Annex 6

Drainage Impact Assessment

URBAN GREEN

Proposed Residential Development at Lot 182 S.B. in DD128, Ha Tsuen

Drainage Impact Assessment Report

Reference: P058/01 Issue 1
Date: July 22
Confidential

Proposed Residential Development at Lot 182 S.B. in DD128, Ha Tsuen

Drainage Impact Assessment Report

Checked and Approved by:

Patrick Ip
Director

Reference: P058 Issue 1

Date: July 22

Issue	Status	Prepared By	Date	Checked by	Date	Approved By	Date
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Contents

List of Figures

List of Tables

List of Appendices

1 Introduction

1.1 Introduction

The Applicant intends to develop a Villa at Lot 182 S.B in D.D.128 in Ha Tsuen, New Territories (hereafter as “the Site”).

According to the Approved Ha Tsuen Fringe Outline Zoning Plan (No. S/YL-HTF/12) published by Town Planning Board in October 2018, the site is currently zoned as “ Residential (Group D) “.

Owing to concerns on possible drainage impact arising from the proposed development. Urban Green Consultants Ltd. (UGC) has been commissioned to conduct a Drainage Impact Assessment (DIA) to demonstrate the acceptability of drainage impact upon the surrounding environment.

1.2 Study Objectives

The objectives of this DIA are to assess the possible drainage impacts may be caused by the proposed development and to recommend the mitigation measures to alleviate such impacts if necessary.

1.3 Report Structure

The remaining chapters of this report are shown below:

Chapter 2 – Site Context

Chapter 3 –Drainage Analysis

Chapter 4 – Conclusions

2 Site Context

2.1 Introduction

The Project Site is located at Lot 182 S.B in D.D.128, Ha Tsuen. The Site falls within an area zoned “Residential (Group D) “. The Site area is approximately 2,555 m^2.

2.2 Site Characteristics and Proposed Uses

The Site is located in Ha Tsuen. To the east of the site is an open storage yard for recycling materials and a warehouse. To the south are open storage yards for metals and a recyclable collection centre. To the west is an open storage yard for construction materials. To the north are vacant land, shrubland and a recyclables collection centre. The Site area is approximately 2,550 m^2.

Figure 2.1 shows the Site Location and the environment.

2.3 Existing Drainage Conditions

Site survey was conducted on 3 December 2021 to collect the updated information of the drainage characteristics, catchments, topography, existing drainage facilities, flow path and surface type within the Site and its surrounding.

Based on the site survey and review of drainage plans (reference no.: 6-NW-1B) from Drainage Services Department (DSD) in December 2021, it has revealed that the Site is not currently served by any form of DSD’s drainage facility. However, the surface runoff from the Site may be possible to discharge into an existing underground U-channel on the south-east of the Site. According to the calculation of flow capacity, the proposed discharge point and the proposed U-channel are able to catch all the runoff from the Site and identified catchments.

3 Drainage Analysis

3.1 Assessment Methodology and Assumption

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 j^{th} catchment (dimensionless).

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

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.

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 proposed U-channels – 0.016

The existing paving condition of the Site has runoff coefficients of 0.95 for concrete, 0.25 for flat heavysoil and 0.35 for steep heavysoil, which are adopted in this DIA. It is anticipated that the extent of the existing paving condition will be improved upon approval of this application as more landscape areas have been proposed.

The capacity s of the proposed U-channels has been checked by comparing with magnitudes of different combinations of the catchments. The Manning's roughness coefficient of 0.016 for U-channels (fair condition) was assumed.

3.2 Design Parameters

11 catchments (Catchments A to K) were identified based on the geographical characteristics of the Site and its nearby area as shown in Figure 3.1. As the existing U-channels are located to the south-east of the Site, the runoff from the Site will be directly discharged into the existing U-channel (E1). Figure 3.1 shows the discharge point of the Site. The surface runoff from relevant catchment has been estimated and presented in Appendix B.

3.3 Assessment Results

Given that the Site is the undeveloped area, site modification would be made to increase concrete paving of the on-site catchment areas (i.e. Catchment G,H,I) after proposed development. The identified on-site catchment area is presented in Figure 3.1. The change in paving characteristics of the on-site catchment area is summarised in Table 3.1.

