Discharge under TM

Load Type	Standards for Effluents Discharge (mg/L)	
	Flow rate <=1000 m^3/day	**Flow rate >1000 m^3/day and <=6000 m^3/day**
BODs	20	10
SS	50	25

2.1.3. With reference to ProPECC PN 1/23 Drainage Plans Subject to Comment by the Environmental Protection Department ("EPD"), foul water should be discharged to a foul sewer under the Building (Standards of Sanitary Fitments, Plumbing, Drainage Works and Latrines) Regulations 40(1) and 41(1).

2.1.4. Besides as stipulated in the Building (Standards of Sanitary Fitments, Plumbing, Drainage Works and Latrines) Regulations 41(1), 40(2), 41(1), 90 and recap in ProPECC PN 5/93, domestic sewage should be discharged to a foul water sewer and surface water should be discharged via rainwater pipes to stormwater drains during operation phase.

2.1.5. The following standards and guidelines are adopted for estimation, assessment and evaluation of sewerage implication of the proposed redevelopment:

- "Water Pollution Control Ordinance" ("WPCO")
- "Hong Kong Planning Standards and Guidelines" issued by the Planning Department;
- "Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (WPCO-TM)";

- "Sewerage Manual Part 1" published by DSD;
- "Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0 (Report No.: EPD/TP1/05)" ("GESF") published by Environmental Protection Department ("EPD");
- Water Supplies Department (WSD) Water Quality Criteria;
- Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (WPCO-TM); and
- Guidelines for the Design of Small Sewage Treatment Plants issued by EPD.

3. The Proposed Redevelopment

3.1. Site Location and Its Environs

3.1.1. The Project Site is bounded by Ping Ha Road to its north, Sha Chau Lei Road to its east and an access road to its west. The Rezoning Site Area is about 3,388.7 m2 while the Development Site Area (for calculation of plot ratio and site coverage) is about 3,090 m2.

3.1.2. The Project Site is currently zoned as "G/IC" under approved Hung Shui Kiu and Ha Tsuen Outline Zoning Plan No. S/HSK/2 with an existing building height of 3 storeys. The surrounding area of the Applicant Site is characterized by a mixture of various land uses, including "OS" "R(A)2", "V" and "G/IC".

3.1.3. The following uses or buildings are located adjacent to the Site:

- North: Open storage across Ping Ha Road ;
- East: Open storage across Sha Chau Lei Road/Tin Shui Wai Main Channel ;
- South: Ching Chung Care and Attention Home for the Aged; and
- West: Sha Chau Lei Tsuen across the access road

3.1.4. ***Figure 2.1*** shows the Site location and its environs.

3.2. Proposed Redevelopment Scheme

3.2.1. The proposed redevelopment comprises of demolition of the existing 3-storey-Pok Oi Hospital Yeung Chun Pui Care and Attention Home and the construction of a new block of 11-storey. The schedule of the existing and proposed redevelopment is listed in ***Table* 3-1** and **Table 3-2**. The redevelopment plan is shown in ***Appendix A***. The proposed redevelopment is expected to be completed by Year 2032.

3.2.2. Upon completion by 2032, a total of 282-bed spaces (i.e. 192 for Care and Attention Home(C&AH),50 for Hostel for Severely Mentally Handicapped Persons (HSMH) and 40 for Hostel for Moderately Mentally Handicapped Persons (HMMH)), will be provided to meet the needs of the community. The Proposed Redevelopment will provide about 20% greenery area, i.e. achieve 20% required under the Hong Kong Planning Standards and Guidelines (HKPSG).

Table 3-1 Existing Development

Floor	Major Uses
G/F	Kitchen, Car Park, E&M Facilities, Care & Attention Home(C&A)
1/F	Care & Attention Home (C&A)
2/F	Care & Attention Home(C&A)

Table 3-2 Redevelopment Schedule

Floor	Major Uses
G/F	Child Care Centre(CCC) , Car Park, E&M Facilities
1/F	Day Care Centre for the Elderly (DE)
1/F-4/F	Care & Attention Home(C&A) (192 nos of bed)
5/F	Hostel for Severely Mentally Handicapped Persons (HSMH) (50 nos of bed)
6/F	Hostel for Moderately Mentally Handicapped Persons (HMMH) (40 nos of bed)
7/F	Day Activity Centre (DAC), clinic, massage
8/F	Showroom, Kitchen, Canteen
9/F	Integrated Vocational Rehabilitation Services Centre (IVRSC), E&M Facilities
R/F	E&M Facilities

3.3. Existing Sewerage Condition

3.3.1. Drainage information was obtained from the GeoInfo Map services of the Lands Department in February 2024 to gather the background information on sewerage infrastructure in the vicinity of the Project Site. Concerned sewage network was identified for estimation of the potential sewage impact to the downstream sewers associated with the proposed redevelopment. A series of public sewers with diameters ranged from 150mm to 300mm were found along service lane to the south of the Project Site at the unnamed access road to the west, then conveyed to 300 mm sewer along Sha Chau Lei Road to Ha Tsuen Pumping Station and eventually to San Wai Sewage Treatment Plant. Sewage generated from the Project Site is currently discharged to an existing Government foul water manhole (FMH1009620). The existing sewer connecting FTMH1 to the public manhole FMH1009620 will be upgraded from 150mm to 200mm by the Project Proponent.

4. Sewage Impact Assessment

4.1. Methodology for Estimation of Average Dry Weather Flow

4.1.1. The global unit flow factors as recommended in the *Guideline for Estimating Sewage Flows for Sewage Infrastructure Planning* (hereafter as "GESF") published by EPD in 2005 has been adopted in the assessment to estimate sewage flow. Relative unit flow factors applied for the sewage generation estimation are tabulated in**Table *4-1*** below.

Table 4-1 Unit Flow Factors Adopted for the Assessment

Type of People	Unit Flow Factors [2]	Category [1]
Residents/overnight staff in C&A, HSMH & HMMH	0.190 m^3/person/day	Domestic(Housing type specific)-Institutional and special class in Table T-1 of GESF.
Employee from CCC,C&A,HSMH, HMMH,DE, DAC & IVRSSC	0.280 m^3/person/day	Commercial Employee + Commercial Activities (J11 Community, Social & Personal Services)
Kitchen & Canteen	1.580 m^3/person/day	Commercial Employee + Restaurants & Hotels (J10)

Notes:
[1] Environmental Protection Department, HKSARG [EPD] (2005). Guidelines for estimating sewage flows for sewage infrastructure planning (EPD/TP 1/05). Hong Kong
[2] UFF for various occupancy types are adopted according to Table T-1 and Table T-2 of the GESF.

4.2. Estimation of Sewage Flow from Existing and Proposed Redevelopment

4.2.1. According to the existing sewer arrangement, foul water from the Project Site will be discharged into FTMH1 and connected to FMH1009620 located at the access road to the west of the Project Site.

4.2.2. The total floor area of the existing development is 2,351m^2, while that of the proposed redevelopment will be 17,922m^2. Comparing the existing and proposed redevelopment, there will be an increased flow from increased residents and staffs. Toilet flushing and kitchen wastewater are the major sewage arising from the Proposed Redevelopment. The estimated sewerage flow for the both the existing and proposed redevelopments of the Project Site is given in ***Table 4.2*** and ***Appendix B***.

4.2.3. With reference to ***Table 4.2***, the total estimated Average Dry Weather Flow ("ADWF") from the existing development and the proposed redevelopment for the Project Site is 49.5 m^3/day and 137.2m^3/day.

4.2.4. In comparison to the estimated sewage flow generated from the existing and proposed developments, it is observed that the estimated sewage flow generated from the proposed redevelopment is increased by 87.7 m^3/day compared with the existing development.

Table 4-2 Sewage Flow Estimation for the Existing and Proposed Redevelopment

Existing Development		
Care & Attention Home (G/F-2/F)		**Remarks**
Generation from Staff		
Total Floor Area	1707 m^2	
Worker Density (in 100m2)	3.3 person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
Total number of person	57 persons	
Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
ADWF	16.0 m^3/day	
Generation from Residents		
Total number of residents	143 persons	Full capacity of subsidised places (https://www.elderlyinfo.swd.gov.hk /en/content/pok-oi-hospital-yeung-c hun-pui-care-and-attention-home)
Unit Flow Factor	0.19 m^3/person/day	Referred to the planning unit flow for Domestic (housing type specific) - Institutional and special class in Table T-1 of GESF.
ADWF	27.2 m^3/day	
Kitchen		
Total Floor Area	61.5 m^2	
Worker Density (in 100m^2)	5.1 person/100 m^2	Refer to worker density for "Restaurants" in Table 8 of CIFSUS.
Total number of person	4 persons	
Unit Flow Factor	1.58 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J10 Restaurants & Hotels" in Table T-2 of GESF.
Average Sewage Discharge	6.3 m^3/day	
Total Average dry weather flow of the Existing Development	**49.5 m^3/day**	
Contributing Population	**183**	
Catchment Inflow Factor	**1.0**	
Revised Total Average Dry Weather Flow	**49.5 m^3/day**	
Peaking Factor	**8**	Referred to the Peaking Factor (including stormwater allowance) for facility with existing upstream sewerage in Table T-5 of GESF.
Peak Flow	**0.0046 m^3/s**	
Proposed Redevelopment		
Child Care Centre (G/F)		
Generation from Staff		**Remarks**
Total Floor Area	324 m^2	
Worker Density (in 100m2)	3.3 person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
Total number of persons	11 persons	

Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
Average Sewage Discharge	3.0 m^3/day	
Elderly Day Care (1/F)		
Generation from Staff		
Total Floor Area	510 m^2	
Worker Density (in 100m2)	3.3 person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
Total number of persons	17 persons	
Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
Average Sewage Discharge	4.7 m^3/day	
Care & Attention Home (1/F-4/F)		
Generation from Staff		**Remarks**
Total Floor Area	2557 m^2	
Worker Density (in 100m2)	3.3 person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
Total number of persons	85 persons	
Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
Average Sewage Discharge	23.8 m^3/day	
Generation from Residents		
Total number of residents	192 persons	full capacity of 192-place residential care home for elderly
Unit Flow Factor	0.19 m^3/person/day	Referred to the planning unit flow for Domestic (housing type specific) - Institutional and special class in Table T-1 of GESF.
Average Sewage Discharge	36.5 m^3/day	
Hostel for Severely Mentally Handicapped Persons (5/F)		
Generation from Staff		
Total Floor Area	682 m^2	
Worker Density (in 100m2)	3.3 persons	
Total number of persons	33 persons	Refer to SWD staffing establishment for HSMH, around 0.66 workers/resident (i.e.50 nos of bed).
Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
Average Sewage Discharge	9.2 m^3/day	
Generation from Residents		
Total number of residents	50 persons	full capacity of 50 place for HSMH
Unit Flow Factor	0.19 m^3/person/day	Referred to the planning unit flow for Domestic (housing type specific) - Institutional and special class in Table T-1 of GESF.
Average Sewage Discharge	9.5 m^3/day	
Hostel for Moderately Mentally Handicapped Persons (6/F)		
Generation from Staff		**Remarks**
Total Floor Area	537 m^2	
Worker Density (in 100m2)	3.3 persons	
Total number of persons	16 persons	Refer to SWD staffing establishment for HSMH, around 0.38 workers/resident.

Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
Average Sewage Discharge	4.5 m^3/day	
Generation from Residents		
Total number of residents	40 persons	full capacity of 40 place for HMMH
Unit Flow Factor	0.19 m^3/person/day	Referred to the planning unit flow for Domestic (housing type specific) - Institutional and special class in Table T-1 of GESF.
Average Sewage Discharge	7.6 m^3/day	
Day Activity Unit, Clinic, Massage, Showroom (7/F&8/F)		
Generation from Staff		
Total Floor Area	1168 m^2	
Worker Density (in 100m2)	3.3 person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
Total number of persons	39 persons	
Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
Average Sewage Discharge	10.8 m^3/day	
Kitchen(8/F)		
Total Floor Area	200 m^2	
Worker Density (in 100m2)	5.1 person/100 m^2	Referred to the worker density of Restaurants (All Types) in Table 8 of CIFSUS
Total number of persons	11 persons	
Unit Flow Factor	1.58 m^3/person/day	Referred to the planning unit flow for Commercial Employee + Restaurants & Hotels - J10 in Table T-2 of GESF.
Average Sewage Discharge	17.4 m^3/day	
Canteen(8/F)		
Total Floor Area	77 m^2	
Worker Density (in 100m2)	5.1 person/100 m^2	Referred to the worker density of Restaurants (All Types) in Table 8 of CIFSUS
Total number of persons	4 persons	
Unit Flow Factor	1.58 m^3/person/day	Referred to the planning unit flow for Commercial Employee + Restaurants & Hotels - J10 in Table T-2 of GESF.
Average Sewage Discharge	6.3 m^3/day	
Integrated Vocational Rehabilitation Services Centre (9/F)		
Generation from Staff		
Total Floor Area	416 m^2	
Worker Density (in 100m2)	3.3 person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
Total number of persons	14 persons	
Unit Flow Factor	0.28 m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
Average Sewage Discharge	3.9 m^3/day	
Total Average dry weather flow of the Proposed redevelopment	**137.2 m^3/day**	
Contributing Population	**508**	
Catchment Inflow Factor	**1.0**	

Revised Total Average Dry Weather Flow	**137.2 m^3/day**	
Peaking Factor	**6**	Referred to the Peaking Factor (excluding stormwater allowance) for facility with new upstream sewerage in Table T-5 of GESF.
Peak Flow	**0.0095 m^3/s**	
Difference of the proposed and existing development		
Difference in ADWF and peak flow of proposed redevelopment and existing development	**ADWF: +87.7 m^3/day** **Peak flow: +0.0089 m^3/s**	

4.3. Estimation of Sewage Flow from Streams

4.3.1. Different streams (i.e. Stream A and B) are defined as shown in ***Figure 3.1*** to consider existing sewage generation. Stream A consists of discharge from Ching Chung Care and Attention Home for the Aged while Stream B consists of discharge from Sha Chau Lei Tsuen. The sewage is discharged into the existing 150 - 300mm public sewerage pipes along the access road to the west. Stream A is discharged at FMH1009619 to join the discharge from Project Site while Stream B joins further downstream at FMH1009602.

4.3.2. Both Stream A and B are assumed to have 100% capacity at the convergent sewer of all discharge to the stream to estimate the total average day flow generated from the surrounding of the Project Site.

4.4. Estimation of Peak Discharge

4.4.1. Catchment inflow factor ("P_{CIF}") caters for the net overall ingress of wastewater to the sewerage system. They are catchment-dependent and applicable to major sewerage facilities of a catchment.

4.4.2. In accordance with Table T-4 of the GESF, P_{CIF} of 1.00 is adopted for existing sewerage as concerned sewerage system is identified in "Yuen Long".

4.4.3. Revised average dry weather flow ("revised ADWF") is determined by production of average dry weather flow and catchment inflow factor. Contributing population is then calculated by dividing the revised ADWF by 0.27. The calculated contributing population is finally used for selection of peaking factors.

4.4.4. Based on **Table 4-3** which is also presented in Table T-5 in GESF, the peaking factors for each sewer are chosen in the hydraulic calculation for peak flow estimation. The peaking factor excluding stormwater allowance is used in the peak flow estimation of proposed development. Meanwhile the peaking factor including stormwater allowance is used in stream with existing upstream (Stream A and Stream B).

Table 4-3 Peaking Factor

Population Range for Sewers [1] [2]	Peaking Factor (including storm water allowance) for facility with existing upstream sewerage	Peaking Factor (excluding storm water allowance) for facility with new upstream sewerage
< 1000	8	6
1000 - 5000	6	5
5000 - 10000	5	4
10000 - 50000	4	3
> 50000	Max (7.3 / $N^{0.15}$, 2.4)	Max (6 / $N^{0.175}$, 1.6)

Notes:
[1] N is the contributing population in thousands.
[2] According to Section 12.1 of GESF, Contributing Population = Calculated Total Average Flow (m3/day) ÷ 0.27 (m3/person/day)

4.5. Sewerage Capacity

4.5.1. According to the "Sewerage Manual – Key Planning Issues and Gravity Collection System" (Sewerage Manual) published by DSD in 2013, the capacities of respective sewers have been calculated based on the Colebrook White's equation. The roughness coefficients (ks) of 3mm for clayware slimed sewer in poor condition are adopted for public sewers in the assessment in accordance with Table 5 of DSD's "Sewerage Manual Part 1".

4.5.2. The sewerage impact on various segments of the sewer were evaluated by comparing the estimated peak flow against the capacity of the respective sewer segments. The detailed calculations are provided in ***Appendix C***.

4.6. Result and Discussion

4.6.1. The discharge point (FTMH1) from the proposed redevelopment will be connected to the existing sewer (S1: FMH1009620). The sewer connecting the FTMH1 and S1 is proposed to be upgraded from 150 mm to 200 mm diameter, and further connect to the existing downstream 300mm sewer at FMH1009620.

4.6.2. The estimated daily flow of the existing development is 49.5m^3/day while the estimated daily flow of the proposed development will be 137.2 m^3/day. **Table 4-4** tabulates the sewage generated from both existing development and proposed development.

Table 4-4 Sewage Generated from Existing and Proposed Development

Developments	Daily Flow (m^3/day)
Existing Development	49.5
Proposed Development	137.2
Difference	87.7

4.6.3. As shown in **Table 4-4**, 87.7 m^3/day of daily flow will be increased after redevelopment.

4.6.4. The capacity of each segment for the proposed and existing sewers (i.e., from Project Site to FMH1009620 as shown in ***Figure 3.1***) between each manhole has been evaluated and is summarized in **Table 4-5**. The utilization of used capacity range for the downstream sewers will range from about 10% to 39%. Estimation of the flows and capacities are detailed in ***Appendix C***.

Table 4-5 Estimated Downstream Sewer Capacities

Pipe Segments	Diameter (m)	Revised ADWF m^3/day[1]	Contributing Population[2]	Peaking Factor[3]	Estimated Cumulative Peak Flow, m^3/s[4]	Utilisation	Percentage Contribution by Proposed Development
FTMH1 – FMH1009620	0.200	137.2	508	6.0	0.010	10%	10%
FMH1009620 – FMH1009619	0.300	137.2	508	8.0	0.013	16%	16%
FMH1009619 – FMH1009618	0.300	277.6	1028	6.0	0.019	35%	23%
FMH1009618 – FMH1009615	0.300	277.6	1028	6.0	0.019	25%	16%
FMH1009615 – FMH1009614	0.300	277.6	1028	6.0	0.019	30%	20%
FMH1009614 – FMH1009613	0.300	277.6	1028	6.0	0.019	29%	19%
FMH1009613 – FMH1009612	0.300	277.6	1028	6.0	0.019	25%	16%
FMH1009612 – FMH1009603	0.300	277.6	1028	6.0	0.019	33%	22%
FMH1009603 – FMH1009602	0.300	277.6	1028	6.0	0.019	19%	13%
FMH1009602 – FMH1009601	0.300	461.2	1708	6.0	0.032	39%	16%

Notes:
Ks (existing sewer)=3.0mm
Pipe segment that exceeded 100% used capacity are bolded and underlined
[1] Revised ADWF (m3/day) = ADWF (m3/day) × Catchment Inflow Factor
[2] According to Section 12.1 of GESF,
Contributing Population = Calculated Total Average Flow (m3/day) ÷ 0.27 (m3/person/day)
[3] According to Table T-5 of GESF
[4] Total Peak Discharge (m3/s) = (Revised ADWF (m3/day) × Peaking Factor ÷ 86400s/day)

4.6.5. The results of the assessment as presented in **Table 4-5** and ***Appendix C*** have indicated that there is no sewer segments that will exceed the capacity after the discharged of proposed redevelopment under the worst-case scenario.

5. Drainage Impact Assessment

5.1. Existing Site and Drainage System

5.1.1. According to the DSD drainage record plans, public stormwater drains are available at the western and eastern boundary of the Project Site along the access road to the West and across Sha Chau Lei Road respectively, as shown in **Figure 3.1**.

5.1.2. The nearest stormwater manholes are SMH1012065 and SMH1012064 which are located about 7m to the west of the Project Site. A catchpit SCH1006385 and a tapping point STH1001640 with oulet of 300mm is located to the east of the Project Site. With reference to EPD Centralised Environmental Database (CED), there is a watercourse found to the east of the Project Site.

5.1.3. The Project Site is located on a gentle flat land (i.e.5.5mPD) and currently paved with concrete with greenery towards the north of the Project Site. There will be no change of gradient of the Site after the redevelopment. As per APP-152, greenery area will be maintained as at least 20% of the Site Area. With the increased greenery area, it helps to enhance infiltration and reduce surface runoff.

5.2. Potential Input on Public Stormwater System due to Surface Runoff

Operation Phase

5.2.1. The Project Site is currently a gentle flat land paved with concrete surface. There will be no major changes in surface properties and gradient, which will not significantly alter the overall catchment characteristics.

5.2.2. Surface runoff within the Project Site will be collected and discharged to existing public stormwater drainage network at terminal manhole SMH1012065 and SMH1012064. Surface runoff will also be collected at the catchpit SCH1006385 and the tapping point STH1001940 before discharging to the Tin Shui Wai Main Channel. The Project consists of redevelopment on a 100% paved site. Reduction of non-paved area is not expected. Additional discharge to the public drainage system is not expected.

5.2.3. The provision of a greenery area of approximately 800 m^2 will further increase filtration of stormwater and minimize surface runoff. As there is a slight increase in greenery area in the proposed redevelopment, peak runoff from the Project Site will slightly decrease as compared to existing site conditions.

5.2.4. Adverse impact to the public drainage system is thus not anticipated. Upgrading works is considered not necessary.

5.3. Liability

5.3.1. The applicant will be responsible for contractor of all necessary drainage system including the pipe connected to the public drain as well as other internal drainage infrastructure with the Project Site. All drainage facilities shall be designed and constructed to conform to the requirements laid down in below while future maintenance of the sewers outside the Project Site boundary will be carried out by the DSD.

a. The Stormwater Drainage Manual, DSD

b. The General Specification for Civil Engineering Works, Hong Kong Government

c. The DSD Standard Drawings

5.3.2. During operational phase, regular inspection of the sewers within the Project Site should be conducted by the property management office to ensure proper performance. Regular maintenance should also be carried out in accordance with standard practices stated in the DSD's "Sewerage Manual Part 1".

6. Overall Conclusion

6.1.1. This Drainage and Sewerage Impact Assessment (DSIA) aims to evaluate the sewerage impacts on the local sewerage and drainage network due to the operation of the proposed redevelopment under no DSD's upgrading works scenario.

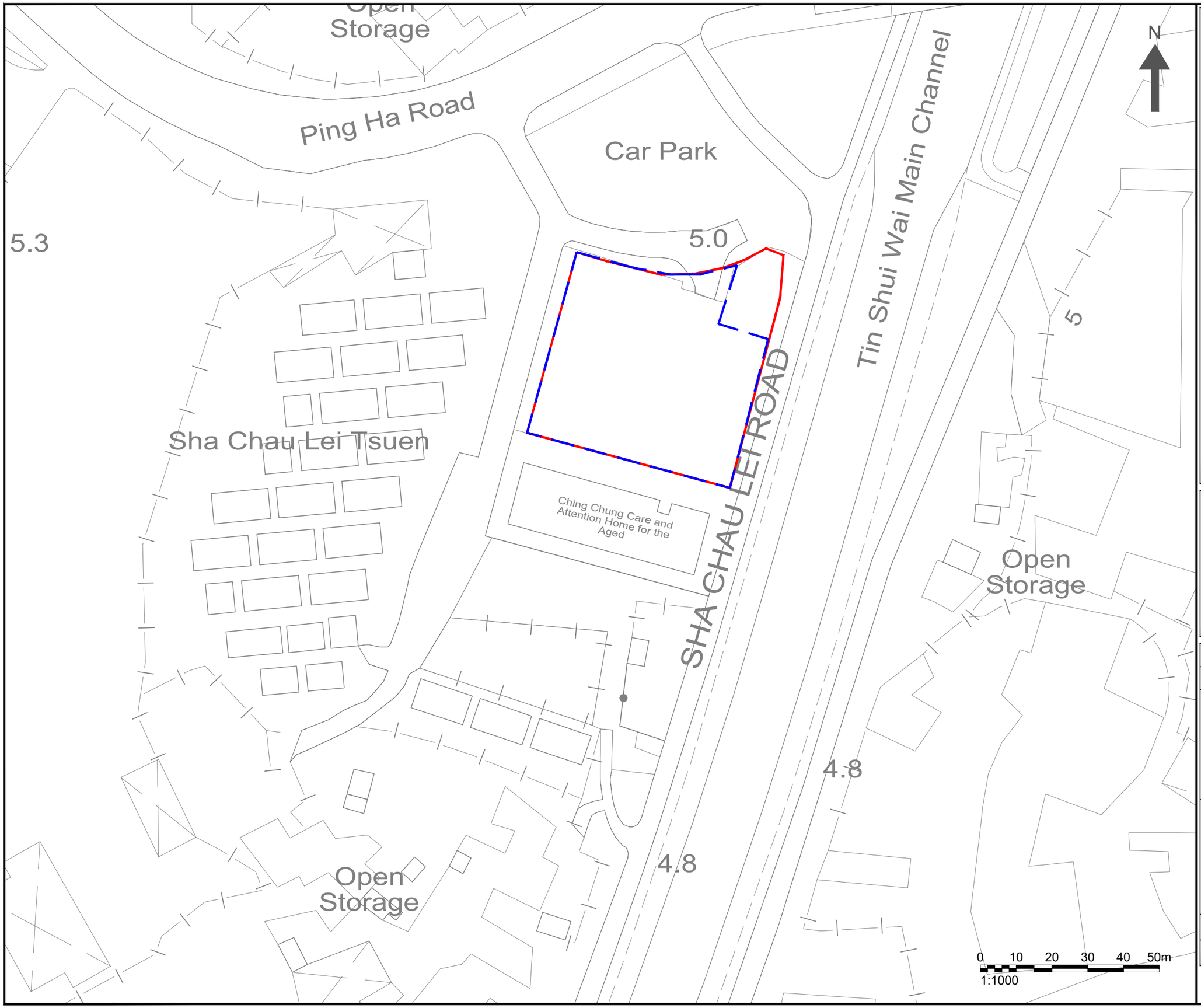
6.1.2. The sewer connecting the site to FMH1009620 will be upgraded to 200mm. Other existing sewage system with diameter of up to 300 mm located at the southwestern side of the Project Site will remain to collect sewage generated from proposed redevelopment and where sewer conveyed to the public sewer system at manhole FMH1009620. The maximum occupied capacity of the proposed sewer by the proposed redevelopment which is 23%, therefore there is sufficient capacity for the existing sewer to cater for the increased in discharge due to the increased residents and staff in the proposed redevelopment.

