Attachment 3

Revised Sewerage Impact Assessment

Prepared for

Lo Hing Investment Company Limited

Prepared by

Ramboll Hong Kong Limited

PROPOSED MINOR RELAXATION OF PLOT RATIO (PR) AND SITE COVERAGE (SC) FOR PROPOSED SOCIAL WELFARE FACILITY (RESIDENTIAL CARE HOME FOR THE ELDERLY) (RCHE(S)), TRAINING CENTRE WITH RESIDENTIAL INSTITUTION AND PERMITTED RESIDENTIAL DEVELOPMENT (FLAT) IN LOT 94 IN D.D. 388 AND ADJOINING GOVERNMENT LAND, CASTLE PEAK ROAD – TSING LUNG TAU, TSUEN WANTAU, TSUEN WAN

SEWERAGE IMPACT ASSESSMENT

Date	**October 2024**
Prepared by	**Miko Wan** **Environmental Consultant**
Signed	
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Signed	
Project Reference	**CCGCPRAFEI00**
Document No.	**R8291_v2.1**

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CHAPTERS

TABLES

FIGURES

APPENDICES

1. INTRODUCTION

1.1 Project Background

1.1.1 The Application Site is zoned "Residential (Group B)" ("R(B)") under the Approved Tsuen Wan West Outline Zoning Plan (No. S/TWW/21) with building height restriction of 60 mPD. It is also the subject of a previous planning application (No. A/TWW/122) for proposed minor relaxation of PR from 2.1 to 2.52 for a permitted residential development, which was approved with conditions by the Town Planning Board (TPB) on 12 Aug 2022.

1.1.2 The Government has launched the enhanced Incentive Scheme to Encourage Provision of Residential Care Homes for the Elderly (RCHEs) in New Private Developments – Time-limited Enhancements (LandsD's Practice Note Issue No. 5/2023). Echoing the incentive scheme, the applicant has now proposed a composite development which contains both private residential use and RCHE.

1.1.3 Ramboll Hong Kong Limited (Ramboll) was responsible for the previous planning application (No. A/TWW/122) and prepared the sewerage impact assessment report (SIAR) as one of the technical supporting documents. Ramboll has been appointed to update the SIAR with respect to the current proposal (including private residential use and RCHE) and latest guidelines to address the drainage impact and demonstrate the acceptability of the proposal.

1.1.4 Architectural drawings and technical information of the development are provided by the applicant and its project architect.

1.2 Project Location and Environ

1.2.1 The Application Site was formerly occupied by an Acid Factory which was already demolished. Currently, the Application Site is a vacant land and most of the area is covered by vegetations.

1.2.2 The Application Site is bounded by Castle Peak Road (Tsing Lung Tau) on southern side. It is surrounded by Vale Villa – Hong Kong Garden to the north, Hong Kong Garden to the west and Hong Kong Garden Commercial Complex (shopping mall) to the east. Seashore is on the opposite side of Castle Peak Road at over 40m apart.

1.2.3 The surrounding is dominated by existing residential development and associated facilities (e.g. shopping mall of the residential development). A vacant site is located to the further north for G/IC uses.

1.2.4 The location of the Application Site and surrounding environs are shown in **Figure 1**.

1.3 Proposed Development

1.3.1 The Proposed Development consists of a RCHE (G/F to 7/F; 8 floors) and a residential tower (8/F to 15/F). There is also 1 basement floor to cater for car parking area for RCHE, residential and visitor uses.

1.3.2 Regarding the RCHE, there will be maximum 320 beds provided in dormitories located at 3/F to 7/F. Other ancillary facilities are mainly located at G/F to 2/F. A rehab facilities (~200m^3) is proposed.

1.3.3 Regarding the residential portion, clubhouse (~347m^2) including an outdoor swimming pool (~167m^2) is located at 8/F. A total of 112 flat units are located at 9/F to 15/F.

1.3.4 The tentative completion year is 2032. The proposed development scheme is shown in **Appendix 1**.

2. SEWERAGE IMPACT ASSESSMENT

2.1 Scope of Work

2.1.1 The aim of this SIA is to assess whether the capacity of the existing sewerage network serving the Application Site is sufficient to cope with the sewage flow from the proposed development. Drainage Record Plans from Drainage Services Department (DSD) were obtained for the purposes of this SIA.

2.2 Assessment Criteria and Methodology

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

2.2.2 Based on the building types in the area, the following unit flow factors are used in the SIA calculation:

- RCHE residents: 0.19 m^3/day (Institutional and special class)
- RCHE Staff: 0.28 m^3/day (J11 - Community, Social & Personal Services)
- F&B employee: 1.58 m^3/day (J10 Restaurants & Hotels)
- Domestic residents and G/IC users: 0.27 m^3/day (Private R2)
- Clubhouse Staff: 0.28 m^3/day (J11 - Community, Social & Personal Services)

2.2.3 Catchment Inflow Factor (P_{CIF}) of Kwan Chung (1.10) has been applied in the assessment.

2.3 Existing and Future Sewerage System

2.3.1 According to the Drainage Record Plans obtained from DSD, there is a Ø500 mm sewer along Castle Peak Road – Tsing Lung Tau. The sewer eventually discharges the collected sewage to Tsing Lung Tau Sewage Pumping Station. The existing sewers in the vicinity of the Application Site are shown in **Figure 2**.

2.3.2 The sewage generated from the Application Site will be discharged to manhole no.: FMH4052284 (S1) as shown in **Figure 2** nearest to the Application Site.

2.4 Wastewater Generated by the Proposed Development

2.4.1 Wastewater arising from the proposed development will be primarily contributed by the residential residents, clubhouse staff, RCHE residents, students and RCHE staff. Detailed calculation for the proposed development is given in **Table 1** below and **Appendix 2**.

Table 1 Estimated Peak Flow

Development Parameters	Residential Portion			RCHE					
	Residential Units	Clubhouse	Swimming Pool	Beds	Worker	Training Centre	Residential Institution	Students Staying Overnight	Rehab Facilities
Area (m^2)	-	347	167	-	-	200	50	-	200
Number of Residential Units	112	-	-	-	-	-	-	-	-
Average Household Size	2.7(1)	-	-	-	-	-	-	-	-
Assumed Population	303	11	-	320	33(2)	7	2	4	-
Design Flow (m^3/person/day)	0.27(3)	0.28(4)	-	0.19(5)	0.28(4)	0.28(4)	0.28(4)	0.19(5)	-
Flow Rate (m^3/day)	**81.8**	**3.2**	-	60.8	9.2	2.0	0.6	0.8	-
Flow Rate (L/s)	-	-	**5.6**	**-**	**-**	**-**	**-**	**-**	**10.0**
Total Flow Rate (m^3/day)	**219.1**								
Total Flow Rate with P_{CIF} (6) (m^3/day)	**241.1**								
Peaking Factor	**8(7)**								
Peak Flow (L/s) (with swimming pool backwash)	**37.9**								

(1) 2021 Population by-Census: Average Household Size of Tsuen Wan DC district
(2) Refer to Code of Practice for Residential Care Homes (Elderly Person)
(3) Refer to Table T-1 of GESF - Private R2
(4) Refer to Table T-2 of GESF - J11
(5) Refer to Table T-1 of GESF – Institutional and special class
(6) With P_{CIF} of Kwan Chung (1.10) applied
(7) Refer to Table T-5 of GESF for population <1,000 incl. stormwater allowance.

2.5 Assessment of Sewerage Impact

2.5.1 **Appendix 2** shows the detailed calculation on the estimated hydraulic capacity of the proposed sewer sections and existing downstream sewers and the calculation of the amount of the sewage entering each segment of the said sewer network. Total flow from the proposed development is assessed in the calculations.

2.6 Discussion

2.6.1 It is proposed to connect the Application Site to the nearest manhole (S1) as shown in **Figure 2**. It is noted that the ramp of the footbridge will be relocated by the Applicant to southeast corner outside the Application Site and will be on top of the proposed connection. As confirmed by the Project Architect, the supporting structure will be designed to take into account the proposed alignment of the sewer and avoid any conflict.

2.6.2 The potential sewerage impact due to the proposed development has been quantitatively addressed. Sewage generation rate from the proposed development is estimated to be 241.1 m^3/day (i.e. peak flow 37.9 litre/sec including backwash from swimming pool).

2.6.3 After calculating the appropriate capacities as mentioned above, the estimated sewage flow from the Application Site and contribution from other existing developments has

been compared with the capacity of the existing and proposed sewerage system to determine whether it has adequate spare capacity to accommodate the flow from the proposed development.

2.6.4 According to Table 4a of **Appendix 2**, regarding the sewage generation rate from the proposed development and surrounding catchment areas (**Figure 2**), it is found that one of existing Ø500mm pipe segment (S3-S4) is found with inadequate capacity.

2.6.5 The proposed upgrading works are summarized in **Table 2** below.

Table 2 Proposed Upgrading Works

Segment	Manhole Reference	Manhole Reference	Length (m)	Original Size (Ø) (mm)	Upgraded Size (Ø) (mm)
S3-S4	FMH4052286	FMH4052287	30.7	500	600
S4-S5	FMH4052287	FSH4001700	8.5	500	600

2.6.6 The proposed upgrading works will be implemented by the Applicant. With the proposed works in place, the sewerage system will have adequate capacity to cater for the proposed development and the nearby catchments.

2.6.7 The key facility in the local sewerage system is the Tsing Lung Tau Sewage Pumping Station (TLTSPS). Detailed calculation for the proposed development is given in **Table 3** below and **Appendix 2**.

Table 3 Existing & Future Flows to TLTSPS

TLTSPS	
Designed Peak Flow (l/s)	240^
Existing Average Daily Flow (m^3/day)	2,288^
Total ADWF of Existing Development and Proposed Development (m^3/day)	2,529
Peak Flow with the Proposed Development (l/s)	132.6(55%*)

^ According to DSD (**Appendix 3**)

* Contribution of average flow to designed Peak Flow of TLTSPS

3. OVERALL CONCLUSION

3.1 Conclusion

3.1.1 A development is proposed at Lot 94, D.D. 388 And Adjoining Government Land, Castle Peak Road Tsing Lung Tau, New Territories. The potential sewerage impact has been quantitatively addressed.

3.1.2 It is proposed to connect the Application Site to the nearest manhole for discharge of sewage to public sewer. Based on the sewerage impact assessment results, it is found that the capacity of some of the existing sewerage system serving the area would not be sufficient to cater for the sewage generation from the proposed development and nearby catchment areas. Upgrading works of sewers will be required.

3.1.3 With the proposed upgrading works in place, this SIA confirms the feasibility of the proposed development in terms of impacts to the public sewerage system. This project will also provide spare capacity for other development in future as well.

Figures

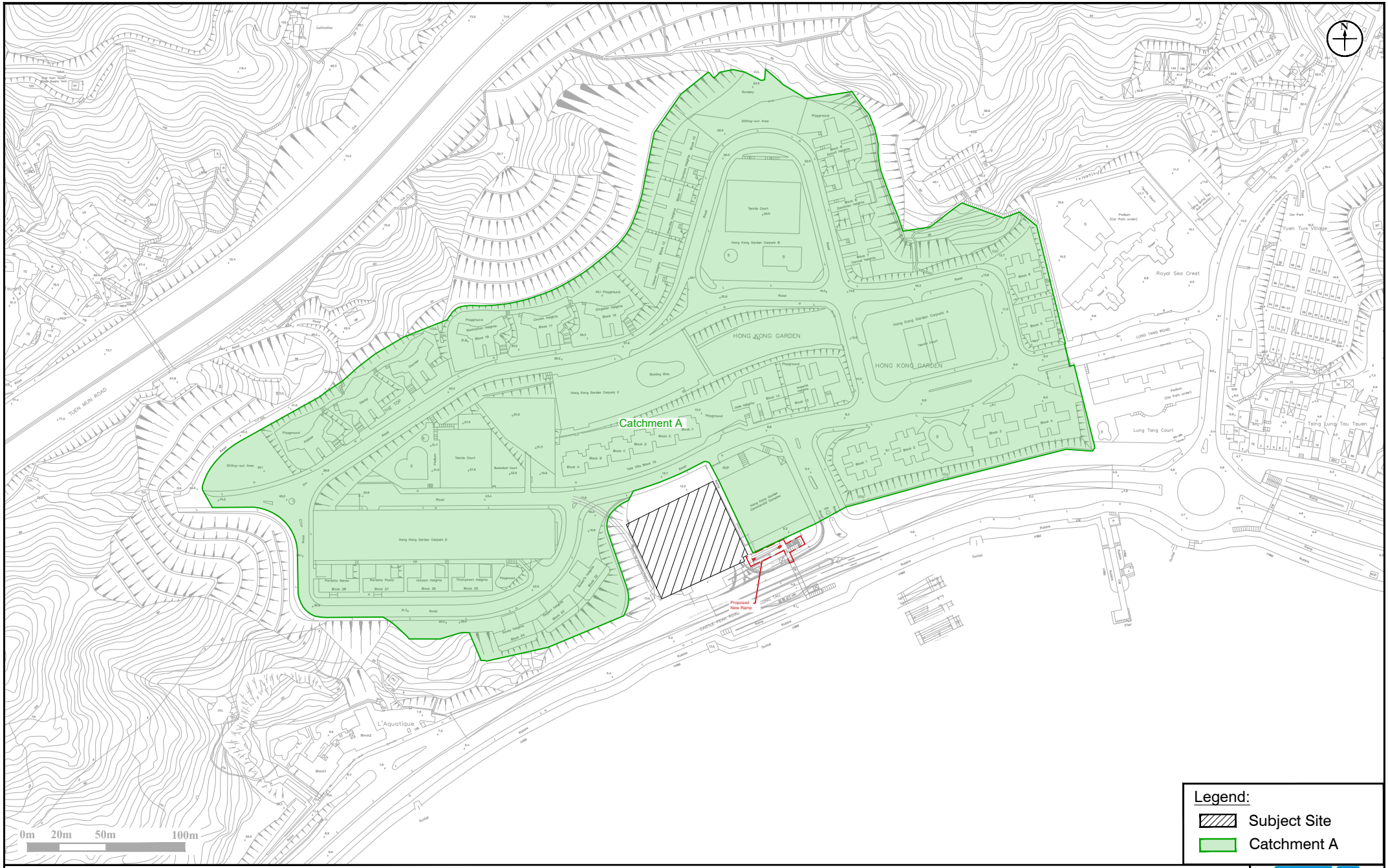

Figure:	1
Title:	Location of the Subject Site and its Environs
Project:	Proposed Minor Relaxation of Plot Ratio (PR) and Site Coverage (SC) for Proposed Social Welfare Facility (Residential Care Home for the Elderly) (RCHE(s)), Training Centre with Residential Institution and Permitted Residential Development (Flat) in Lot 94 in D.D. 388 and adjoining Government land, Castle Peak Road - Tsing Lung Tau, Tsuen Wan

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Date:	Sep 2024

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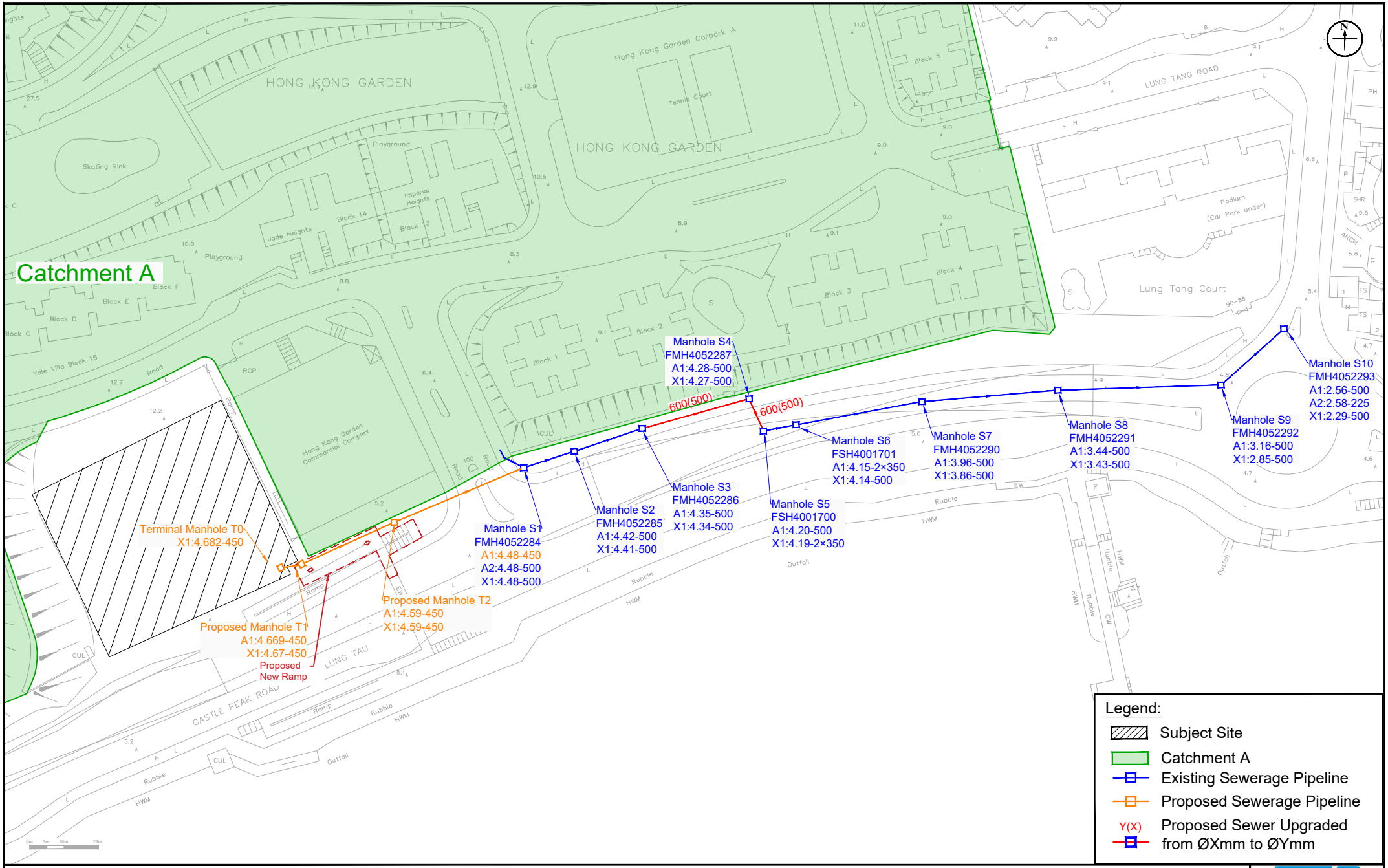