Table 3.1 Changes in Grassland and Concrete Areas

On-Site Catchment Area	Before Development		After Development	
	Grassland	Concrete	Grassland	Concrete
G	100%	0%	30%	70%
H	100%	0%	30%	70%
I	100%	0%	20%	80%

Note: (1) The coefficient of permeable concrete is 0.3 which is reference from Permeable Interlocking Concrete Pavement. (2008). Interlocking Concrete Pavement Institute.

As summarised above, the concrete paving area for on-site catchment area is increased which imply there shall increase the surface runoff generated from the Site after proposed development. The increase of on-site catchment runoff is summarised in Table 3.2.

Table 3.2 Estimated Runoff from the Site

On-Site Catchment Area	Estimated Runoff, m^3/s		Increase of Runoff m^3/s
	Before Development	After Development	After Development
G+H+I	0.0511	0.1553	0.1042

As shown in Table 3.2, 0.1042 m^3/s increased runoff will be resulted from the proposed development.

30% greenery area will be provided for Catchment G and H, while 20% greenery area will be provided for Catchment I. Estimation of the on-site runoff before and after proposed development are detailed in Table A1 and Table A2 of Appendix B.

Details calculation of the estimated proposed site catchment runoffs is shown in Table A3 of Appendix B.

Table 3.3 Estimated Proposed Site Catchment Runoffs to Existing Drainage

Channel Segment(1)	Diameter, m	Gradient	Capacity, m^3/s	Runoff, m^3/s	Catchment Served	Surfficient Capacity? (Y/N)
E1-E2	0.6	0.1	1.58	0.4	A-I	Y
E2-E3	0.6	0.1	1.58	0.5	A-K	Y
E3-E4	0.6	0.1	1.58	0.5	A-K	Y
E4-E5	0.6	0.1	1.58	0.5	A-K	Y

Note:
(1) All segments (E1-E5) are the U-channels.

The assessment results presented in Table 3.3 demonstrate that the proposed development has induced limited runoff to the proposed U-channels.

As summarised above, the proposed development would not cause adverse drainage impacts nor increase in flooding susceptibility of the surrounding areas.

4 Conclusions

A Drainage Impact Assessment (DIA) has been conducted for the Proposed Residential Development at Lot 182 S.B. in DD128, Ha Tsuen.

The peak surface runoff was calculated based on a 50-year return period. The assessment results have demonstrated that there shall be no adverse impact due to the proposed development. In addition, with reference to the Flooding Blackspots available on the DSD website, the Site is not located within the flooding blackspots locations/ regions. As a result, no unacceptable drainage impact is anticipated from the proposed development.

Based on the above, it is concluded that the Proposed Development shall not result in any adverse drainage impacts.

