

**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**

**Sewerage Impact Assessment**

SEPTEMBER 2024

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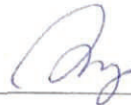
**PROPOSED AMENDMENT TO THE APPROVED WAN CHAI OUTLINE ZONING PLAN NO. S/H5/31 FROM “COMPREHENSIVE DEVELOPMENT AREA”, “RESIDENTIAL (GROUP C)”, “OPEN SPACE” AND “GOVERNMENT, INSTITUTION OR COMMUNITY” ZONES AND AREA SHOWN AS ‘ROAD’ TO “OTHER SPECIFIED USES (RESIDENTIAL DEVELOPMENT WITH HISTORICAL BUILDING 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**

Sewerage Impact Assessment

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**Report No** EB000176/NKT/S16/SIA/R07

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# 1 INTRODUCTION

## 1.1 Background

- 1.1.1 Asia Infrastructure Solutions Limited was commissioned by Yuba Company Limited to prepare this Sewerage Impact Assessment (SIA) report.
- 1.1.2 This SIA is prepared in support of the Section 12A Planning Application (“S12A”)/ Rezoning Request (“RR”) to amend the Approved Wan Chai Outline Zoning Plan No. S/H5/31 (the “Approved OZP”) at Nos. 1, 1A, 2 and 3 Hill Side Terrace (“HST”), No. 55 Ship Street [a.k.a Nam Koo Terrace (“NKT”)], Nos. 1 - 5 Schooner Street, No. 53 Ship Street, No. 18 Sau Wa Fong, Inland Lot No. 9048 (“IL 9048”) and adjoining Government Land, Wan Chai (the “Site”/ “Rezoning Site”).
- 1.1.3 The Rezoning Site is currently zoned “Comprehensive Development Area” (“CDA”), “Residential (Group C)” (“R(C)”), “Open Space” (“O”) and minor encroachment into the “Government, Institution or Community” (“G/IC”) and falls in to area shown as ‘Road’ on the Approved OZP gazetted on 12 May 2023. The Applicant proposed to rezone the Site to “Other Specified Uses (Residential Development with Historical Building Conserved)” (“OU(RDHBC)”) and “Other Specified Uses (Elevated Walkway)” (“OU(EW)”) zone to facilitate a Comprehensive Residential Development with supporting commercial uses and conservation of the NKT. The RR also seeks to relax the plot ratio (“PR”) restriction to the level permitted under Building (Planning) Regulations (“B(P)R”) and building height (“BH”) restriction to 120mPD correspondingly. An Indicative Development Scheme (“IDS”) is put forth to demonstrate the development intention and the feasibility of the Proposed “OU(RDHBC)” zone.
- 1.1.4 This Sewerage Impact Assessment (SIA) takes into account the permanent sewerage upgraded sewer pipelines that will result from the construction of the Hopewell Centre II Development (HCII) located immediately east of the site and the proposed development at Nos.153-167 Queen’s Road East.

## 1.2 Objectives

- 1.2.1 This report outlines the existing sewerage system in the vicinity of the Site and examines the potential sewage impacts arisen from the Indicative Development Scheme. It also proposed appropriate mitigation measures if necessary.
- 1.2.2 The objectives of SIA are as follow:
- Identify any potential sewerage impact arising from the Site;
  - Assess sewerage impact of the Indicative Development Scheme on the permanent diverted sewerage system proposed under the Development;
  - Propose the necessary changes to the existing and the foregoing diverted sewerage network due to the Indicative Development Scheme; and
  - Identify design requirements of the sewerage system of the 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.

## **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**

2.4.1 The Rezoning Site is located at southwestern part of Wan Chai. It is bounded by Schooner Street and Greenland House to the north, Ship Street to the east, St. Francis’ Canossian College to the south and St. Francis’ Canossian School to the west.

## **2.5 Area of Rezoning Site**

- 2.5.1 The Rezoning Site has a site area of 3,157.6m<sup>2</sup>, in which the development site area is 3,140.7m<sup>2</sup> after excluding elevated walkway above Ship Street staircase.
- 2.5.2 The G.F.A. for domestic use is approximately 27,820.3m<sup>2</sup>.
- 2.5.3 The domestic plot ratio is approximately 8.858.

## **3 PLANNING AND IMPLEMENTATION OF PROGRAMME**

### **3.1 Planning and Implementation**

- 3.1.1 The Indicative Development Scheme will be constructed in one single phase.
- 3.1.2 The tentative completion year will be 2028.

