

Appendix 4

Drainage Impact Assessment

Section 16 Planning Application for Proposed Comprehensive Development ('Flat', 'Social Welfare Facility (Residential Care Home for the Elderly)' and 'Shop and Services' Uses) with Minor Relaxation of Plot Ratio and Building Height Restrictions at Various Lots in D.D. 92 and 94 and the Adjoining Government Land, Hang Tau Tai Po, Kwu Tung South.

Drainage Impact Assessment

July 2026

Submitted to

Fonnie Holdings Limited

Prepared By

Meinhardt Infrastructure and Environment Ltd

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1 INTRODUCTION

1.1 Project Background

- 1.1.1.1 The Applicant, Fonnies Holdings Limited intends to develop the residential development cum Resident Care Home for the Elderly and Shop and Services (hereafter as "the proposed development") in D.D.94 and the adjoining Government land in Hang Tau Tai Po, Kwu Tung South (hereafter as "the Application Site").
- 1.1.1.2 This planning application is submitted under Section 16 of the Town Planning Ordinance ("the Ordinance") for the proposed development with minor relaxation of plot ratio and building height restrictions in the prevailing Draft Kwu Tung South Outline Zoning Plan No. S/NE-KTS/21.
- 1.1.1.3 Meinhardt Infrastructure and Environment Limited (MIEL) was commissioned by the Applicant to conduct an Environment Assessment (EA) to support the Section 16 Planning Application of the proposed development, and to assess the environmental impact due to / upon the proposed development.

1.2 Objective of the Report

- 1.2.1.1 The objectives of this DIA are to assess the potential drainage impacts arising from the proposed development and recommend the mitigation measures, if necessary, to alleviate the impacts.

1.3 Report Structure

- 1.3.1.1 The remaining chapters of this report are shown below:

- Chapter 2 – Site Description
- Chapter 3 – Drainage Analysis
- Chapter 4 – Conclusion

2 SITE DESCRIPTION

2.1 Site Location and Its Environs

- 2.1.1.1 The proposed development will be located at the various lots in D.D.94 and the adjoining Government land in Hang Tau Tai Po, Kwu Tung South.
- 2.1.1.2 The Application Site is currently occupied by unused structures including a 2-story house, a pavilion, swimming pool and landscape garden. The proposed development is located in the "Comprehensive Development Area" Zone bounded by "Agriculture" (AGR) Zone, "Residential (Group D)" (R(D)) Zone and "Government Institution or Community" (G/IC) Zone according to the Draft Kwu Tung South Outline Zoning Plan (OZP) (OZP No.: S/NE-KTS/21). Existing land uses in the surroundings include low-rise village type development and temporary structures.
- 2.1.1.3 **Figure 2.1** shows the Application Site location and its environs.

2.2 Proposed Development

- 2.2.1.1 The proposed development consists of 4 nos. of residential towers, a clubhouse, a retail and a Residential Care Home for the Elderly (RCHE) with total site area of approximately 17,990.9 m². The development schedule of the proposed development is tabulated in **Table 2.1**. The layout plans of the proposed development are shown in **Appendix 2.1**.

Table 2-1 Development Schedule

Development Items	Design Parameter
No. of Tower	4
No. of Flat Unit	334
No. Clubhouse	1
No. of Swimming Pool	1
No. of RCHE	1
No. of Retail	1
Site Area	17,990.9m ²

- 2.2.1.2 According to the latest programme, the year of occupancy of the proposed development is expected to be Year 2031.

2.3 Existing Drainage Condition

- 2.3.1.1 The latest drainage plans including 2-SE-15A, 2-SE-14B, 2-SE-9D, 2-SE-10C, 2-SE-10D, 2-SE-15B, 2-SE-14D, 2-SE-15C, 2-SE-15D, were obtained and reviewed to gather the background information on drainage infrastructure in the vicinity of the Application Site.
- 2.3.1.2 According to the drainage plans, the Application Site is currently served by the public drainage facilities along Hang Tau Road (eastern side of the Application Site), and the collected surface runoff will be ultimately discharged to an existing channel to the north of the Application Site. Relevant drainage data are extracted from the drainage plans and presented in **Figure 2.2** for ease of reference.

- 2.3.1.3 One on-site catchments (Catchment A) and 10 off-site catchments (Catchments E to M) were identified based on the geographical characteristics of the Application Site and its nearby areas as shown in **Figure 2.2**.
- 2.3.1.4 Surface runoff from **Catchment A** would be discharged to the existing channel (Channel CH. 67), located to the north of the Application Site, via public drainage pipes A1 to A7. Meanwhile, surface runoff from Catchment E to M would also ultimately be discharged to the same existing channel (**Channel CH. 67**). As such, Catchment A, and E to M were considered in the channel capacity assessment. The existing drainage system is shown in **Figure 2.2**.
- 2.3.1.5 Site photos of the existing channels (i.e. Channel CH. 67) and box culverts, with aerial photos of the site, are shown in **Appendix 2.2**.

2.4 Paving Conditions

- 2.4.1.1 The Application Site is currently occupied by unused structures, it is generally unpaved with amount of 80% vegetation area of the Application Site, the paved area about 20% to the existing Site. The paving condition of the proposed development, 75% of the area would be paved with concrete and 25% of the area would be unpaved. Paving conditions is summarized in **Table 2.2**.

Table 2.2 Paving Conditions of the Catchment

Paving Conditions	Pre-development	Post-development
Paved Area	20%	75%
Unpaved Area	80%	25%

3 EVALUATION OF DRAINAGE IMPACT

3.1 Proposed Drainage System

- 3.1.1.1 Surface runoff generated from the Catchment A will be collected at the on-site terminal manhole (T1). To enhance the capacity of the public drainage pipe A1 to A7, it is proposed to upgrade to 750mm (i.e. T1/A1 to A7).
- 3.1.1.2 The proposed drainage system is demonstrated in **Figure 3.1**.

3.2 Assessment Methodology and Assessment

- 3.2.1.1 Surface runoff from the proposed development is proposed to be discharged to the stormwater drains along Hang Tau Road to the channel (as shown in **Figure 3.1**).
- 3.2.1.2 This DIA has adopted the Rational Method for runoff estimation:

$$Q_p = 0.278 i \sum C_j A_j$$

where

Q_p is peak runoff (m^3/s);

i is rainfall intensity (mm/hr);

A_j is the j^{th} catchment (km^2);

C_j is the runoff coefficient of the jth catchment (dimensionless)

3.2.1.3 The details of the Rational Method can be referred to the *Stormwater Drainage Manual* (SDM) (DSD, 2018).

3.2.1.4 Based on a 1:50 year flood protection standard in the SDM and the estimated time of concentration, the appropriate rainfall intensities (i) were calculated based on linear interpolation of the intermediate table values.

3.3 Design Parameters

3.3.1.1 There is no change in size and flow path of all concerned catchments, **except for Catchment A, before pre-development after- development**, while the change in paving condition has been discussed in **Section 2.4**.

3.3.1.2 In the hydraulic analysis, runoff coefficient of 0.95 was adopted to represent a concrete-paved area, and runoff coefficient of 0.25 and 0.35 were adopted to represent flatted grassland (heavysoil) and steep grassland (heavysoil) respectively. The Manning's roughness coefficient of 0.015 (fair condition for concrete-lined circular pipes) and 0.016 (fair condition for U-channel) as stated in Table 13 of SDM were assumed for the capacity calculation as referred in the SDM.

3.3.1.3 The capacity of the existing channel has been estimated and compared with the total runoff generated from the identified catchments (i.e. Catchment A, E to M). The value of Manning's roughness coefficient used for estimating the channel capacity by using Manning's Equation was assumed to be 0.035 for channel – CH.67 [fair condition for canals and ditches (canals with rough stony beds, weeds on earth banks)] and 0.016 for box culvert [fair condition for concrete-lined channels].

3.3.1.4 The drainage design has incorporated climate change considerations by adopting a projected 16.0% increase in rainfall by the end of the 21st century, as specified in Table 28 of SDM Corrigendum No. 1/2022.

3.3.1.5 The assumptions of this DIA are summarised below:

- Rainstorm return period – 1 in 50 years
- Runoff coefficient for concrete-paved area – 0.95
- Runoff coefficient for flatted grassland (heavysoil) – 0.25
- Runoff coefficient for steep grassland (heavysoil) – 0.35
- Manning's roughness coefficient for the existing / proposed circular pipe – 0.015
- Manning's roughness coefficient for the proposed U-channels – 0.016
- Manning's roughness coefficient for the channel – 0.035
- Manning's roughness coefficient for the box culvert in the channel – 0.016

3.4 Results and Discussion

3.4.1.1 A calculation of the on-site catchment runoff for both pre-development and post-development scenarios resulting from a 50-year return period rainstorm event has been conducted. The estimated peak runoff is 0.37 m³/s for pre-development condition and 0.73 m³/s for post-development from the proposed development site (Catchment A), and 25.57m³/s from Catchment E to M. Detailed calculation for the pre-development scenario is presented in **Appendix 3.1**, while those for the post-development scenario are presented in **Appendix 3.2**.

3.4.1.2 The capacity of the proposed upgrading public drainage pipes (i.e. pipe segments T1/A1 – A7 as shown in **Figure 3.1**) have been evaluated to ensure that the proposed pipes are capable of receiving storm water from the Application Site. The results are summarized in **Table 3.1** and detailed in **Appendix 3.2**.

Table 3.1 Estimated Runoff and Capacities of Upgrading Pipe and Channel

Drainage Pipe Segment / Stream	Existing Diameter, m	Upgraded Diameter, m	Catchment	Slope	Total Runoff, m ³ /s	Pipe Capacities, m ³ /s	% of Capacity Flow
T1/A1 – A2	0.300	0.750	A	0.022	0.78	1.19	65%
A2 – A3	0.300	0.750	A	0.074	0.78	2.20	35%
A3 – A4	0.300	0.750	A	0.017	0.78	1.04	75%
A4 – A5	0.450	0.750	A, E	0.024	0.82	1.27	64%
A5 – A6	0.450	0.750	A, E	0.018	0.82	1.09	75%
A6 – A7	0.450	0.750	A, E	0.024	0.82	1.24	66%
Channel – CH. 67	See Appendix 3.3		A - K	0.003	22.91	24.66	93%
Box Culvert			A - M	0.008	25.56	46.76	57%

3.4.1.3 The water levels and flow of the channel (i.e. Channel CH 67) and the box culvert are shown in **Table 3.2**. The calculated freeboards for both the channel and the box culvert remain satisfactory under the design flow conditions and no mitigation measure is required.

Table 3.2 Water Levels and Flow of Channel and Box Culvert

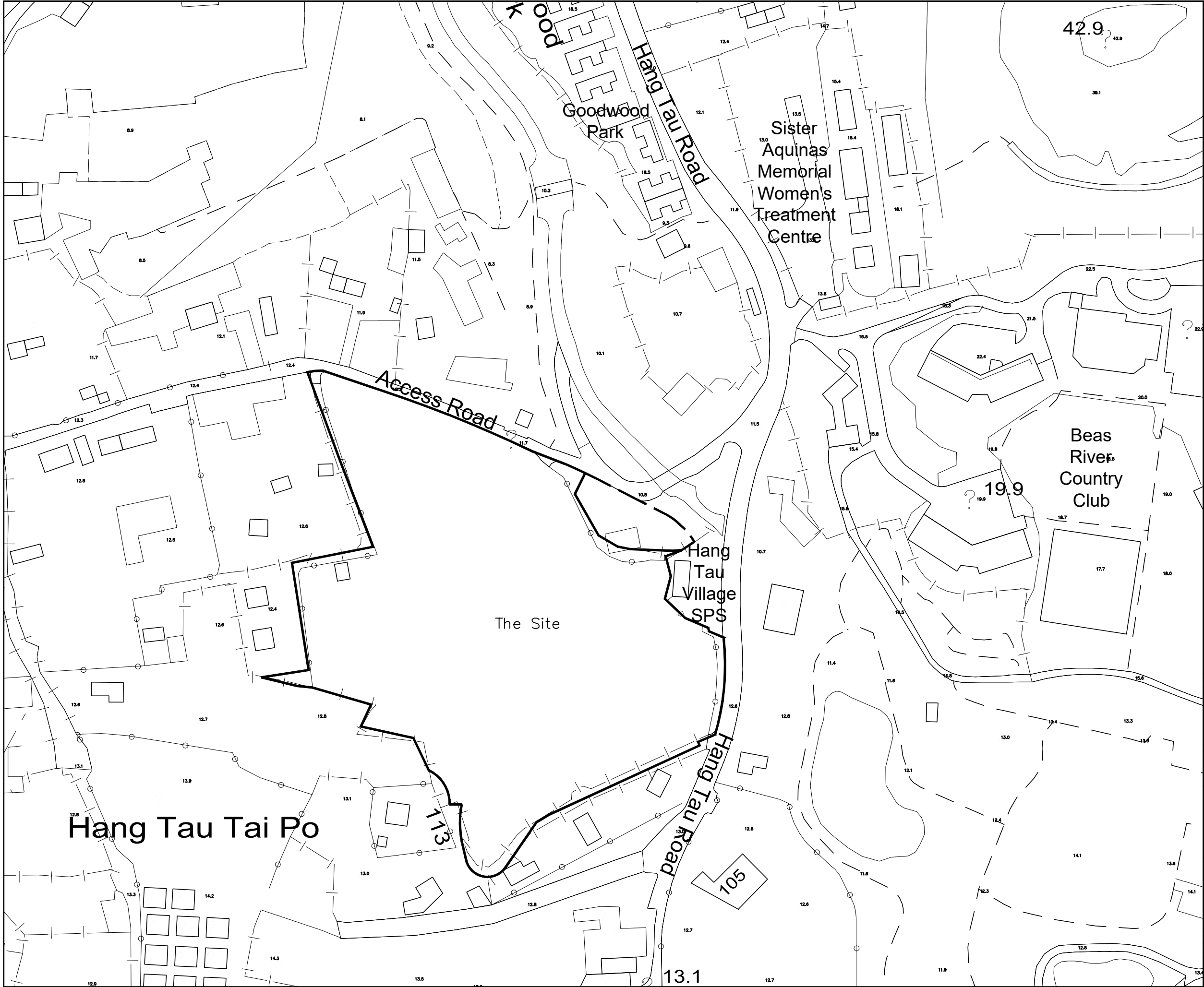
Parameter	Channel CH 67		The Box Culvert	
	Pre-development	Post-development	Pre-development	Post-development
Runoff, m ³ /s	22.55	22.91	26.20	26.56
Cross Section Area, m ²	14.030		11.822	
Water Levels, m	1.44	1.46	1.10	1.12
Freeboard, m	0.42	0.40	0.90	0.88

3.4.1.4 Capacity of all the proposed pipes are sufficient to cater the peak storm water flow. Also, no flooding blackspot was identified within or near the site according to DSD flooding blackspots records. This indicates that the project is unlikely to contribute to flooding issues in the surrounding area. Therefore, adverse drainage impact arising from the proposed development is not anticipated.

4 Conclusion

- 4.1.1.1 A Drainage Impact Assessment has been conducted for the proposed development. The public drainage pipe T1/A1 to A7 are proposed to upgraded to 750mm.
- 4.1.1.2 The peak surface runoff was calculated based on a 50-year return period. The assessment findings have demonstrated and confirmed that the proposed drainage pipes are sufficient to cater with the estimated surface runoff from proposed development. No adverse drainage impact arising from the proposed development is anticipated.
- 4.1.1.3 The detailed arrangement of the proposed drainage system will be further investigated at the detailed design stage of the project. The detailed drainage proposal shall be submitted to DSD for further approval.

Figures



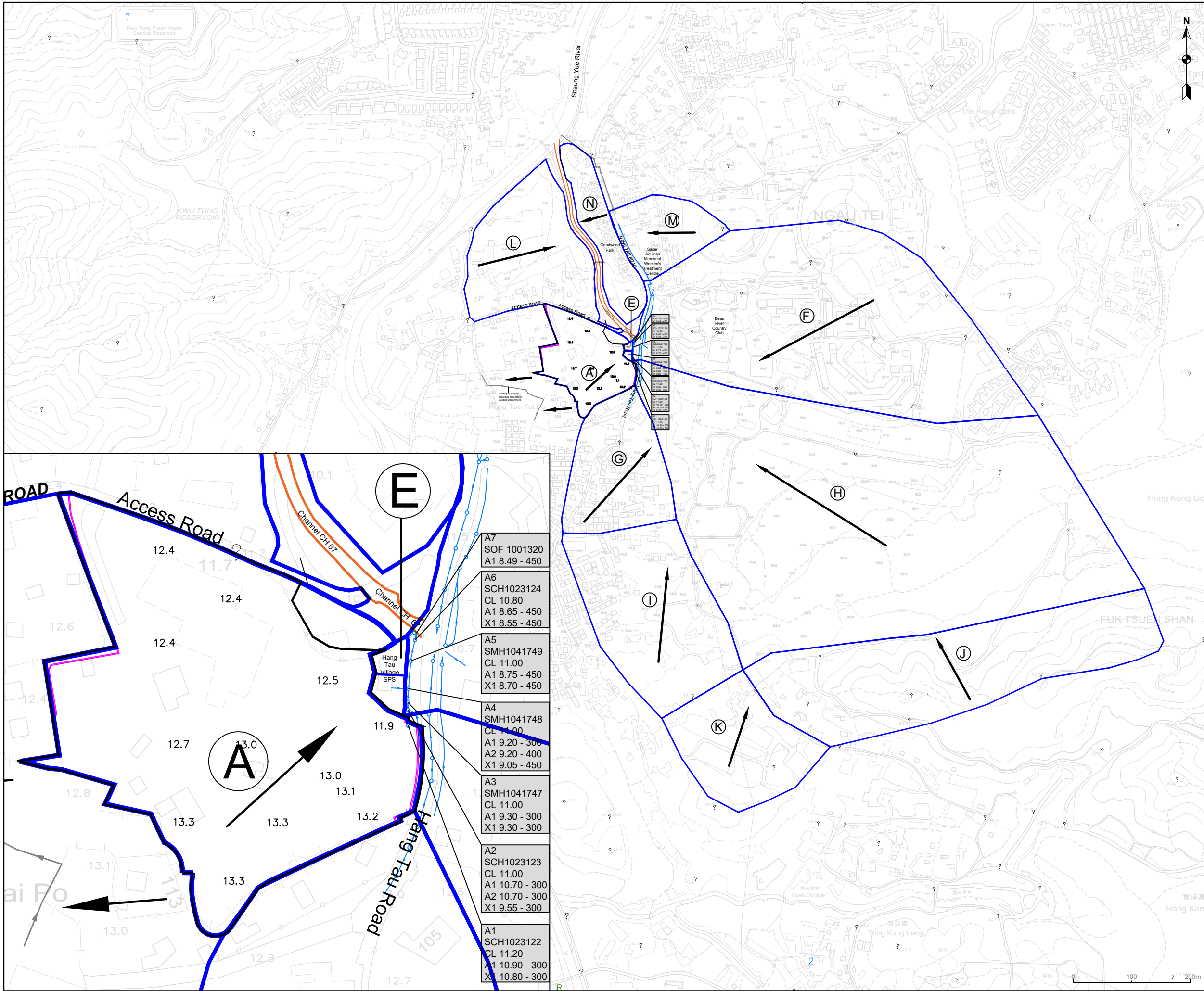
LEGEND

The Application Site

CDA Zone Boundary

Rev	Amendment	By	Chk.	App.	Date
Client					
MEINHARDT Meinhardt Infrastructure and Environment Limited 香港測量師工程師有限公司					
Project Proposed Amendments to the Kwu Tung South Outline Zoning Plan for Residential Development at Various Lots in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" Zone, Hang Tau Tai Po, Kwu Tung South, New Territories					
Title Site Location and its Environs					
Drawn	Checked	Approved			
Scale	CAD File No. \$FILEA\$	First issued			
Drawing No. Figure 2.1					Rev.

