銅鑼灣
Causeway Bay

Annex E
Sewerage Impact Assessment

Proposed Redevelopment at Caroline Hill Road, Causeway Bay

Sewerage Impact Assessment for Proposed Redevelopment at Caroline Hill Road, Causeway Bay

Report Ref

05 | 16 January 2024

Job number   285077

ARUP

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Preliminary Design of Sewerage System from District Court Complex at
Caroline Hill Road, ArchSD

1 Introduction

Sewerage Impact Assessment ("SIA") had been submitted in fulfilment of the Special Conditions (61) (a) of the Conditions of Sale of the Lot requiring for submission of a SIA and was approved by EPD and DSD on 5 January 2022 and 3 May 2022 respectively.

This revised SIA had been submitted to support the Fresh S16 Planning Application with the revised layout plan submission. The recommendation established in the previously approved SIA remains unchanged.
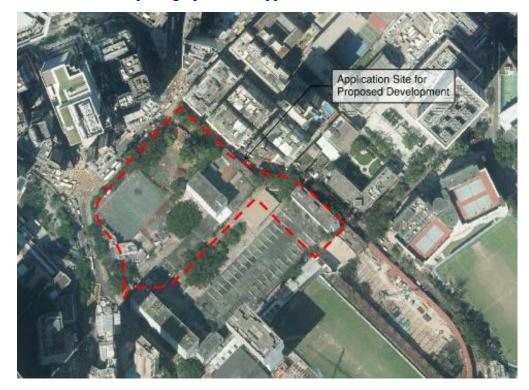
1.1 Reference Materials

In evaluating the sewerage impact arising from the proposed development, the following sources of information have been specifically referred to:

- Environmental Protection Department (EPD) Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning No. : EPD/TP 1/05;

- DSD Sewerage Manual – Key Planning Issues and Gravity Collection System; and

- Drainage Record Plans obtained from DSD.

2 The Development

For easy reference, a comparison table showing the difference between the Approved Scheme and the Proposed Scheme is shown in table below:

Description	Approved Scheme	Proposed Scheme	Difference
Project Title	Proposed Redevelopment at Caroline Hill Road, Causeway Bay		
Description	Two 24-storeys office towers (Tower 1 and Tower 2) and one 18-storeys office tower (Tower 3) for office, retail and GIC facilities use.		
Location	The site is located at Caroline Hill Road, Causeway Bay (see **Figure 1**).		
Land Use Zoning	Commercial		
Site Area	14,802 m^2	14,802 m^2	Nil
Office GFA	85,000 m^2	85,000 m^2	Nil
Retail GFA	10,000 m^2	10,000 m^2	Nil
GIC GFA	5,000 m^2	5,000 m^2	Nil
GIC GFA (Performing Art & Cultural Facilities)	2,000 m^2	-	-2,000 m^2

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Page 1

Below is an aerial photograph of the Application Site.

3 Description of Existing Environment and Baseline Conditions

3.1 Site Location and Topography

The Application site is located at Causeway Bay at the junction of Caroline Hill Road and Leighton Road. The Application Site covers approximately $14802m^2$ of area. It was occupied by the ex-Electrical and Mechanical Services Department (EMSD) Headquarters, the ex-Civil Aid Service Headquarters, the ex-Post Office Recreation Club and the PCCW Recreation Club.

3.2 Approach and Methodology

The sewage generated from the proposed development will be collected and conveyed to the existing sewerage system via the existing manhole FMH7058242 and FMH7058644. In order to assess the associated sewerage impact, the capacities of the existing public sewers along Caroline Hill Road were checked.

The adequacy of sewerage capacity along Caroline Hill Road was determined by using the estimate of future sewage generation from the proposed development.

The global unit flow factors recommended in the EPD Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning No.: EPD/TP 1/05 have been adopted in the estimation.

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Page 2

3.3 Evaluation of Sewerage Impact

The sewage flow estimation from the proposed development, the unit flow factors as stated in EPD/TP 1/05 have been adopted.

The capacities of sewers have been calculated based on Colebrook-White equation, assuming full bore flow as below:

(a) Pipe capacity is calculated based on the continuity equation

$$Q = AV$$

Where Q = pipe full flow capacity in m^3/s

A = pipe cross-sectional area in m^2

V = velocity at full bore flow in m/s

(b) Velocity at full bore flow is based on the Colebrook-White equation

$$V = -(32gRS)^{0.5} \log \{(ks/14800R) + (1.255v/ R (32gRS)^{0.5})\}$$

Where g = acceleration due to gravity in m/s^2

R = hydraulic radius in m

S = pipe gradient

ks = pipe roughness in mm

v = kinematic viscosity of water in m^2/s

(c) The sewerage impact due to the proposed development on the two existing public sewers have been evaluated by calculating the estimated peak flow against the capacity of the existing public sewer. One is the existing public sewer with downstream sewer of 600Ø run along the South of Caroline Hill Road. Another one is the existing public sewer with downstream sewer of 500Ø run along the East of Caroline Hill Road.

(d) The detailed calculations are provided in **Appendix B** for reference.

3.4 Sewage Generation from the Proposed Development

The prediction for the proposed development sewage generation has been based on the information extracted from the development schedule (refer to Section 2). The quantity of sewage generated by the proposed is estimated from expected total population.

The table showing the sewage generation of the proposed development is calculated based on the guideline set in EPD Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning and is shown on **Table B1** in **Appendix B** <mark>with the comparison between the Approved Scheme and the Proposed Scheme shown in the table below.</mark>

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Page 3

Description	Approved Scheme	Proposed Scheme	Difference
ADWF (m³/day)	991.7	973.2	-18.5
Catchment Inflow Factor	1.0	1.0	Nil
Contributing Population	3673	3604	-69
Global Peaking Factor	6	6	Nil
Peak Discharge, L/s	68.87	67.58	-1.29

3.5　　Impact of the Proposed Development

In order to assess the impact on the existing public sewer associated with the proposed development, the capacities of the existing public sewers have been checked and shown on **Tables B2** in **Appendix B**.

The estimation of sewage generation in the vicinity of the Application Site is based on the assumptions as below:

1)　Existing public sewer information based on DSD drainage record plans and shown in **Figure 2-5**;

2)　Existing development parameters in the vicinity of the proposed development are obtained from public domain and sewerage catchment plan shown in **Figure 6**;

3)　Flow factors as per EPD Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning; and

4)　Global peaking factor with stormwater allowance is adopted as per EPD Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning.

5)　The sewage flow and tentative sewerage system from Proposed District Court Complex is based on the design reference to the approved technical feasibility statement from ArchSD and shown in **Figure 7**.

6)　As per ArchSD's current design, the sewer of FC tower is recommended to be connected to the existing sewerage manhole FSH7003584 and that of DC tower is recommended to be connected to the existing sewerage manhole FMH7009989.

The peak sewage flow from the proposed development is slightly reduced from 68.87 L/s to 67.58 L/s.

On the South side of Caroline Hill Road, it has proven that an existing public sewerage serving the Application Site comprising an existing 300Ø public gravity sewer running along the south of Caroline Hill Road and the downstream existing public sewer of 600Ø running along the Leighton Road has sufficient capacity to carry the estimated sewage from the Application Site.

On the East side of Caroline Hill Road, it has proven that an existing 400Ø public gravity sewer running along the east of Caroline Hill Road and the downstream