6.1.3. The findings of the assessment have demonstrated all segments have sufficient sewer capacity to cope with the sewage flow. Significant sewerage impact arising from the proposed redevelopment on the existing sewer is not expected, no mitigation measures and/or upgrading works are considered necessary for the existing sewer except for the FTMH1-FMH1009620 sewer.

6.1.4. For drainage impact assessment, the Project Site is paved with concrete in good condition, no change in surface properties and gradient is anticipated. With the provision of greenery and insignificant contribution of stormwater surface runoff associated with the Proposed redevelopment, no potential drainage impact is anticipated, thus no upgrading works are considered necessary.

1.3.2. Based on the above, it is concluded that the drainage and sewerage impact arising from the proposed redevelopment should be acceptable.

Figures



NOTES :

DEVELOPMENT SITE BOUNDARY

REZONING SITE BOUNDARY

Consultant

Allied Environmental Consultants Limited

Project No. :	2164EA
Drawing By :	LL

Project :

PROPOSED REDEVELOPMENT OF POK OI HOSPITAL YEUNG CHUN PUI CARE AND ATTENTION HOME IN YUEN LONG

Drawing Title :

PROJECT SITE LOCATION

Drawing No :	Revision :
Fig2.1	1
Scale :	Date :
AS SHOWN	Jan 2024

A3 420 x 297

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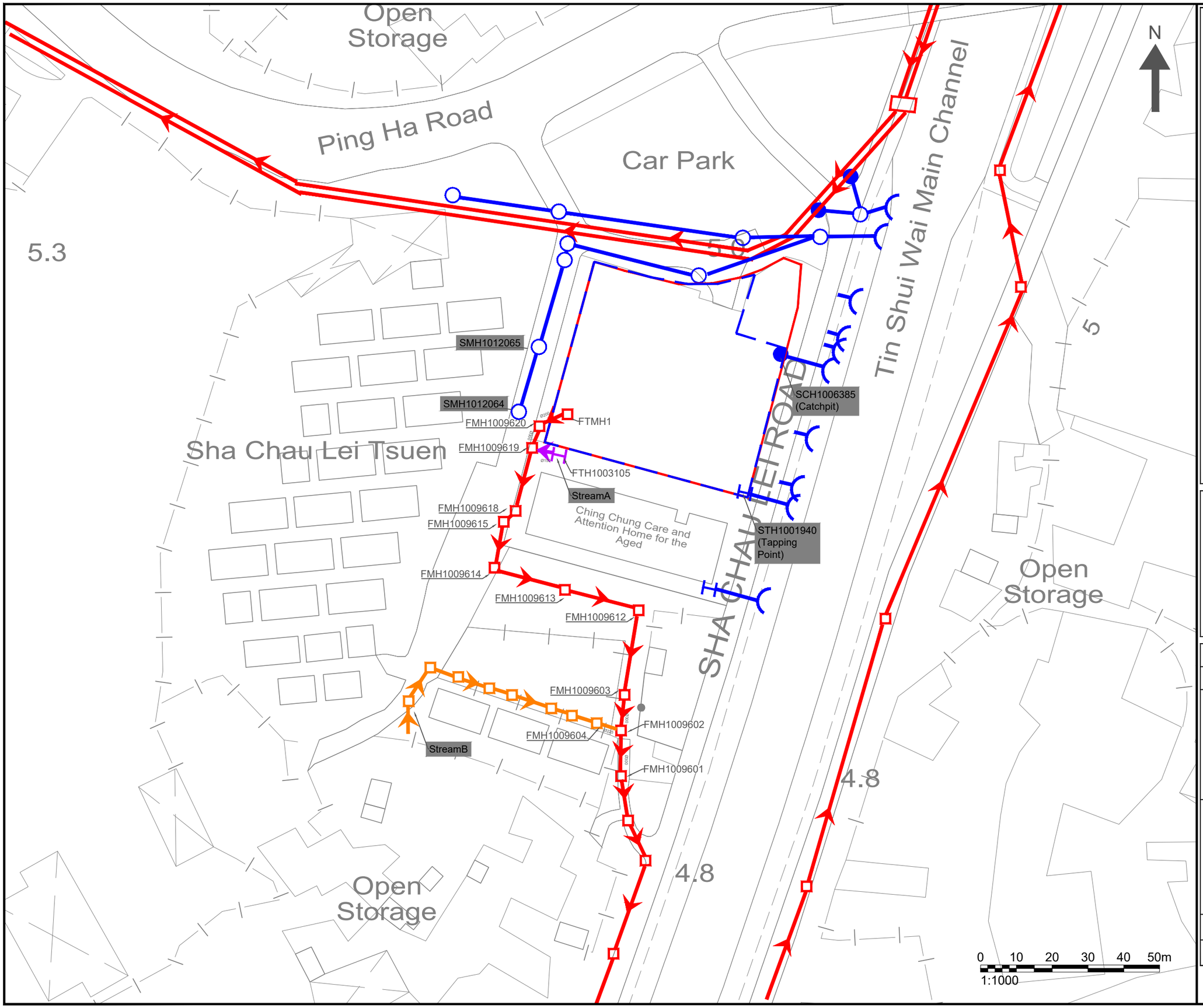

NOTES :

- DEVELOPMENT SITE BOUNDARY
- REZONING SITE BOUNDARY
- EXISTING SEWER AND MANHOLE
- STREAM A (SEWAGE)
- STREAM B (SEWAGE)
- EXISTING DRAINAGE AND MANHOLE

Consultant

Allied Environmental Consultants Limited

Project No. :	2164EA
Drawing By :	LL

Project :

PROPOSED REDEVELOPMENT OF POK OI HOSPITAL YEUNG CHUN PUI CARE AND ATTENTION HOME IN YUEN LONG

Drawing Title :

OVERVIEW OF PROPOSED AND EXISTING SEWAGE NETWORK AND CATCHMENT

Drawing No :	Revision :
Fig3.1	1
Scale :	Date :
AS SHOWN	Jan 2024

A3 420 x 297

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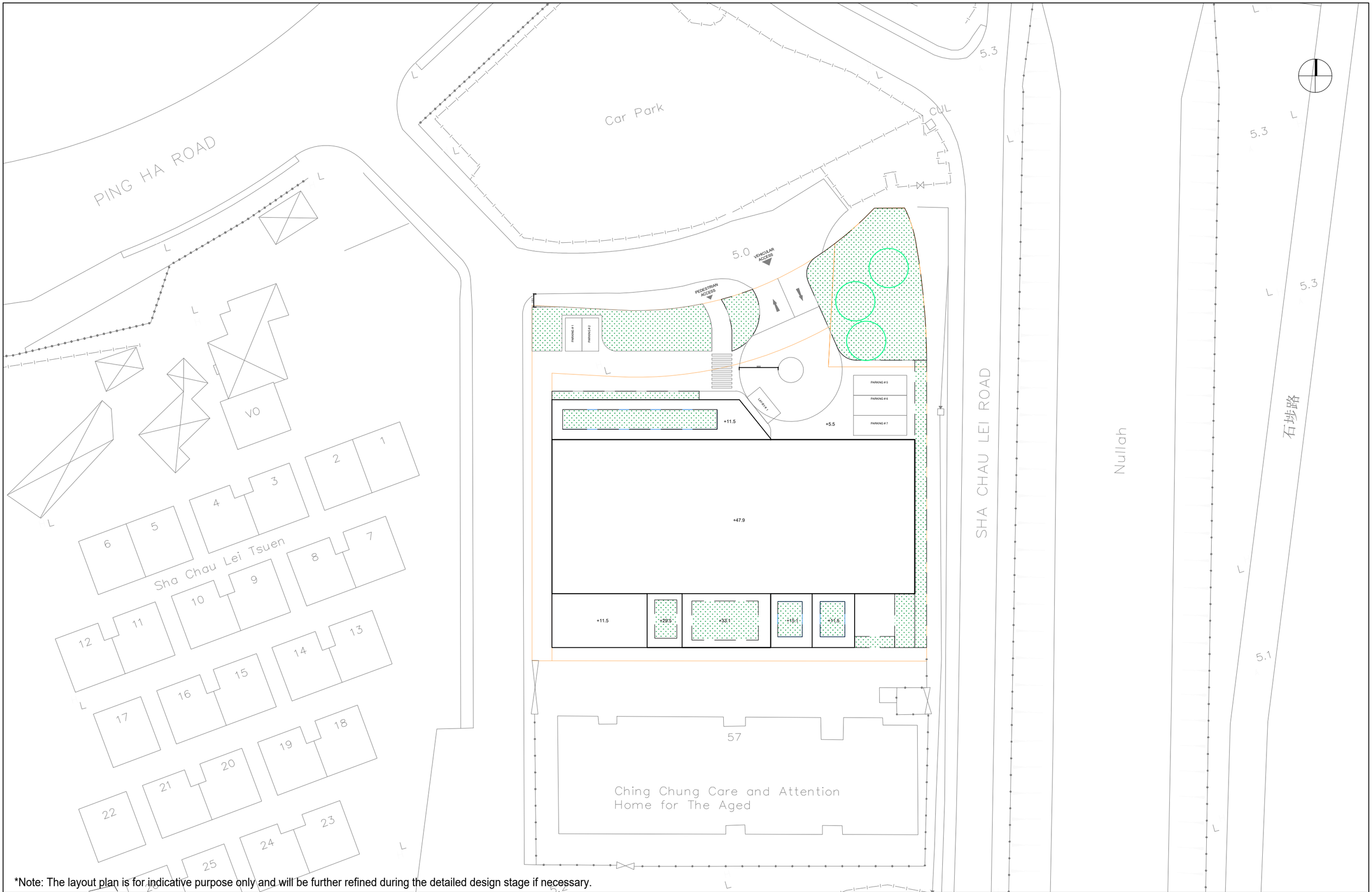
Appendix A

General Building Plans of the Proposed Redevelopment



*Note: The layout plan is for indicative purpose only and will be further refined during the detailed design stage if necessary.