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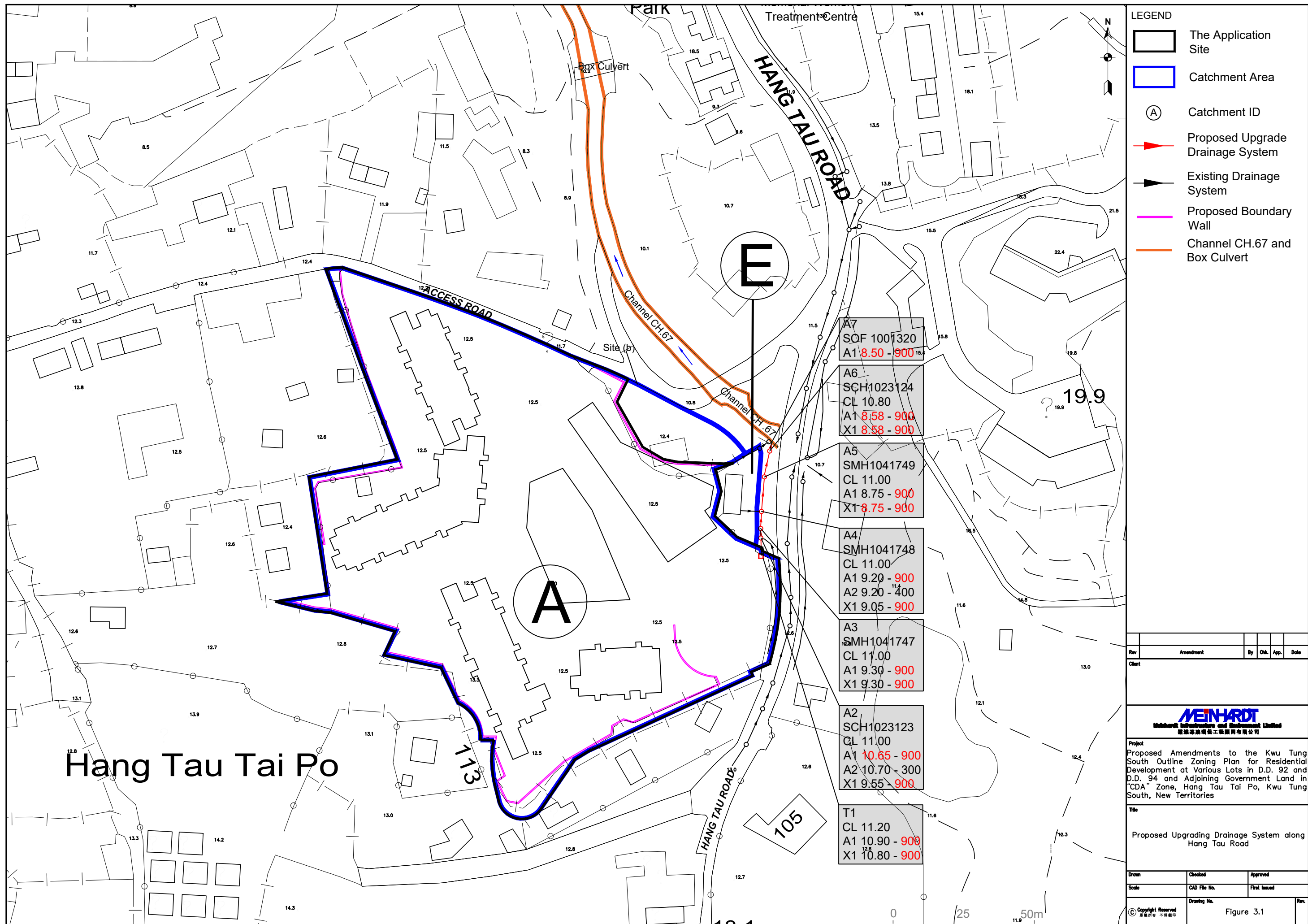


LEGEND

- The Application Site
- Catchment Area
- Catchment ID
- Direction of Flow Path
- Involved Existing Drainage System
- Existing Boundary Wall
- Channel CH.67 and Box Culvert

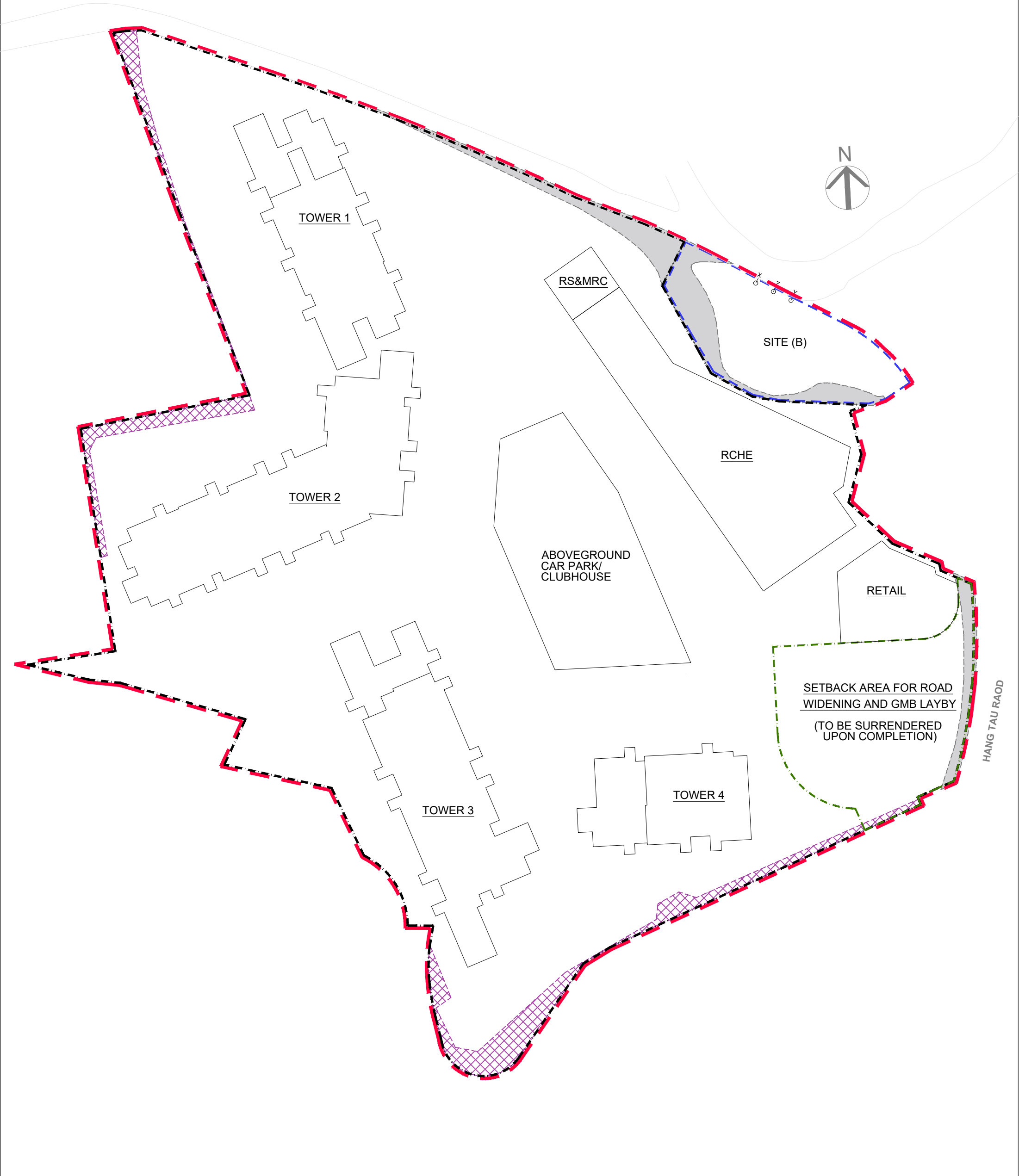
Rev	Amendment	By	Chk.	App.	Date
Client					
MEINHARDT Meinhardt Infrastructure and Environment Limited 香港測量師學會工程師有限公司 Project Proposed Amendments to the Kwu Tung South Outline Zoning Plan for Residential Development at Various Lots in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" Zone, Hang Tau Tai Po, Kwu Tung South, New Territories Title Catchment of the Existing Drainage System along Hang Tau Road					
Drawn	Checked	Approved			
Scale	CAD File No. \$FILEA\$	First Issued			
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Figure 2.2



Appendix 2.1

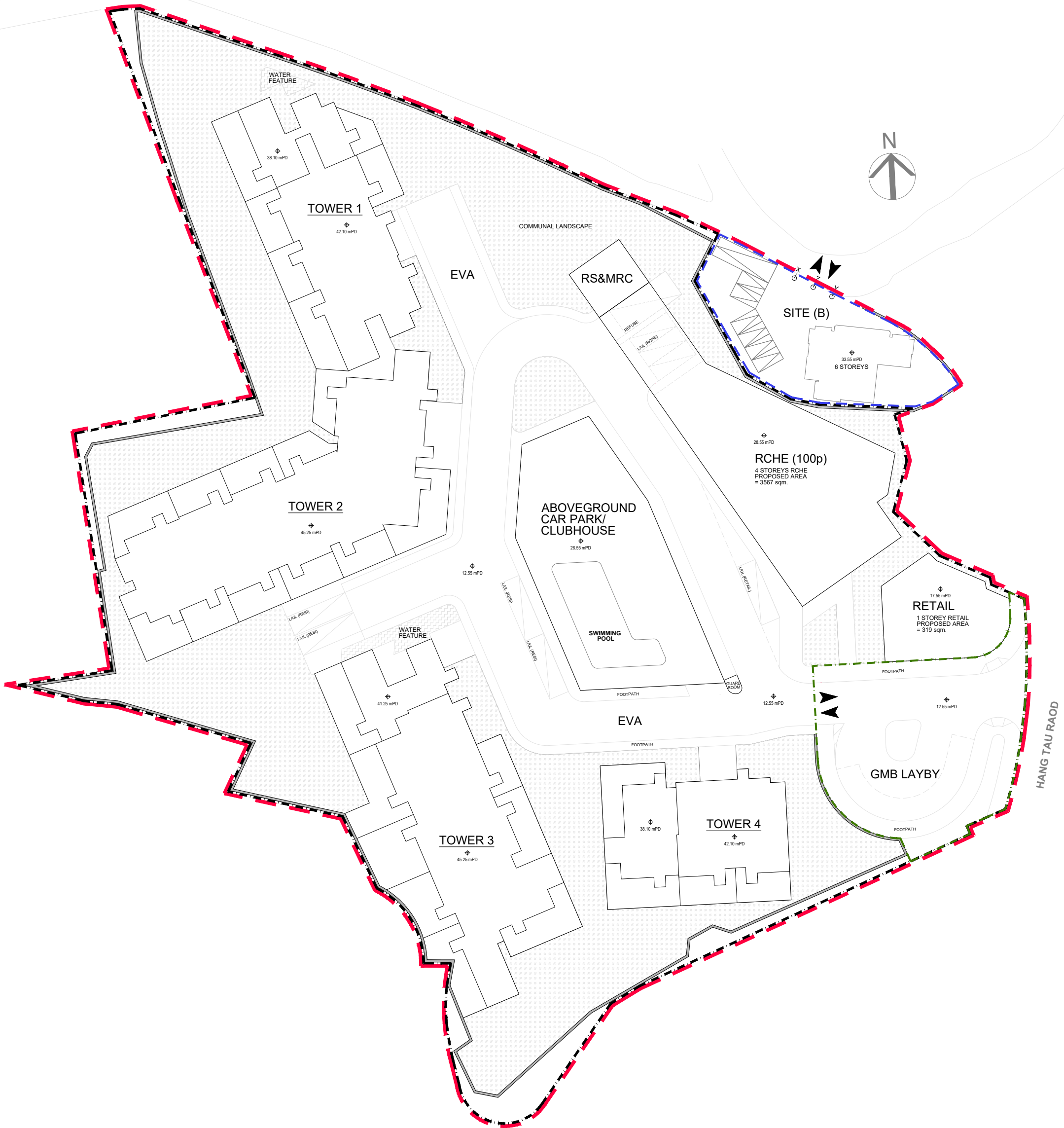
Layout Plan of Proposed Development



LOT PLAN

- LEGEND
- CDA Zone Boundary
 - Application Site Boundary
 - Site (B) Boundary
 - Surrender Area
 - Right of Ways for Adjacent "R(D)" Zone
 - Government Land

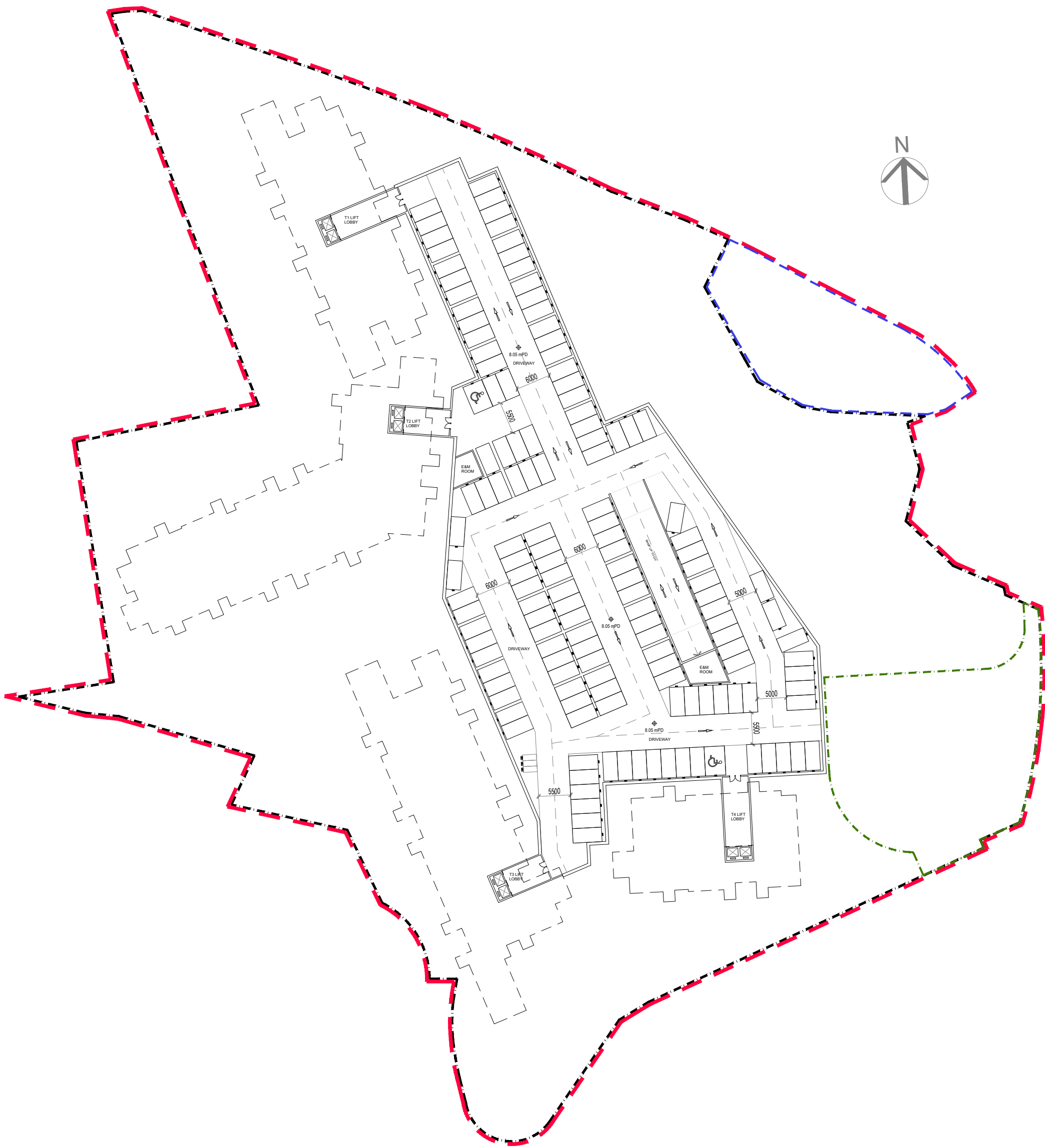
Master Layout Plan for Residential Development at Various Lots
in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" zone
Hang Tau Tai Po, Kwu Tung South, New Territories