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Page 4

existing public sewer of 500Ø running along Leighton Road has sufficient capacity to carry the estimated sewage from the Application Site.
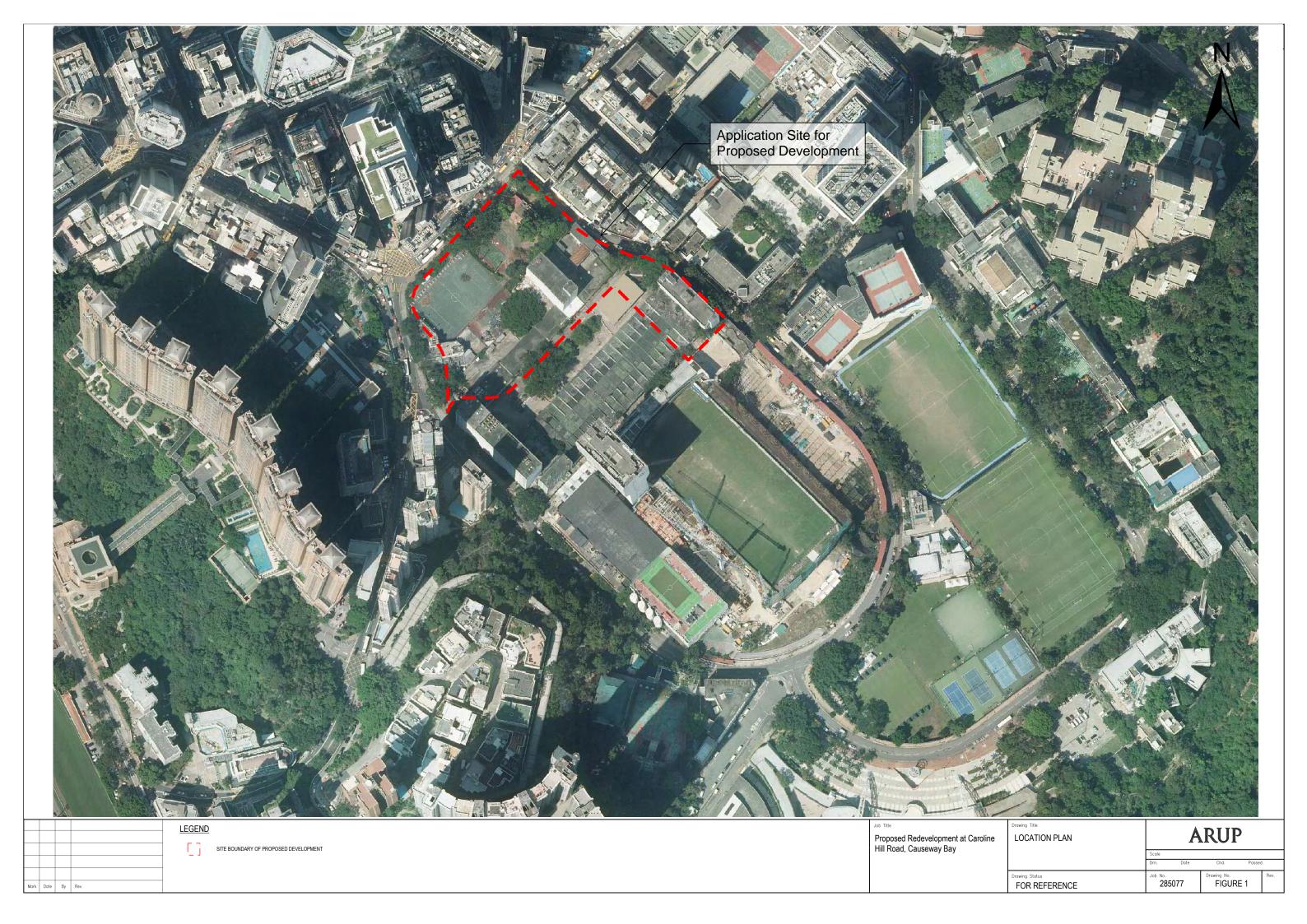
It is concluded that the proposed development would not result in any adverse sewerage impact to the existing public sewerage system. The capacities checking of the existing public sewers is shown in **Table B2**.
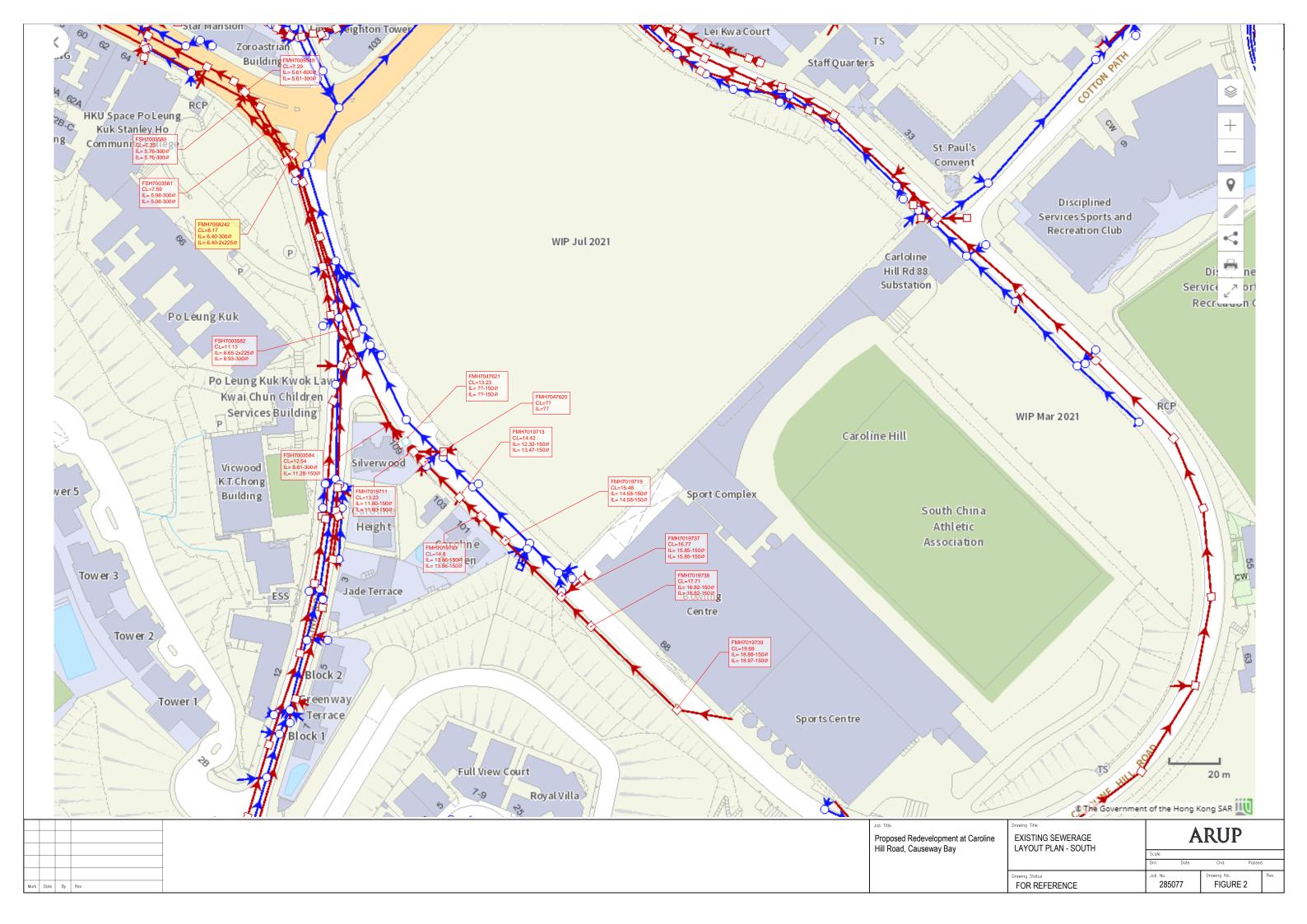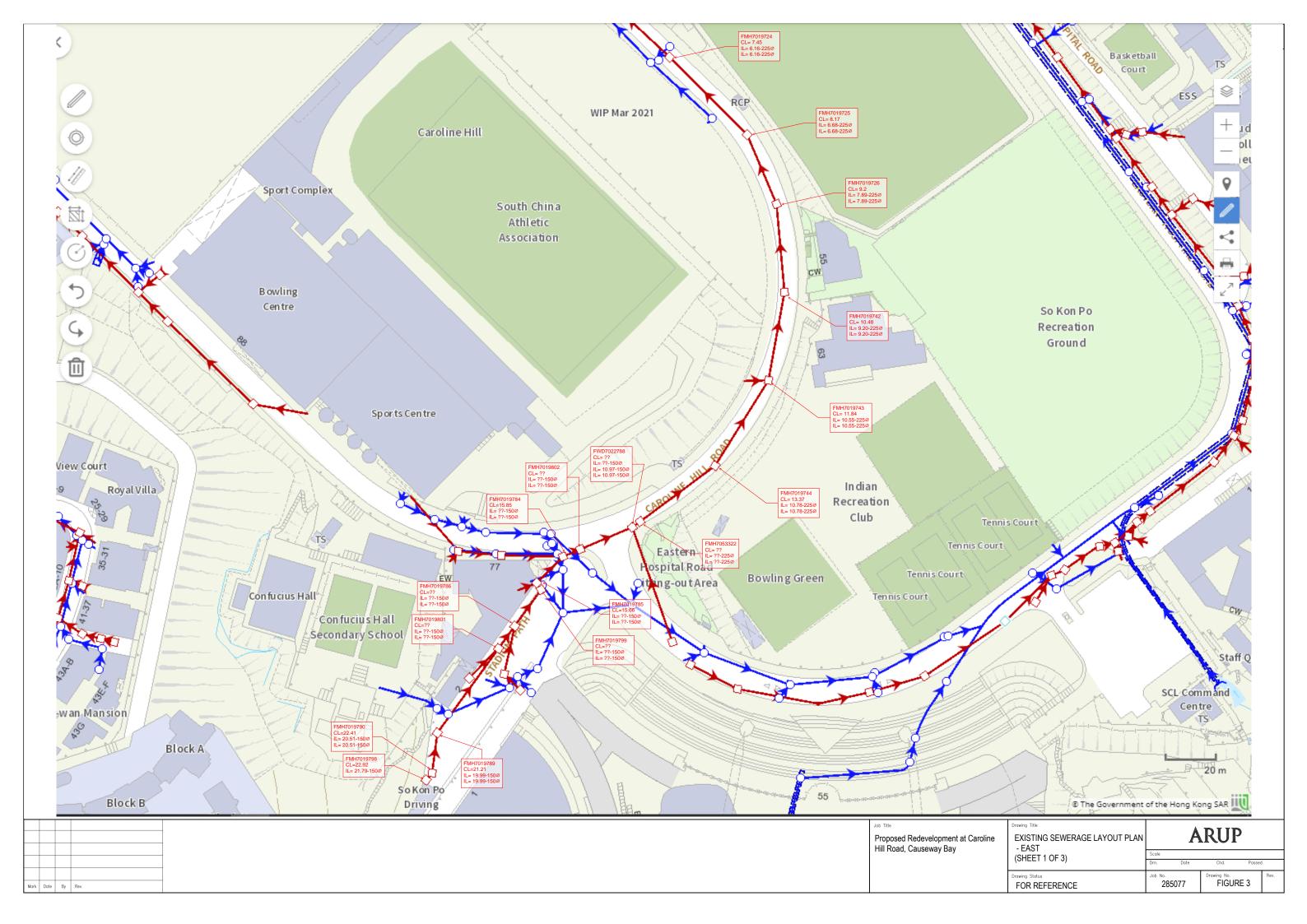
4   Conclusion