Figure: 2

Title: Existing Sewerage System in the Vicinity of the Subject Site and Proposed Sewerage Pipeline

Project: Proposed Minor Relaxation of Plot Ratio (PR) and Site Coverage (SC) for Proposed Social Welfare Facility (Residential Care Home for the Elderly) (RCHE(s)), Training Centre with Residential Institution and Permitted Residential Development (Flat) in Lot 94 in D.D. 388 and adjoining Government land, Castle Peak Road - Tsing Lung Tau, Tsuen Wan

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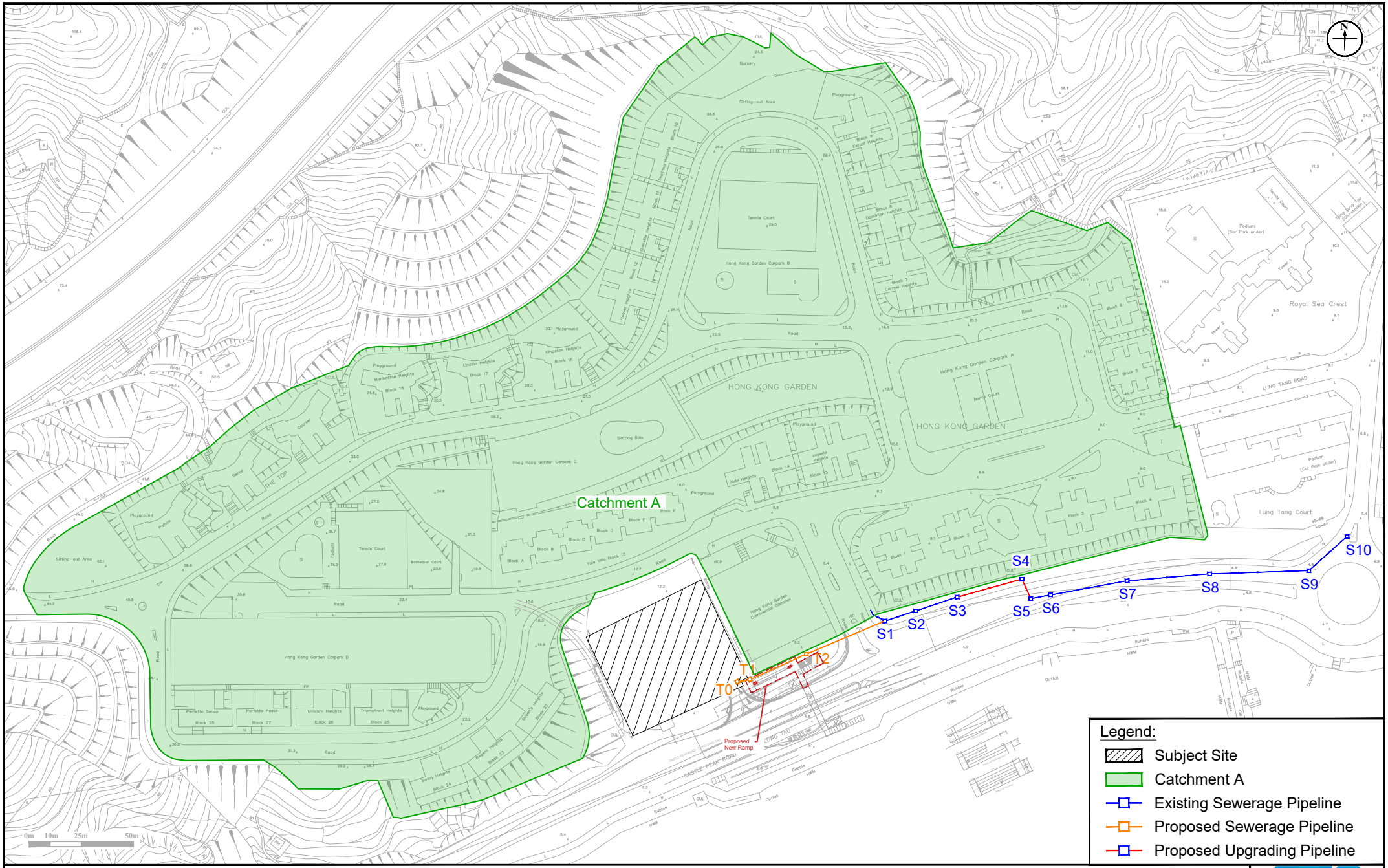

Figure:	3
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Project:	Proposed Minor Relaxation of Plot Ratio (PR) and Site Coverage (SC) for Proposed Social Welfare Facility (Residential Care Home for the Elderly) (RCHE(s)), Training Centre with Residential Institution and Permitted Residential Development (Flat) in Lot 94 in D.D. 388 and adjoining Government land, Castle Peak Road - Tsing Lung Tau, Tsuen Wan

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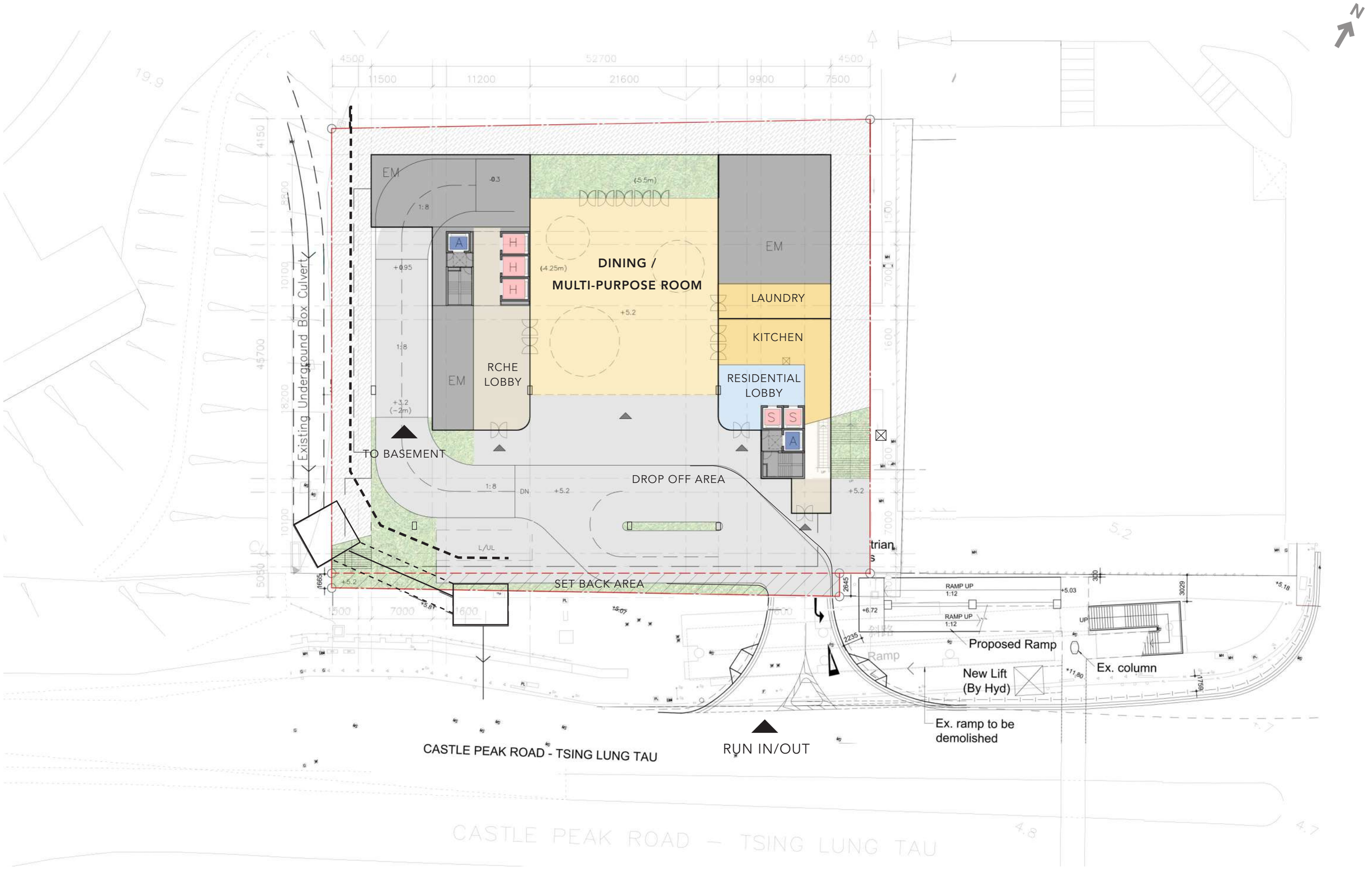
Appendix 1 Indicative MLP of the Proposed Scheme



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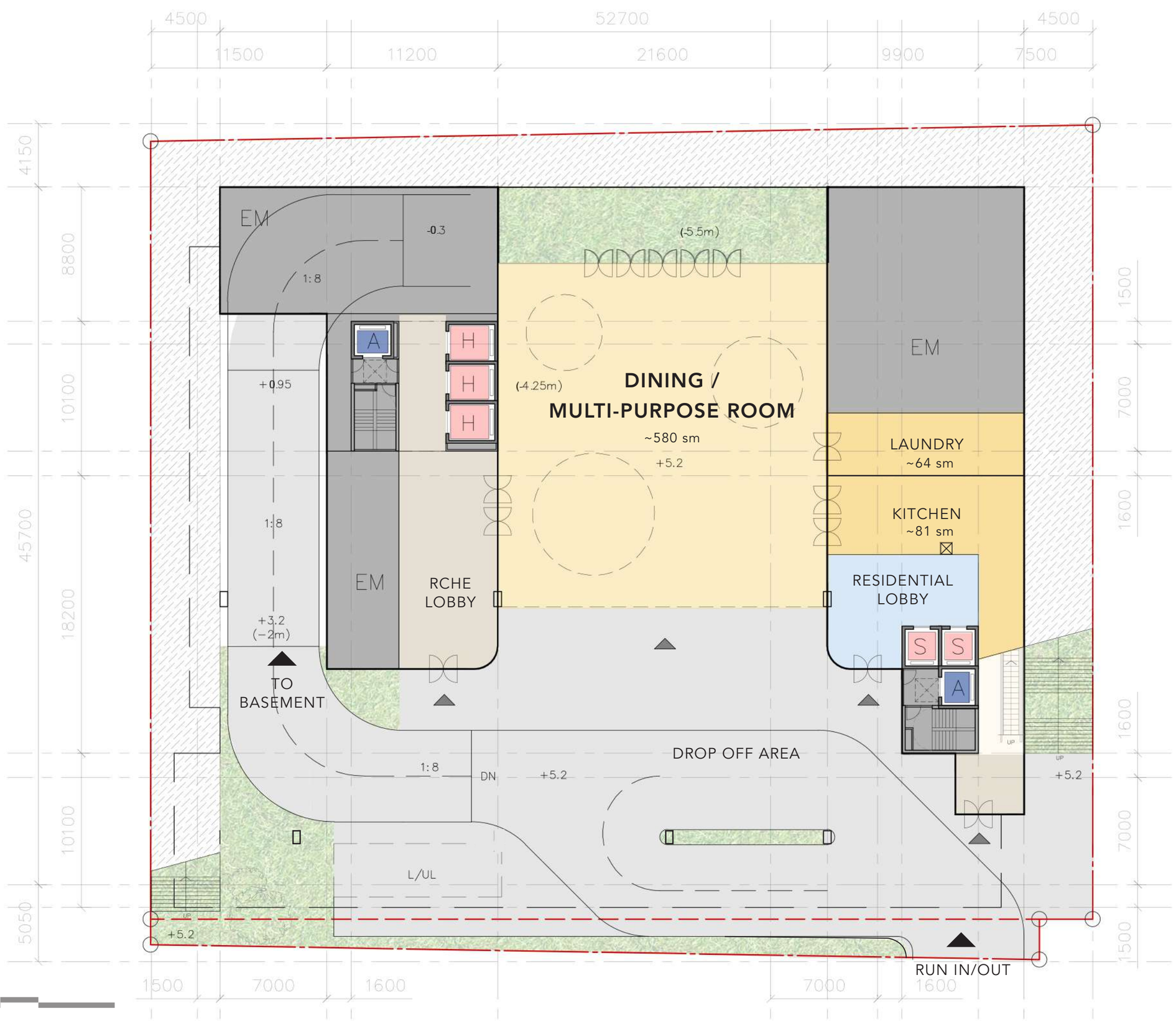

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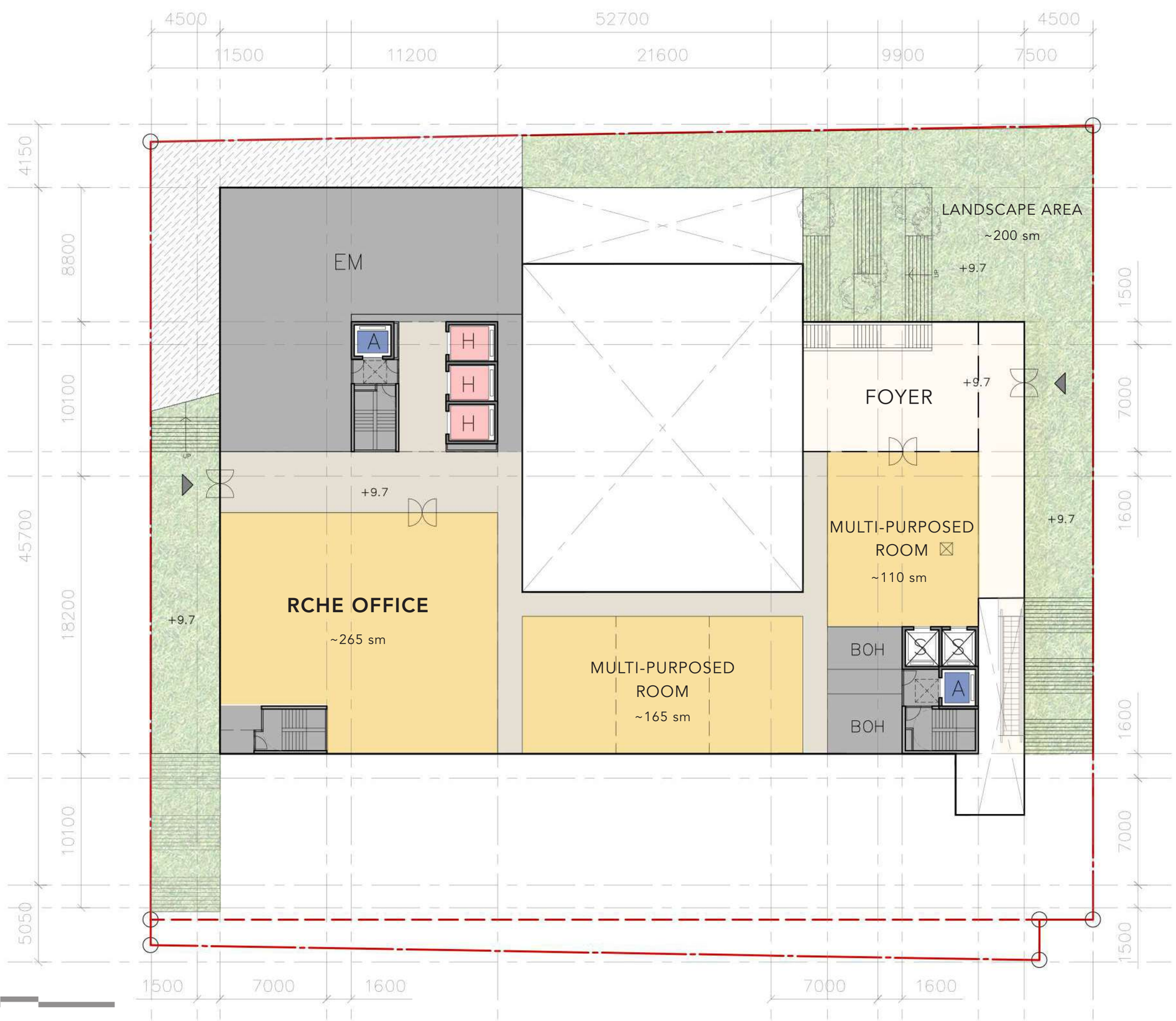

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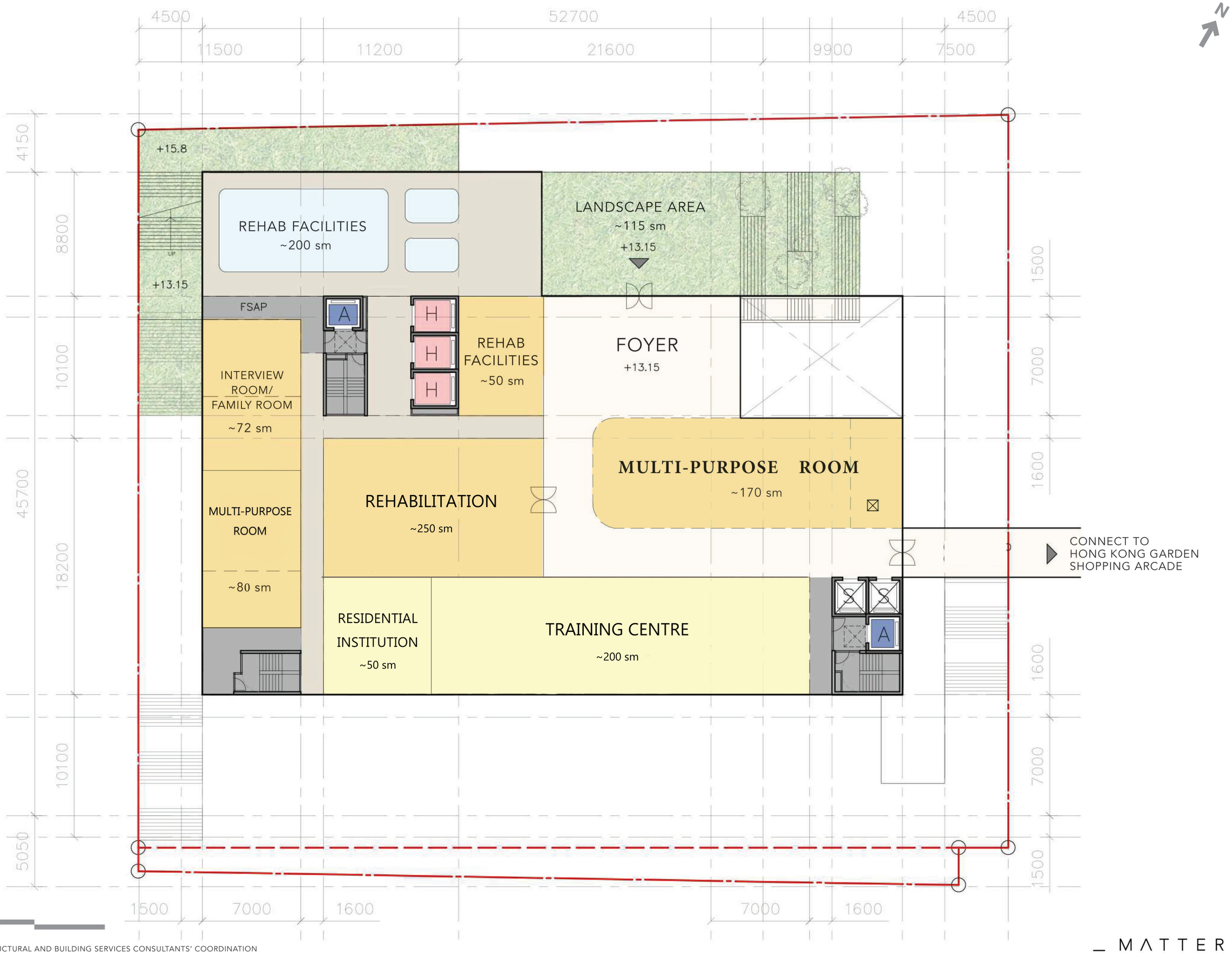

