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## APPENDIX H

Proposed Sewerage Connection for Indicative Development Scheme

## **1.3 Information Available for the Study**

1.3.1 The following information was reviewed for the Study:

- a. Hopewell Centre II Development SIA Report No. EB000176/HCI2017/SIA/R10 dated August 2023;
- b. DSD Sewerage Manual (Part I) – Key Planning Issues and Gravity Collection System (Part I) (Third Edition, May 2013);
- c. EPD Technical Paper EPD/TP 1/05, Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0 (March 2005) (GESF);
- d. PlanD’s Commercial and Industrial Floor Space Utilization Survey (CIFSUS);
- e. Census and Statistics Department, 2021 Population Census – Fact Sheet for Tertiary Planning Unit 131;
- f. BS EN 12056-2:2000 - Gravity drainage systems inside buildings - Part 2: Sanitary pipework, layout and calculation.
- g. Planning, Provision and Management of Public Toilets by the Food and Environmental Hygiene Department
- h. WSD Water Efficiency Labelling Scheme
- i. Guidelines for Good Handwashing Hong Kong

## **2 PROJECT OUTLINE**

### **2.1 Project Title**

2.1.1 The project title is “Proposed Amendment To The Approved Wan Chai Outline Zoning Plan No. S/H5/31 From “Comprehensive Development Area”, “Residential (Group C)”, “Open Space” And “Government, Institution Or Community” Zones And Area Shown As ‘Road’ To “Other Specified Uses (Residential Development With Historical Building Conserved)” And “Other Specified Uses (Elevated Walkway)” At Nos. 1, 1a, 2 And 3 Hill Side Terrace, No. 55 Ship Street (A.K.A. Nam Koo Terrace), Nos. 1 - 5 Schooner Street, No. 53 Ship Street, No. 18 Sau Wa Fong, Inland Lot No. 9048 And Adjoining Government Land, Wan Chai”.

### **2.2 Proponent**

2.2.1 The proponent of the project is Yuba Company Limited.

### **2.3 Nature and Description of Project**

2.3.1 The Indicate Development Scheme comprises 24-storeys of residential use and over 3 podium levels with shops proposed at G/F and E&M and residential recreational facilities on 2/F and 3/F of the podium. It is situated to the west of the HCII. The historical building NKT will be preserved in-situ.

2.3.2 The scope of this SIA comprises the sewers downstream of the Indicative Development Scheme at Sik On Street to the sewerage system at Queen’s Road East, and all of the upstream sewers affected by the works.

### **2.4 Location**

5.1.8 In the calculation of foul sewer capacity, the Colebrook-White equation for circular pipes was applied.

5.1.9 Colebrook-White equation for circular pipes:

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

where: V = mean velocity (m/s)  
g = gravitational acceleration (m/s<sup>2</sup>)  
R = hydraulic radius (m)  
D = pipe diameter (m)  
k<sub>s</sub> = equivalent sand roughness (m)  
ν = kinematic viscosity of fluid (m<sup>2</sup>/s)  
s = frictional slope (energy gradient due to frictional loss)

5.1.10 The design sewage flows of the public toilet were estimated as discussed in Section 5.2.

## 5.2 Assumptions

5.2.1 The sewage flow rates for the Indicative Development Scheme were estimated with the use of the unit flow factors given in Tables T-1 and T-2, and the relevant peaking factors in Table T-5 of the EPD GESF.

5.2.2 For the purpose of estimation of sewage flows from the Indicative Development Scheme, three commercial categories and one domestic category of population are used: i) Community, Social, and Personal Services; ii) Restaurants & Hotels; iii) Wholesale and Retail and iv) Residential R2. These three categories cover the entire population in the Indicative Development Scheme.

5.2.3 The unit flow factors used in the estimation of sewage flows for the Indicative Development Scheme are summarized in the table below.

Types of Population	Unit Flow Factor (m <sup>3</sup> /head/day)
Residential R2	0.27
Commercial Employee	0.08
Wholesale and Retail	0.20
Community, Social, and Personal Services	0.20
Restaurants & Hotels	1.50

**Table 3 –Unit Flow Factors used in the estimation of sewage flows**

5.2.4 For the purpose of estimation of the sewage flow of the residential portion of the Indicative Development Scheme was considered as Residential R2 dwelling.