### **3.2 Project Interface**

- 3.2.1 This SIA takes into account the proposed HCII and the proposed commercial development at Nos. 153-167 Queen's Road East.
- 3.2.2 The Indicative Development Scheme will discharge its sewage flow to a sewerage pipeline at Schooner Street that is proposed under the public sewerage works for HCII.

## **4 EXISTING AND PROPOSED SEWERAGE SYSTEM**

### **4.1 Existing Sewerage System**

- 4.1.1 The existing sewerage system considered in this SIA currently serves several properties at Sik On Street. The downstream ends of the sewerage pipelines connect to the 600mm diameter public sewerage pipeline at Queen's Road East.
- 4.1.2 There is an existing sewerage pipeline along Schooner Street comprising a series of 150mm diameter pipes that start from the west end of Schooner Street.
- 4.1.3 The sewage flow from the historical building NKT is discharged to the existing sewer manhole no. FMH7014691 at Ship Street via existing connecting sewer.
- 4.1.4 The existing sewerage system is shown in drawings no. S001-EB000176/HCII/2017 to S006-EB000176/HCII/2017 contained in Appendix B (extracted from HCII SIA report no. EB000176/HCII2017/SIA/R10).

## 5 SEWERAGE IMPACT ASSESSMENT

### 5.1 Estimation of Sewage Flow Rate

5.1.1 The average dry weather flow for the Indicative Development Scheme was estimated in accordance with EPD Technical Paper EPD/TP 1/05, Guidelines for estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0 (March 2005) (GESF). Detailed calculations are contained in Appendix B.

5.1.2 The average dry weather flow (i.e. average sewage flow rate) for the Indicative Development Scheme was calculated with the unit flow factor as follows:

**Average Dry Weather Flow (ADWF) (m<sup>3</sup>/day) =**

$$\Sigma [\text{Population (head)} \times \text{unit flow factor (m}^3\text{/head/day)}]$$

5.1.3 In the case of Commercial and Industrial Flows, the total unit flow generated from an employee in a particular trade is the sum of the unit flow factor of employee and the unit flow factor of a particular trade under consideration.

5.1.4 According to section 2.2 of the EPD GESF the equation for average flow is as follows:

$$Q_{\text{AVERAGE}} = (Q_{\text{DOMESTIC}} + Q_{\text{COMMERCIAL}} + Q_{\text{INSTITUTIONAL}} + Q_{\text{INDUSTRIAL}}) \times P_{\text{CIF}}$$

Where,

$Q_{\text{DOMESTIC}}$  Is the average dry weather domestic flow;

$Q_{\text{COMMERCIAL}}$  Is the average dry weather commercial flow;

$Q_{\text{INSTITUTIONAL}}$  Is the average dry weather institutional flow;

$Q_{\text{INDUSTRIAL}}$  Is the average dry weather industrial flow;

$P_{\text{CIF}}$  Is the catchment inflow factor;

5.1.5 The catchment inflow factor takes into account the excessive inflow quantities that occurs in some catchments. They are catchment-dependent and applicable to major sewerage facilities of a catchment. The values are given in Table T-4 of the EPD GESF.

5.1.6 The peak flow was calculated with peaking factor as follows:

$$\text{Peak Flow (m}^3\text{/day)} = Q_{\text{AVERAGE}} \times \text{Peaking Factor}$$

5.1.7 For the identification of the appropriate peaking factor to be used, the contributing population was calculated with total average flow as follows:

**Contributing Population =**

$$\text{Calculated total average flow (m}^3\text{/day)} / 0.27(\text{m}^3\text{/person/day)}$$



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:

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

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)  
v = 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 toilets were estimated by the approach stipulated in BS EN 12056-2:2000 “Gravity Drainage Systems based on Buildings – Part 2: Sanitary pipework, layout and calculation”.

5.1.11 Accordingly, the sewage flow rate is determined as follows:

5.1.12 Sewage Flow Rate (L/s) =

$$K\sqrt{\sum DU}$$

where: K = Frequency factor  
 $\sum DU$  = Sum of discharge units

## 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 R3. 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 R3	0.37
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 R3 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 The peak sewage flow from the proposed public lavatory was estimated in accordance with the criteria presented on BS EN 12056-2:2000 – Gravity drainage systems inside buildings – Part 2: Sanitary pipework, layout and calculation. The exact number of sanitary fittings was based on the MLP. The detailed calculation of estimated peak sewage flows from public lavatory is contained in Appendix B.