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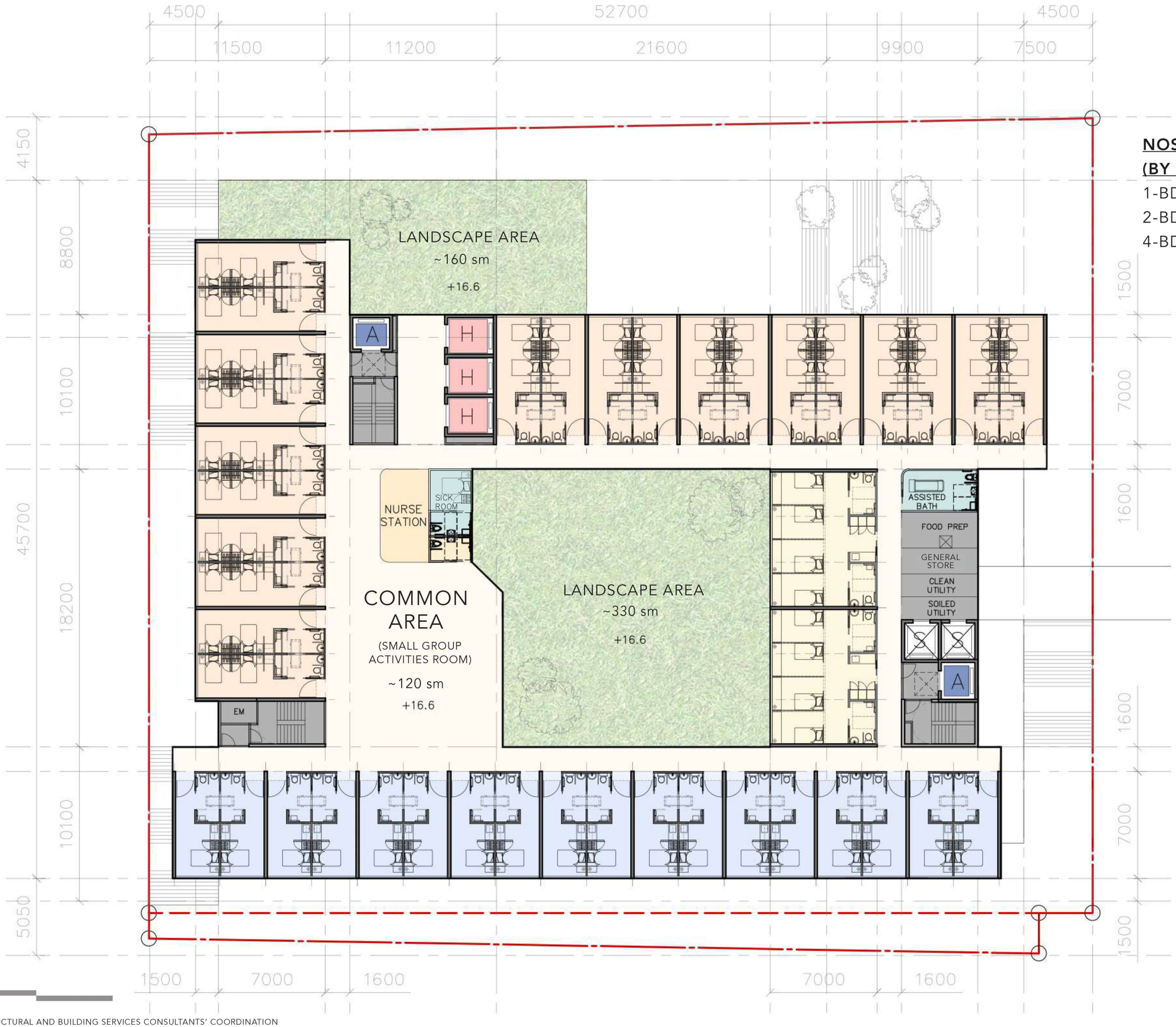

NOS. OF BEDS (BY FLOOR)

1-BD	: 18 BEDS
2-BD	: 44 BEDS
4-BD	: 8 BEDS

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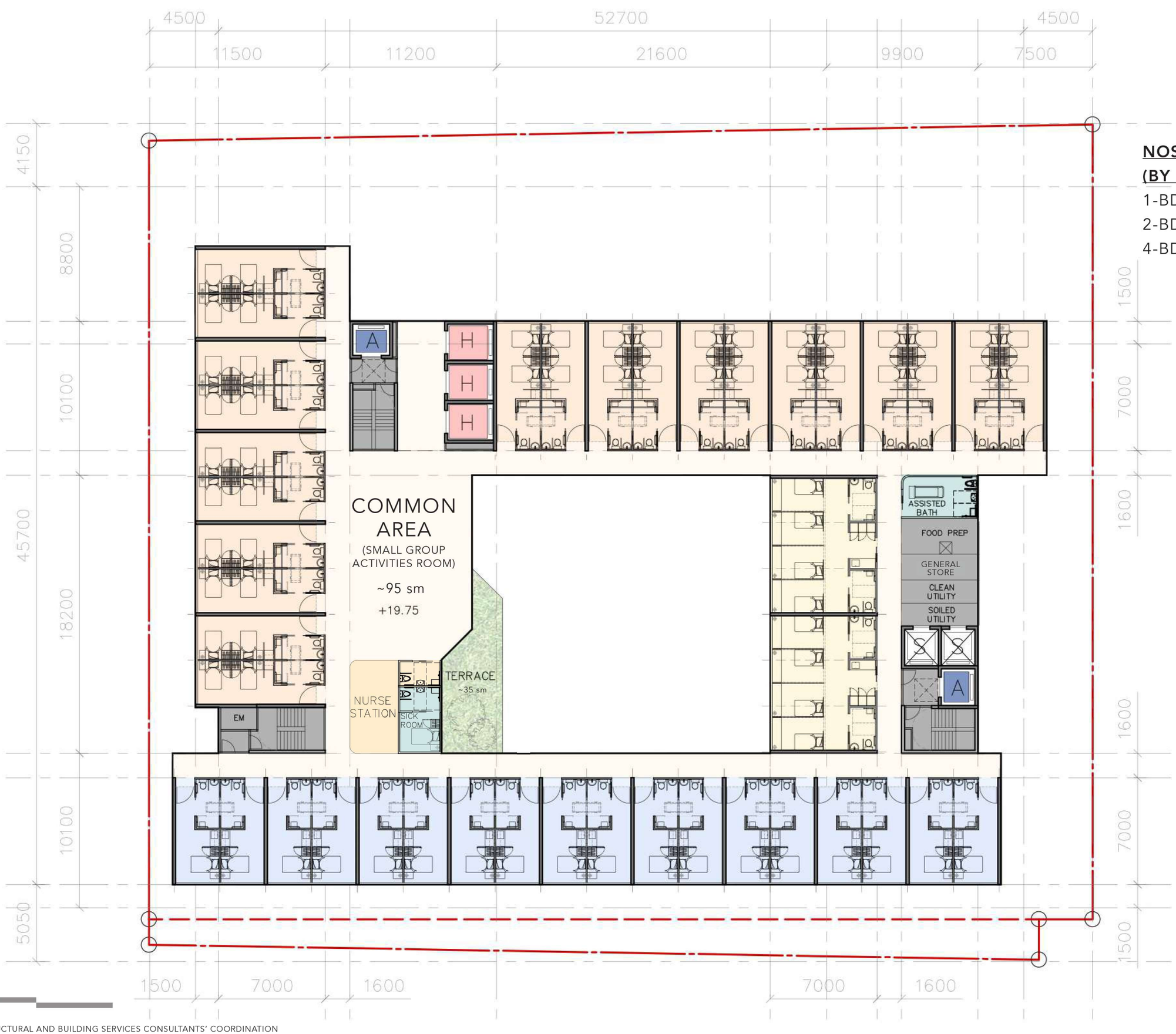

NOS. OF BEDS (BY FLOOR)

1-BD	: 18 BEDS
2-BD	: 44 BEDS
4-BD	: 8 BEDS

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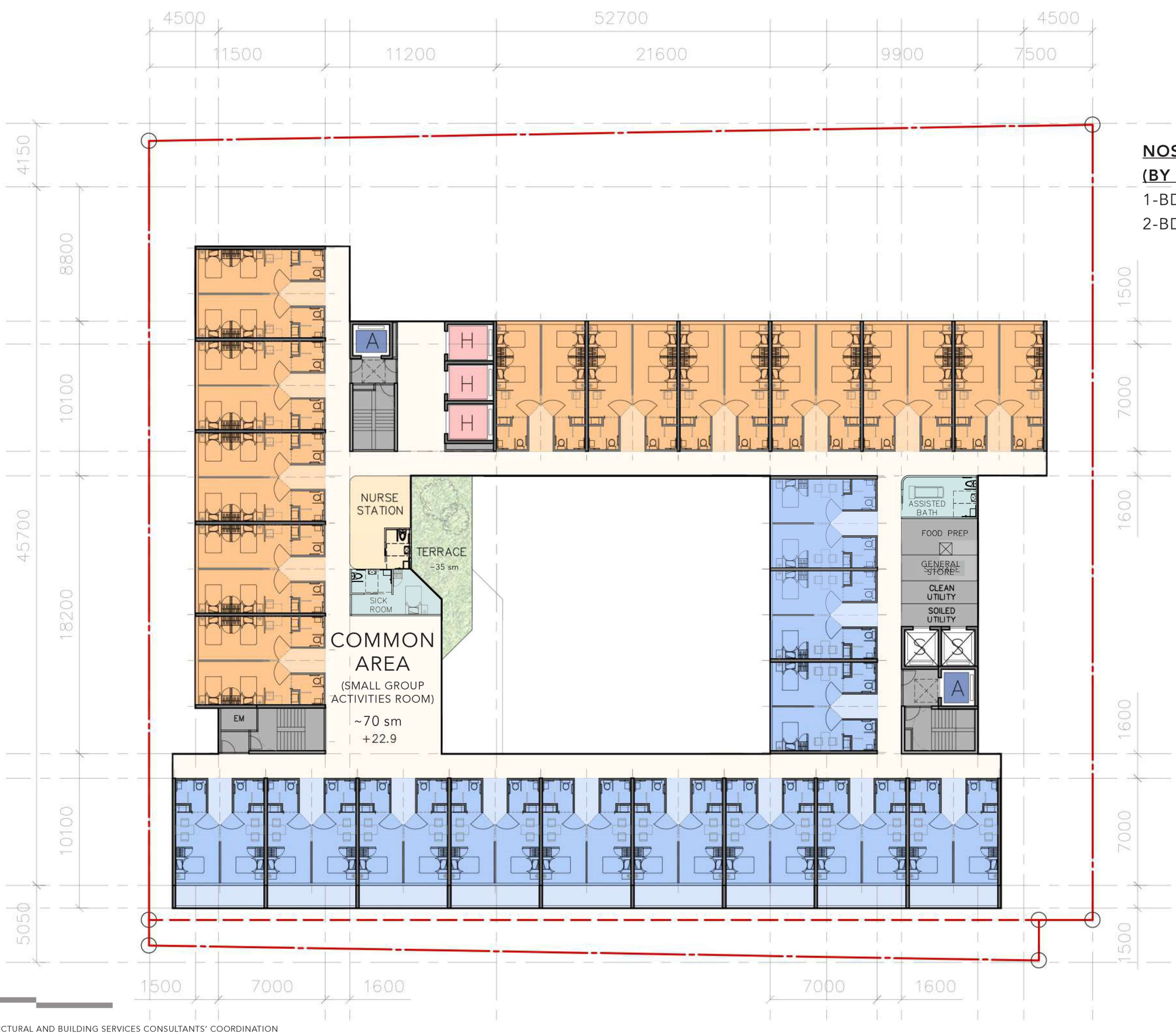

NOS. OF BEDS (BY FLOOR)

1-BD : 24 BEDS

2-BD : 44 BEDS

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NOS. OF BEDS (BY FLOOR)

1-BD : 42 BEDS

6F

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NOS. OF BEDS (BY FLOOR)

SUITE : 6 BEDS

1-BD : 28 BEDS

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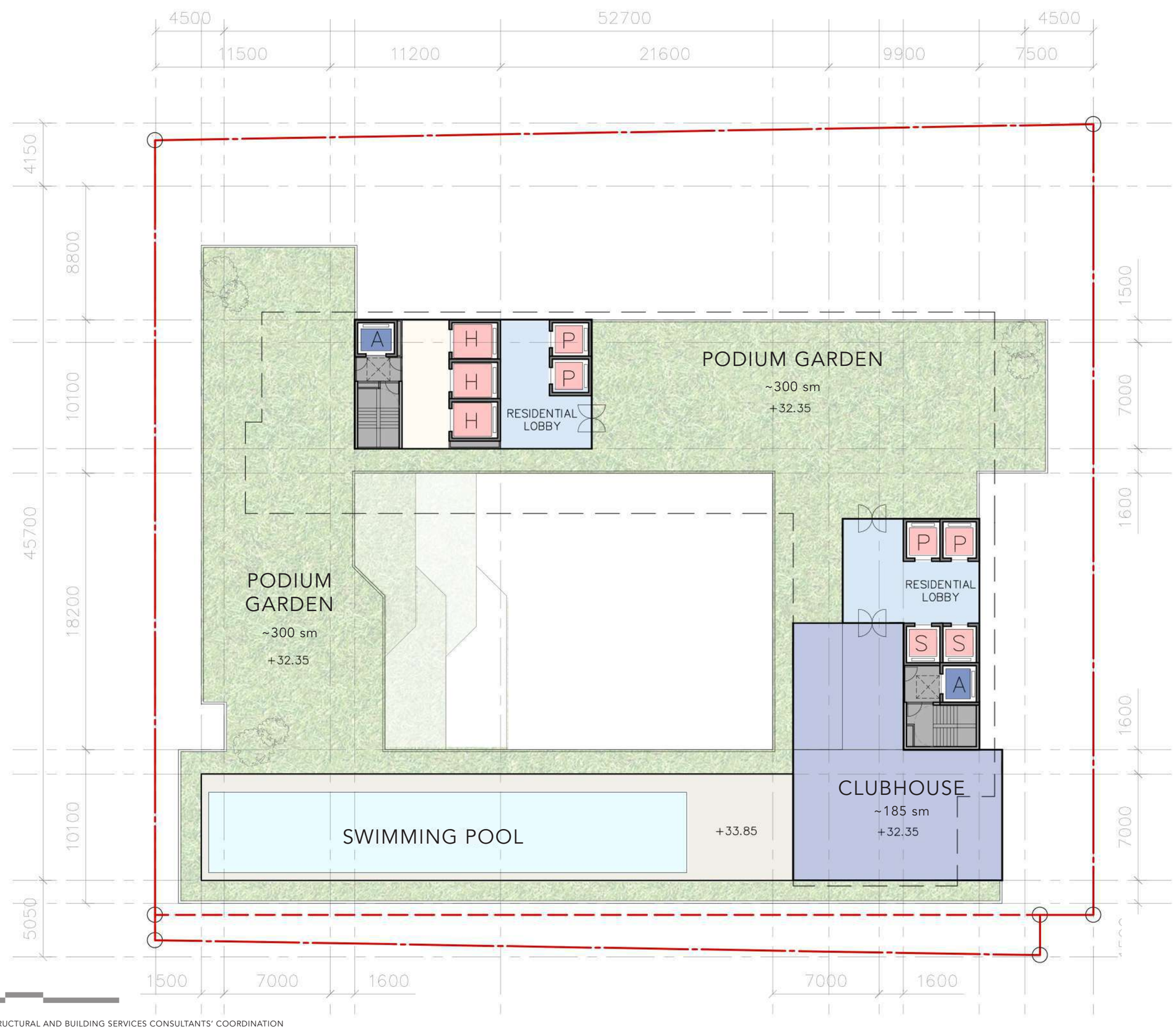

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TYPICAL FLOORS - 9,11,13,15/F