Proposed Redevelopment of Pok Oi Hospital
Yeung Chun Pui Care and Attention Home in Yuen Long

SITE LOCATION PLAN

Date : 14 JUN 2024
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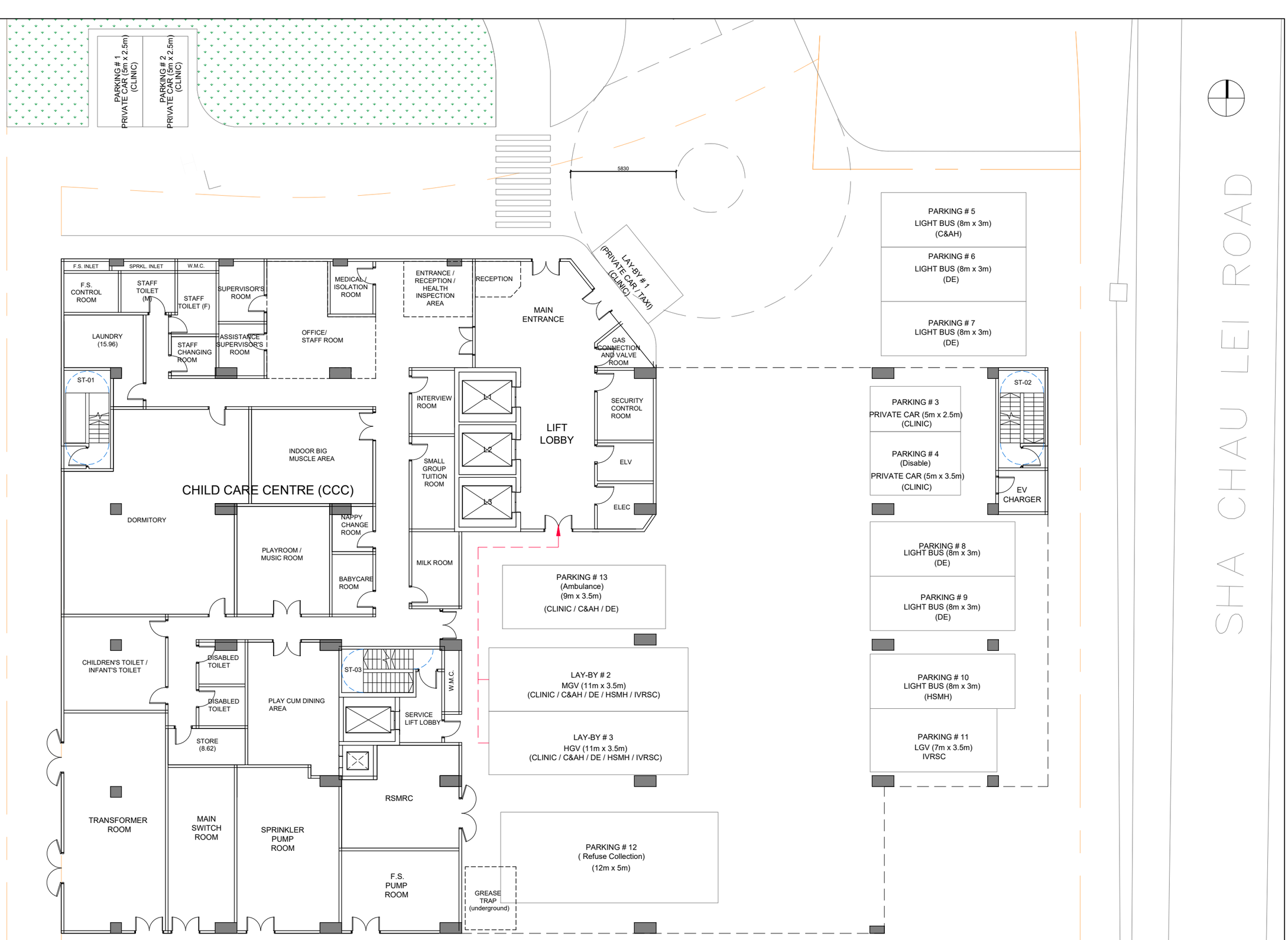

*Note: The layout plan is for indicative purpose only and will be further refined during the detailed design stage if necessary.

Proposed Redevelopment of Pok Oi Hospital
Yeung Chun Pui Care and Attention Home in Yuen Long

GROUND FLOOR PLAN

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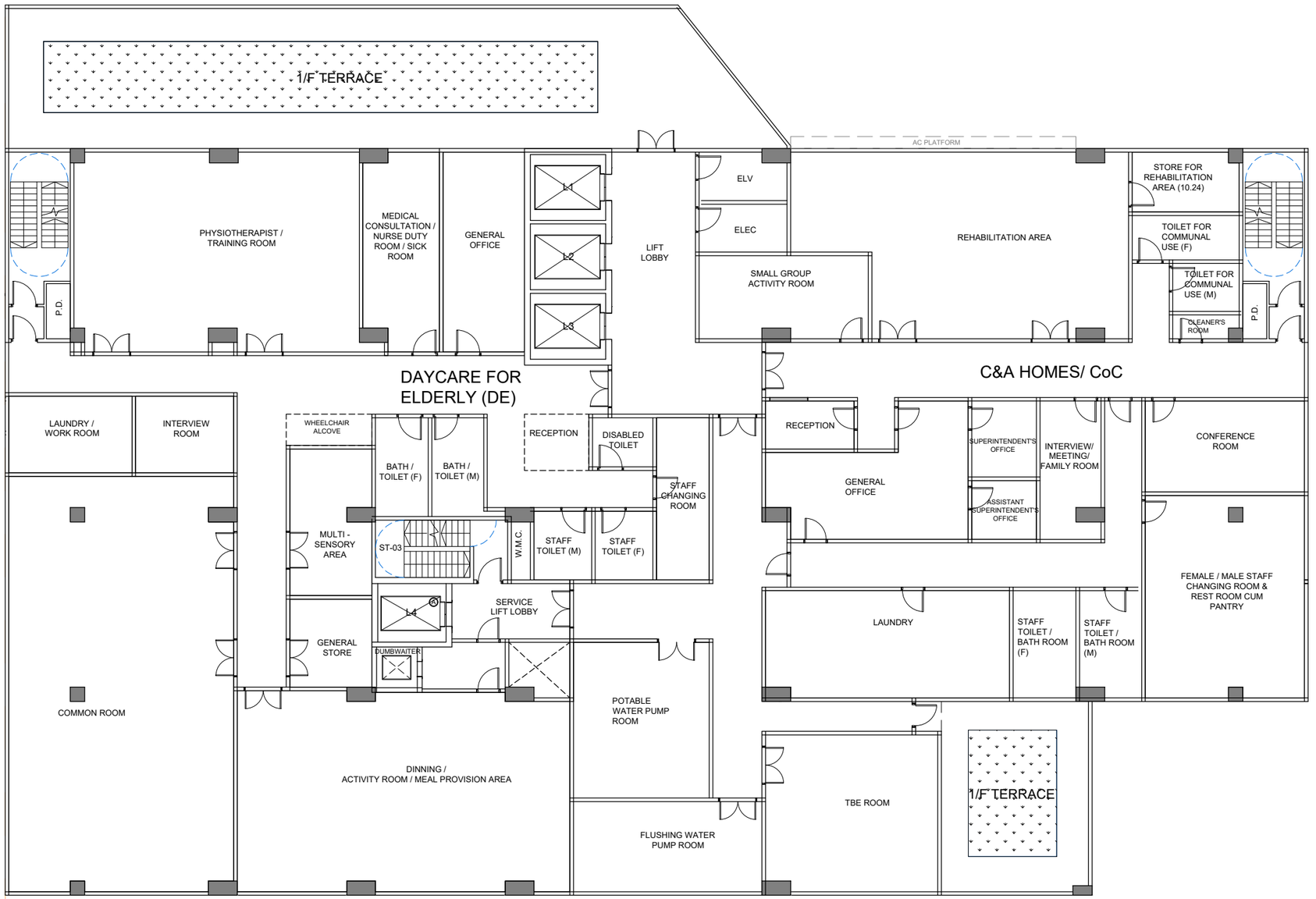
Scale : 1 : 200 (A3)



*Note: The layout plan is for indicative purpose only and will be further refined during the detailed design stage if necessary.

Proposed Redevelopment of Pok Oi Hospital
Yeung Chun Pui Care and Attention Home in Yuen Long

FIRST FLOOR PLAN

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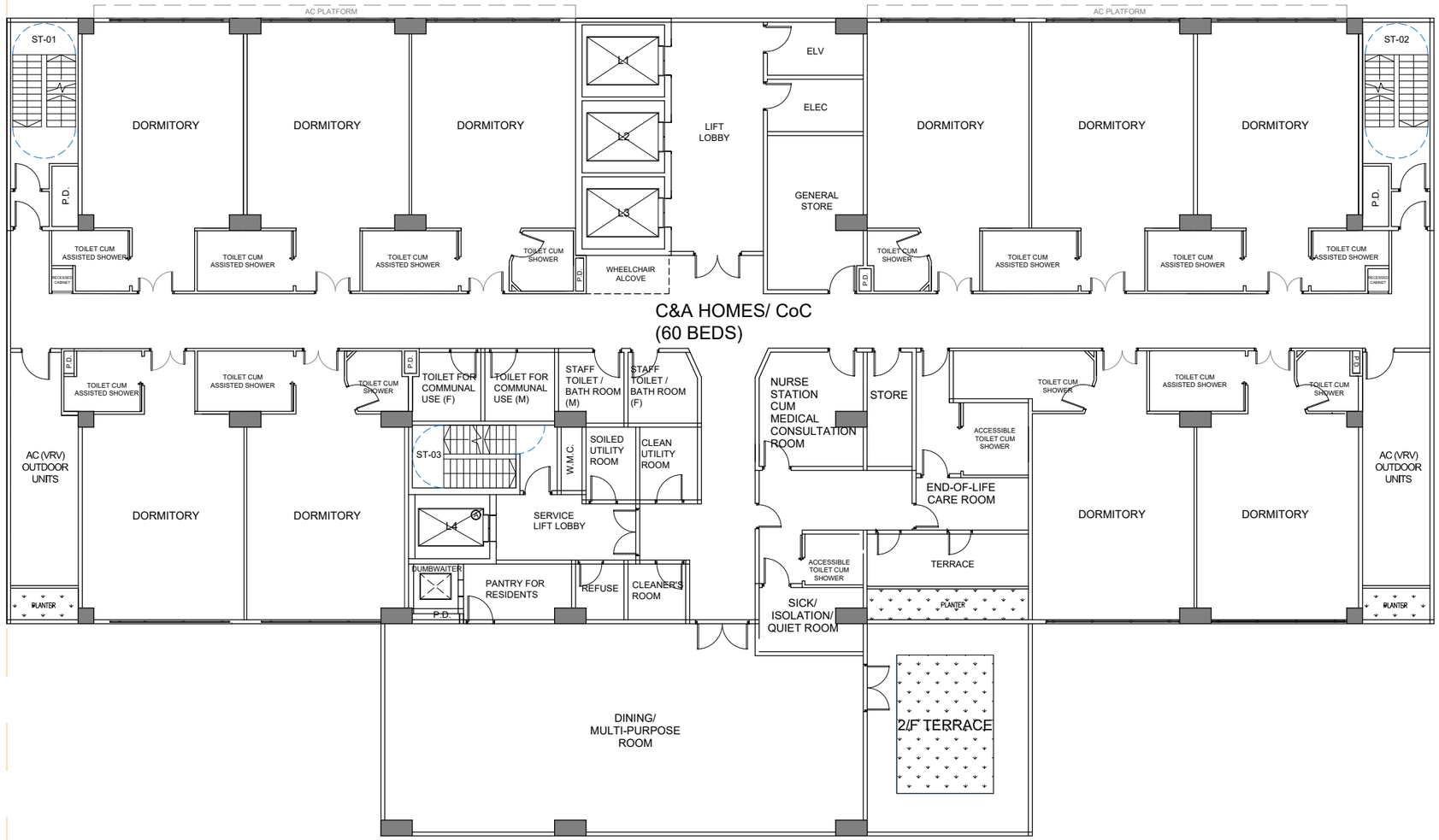
Scale : 1 : 200 (A3)



*Note: The layout plan is for indicative purpose only and will be further refined during the detailed design stage if necessary.