The peak sewage flow from the proposed development is <mark>slightly reduced from 68.87 L/s to 67.58 L/s</mark> . It is observed that the two existing public sewerage serving the Application Site through existing FMH7058644 and FMH7058242 running along the Leighton Road, have sufficient capacity to carry the estimated sewage from the Application Site. It is concluded that the proposed development would not result in any adverse sewerage impact to the existing public sewerage system.
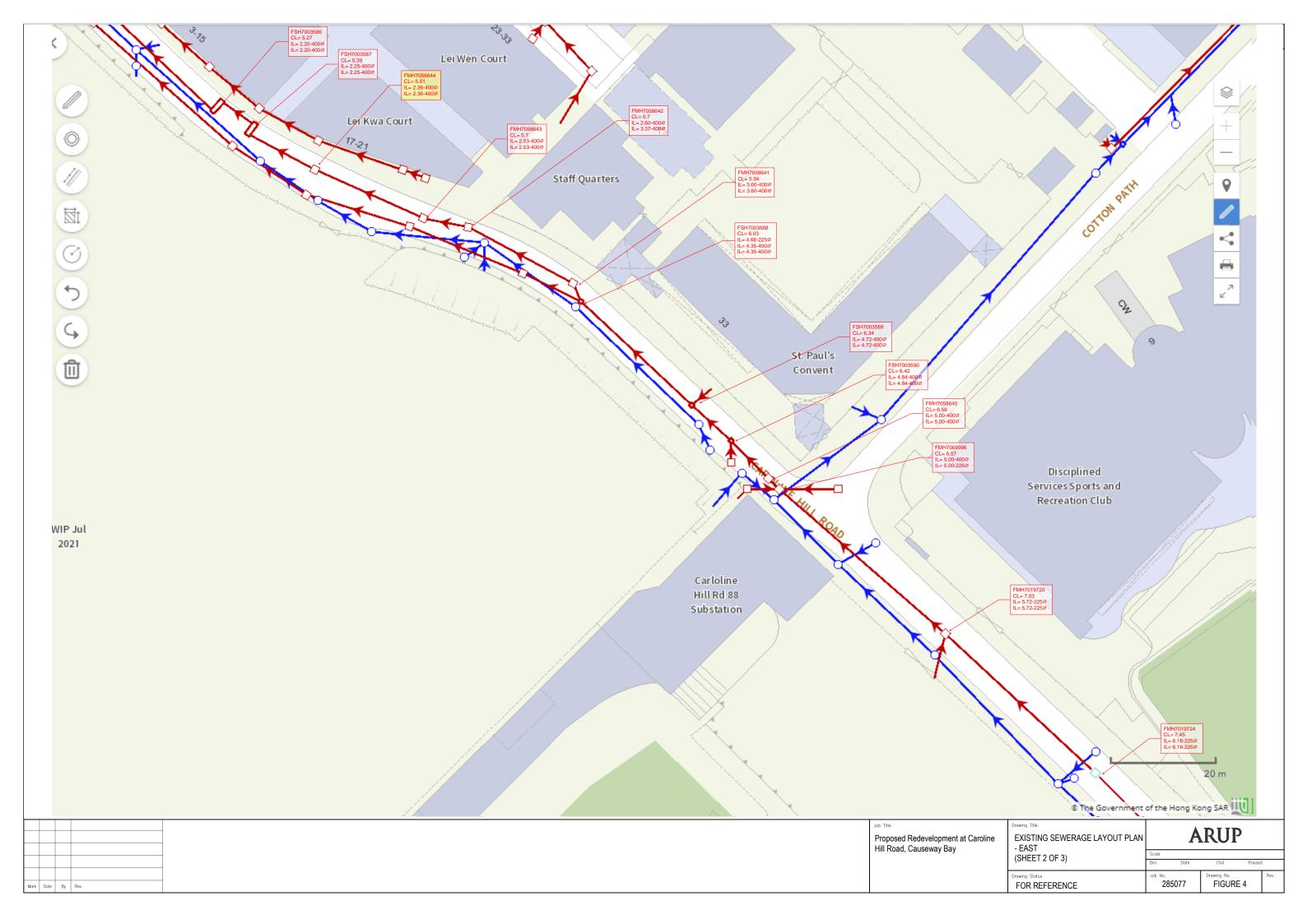
Appendix A