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TYPICAL FLOORS - 10,12,14/F

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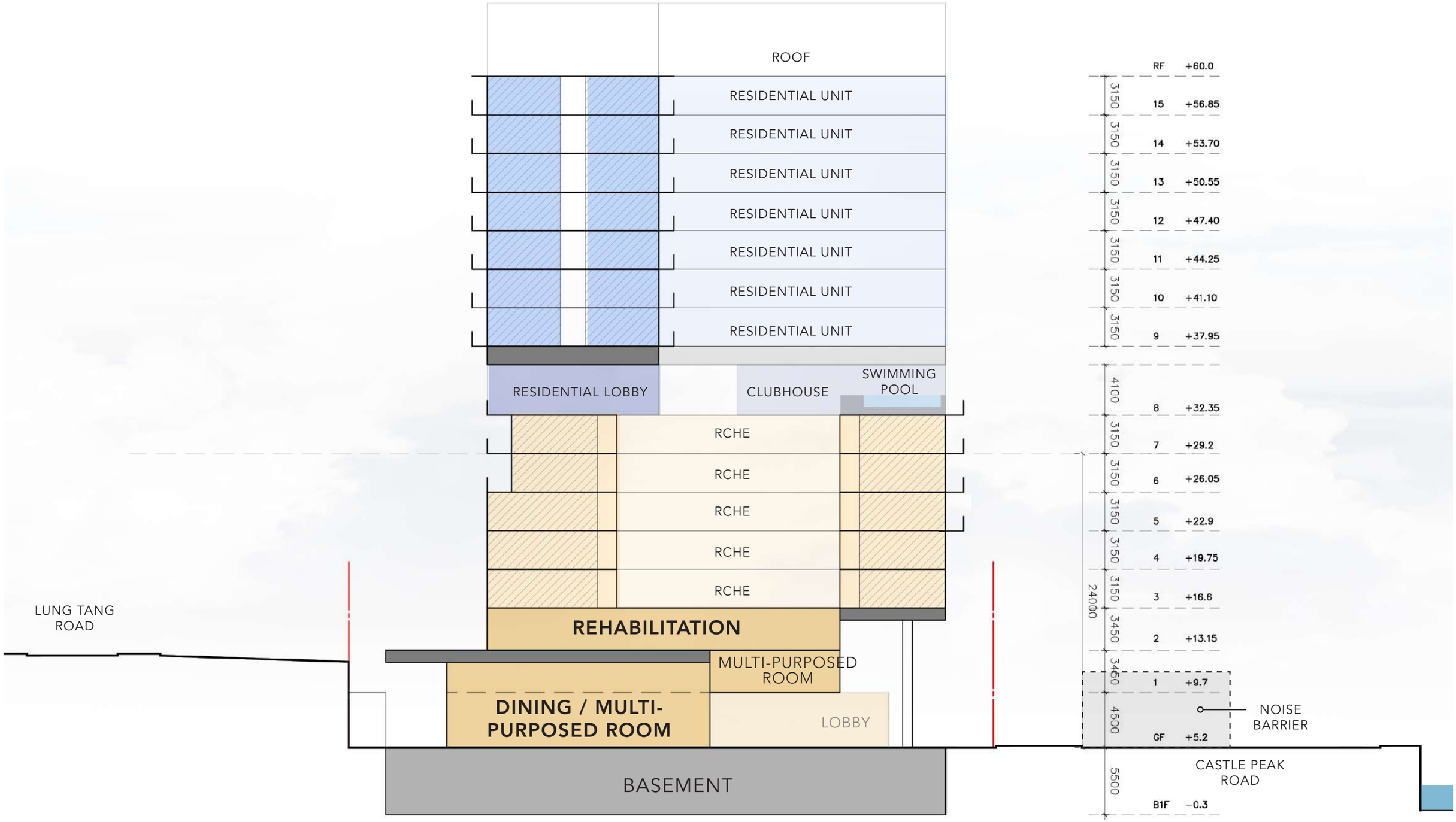

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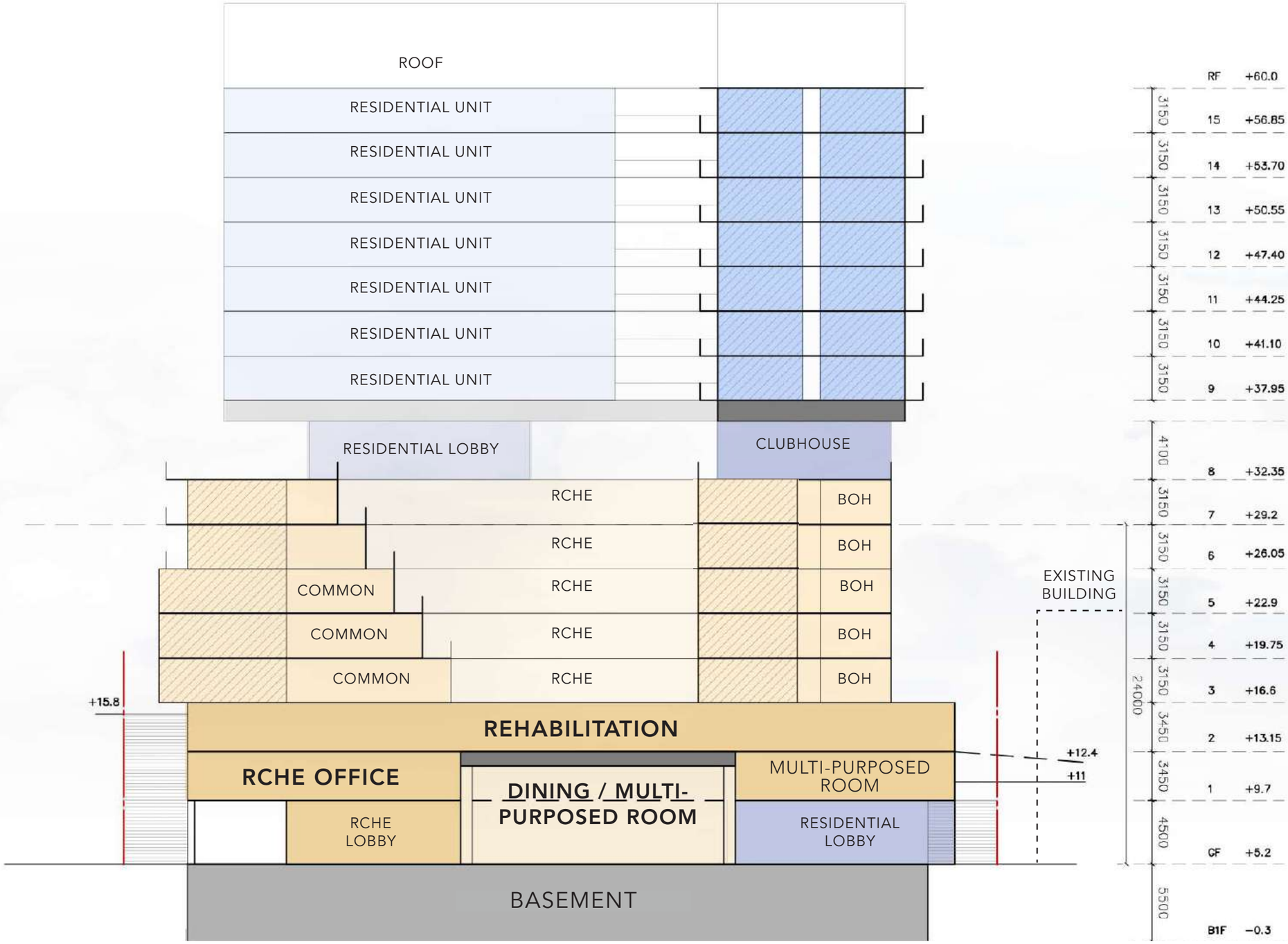

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Appendix 2 Detailed Sewerage Impact Assessment Calculations

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

Residential Tower			
Total number of residential units	=	112	units
Total number of residents	=	303	people -- (2021 Population Census: Average Household Size of 2.7 in Tsuen Wan DC)
Design flow	=	0.27	m^3/person/day -- (Private R2 in Table T-1 of GESF)
Sewage Generation rate	=	**81.8**	m^3/day
Clubhouse			
Assumed Area	=	347	m^2
Assumed floor area per employee	=	30.3	m^2 per worker -- (refer to Table 8 of CIFSUS - Community, Social & Personal Services)
Total number of employees	=	11	employees
Design flow for commercial activities	=	0.28	m^3/employee/day -- (refer to Table T-2 of GESF - J11)
Sewage Generation rate	=	**3.2**	m^3/day
RCHE			
Resident			
Total number of places	=	320	beds
Design flow	=	0.19	m^3/person/day -- (Institutional and Special Class in Table T-1 of GESF)
Sewage Generation rate (Residence)	=	**60.8**	m^3/day
Staff			
Total number of employees	=	33	employees -- (refer to Code of Practice for Residential Care Homes (Elderly Persons))
Design flow for commercial activities	=	0.28	m^3/employee/day -- (refer to Table T-2 of GESF - J11)
Sewage Generation rate	=	**9.2**	m^3/day
Total	=	**70.0**	m^3/day
Training Centre			
Assumed Area	=	200	m^2
Assumed floor area per employee	=	30.3	m^2 per worker -- (refer to Table 8 of CIFSUS - Community, Social & Personal Services)
Total number of employees	=	7	employees
Design flow for commercial activities	=	0.28	m^3/employee/day -- (refer to Table T-2 of GESF - J11)
Sewage Generation rate	=	**2.0**	m^3/day

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

Residential Institution

Students staying overnight			
Total number of residents	=	4	people -- (provided by project architect)
Design flow	=	0.19	m^3/person/day -- (Institutional and Special Class in Table T-1 of GESF)
Sewage Generation rate	=	**0.8**	m^3/day
Staff			
Assumed Area	=	50	m^2
Assumed floor area per employee	=	30.3	m^2 per worker -- (refer to Table 8 of CIFSUS - Community, Social & Personal Services)
Total number of employees	=	2	employees
Design flow for commercial activities	=	0.28	m^3/employee/day -- (refer to Table T-2 of GESF - J11)
Sewage Generation rate	=	**0.6**	m^3/day

Rehab Facilities

Assumed Area of Swimming Pool	=	200	m^2
Average Depth of Water	=	1.2	m
Volume of Swimming Pool (Ordinary Assumption)	=	240	m^3
Turnover Rate	=	4	hr
Required Surface Loading Rate of Filter	=	50	m^3/m^2/hr
Filter Area required	=	1.2	m^2
Backwash Duration	=	3	min/d
Backwash flow rate	=	30	m^3/m^2/hr
Design flow for Swimming Pool Backwashing	=	1.8	m^3/day
Design flow for Swimming Pool Backwashing	=	**10.0**	litre/sec

Swimming Pools (Outdoor)

Assumed Area of Swimming Pool	=	167	m^2
Average Depth of Water	=	1.2	m
Volume of Swimming Pool (Ordinary Assumption)	=	200	m^3
Turnover Rate	=	6	hr
Required Surface Loading Rate of Filter	=	50	m^3/m^2/hr
Filter Area required	=	0.7	m^2
Backwash Duration	=	3	min/d
Backwash flow rate	=	30	m^3/m^2/hr
Design flow for Swimming Pool Backwashing	=	1.0	m^3/day
Design flow for Swimming Pool Backwashing	=	**5.6**	litre/sec

Total Flow from Proposed Development

Flow Rate (without Catchmnet Inflow Factor)	=	219.1	m^3/day
Catchment Inflow Factor	=	1.10	Catchment Inflow Factor for Kwai Chung in Table T-4 of GEFS
Flow Rate (with Catchment Inflow Factor)	=	**241.1**	m^3/day
Contributing Population	=	893	people
Peaking factor	=	8	Refer to Table T-5 of GESF for population <1,000 incl. stormwater allowance
Peak Flow	=	**37.9**	litre/sec

Table 2a Hydraulic Capacity of Existing Sewers at Castle Peak Road – Tsing Lung Tau, Tsuen Wan

Segment	Manhole Reference	Manhole Reference	Pipe Dia.	Pipe Length	Invert Level 1	Invert Level 2	g	k_s	s	v	V	Area	Q	Estimated Capacity
			mm	m	mPD	mPD	m/s^2	m		m^2/s	m/s	m^2	m^3/s	L/s
S1-S2	FMH4052284	FMH4052285	500	13.8	4.48	4.42	9.81	0.00060	0.004	0.000001	1.43	0.20	0.28	280
S2-S3	FMH4052285	FMH4052286	500	19.2	4.41	4.35	9.81	0.00060	0.003	0.000001	1.21	0.20	0.24	237
S3-S4	FMH4052286	FMH4052287	500	30.7	4.34	4.28	9.81	0.00060	0.002	0.000001	0.95	0.20	0.19	187
S4-S5	FMH4052287	FSH4001700	500	8.5	4.27	4.20	9.81	0.00060	0.008	0.000001	1.97	0.20	0.39	386
S5-S6	FSH4001700	FSH4001701	2 x 350	8.0	4.19	4.15	9.81	0.00060	0.005	0.000001	1.22	0.19	0.24	236
S6-S7	FSH4001701	FMH4052290	500	35.7	4.14	3.96	9.81	0.00060	0.005	0.000001	1.54	0.20	0.30	302
S7-S8	FMH4052290	FMH4052291	500	38.1	3.86	3.44	9.81	0.00060	0.011	0.000001	2.28	0.20	0.45	448
S8-S9	FMH4052291	FMH4052292	500	46.0	3.43	3.16	9.81	0.00060	0.006	0.000001	1.66	0.20	0.33	326
S9-S10	FMH4052292	FMH4052293	500	22.9	2.85	2.56	9.81	0.00060	0.013	0.000001	2.45	0.20	0.48	480

Table 2b Hydraulic Capacity of Existing Sewers at Castle Peak Road – Tsing Lung Tau, Tsuen Wan (After Upgrading Segment S3-S5)

Segment	Manhole Reference	Manhole Reference	Pipe Dia.	Pipe Length	Invert Level 1	Invert Level 2	g	k_s	s	v	V	Area	Q	Estimated Capacity
			mm	m	mPD	mPD	m/s^2	m		m^2/s	m/s	m^2	m^3/s	L/s
S1-S2	FMH4052284	FMH4052285	500	13.8	4.48	4.42	9.81	0.00060	0.004	0.000001	1.43	0.20	0.28	280
S2-S3	FMH4052285	FMH4052286	500	19.2	4.41	4.35	9.81	0.00060	0.003	0.000001	1.21	0.20	0.24	237
S3-S4	FMH4052286	FMH4052287	600	30.7	4.34	4.28	9.81	0.00030	0.002	0.000001	1.15	0.28	0.33	325
S4-S5	FMH4052287	FSH4001700	600	8.5	4.27	4.20	9.81	0.00030	0.008	0.000001	2.38	0.28	0.67	673
S5-S6	FSH4001700	FSH4001701	2 x 350	8.0	4.19	4.15	9.81	0.00060	0.005	0.000001	1.22	0.19	0.24	236
S6-S7	FSH4001701	FMH4052290	500	35.7	4.14	3.96	9.81	0.00060	0.005	0.000001	1.53	0.20	0.30	301
S7-S8	FMH4052290	FMH4052291	500	38.1	3.86	3.44	9.81	0.00060	0.011	0.000001	2.28	0.20	0.45	448
S8-S9	FMH4052291	FMH4052292	500	46.0	3.43	3.16	9.81	0.00060	0.006	0.000001	1.66	0.20	0.33	326
S9-S10	FMH4052292	FMH4052293	500	22.9	2.85	2.56	9.81	0.00060	0.013	0.000001	2.45	0.20	0.48	480

Table 2c Hydraulic Capacity of Proposed Sewers from the Terminal Manhole of the Proposed Development for Sewage generated from the Proposed Development

Segment	Manhole Reference	Manhole Reference	Pipe Dia.	Pipe Length	Invert Level 1	Invert Level 2	g	k_s	s	v	V	Area	Q	Estimated Capacity
			mm	m	mPD	mPD	m/s^2	m		m^2/s	m/s	m^2	m^3/s	L/s
T0-T1	-	-	450	4.6	4.682	4.669	9.81	0.00030	0.0028	0.000001	1.15	0.16	0.18	184
T1-T2	-	-	450	28.0	4.67	4.59	9.81	0.00030	0.0028	0.000001	1.15	0.16	0.18	184
T2-S1	-	FMH4052284	450	39.2	4.59	4.48	9.81	0.00030	0.0028	0.000001	1.15	0.16	0.18	184

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

(2) Table 2a: The value of k_s = 0.6mm is used for the calculation of slimed clayware sewer, poor condition (based on Table 5: Recommended roughness values in Sewerage Manual)

(3) Table 2c: The value of k_s = 0.3mm is used for the calculation of slimed polyethelyene for the proposed sewers, poor condition (based on Table 5: Recommended roughness values in Sewerage Manual)

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

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

Table 3 Calculation for Sewage Generation Rate of the Existing Surrounding Building

Catchment A (S1)

Hong Kong Garden

Total number of units	=	2830	units
Total number of residents	=	7641	people -- (2021 Population Census: Average Household Size of 2.7 in Tsuen Wan DC)
Design flow	=	0.27	m^3/person/day -- (Private R2 in Table T-1 of GESF)
Sewage Generation rate	=	**2063.1**	m^3/day

Retail

Assumed Area	=	2702	m^2
Assumed floor area per employee	=	28.6	m^2 per worker -- (refer to Table 8 of CIFSUS - Retail Trade)
Total number of employees	=	94	employees
Design flow for commercial activities	=	0.28	m^3/employee/day -- (refer to Table T-2 of GESF - J4)
Sewage Generation rate	=	**26.5**	m^3/day

F&B

Assumed Area	=	1158	m^2
Assumed floor area per employee	=	19.6	m^2 per worker -- (refer to Table 8 of CIFSUS - Restaurants)
Total number of employees	=	59	employees
Design flow for commercial activities	=	1.58	m^3/employee/day -- (refer to Table T-2 of GESF - J10)
Sewage Generation rate	=	**93.3**	m^3/day

Swimming Pools (Outdoor)

Assumed Area of Swimming Pool	=	338	m^2
Average Depth of Water	=	1.25	m
Volume of Swimming Pool (Ordinary Assumption)	=	423	m^3
Turnover Rate	=	6	hr
Required Surface Loading Rate of Filter	=	50	m^3/m^2/hr
Filter Area required	=	1.4	m^2
Backwash Duration	=	3	min/d
Backwash flow rate	=	30	m^3/m^2/hr
Design flow for Swimming Pool Backwashing	=	2.1	m^3/day
Design flow for Swimming Pool Backwashing	=	**11.7**	litre/sec

Overall Catchment A

Estimated Flow Rate	=	2182.9	m^3/day
Catchment Inflow Factor	=	1.1	Catchment Inflow Factor for Kwai Chung in Table T-4 of GEFS
Total Flow Rate	=	**2401.2**	m^3/day