MASTER LAYOUT PLAN

- LEGEND
- CDA Zone Boundary
 - Application Site Boundary
 - Site (B) Boundary
 - Surrender Area

Master Layout Plan for Residential Development at Various Lots
in D.D. 92 and D.D. 94 and Adjoining Government Land in "CDA" zone
Hang Tau Tai Po, Kwu Tung South, New Territories



B1/F FLOOR PLAN

LEGEND

- CDA Zone Boundary
- Application Site Boundary
- Site (B) Boundary
- Surrender Area

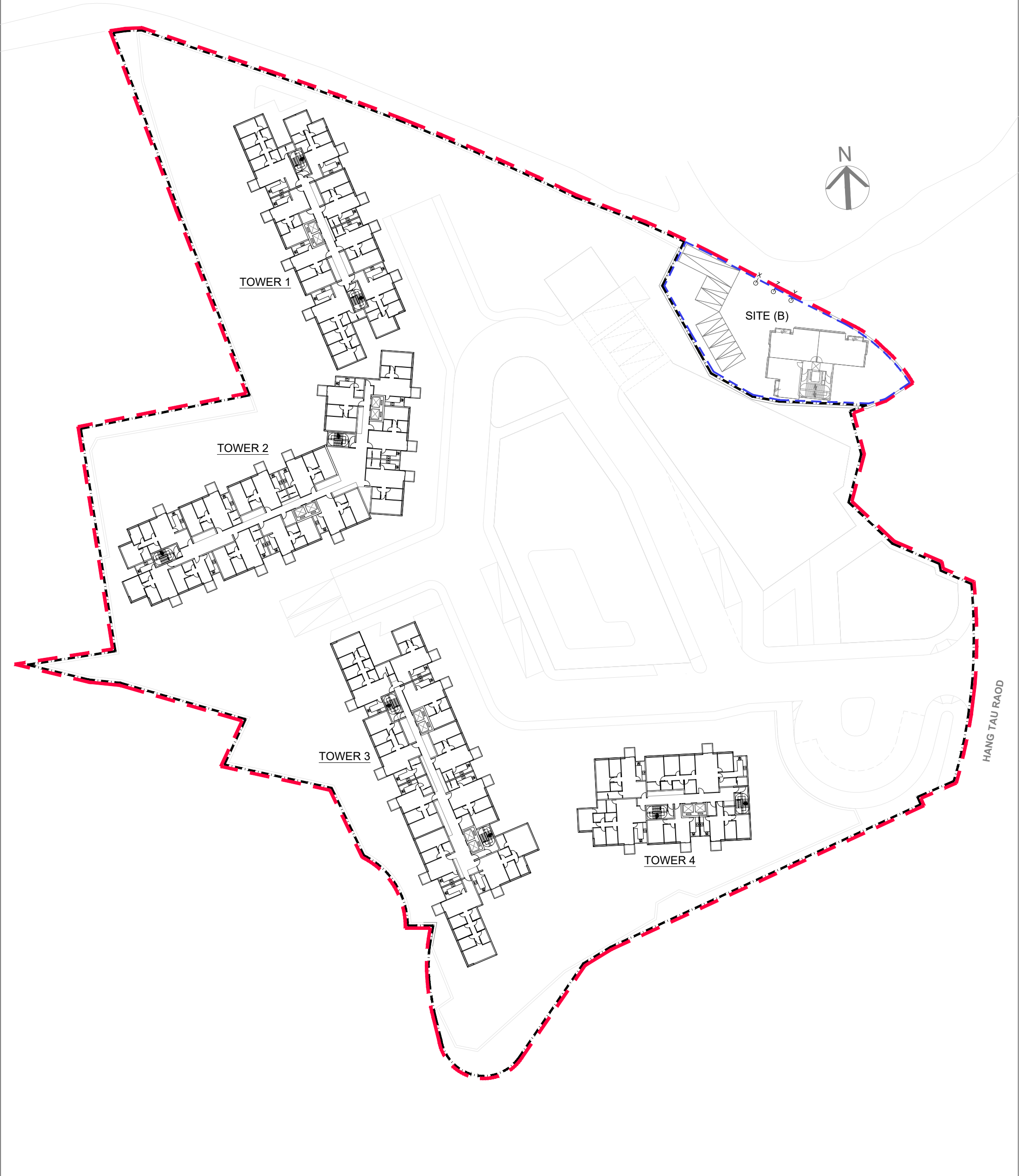


FIRST FLOOR PART PLAN

GROUND FLOOR PLAN

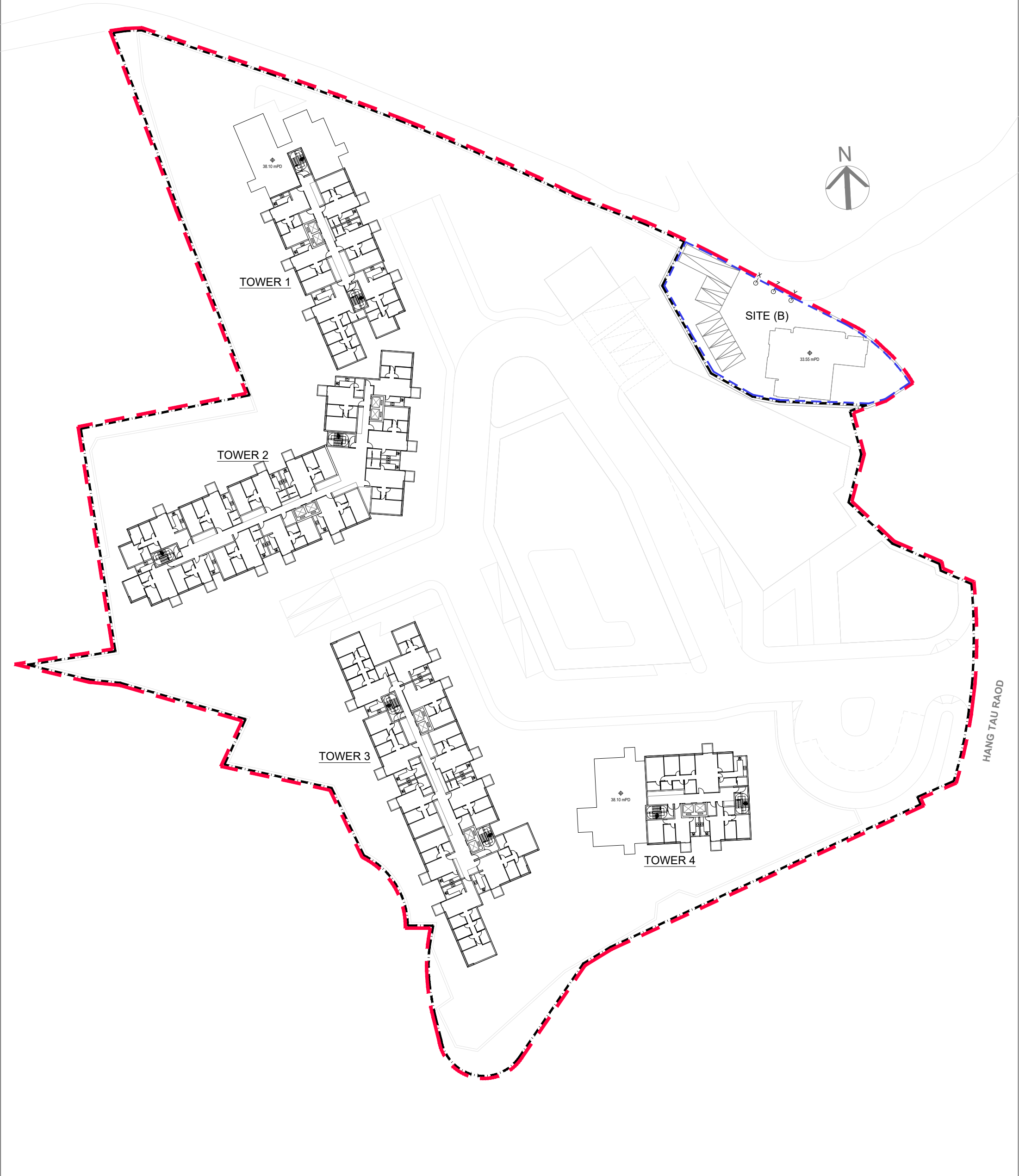
LEGEND

- CDA Zone Boundary
- Application Site Boundary
- Site (B) Boundary
- Surrender Area



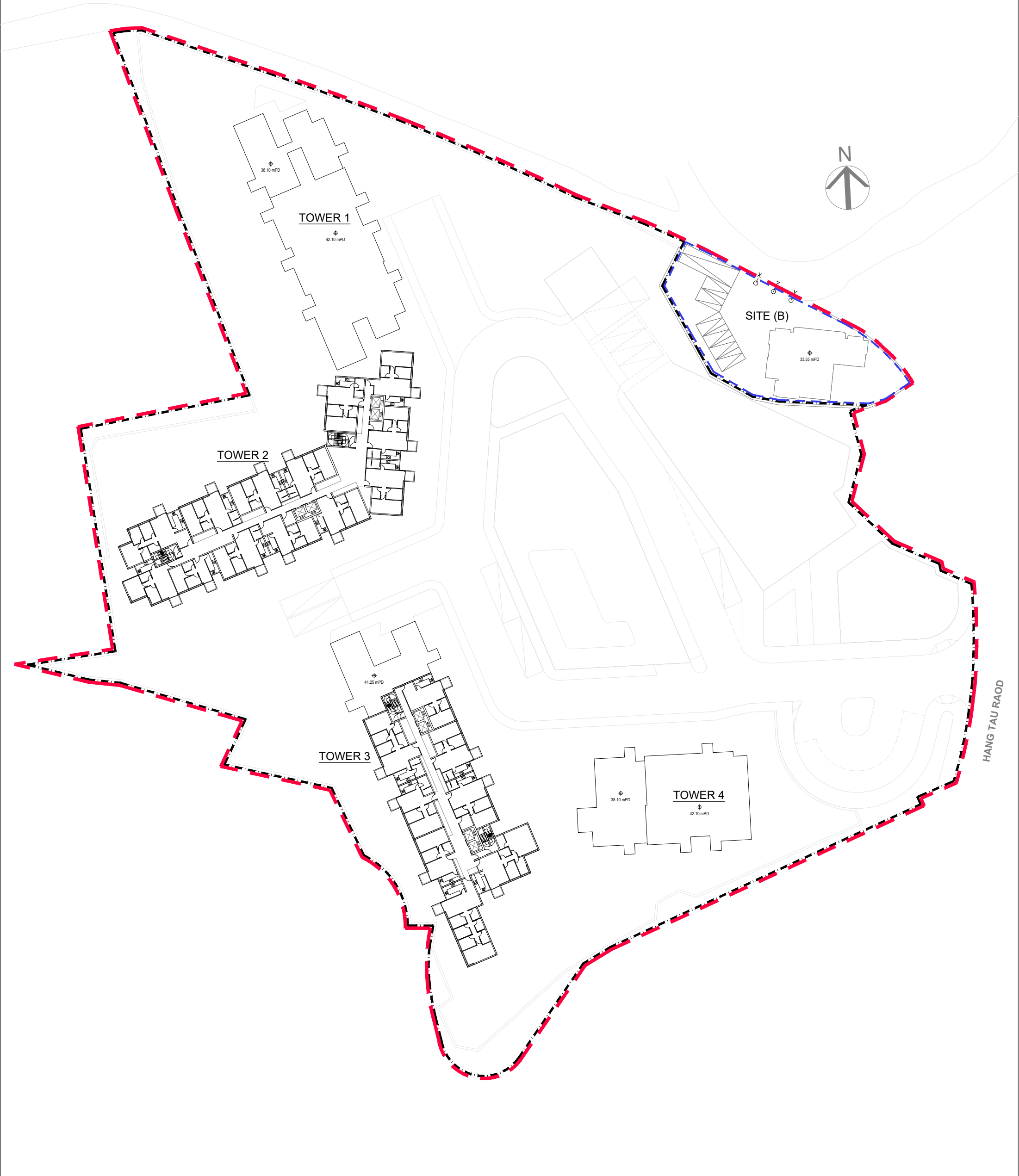
TYPICAL FLOOR PLAN (1/F to 7/F)

- LEGEND
- CDA Zone Boundary
 - - - Application Site Boundary
 - - - Site (B) Boundary



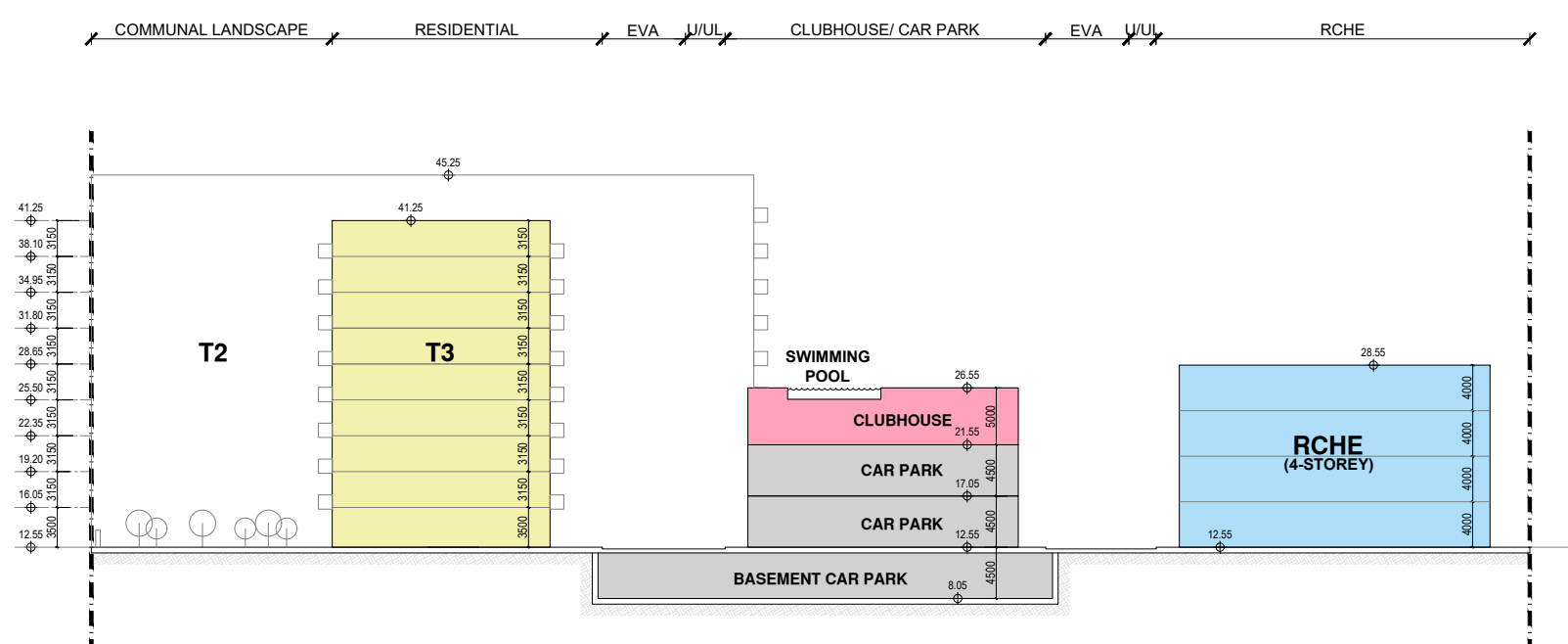
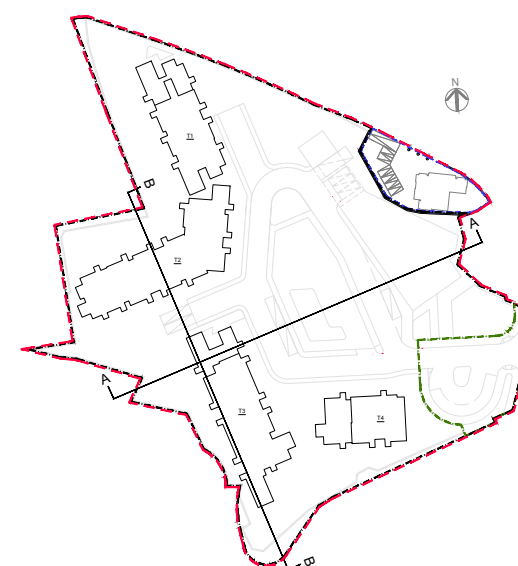
8/F FLOOR PLAN