Figures

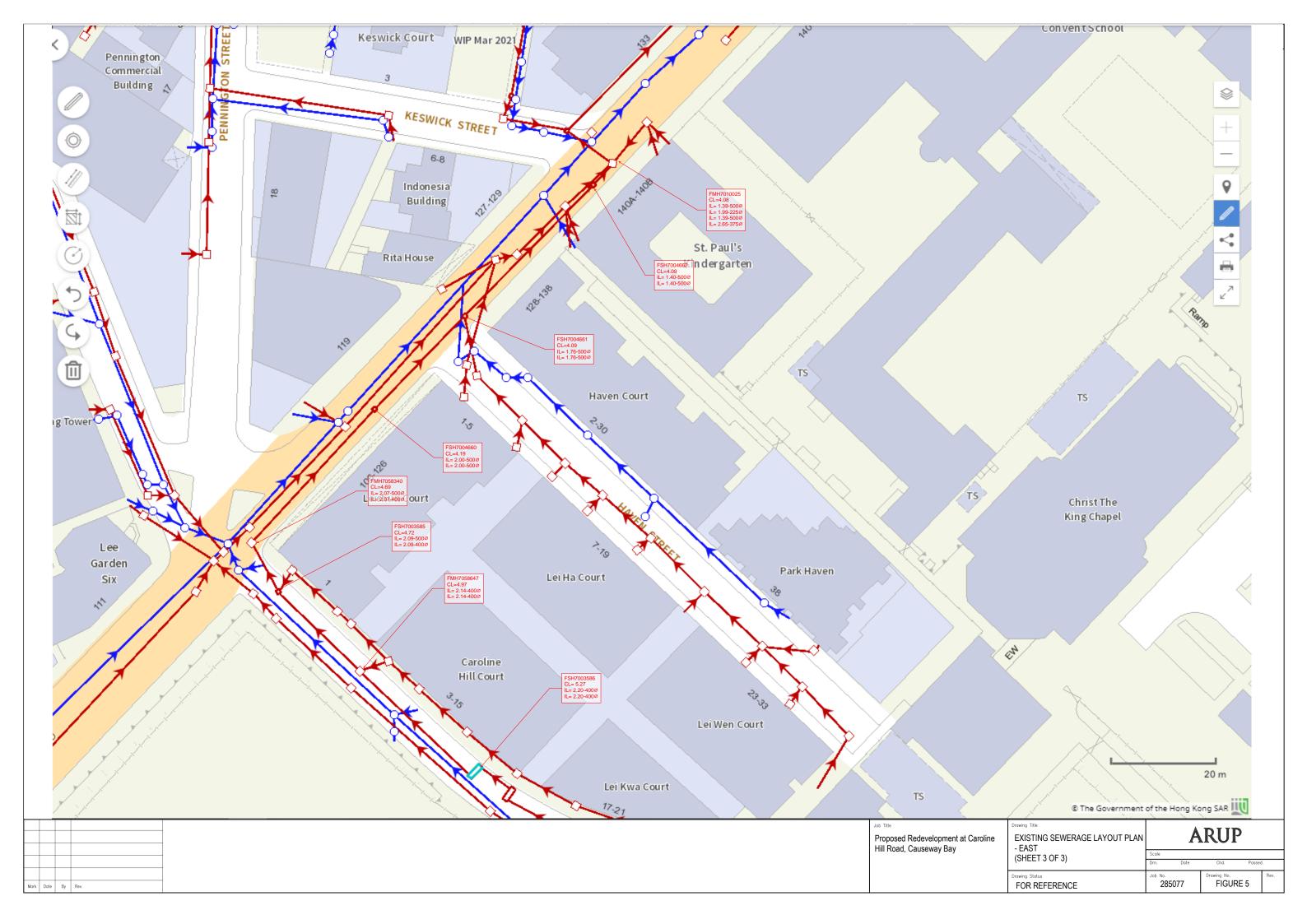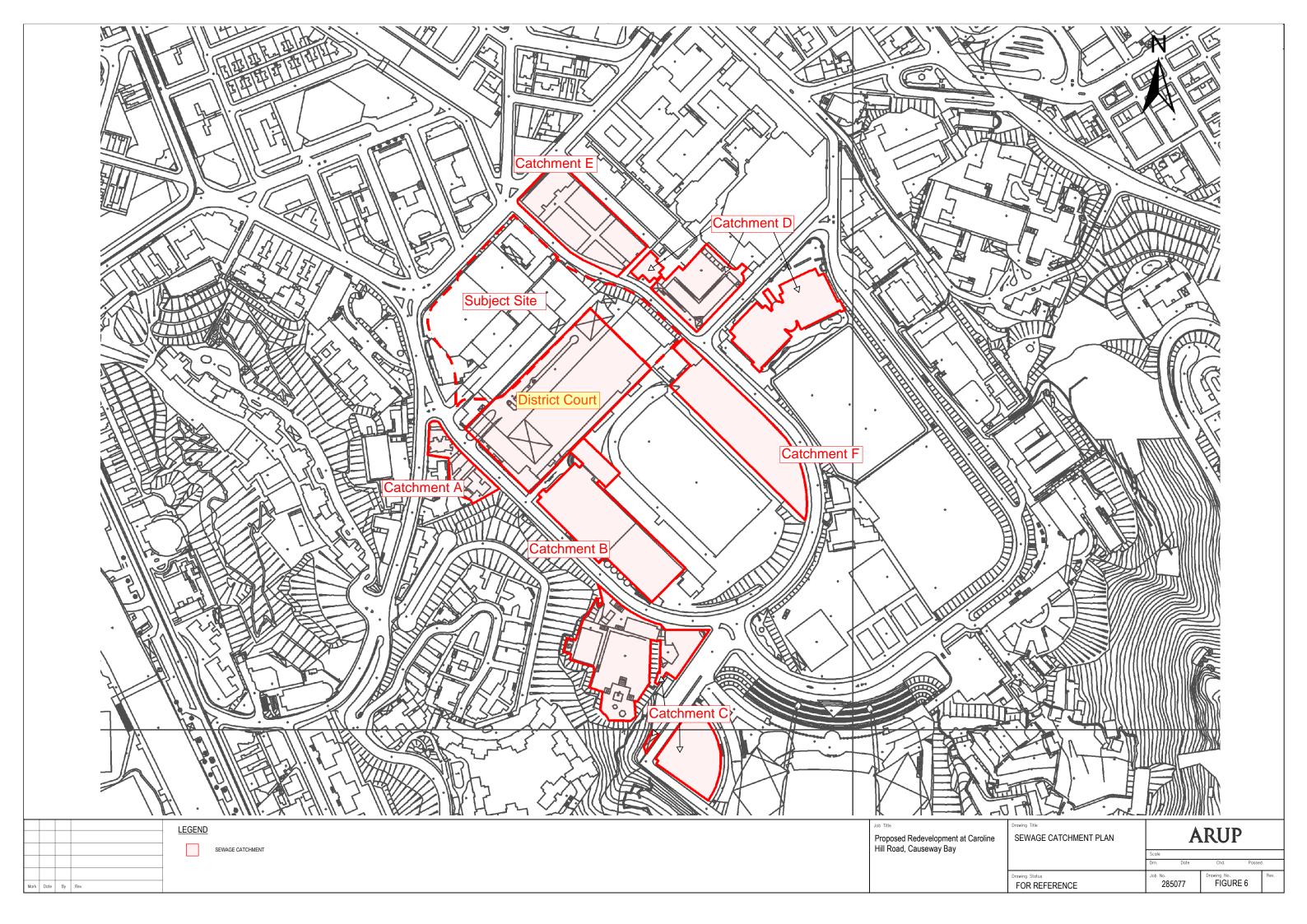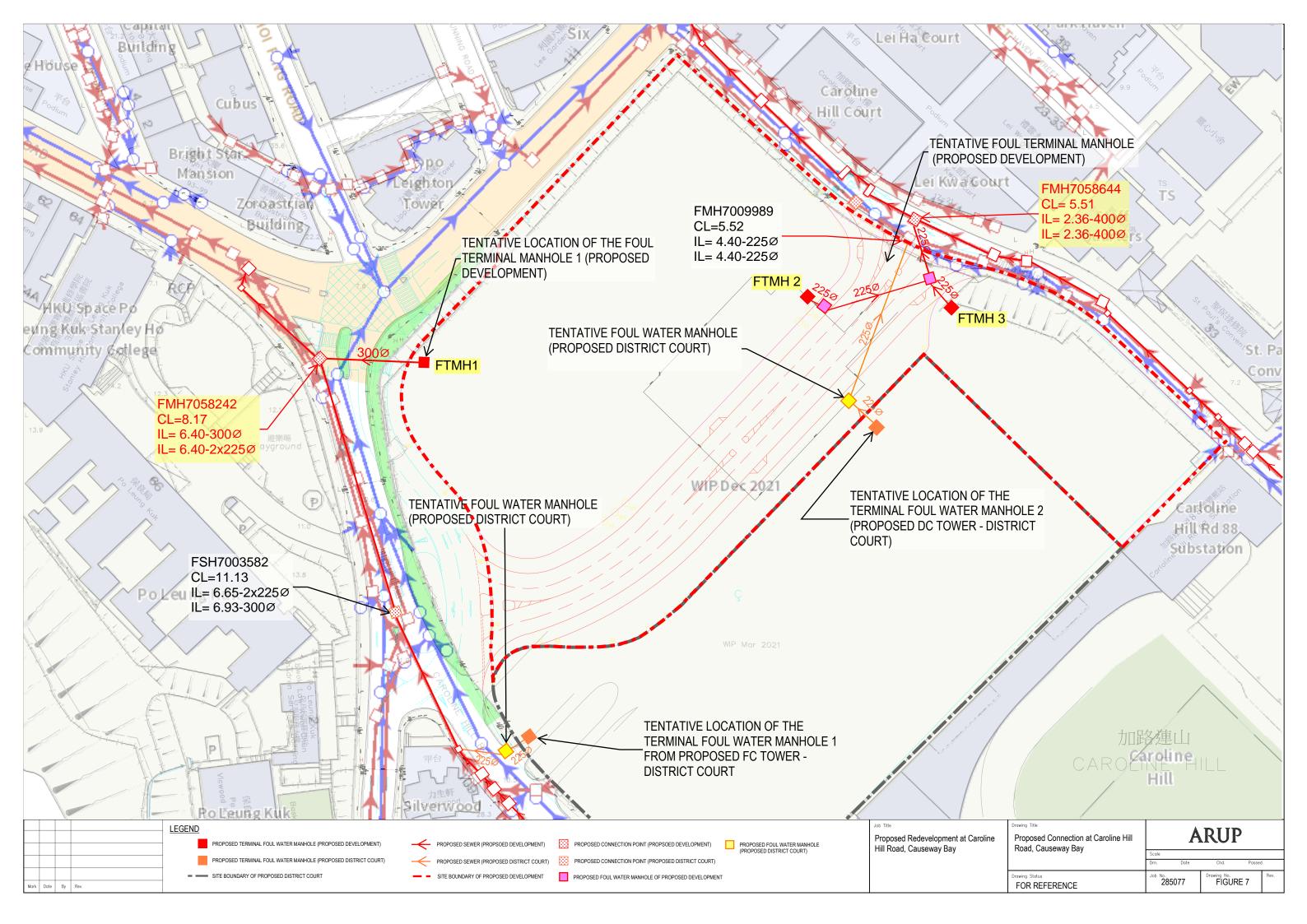Application Site for
Proposed Development

Job Title
Proposed Redevelopment at Caroline
Hill Road, Causeway Bay

Drawing Title
LOCATION PLAN

ARUP

Scale

Drn. Date Chd. Passed

Drawing Status
FOR REFERENCE

Job No.
285077

Drawing No.
FIGURE 1

Rev.

Star Mansion
Zoroastrian Building
Lei Kwa Court
Staff Quarters
TS

FMH7009549
CL=7.29
IL= 5.61-600Ø
IL= 5.61-300Ø

HKU Space Po Leung
Kuk Stanley Ho
Community College
RCP

FSH7003580
CL=7.25
IL= 5.76-300Ø
IL= 5.76-300Ø

FSH7003581
CL=7.59
IL= 5.98-300Ø
IL= 5.98-300Ø

FMH7058242
CL=8.17
IL= 6.40-300Ø
IL= 6.40-2x225Ø

St. Paul's Convent

COTTON PATH

CW

Disciplined Services Sports and Recreation Club

Caroline Hill Rd 88 Substation

WIP Jul 2021

Disciplined Services Sports and Recreation C

Po Leung Kuk

FSH7003582
CL=11.13
IL= 6.65-2x225Ø
IL= 6.93-300Ø

Po Leung Kuk Kwok Law
Kwai Chun Children
Services Building

FMH7047621
CL=13.23
IL= ??-150Ø
IL= ??-150Ø

FMH7047620
CL=??
IL=??