Figures

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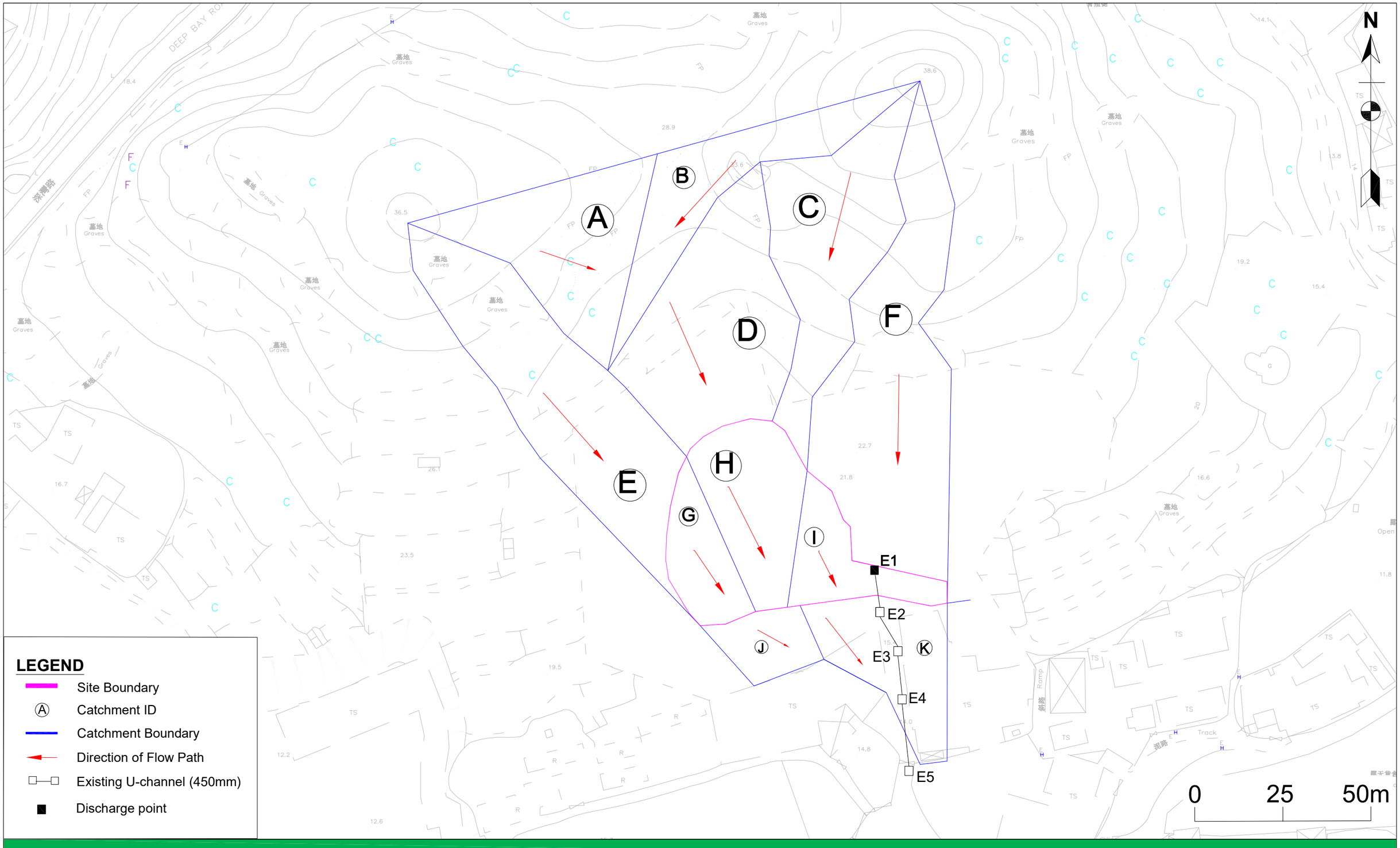
Proposed Residential Development at Lot 182 S.B. in DD128