- LEGEND
- CDA Zone Boundary
 - Application Site Boundary
 - Site (B) Boundary

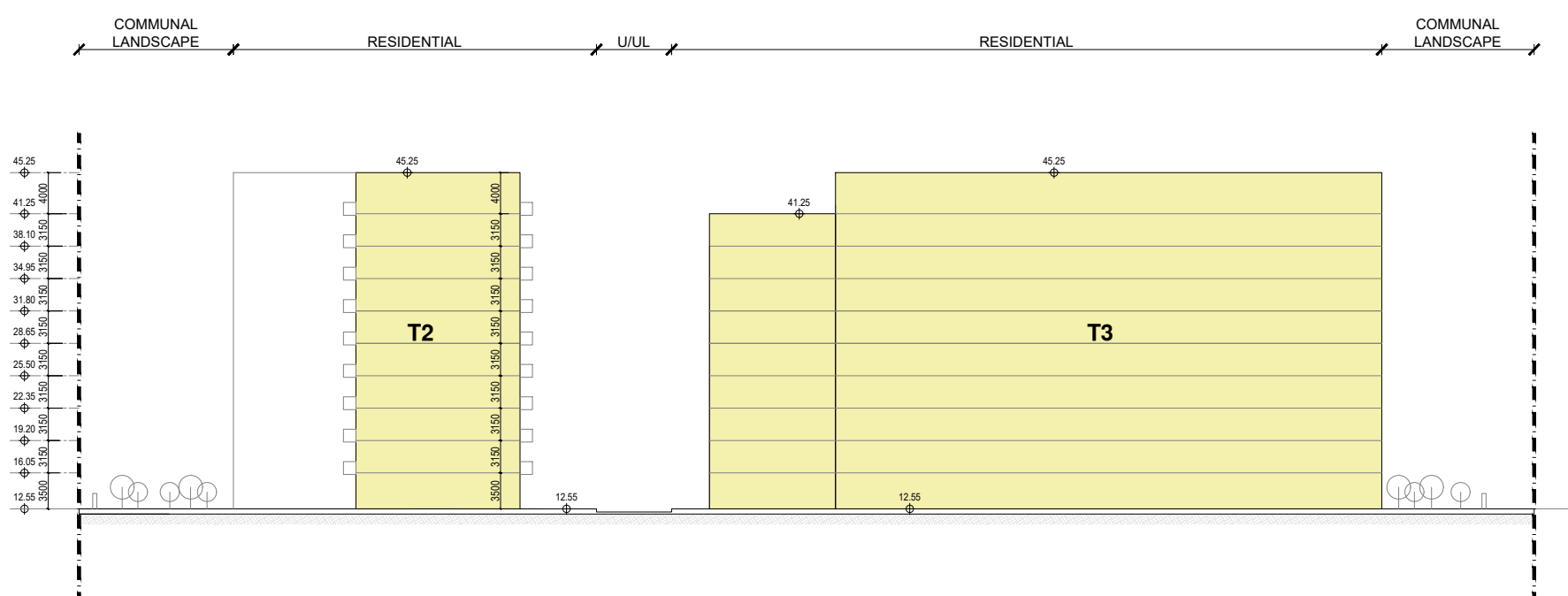


9/F FLOOR PLAN

- LEGEND
- CDA Zone Boundary
 - Application Site Boundary
 - Site (B) Boundary



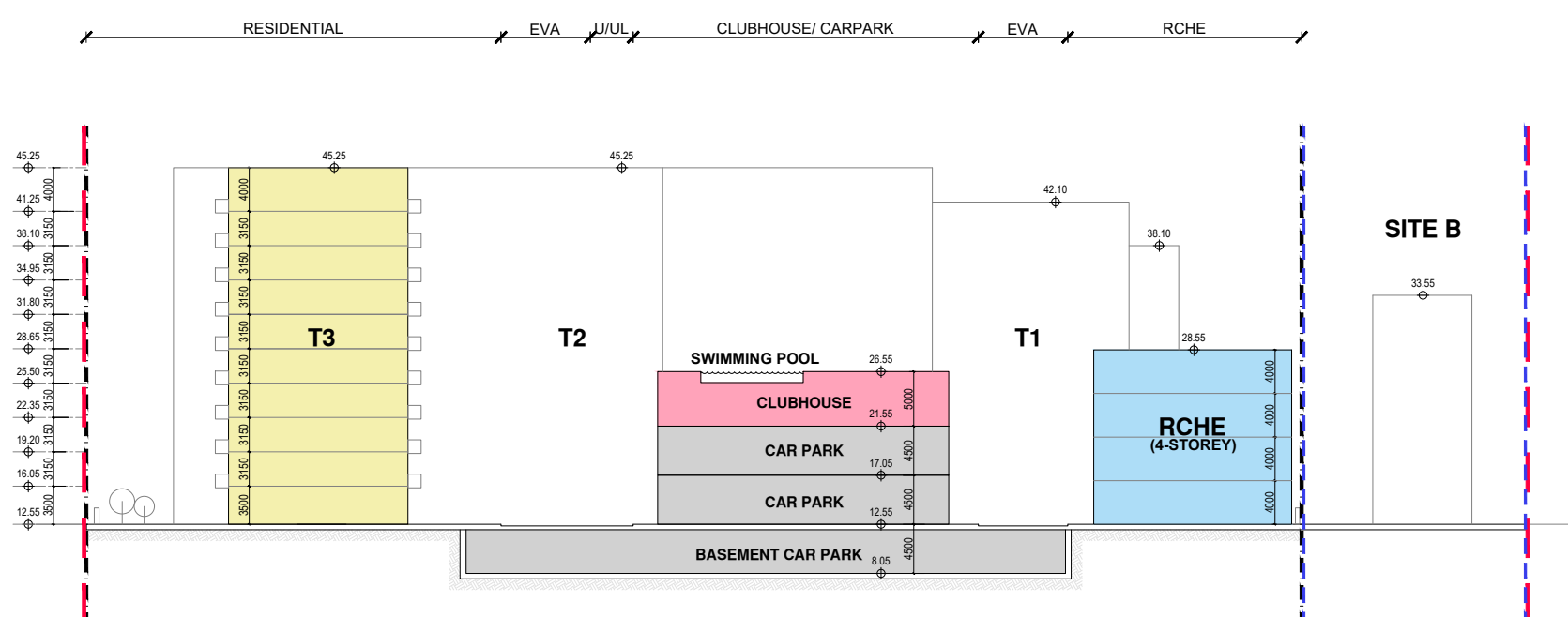
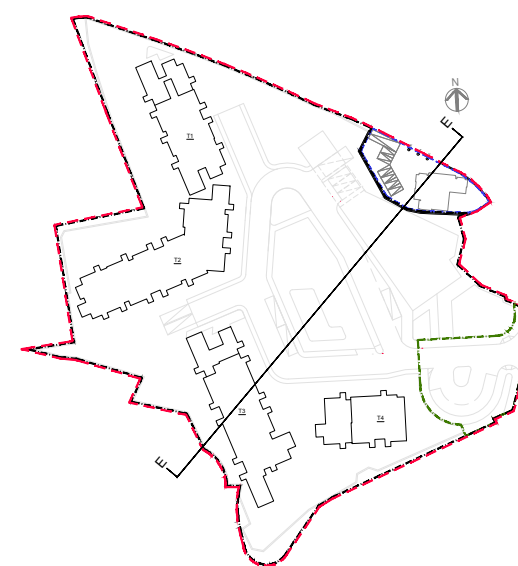
SCHEMATIC SECTION A