5.2.5 According to 2021 Population By-census, the average domestic household size for Tertiary Planning Unit 131 (i.e. where the Rezoning Site falls) is 2.1. The total estimated residential population figure for the Indicative Development Scheme is shown in Table 5.

5.2.6 For the purpose of estimation of the sewage flow rate discharge from the commercial part of the Indicative Development Scheme, the commercial activity was considered as Recreational, Retail and Restaurants.

- 5.2.7 The existing NKT is proposed to be used on a non-profit making basis, with Eating Place at G/F and event space which could serve for art and cultural purposes at 1/F (e.g. arts centre, arts gallery, arts studio, rehearsal room for art performance).
- 5.2.8 The employment population figure for the non-profit making usage of the existing NKT in the Site was estimated using the value of 3.3 workers per 100 square metres of GFA presented in Figure 9 of the “PlanD’s Commercial and Industrial Floor Space Utilization Survey” for the Worker Density regarding Community, Social & Personal Services.
- 5.2.9 The values of worker density by economic activity and planned usage type for the new building of Indicative Development Scheme were estimated with the use of worker density in Table 8 of the “PlanD’s Commercial and Industrial Floor Space Utilization Survey”. The planned usage type for the proposed development was considered as private commercials. Estimated number of employees per commercial activity is shown in Table 5.
- 5.2.10 The worker density values used to estimate the commercial population of the Site are summarized in the Table 4.

<b>Economic Activities</b>	<b>Worker Density (worker/100m<sup>2</sup> GFA)</b>
Existing Community, Social, and Personal Services (Nam Koo Terrace, non-profit making use)	3.3
Proposed Community, Social, and Personal Services (Residential recreational facilities)	2.3
Proposed Retail Trade	2.1
Proposed Restaurants	5.1

**Table 4 – Worker density figures used for estimation of population**

- 5.2.11 The sewage flow from NKT will be discharged to the HCII Development’s proposed sewerage system at Ship Street located at the southeast of the site via the existing sewer. NKT’s sewage flow is separated from the new building works in the Indicative Development Scheme in which the sewage flow from existing NKT was considered in the HCII SIA.
- 5.2.12 Since NKT adopts the existing sewerage connection and there is no additional sewage flow induced from NKT, this report only considers the additional sewage flow induced from the new building works in the Indicative Development Scheme.
- 5.2.13 An appropriate peaking factor including stormwater allowance was adopted to estimate the design peak flows taking under consideration the population size of the sewage catchment area under consideration.
- 5.2.14 According to the Planning, Provision and Management of Public Toilets by the Food and Environmental Hygiene Department, public toilets are classified by utilisation rate (measured by average number of daily visitors). A toilet with 300 or more daily visitors on average is classified as having a high utilisation rate.
- 5.2.15 Assuming that the proposed NKT public toilet has a high utilisation rate, the number of visitors adopted in the sewage flow estimation is to be 300.
- 5.2.16 Since there are two proposed public toilets in NKT, each toilet is assumed to have 150 visitors.

5.2.17 Adopted values for the flow rate from the water taps and water closets are based on WSD Water Efficiency Labelling Scheme (WELS) considering WSD Efficiency Grade 4.

5.2.18 The exact number of sanitary fitments was based on the MLP. The detailed calculation of the estimated average dry weather flow from the public lavatory is contained in Appendix C.

## 6 ASSESSMENT

### 6.1 Existing Sewage Flow

6.1.1 According to existing sewerage network, it is assumed that NKT discharges sewage to the nearest existing manhole FMH7014690, HST discharges sewage to existing manhole FMH7014440, while the former MKT discharges sewage to existing manhole FMH7014436.

6.1.1 Since the sewage flow generated from the Site will be discharged to the sewerage pipeline at Schooner Street that is proposed under HCII, the sewage flows considered in HCII SIA Report are adopted in this SIA report.

6.1.2 The calculation of the estimated peak sewage flows from the existing buildings are contained in Appendix C (extracted from HCII SIA Report).