Proposed Redevelopment of Pok Oi Hospital
Yeung Chun Pui Care and Attention Home in Yuen Long

SECOND FLOOR PLAN

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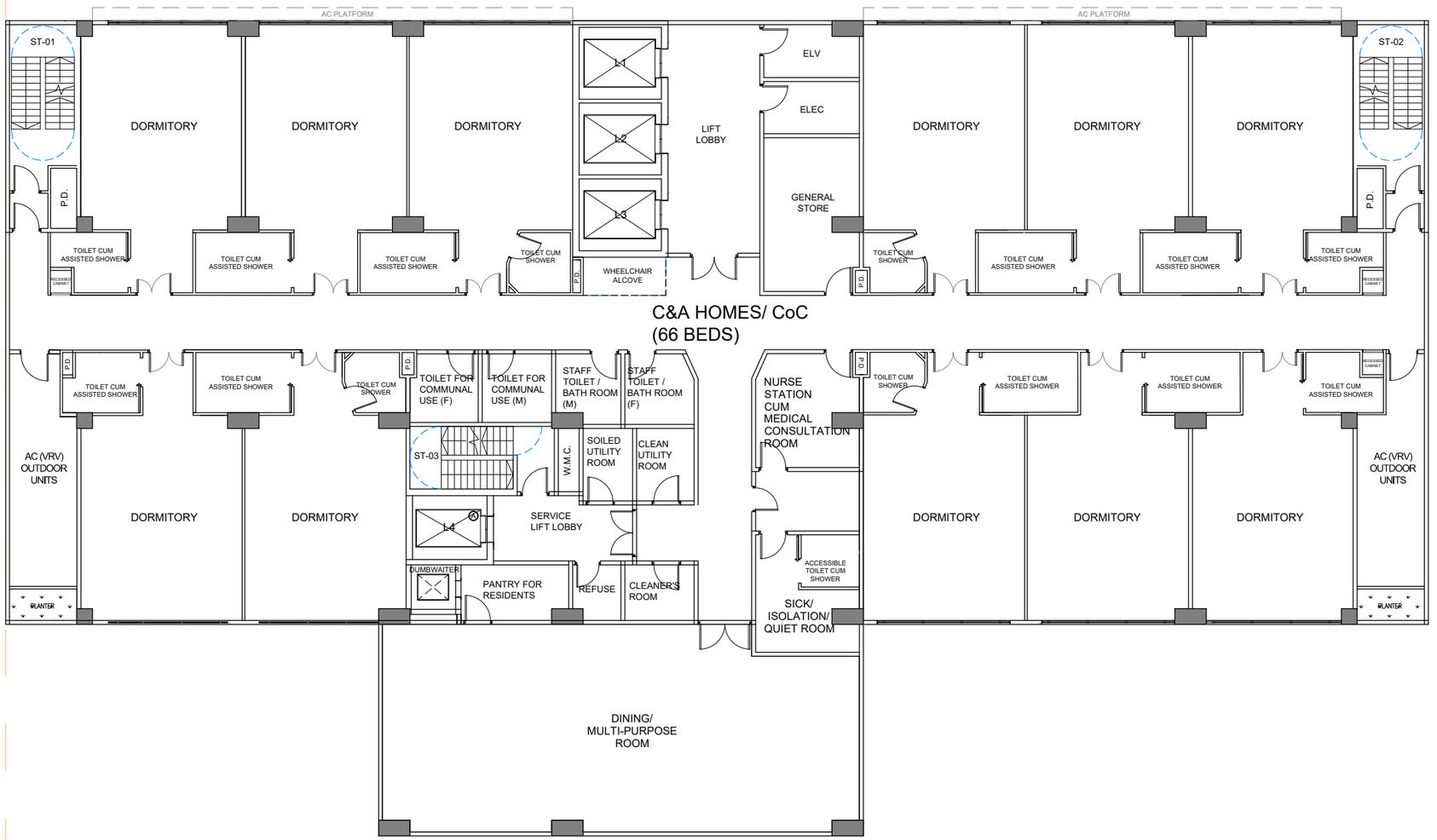

*Note: The layout plan is for indicative purpose only and will be further refined during the detailed design stage if necessary.

Proposed Redevelopment of Pok Oi Hospital
Yeung Chun Pui Care and Attention Home in Yuen Long

THIRD & FORTH FLOOR PLAN

Date : 14 JUN 2024
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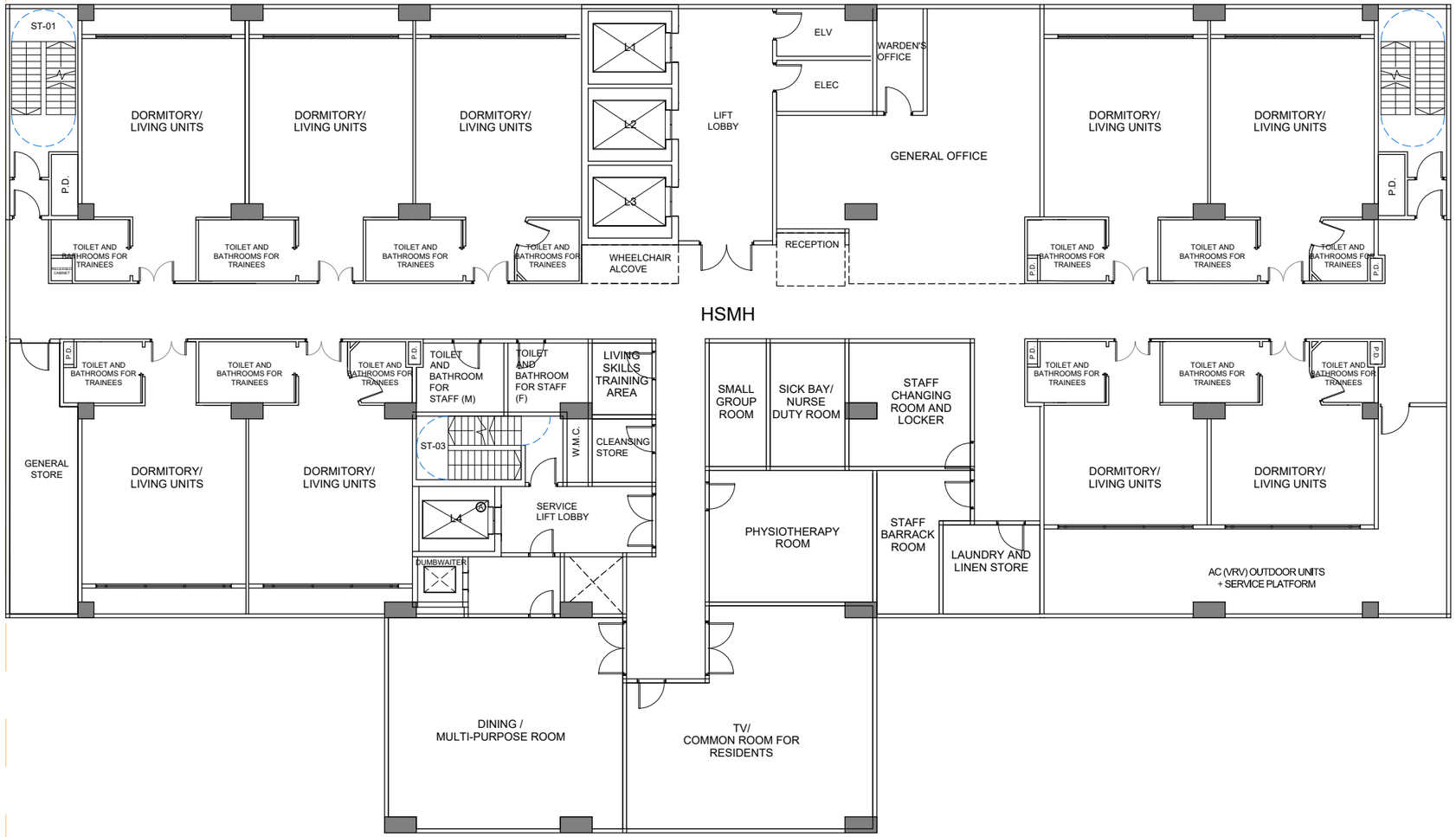

*Note: The layout plan is for indicative purpose only and will be further refined during the detailed design stage if necessary.

Proposed Redevelopment of Pok Oi Hospital
Yeung Chun Pui Care and Attention Home in Yuen Long

FIFTH FLOOR PLAN

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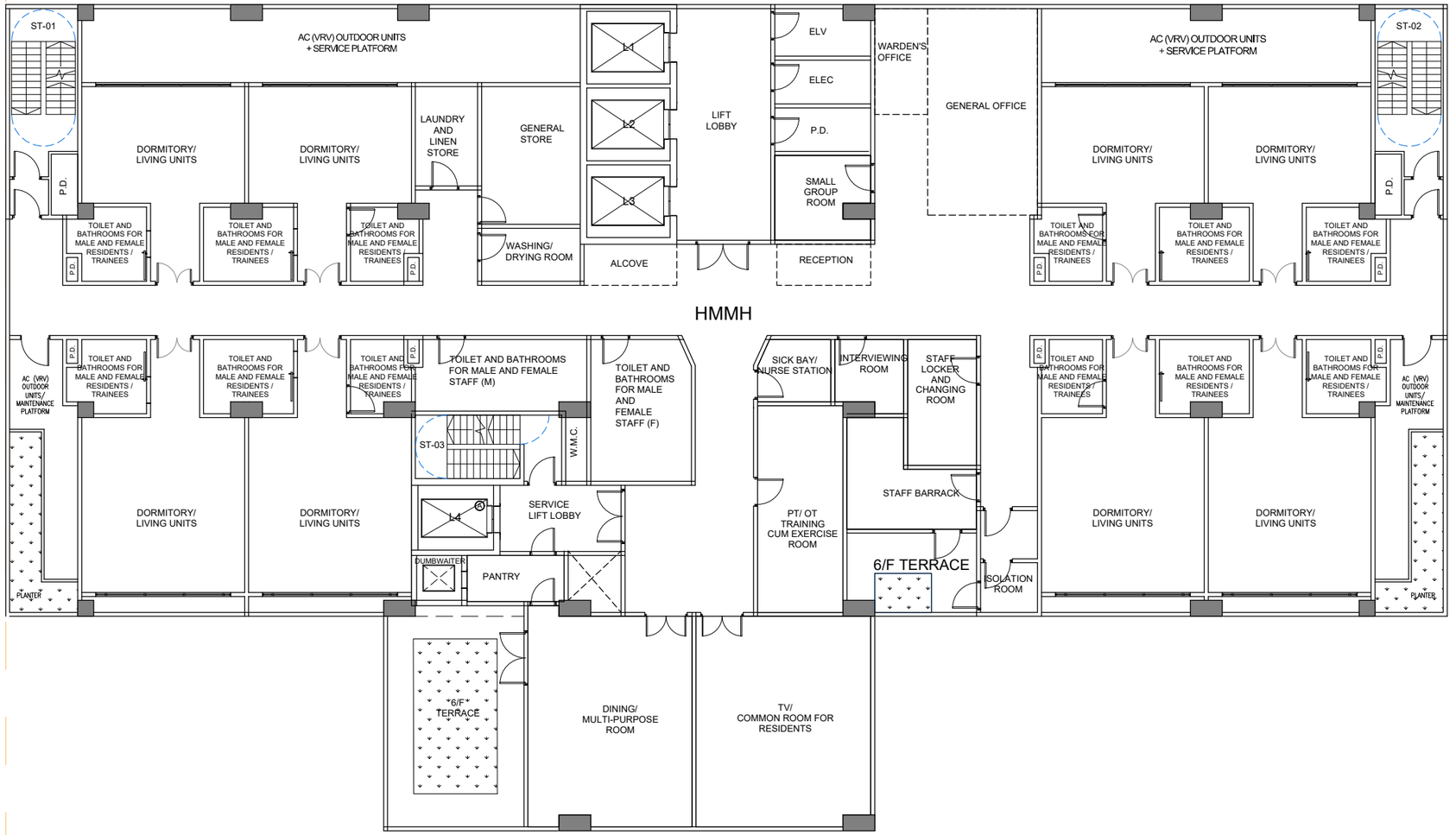

*Note: The layout plan is for indicative purpose only and will be further refined during the detailed design stage if necessary.

Proposed Redevelopment of Pok Oi Hospital
Yeung Chun Pui Care and Attention Home in Yuen Long

SIXTH FLOOR PLAN

Date : 14 JUN 2024
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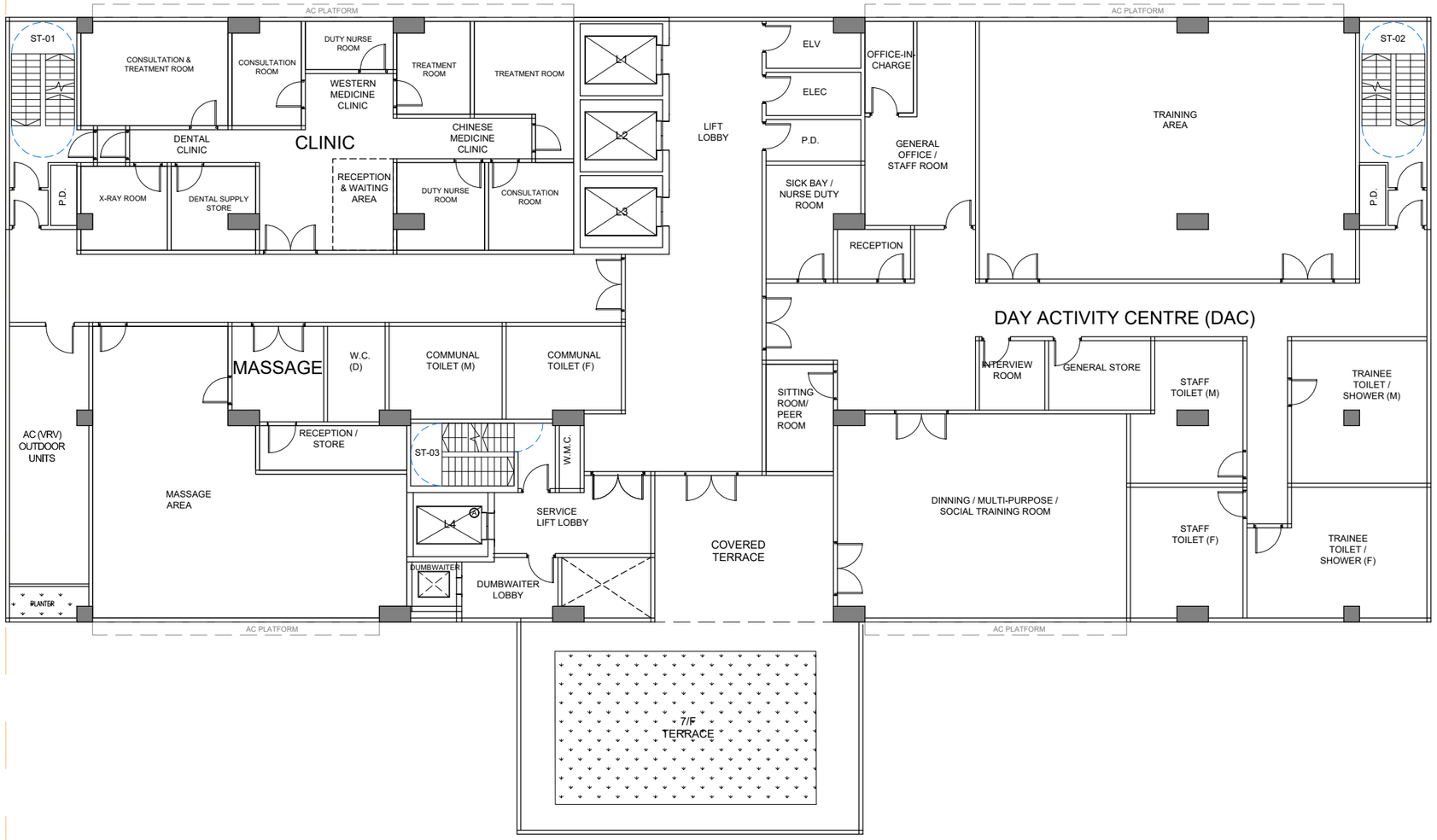