WIP Mar 2021

RCP

Caroline Hill

Vicwood
K.T.Chong
Building

FSH7003584
CL=12.54
IL= 8.61-300Ø
IL= 11.28-150Ø

Silverwood

FMH7019713
CL=14.42
IL= 12.32-150Ø
IL= 13.47-150Ø

FMH7019719
CL=15.48
IL= 14.58-150Ø
IL= 14.58-150Ø

Sport Complex

South China
Athletic
Association

Tower 5

FMH7019711
CL=13.23
IL= 11.80-150Ø
IL= 11.80-150Ø

Height

FMH7019793
CL=14.8
IL= 13.86-150Ø
IL= 13.86-150Ø

Caroline
Garden

FMH7019737
CL=16.77
IL= 15.85-150Ø
IL= 15.85-150Ø

Tower 3

ESS

Jade Terrace

FMH7019738
CL=17.71
IL= 16.82-150Ø
IL= 16.82-150Ø

Bowling
Centre

Tower 2

Block 2

FMH7019739
CL=19.69
IL= 18.88-150Ø
IL= 18.97-150Ø

Tower 1

Greenway
Terrace

Block 1

Sports Centre

Full View Court

Royal Villa

TS

CAROLINE HILL ROAD

20 m

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Basketball Court

TS

ESS

FMH7019724
CL= 7.45
IL= 6.16-225ø
IL= 6.16-225ø

WIP Mar 2021

RCP

FMH7019725
CL= 8.17
IL= 6.68-225ø
IL= 6.68-225ø

Caroline Hill

FMH7019726
CL= 9.2
IL= 7.89-225ø
IL= 7.89-225ø

Sport Complex

South China
Athletic
Association

55

CW

So Kon Po
Recreation
Ground

FMH7019742
CL= 10.48
IL= 9.20-225ø
IL= 9.20-225ø

Bowling
Centre

88

63

Sports Centre

FMH7019743
CL= 11.84
IL= 10.55-225ø
IL= 10.55-225ø

FWD7022788
CL= ??
IL= ??-150ø
IL= 10.97-150ø
IL= 10.97-150ø

TS

Indian
Recreation
Club

FMH7019802
CL= ??
IL= ??-150ø
IL= ??-150ø

View Court

Royal Villa

FMH7019784
CL=15.85
IL= ??-150ø
IL= ??-150ø

CAROLINE HILL ROAD

FMH7019744
CL= 13.37
IL= 10.78-225ø
IL= 10.78-225ø

Tennis Court

Tennis Court

52

29

TS

Eastern
Hospital Road
Sitting-out Area

FMH7053322
CL= ??
IL= ??-225ø
IL= ??-225ø

Bowling Green

Tennis Court

EW

77

Confucius Hall

FMH7019786
CL=??
IL= ??-150ø
IL= ??-150ø

FMH7019785
CL=15.66
IL= ??-150ø
IL= ??-150ø

Tennis Court

CW

41-37

Confucius Hall
Secondary School

FMH7019801
CL=??
IL= ??-150ø
IL= ??-150ø

FMH7019799
CL=??
IL= ??-150ø
IL= ??-150ø

Staff Q

43A-B

43E-F

STADIUM PATH

SCL Command
Centre

TS

-wan Mansion

43G

FMH7019790
CL=22.41
IL= 20.51-150ø
IL= 20.51-150ø

Block A

FMH7019798
CL=22.92
IL= 21.79-150ø

FMH7019789
CL=21.21
IL= 19.99-150ø
IL= 19.99-150ø

Block B

So Kon Po
Driving

55

20 m

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FSH7003586
CL= 5.27
IL= 2.20-400∅
IL= 2.20-400∅

FSH7003587
CL= 5.39
IL= 2.25-400∅
IL= 2.25-400∅

FMH7058644
CL= 5.51
IL= 2.36-400∅
IL= 2.36-400∅

FMH7058643
CL= 5.7
IL= 2.53-400∅
IL= 2.53-400∅

FMH7058642
CL= 5.7
IL= 2.60-400∅
IL= 3.37-400∅

FMH7058641
CL= 5.94
IL= 3.60-400∅
IL= 3.60-400∅

FSH7003588
CL= 6.03
IL= 4.66-225∅
IL= 4.35-400∅
IL= 4.35-400∅

FSH7003589
CL= 6.34
IL= 4.72-400∅
IL= 4.72-400∅

FSH7003590
CL= 6.42
IL= 4.84-400∅
IL= 4.84-400∅

FMH7058640
CL= 6.58
IL= 5.00-400∅
IL= 5.00-400∅

FMH7009996
CL= 6.57
IL= 5.00-400∅
IL= 5.00-225∅

FMH7019720
CL= 7.03
IL= 5.72-225∅
IL= 5.72-225∅

FMH7019724
CL= 7.45
IL= 6.16-225∅
IL= 6.16-225∅

Lei Wen Court

Lei Kwa Court

Staff Quarters

St. Paul's Convent

COTTON PATH

CW

Disciplined Services Sports and Recreation Club

CAROLINE HILL ROAD

Carloline Hill Rd 88 Substation

WIP Jul 2021

3-15

23-33

17-21

33

9

20 m

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Mark	Date	By	Rev.		Job Title	Drawing Title	ARUP		
					Proposed Redevelopment at Caroline Hill Road, Causeway Bay	EXISTING SEWERAGE LAYOUT PLAN - EAST (SHEET 2 OF 3)			
							Scale		
							Drn.	Date	Chd.	Passed
						Drawing Status	Job No.	Drawing No.	Rev.
						FOR REFERENCE	285077	FIGURE 4	

Pennington Commercial Building

Keswick Court

WIP Mar 2021

Convent School

PENNINGTON STREET

KESWICK STREET

Indonesia Building

Rita House

140A-140B

FMH7010025
CL=4.08
IL= 1.39-500∅
IL= 1.99-225∅
IL= 1.39-500∅
IL= 2.65-375∅

St. Paul's indergarten

FSH7004662
CL=4.09
IL= 1.40-500∅
IL= 1.40-500∅

FSH7004661
CL=4.09
IL= 1.76-500∅
IL= 1.76-500∅

Haven Court

TS

TS

Ramp

1-5

2-30

FSH7004660
CL=4.19
IL= 2.00-500∅
IL= 2.00-500∅

FMH7058340
CL=4.69
IL= 2.07-500∅
IL= 2.07-400∅

L   ourt

FSH7003585
CL=4.72
IL= 2.09-500∅
IL= 2.09-400∅

HAVEN STREET

7-19

TS

TS

Christ The King Chapel

Park Haven

38

Lee Garden Six

111

FMH7058647
CL=4.97
IL= 2.14-400∅
IL= 2.14-400∅

Lei Ha Court

Caroline Hill Court

3-15

FSH7003586
CL= 5.27
IL= 2.20-400∅
IL= 2.20-400∅

23-33

Lei Wen Court

EW

Lei Kwa Court

17-21

20 m

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Mark	Date	By	Rev.				Job Title	Drawing Title	ARUP

Job Title: Proposed Redevelopment at Caroline Hill Road, Causeway Bay

Drawing Title: EXISTING SEWERAGE LAYOUT PLAN - EAST (SHEET 3 OF 3)

Scale
Drn.   Date   Chd.   Passed

Drawing Status: FOR REFERENCE

Job No. 285077

Drawing No. FIGURE 5

Rev.

Catchment E

Catchment D

Subject Site

District Court

Catchment A

Catchment F

Catchment B

Catchment C

Job Title	Drawing Title	ARUP
Proposed Redevelopment at Caroline Hill Road, Causeway Bay	SEWAGE CATCHMENT PLAN	

Scale

Drn.	Date	Chd.	Passed

Drawing Status	Job No.	Drawing No.	Rev.
FOR REFERENCE	285077	FIGURE 6	

Mark	Date	By	Rev.

TENTATIVE FOUL TERMINAL MANHOLE
(PROPOSED DEVELOPMENT)

FMH7058644
CL= 5.51
IL= 2.36-400∅
IL= 2.36-400∅

TENTATIVE LOCATION OF THE FOUL
TERMINAL MANHOLE 1 (PROPOSED
DEVELOPMENT)

FMH7009989
CL=5.52
IL= 4.40-225∅
IL= 4.40-225∅

FTMH 2   225∅

225∅   225∅   225∅

FTMH 3

TENTATIVE FOUL WATER MANHOLE
(PROPOSED DISTRICT COURT)

300∅

FTMH1

FMH7058242
CL=8.17
IL= 6.40-300∅
IL= 6.40-2x225∅

225∅

WIP Dec 2021

TENTATIVE LOCATION OF THE
TERMINAL FOUL WATER MANHOLE 2
(PROPOSED DC TOWER - DISTRICT
COURT)

TENTATIVE FOUL WATER MANHOLE
(PROPOSED DISTRICT COURT)

FSH7003582
CL=11.13
IL= 6.65-2x225∅
IL= 6.93-300∅

WIP Mar 2021

TENTATIVE LOCATION OF THE
TERMINAL FOUL WATER MANHOLE 1
FROM PROPOSED FC TOWER -
DISTRICT COURT

225∅   225∅

LEGEND

■ PROPOSED TERMINAL FOUL WATER MANHOLE (PROPOSED DEVELOPMENT)	→ PROPOSED SEWER (PROPSOED DEVELOPMENT)	▦ PROPOSED CONNECTION POINT (PROPSOED DEVELOPMENT)	□ PROPOSED FOUL WATER MANHOLE (PROPOSED DISTRICT COURT)
■ PROPOSED TERMINAL FOUL WATER MANHOLE (PROPOSED DISTRICT COURT)	→ PROPOSED SEWER (PROPOSED DISTRICT COURT)	▦ PROPOSED CONNECTION POINT (PROPOSED DISTRICT COURT)	
┄ SITE BOUNDARY OF PROPOSED DISTRICT COURT	┅ SITE BOUNDARY OF PROPOSED DEVELOPMENT	■ PROPOSED FOUL WATER MANHOLE OF PROPOSED DEVELOPMENT	

Job Title
Proposed Redevelopment at Caroline Hill Road, Causeway Bay

Drawing Title
Proposed Connection at Caroline Hill Road, Causeway Bay

ARUP

Scale

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Drawing Status
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Job No.
285077

Drawing No.
FIGURE 7

Rev.

Mark	Date	By	Rev.