Site Location and its Environ

Figure 2.1

Rev. 0



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HSK Villa

Identified Catchments Area and Existing Drainage System

Figure 3.1

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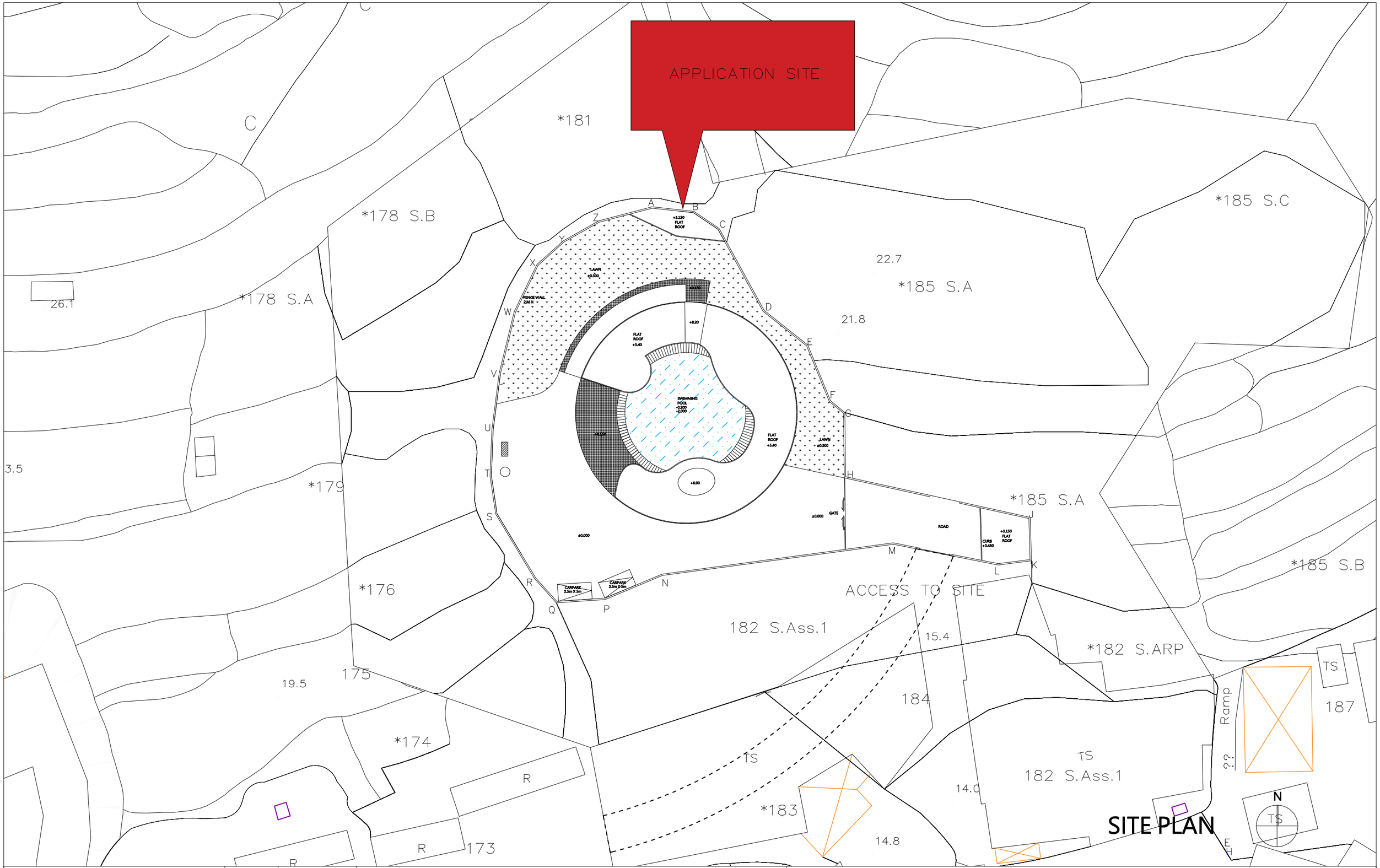
Appendix A



DESIGN DRAWING

Rev	Date	Description
-	-	-

Project:

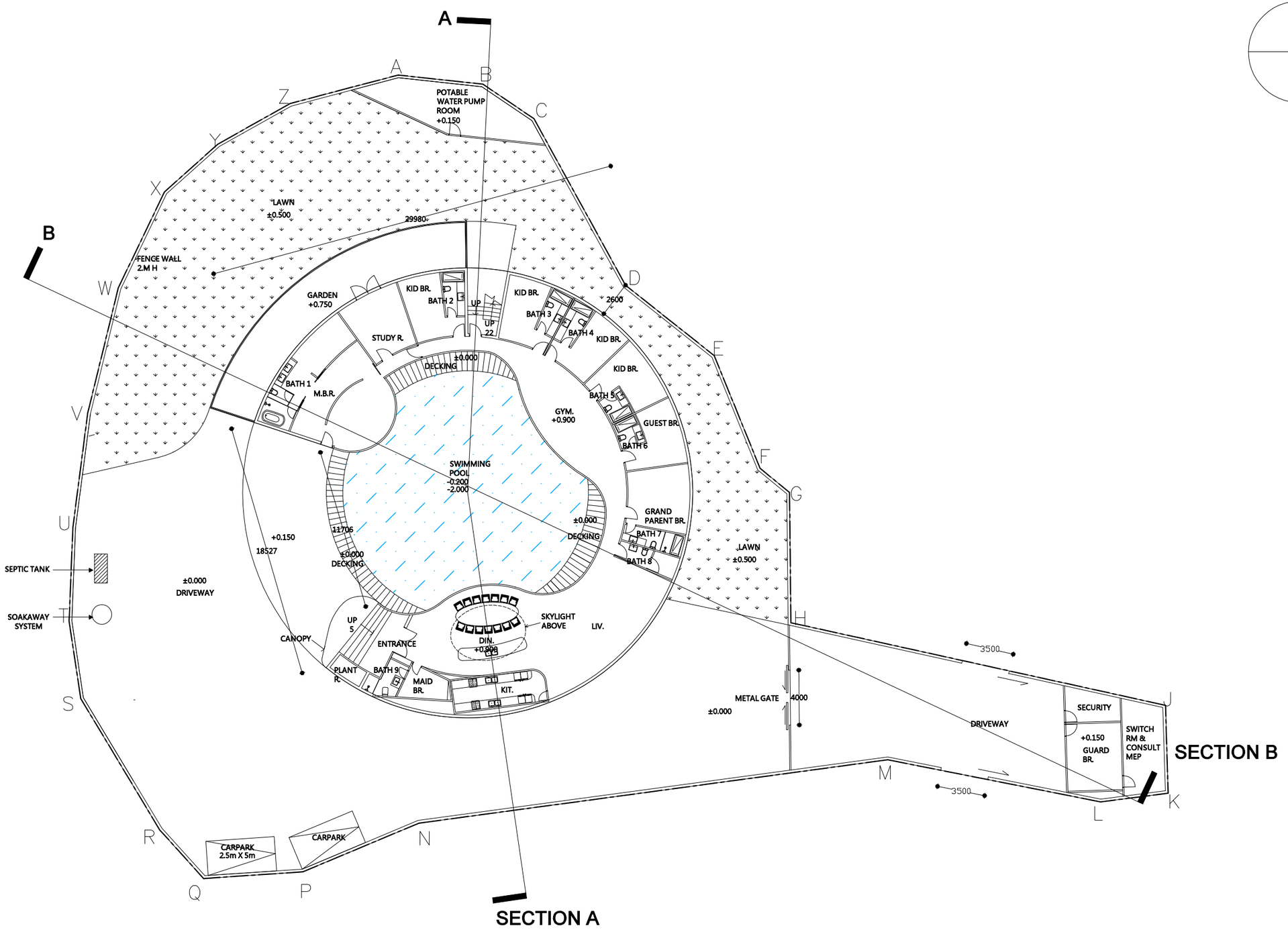
PROPOSED HOUSE DEVELOPMENT AT LOT NO. 182 S.B IN D.D. 128

ADO LTD. 18C6 TML Tower, 3 Hoi Shing Road, Tsuen Wan West, HK Tel: 2646-6381 Fax: 2634-6648

Drawing Title:

SITE PLAN

Project reference	Scale	Drawn	Checked	Approved
-	1:500 (A3)			
CAD reference	Date	Revision No./Date	Read in conj. with Drawing No.	
	2022-02-17			



DESIGN DRAWING

Rev	Date	Description
-	-	-

Project:

PROPOSED HOUSE DEVELOPMENT AT LOT NO. 182 S.B. IN D.D. 128

ADO LTD. 18C6 TML Tower, 3 Hoi Shing Road, Tsuen Wan West, HK Tel: 2646-6381 Fax: 2634-6648

Drawing Title:

GROUND FLOOR LAYOUT PLAN

Project reference	Scale	Drawn	Checked	Approved
-	1:300 (A3)	PY		

CAD reference	Date	Revision No./Date	Read in conj. with Drawing No.
	2022-02-16		

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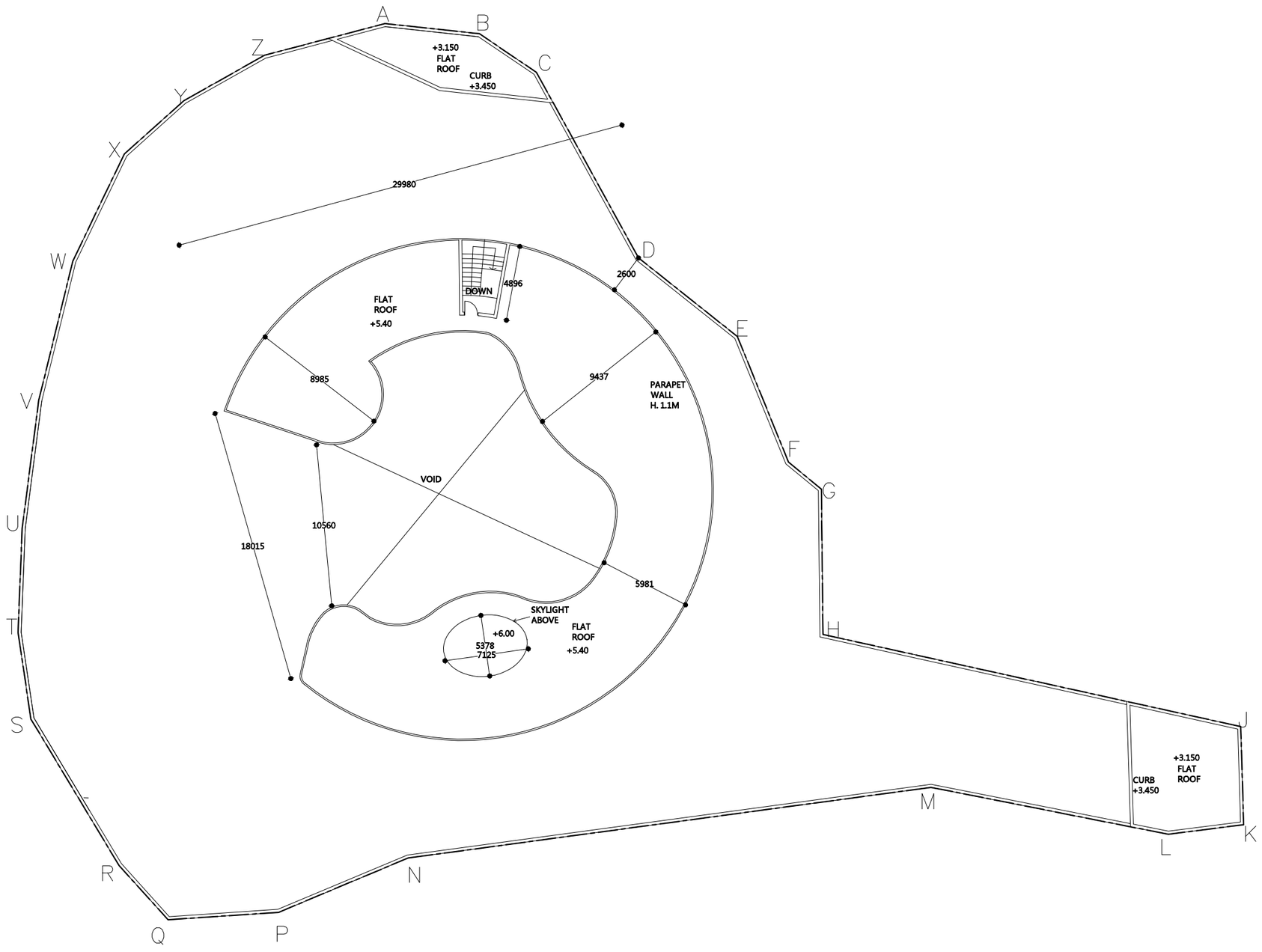

DESIGN DRAWING

Rev	Date	Description
-	-	-

Project:

PROPOSED HOUSE DEVELOPMENT AT LOT NO. 182 S.B. IN D.D. 128

ADO LTD. 18C6 TML Tower, 3 Hoi Shing Road, Tsuen Wan West, HK Tel: 2646-6381 Fax: 2634-6648

Drawing Title:

ROOF FLOOR LAYOUT PLAN

Project reference	Scale	Drawn	Checked	Approved
-	1:300 (A3)			
CAD reference	Date	Revision No./Date	Read in conj. with	Drawing No.
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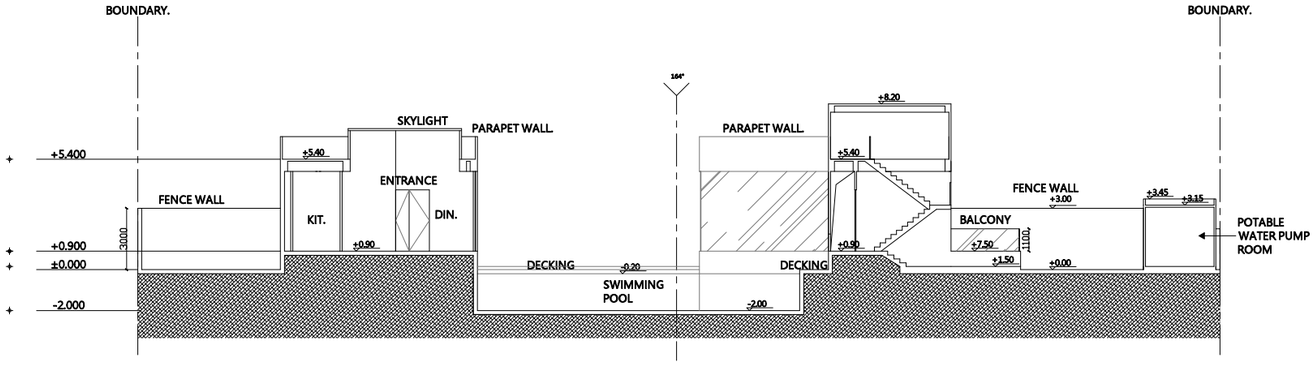
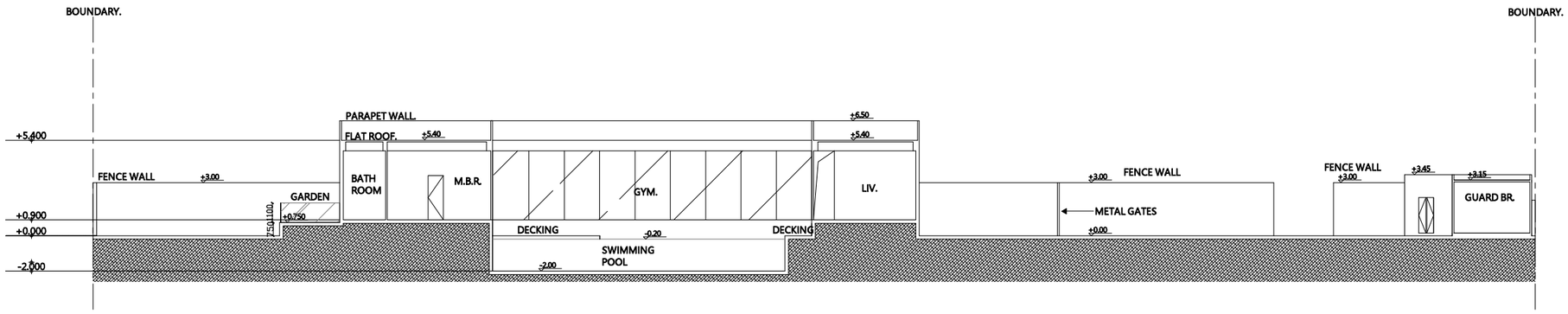


SECTION A -A



SECTION B -B

DESIGN DRAWING

Rev	Date	Description
-	-	-

Project:

PROPOSED HOUSE DEVELOPMENT AT LOT NO. 182 S.B. IN D.D. 128

ADO LTD. 18C6 TML Tower, 3 Hoi Shing Road, Tsuen Wan West, HK Tel: 2646-6381 Fax: 2634-6648

Drawing Title:

SECTION A - A & B - B

Project reference	Scale	Drawn	Checked	Approved
-	1:300 (A3)			
CAD reference	Date	Revision No./Date	Read in conj. with	Drawing No.
	2021-2-16			

Appendix B

Capacity Flows Estimation for Propose Catchments and Drainage System with 50 Year Return Period

A1.Calculation of On-Site Runoff (Existing Development)

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_o), min	Time of Concentration (t_c), min	Duration (t_d), min	a (50 year return period)	b (50 year return period)	c (50 year return period)	Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s
G	100% Grassland (heavysoil), flat	656	0.00066	13.79	29.00	1.30	1.30	1.30	451.3	2.5	0.34	287	0.25	0.000163948	0.0131
H	100% Grassland (heavysoil), flat	1,189	0.00119	13.89	36.00	1.52	1.52	1.52	451.3	2.5	0.34	281	0.25	0.000297337	0.0233
I	100% Grassland (heavysoil), flat	712	0.00071	18.10	21.00	0.88	0.88	0.88	451.3	2.5	0.34	298	0.25	0.000177957	0.0148
														Total	**0.0511**

A2.Calculation of On-Site Runoff (After Development)