6.1.3 For reference, proposed public sewerage works under the HCII are shown in drawing no. S007-EB000176/HCII/2017-08 extracted from HCII SIA Report No. (Refer to Appendix E).

### 6.2 Design Sewage Flow and Assessment

6.2.1 Taking into account the latest changes in the Indicative Development Scheme, the estimated Average Dry Weather Flow is  $210.07 \text{ m}^3/\text{d}$ . Detailed calculations are shown in Appendix C.

6.2.2 The contributing population of the Indicative Development Scheme is  $778$ . A peaking factor of 8 (including storm allowance) is used to estimate the peak flow of the Site. Detailed calculations are shown in Appendix C.

6.2.3 The total peak flow of the Site is the sum of two peak flows. The peak flow from the domestic and commercial activities, and the peak flow from the proposed public lavatory.

6.2.4 The estimated peak flow from the Site for domestic and commercial activities is  $0.017\text{m}^3/\text{s} + 0.00147\text{m}^3/\text{s} = 0.01916\text{m}^3/\text{s}$  and the estimated peak flow from the proposed public lavatory is  $0.00029 \text{ m}^3/\text{s}$ . Detailed calculations are shown in Appendix C.

6.2.5 The estimated total peak flow of the Indicative Development Scheme is  $0.01945\text{m}^3/\text{s}$ . Detailed calculations are shown in Appendix C.

## Indicative Development Scheme Parameters and Estimation of Average Dry Weather Sewage Flows

Development Site area	3140.7m <sup>2</sup>
No. of flats	312
Average domestic household size	2.1
Estimated residential population	656
Residential recreational facilities area (m <sup>2</sup> )	1390.2
Average Worker Density for Community, Social & Personal Services – Private Commercials (workers per 100m <sup>2</sup> of GFA – PlanD Commercial and Industrial Floor Space Utilization Survey)	2.3
Estimated Workers for Community Social & Personal Services (Residential Recreational Facilities)	32
Kiosk (m <sup>2</sup> )	10.2
Average Worker Density for Restaurant & Hotels (workers per 100m <sup>2</sup> of GFA – PlanD Commercial and Industrial Floor Space Utilization Survey)	5.1
Estimated Workers for Restaurant & Hotels (Kiosk)	1
Shop area (m <sup>2</sup> )	536.7
Average Worker Density for Retail Trade (workers per 100m <sup>2</sup> of GFA – PlanD Commercial and Industrial Floor Space Utilization Survey)	2.1
Estimated Workers for Retail Trade (Shop)	12
Estimated Average Dry Weather Domestic Sewage Flow (m <sup>3</sup> /day)	<b>177.12</b>
Estimated Average Dry Weather Commercial Sewage Flow – Residential Recreational facilities (m <sup>3</sup> /day)	8.96
Estimated Average Dry Weather Commercial Sewage Flow – Kiosk (m <sup>3</sup> /day)	1.58
Estimated Average Dry Weather Commercial Sewage Flow – Shop – Retail (m <sup>3</sup> /day)	3.36
<b>Estimated Average Dry Weather Sewage Flow (m<sup>3</sup>/day) – Accessible Lavatory</b>	<b>3.15</b>
Catchment inflow factor (P <sub>CIF</sub> – as defined in Section 10.1 of EPD/TP1/05)	1.0
Estimated Average Dry Weather Sewage Flow (m <sup>3</sup> /day) (with P <sub>CIF</sub> applied)	<b>191.02</b>
NKT – Eating Space (m <sup>2</sup> )	159.6
Average Worker Density for Restaurant & Hotels (workers per 100m <sup>2</sup> of GFA – PlanD Commercial and Industrial Floor Space Utilization Survey)	5.1
Estimated Workers for Restaurant & Hotels (Eating Place)	9
NKT Event Space (m <sup>2</sup> )	159.6