Appendix B

Calculation

ARUP

	Ove Arup & Partners Calculation Sheet	Job No.	285077	Sheet No.	1	Rev.	5
Job Title	**Caroline Hill Road, Causeway Bay**	Made by	IP	Date	16/01/24	Checked	CC

TABLE B1
Sewage Flow Estimation for Proposed Development

(Based on EPD Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning)

Design Assumption:
Global Peaking Factor, P (Including Stormwater Allowance) as per Table T-5
Global Unit Flow Factors as per Tables T-2 and T-3
Catchment Inflow Factor for Wan Chai (PCIF = 1.0) as per Table T-4

Development Schedule		
Sewage Flow Estimation for Caroline Hill Road - South	**Estimation**	**Remark**
Proposed Development		
(S) **Subject Site**		
GFA (m^2) for Office use	85000	
Worker Density (No. of Worker per $100m^2$)	5.5	
No. of Employee	4675	
Unit flow factor (m^3/person/day) - J6 Financial, Insurance, Real Estate & Business Services	0.08	
GFA (m^2) for F&B	10000	
Worker Density (No. of Worker per $100m^2$)	3.5	
No. of Employee	350	
Unit flow factor (m^3/person/day) - J10 Restaurant & Hotels	1.58	
GFA (m^2) for GIC	5000	
Worker Density (No. of Worker per $100m^2$)	3.3	
No. of Employee	165	
Unit flow factor (m^3/person/day) - J11 Community, Social & Personal Services	0.28	
Total ADWF, (m^3/day)	973.2	
70% of Total ADWF, (m^3/day)	681.2	
Total ADWF, (L/s)	11.26	
70% of Total ADWF, (L/s)	7.88	**New Development**
Catchment A		
A1 **Silverwood**		
Number of flats	81	
Population	219	
Unit flow factor (m^3/person/day) - Residential R2	0.27	
ADWF, (m^3/day)	59.05	
ADWF, (L/s)	0.68	P_{CIF} = 1 included
A2 **103 Caroline Hill Road (CHR)**		
Number of flats	8	
Population	22	
Unit flow factor (m^3/person/day) - Residential R2	0.270	
ADWF, (m^3/day)	5.83	
ADWF, (L/s)	0.07	P_{CIF} = 1 included
A3 **Caroline Garden**		
Number of flats	48	
Population	130	
Unit flow factor (m^3/person/day) - Residential R2	0.270	
ADWF, (m^3/day)	34.99	
ADWF, (L/s)	0.41	P_{CIF} = 1 included
Catchment B		
B1 **Bowling centre**		
GFA (m^2)	5704	
Worker Density (No. of Worker per $100m^2$)	3.3	
No. of Employee	188	
Unit flow factor (m^3/person/day) - J11 Community, Social & Personal Services	0.28	
ADWF, (m^3/day)	52.71	
ADWF, (L/s)	0.61	P_{CIF} = 1 included
B2 **Sport Complex**		
GFA (m^2)	8352	
Worker Density (No. of Worker per $100m^2$)	3.3	
No. of Employee	276	
Unit flow factor (m^3/person/day) - J11 Community, Social & Personal Services	0.28	
ADWF, (m^3/day)	77.17	
ADWF, (L/s)	0.89	P_{CIF} = 1 included
B3 **Sports Centre (50%)**		
GFA (m^2)	6351	
Worker Density (No. of Worker per $100m^2$)	3.3	
No. of Employee	210	
Unit flow factor (m^3/person/day) - J11 Community, Social & Personal Services	0.28	
ADWF, (m^3/day)	29.34	
ADWF, (L/s)	0.34	P_{CIF} = 1 included
District Court		
District court - DC tower (connected to FSH7003584)		
ADWF, (m^3/day)	119.46	
ADWF, (L/s)	3.32	According to approved technical feasibility statement from ArchSD
District court - FC tower (connected to FMH7009989)		
ADWF, (m^3/day)	38.39	
ADWF, (L/s)	1.07	According to approved technical feasibility statement from ArchSD
Proposed Scenario Caroline Hill Road - South		
Total ADWF (m^3/day)	1060	
Total ADWF (L/s)	12.27	
Contributing Population	3925	
Global Peaking Factor	6.00	
Total Peak Flow (L/s)	85.22	

Notes:
Employment density shall refer to Commercial and Industrial Floor Space Utilization Survey published by PlanD.
Office = 5.5 employee per $100m^2$ of GFA
Retails = 3.5 employee per $100m^2$ of GFA
Community, Social & Personal Services = 3.3 employee per $100m^2$ of GFA

TABLE B1
Sewage Flow Estimation for Proposed Development

(Based on EPD Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning)

Design Assumption:
Global Peaking Factor, P (Including Stormwater Allowance) as per Table T-5
Global Unit Flow Factors as per Tables T-2 and T-3
Catchment Inflow Factor for Wan Chai (PCIF = 1.0) as per Table T-4

Development Schedule		
Sewage Flow Estimation for Caroline Hill Road - East	**Estimation**	**Remark**
Proposed Development		
(S) **Subject Site**		
GFA (m^2) for Office use	85000	
Worker Density (No. of Worker per 100m^2)	5.5	
No. of Employee	4675	
Unit flow factor (m^3/person/day) - J6 Financial, Insurance, Real Estate & Business Services	0.08	
GFA (m^2) for Retail use	10000	
Worker Density (No. of Worker per 100m^2)	3.5	
No. of Employee	350	
Unit flow factor (m^3/person/day) - J10 Restaurant & Hotels	1.58	
GFA (m^2) for GIC	5000	
Worker Density (No. of Worker per 100m^2)	3.3	
No. of Employee	165	
Unit flow factor (m^3/person/day) - J11 Community, Social & Personal Services	0.28	
Total ADWF, (m^3/day)	973.20	
30% of Total ADWF, (m^3/day)	291.96	
Total ADWF, (L/s)	11.26	
30% of Total ADWF, (L/s)	3.38	**New Development**
Catchment B		
B3 **Sports Centre (50%)**		
GFA (m^2)	6351	
Worker Density (No. of Worker per 100m^2)	3.3	
No. of Employee	210	
Unit flow factor (m^3/person/day) - J11 Community, Social & Personal Services	0.28	
ADWF, (m^3/day)	29.34	
ADWF, (L/s)	0.34	P_{CIF} = 1 included
Catchment C		
C1 **Confucius Hall Secondary School**		
Number of students	360	
Number of staffs	29	
Unit flow factor (m^3/person/day) - students	0.04	
Unit flow factor (m^3/person/day) - staffs	0.28	
ADWF, (m^3/day)	22.52	
ADWF, (L/s)	0.26	P_{CIF} = 1 included
C2 **So Kon Po Driving Test Centre**		
GFA (m^2)	357	
Worker Density (No. of Worker per 100m^2)	3.3	
No. of Employee	12	
Unit flow factor (m^3/person/day) - J11 Community, Social & Personal Services	0.28	
ADWF, (m^3/day)	3.30	
ADWF, (L/s)	0.04	P_{CIF} = 1 included
C3 **Olypmic House**		
GFA (m^2)	4343	
Worker Density (No. of Worker per 100m^2)	3.3	
No. of Employee	143	
Unit flow factor (m^3/person/day) - J11 Community, Social & Personal Services	0.28	
ADWF, (m^3/day)	40.13	
ADWF, (L/s)	0.46	P_{CIF} = 1 included

ARUP

Ove Arup & Partners Calculation Sheet

		Job No.	285077	Sheet No.	2	Rev.	5
Job Title	**Caroline Hill Road, Causeway Bay**	Made by	IP	Date	16/01/24	Checked	CC

TABLE B1
Sewage Flow Estimation for Proposed Development

(Based on EPD Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning)

Design Assumption:
Global Peaking Factor, P (Including Stormwater Allowance) as per Table T-5
Global Unit Flow Factors as per Tables T-2 and T-3
Catchment Inflow Factor for Wan Chai (PCIF = 1.0) as per Table T-4

Development Schedule		
Sewage Flow Estimation for Caroline Hill Road - East	**Estimation**	**Remark**
Catchment D		
D1 **Disciplined Services Sports and Recreation Club**		
GFA (m^2)	10440	
Worker Density (No. of Worker per 100m^2)	3.3	
No. of Employee	345	
Unit flow factor (m^3/person/day) - J11 Community, Social & Personal Services	0.28	
ADWF, (m^3/day)	96.47	
ADWF, (L/s)	1.12	P_{CIF} = 1 included
D2 **St. Paul Convent**		
GFA (m^2)	1528	
Worker Density (No. of Worker per 100m^2)	3.3	
No. of Employee	50	
Unit flow factor (m^3/person/day) - J11 Community, Social & Personal Services	0.28	
ADWF, (m^3/day)	14.12	
ADWF, (L/s)	0.16	P_{CIF} = 1 included
Staff Quarters (D)		
D3 Number of units	25	
Population	68	
Unit flow factor (m^3/person/day) - Residential R2	0.27	
ADWF, (m^3/day)	18.23	
ADWF, (L/s)	0.21	P_{CIF} = 1 included
Catchment E		
E1 **Leishun Court**		
Number of flats	120	
Population	324	
Unit flow factor (m^3/person/day) - Residential R2	0.27	
ADWF, (m^3/day)	87.48	
ADWF, (L/s)	1.01	P_{CIF} = 1 included
E2 **Caroline Hill Court**		
Number of flats	1146	
Population	3094	
Unit flow factor (m^3/person/day) - Residential R2	0.27	
ADWF, (m^3/day)	835.43	
ADWF, (L/s)	9.67	P_{CIF} = 1 included
E3 **Lei Kwa Court**		
Number of flats	56	
Population	151	
Unit flow factor (m^3/person/day) - Residential R2	0.27	
ADWF, (m^3/day)	40.82	
ADWF, (L/s)	0.47	P_{CIF} = 1 included
E4 **Lei Ha Court**		
Number of flats	120	
Population	324	
Unit flow factor (m^3/person/day) - Residential R2	0.27	
ADWF, (m^3/day)	87.48	
ADWF, (L/s)	1.01	P_{CIF} = 1 included
E5 **Lei Wen Court**		
Number of flats	146	
Population	394	
Unit flow factor (m^3/person/day) - Residential R2	0.27	
ADWF, (m^3/day)	106.43	
ADWF, (L/s)	1.23	P_{CIF} = 1 included
Catchment F		
F1 **Staff Quarters**		
Number of units	35	
Population	95	
Unit flow factor (m^3/person/day) - Residential R2	0.27	
ADWF, (m^3/day)	25.52	
ADWF, (L/s)	0.30	P_{CIF} = 1 included
Proposed Scenario Caroline Hill Road - East		
Total ADWF (m3/day)	1655	
Total ADWF (L/s)	19.16	
Contributing Population	6131	
Global Peaking Factor	5.00	
Total Peak Flow (L/s)	95.80	