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_o), min	Time of Concentration (t_c), min	Duration (t_d), min	a (50 year return period)	b (50 year return period)	c (50 year return period)	Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s
G	70% Concrete + 30% Grassland (heavysoil), flat	656	0.00066	13.79	29.00	1.30	1.30	1.30	451.3	2.5	0.34	287	0.74	0.000485285	0.0387
H	70% Concrete + 30% Grassland (heavysoil), flat	1,189	0.00119	13.89	36.00	1.52	1.52	1.52	451.3	2.5	0.34	281	0.74	0.000880116	0.0688
I	80% Concrete + 20% Grassland (heavysoil), flat	712	0.00071	18.10	21.00	0.88	0.88	0.88	451.3	2.5	0.34	298	0.81	0.000576581	0.0478
														Total	**0.1553**
														Changes in peak runoff	**0.1042**

A3.Calculation of All Catchment Runoff (After Development)

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_o), min	Time of Concentration (t_c), min	Duration (t_d), min	a (50 year return period)	b (50 year return period)	c (50 year return period)	Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s
A	100% Grassland (heavysoil), flat	1,799	0.00180	20.73	41.00	1.53	1.53	1.53	451.3	2.5	0.34	281	0.25	0.000449755	0.0351
B	100% Grassland (heavysoil), flat	1,354	0.00135	13.49	86.00	3.59	3.59	3.59	451.3	2.5	0.34	244	0.25	0.000338476	0.0230
C	100% Grassland (heavysoil), flat	2,072	0.00207	18.35	85.00	3.20	3.20	3.20	451.3	2.5	0.34	250	0.25	0.00051792	0.0360
D	100% Grassland (heavysoil), flat	2,451	0.00245	17.67	60.00	2.24	2.24	2.24	451.3	2.5	0.34	266	0.25	0.000612733	0.0453
E	100% Grassland (heavysoil), flat	2,806	0.00281	19.07	97.00	3.52	3.52	3.52	451.3	2.5	0.34	245	0.25	0.0007015	0.0478
F	10% Concrete + 90% Grassland (heavysoil), flat	3,278	0.00328	17.88	104.00	3.76	3.76	3.76	451.3	2.5	0.34	242	0.32	0.00104896	0.0705
G	70% Concrete + 30% Grassland (heavysoil), flat	656	0.00066	13.79	29.00	1.30	1.30	1.30	451.3	2.5	0.34	287	0.74	0.000485285	0.0387
H	70% Concrete + 30% Grassland (heavysoil), flat	1,189	0.00119	13.89	36.00	1.52	1.52	1.52	451.3	2.5	0.34	281	0.74	0.000880116	0.0688
I	80% Concrete + 20% Grassland (heavysoil), flat	712	0.00071	18.10	21.00	0.88	0.88	0.88	451.3	2.5	0.34	298	0.81	0.000576581	0.0478
J	80% Concrete + 20% Grassland (heavysoil), flat	464	0.00046	30.00	10.00	0.40	0.40	0.40	451.3	2.5	0.34	314	0.81	0.00037584	0.0328
K	60% Concrete + 40% Grassland (heavysoil), flat	1,139	0.00114	22.22	18.00	0.69	0.69	0.69	451.3	2.5	0.34	304	0.67	0.00076313	0.0645
														Total	**0.5104**

Note:

Runoff is calculated in accordance with DSD's "*Stormwater Drainage Manual - Planning, Design and Management*" (SDM), fifth edition, January 2018..

Equation 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. Contribution Estimation and Adequacy Check for Existing Drainage System (For Enhanced Design)

Point (Channel No.)	Channel	Diameter, m	Slope	Manning's Roughness Coefficient	Cross Section Area,m2	Wetted Perimeter,m	Hydraulic radius,m	Mean Velocity,m/s	Capacity flow,m3/s	Catchment Served	Runoff,m3/s	% of capacity flow	Sufficient Capacity(Y/N)
E1-E2	U-channel	0.6	0.1000	0.016	0.2827	1.8850	0.15	5.5797	1.5776	A-I	0.4130	26%	Y
E2-E3	U-channel	0.6	0.1000	0.016	0.2827	1.8850	0.15	5.5797	1.5776	A-K	0.5104	32%	Y
E3-E4	U-channel	0.6	0.1000	0.016	0.2827	1.8850	0.15	5.5797	1.5776	A-K	0.5104	32%	Y
E4-E5	U-channel	0.6	0.1000	0.016	0.2827	1.8850	0.15	5.5797	1.5776	A-K	0.5104	32%	Y