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

Segment	Pipe Dia. (mm)	Pipe Length (m)	Gradient	Estimated Capacity (L/s)	ADWF (m^3/day)	Contributing Population	Peaking Factor	Swimming Pool/Rehab Facilities (L/s)	Peak Flow from the Proposed Development and Catchment Areas (L/s)	Contribution from the Proposed Development and the Surrounding Catchment Areas (%)	Status
S1-S2	500	13.8	0.004	280	2642.2	9786	5	27.3	180.2	64.3%	OK
S2-S3	500	19.2	0.003	237	2642.2	9786	5	27.3	180.2	76.0%	OK
S3-S4	500	30.7	0.002	187	2642.2	9786	5	27.3	180.2	96.2%	Not OK
S4-S5	500	8.5	0.008	386	2642.2	9786	5	27.3	180.2	46.7%	OK
S5-S6	2 x 350	8.0	0.005	236	2642.2	9786	5	27.3	180.2	76.5%	OK
S6-S7	500	35.7	0.005	302	2642.2	9786	5	27.3	180.2	59.6%	OK
S7-S8	500	38.1	0.011	448	2642.2	9786	5	27.3	180.2	40.2%	OK
S8-S9	500	46.0	0.006	326	2642.2	9786	5	27.3	180.2	55.2%	OK
S9-S10	500	22.9	0.013	480	2642.2	9786	5	27.3	180.2	37.5%	OK

Table 4c Comparision of the Hydraulic Capacity of Existing Sewers for Sewerage generated from the Proposed Development and Surrounding Catchment Areas (After Upgrading Segment S3-S5)

Segment	Pipe Dia. (mm)	Pipe Length (m)	Gradient	Estimated Capacity (L/s)	ADWF (m^3/day)	Contributing Population	Peaking Factor	Swimming Pool/Rehab Facilities (L/s)	Peak Flow from the Proposed Development and Catchment Areas (L/s)	Contribution from the Proposed Development and the Surrounding Catchment Areas (%)	Status
S1-S2	500	13.8	0.004	280	2642.2	9786	5	27.3	180.2	64.3%	OK
S2-S3	500	19.2	0.003	237	2642.2	9786	5	27.3	180.2	76.0%	OK
S3-S4	600	30.7	0.002	325	2642.2	9786	5	27.3	180.2	55.4%	OK
S4-S5	600	8.5	0.008	673	2642.2	9786	5	27.3	180.2	26.8%	OK
S5-S6	2 x 350	8.0	0.005	236	2642.2	9786	5	27.3	180.2	76.5%	OK
S6-S7	500	35.7	0.005	301	2642.2	9786	5	27.3	180.2	59.8%	OK
S7-S8	500	38.1	0.011	448	2642.2	9786	5	27.3	180.2	40.2%	OK
S8-S9	500	46.0	0.006	326	2642.2	9786	5	27.3	180.2	55.2%	OK
S9-S10	500	22.9	0.013	480	2642.2	9786	5	27.3	180.2	37.5%	OK

Remarks: (1) The value of peaking factor = 5 is used for population 5,000-10,000 incl. stormwater allowance (refers to Table T-5 of GESF)

Table 4b Comparision of the Hydraulic Capacity of Proposed Sewers from the Terminal Manhole of the Proposed Development for Sewage generated from the Proposed Development

Segment	Pipe Dia. (mm)	Pipe Length (m)	Gradient	Estimated Capacity (L/s)	ADWF (m^3/day)	Contributing Population	Peaking Factor	Swimming Pool/Public Toilet (L/s)	Peak Flow from the Proposed Development and Catchment Areas (L/s)	Contribution from the Proposed Development and the Surrounding Catchment Areas (%)	Status
T0-T1	450	4.6	0.003	184	241.1	893	8	15.6	37.9	20.6%	OK
T1-T2	450	28.0	0.003	184	241.1	893	8	15.6	37.9	20.6%	OK
T2-S1	450	39.2	0.003	184	241.1	893	8	15.6	37.9	20.6%	OK

Remarks: (1) The value of peaking factor = 8 is used for population <1,000 incl. stormwater allowance (refers to Table T-5 of GESF)

Table 5 Existing & Future Flows to Tsing Lung Tau Sewage Pumping Station (TLTSPS)

ADWF

1. Designed Capacity

Design Daily Flow	=	240.0	l/s (DSD)

2. Existing Situation

Average Flow of 2023	=	2288	m^3/day (DSD)

3. Future Situation (including sewerage generated by the Proposed Development)

Existing and Planned Development	=	2288	m^3/day
Proposed Development (ADWF)	=	241	m^3/day
Total	=	2529	m^3/day
Equivalent Contributing Population	=	9367	
Peaking Factor	=	4.0	Population <10,000 including stormwater allowance
Peak Flow with Existing Development and Proposed Development (including swimming pool and rehab facilities)	=	132.6	l/s
		55%	(of designed pump rate)

Appendix 3 Relevant Information from DSD

Lily Chow

From: kkchoi@dsd.gov.hk
Sent: 17 November 2021 12:04 PM
To: Lily Chow
Cc: mcchung@dsd.gov.hk; kwliu@dsd.gov.hk; wfsin@dsd.gov.hk; hktung@dsd.gov.hk; Calvin Chiu; Austin Chan
Subject: Fw: [Internet] RE: [Internet] Request for Information of Tsing Lung Tau Sewage Pumping Station
Attachments: R8291_v1.0 all 20211013.pdf

Dear Ms Chow

We spoke.
The information required are listed below for your attention, please : -
a) The average daily flow of Tsing Lung Tau Sewage Pumping Station in 2020 was 2,581 cubic meter
b) The peak pumping capacity is around 240 l/s
I would like to draw your attention that the above information is for reference & used for the captioned project only. No any part of obtained information from DSD is allowed to disclose to others.

Should you have any queries, please feel free to contact me.
Best Regards

K.K. CHOI
AMI/TM
DSD ST1/3
Tel:2491 3609/9313 2373 Fax: 2613 5709

----- Forwarded by KK CHOI/ST1/DSD/HKSARG on 17/11/2021 11:51 -----

Miko Wan

From: kkchoi@dsd.gov.hk
Sent: Monday, 23 September 2024 18:30
To: Miko Wan
Cc: ckcho@dsd.gov.hk; kwliu@dsd.gov.hk; kflam@dsd.gov.hk; hktung@dsd.gov.hk; ksyuen02@dsd.gov.hk
Subject: Fw: [Internet]RE: Request for Information of Tsing Lung Tau Sewage Pumping Station (TLTSPS)
Attachments: R8963_V1.3_all.pdf

Dear Ms Wan
As spoken, please find the information for you onward action:-

a) Average flow in 2023 around 2288 (m^3/d)

It is worth mentioning that the above information is for reference & used for the captioned project only. No any part of the obtained information from DSD is allowed to disclose to others.

Should you have any queries, please feel free to contact me.
Best Regards

K.K. CHOI
AMI/TM
DSD ST1/3
Tel:2491 3609/9313 2373 Fax: 2613 5709

Zero "O" 意外
ACCIDENT
地盤零意外 關懷建未來
Zero Accident, we Build, we Care

----- Forwarded by KK CHOI/ST1/DSD/HKSARG on 23/09/2024 18:22 -----

From: Miko Wan <MIKOWAN@ramboll.com>
To: "kkchoi@dsd.gov.hk" <kkchoi@dsd.gov.hk>
Cc: Calvin Chiu <cchiu@ramboll.com>
Date: 19/09/2024 10:53
Subject: [Internet]RE: Request for Information of Tsing Lung Tau Sewage Pumping Station (TLTSPS)
Serial No.:

Dear Mr. Choi,

Please find the approved SIA (v1.3) for your reference.

Attachment 4

Revised Drainage Impact Assessment

Prepared for

Lo Hing Investment Company Limited

Prepared by

Ramboll Hong Kong Limited

PROPOSED MINOR RELAXATION OF PLOT RATIO (PR) AND SITE COVERAGE (SC) FOR PROPOSED SOCIAL WELFARE FACILITY (RESIDENTIAL CARE HOME FOR THE ELDERLY) (RCHE(S)), TRAINING CENTRE WITH RESIDENTIAL INSTITUTION AND PERMITTED RESIDENTIAL DEVELOPMENT (FLAT) IN LOT 94 IN D.D. 388 AND ADJOINING GOVERNMENT LAND, CASTLE PEAK ROAD – TSING LUNG TAU, TSUEN WAN

DRAINAGE IMPACT ASSESSMENT

Date	**October 2024**
Prepared by	**Miko Wan** **Environmental Consultant**
Signed	
Approved by	**Calvin Chiu** **Technical Director**
Signed	
Project Reference	**CCGCPRAFEI00**
Document No.	**R8290_v2.1**

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CHAPTERS

TABLES

FIGURES

APPENDICES

1. INTRODUCTION

1.1 Project Background

1.1.1 The Application Site is zoned "Residential (Group B)" ("R(B)") under the Approved Tsuen Wan West Outline Zoning Plan (No. S/TWW/21) with building height restriction of 60 mPD. It is also the subject of a previous planning application (No. A/TWW/122) for proposed minor relaxation of PR from 2.1 to 2.52 for a permitted residential development, which was approved with conditions by the Town Planning Board (TPB) on 12 Aug 2022.

1.1.2 The Government has launched the enhanced Incentive Scheme to Encourage Provision of Residential Care Homes for the Elderly (RCHEs) in New Private Developments – Time-limited Enhancements (LandsD's Practice Note Issue No. 5/2023). Echoing the incentive scheme, the applicant has now proposed a composite development which contains both private residential use and RCHE.

1.1.3 Ramboll Hong Kong Limited (Ramboll) was responsible for the previous planning application (No. A/TWW/122) and prepared the drainage impact assessment report (DIAR) as one of the technical supporting documents. Ramboll has been appointed to update the DIAR with respect to the current proposal (including private residential use and RCHE) and latest guidelines (e.g. latest corrigendum) to address the drainage impact and demonstrate the acceptability of the proposal.

1.1.4 Architectural drawings and technical information of the development are provided by the applicant and its project architect.

1.2 Project Location and Environ

1.2.1 The Application Site was formerly occupied by an Acid Factory which was already demolished. Currently, the Application Site is a vacant land and most of the area is covered by vegetations.

1.2.2 The Application Site is bounded by Castle Peak Road (Tsing Lung Tau) on southern side. It is surrounded by Vale Villa – Hong Kong Garden to the north, Hong Kong Garden to the west and Hong Kong Garden Commercial Complex (shopping mall) to the east. Seashore is on the opposite side of Castle Peak Road at over 40m apart.

1.2.3 The surrounding is dominated by existing residential development and associated facilities (e.g. shopping mall of the residential development). A vacant site is located to the further north for G/IC uses.

1.2.4 The location of the Application Site and its surrounding environs are shown in **Figure 1**.

1.3 Proposed Development

1.3.1 The Proposed Development consists of a RCHE and a residential tower with maximum building height of 60mPD. There is also 1 basement floor to cater for car parking area for RCHE, residential and visitor uses.

1.3.2 The tentative completion year is 2032.

1.3.3 The scheme of the Proposed Development is shown in **Appendix 1**. With reference to the scheme, tentatively 20% of the Application Site area will be provided as the greenery area (i.e. one of blue-green drainage infrastructure) which can reduce surface runoff, so as to relieve the increasing pressure on the drainage system due to development and ensure sustainable development in Hong Kong in face of climate-change.

2. DRAINAGE IMPACT ASSESSMENT

2.1 Scope of Work

2.1.1 The aim of this DIA is to assess whether the capacity of the existing drainage network serving the Application Site is sufficient to cope with the stormwater runoff from the proposed development. Drainage Record Plans were referred to the Geoinfo Map for the purpose of this DIA.

2.2 Assessment Criteria and Methodology

2.2.1 The assessment standard complies with Drainage Services Department (DSD) Stormwater Drainage Manual (SDM) (2018 Edition) and corrigendum no. 01/2022, 01/2024 and 02/2024. The Application Site is situated next to and would be connected to the drainage system which is equivalent to an urban drainage trunk system, at least 1 in 200 years return period should be assessed. To take into account the effect of climate change, the runoff is marked up by 28.1% (16%+12.1%) in accordance with Table 28 and 31 of SDM and corrigendum.

2.2.2 The catchment runoff has been calculated using the "Rational Method", as outlined in the DSD SDM:

$$Q = 0.278\ C\ i\ A$$

Where	Q	=	peak runoff in m^3/s
	C	=	runoff coefficient (dimensionless)
	i	=	rainfall intensity in mm/hr
	A	=	catchment area in km

2.2.3 According to surface characteristics of the catchments, the runoff coefficient for paved area is 0.95, and for unpaved area is 0.35.

2.2.4 The rainfall intensity parameter "i" is dependent on the return period, rainfall duration and the time of concentration of the catchment under consideration. Runoff calculations are included in **Appendix 2.**

2.3 Existing Drainage Condition

2.3.1 According to the Drainage Record Plans obtained from DSD, a series of public drainage system is located to the west to southwest of the Site as indicated in **Figure 2**.

2.3.2 The aforementioned drainage system is mainly used for conveying the runoff from upper catchment. It begins with 2400mm x 2400mm box culvert, connected by a series of double drainpipes with a diameter of 1800mm in between, and ends in a 2400mm x 2600mm U-shaped channel with an outfall to the sea.

2.3.3 Based on the site visit conducted on 7/6/2021 for the DIA and updated survey on 03/07/2024, the site is mainly covered by vegetation and no drainage facilities were observed. Therefore, it is assumed that the existing surface runoff would be collected by the nearby slope channel.

2.4 Identification of Catchment

2.4.1 Catchments A to E as shown on **Figure 3** have been identified as related to drainage system under concern.

2.4.2 Catchment E represents the Site Catchment.

2.4.3 As conservative approach, all catchments are assumed to be fully paved, except Catchment A, which is a natural slope.

2.4.4 The areas and the surface runoff of the identified catchments are detailed in **Table 1**.

Table 1 Summary of Areas and Surface Runoff of the Identified Catchments

Catchment	Area (m^2)	Runoff Coefficient (C)	Runoff (m^3/s) under 1 in 200 years scenario(1)
A	306,445	0.35	**7.913**
A1	40,008	0.95	**2.982**
B1	700	0.95	**0.052**
B2	1,020	0.95	**0.076**
C	6,060	0.95	**0.452**
D	2,900	0.95	**0.216**
E (Site)	3,210	0.83	**0.215**

(1) To take into account the effect of climate change, the surface runoff is marked up by 28.1% (16%+12.1%) in accordance to Table 28 and 31 of SDM

2.4.5 The calculated runoff from the above catchments for storm return period of 200 years is shown in **Appendix 2**.

2.5 Effluent from Annual Cleaning of Swimming Pool

2.5.1 An open-air swimming pool and rehab facilities with a volume of 167m^3 and 200m^3 will be constructed as part of the Proposed Development respectively. With reference to the EPD's "*Guidelines to Property Managers for Formulation of their House-rules to Protect the Environment*", the direct effluent from annual cleaning of swimming pool should be discharged to stormwater drain.

2.5.2 As conservative approach, it is assumed that the discharge of the effluent from annual cleaning of swimming pool and rehab facilities would be carried out during the rainy day. Furthermore, it is assumed that the water used for cleaning is equivalent to the volume of the swimming pool and rehab facilities (i.e. 167m^3 and 200m^3).

2.5.3 Given that the open-air swimming pool will be designed in accordance with Cap 132CA Swimming Pools Regulations, the minimum time for completely changing the water by circulating through a filtration system of not less than once every 6 hours. For the covered pool, the minimum time for completely changing the water by circulating through a filtration system of not less than once every 4 hours. Considering the discharge time will be controlled by using the same filtration / recirculation system (but discharged to the stormwater drainage system rather than being recirculated), 6 hours for swimming pool and 4 hours for rehab facilities would be adopted for the effluent of annual cleaning water.

2.5.4 Based on the above assumptions, the flow of annual cleaning water is estimated to be 0.022 m^3 /s (i.e. 167 m^3 / 6 hours for swimming pool and 200 m^3 / 4 hours for rehab facilities) and would be included in the peak flow as shown in **Appendix 2**.

2.6 Proposed Drainage System

2.6.1 Due to the large capacity of the existing drainage system near the Application Site, it is proposed to discharge the Site runoff into the aforementioned drainage system.

2.6.2 Runoff from within the site (Catchment E) and the immediate upstream catchment (Catchment B1) will be collected.

2.6.3 A new drainage layout is proposed as shown in **Figure 2**. A new stormwater terminal manhole (STMH-1) will be constructed at the southwest of the Site. In order to connect to the existing government stormwater manhole SSH4000781, a drainage pipe of 450mmØ with a gradient of 1:100 fall would be constructed.

2.7 Capacity of Proposed Drainage Layout

2.7.1 As shown in **Table 2** below, both the existing drainage pipes and the proposed drainage pipes have sufficient capacity to accommodate for the peak surface runoff based on the return period of 200 years of the Application Site. The detail calculation can be referred to **Appendix 2**.

Table 2 Drainage Capacities of Storm Drains under 200 years Return Period

Manhole		Size, mm	No. of Pipe	Total Runoff (m^3/s)	Capacity (m^3/s)	% of Capacity Used	Remark
From	To						
Proposed Drainage Pipes							
STMH-1	SSH400781	450Ø	1	0.28	0.44	64%	OK
Existing Drainage Pipes							
SSH4000781	SSH4004628	1800Ø	2	11.93	32.39	37%	OK
SSH4004628	SSH4004629	1800Ø	2	11.93	30.75	39%	OK
SSH4004629	SSH4006140	1800Ø	2	11.93	32.21	37%	OK

2.7.2 Under the worst-case scenario with the Proposed Development (i.e. including the effluent form annual cleaning of swimming pool in the peak flow), the usage of the existing and proposed storm drain amounts to not more than 64% of the capacity based on the return period of 200 years. Therefore, there will be no unacceptable drainage impact arising from the worst-case scenario of the Proposed Development

2.7.3 Considering that the further downstream drainage system is a 2000mm x 2000mm box culvert and a 2400mm x 2600mm U-shaped channel, it would have sufficient capacity to convey the runoff from the upstream pipeline. Moreover, in design principal, the downstream pipe would always have sufficient capacity to convey the runoff collected by the upstream pipe. Thus, it is considered that the cumulative runoff would not have adverse impact to the further downstream drainage system (i.e. 2000mm x 2000mm box culvert and 2400mm x 2600mm U-shaped channel) as well

2.7.4 In addition, based on **Table 2**, the runoff generated from the Site is only $0.215m^3/s$ whereas the minimum capacity of the existing drainage pipe is about $30.75m^3/s$, which means that the runoff from the Site contributes to only 0.69% of the pipe capacity. Therefore, the runoff from the Site is not likely to cause adverse impact to the existing public drainage system.