Notes:
Employment density shall refer to Commercial and Industrial Floor Space Utilization Survey published by PlanD.
Office = 5.5 employee per 100m^2 of GFA
Retails = 3.5 employee per 100m^2 of GFA
Community, Social & Personal Services = 3.3 employee per 100m^2 of GFA

ARUP

Ove Arup & Partners Calculation Sheet

Job Title
Proposed Development along Caroline Hill Road, Causeway Bay

| Job No. | 285077 | Sheet No. | 4 | Rev. | 5 |
| Made by | IP | Date | 16/01/24 | Checked | CC |

Table B2 - Capacity Performance of Existing Sewer

Notes:
(1) Calculate by Colebrook-White Equation

$$\bar{V} = -\sqrt{32gRS_f}\,\log\left[\frac{k_s}{14.8R} + \frac{1.255v}{R\sqrt{32gRS_f}}\right]$$

where ks is roughness value
for clayware slimed sewers, ks equals 3mm
v is kinematic viscosity of fluid = 1.14 x 10-6 m2/s and g is the gravity = 9.81m/s2
V is the velocity, D is the diameter of the sewer and S is the gradient of the sewer.

Abbreviation:

UP_MAN	Upstream Manhole	CON_POP	Contributing Population	DN_GL	Downstream Ground Level	CAP	Peak Pipe Capacity
DN_MAN	Downstream Manhole	DIA	Diameter	UP_INV	Upstream Invert Level	F/C	Peak Flow/Capacity
ADWF	Average Dry Weather Flow	LEN	Length	DN_INV	Downstream Invert Level		
ACC_ADWF	Accumulated Average Dry Weather Flow	UP_GL	Upstream Ground Level	VEL	Peak Pipe Velocity		

Proposed Development

Manhole UP_MAN No.	DN_MAN No.	FROM SITE Catchment	Description	CON_POP	PEAKING FACTOR (%)	ACC_ADWF (L/s)	Peak Flow (L/s)	DIA (D) (mm)	LEN (m)	UP_GL (mPD)	DN_GL (mPD)	UP_INV (mPD)	DN_INV (mPD)	Gradient (S)	VEL (m/s)	AREA (m²)	REDUCTION AREA (m²)	CAP (L/s)	F/C (%)	Adequate Capacity?
Caroline Hill Road - South																				
FMH7019739	FMH7019738	B1, 50%B3	Bowling centre, Sports Centre (50%)	304	8	0.95	7.60	150	44.5	19.69	17.71	18.88	16.82	22	1.67	0.0177	0.0159	26.58	28.6%	YES
FMH7019738	FMH7019737	B1, 50%B3	Bowling centre, Sports Centre (50%)	304	8	0.95	7.60	150	15.7	17.71	16.77	16.82	15.85	16	1.93	0.0177	0.0159	30.70	24.7%	YES
FMH7019737	FMH7019719	B1, 50%B3, B2	Bowling centre, Sports Centre (50%), Sport Complex	590	8	1.84	14.74	150	29.6	16.77	15.48	15.85	14.58	23	1.61	0.0177	0.0159	25.58	57.6%	YES
FMH7019719	FMH7019793	B1, 50%B3, B2	Bowling centre, Sports Centre (50%), Sport Complex	590	8	1.84	14.74	150	12.8	15.48	14.80	14.58	13.86	18	1.84	0.0177	0.0159	29.29	50.3%	YES
FMH7019793	FMH7019713	B1, 50%B3, B2, A3	Bowling centre, Sports Centre (50%), Sport Complex, Caroline Garden	719	8	2.25	17.98	150	10.1	14.80	14.42	13.86	13.47	26	1.53	0.0177	0.0159	24.26	74.1%	YES
FMH7019713	FMH7047620	B1, 50%B3, B2, A3	Bowling centre, Sports Centre (50%), Caroline Garden	719	8	2.25	17.98	150	17.0	14.42	13.46	12.32	11.91	41	1.21	0.0177	0.0159	19.27	93.3%	YES
FMH7047620	FMH7019711	B1, 50%B3, B2, A3, A2	Bowling centre, Sports Centre (50%), Sport Complex, Caroline Garden, 103 Caroline Hill Road	741	8	2.32	18.52	150	4.0	13.46	13.23	11.91	11.80	38	1.26	0.0177	0.0159	20.03	92.5%	YES
FMH7019711	FMH7047621	B1, 50%B3, B2, A3, A2	Bowling centre, Sports Centre (50%), Sport Complex, Caroline Garden, 103 Caroline Hill Road	741	8	2.3	18.52	150	4.7	13.23	13.23	11.80	11.64	30	1.42	0.0177	0.0159	22.54	82.2%	YES
FMH7047621	FSH7003584	B1, 50%B3, B2, A3, A2	Bowling centre, Sports Centre (50%), Sport Complex, Caroline Garden, 103 Caroline Hill Road	741	8	2.3	18.52	150	8.9	13.23	12.54	11.64	11.28	24	1.57	0.0177	0.0159	24.95	74.2%	YES
FSH7003584	FSH7003582	B1, 50%B3, B2, A3, A2, A1	Bowling centre, Sports Centre (50%), Sport Complex, Caroline Garden, 103 Caroline Hill Road, Silverwood, District Court DC tower	2,022	6	6.3	37.91	300	38.8	12.54	11.13	8.61	6.93	23	2.59	0.0707	0.0636	164.77	23.0%	YES
FSH7003582	FMH7058242	B1, 50%B3, B2, A3, A2, A1, G	Bowling centre, Sports Centre (50%), Sport Complex, Caroline Garden, 103 Caroline Hill Road, Silverwood, District Court DC tower	2,022	6	6.3	37.91	2x225	67.4	11.13	4.44	6.65	6.40	269	0.62	0.0398	0.0358	44.55	85.1%	YES
FMH7058242	FSH7003581	B1, 50%B3, B2, A3, A2, A1, G, 70%S	Bowling centre, Sports Centre (50%), Sport Complex, Caroline Garden,103 Caroline Hill Road, Silverwood, District Court DC tower, Proposed development (70%)	4,545	6	14.2	85.22	300	13.1	4.44	4.44	6.40	5.98	31	2.23	0.0707	0.0636	141.76	60.1%	YES
FSH7003581	FSH7003580	B1, 50%B3, B2, A3, A2, A1, G, 70%S	Bowling centre, Sports Centre (50%), Sport Complex, Caroline Garden,103 Caroline Hill Road, Silverwood, District Court DC tower, Proposed development (70%)	4,545	6	14.2	85.22	300	14.4	4.44	4.44	5.98	5.76	65	1.54	0.0707	0.0636	97.79	87.1%	YES
FSH7003580	FMH7009549	B1, 50%B3, B2, A3, A2, A1, G, 70%S	Bowling centre, Sports Centre (50%), Sport Complex, Caroline Garden,103 Caroline Hill Road, Silverwood, District Court DC tower, Proposed development (70%)	4,545	6	14.2	85.22	300	5.6	4.44	4.44	5.76	5.61	37	2.05	0.0707	0.0636	130.14	65.5%	YES
FTMH 1	**FMH7058242**	**70%S**	Proposed development (70%)	2,523	6	7.9	47.31	300	3.0	8.00	4.44	6.43	6.40	100	1.24	0.0707	0.0636	79.08	59.8%	YES
Caroline Hill Road - East																				
FMH7019744	FMH7019743	C1, C2, C3, 50%B3	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%)	353	8	1.1	8.82	225	37.5	13.37	11.84	10.78	10.55	163	0.80	0.0398	0.0358	28.66	30.8%	YES
FMH7019743	FMH7019742	C1, C2, C3, 50%B3	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%)	353	8	1.1	8.82	225	33.4	11.84	10.48	10.55	9.20	25	2.06	0.0398	0.0358	73.75	12.0%	YES
FMH7019742	FMH7019726	C1, C2, C3, 50%B3	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%)	353	8	1.1	8.82	225	33.4	10.48	9.20	9.20	7.89	25	2.03	0.0398	0.0358	72.65	12.1%	YES
FMH7019726	FMH7019725	C1, C2, C3, 50%B3	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%)	353	8	1.1	8.82	225	28.3	9.20	8.17	7.89	6.68	23	2.12	0.0398	0.0358	75.86	11.6%	YES
FMH7019725	FMH7019724	C1, C2, C3, 50%B3	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%)	353	8	1.15	8.82	225	41.5	8.17	7.45	6.68	6.16	80	1.15	0.0398	0.0358	41.02	21.5%	YES
FMH7019724	FMH7019720	C1, C2, C3, 50%B3	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%)	353	8	1.1	8.82	225	38.1	7.45	7.03	6.16	5.72	87	1.10	0.0398	0.0358	39.37	22.4%	YES
FMH7019720	FMH7009996	C1, C2, C3, 50%B3, F	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters	447	8	1.4	11.19	225	40.6	7.03	6.57	5.72	5.00	56	1.36	0.0398	0.0358	48.82	22.9%	YES
FMH7009996	FMH7058640	C1, C2, C3, 50%B3, F, D1, D2	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent	857	8	2.68	21.43	400	3.1	6.57	6.58	5.00	5.00	2067	0.33	0.1257	0.1131	37.20	57.6%	YES
FMH7058640	FSH7003590	C1, C2, C3, 50%B3, F, D1, D2	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent	857	8	2.68	21.43	400	10.1	6.58	6.42	5.00	4.84	63	1.90	0.1257	0.1131	214.45	10.0%	YES
FSH7003590	FSH7003589	C1, C2, C3, 50%B3, F, D1, D2	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent	857	8	2.68	21.43	400	9.9	6.42	6.34	4.84	4.72	82	1.66	0.1257	0.1131	194.64	11.4%	YES
FSH7003589	FSH7003588	C1, C2, C3, 50%B3, F, D1, D2	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent	857	8	2.68	21.43	400	28.4	6.34	6.03	4.72	4.35	77	1.72	0.1257	0.1131	194.44	11.0%	YES
FSH7003588	FMH7058641	C1, C2, C3, 50%B3, F, D1, D2	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent	857	8	2.68	21.43	400	3.3	6.03	5.94	4.35	3.60	4	7.19	0.1257	0.1131	813.22	2.6%	YES
FMH7058641	FMH7058642	C1, C2, C3, 50%B3, F, D1, D2	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent	857	8	2.68	21.43	400	21.9	5.94	5.70	3.60	3.37	95	1.54	0.1257	0.1131	174.54	12.3%	YES
FMH7058642	FMH7058643	C1, C2, C3, 50%B3, F, D1, D2	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent	857	8	2.68	21.43	400	8.4	5.70	5.70	2.60	2.53	120	1.37	0.1257	0.1131	155.44	13.8%	YES
FMH7058643	FMH7058644	C1, C2, C3, 50%B3, F, D1, D2	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent	857	8	2.68	21.43	400	22.4	5.70	5.51	2.53	2.36	134	1.30	0.1257	0.1131	147.01	14.6%	YES
FMH7058644	FSH7003587	C1, C2, C3, 50%B3, F, D1, D2, 30%S	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent, Proposed development (30%)	1,938	6	6.06	36.34	400	13.4	5.51	5.39	2.36	2.25	119	1.38	0.1257	0.1131	156.37	23.2%	YES
FSH7003587	FSH7003586	C1, C2, C3, 50%B3, F, D1, D2, 30%S	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent, Proposed development (30%)	1,938	6	6.06	36.34	400	7.8	4.53	5.27	2.25	2.20	156	1.21	0.1257	0.1131	136.29	26.7%	YES
FSH7003586	FMH7058647	C1, C2, C3, 50%B3, F, D1, D2, 30%S	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent, Proposed development (30%)	1,938	6	6.06	36.34	400	28.2	5.27	4.97	2.20	2.14	470	0.69	0.1257	0.1131	78.38	46.4%	YES
FMH7058647	FSH7003585	C1, C2, C3, 50%B3, F, D1, D2, 30%S, 50%E2, 50%E3	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent, Proposed development (30%), Lei Kwa Court (50%)	3,561	6	11.13	66.77	400	21.1	4.97	4.72	2.14	2.09	422	0.73	0.1257	0.1131	82.73	80.7%	YES
FSH7003585	FMH7058340	C1, C2, C3, 50%B3, F, D1, D2, 30%S, E2, E3, E5, E4, 50%E1	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent, Proposed development (30%), Caroline Hill Court, Lei Kwa Court, Lei Wen Court, Lei Ha Court, Leishun Court (50%)	6,064	5	18.95	94.75	500	10.9	4.72	4.69	2.09	2.07	545	0.75	0.1963	0.1767	131.76	71.9%	YES
FMH7058340	FSH7004660	C1, C2, C3, 50%B3, F, D1, D2, 30%S, E2, E3, E5, E4, 50%E1	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent, Proposed development (30%), Caroline Hill Court, Lei Kwa Court, Lei Wen Court, Lei Ha Court, Leishun Court (50%)	6,064	5	18.95	94.75	500	34.1	4.69	4.19	2.07	2.00	487	0.79	0.1963	0.1767	139.40	68.0%	YES
FSH7004660	FSH7004661	C1, C2, C3, 50%B3, F, D1, D2, 30%S, E2, E3, E5, E4, 50%E1	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent, Proposed development (30%), Caroline Hill Court, Lei Kwa Court, Lei Wen Court, Lei Ha Court, Leishun Court (50%)	6,064	5	18.95	94.75	500	24.1	4.19	4.09	2.00	1.76	100	1.74	0.1963	0.1767	307.67	30.8%	YES
FSH7004661	FSH7004662	C1, C2, C3, 50%B3, F, D1, D2, 30%S, E2, E3, E5, E4, 50%E1, D3	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent, Proposed development (30%), Caroline Hill Court, Lei Kwa Court, Lei Wen Court, Lei Ha Court, Leishun Court (50%), Staff Quarters (D)	6,131	5	19.16	95.80	500	34.5	4.09	4.09	1.76	1.40	96	1.78	0.1963	0.1767	314.95	30.4%	YES
FSH7004662	FMH7010025	C1, C2, C3, 50%B3, F, D1, D2, 30%S, E2, E3, E5, E4, 50%E1, D3	Confucius Hall Secondary School, So Kon Po Driving Test Centre, Olympic House, Sports Centre (50%), Staff Quarters, Disciplined Services Sports and Recreation Club, St. Paul Convent, Proposed development (30%), Caroline Hill Court, Lei Kwa Court, Lei Wen Court, Lei Ha Court, Leishun Court (50%), Staff Quarters (D)	6,131	5	19.16	95.80	500	6.0	4.09	4.08	1.40	1.39	600	0.71	0.1963	0.1767	125.55	76.3%	YES
FTMH 2	**FMH7058644**	**30%S**	Proposed development (30%)	1,081	6	3.4	20.28	225	3.0	8.00	5.51	2.39	2.36	100	1.02	0.0398	0.0358	36.63	55.3%	YES