Average Worker Density for Community, Social & Personal Services (workers per 100m <sup>2</sup> of GFA – PlanD Commercial and Industrial Floor Space Utilization Survey)	3.3
Estimated Workers for Community Social & Personal Services (Residential Recreational Facilities)	6
Estimated Average Dry Weather Commercial Sewage Flow – Eating Place (m <sup>3</sup> /day)	14.22
Estimated Average Dry Weather Commercial Sewage Flow – Event Space (m <sup>3</sup> /day)	1.68
Catchment inflow factor (P <sub>CIF</sub> – as defined in Section 10.1 of EPD/TP1/05)	1.0
Estimated Average Dry Weather Sewage Flow (m <sup>3</sup> /day) (with P <sub>CIF</sub> applied)	15.9
<b>Total Estimated Average Dry Weather Sewage Flow from the Development (m<sup>3</sup>/day) (with P<sub>CIF</sub> applied)</b>	<b>210.07</b>

**Table 5 – Average Dry Weather Sewage Flows**

6.2.6 With reference to Sections 1.1.3 and 3.2.1 of the HCII SIA report (Appendix E refers), the HCII SIA report takes into account the future development of the site at NKT, HST, MKT, Inland Lot No. 9048 and Adjoining Government Land.

6.2.7 With reference to Section 6.2.2 of the HCII SIA, the peak sewage flow rates are estimated for three scenarios to assess the sewerage pipes and manholes under the HCII Development. Each scenario has a different peaking factor as summarized below.

<b>Scenarios</b>	<b>Description</b>	<b>Peaking Factor</b>
Scenario 1	Assessment of sewerage impact from existing foul manholes FMH7014431 at Kennedy Road to FMH7014499 at Queen's Road East (QRE) and SM_A1 to SM24 at QRE Back Lane.	6
Scenario 2	Assessment of sewerage impact from existing foul manholes FMH7015024 to FMH7015169 and FMH7015092 to FMH7015059 at Queen's Road East.	5
Scenario 3	Assessment of sewerage impact from foul manholes FMH7014499 to FMH7013912 and SM24 to FMH7014502. Populations of the proposed Hopewell Centre II Development, proposed development at Nos. 153-167 Queen's Road East, Indicative Development Scheme and populations of the existing buildings on the eastern and western sides of Ship Street are included for assessment.	4

6.2.8 Among these three scenarios, the sewage flow from the Indicative Development Scheme is only considered under Scenario 1 and Scenario 3 in the HCII SIA.

- 6.2.9 Since the sewage flow from the Site is estimated in the HCII SIA using peaking factors 6 and 4 for Scenario 1 and Scenario 3 respectively, these peaking factors and the ADWF in Section 6.2.1 are used to estimate the sewage flow of the Indicative Development Scheme when incorporated in the HCII SIA.
- 6.2.10 The new estimated peak flow generated by the Site when incorporated in the HCII SIA are the following (detailed calculation is contained in Appendix C):  
 Scenario 1 = 0.0147 m<sup>3</sup>/s  
 Scenario 3 = 0.0100 m<sup>3</sup>/s
- 6.2.11 The estimated peak flow adopted in the latest HCII SIA (refer to Appendix D) are as follows:  
 Scenario 1 = 0.0178 m<sup>3</sup>/s  
 Scenario 3 = 0.0123 m<sup>3</sup>/s
- 6.2.12 As per assessment, the estimated peak flow in the latest HCII SIA Report is larger than the new estimated peak flow under this SIA:  
 Scenario 1: 0.0178 m<sup>3</sup>/s > 0.0147 m<sup>3</sup>/s  
 Scenario 3: 0.0123 m<sup>3</sup>/s > 0.0100 m<sup>3</sup>/s

### 6.3 Hydraulic Modelling of Existing Public Sewerage System

- 6.3.1 Computer hydraulic models using Version 20.2.3 of InfoWorks ICM were formulated to assess the hydraulic performance of existing public sewerage system between Kennedy Road and Johnston Road.
- 6.3.2 These hydraulic models were evolved from the hydraulic model created for the HCII SIA study.
- 6.3.3 The hydraulic model includes a network comprising the existing sewer from existing DSD manholes no. FMH7014722 to FMH7013911.
- 6.3.4 The hydraulic models include the proposed sewer pipes and manholes in HCII Development along Ship Street, Schooner Street and Sik On Street.
- 6.3.5 In the hydraulic model the proposed sewerage network has incorporated the approved layout of the stairway along Ship Street and the Shit Street Garden.
- 6.3.6 The Colebrook-White pipe roughness values (ks) presented in DSD SDM Table 14 were adopted in the hydraulic model as follows:

Pipe material	Pipe roughness values (ks)
Existing sewers	3.0mm
Ductile Iron with internal cement mortar lining pipes	3.0mm
Plastic pipes (e.g. uPVC, PE)	1.5mm

**Table 4 – Colebrook-White pipe roughness values (ks)**

- 6.3.7 Shaft and chamber areas for manholes (nodes) were modelled based on relevant DSD manholes standard drawings.