## **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 256.62 m<sup>3</sup>/d. Detailed calculations are shown in Appendix C.
- 6.2.2 The contributing population of the Indicative Development Scheme is 950. 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 0.0237m<sup>3</sup>/s and the estimated peak flow from the proposed public lavatory is 0.0019m<sup>3</sup>/s. Detailed calculations are shown in Appendix C.
- 6.2.5 The estimated total peak flow of the Indicative Development Scheme is 0.0251m<sup>3</sup>/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)	242.72
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
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)	256.62
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

**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.

Scenarios	Description	Peaking Factor
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 = 0.0197 m<sup>3</sup>/s  
 Scenario 3 = 0.0137 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 smaller than the new estimated peak flow under this SIA:  
 Scenario 1: 0.0178 m<sup>3</sup>/s < 0.0197 m<sup>3</sup>/s  
 Scenario 3: 0.0123 m<sup>3</sup>/s < 0.0137 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.
- 6.3.8 Sewage flows from individual buildings discharged to corresponding manholes as shown in the sewerage record plan were modelled as inflows to corresponding manhole nodes.

- 6.3.9 Normal headloss types were used in the model. Normal headloss pipe coefficients were derived using the automated inference routine built into the InfoWorks ICM software.
- 6.3.10 The following reduction of pipe flow area were adopted to simulate the pipe hydraulic performance of both existing and proposed sewerage systems:
- i) a 5% reduction in flow area if the pipe gradient is greater than 1 in 25 and
  - ii) a 10% reduction in flow area for all other pipes.
- 6.3.11 In order to take into consideration the effect of the downstream system on the hydraulic capacity of the proposed sewer pipes, the water level at the outfall node was fixed at 2.030mPD in the InfoWorks model. This level was estimated by assuming that the flow inside the 900mm diameter downstream pipe from manhole FMH7013912 to manhole FMH7013919 is at full bore condition.
- 6.3.12 The water levels at the outfall nodes FMH7014499 and SM24 in Scenario 1 were extracted from the simulated water levels at those nodes in Scenario 3 hydraulic simulation.
- 6.3.13 The water levels at the outfall nodes FMH7015059 and FMH7015169 in Scenario 2 were extracted from the simulated water levels at those nodes in Scenario 3 hydraulic simulation.
- 6.3.14 The hydraulic model was validated without error. Model data and results outputs for pre and post development are included in Appendix E.
- 6.3.15 It is recommended that sewage generated from the Indicative Development Scheme and exiting Nam Koo Terrace be discharged to the proposed manhole SM16 and SM10 respectively.

## **6.4 Proposed Sewerage Connection and Sewerage Impact**

- 6.4.1 Taking into account the Architectural Plans of the Indicative Development Scheme the sewage flow from the Site is to be discharged to proposed sewerage manhole SM16 at Schooner Street.
- 6.4.2 The proposed sewerage connection is shown in drawing no. S001-EB000176/NKT/S16SIA-04 (Appendix H).
- 6.4.3 The estimated sewage flow from the Site is taken into account in the latest HCII SIA. Refer to Appendix C.
- 6.4.4 Necessary adjustments to ensure no adverse impact to sewers downstream of the Site were considered in the latest HCII SIA. Extracts of the hydraulic performance for the downstream sewers considered under Scenarios 1 and 3 of HCII are contained in Appendix G.
- 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 =  $0.0197\text{m}^3/\text{s}$

Scenario 3 =  $0.0137\text{m}^3/\text{s}$

7.1.4 The estimated peak flow adopted in the latest HCII SIA (refer to Appendix D) are as follows:

Scenario 1 =  $0.0178\text{ m}^3/\text{s}$

Scenario 3 =  $0.0123\text{ m}^3/\text{s}$

7.1.5 As per this SIA, the estimated peak flow in the latest HCII SIA Report is smaller than the new estimated peak flow under this SIA:

Scenario 1:  $0.0178\text{ m}^3/\text{s} < 0.0197\text{m}^3/\text{s}$

Scenario 3:  $0.0123\text{ m}^3/\text{s} < 0.0137\text{m}^3/\text{s}$

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.