3. OVERALL CONCLUSION

3.1 Proposed Drainage Layout

3.1.1 The proposed development will be provided with greenery amounting to at least 20% of the site area.

3.1.2 A terminal manhole of STMH-1 is proposed to collect the surface runoff from the Application Site as shown in **Figure 2.**

3.1.3 In order to connect between the STMH-1 and existing government stormwater manhole SSH4000781, a concrete drainage pipe of 450mmØ with gradient of at least 1:100 fall is proposed.

3.2 Conclusion

3.2.1 Based on the drainage impact assessment results, the existing and proposed drainage system will have adequate capacity to cater for additional flow from the Application Site after development.

3.2.2 In addition, the runoff generated from the Site is only 0.215m^3/s whereas the minimum capacity of the existing drainage system is about 30.75m^3/s, which means that the runoff from the Site contributes to only 0.69% of the capacity. Therefore, the runoff from the Site is not likely to cause adverse impact to the existing public drainage system.

3.2.3 As shown in **Appendix 1**, there are no building, structure and other permanent obstructions located within the 3m buffer distance from the external wall of the culvert or channel. Thus, the Proposed Development would not cause adverse impact to the existing box culvert.

3.2.4 This DIA confirms the feasibility of the Proposed Development in terms of impacts to the public drainage system.

Figures

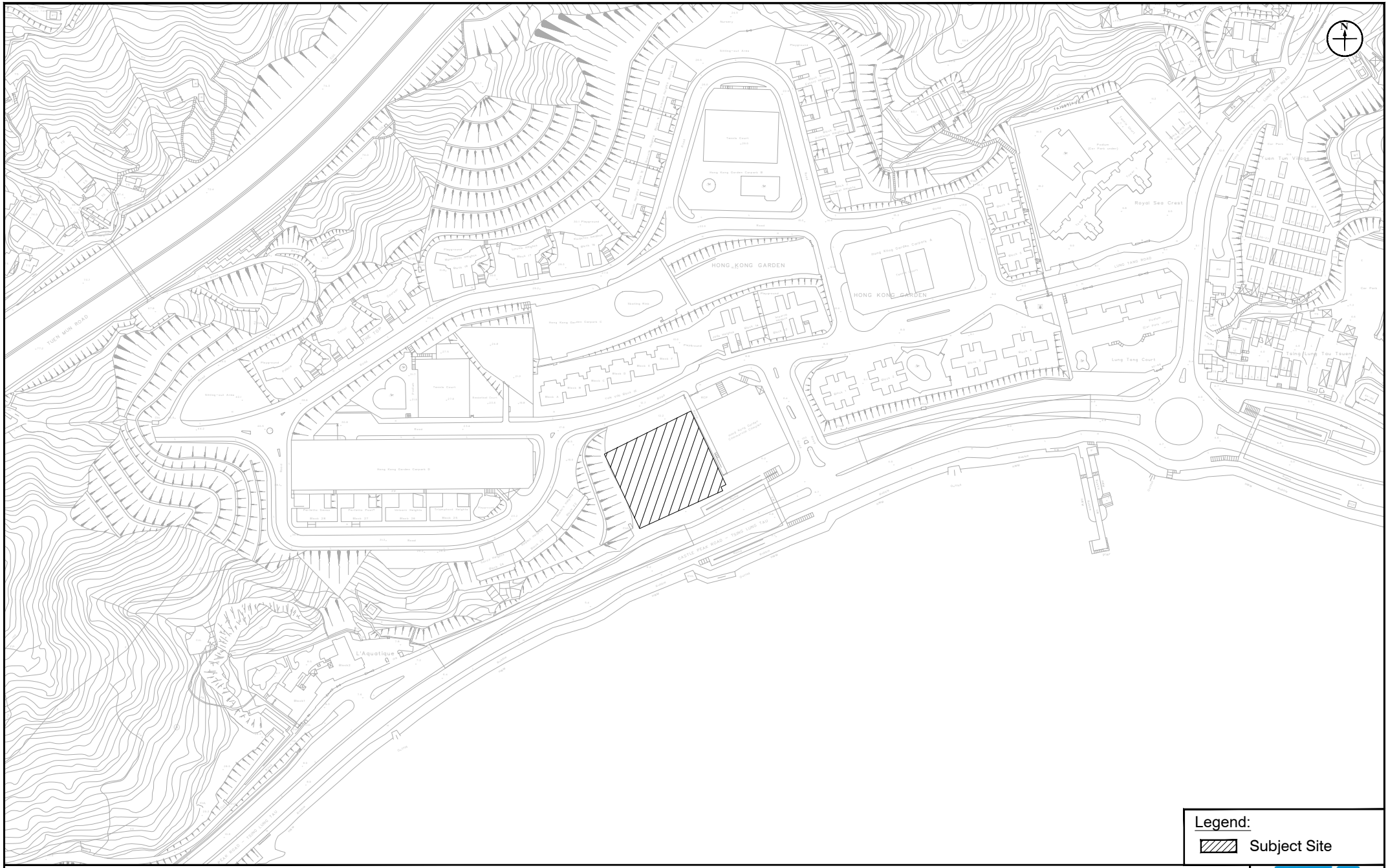

Figure: 1	RAMBOLL
Title: Location of the Subject Site and its Environs	Drawn by: MW Checked by: CC
Project: Proposed Minor Relaxation of Plot Ratio (PR) and Site Coverage (SC) for Proposed Social Welfare Facility (Residential Care Home for the Elderly) (RCHE(s)), Training Centre with Residential Institution and Permitted Residential Development (Flat) in Lot 94 in D.D. 388 and adjoining Government land, Castle Peak Road - Tsing Lung Tau, Tsuen Wan	Rev.: 2.0 Date: Jul 2024

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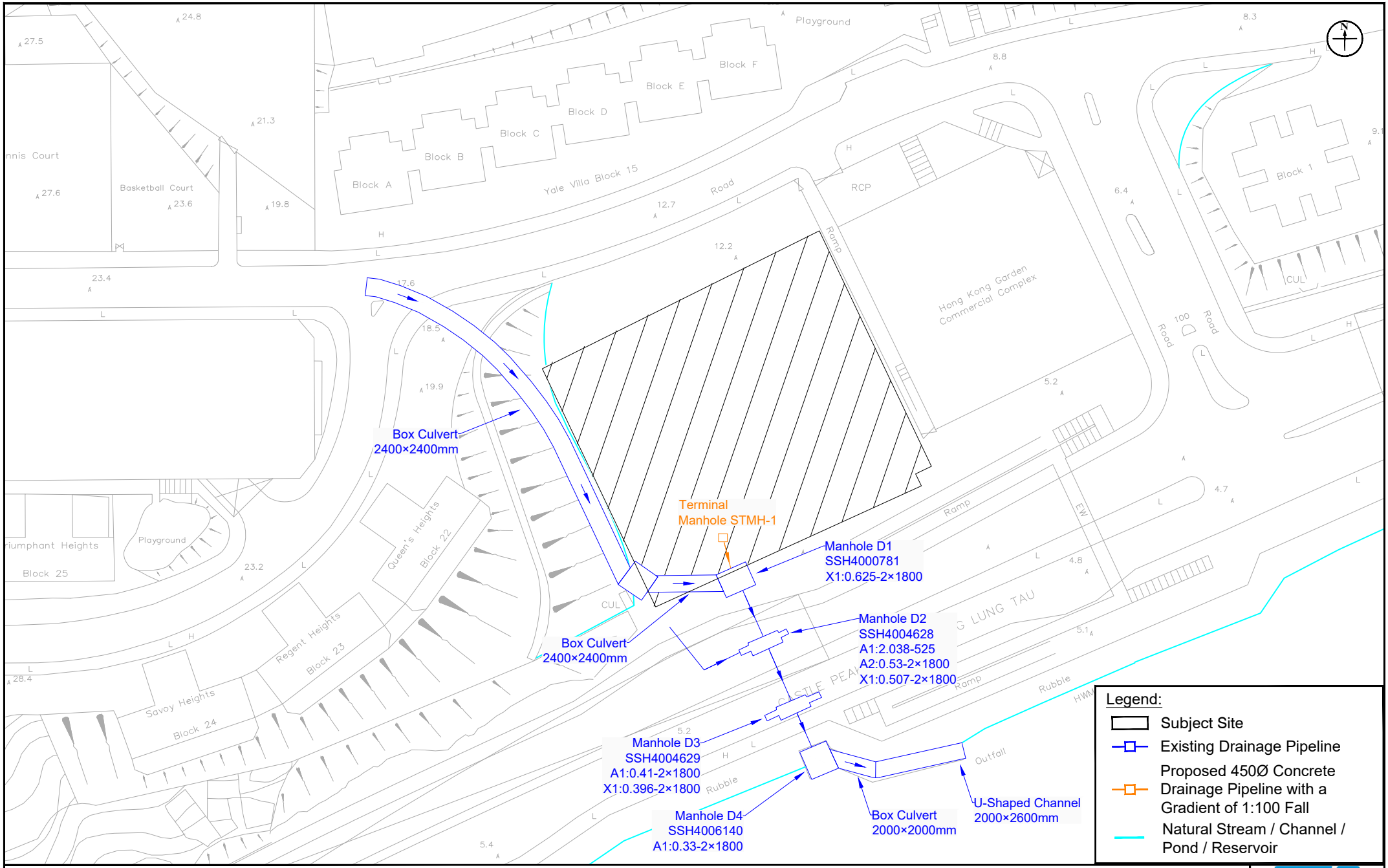

Figure: 2

Title: Existing Drainage System in the Vicinity of the Subject Site and Proposed Drainage Pipeline

Project: Proposed Minor Relaxation of Plot Ratio (PR) and Site Coverage (SC) for Proposed Social Welfare Facility (Residential Care Home for the Elderly) (RCHE(s)), Training Centre with Residential Institution and Permitted Residential Development (Flat) in Lot 94 in D.D. 388 and adjoining Government land, Castle Peak Road - Tsing Lung Tau, Tsuen Wan

RAMBOLL

Drawn by:	MW
Checked by:	CC
Rev.:	2.1
Date:	Oct 2024

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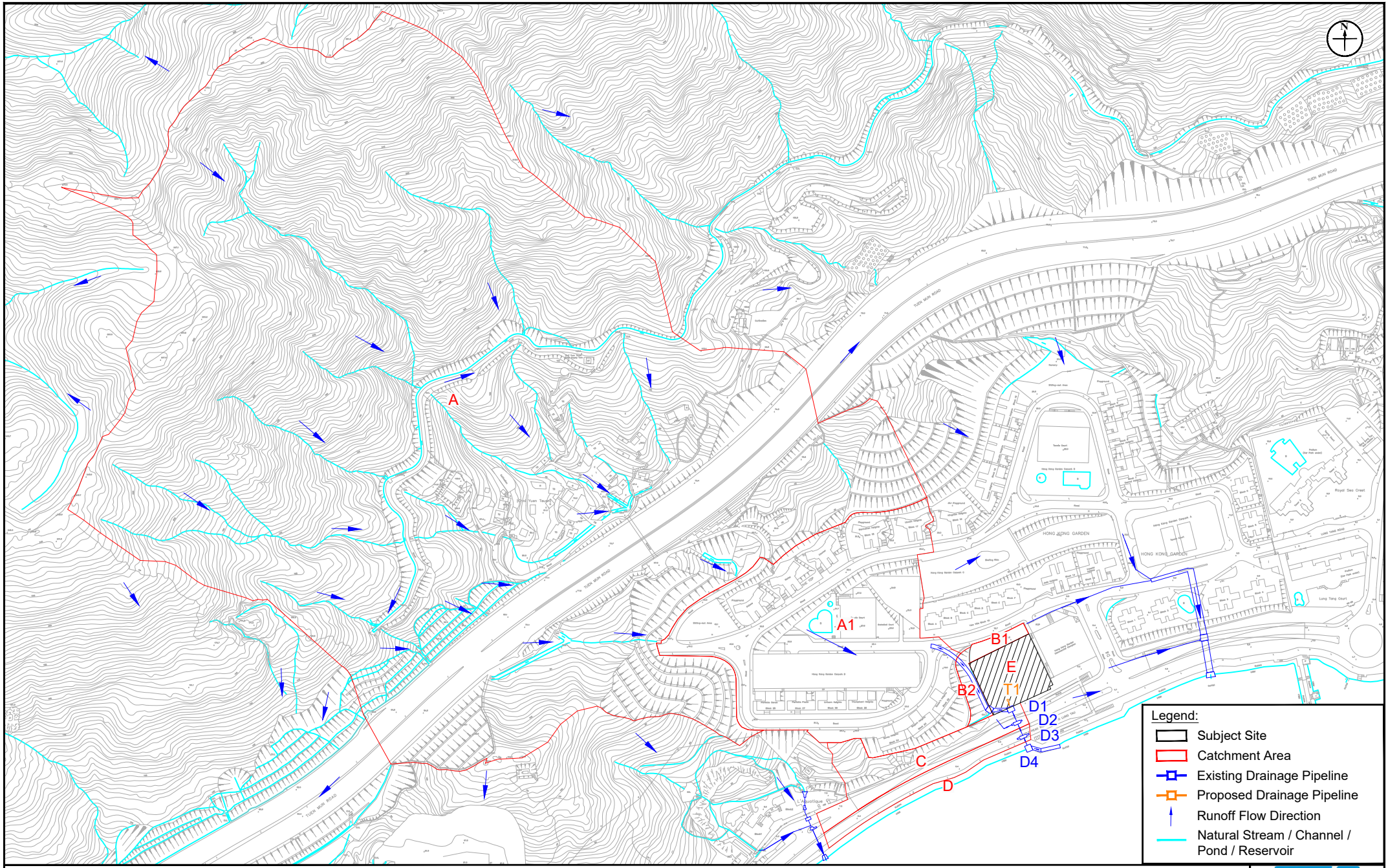

Figure: 3

Title: Existing Drainage System and Catchment Area in the Vicinity of the Subject Site and Proposed Drainage Pipeline

Project: Proposed Minor Relaxation of Plot Ratio (PR) and Site Coverage (SC) for Proposed Social Welfare Facility (Residential Care Home for the Elderly) (RCHE(s)), Training Centre with Residential Institution and Permitted Residential Development (Flat) in Lot 94 in D.D. 388 and adjoining Government land, Castle Peak Road - Tsing Lung Tau, Tsuen Wan

RAMBOLL

Drawn by:	MW
Checked by:	CC
Rev.:	2.1
Date:	Oct 2024

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Appendix 1 Indicative MLP of the Proposed Scheme

3m Buffer Distance from the existing box culvert

Existing Underground Box Culvert

EM

DINING / MULTI-PURPOSE ROOM

LAUNDRY

KITCHEN

RESIDENTIAL LOBBY

RCHE LOBBY

TO BASEMENT

DROP OFF AREA

SET BACK AREA

RAMP UP 1:12

RAMP UP 1:12

Proposed Ramp

Ex. column

New Lift (By Hyd)