*Note: The layout plan is for indicative purpose only and will be further refined during the detailed design stage if necessary.

Proposed Redevelopment of Pok Oi Hospital
Yeung Chun Pui Care and Attention Home in Yuen Long

SEVENTH FLOOR PLAN

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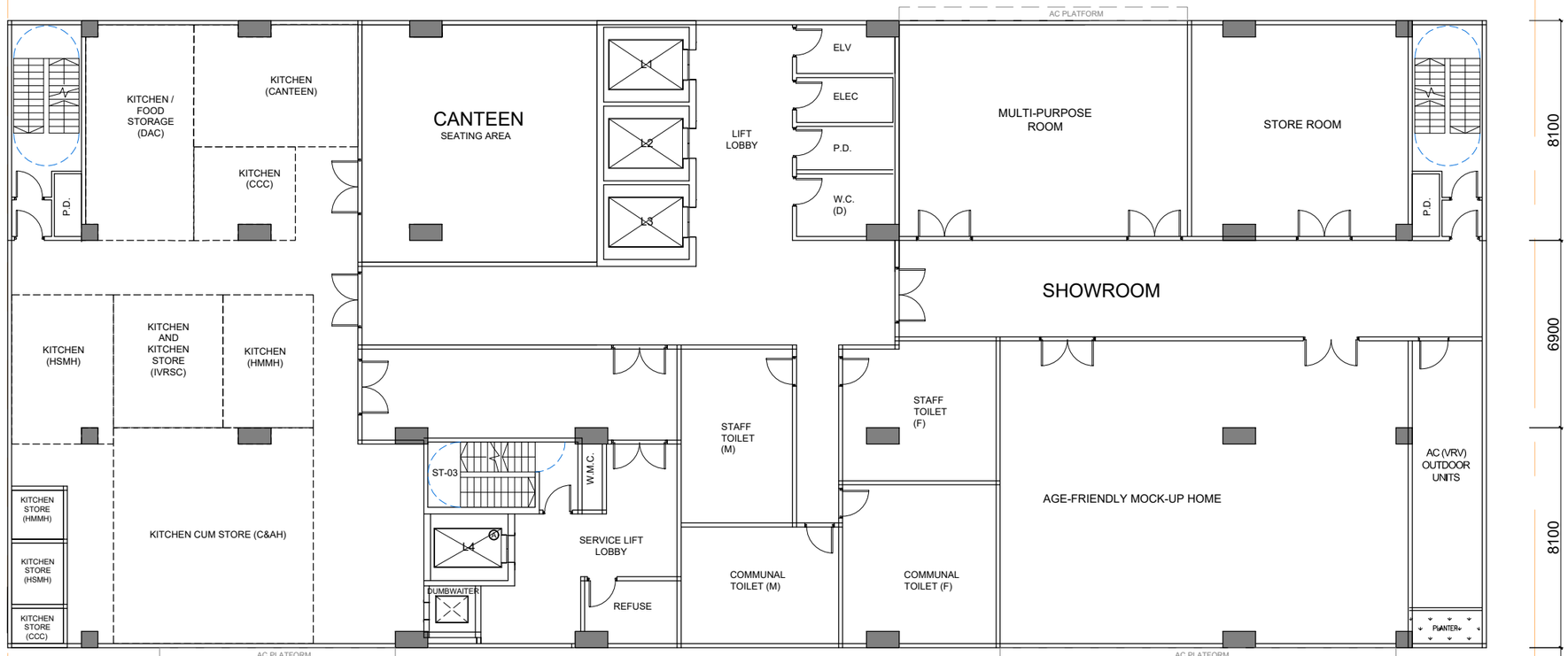

*Note: The layout plan is for indicative purpose only and will be further refined during the detailed design stage if necessary.

Proposed Redevelopment of Pok Oi Hospital
Yeung Chun Pui Care and Attention Home in Yuen Long

EIGHTH FLOOR PLAN

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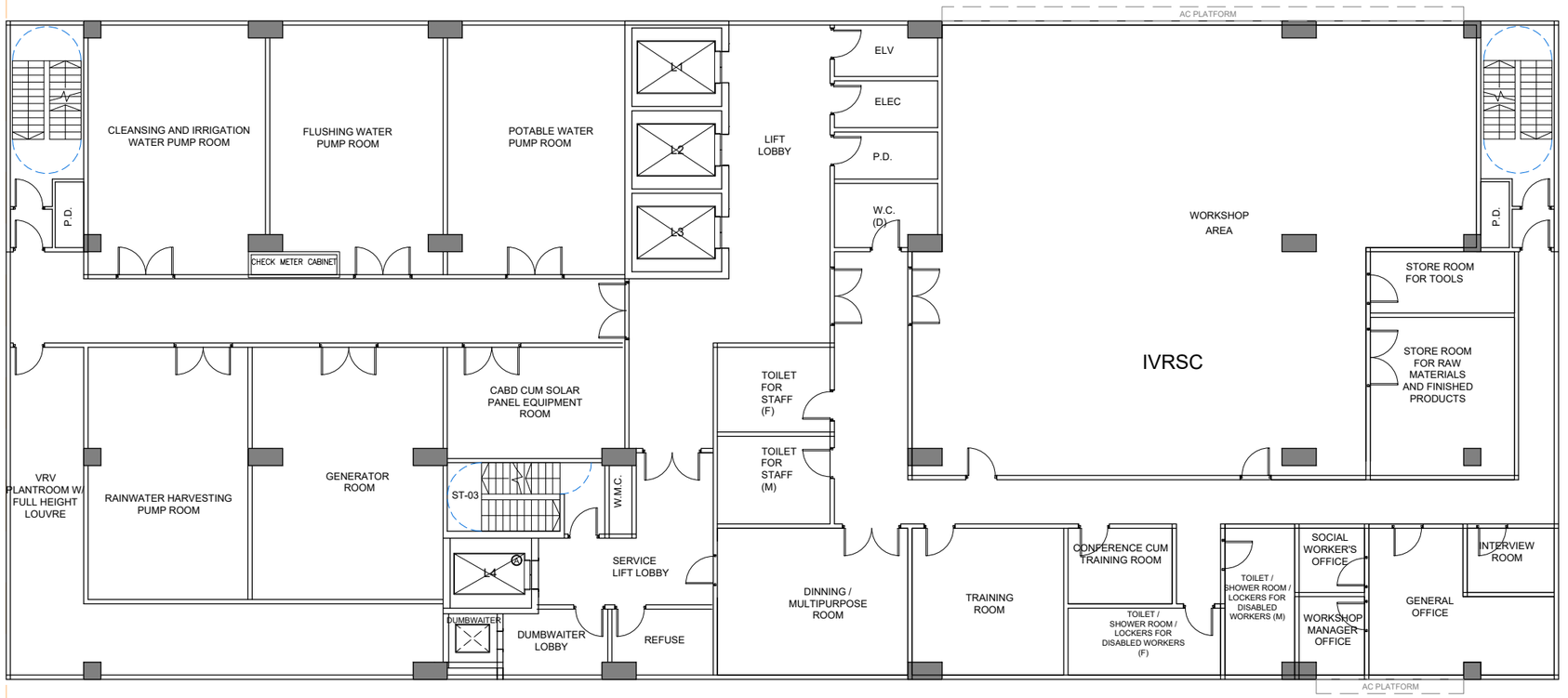

*Note: The layout plan is for indicative purpose only and will be further refined during the detailed design stage if necessary.

Proposed Redevelopment of Pok Oi Hospital
Yeung Chun Pui Care and Attention Home in Yuen Long

NINTH FLOOR PLAN

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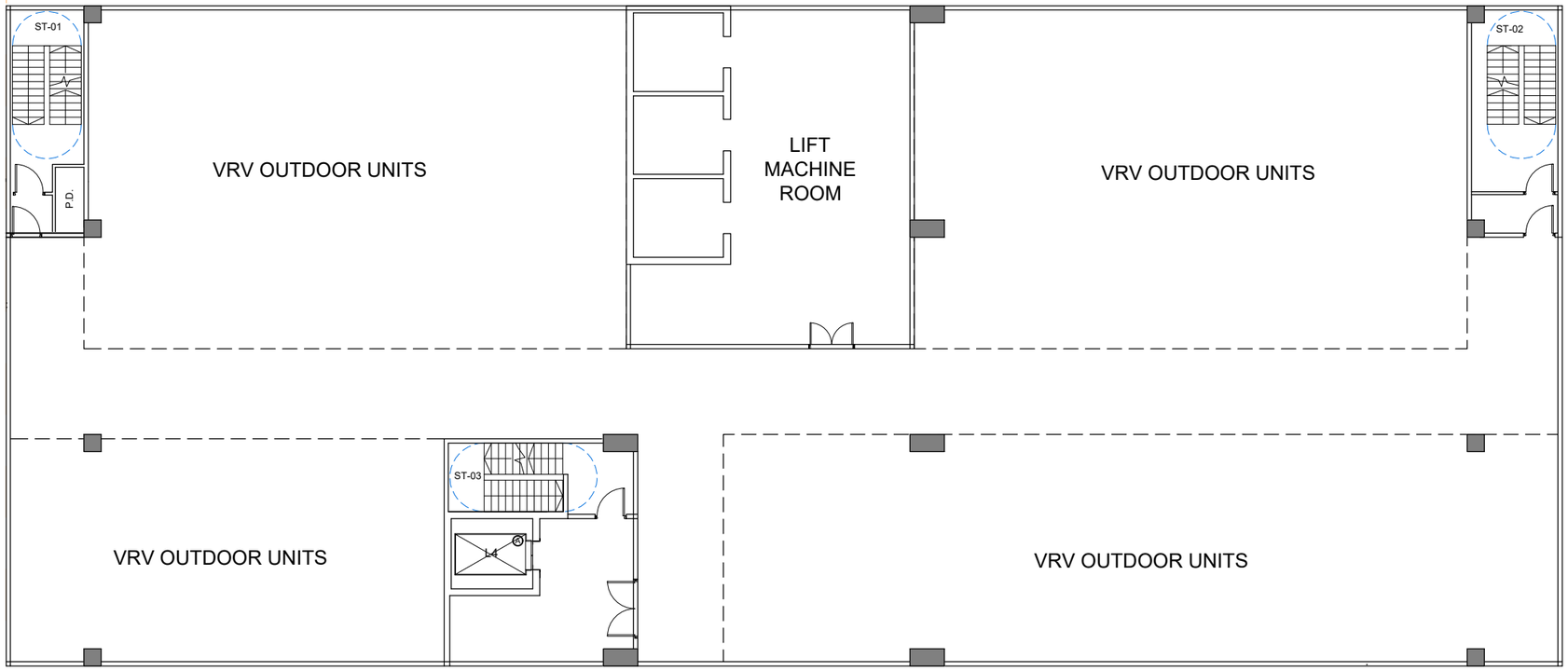