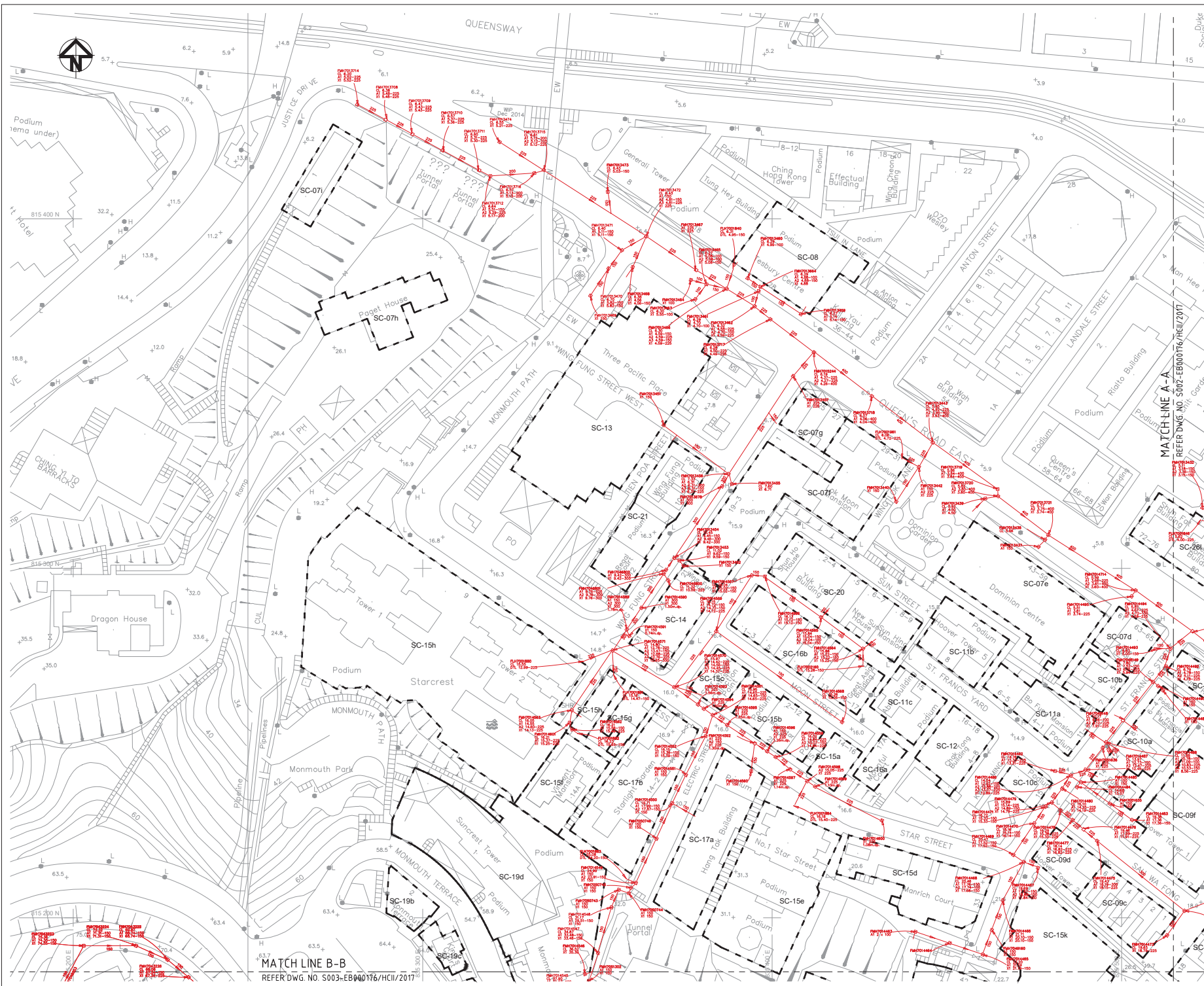


## **APPENDIX A**

**Architectural Drawings for the Indicative Development Scheme (Please refer to Appendix 1 of the Supplementary Planning Statement)**

## **APPENDIX B**

**Existing Sewerage System (Extracted from HCII SIA Report No. EB000176/HCII2017/SIA/R10)**



**LOCATION PLAN**  
SCALE 1 : 7500

- LEGEND:**
- SEWER MANHOLE
  - EXISTING PIPE (SEWER)
  - - - CATCHMENT BOUNDARY
  - SC-27a CATCHMENT ID
- NOTE:**
- THE INCOMING PIPES ARE MARKED A1, A2, A3... COUNTING CLOCKWISE FROM THE FIRST OUTGOING PIPE X1. OUTGOING PIPES ARE MARKED X1, X2, X3... COUNTING CLOCKWISE FROM NORTH.