Appendix C

Preliminary Design of sewerage system from District Court Complex at Caroline Hill Road, ArchSD

Hydraulic Calculation of Foul Water Connection Pipe (for information only)

	Population density (approx.)	Daily Sewage discharged capacity/ head (liter)	Flow Period in a day (hour)	DWF (m3/day)	DWF (lit/sec)	Peak Factor	Peak Discharge Flow Rate (lit/sec)
Tower DC	2172	55	10	119.46	3.32	6	19.91
Tower FC	698	55	10	38.39	1.07	6	6.40
						Total	26.31

By Manning Formula

$$V = \left(\frac{HMD^{2/3} \times S^{1/2}}{n} \right)$$

Where:

V	=	mean velocity (m/s)
s	=	slope of the total energy line
n	=	Manning's roughness coefficient (For Vitrified Clay pipe: n = 0.012 value)

HMD = Hydraulic Mean Depth (HMD = 0.25 x d @ 1/2 bore capacity)

A = Sectional Area (0.393 x d² @ 1/2 bore capacity)

For Ductile Iron Pipe in Tower DC : Internal Diameter = 225mm

HMD	0.05625
Pipe size	225 m
Slope of the total energy line	0.01
Manning's roughness coefficient, n	0.012 (for Ductile Iron pipe)
V=	1.223 m/s

Q= V x A
where
Q = discharge flow rate capacity (l/s)
A = area of pipe work (m2)
24.31 l/s

According to the calculation (1/2 bore capacity)
24.31 l/s > 19.91 l/s
Thus, a 225mm Ductile Iron pipe with gradient 1:100 shall cater the site discharge 1/2 bore capacity at 1.223m/s velocity.

For Ductile Iron Pipe in Tower FC : Internal Diameter = 225mm

HMD	0.05625
Pipe size	225 m
Slope of the total energy line	0.01
Manning's roughness coefficient, n	0.012 (for Ductile Iron pipe)
V=	1.223 m/s

Q= V x A
where
Q = discharge flow rate capacity (l/s)
A = area of pipe work (m2)
24.31 l/s

According to the calculation (1/2 bore capacity)
24.31l/s >6.40 l/s
200mm Ductile Iron pipe with gradient 1:100 shall cater the site discharge 1/2 bore capacity at 1.131m/s velocity.
The connection to DSD manhole shall be 225mm at least. Thus, 225mm discharge pipe shall be connected to DSD government manhole.

For Ductile Iron Pipe in Tower FC : Internal Diameter = 200mm

HMD	0.05
Pipe size	200 m
Slope of the total energy line	0.01
Manning's roughness coefficient, n	0.012 (for Ductile Iron pipe)
V=	1.131 m/s

Q= V x A
where
Q = discharge flow rate capacity (l/s)
A = area of pipe work (m2)
17.76 l/s

According to the calculation (1/2 bore capacity)
17.76l/s >6.40 l/s

100mm	1:40
150mm	1:70
200mm	1:70
225mm	1:100
250mm	1:120
300mm	1:150

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