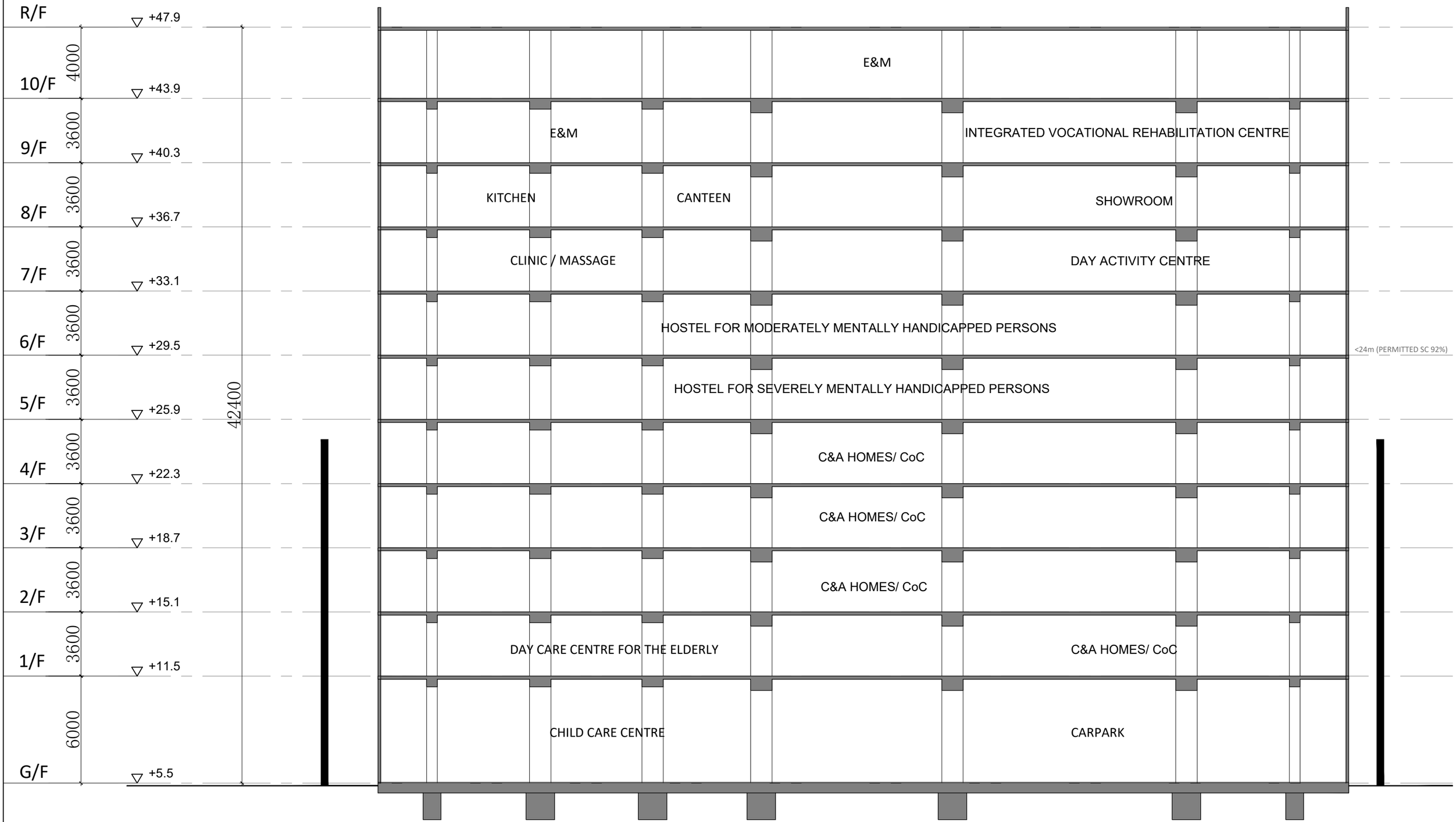
SHA CHAU LEI ROAD

*Note: The layout plan is for indicative purpose only and will be further refined during the detailed design stage if necessary.

Proposed Redevelopment of Pok Oi Hospital
Yeung Chun Pui Care and Attention Home in Yuen Long

TENTH FLOOR PLAN

Date : 14 JUN 2024
Scale : 1 : 200 (A3)



Proposed Redevelopment of Pok Oi Hospital
Yeung Chun Pui Care and Attention Home in Yuen Long

SCHEMATIC SECTION

Date : 14 JUN 2024
Scale : 1 : 200 (A3)

Appendix B1

Estimation of Sewage Discharge from the Site (Existing)

Appendix B Estimation of Sewage Discharge from the Site

Table 1 Estimation of Sewage Flow from the Existing Development

	Generation from RCHE (3-storey)			
i)	**Care and Attention Home (G/F-2/F)**			
a)	**Generation from staff**			
	Total Floor Area	1707	m^2	
	Worker Density (in $100m^2$) [2]	3.3	person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
	Total number of person	57	persons	
	Unit Flow Factor [1]	0.28	m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
	Average Sewage Discharge	16.0	m^3/day	
b)	**Generation from residents**			
	Total number of residents	143	persons	Full capacity of subsidised places (https://www.elderlyinfo.swd.gov.hk/en/content/pok-oi-hospital-yeung-chun-pui-care-and-attention-home)
	Total number of person	143	persons	
	Unit Flow Factor	0.19	m^3/person/day	Referred to the planning unit flow for Domestic (housing type specific) - Institutional and special class in Table T-1 of GESF.
	Average Sewage Discharge	27.2	m^3/day	
vii)	**Kitchen(G/F)**			
	Total Floor Area	61.5	m2	Total Floor area for kitchen
	Worker Density per GFA (in 100m2)	5.1	person/100m2	Referred to the worker density of Restaurants (All Types) in Table 8 of CIFSUS
	Total Number of Person	4	persons	
	Unit Flow Factor	1.58	m3/person/day	Referred to the planning unit flow for Commercial Employee + Restaurants & Hotels - J10 in Table T-2 of GESF.
	Average Sewage Discharge	6.3	m3/day	
	Total			
	Total estimated daily flow	**49.5**	**m^3/day**	
	Contributing Population	183		
	Catchment Inflow Factor [1]	1.00		Refer to the Catchment Inflow Factor for "Yuen Long" in Table T-4 of GESF.
	Peaking factor	8.00		Referred to the Peaking Factor (including stormwater allowance) for facility with existing upstream sewerage in Table T-5 of GESF.
	Peak Flow	**0.0046**	**m^3/s**	

Notes:

[1] The worker density is made reference to CIFSUS - "*Commercial and Industrial Floor Space Utilization Survey* " published by Planning Department (PlanD).

[2] The unit flow factor is made reference to "*Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (Version 1.0)* ", published by EPD.

Appendix B2

Estimation of Sewage Discharge from the Site (Proposed)

Appendix B Estimation of Sewage Discharge from the Site

Table 2 Estimation of Sewage Flow from the Proposed Redevelopment

Generation from Proposed Redevelopment (11-storey)

i)	**Child Care Centre (G/F)**			
a)	**Generation from staff**			
	Total Floor Area	324	m^2	
	Worker Density (in $100m^2$) [2]	3.3	person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
	Total number of person	11	persons	
	Unit Flow Factor [1]	0.28	m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
	Average Sewage Discharge	3.0	m^3/day	
ii)	**Elderly Day Care (1/F)**			
a)	**Generation from Staff**			
	Total Floor Area	510	m^2	
	Worker Density (in $100m^2$) [2]	3.3	person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
	Total number of person	17	persons	
	Unit Flow Factor [1]	0.28	m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
	Average Sewage Discharge	4.7	m^3/day	
iii)	**Care & Attention Home (1/F-4/F)**			
a)	**Generation from staff**			
	Total Floor Area	2557	m^2	
	Worker Density (in $100m^2$) [2]	3.3	person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
	Total number of person	85	persons	
	Unit Flow Factor [1]	0.28	m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
	Average Sewage Discharge	23.8	m^3/day	
b)	**Generation from Residents**			
	Total number of residents	192	persons	full capacity of 192-place residential care home for elderly
	Total number of overnight staff	0	persons	Refer to Cap. 459A Residential Care Homes (Elderly Persons) Regulation,1 care worker for every 30 residents or part thereof, between 10 p.m. and 7 a.m
	Total number of person	192	persons	
	Unit Flow Factor	0.19	m^3/person/day	Referred to the planning unit flow for Domestic (housing type specific) - Institutional and special class in Table T-1 of GESF.
	Average Sewage Discharge	36.5	m^3/day	
iv)	**Hostel for Severely Mentally Handicapped Persons (5/F)**			
a)	**Generation from staff**			
	Total Floor Area	682	m^2	
	Worker Density (in $100m^2$) [2]	3.3	person/100 m^2	
	Total number of person	33	persons	Refer to SWD staffing establishment for HSMH, around 0.66 workers/resident.
	Unit Flow Factor [1]	0.28	m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
	Average Sewage Discharge	9.2	m^3/day	
b)	**Generation from Residents**			
	Total number of residents	50	persons	Refer to Proposed Development Layout, full capacity of 50 nos of bed will be provided for HSMH
	Total number of overnight staff	0	persons	Refer to CAP613A Residential Care Homes (Persons with Disabilities) Regulation (High Care Level Home),1 care worker for every 40 residents, between 10 p.m. and 7 a.m
	Total number of person	50	persons	
	Unit Flow Factor	0.19	m^3/person/day	Referred to the planning unit flow for Domestic (housing type specific) - Institutional and special class in Table T-1 of GESF.
	Average Sewage Discharge	9.5	m^3/day	
v)	**Hostel for Moderately Mentally Handicapped Persons (6/F)**			
a)	**Generation from staff**			
	Total Floor Area	537	m^2	
	Worker Density (in $100m^2$) [2]	3.3	person/100 m^2	
	Total number of person	16	persons	Refer to SWD staffing establishment for HMMH, around 0.38 workers/resident.
	Unit Flow Factor [1]	0.28	m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
	Average Sewage Discharge	4.5	m^3/day	

Appendix B Estimation of Sewage Discharge from the Site

b)	**Generation from Residents**			
	Total number of residents	40	persons	Refer to Proposed Development Layout, full capacity of 40 nos of bed will be provided for HMMH
	Total number of overnight staff	0	persons	Refer to CAP613A Residential Care Homes (Persons with Disabilities) Regulation (High Care Level Home),1 care worker for every 40 residents, between 10 p.m. and 7 a.m
	Total number of person	40	persons	
	Unit Flow Factor	0.19	m^3/person/day	Referred to the planning unit flow for Domestic (housing type specific) - Institutional and special class in Table T-1 of GESF.
	Average Sewage Discharge	7.6	m^3/day	
vi)	**Day Acitvity Centre, Clinic,Massage,Showroom (7/F&8/F)**			
a)	**Generation from Staff**			
	Total Floor Area	1168	m^2	
	Worker Density (in 100m^2) [2]	3.3	person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
	Total number of person	39	persons	
	Unit Flow Factor [1]	0.28	m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
	Average Sewage Discharge	10.8	m^3/day	
vii)	**Kitchen(8/F)**			
	Total Floor Area	200	m2	Total Floor area for kitchen
	Worker Density per GFA (in 100m2)	5.1	person/100m2	Referred to the worker density of Restaurants (All Types) in Table 8 of CIFSUS
	Total Number of Person	11	persons	
	Unit Flow Factor	1.58	m3/person/day	Referred to the planning unit flow for Commercial Employee + Restaurants & Hotels - J10 in Table T-2 of GESF.
	Average Sewage Discharge	17.4	m3/day	
	Canteen(8/F)			
	Total Floor Area	77	m2	Total Floor area for kitchen
	Worker Density per GFA (in 100m2)	5.1	person/100m2	Referred to the worker density of Restaurants (All Types) in Table 8 of CIFSUS
	Total Number of Person	4	persons	
	Unit Flow Factor	1.58	m3/person/day	Referred to the planning unit flow for Commercial Employee + Restaurants & Hotels - J10 in Table T-2 of GESF.
	Average Sewage Discharge	6.3	m3/day	
viii)	**Integrated Vocational Rehabilitation Services Centre (9/F)**			
a)	**Generation from staff**			
	Total Floor Area	416	m^2	
	Worker Density (in 100m^2) [2]	3.3	person/100 m^2	Refer to worker density for "Community, Social & Personal Services" in Table 8 of CIFSUS.
	Total number of person	14	persons	
	Unit Flow Factor [1]	0.28	m^3/person/day	Refer to the planning unit flow factor for "Commercial Employee" + "Commercial Activities: J11 Community, Social & Personal Services" in Table T-2 of GESF.
	Average Sewage Discharge	3.9	m^3/day	
	Total			
	Total estimated daily flow	**137.2**	**m^3/day**	
	Contributing Population	508		
	Catchment Inflow Factor [1]	1.00		Refer to the Catchment Inflow Factor for "Yuen Long" in Table T-4 of GESF.
	Peaking Factor	6.00		Referred to the Peaking Factor (excluding stormwater allowance) for facility with new upstream sewerage in Table T-5 of GESF.
	Peak Flow	**0.0095**	**m^3/s**	
	Generation from Catchment Areas			
	Stream A			
	Assumed 100% Capacity (FTH1003105-FMH1009619)			
	Max Peak Discharge	0.013		Peak Discharge through manhole=Max Capacity
	Total estimated daily flow	140.4	m3/day	Peak Discharge*86400*Peaking Factor
	Contributing Population	520		
	Catchment Inflow Factor [1]	1.00		
	Stream B			
	Assumed 100% Capacity (FTH1009604-FMH1009602)			
	Max Peak Discharge	0.017		Peak Discharge through manhole=Max Capacity
	Total estimated daily flow	183.6	m3/day	Peak Discharge*86400*Peaking Factor
	Contributing Population	680		
	Catchment Inflow Factor [1]	1.00		

Notes:

[1] The worker density is made reference to CIFSUS - "*Commercial and Industrial Floor Space Utilization Survey* " published by Planning Department (PlanD).