Ex. ramp to be demolished

Ramp

CASTLE PEAK ROAD - TSING LUNG TAU

RUN IN/OUT

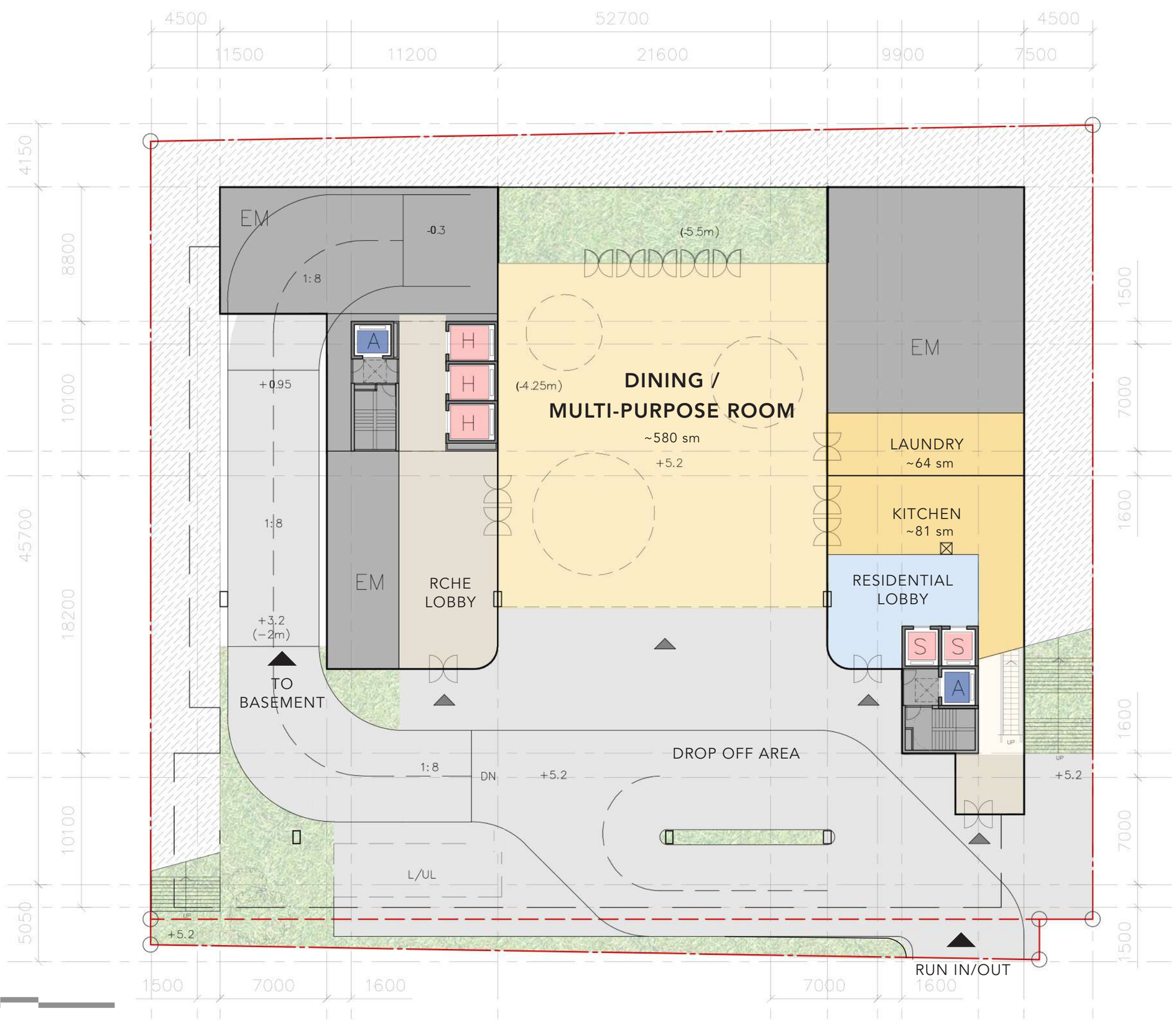
CASTLE PEAK ROAD – TSING LUNG TAU

GF

1:400 @ A3

*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION

_ MATTER



GF

1:250 @ A3

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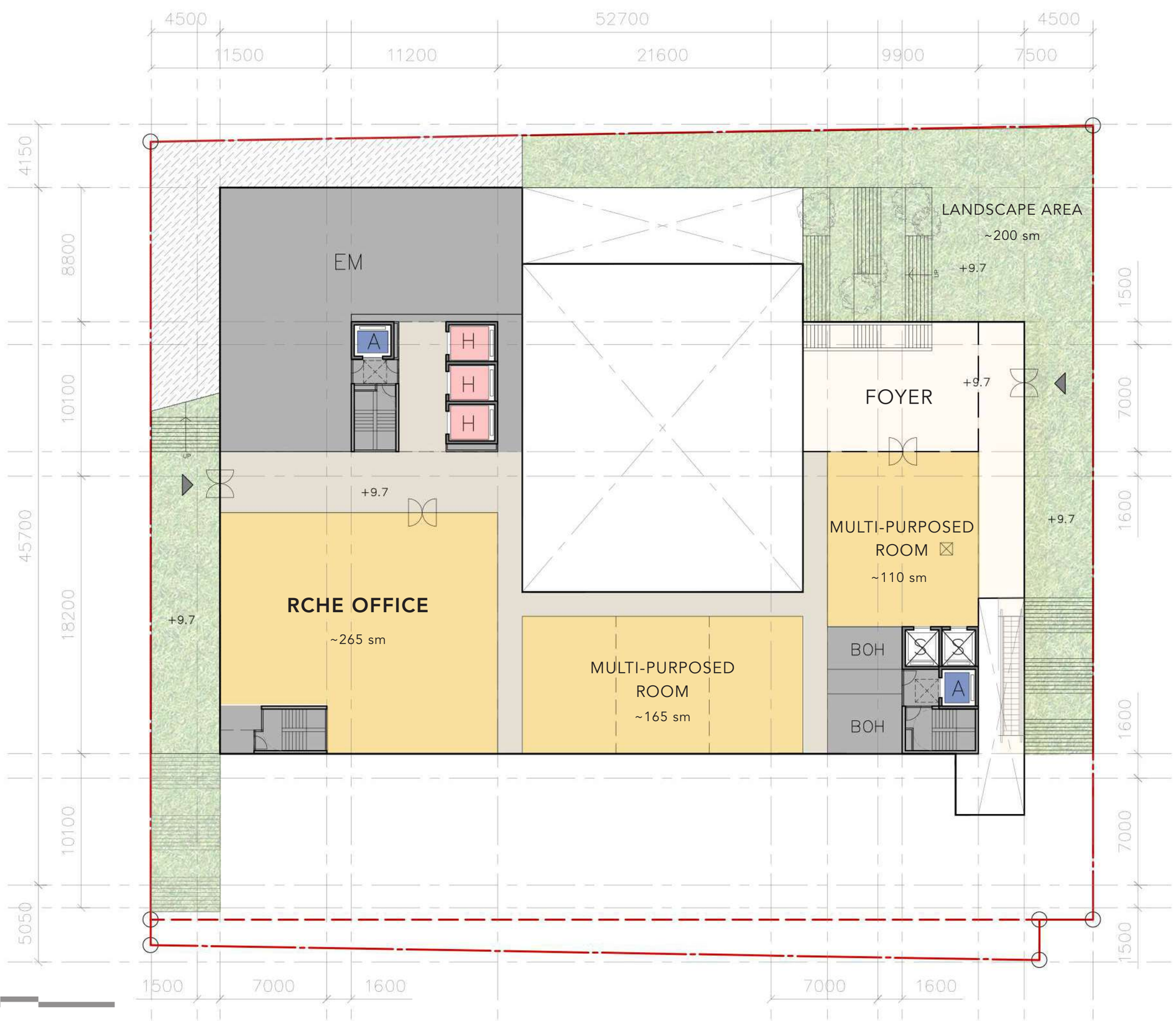
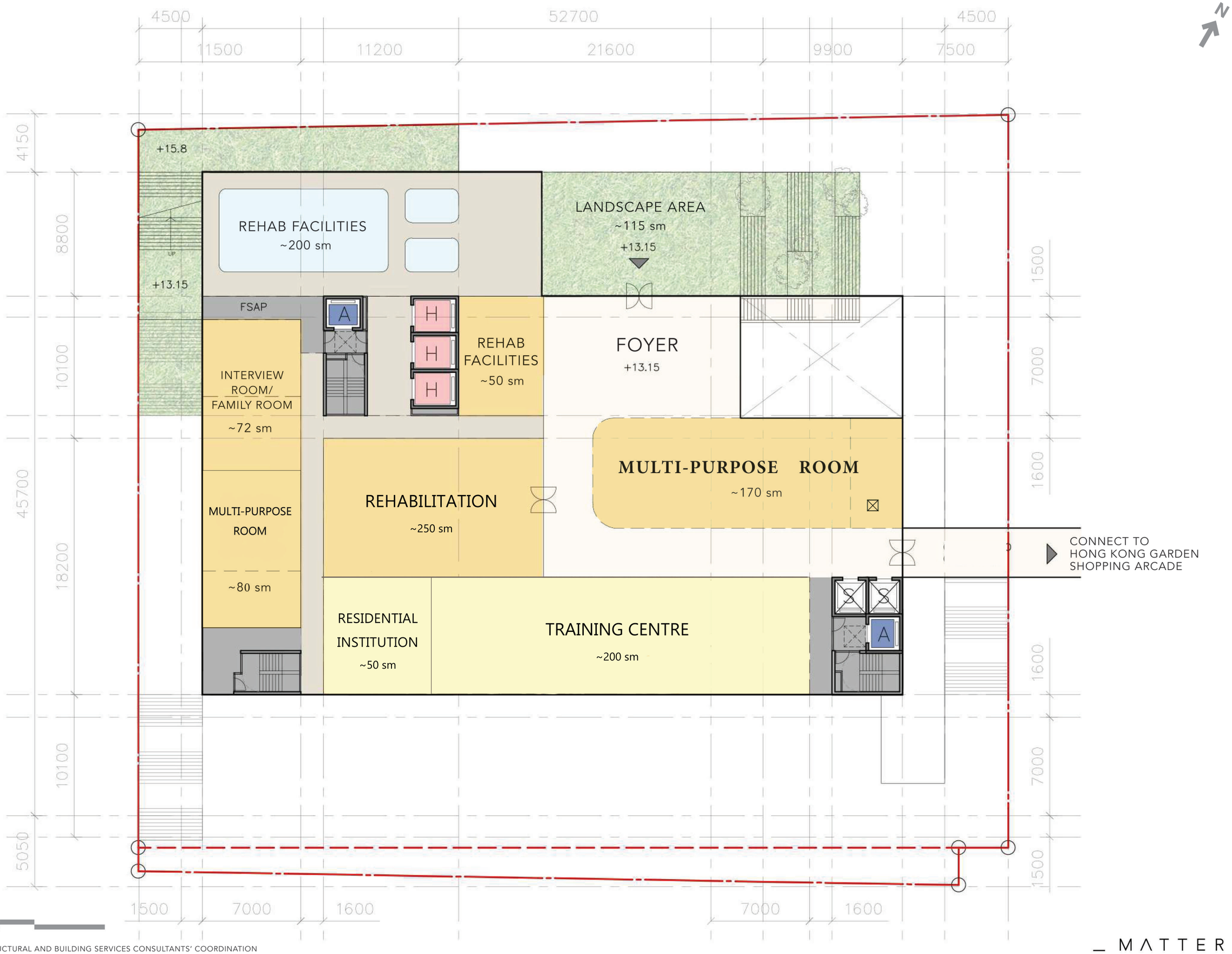


1F

1:250 @ A3

*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION

_ MATTER

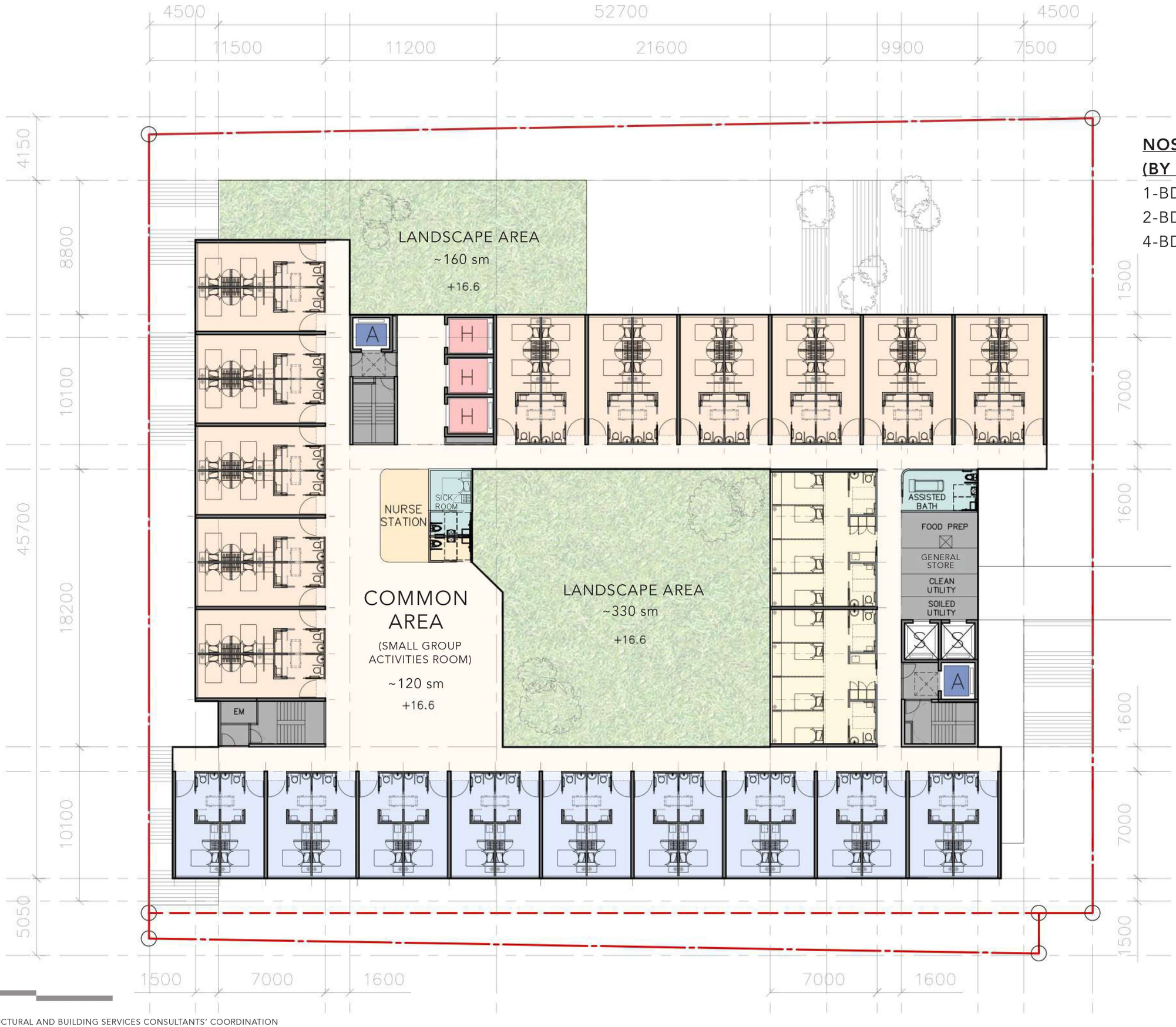


2F

1:250 @ A3

*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION

_ MATTER



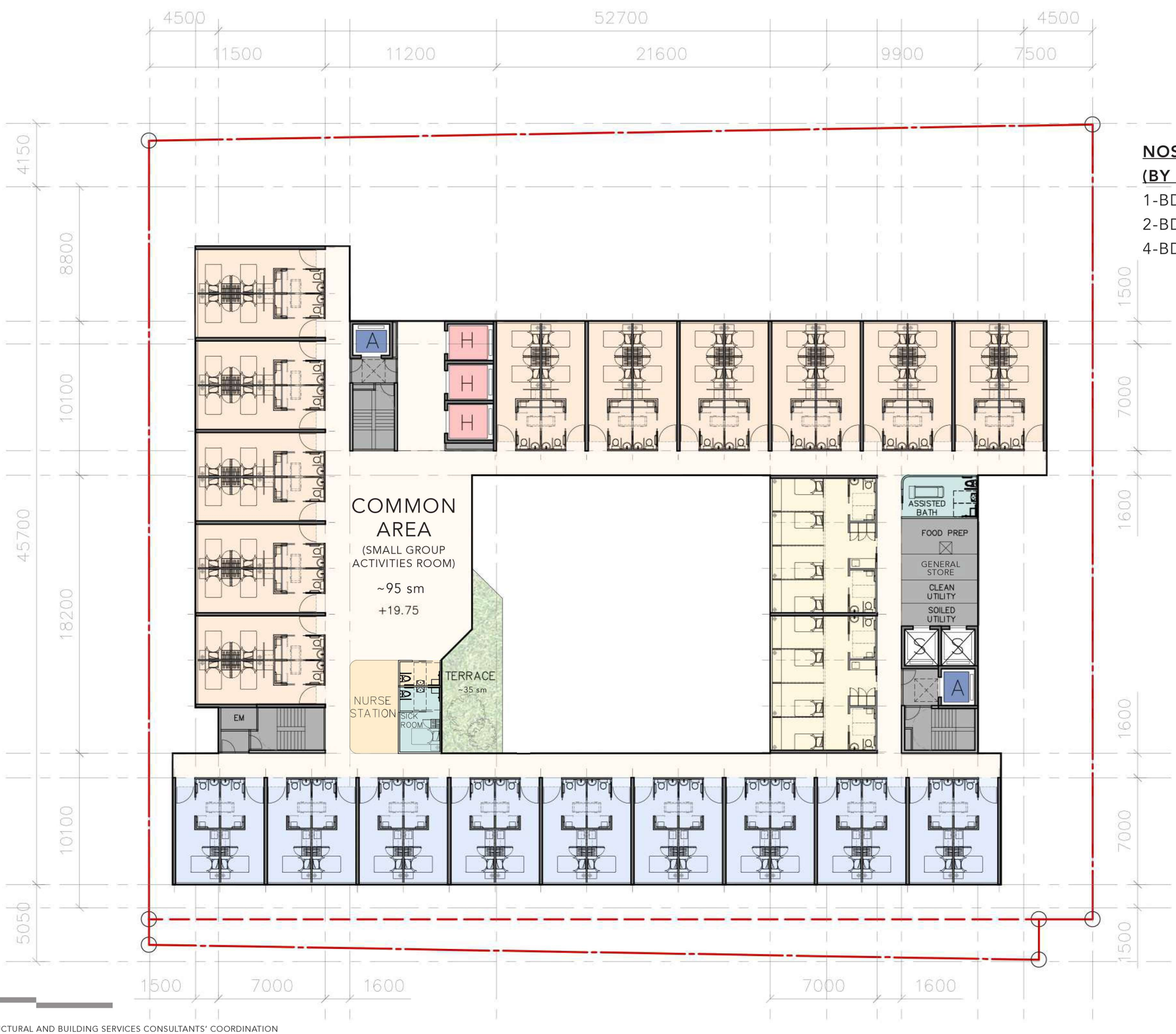
NOS. OF BEDS (BY FLOOR)

1-BD	: 18 BEDS
2-BD	: 44 BEDS
4-BD	: 8 BEDS

3F

1:250 @ A3

*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION



NOS. OF BEDS (BY FLOOR)

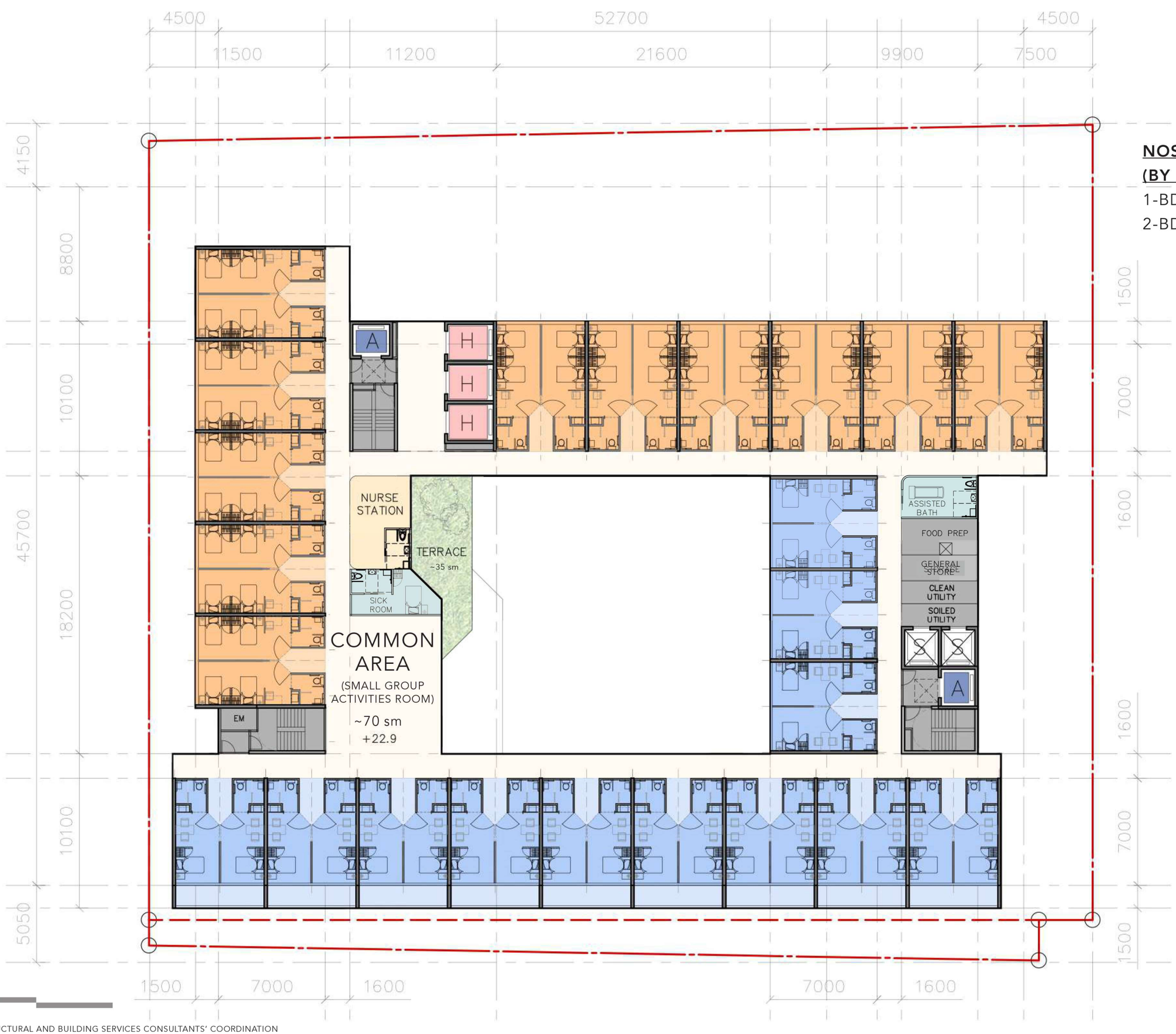
1-BD	: 18 BEDS
2-BD	: 44 BEDS
4-BD	: 8 BEDS