- 6.4.5 The sizing of the proposed sewerage connection pipe is presented in Appendix F.
- 6.4.6 Extracts of the hydraulic performance for the downstream sewers considered under Scenarios 1 and 3 of HCII are contained in Appendix G for reference.

## 7 CONCLUSIONS

- 7.1.1 The Indicative Development Scheme will discharge its sewage flow to a sewerage pipeline at Schooner Street that is proposed to be diverted and upgraded under the HCII Development.
- 7.1.2 With reference to Sections 1.1.3 and 3.2.1 of the HCII SIA report, the HCII SIA report takes into account the future development of part of the site at Nam Koo Terrace, Hill Side Terrace, Former Miu Kang Terrace, Inland Lot No. 9048 and Adjoining Government Land.
- 7.1.3 The new estimated peak flow generated by the Site when incorporated in the HCII SIA are the following:
  - Scenario 1 = 0.0147 m<sup>3</sup>/s
  - Scenario 3 = 0.0100 m<sup>3</sup>/s
- 7.1.4 The estimated peak flow adopted in the latest HCII SIA (refer to Appendix D) are as follows:
  - Scenario 1 = 0.0178 m<sup>3</sup>/s
  - Scenario 3 = 0.0123 m<sup>3</sup>/s
- 7.1.5 As per this SIA, the estimated peak flow in the latest HCII SIA Report is larger than the new estimated peak flow under this SIA:
  - Scenario 1: 0.0178 m<sup>3</sup>/s > 0.0147 m<sup>3</sup>/s
  - Scenario 3: 0.0123 m<sup>3</sup>/s > 0.0100 m<sup>3</sup>/s
- 7.1.6 According to the performance of hydraulic modelling, there should be no adverse sewerage impact generated from the Site to sewers downstream. Extracts of the hydraulic performance for the downstream sewers considered under Scenarios 1 and 3 of HCII are contained in Appendix G for reference.

## **APPENDIX C**

### **Estimation of Average Dry Weather Flow and Peak Flow of the Indicative Development Scheme**

**Appendix C**

Flow Estimation for: Proposed Comprehensive Development at Hillside & Nam Koo Terrace, Wan Chai, Hong Kong

Floor	Activity Type	No. of Floors	GFA (m <sup>2</sup> )	ACTIVITY TYPE (DOMESTIC / COMMERCIAL)	COMMERCIAL ACTIVITY TYPE	Worker Density / 100 m <sup>2</sup> GFA	No. of Workers	Flats per Floor	Total No. of Flats	No. of Residents per Flats	Total no. of Residents	UFF m <sup>3</sup> /day	ADWF m <sup>3</sup> /day	Total ADWF m <sup>3</sup> /day	Cumulative ADWF m <sup>3</sup> /day	Contribution Population	Cumulative Contribution Population	Catchment Inflow Factor	Peaking Factor	Peak Flow (L/s)	Cumulative Peak Flow (L/s)	Scenario 1*			Scenario 3*		
																						Peaking Factor	Peak Flow (L/s)	Cumulative Peak Flow (L/s)	Peaking Factor	Peak Flow (L/s)	Cumulative Peak Flow (L/s)
5/F TO 28/F	Residential Flats	24	-	Domestic	-	-	-	13	312	2.1	656	0.27	177.12	191.02	191.02	707	707	1.0	8	17.6870	17.6870	6	13.2653	13.2653	4	8.8435	8.8435
2/F & 3F	Recreational Facilities	2	1390.20	Commercial	Community, Social, & Personal Services	2.3	32	-	0	-	-	0.28	8.96														
G/F	Shop	1	536.70	Commercial	Retail Trade	2.1	12	-	0	-	-	0.28	3.36														
4/F	Kiosk	1	10.20	Commercial	Restaurants & Hotels	5.1	1	-	0	-	-	1.58	1.58														
4/F	Public Lavatory	SEE BELOW FLOW ESTIMATION FOR ACCESSIBLE LAVATORY											3.15	3.15	194.17	12	719	0.2917	17.9787	-	0.2917	13.5569	-	0.2917	9.1352		
G/F	NKT Eating Place	1	159.60	Commercial	Restaurants & Hotels	5.1	9	-	0	-	-	1.58	14.22	15.90	15.90	59	59	1.0	8	1.4722	1.4722	6	1.1042	1.1042	4	0.7361	0.7361
1/F	NKT Event Space	1	159.60	Commercial	Community, Social, & Personal Services	3.3	6	-	0	-	-	0.28	1.68														
																			Total peak flow from the Site (L/s)		19.45			14.66			9.87
																			Total peak flow from the Site (m <sup>3</sup> /s)		0.01945			0.0147			0.010