[2] The unit flow factor is made reference to "*Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (Version 1.0)*", published by EPD.

Appendix C1

Calculation of Flow Capacity of Existing Development

Calculation of Flow Capacity of Existing Development

Sewer No.				Material	Internal Diameter (m) [a]	Cross-section Area (m^2)	Length (m)	Inlet mPD US_IL (m) [a]	Outlet mPD DS_IL (m) [a]	Hydraulic pipeline roughness (m) [b]	Hydraulic Gradient	Mean Velocity (m/s) [c]	Max Capacity of Sewer (m^3/s)	Total Average Dry Weather Flow m^3/day	Catchment Inflow Factor	Revised Total Average Dry Weather Flow [g] m^3/day	Contributing Population	Peaking Factor	Peak Discharge from Project Site m^3/day	Peak Discharge through Manhole m^3/s	Percentage of capacity	Percentage Contribution by Proposed Development	Remark
ID	From	ID	To		D	A	l				s	V			[f]		[d]	[e]			[h]		
FTMH1	Site	S1	FMH1009620	Clayware	0.150	0.018	4.89	4.88	4.39	0.003	0.101	2.47	0.044	49.5	1.0	49.5	183	8.0	395.6	0.0046	11%	11%	Site (Existing)
S1	FMH1009620	S2	FMH1009619	Clayware	0.300	0.071	4.96	4.38	4.34	0.003	0.008	1.12	0.079	49.5	1.0	49.5	183	8.0	395.6	0.0046	6%	6%	Site (Existing)
Stream A	FTH1003105	S2	FMH1009619	Clayware	0.150	0.018	3.78	4.374*	4.34	0.003	0.009	0.73	0.013	140.4	1.0	140.4	520	8.0	1123.2	0.013	100%	/	Stream A: Assumed 100% capacity
S2	FMH1009619	S3	FMH1009618	Clayware	0.300	0.071	17.31	4.33	4.26	0.003	0.004	0.79	0.056	189.9	1.0	189.9	703	8.0	1518.8	0.018	32%	8%	Site (Existing) + Stream A
S3	FMH1009618	S4	FMH1009615	Clayware	0.300	0.071	2.54	4.26	4.24	0.003	0.008	1.10	0.078	189.9	1.0	189.9	703	8.0	1518.8	0.018	23%	23%	Site (Existing) + Stream A
S4	FMH1009615	S5	FMH1009614	Clayware	0.300	0.071	11.55	4.24	4.18	0.003	0.005	0.89	0.063	189.9	1.0	189.9	703	8.0	1518.8	0.018	28%	28%	Site (Existing) + Stream A
S5	FMH1009614	S6	FMH1009613	Clayware	0.300	0.071	19.18	4.15	4.04	0.003	0.006	0.94	0.066	189.9	1.0	189.9	703	8.0	1518.8	0.018	26%	26%	Site (Existing) + Stream A
S6	FMH1009613	S7	FMH1009612	Clayware	0.300	0.071	20.61	4.03	3.87	0.003	0.008	1.09	0.077	189.9	1.0	189.9	703	8.0	1518.8	0.018	23%	23%	Site (Existing) + Stream A
S7	FMH1009612	S8	FMH1009603	Clayware	0.300	0.071	22.51	3.85	3.75	0.003	0.004	0.83	0.058	189.9	1.0	189.9	703	8.0	1518.8	0.018	30%	30%	Site (Existing) + Stream A
S8	FMH1009603	S9	FMH1009602	Clayware	0.300	0.071	8.43	3.73	3.62	0.003	0.013	1.42	0.100	189.9	1.0	189.9	703	8.0	1518.8	0.018	18%	18%	Site (Existing) + Stream A
Stream B	FMH1009604	S9	FMH1009602	Clayware	0.225	0.040	5.72	3.63	3.62	0.003	0.002	0.43	0.017	183.6	1.0	183.6	680	8.0	1468.8	0.017	100%	/	Stream B: Assumed 100 % capacity
S9	FMH1009602	S10	FMH1009601	Clayware	0.300	0.071	11.50	3.61	3.51	0.003	0.009	1.16	0.082	373.5	1.0	373.5	1383	6.0	2240.7	0.026	32%	21%	Site (Existing) + Stream A+ Stream B

[a] Reference from GeoInfo Map, * inlet height calculated with min 1:150 gradient for 150mm pipe (as suggested by DSD)

[b] Roughness values adopted in the calculations is based on the interpolated values for velocities between 0.75 m/s and 1.2 m/s in accordance with the DSD's Sewerage Manual.
For public sewers, assumed clayware slimed sewers in "poor" condition, ks value of 3.0mm is adopted.

[c] The velocity is calculated using the Colebrook-White Formula:

$$V = -2(2gDS)^{0.5}\log\left(\frac{k}{3.7D} + \frac{2.5\nu}{D(2gDS)^{0.5}}\right)$$

where
k = Colebrook-White roughness coefficient, in meter
V = mean velocity (m/s)
D = circular cross-section pipe, inside diameter (m)
S = slope, in meters per meter
ν = kinematic viscosity of water, in meter per second (0.000001306 m/s)
g = gravitational acceleration (m/s2) (9.807m/s2)

[d] The Contributing Population is defined as:

$$\text{Contributing Population} = \frac{\text{Calculated total average flow } (m^3/\text{day})}{0.27\ (m^3/\text{person/day})}$$

[e] Reference from Table T-5 of Guidelines for Estimating Sewage Flows for Sewerage Infrastructure Planning
[f] Reference from Table T-4 of Guidelines for Estimating Sewage Flows for Sewerage Infrastructure Planning
[g] Revised Total Average Dry Weather Flow = Total Average Dry Weather Flow x Catchment Inflow Factor
[h] Pipe segment that exceeded 100% used capacity are bolded and underlined

Appendix C2

Calculation of Flow Capacity of Proposed Redevelopment

Calculation of Flow Capacity of Proposed Redevelopment

Sewer No.				Material	Internal Diameter (m) [a]	Cross-section Area (m^2)	Length (m)	Inlet mPD US_IL (m) [a]	Outlet mPD DS_IL (m) [a]	Hydraulic pipeline roughness (m) [b]	Hydraulic Gradient	Mean Velocity (m/s) [c]	Max Capacity of Sewer (m^3/s)	Total Average Dry Weather Flow	Catchment Inflow Factor	Revised Total Average Dry Weather Flow [g]	Contributing Population	Peaking Factor	Peak Discharge from Project Site m^3/day	Peak Discharge through Manhole m^3/s	Utilization	Percentage Contribution by Proposed Development [i]	Remark
ID	From	ID	To		D	A	l				s	V		m^3/day	[f]	m^3/day	[d]	[e]			[h]		
FTMH1	Site	S1	FMH1009620	Clayware	0.200	0.031	4.89	4.88	4.39	0.003	0.101	3.01	0.094	137.2	1.0	137.2	508	6.0	823.2	0.010	10%	10%	Site (Proposed)
S1	FMH1009620	S2	FMH1009619	Clayware	0.300	0.071	4.96	4.38	4.34	0.003	0.008	1.12	0.079	137.2	1.0	137.2	508	8.0	1097.6	0.013	16%	16%	Site (Proposed)
Stream A	FTH1003105	S2	FMH1009619	Clayware	0.150	0.018	3.78	4.374*	4.34	0.003	0.009	0.73	0.013	140.4	1.0	140.4	520	8.0	1123.2	0.013	100%	/	Stream A: Assumed 100% capacity
S2	FMH1009619	S3	FMH1009618	Clayware	0.300	0.071	17.31	4.33	4.26	0.003	0.004	0.79	0.056	277.6	1.0	277.6	1028	6.0	1665.6	0.019	35%	23%	Site (Proposed) + Stream A
S3	FMH1009618	S4	FMH1009615	Clayware	0.300	0.071	2.54	4.26	4.24	0.003	0.008	1.10	0.078	277.6	1.0	277.6	1028	6.0	1665.6	0.019	25%	16%	Site (Proposed) + Stream A
S4	FMH1009615	S5	FMH1009614	Clayware	0.300	0.071	11.55	4.24	4.18	0.003	0.005	0.89	0.063	277.6	1.0	277.6	1028	6.0	1665.6	0.019	30%	20%	Site (Proposed) + Stream A
S5	FMH1009614	S6	FMH1009613	Clayware	0.300	0.071	19.18	4.15	4.04	0.003	0.006	0.94	0.066	277.6	1.0	277.6	1028	6.0	1665.6	0.019	29%	19%	Site (Proposed) + Stream A
S6	FMH1009613	S7	FMH1009612	Clayware	0.300	0.071	20.61	4.03	3.87	0.003	0.008	1.09	0.077	277.6	1.0	277.6	1028	6.0	1665.6	0.019	25%	16%	Site (Proposed) + Stream A
S7	FMH1009612	S8	FMH1009603	Clayware	0.300	0.071	22.51	3.85	3.75	0.003	0.004	0.83	0.058	277.6	1.0	277.6	1028	6.0	1665.6	0.019	33%	22%	Site (Proposed) + Stream A
S8	FMH1009603	S9	FMH1009602	Clayware	0.300	0.071	8.43	3.73	3.62	0.003	0.013	1.42	0.100	277.6	1.0	277.6	1028	6.0	1665.6	0.019	19%	13%	Site (Proposed) + Stream A
Stream B	FMH1009604	S9	FMH1009602	Clayware	0.225	0.040	5.72	3.63	3.62	0.003	0.002	0.43	0.017	183.6	1.0	183.6	680	8.0	1468.8	0.017	100%	/	Stream B: Assumed 100 % capacity
S9	FMH1009602	S10	FMH1009601	Clayware	0.300	0.071	11.50	3.61	3.51	0.003	0.009	1.16	0.082	461.2	1.0	461.2	1708	6.0	2767.2	0.032	39%	16%	Site (Proposed) + Stream A+ Stream B

[a] Reference from GeoInfo Map. * inlet height calculated with min 1:150 gradient for 150mm dise (as suggested by DSD)

[b] Roughness values adopted in the calculations is based on the interpolated values for velocities between 0.75 m/s and 1.2 m/s in accordance with the DSD's Sewerage Manual.
For public sewers, assumed clayware slimed sewers in "poor" condition, ks value of 3.0mm is adopted.

[c] The velocity is calculated using the Colebrook-White Formula:

$$V = -2\left(2gDS\right)^{0.5}\log\left(\frac{k}{3.7D} + \frac{2.5\nu}{D\left(2gDS\right)^{0.5}}\right)$$

where
k = Colebrook-White roughness coefficient, in meter
V = mean velocity (m/s)
D = circular cross-section pipe, inside diameter (m)
S = slope, in meters per meter
v = kinematic viscosity of water, in meter per second (0.000001306 m/s)
g = gravitational acceleration (m/s2) (9.807m/s2)

[d] The Contributing Population is defined as:

$$\text{Contributing Population} = \frac{\text{Calculated total average flow } (m^3/day)}{0.27\ (m^3/person/day)}$$

[e] Reference from Table T-5 of Guidelines for Estimating Sewage Flows for Sewerage Infrastructure Planning
[f] Reference from Table T-4 of Guidelines for Estimating Sewage Flows for Sewerage Infrastructure Planning
[g] Revised Total Average Dry Weather Flow = Total Average Dry Weather Flow x Catchment Inflow Factor
[h] Pipe segment that exceeded 100% used capacity are bolded and underlined
[i] Percentage contribution by proposed development=

$$\frac{\text{Peak Discharge through Manhole } (m3/s)}{\text{Max Capacity of Sewer } (m^3/s)}$$