LEGEND

- CDA Zone Boundary
- Application Site Boundary

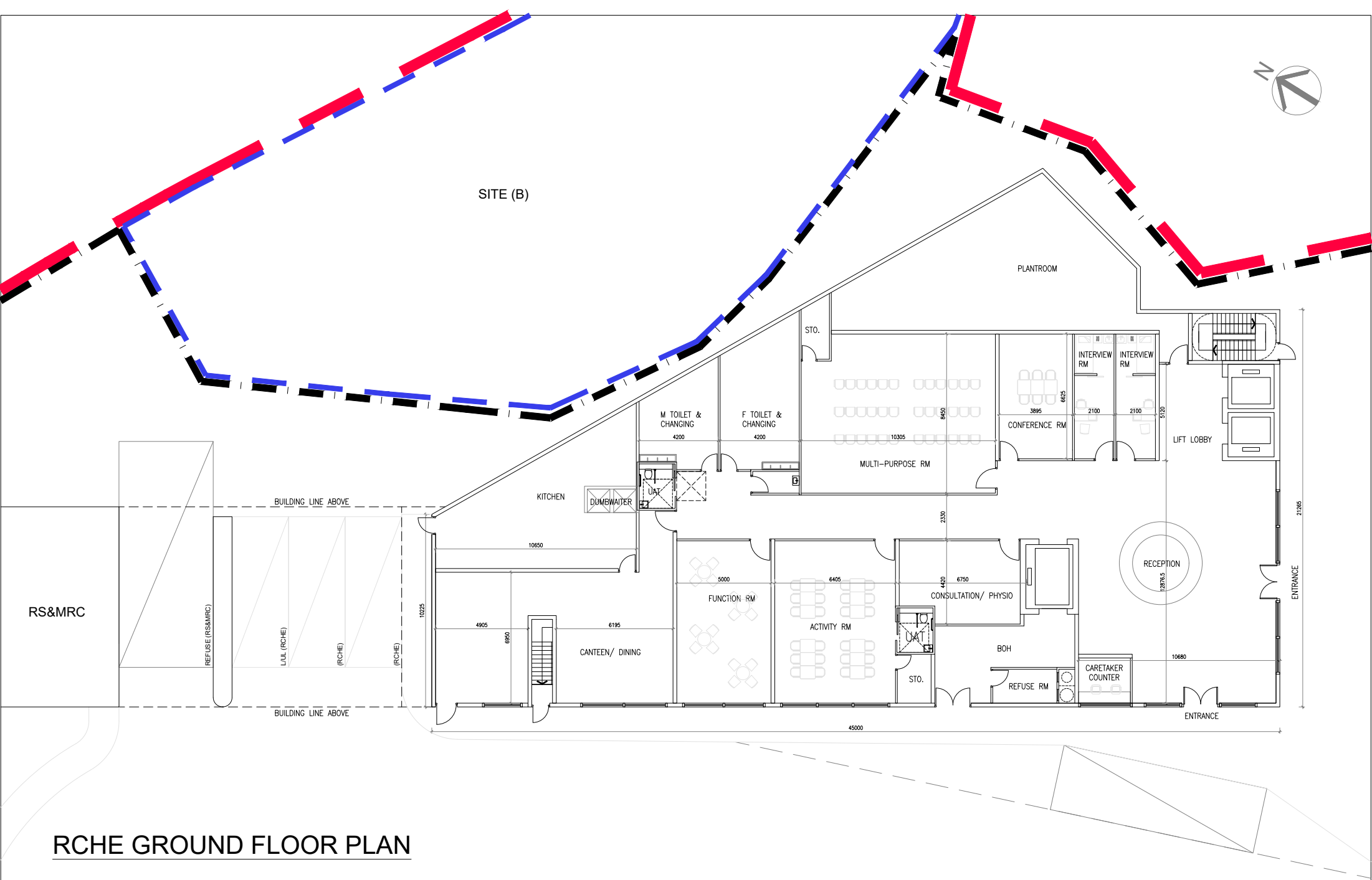
SCHEMATIC SECTION B



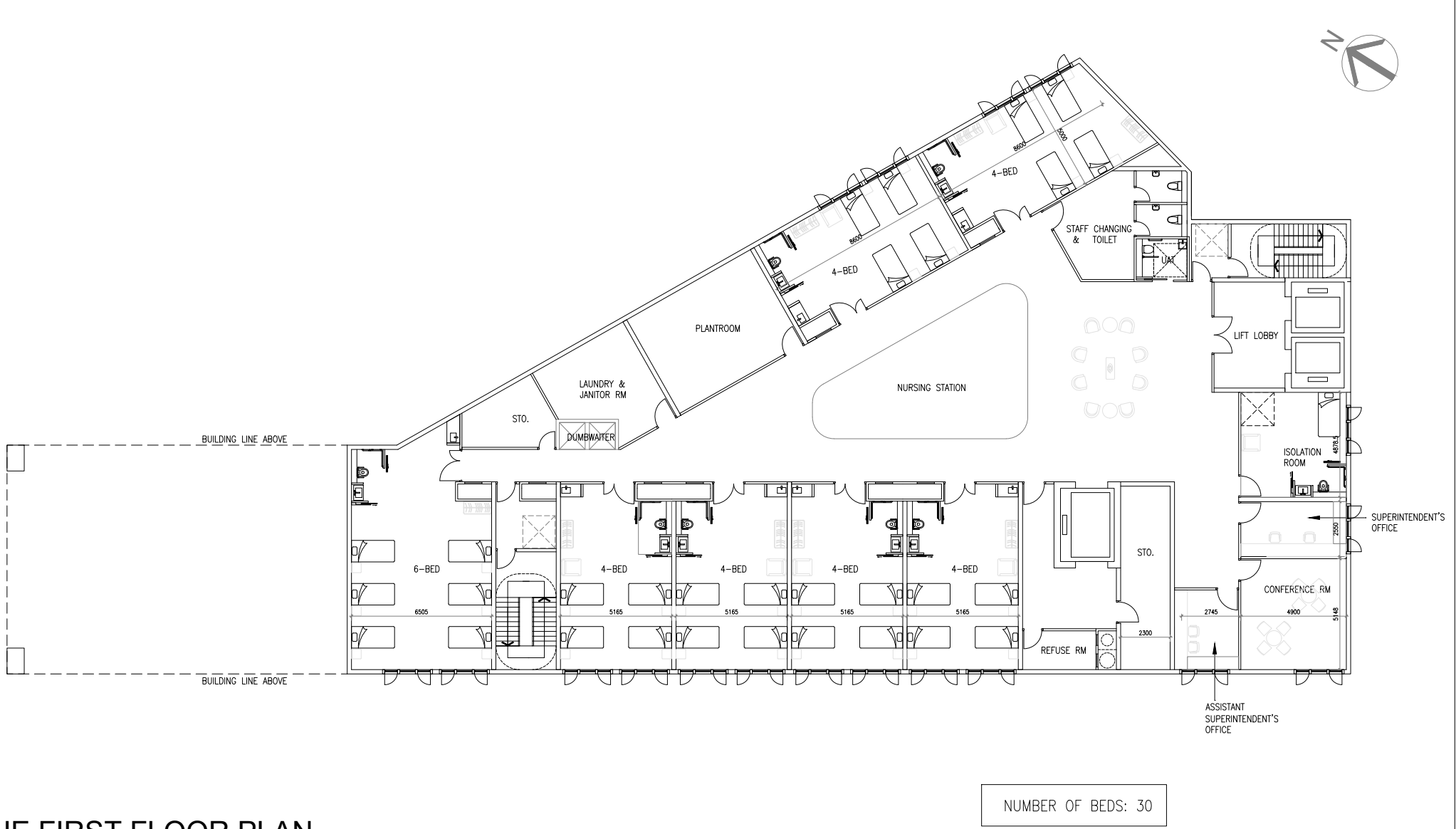
SCHEMATIC SECTION E

LEGEND

- CDA Zone Boundary
- Application Site Boundary
- Site (B) Boundary

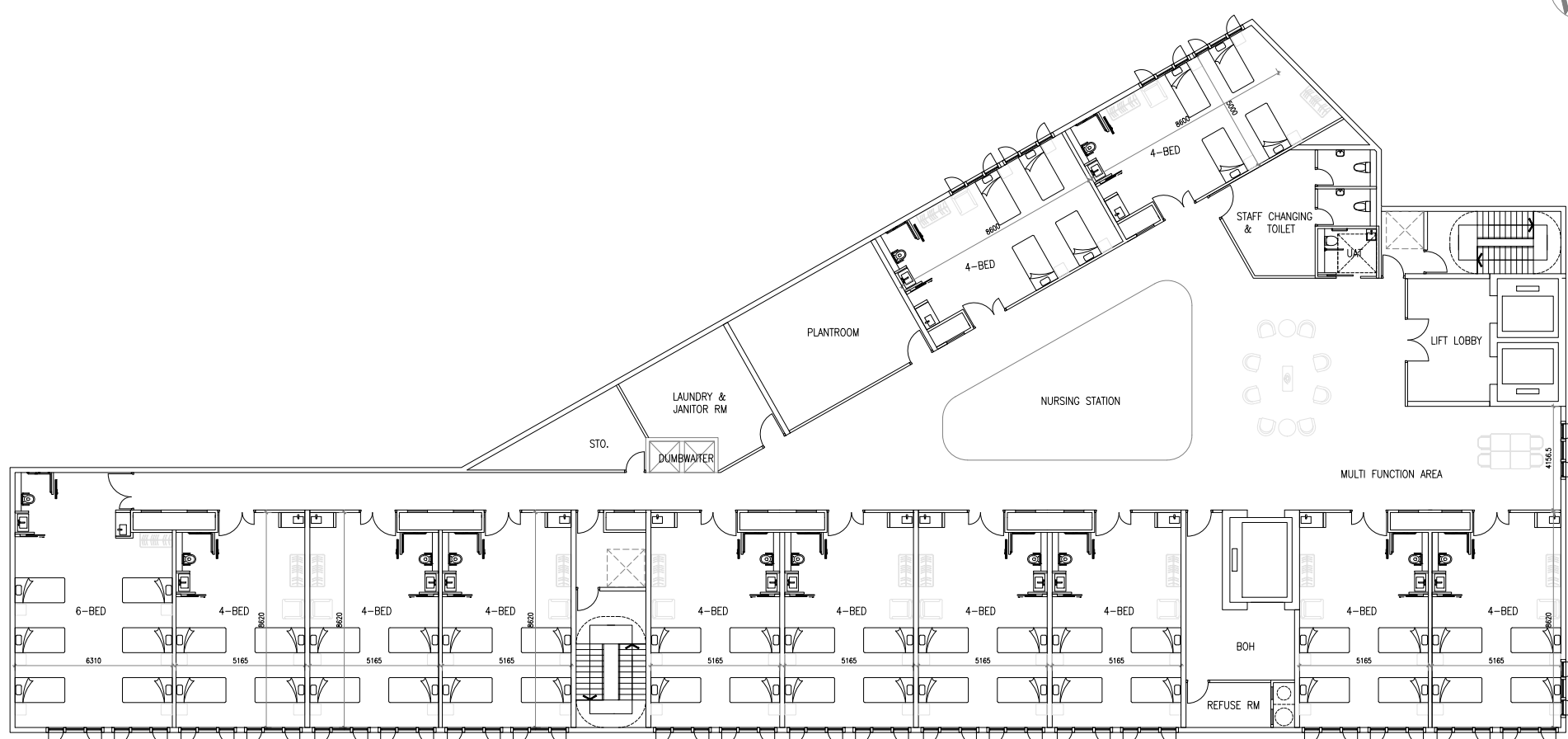


RCHE GROUND FLOOR PLAN



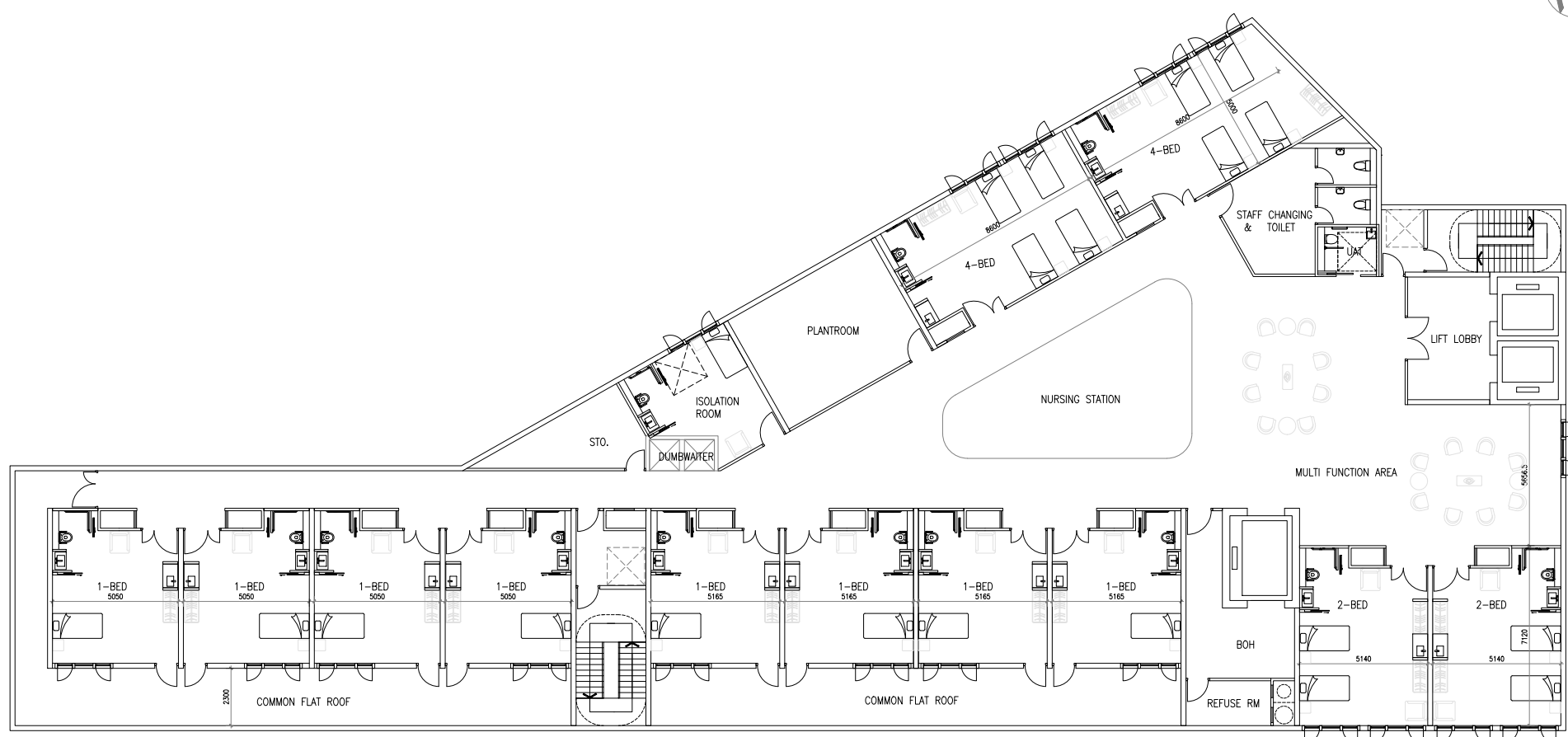
RCHE FIRST FLOOR PLAN

NUMBER OF BEDS: 30



NUMBER OF BEDS: 50

RCHE SECOND FLOOR PLAN



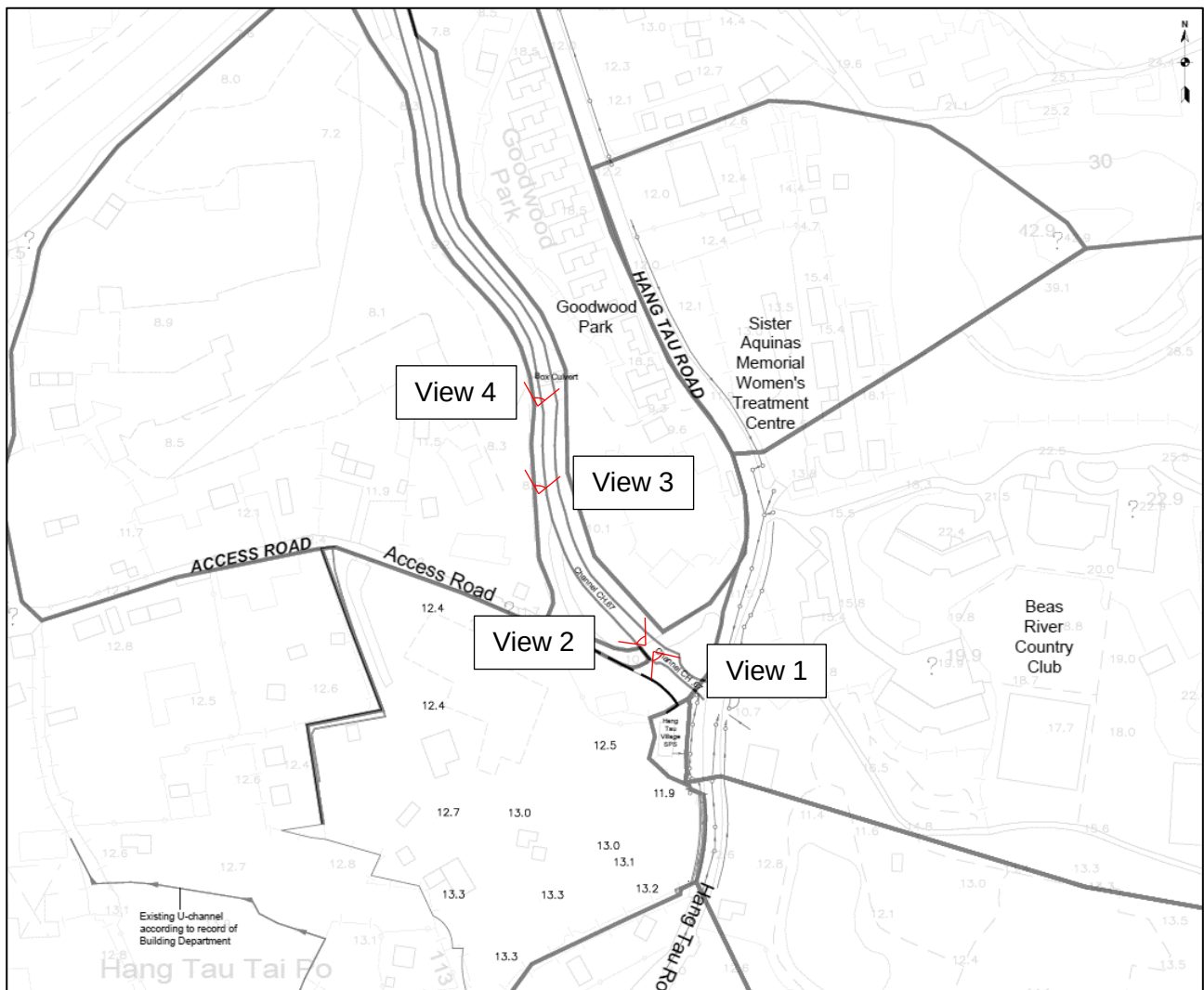
NUMBER OF BEDS: 20

RCHE THIRD FLOOR PLAN

Appendix 2.2

Site Photos and Aerial Photo for the Channel and Box Culvert

Appendix 2.2 Site Photos and Aerial Photo for the Channel and Box Culvert

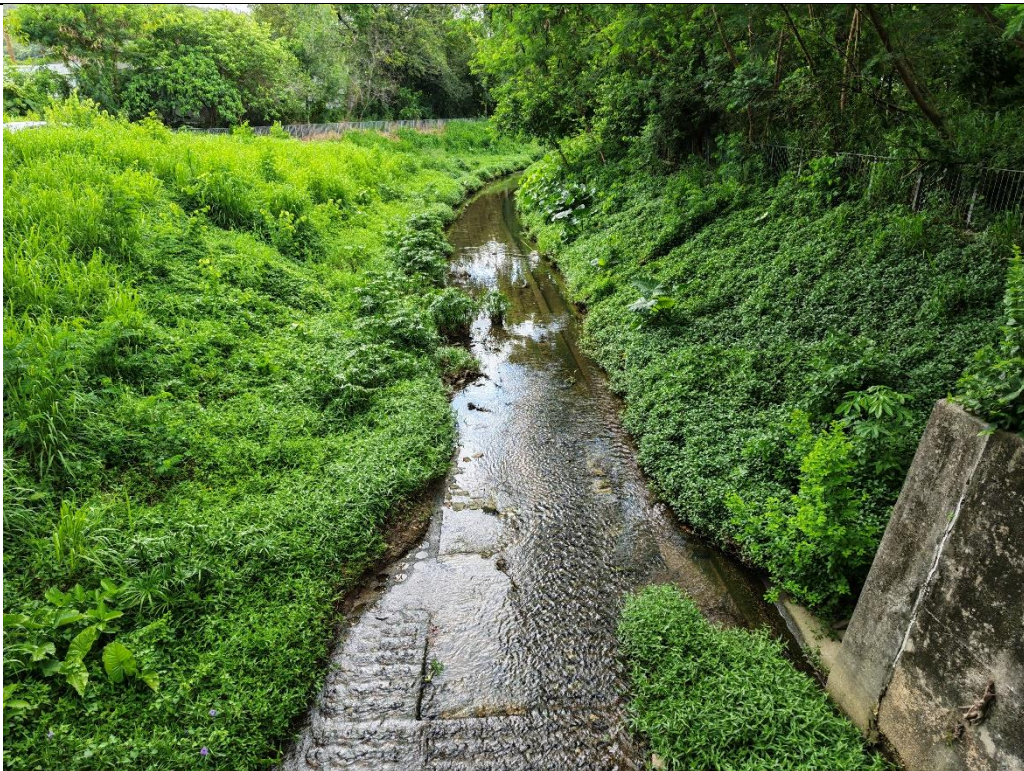


Appendix 2.2 Site Photos and Aerial Photo for the Channel and Box Culvert

Site Photo:



View 1



View 2



View 3



View 4

Appendix 2.2 Site Photos and Aerial Photo for the Channel and Box Culvert

Aerial Photo:



Appendix 3.1

Detailed Drainage Analysis for Per-development Scenario

A. Calculation of Runoff (50 years return period)

Catchment ID	Surface Type	Catchment Area (A), m ²	Catchment Area (A), km ²	Average slope (H), m/100m	Flow path length (L), m	Inlet time (t ₀), min	Time of Concentration (t _c), min	Duration (t _d), min	a ^[1]	b ^[1]	c ^[1]	Rainfall Increase due to Climate Change ^[2]	Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q _p), m ³ /s
Before Development																
A	80% Grassland (Heavy Soil), Flat + 20% concrete	18,724	0.0187	0.05	182.0	17.59	17.59	17.59	474.6	2.9	0.37	16.0%	180	0.39	0.0073	0.37
E	100% concrete	410	0.0004	3.72	14.2	0.86	0.86	0.86	474.6	2.9	0.37	16.0%	337	0.95	0.0004	0.04
F	10% Grassland (Heavy Soil), Steep + 90% concrete	157,117	0.1571	8.47	229.0	6.53	6.53	6.53	474.6	2.9	0.37	16.0%	240	0.89	0.1398	9.33
G	100% concrete	34,637	0.0346	0.94	115.1	5.92	5.92	5.92	474.6	2.9	0.37	16.0%	246	0.95	0.0329	2.25
H	96% Grassland (Heavy Soil), Flat + 4% concrete	276,309	0.2763	3.83	445.9	14.09	14.09	14.09	474.6	2.9	0.37	16.0%	193	0.28	0.0768	4.12
I	74% Grassland (Heavy Soil), Flat + 26% concrete	62,623	0.0626	5.11	172.1	5.95	5.95	5.95	474.6	2.9	0.37	16.0%	246	0.43	0.0271	1.85
J	69% Grassland (Heavy Soil), Steep + 11% concrete	94,014	0.0940	38.21	95.0	2.11	2.11	2.11	474.6	2.9	0.37	16.0%	303	0.42	0.0391	3.30
K	88% Grassland (Heavy Soil), Flat + 12% concrete	38,004	0.0380	20.09	118.1	3.27	3.27	3.27	474.6	2.9	0.37	16.0%	281	0.33	0.0127	0.99
L	60% Grassland (Heavy Soil), Flat + 40% concrete	40,988	0.0410	1.03	135.3	6.72	6.72	6.72	474.6	2.9	0.37	16.0%	238	0.53	0.0217	1.44
N	30% Grassland (Heavy Soil), Flat + 70% concrete	16,005	0.0160	1.75	34.3	1.69	1.69	1.69	474.6	2.9	0.37	16.0%	313	0.74	0.0118	1.03
M	20% Grassland (Heavy Soil), Steep + 74% concrete	18,118	0.0181	20.21	85.5	2.54	2.54	2.54	474.6	2.9	0.37	16.0%	294	0.79	0.0144	1.18

Note

Runoff is calculated in accordance with DSD's "Stormwater Drainage Manual - Planning, Design and Managemen t" (SDM), fifth edition, January 2018.

Rainfall Increase due to the climate change effects up to mid 21st Century has been adopted with reference to Table 28 of DSD's SDM, fifth edition, January 2018.

[1] Table 3d - Storm Constants for Different Return Periods of North District Area in the SDM Corrigendum No. 1/2024 (26 March 2024) has been adopted.

[2] Table 28 - Rainfall increase for End of 21st Century in the SDM Corrigendum No. 1/2022 has been adopted.

Equations Used

$$t_0 = \frac{0.14465L}{H^{0.2}A^{0.1}}$$

$$t_c = t_0 + t_f$$

$$i = \frac{a}{(t_d + b)^c}$$

$$Q_p = 0.278 C i A$$

B. Estimated Pipe Capacity and Adequacy Check for the Proposed Upgrading Drainage System

Drainage Pipe	Diameter, m	Length, m	Level (out), mPD	Level (in), mPD	Slope	Manning's roughness coefficient	Cross Section Area, m ² [4]	Wetted perimeter, m	Hydraulic radius, m	Mean velocity, m/s	Capacity flow, m ³ /s [4]	Catchments Served	Runoff, m ³ /s	% of capacity flow	Sufficient Capacity? (Y/N)	Flow time (t _f), min
A1 - A2	0.300	6.9	10.80	10.65	0.022	0.015	0.064	0.942	0.07	1.63	0.104	A	0.42	405%	N	0.07
A2 - A3	0.300	3.4	9.55	9.30	0.074	0.015	0.064	0.942	0.07	3.01	0.191	A	0.42	219%	N	0.02
A3 - A4	0.300	6.0	9.30	9.20	0.017	0.015	0.064	0.942	0.07	1.42	0.090	A	0.42	463%	N	0.07
A4 - A5	0.450	12.3	9.05	8.75	0.024	0.015	0.143	1.414	0.10	2.27	0.324	A and E	0.46	141%	N	0.09
A5 - A6	0.450	9.4	8.75	8.58	0.018	0.015	0.143	1.414	0.10	1.95	0.279	A and E	0.46	163%	N	0.08
A6 - A7	0.450	3.4	8.58	8.50	0.024	0.015	0.143	1.414	0.10	2.23	0.319	A and E	0.46	143%	N	0.03

Stream	Width, m	Depth, m	Slope [3]	Manning's roughness coefficient	Cross Section Area, m ² [4]	Wetted perimeter, m	Hydraulic radius, m	Mean velocity, m/s	Capacity flow, m ³ /s	Catchments Served	Runoff, m ³ /s	% of capacity flow	Sufficient Capacity? (Y/N)
Channel - CH. 67	Note [1]	Note [1]	0.003	0.035	14.030	11.486	1.22	1.76	24.660	A, E to K	22.55	91%	Y
Box Culvert	Note [2]	Note [2]	0.008	0.016	11.822	20.359	0.58	3.95	46.755	A, E to M	26.20	56%	Y

Note

[1] Dimension of Channel - CH.67 was adopted and referred to the As-built Drawing of the Channel in Appendix 3.2(Section B - AT CH.67 in Drawing No. MCL-118CD-P-KTS08-D111).

[2] Dimension of Box Culvert was referred to the As-built Drawing of the Channel in Appendix 3.2 (Section B in Drawing No. MCL-118CD-P-KTS08-S407).

[3] Slope of Channel - CH.67 and Box Culvert were referred to As-built Drawing of the Channel in Appendix 3.2 (Drawing No. MCL-118CD-P-KTS08-D101).

[4] A 5% reduction in flow area shall be applied if the gradient is greater than or equal to 1 in 25, and a 10% reduction in flow area shall be applied if the gradient is less than 1 in 25.