\*Scenario 1 and Scenario 3 are scenarios under the HClI SIA wherein the Proposed Comprehensive Development contributes to. The new estimated total peak flow per scenario from the Site are shown when incorporated into HClI SIA.

FLOW ESTIMATION FOR ACCESSIBLE LAVATORY		
<b>References:</b>		
1) WSD Water Efficiency Labelling Scheme (WELS) for Water Taps ( <a href="https://www.wsd.gov.hk/filemanager/en/content_1476/wels.pdf">https://www.wsd.gov.hk/filemanager/en/content_1476/wels.pdf</a> )		
2) WSD WELS on Water Closets ( <a href="https://www.wsd.gov.hk/en/plumbing-engineering/water-efficiency-labelling-scheme/wels-on-water-closets/voluntary-water-efficiency-labelling-scheme-on-clo/index.html">https://www.wsd.gov.hk/en/plumbing-engineering/water-efficiency-labelling-scheme/wels-on-water-closets/voluntary-water-efficiency-labelling-scheme-on-clo/index.html</a> )		
3) Guidelines for Good Handwashing ( <a href="https://www.info.gov.hk/info/sars/en/handwashing.htm">https://www.info.gov.hk/info/sars/en/handwashing.htm</a> )		
4) Planning, Provision and Management of Public Toilets by the Food and Environmental Hygiene Department ( <a href="https://www.aud.gov.hk/pdf_e/e73ch01sum.pdf">https://www.aud.gov.hk/pdf_e/e73ch01sum.pdf</a> )		
<b>Toilet 1</b>		
Reasonable Hours (6am -11pm)	17 hrs/day	refer to MLP
No. of Water Closet	1	
Water flush volume for full flush	7.5 L/flush	WSD Efficiency Grade 4
Assumed number of users per day	150 persons /day	assuming one flush per person
Daily sewage discharge (water closet)	1125 L/day	
No. of Sink	1	
Nominal Flow Rate	6 L/min	WSD Efficiency Grade 4
Assumed washing duration	30 s	recommended washing duration is 10 seconds
Assumed number of users per day	150 persons/day	
Daily sewage discharge (water tap)	450 L/day	
Total sewage discharge (Toilet 1)	1575 L/day	
<b>Toilet 2</b>		
Reasonable Hours (6am -11pm)	17 hrs/day	refer to MLP
No. of Water Closet	1	
Water flush volume for full flush	7.5 L/flush	WSD Efficiency Grade 4
Assumed number of users per day	150 persons /day	assuming one flush per person
Daily sewage discharge (water closet)	1125 L/day	
No. of Sink	1	
Nominal Flow Rate	6 L/min	WSD Efficiency Grade 4
Assumed washing duration	30 s	recommended washing duration is 10 seconds
Assumed number of users per day	150 persons/day	
Daily sewage discharge (water tap)	450 L/day	
Total sewage discharge (Toilet 2)	1575 L/day	
<b>ADWF for Public Toilets at Public Open Space</b>	<b>3.15 m<sup>3</sup>/day</b>	