4F

1:250 @ A3

*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION

_ MATTER



NOS. OF BEDS (BY FLOOR)

1-BD : 24 BEDS

2-BD : 44 BEDS

5F

1:250 @ A3

*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION

_ MATTER

NOS. OF BEDS (BY FLOOR)

1-BD : 42 BEDS

6F

1:250 @ A3

*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION

_ MATTER

NOS. OF BEDS (BY FLOOR)

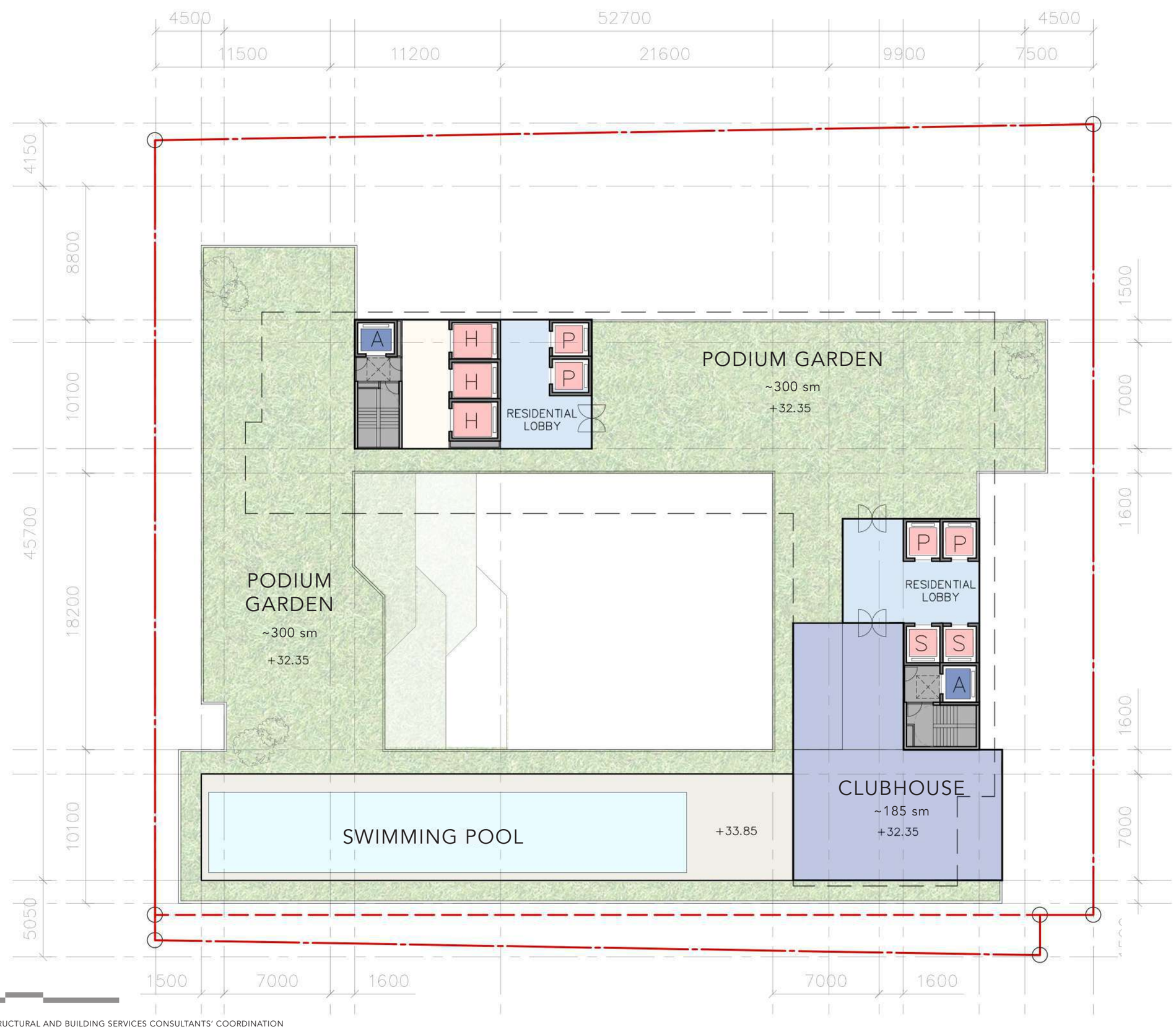
SUITE : 6 BEDS

1-BD : 28 BEDS

7F

1:250 @ A3

*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION



8F

1:250 @ A3

*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION

_ MATTER

TYP

1:250 @ A3

TYPICAL FLOORS - 9,11,13,15/F

*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION

_ MATTER

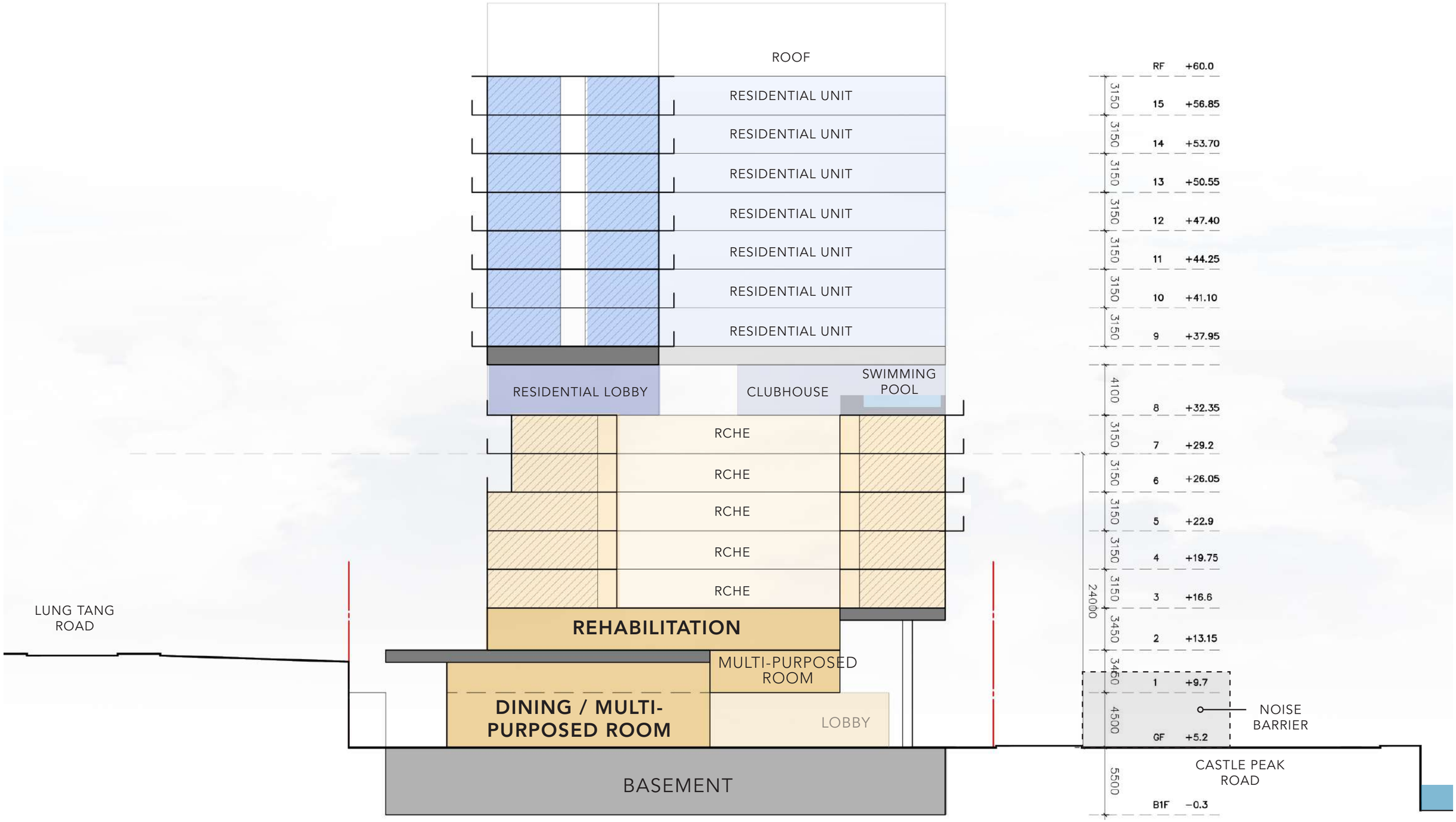
TYP

1:250 @ A3

TYPICAL FLOORS - 10,12,14/F

*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION

_ MATTER



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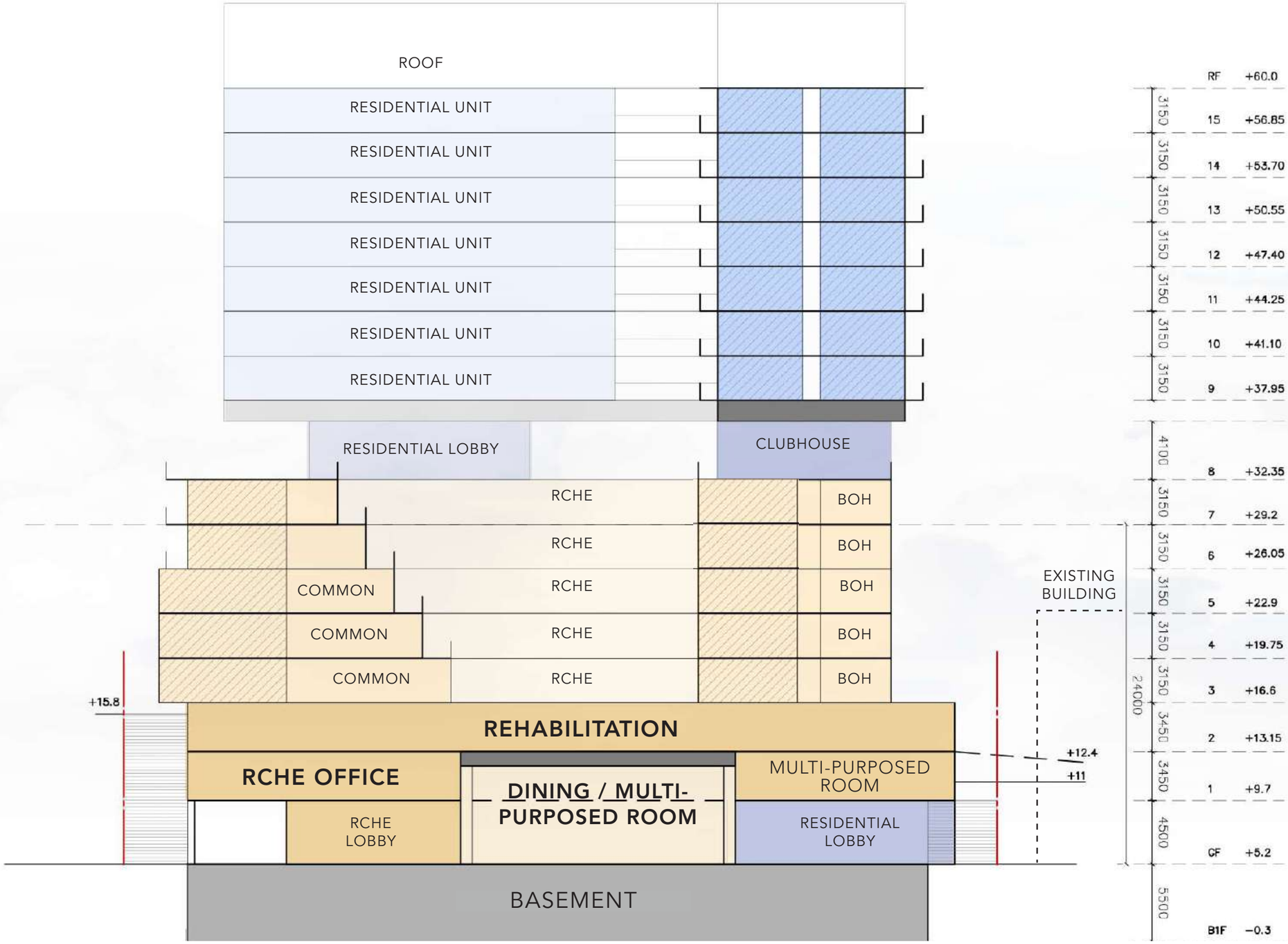

1:300 @ A3

_ MATTER

Appendix 2 Detailed Drainage Impact Assessment Calculations

Calculation of Drainage Capacity for Return Period of 200 Years

Catchment ID	Catchment Area (A), km^2	Inlet time (t_0), min	Duration (t_d), min	Storm Constants			Runoff intensity (i), mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s
				a	b	c				
Before Development										
Catchment A	0.3064	12.83	12.83	508.8	3.46	0.322	207.17	0.35	0.1073	7.913
Catchment A1	0.0400	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0380	2.982
Catchment B1	0.0007	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0007	0.052
Catchment B2	0.0010	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0010	0.076
Catchment C	0.0061	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0058	0.452
Catchment D	0.0029	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0028	0.216
Catchment E (Site, unpaved)	0.0033	10.00	10.00	508.8	3.46	0.322	220.29	0.35	0.0012	0.091
								Flow from Annual Cleaning of Rehab Facilities(Site)		0.000
								Flow from Annual Cleaning of Swimming Pool (Site)		0.000
									Total	**11.78**

Catchment ID	Catchment Area (A), km^2	Inlet time (t_0), min	Duration (t_d), min	Storm Constants			Runoff intensity (i), mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s
				a	b	c				
After Development										
Catchment A	0.3064	12.83	12.83	508.8	3.46	0.322	207.17	0.35	0.1073	7.913
Catchment A1	0.0400	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0380	2.982
Catchment B1	0.0007	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0007	0.052
Catchment B2	0.0010	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0010	0.076
Catchment C	0.0061	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0058	0.452
Catchment D	0.0029	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0028	0.216
Catchment E (Site with 20% unpaved)	0.0033	10.00	10.00	508.8	3.46	0.322	220.29	0.83	0.0027	0.215
								Flow from Annual Cleaning of Rehab Facilities(Site)		0.014
								Flow from Annual Cleaning of Swimming Pool (Site)		0.008
									Total	**11.93**

Note:
1) Runoff is calculated in accordance with DSD's "*Stormwater Drainage Manual (with Eurocodes incorporated) - Planning, Design and Managemen*t" (SDM), fifth edition, May 2018.
2) To taken into account the effect of climate change, the surface runoff is marked up by 28.1% (16%+12.1%) in accordance to Table 28 and 31 of SDM.

Calculation of Drainage Capacity for Return Period of 200 Years

Manhole ID	Manhole ID	Catchment Served	Length	Level (Out)	Level (In)	D	r	A_w	P_w	R	s	k_s	V	Np	Q_C	Total Runoff (Climate Change 16.0% + Design Allowance 12.1%)	% of capacity	Remark
			m	mPD	mPD	m	m	m^2	m	m	-	mm	m/s	-	m^3/s	m^3/s	%	
Propsed Drainage Pipes																		
STMH-1	SSH400781 (D1)	Catchment B1 and E	--	--	--	0.450	0.225	0.159	1.414	0.112	0.010	0.003	2.784	1	0.44	0.28	64%	OK
Existing Drainage Pipes																		
SSH4000781 (D1)	SSH4004628 (D2)	Catchment A to E	10.4	0.625	0.530	1.800	0.900	2.545	5.655	0.450	0.009	0.0003	6.364	2	32.39	11.93	37%	OK
SSH4004628 (D2)	SSH4004629 (D3)	Catchment A to E	11.7	0.507	0.410	1.800	0.900	2.545	5.655	0.450	0.008	0.0003	6.041	2	30.75	11.93	39%	OK
SSH4004629 (D3)	SSH4006140 (D4)	Catchment A to E	7.3	0.396	0.330	1.800	0.900	2.545	5.655	0.450	0.009	0.0003	6.329	2	32.21	11.93	37%	OK

Note:

1. Information of the invert levels and diameters of stormwater pipes and existing manholes are given in the DSD's Drainage Record Plan.
2. The value of ks = 0.3mm is used for the calculation of slimed polyethelyene for the proposed sewers, poor condition (based on Table 5: Recommended roughness values in Sewerage Manual)
3. The value of ks = 3mm is used for the calculation of slimed precast concrete for the proposed drains, poor condition (based on Table 5: Recommended roughness values in Sewerage Manual)
4. The velocity is calculated using the Colebrook-White Equation, which can be applied to analyze a wide range of flow condition.

For circular pipes flowing full,

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

Legend

D = pipe diameter, m
r = pipe radius (m) = 0.5d
A_w = wetted area (m^2) = p r^2
P_w = wetted perimeter (m) = 2pr
R = Hydraulic radius (m) = A_w/P_w
s = Slope of the total energy line
k_s = equivalent sand roughness, mm
V = Mean Velocity of flow calculated based on Colebrook White Equation, m/s
Q_c = Flow Capacity, m^3/s
Q_p = Estimated total peak flow from the Site during peak season, m^3/s
Np = Number of Pipe