Appendix 3.2

Detailed Drainage Analysis for Post-development Scenario

A. Calculation of Runoff (50 years return period)

Catchment ID	Surface Type	Catchment Area (A), m ²	Catchment Area (A), km ²	Average slope (H), m/100m	Flow path length (L), m	Inlet time (t ₀), min	Time of Concentration (t _c), min	Duration (t _d), min	a ^[1]	b ^[1]	c ^[1]	Rainfall Increase due to Climate Change ^[2]	Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q _p), m ³ /s
After Development																
A	25% Grassland (Heavy Soil), Flat + 75% concrete	18,724	0.0187	0.05	182.0	17.59	17.59	17.59	474.6	2.9	0.37	16.0%	180	0.78	0.0145	0.73
E	100% concrete	410	0.0004	3.72	14.2	0.86	0.86	0.86	474.6	2.9	0.37	16.0%	337	0.95	0.0004	0.04
F	10% Grassland (Heavy Soil), Steep + 90% concrete	157,117	0.1571	8.47	229.0	6.53	6.53	6.53	474.6	2.9	0.37	16.0%	240	0.89	0.1398	9.33
G	100% concrete	34,637	0.0346	0.94	115.1	5.92	5.92	5.92	474.6	2.9	0.37	16.0%	246	0.95	0.0329	2.25
H	96% Grassland (Heavy Soil), Flat + 4% concrete	276,309	0.2763	3.83	445.9	14.09	14.09	14.09	474.6	2.9	0.37	16.0%	193	0.28	0.0768	4.12
I	74% Grassland (Heavy Soil), Flat + 26% concrete	62,623	0.0626	5.11	172.1	5.95	5.95	5.95	474.6	2.9	0.37	16.0%	246	0.43	0.0271	1.85
J	69% Grassland (Heavy Soil), Steep + 11% concrete	94,014	0.0940	38.21	95.0	2.11	2.11	2.11	474.6	2.9	0.37	16.0%	303	0.42	0.0391	3.30
K	88% Grassland (Heavy Soil), Flat + 12% concrete	38,004	0.0380	20.09	118.1	3.27	3.27	3.27	474.6	2.9	0.37	16.0%	281	0.33	0.0127	0.99
L	60% Grassland (Heavy Soil), Flat + 40% concrete	40,988	0.0410	1.03	135.3	6.72	6.72	6.72	474.6	2.9	0.37	16.0%	238	0.53	0.0217	1.44
N	30% Grassland (Heavy Soil), Flat + 70% concrete	16,005	0.0160	1.75	34.3	1.69	1.69	1.69	474.6	2.9	0.37	16.0%	313	0.74	0.0118	1.03
M	20% Grassland (Heavy Soil), Steep + 74% concrete	18,118	0.0181	20.21	85.5	2.54	2.54	2.54	474.6	2.9	0.37	16.0%	294	0.79	0.0144	1.18

Note

Runoff is calculated in accordance with DSD's "Stormwater Drainage Manual - Planning, Design and Managemen t" (SDM), fifth edition, January 2018.

Rainfall Increase due to the climate change effects up to mid 21st Century has been adopted with reference to Table 28 of DSD's SDM, fifth edition, January 2018.

[1] Table 3d - Storm Constants for Different Return Periods of North District Area in the SDM Corrigendum No. 1/2024 (26 March 2024) has been adopted.

[2] Table 28 - Rainfall increase for End of 21st Century in the SDM Corrigendum No. 1/2022 has been adopted.

Equations Used

$$t_0 = \frac{0.14465L}{H^{0.2}A^{0.1}}$$

$$t_c = t_0 + t_f$$

$$i = \frac{a}{(t_d + b)^c}$$

$$Q_p = 0.278 C i A$$

B. Estimated Pipe Capacity and Adequacy Check for the Proposed Upgrading Drainage System

Drainage Pipe	Diameter, m	Length, m	Level (out), mPD	Level (in), mPD	Slope	Manning's roughness coefficient	Cross Section Area, m ² [4]	Wetted perimeter, m	Hydraulic radius, m	Mean velocity, m/s	Capacity flow, m ³ /s [4]	Catchments Served	Runoff, m ³ /s	% of capacity flow	Sufficient Capacity? (Y/N)	Flow time (t _f), min
T1 - A2	0.900	6.9	10.80	10.65	0.022	0.015	0.573	2.827	0.20	3.39	1.938	A	0.78	40%	Y	0.03
A2 - A3	0.900	3.4	9.55	9.30	0.074	0.015	0.573	2.827	0.20	6.25	3.580	A	0.78	22%	Y	0.01
A3 - A4	0.900	6.0	9.30	9.20	0.017	0.015	0.573	2.827	0.20	2.96	1.693	A	0.78	46%	Y	0.03
A4 - A5	0.900	12.3	9.05	8.75	0.024	0.015	0.573	2.827	0.20	3.60	2.059	A and E	0.82	40%	Y	0.06
A5 - A6	0.900	9.4	8.75	8.58	0.018	0.015	0.573	2.827	0.20	3.10	1.774	A and E	0.82	46%	Y	0.05
A6 - A7	0.900	3.4	8.58	8.50	0.024	0.015	0.573	2.827	0.20	3.53	2.024	A and E	0.82	40%	Y	0.02

Stream	Width, m	Depth, m	Slope [3]	Manning's roughness coefficient	Cross Section Area, m ² [4]	Wetted perimeter, m	Hydraulic radius, m	Mean velocity, m/s	Capacity flow, m ³ /s	Catchments Served	Runoff, m ³ /s	% of capacity flow	Sufficient Capacity? (Y/N)
Channel - CH. 67	Note [1]	Note [1]	0.003	0.035	14.030	11.486	1.22	1.76	24.660	A, E to K	22.91	93%	Y
Box Culvert	Note [2]	Note [2]	0.008	0.016	11.822	20.359	0.58	3.95	46.755	A, E to M	26.56	57%	Y

Note

[1] Dimension of Channel - CH.67 was adopted and referred to the As-built Drawing of the Channel in Appendix 3.2(Section B - AT CH.67 in Drawing No. MCL-118CD-P-KTS08-D111).

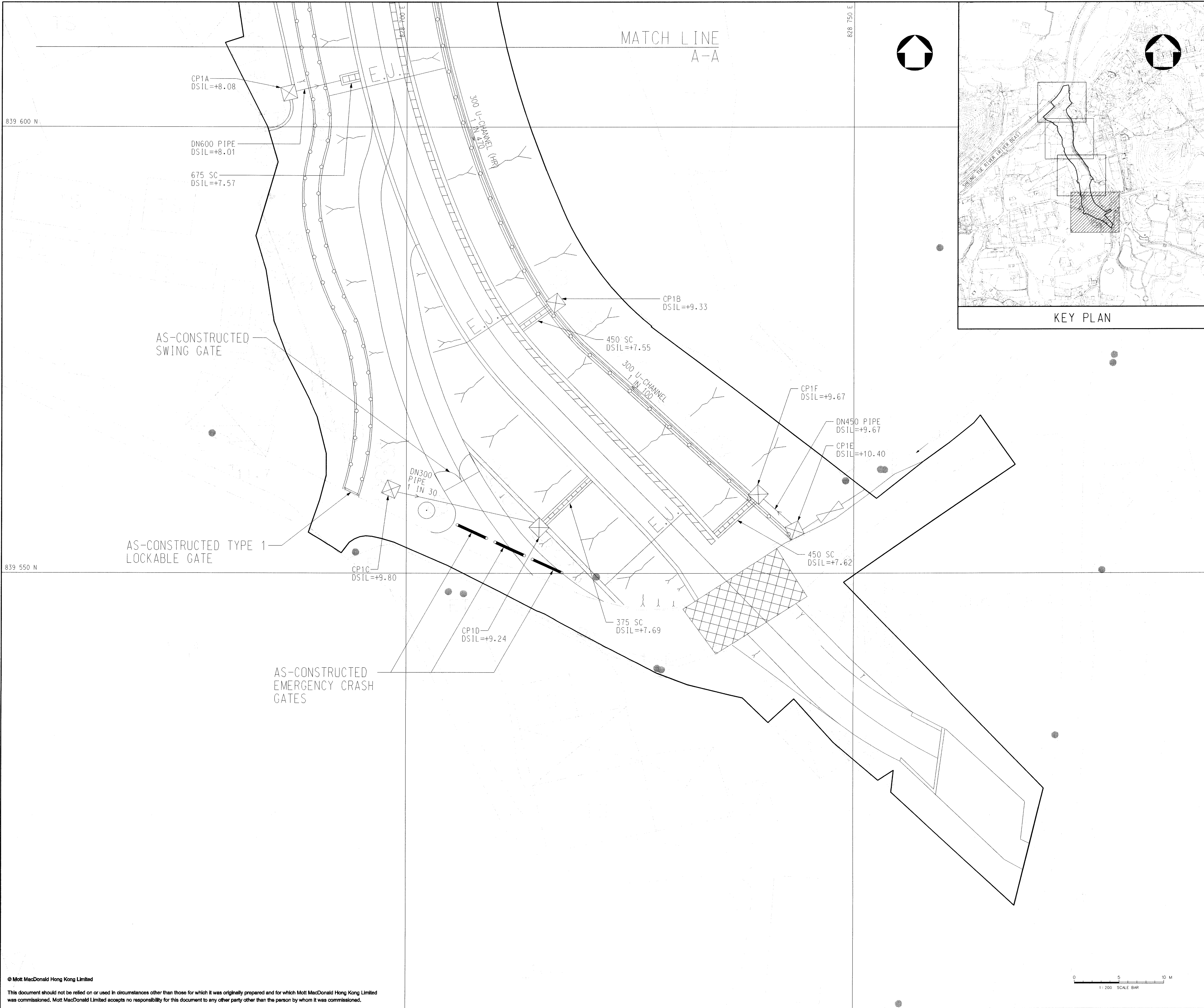
[2] Dimension of Box Culvert was referred to the As-built Drawing of the Channel in Appendix 3.2 (Section B in Drawing No. MCL-118CD-P-KTS08-S407).

[3] Slope of Channel - CH.67 and Box Culvert were referred to As-built Drawing of the Channel in Appendix 3.2 (Drawing No. MCL-118CD-P-KTS08-D101).

[4] A 5% reduction in flow area shall be applied if the gradient is greater than or equal to 1 in 25, and a 10% reduction in flow area shall be applied if the gradient is less than 1 in 25.

Appendix 3.3

As-built Drawing of the Channel and Box Culvert



NOTES:

1. FOR GENERAL NOTES REFER TO DRAWING Nos. MCL-118CD-P-PHASE2-GA000 & MCL-118CD-P-PHASE2-GA001.

KEY TO SYMBOLS

- SITE BOUNDARY
- CENTRE LINE OF AS-CONSTRUCTED CHANNEL
- AS-CONSTRUCTED SUB-SOIL DRAIN
- AS-CONSTRUCTED 300 U-CHANNEL
- AS-CONSTRUCTED TYPE 2 HANDRAILING
- FILLED SLOPE
- GRASSED PAVING BLOCKS
- AS-CONSTRUCTED 600(W) X 300(D) DRY WEATHER FLOW CHANNEL
- AS-CONSTRUCTED CATCHPIT WITH COVERS
- AS-CONSTRUCTED DSD STANDARD TYPE "E1" MANHOLE
- AS-CONSTRUCTED STAIRCASE OF 3m WIDE FOR MAINTENANCE
- AS-CONSTRUCTED STEPPED CHANNEL
- AS-CONSTRUCTED EMERGENCY CRASH GATE
- AS-CONSTRUCTED TYPE 1 LOCKABLE GATE
- AS-CONSTRUCTED SWING GATE

KEY PLAN

AB	JAN 11	CYC	AS-CONSTRUCTED DRAWING	SSC	JBK
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Drawn	CW	CW	Approved	TMC	
Dwg.Chk.	GT		Scale	1:200@A1	

Project 204521

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Rev

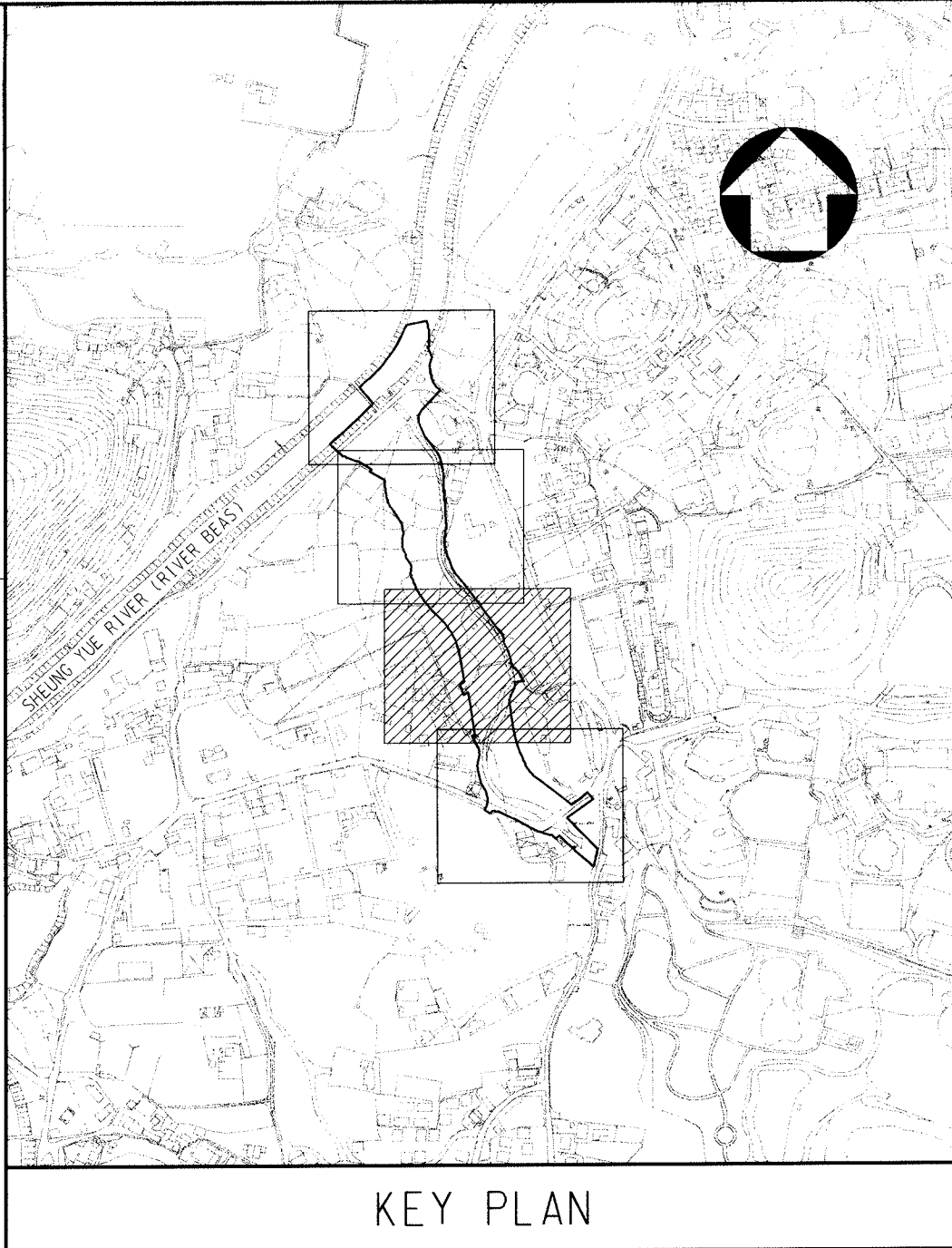
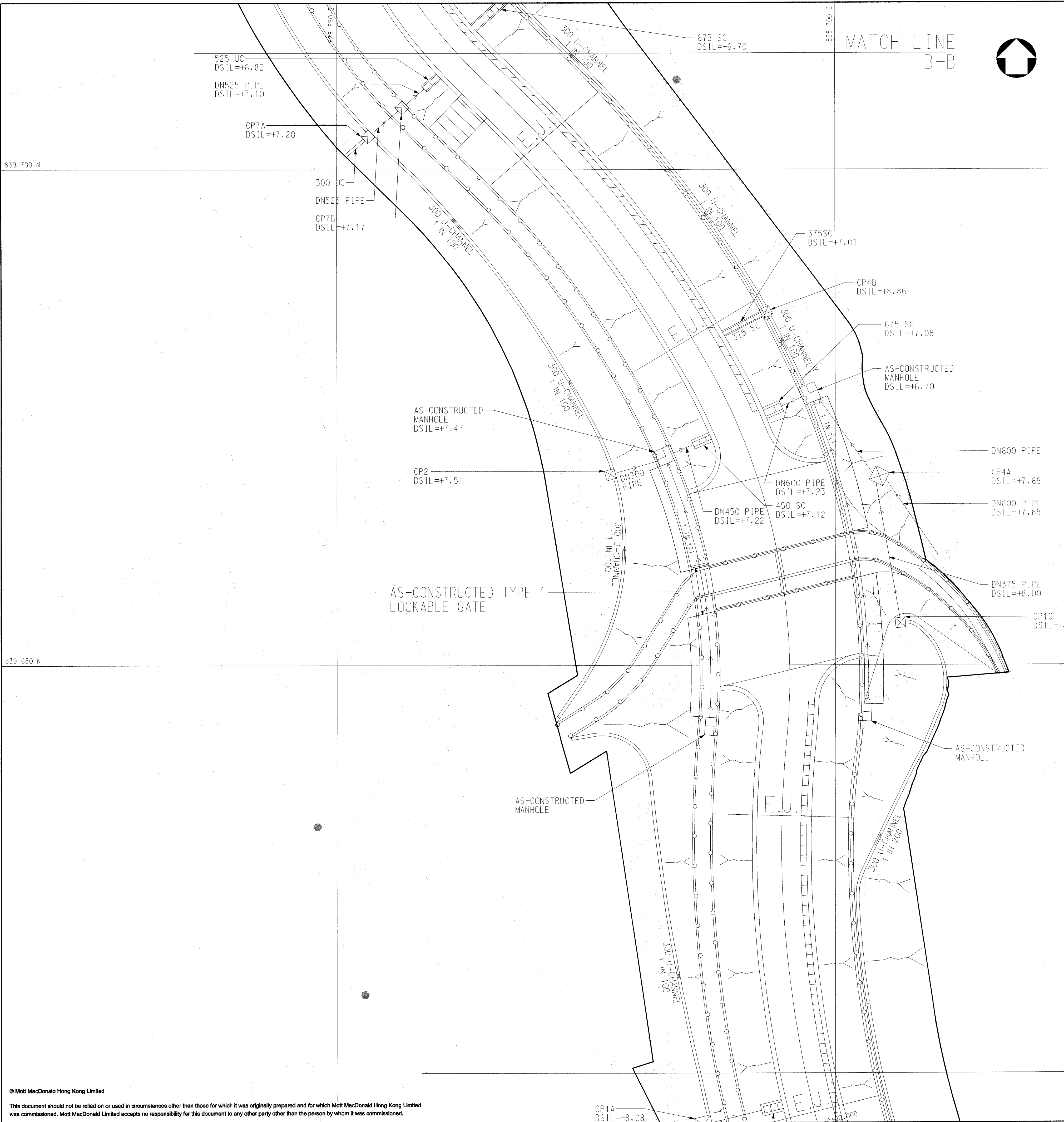
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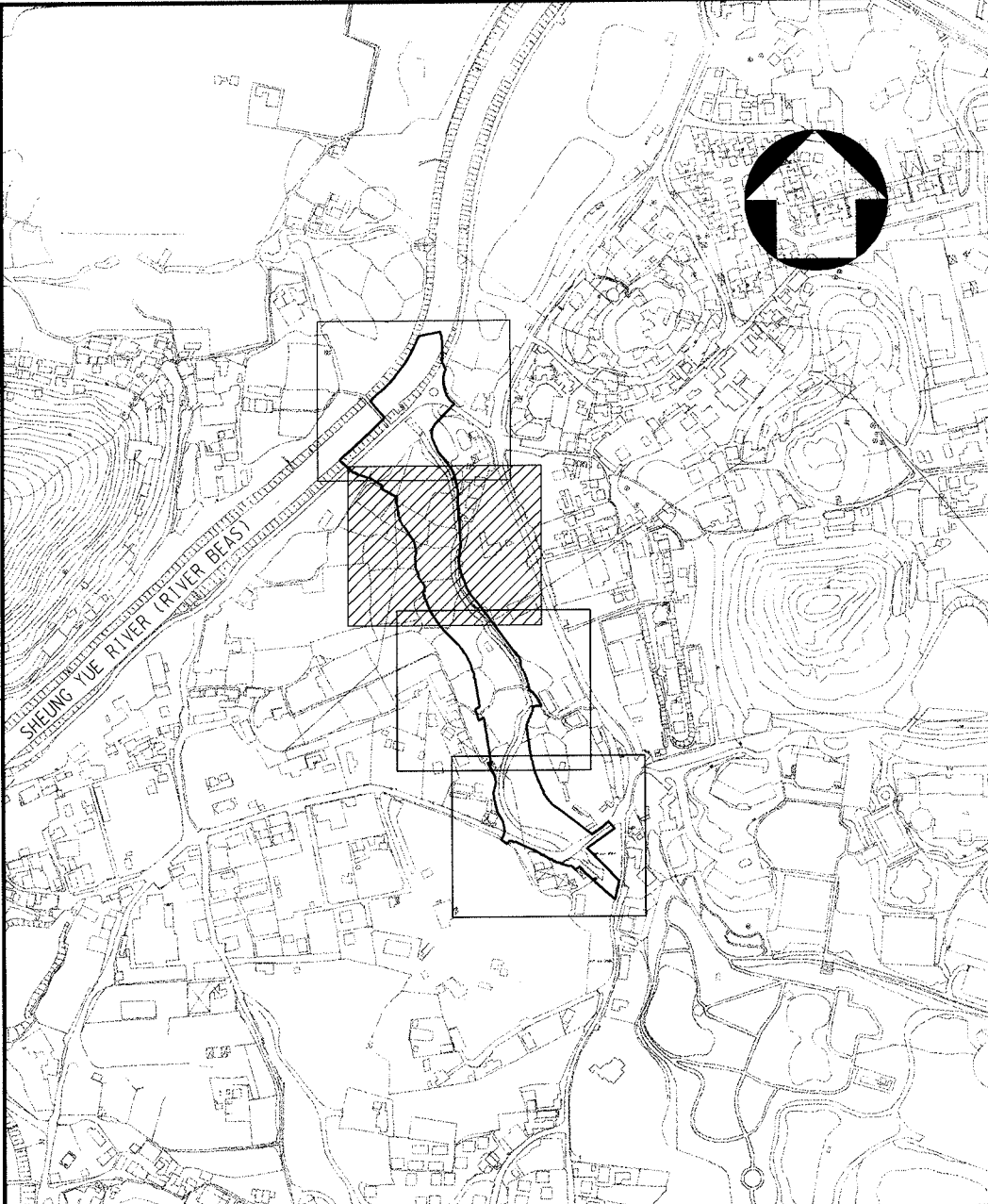
NOTES:

1. FOR GENERAL NOTES REFER TO DRAWING Nos. MCL-118CD-P-PHASE2-GA000 & MCL-118CD-P-PHASE2-GA001.

KEY TO SYMBOLS

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	AS-CONSTRUCTED SUB-SOIL DRAIN
	AS-CONSTRUCTED 300 U-CHANNEL
	AS-CONSTRUCTED TYPE 2 HANDRAILING
	FILLED SLOPE
	GRASSED PAVING BLOCKS
	AS-CONSTRUCTED 600(W) X 300(D) DRY WEATHER FLOW CHANNEL
	AS-CONSTRUCTED CATCHPIT WITH COVERS
	AS-CONSTRUCTED DSD STANDARD TYPE "E1" MANHOLE
	AS-CONSTRUCTED STAIRCASE OF 3m WIDE FOR MAINTENANCE
	AS-CONSTRUCTED STEPPED CHANNEL
	AS-CONSTRUCTED EMERGENCY CRASH GATE
	AS-CONSTRUCTED TYPE 1 LOCKABLE GATE
	AS-CONSTRUCTED SWING GATE

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	AS-CONSTRUCTED TYPE 1 LOCKABLE GATE
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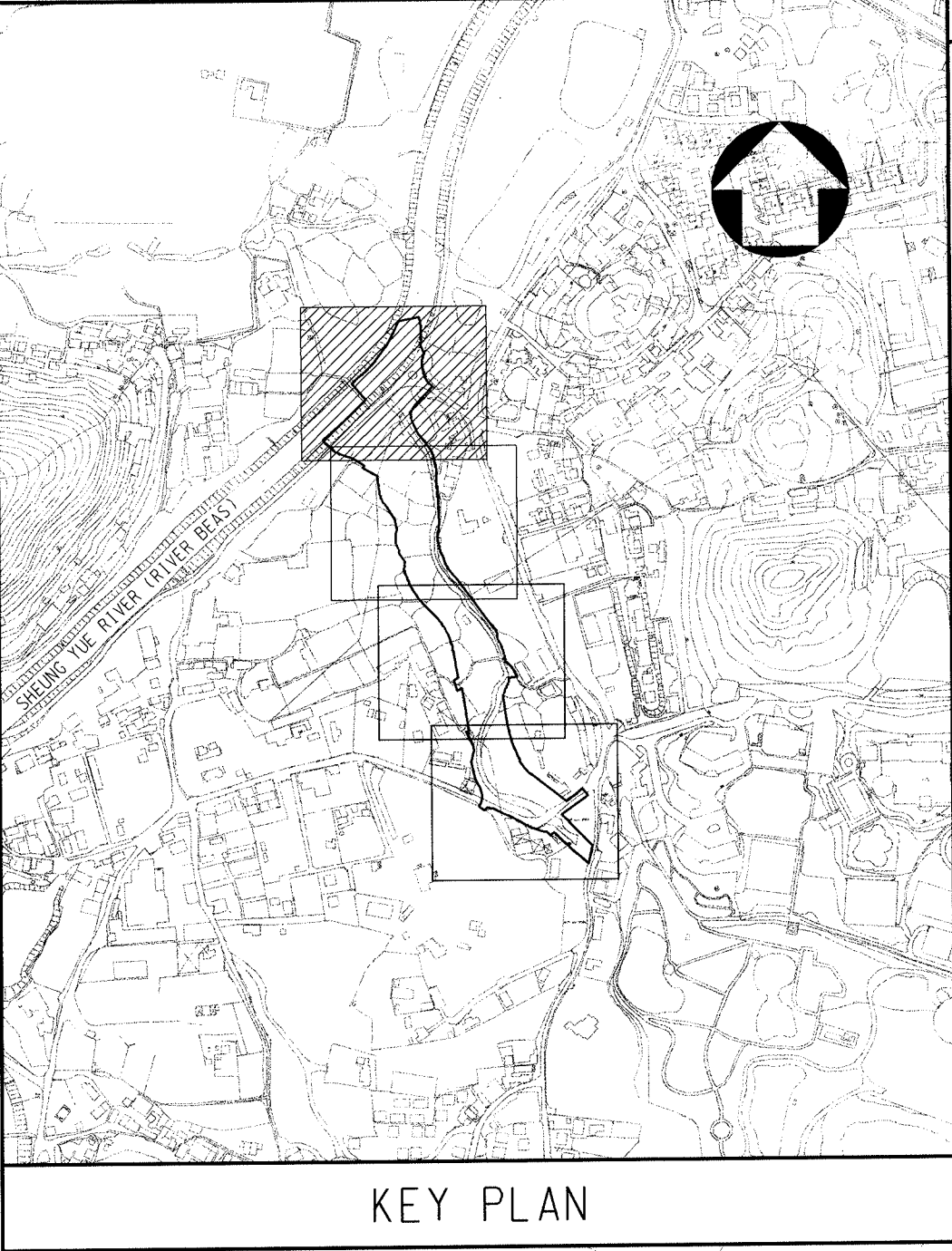
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GENERAL LAYOUT OF AS-CONSTRUCTED
DRAINAGE AND PERMANENT WORKS
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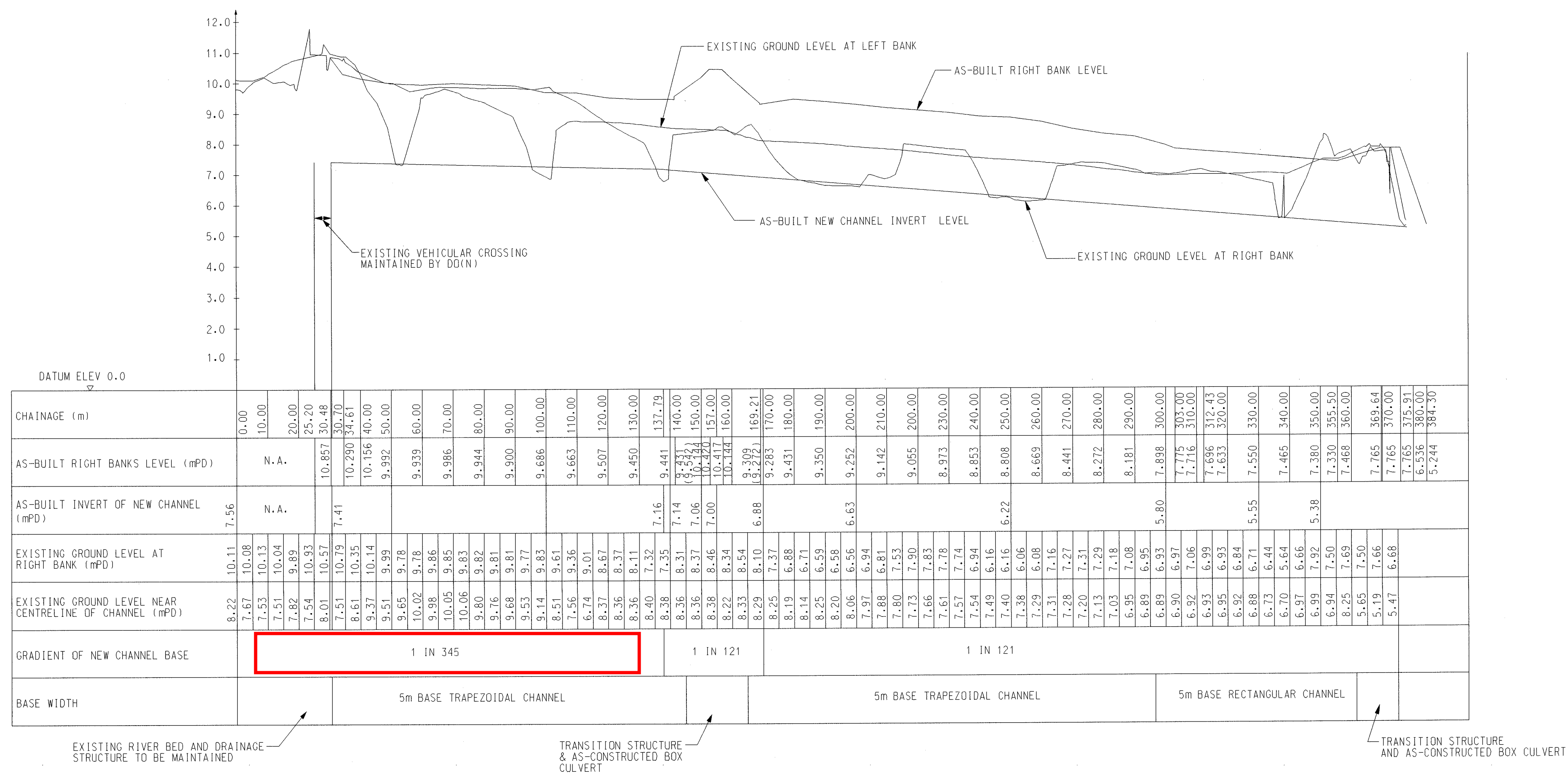
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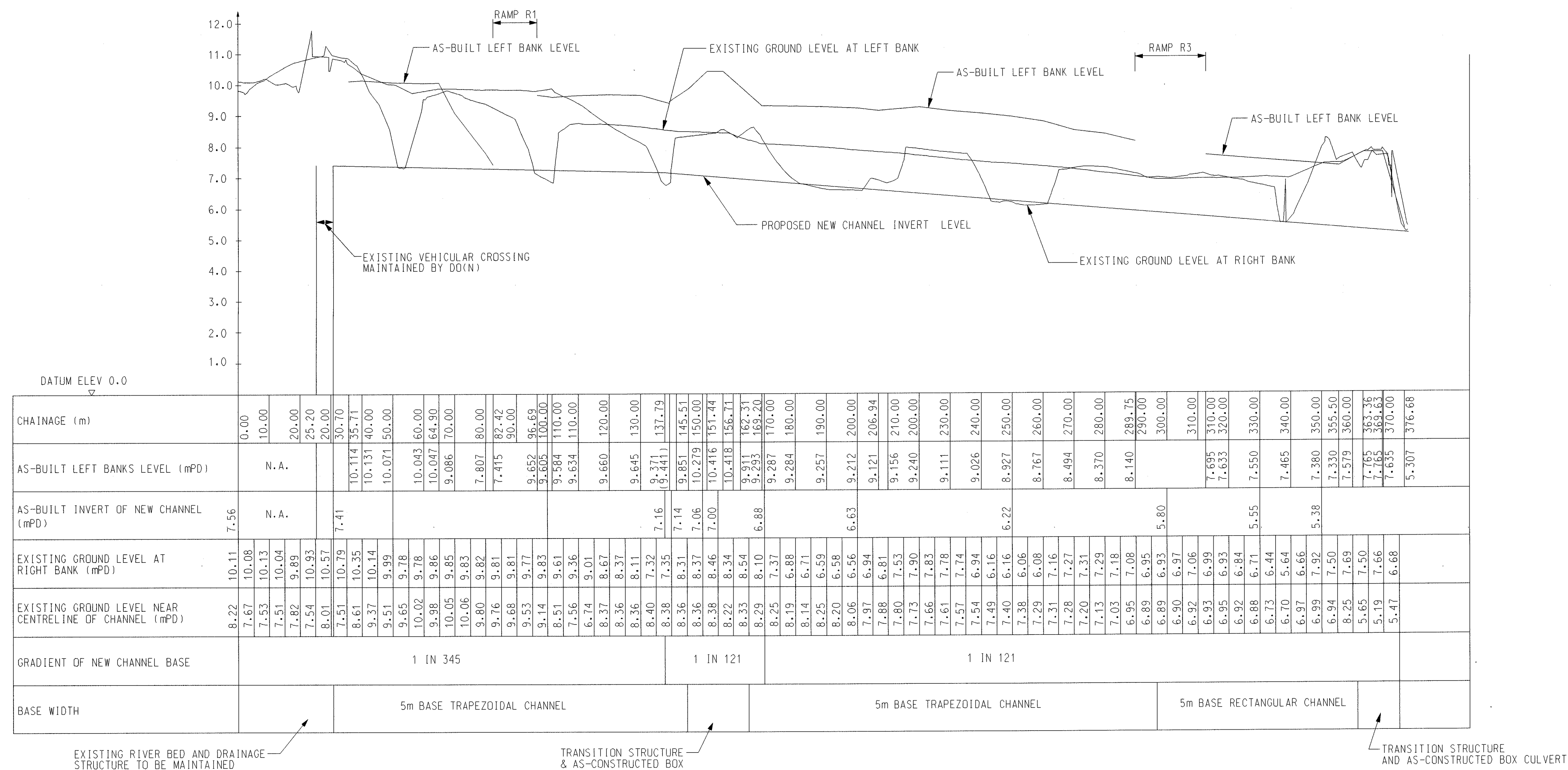
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Drawing No.	MCL-118CD-P-KTS08-D004				



LONGITUDINAL PROFILE OF KTS08 (R.H.S.)

SCALE: HORIZONTAL 1 : 1000
VERTICAL 1 : 100



LONGITUDINAL PROFILE OF KTS08 (L.H.S.)

SCALE: HORIZONTAL 1 : 1000
VERTICAL 1 : 100

Notes:

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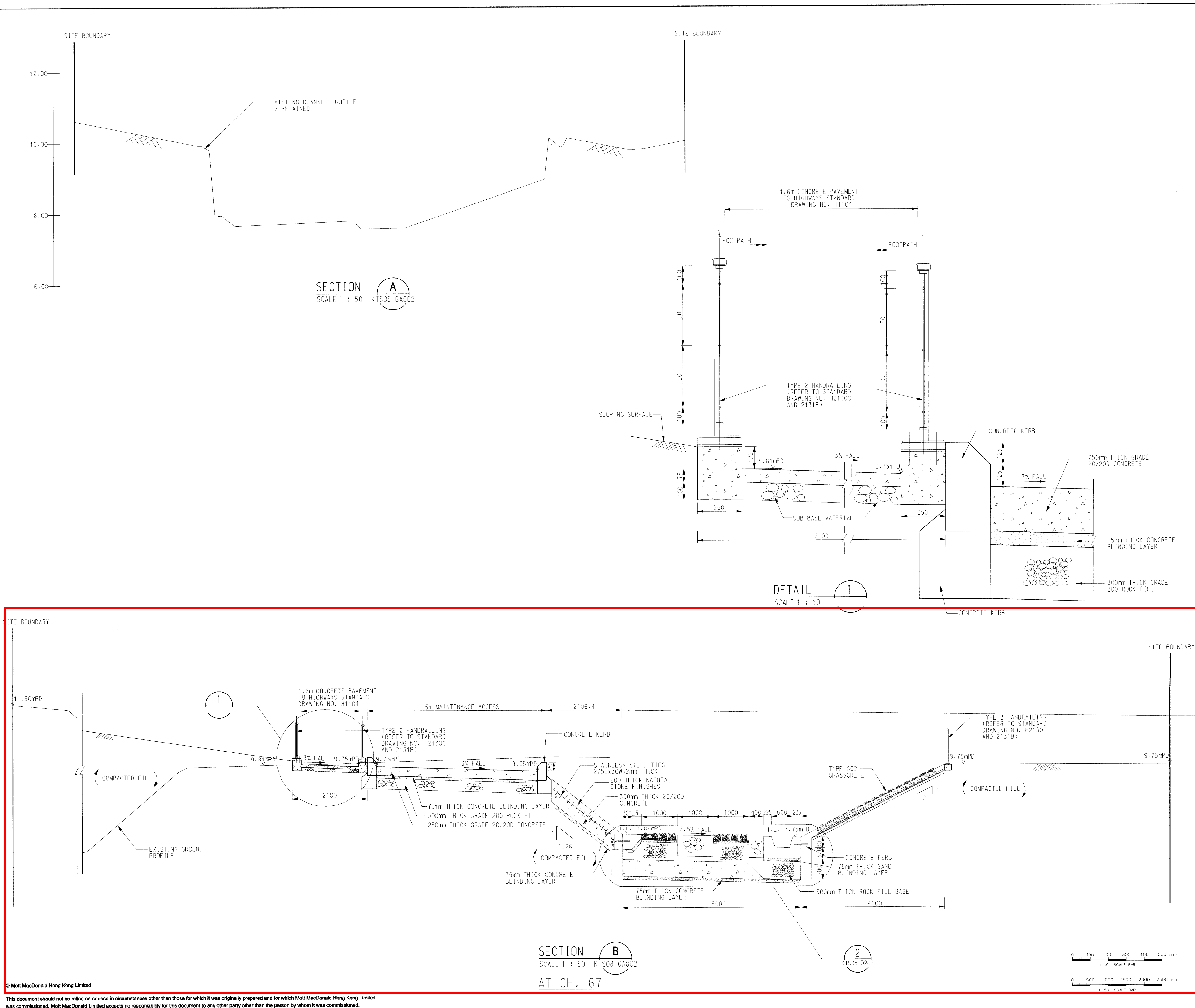
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Drainage Improvement Works
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Drawing Title

CHANNEL KTS08
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 2. FOR DETAILS OF CROSS SECTION REFER TO DRAWING NO. MCL-118CD-P-KTS08-GA002.
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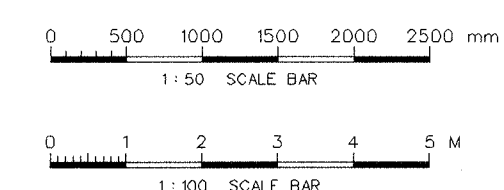
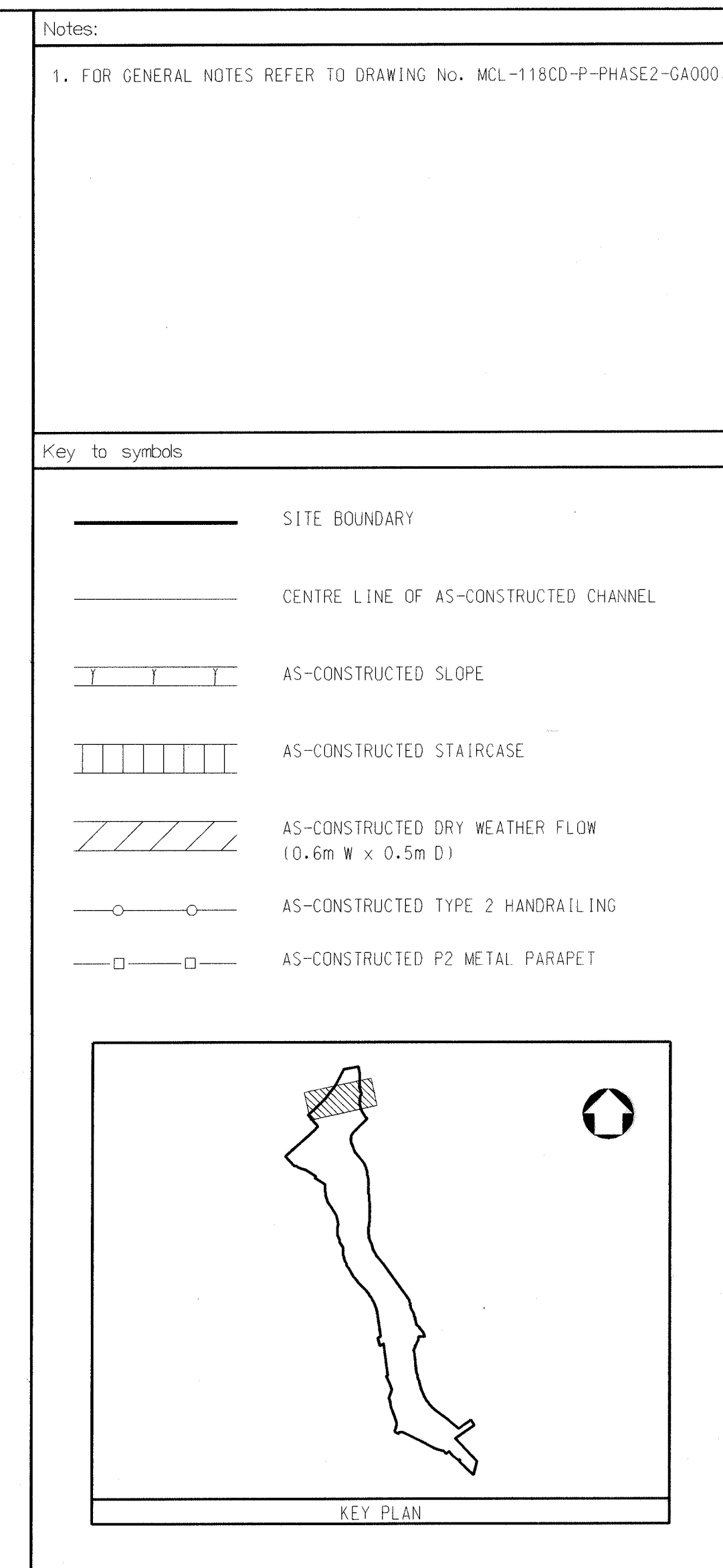
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Drawing Title
CHANNEL KTS08
SECTIONS & DETAILS
(SHEET 1 OF 12)

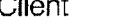
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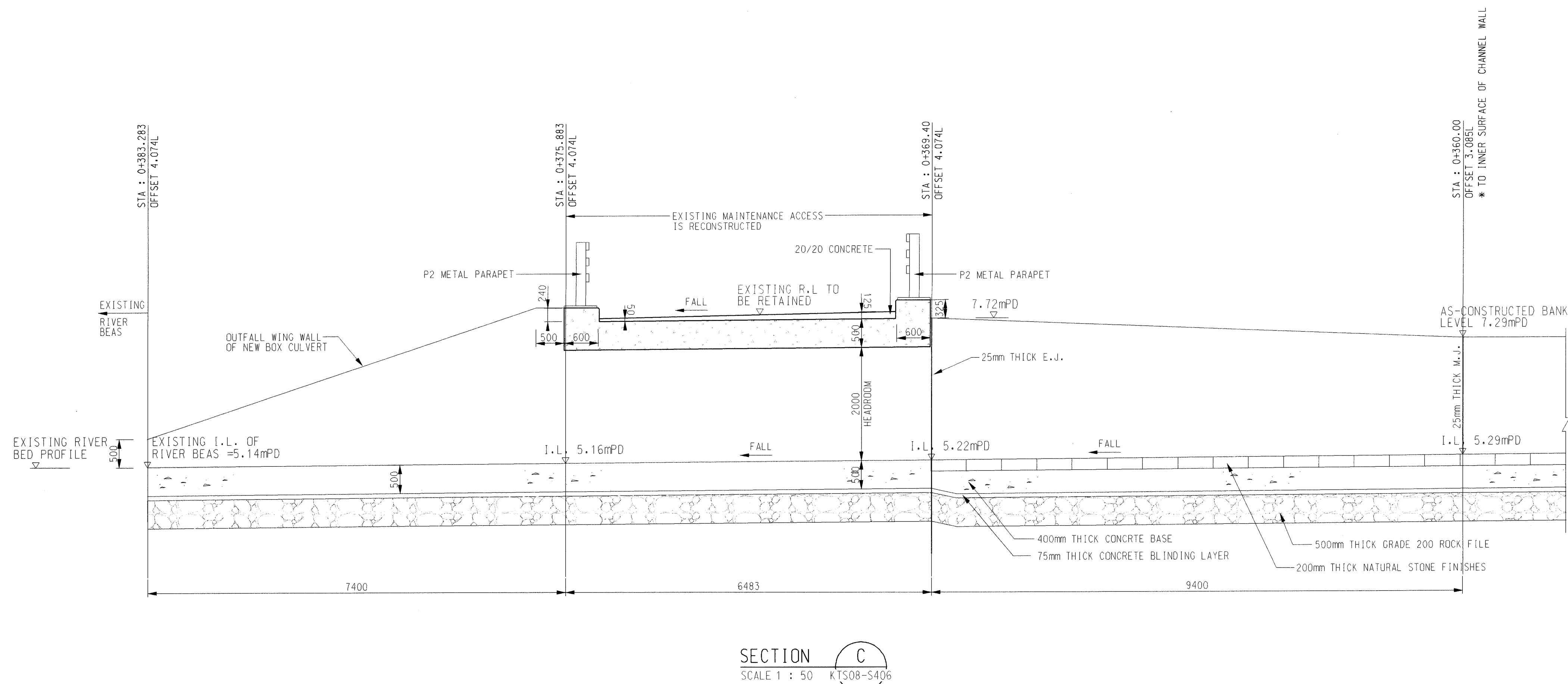
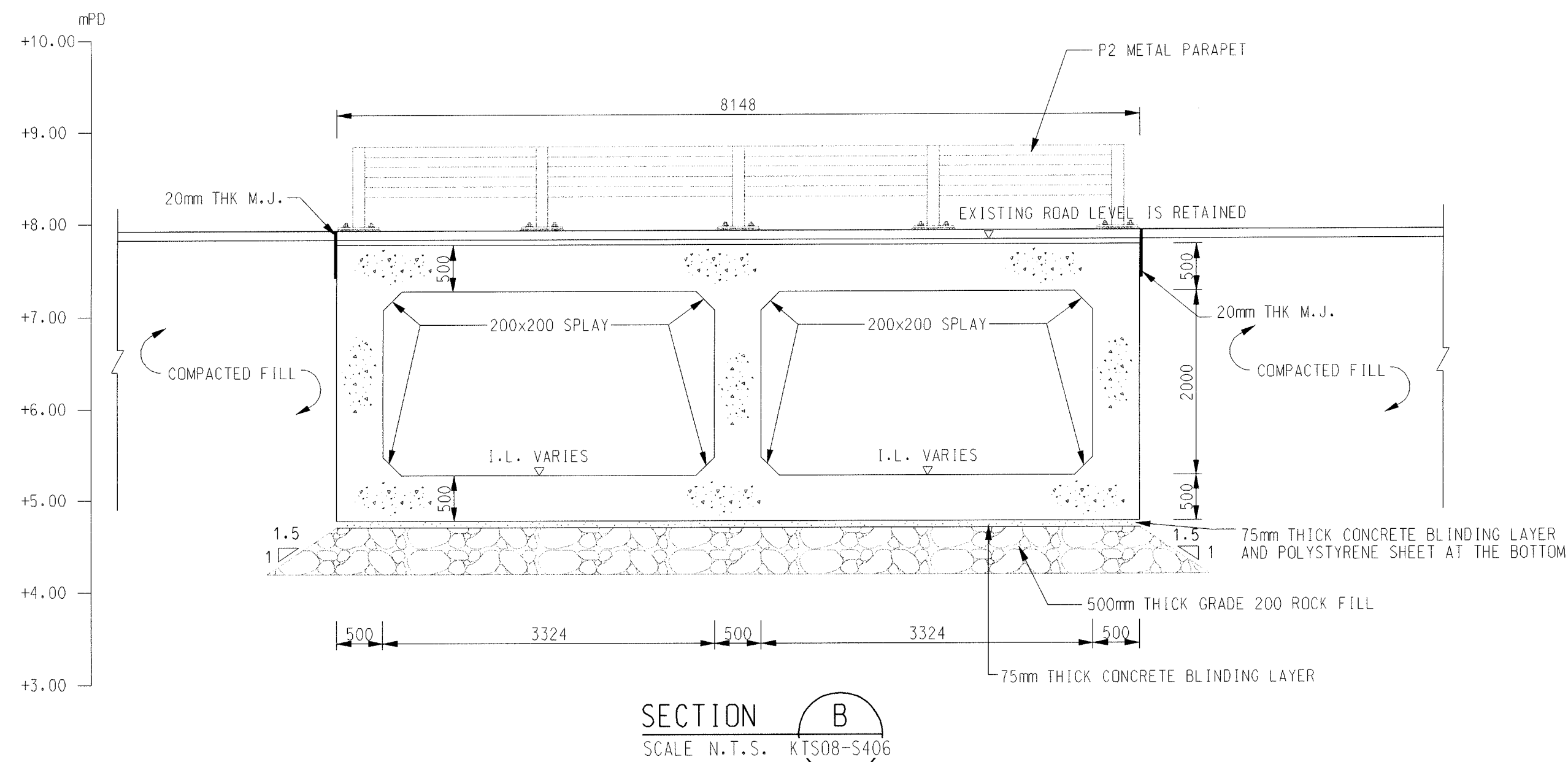
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Contract No.	DC/2006/06
Contract	Drainage Improvement Works in Kwu Tung South and Fu Tei Au, Sheung Shui

Drawing Title

CHANNEL KTS08
GENEARL LAYOUT & DETAILS OF
AS-CONSTRUCTED BOX CULVERT No. 2
(SHEET 1 OF 3)

Designed	AW	<i>AW</i>	Eng.Chk.	TT	<i>TT</i>
Drawn	CW	CW	Approved	TMC	<i>TMC</i>
Dwg.Chk.	GT	<i>Griffin</i>	Scale	AS	SHOWN@A1
Project	204521				Status
CAD file	_DC_2006_06/PHASE 21/AS-built/KTS08/KTS08-S406-rev_AB.dgn				A
Drawing No.	MCL-118CD-P-KTS08-S406				Rev
					AB



Notes:

1. FOR GENERAL NOTES REFER TO DRAWING No. MCL-118CD-P-PHASE2-GA000.

2. FOR LOCATION OF CROSS SECTIONS REFER TO DRAWING No. MCL-118CD-P-KTS08-S406.

Key to symbols

— SITE BOUNDARY

— EXISTING GROUND PROFILE

AB	JAN 11	CYC	AS-CONSTRUCTED DRAWING	SSC	JBK
B	MAR 07	RL	DESIGN MODIFICATION FOR CONSTRUCTION	<i>[Signature]</i>	
A	JUL 06	CW	IDENTICAL TO TENDER DRAWING REVISION 02	TT	TMC
Rev	Date	Drawn	Description	Ch'k'd	App'd

Client

DRAINAGE SERVICES DEPARTMENT

GOVERNMENT OF THE HONG KONG

SPECIAL ADMINISTRATIVE REGION

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Contract No. DC/2006/06

Contract

Drainage Improvement Works

in Kwu Tung South and Fu Tei Au, Sheung Shui

Drawing Title

CHANNEL KTS08

GENERAL LAYOUT & DETAILS OF

AS-CONSTRUCTED BOX CULVERT No. 2

(SHEET 2 OF 3)

Designed	AH	<i>[Signature]</i>	Eng.Chk.	TT	<i>[Signature]</i>
Drawn	CW	<i>[Signature]</i>	Approved	TMC	<i>[Signature]</i>
Dwg.Chk.	GT	<i>[Signature]</i>	Scale	1:50@A1	

Project 204521

CAD file /DC_2006_06/PHASE 2/AS-Bui/11/KTS08/KTS08-S407-rev_AB.dgn

Drawing No. MCL-118CD-P-KTS08-S407

Status A

Rev AB

0 500 1000 1500 2000 2500 mm

1:50 SCALE BAR

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