Issue	Description	Date
01	FIRST ISSUE FOR SIA	17-10-17

**PRELIMINARY**  
NOT TO BE USED FOR CONSTRUCTION

Scales	Current Issue Signatures
A1 (1:500) A3 (1:1000)	Author: F. COUINHO Checker: L. LEUNG Approver: B. IEONG

Filename: S001-EB000176-HCI-2017-01DWG

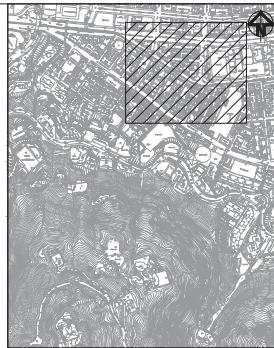
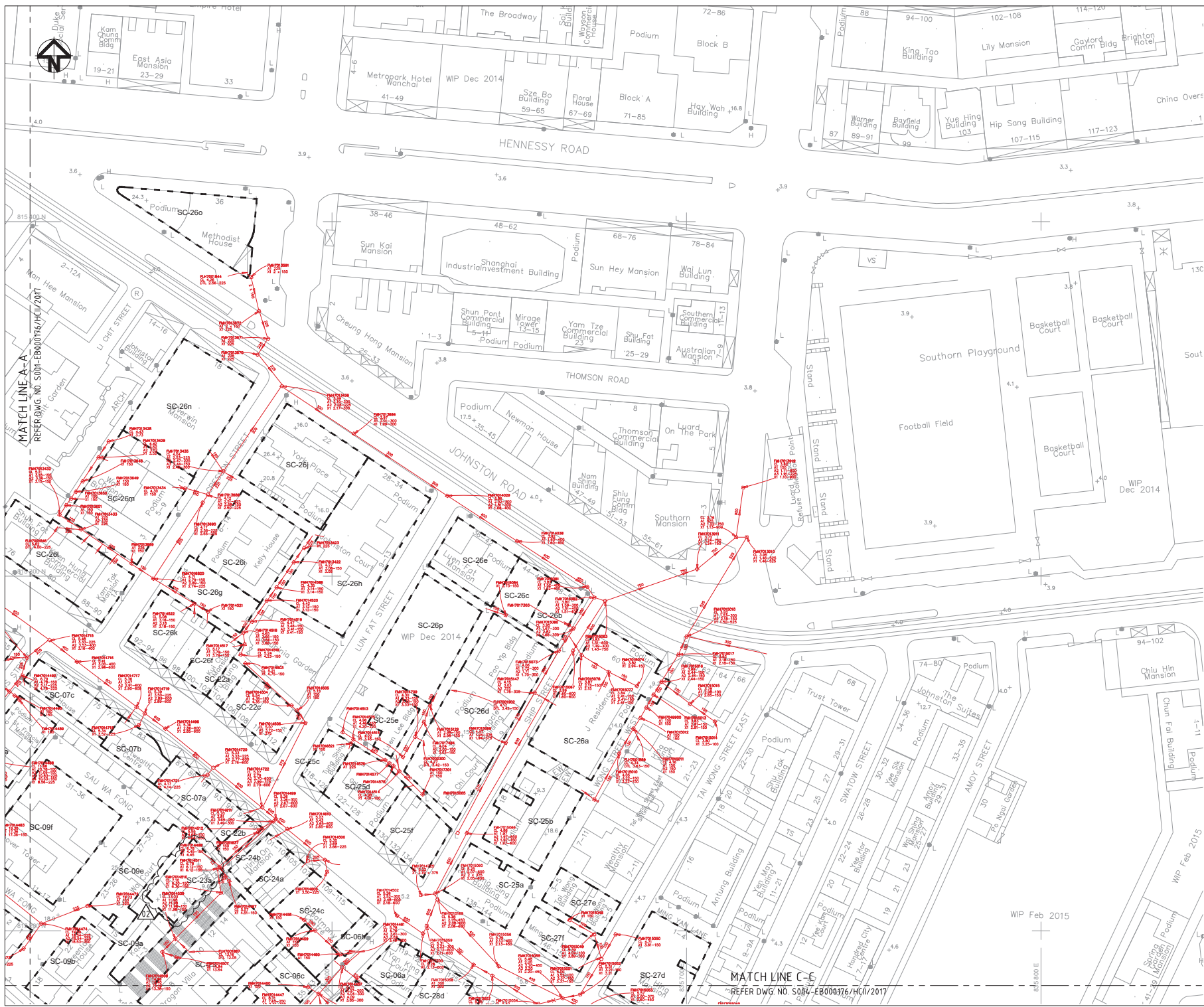
**WETHERALL INVESTMENTS LIMITED**



**Project**  
HOPEWELL CENTRE II DEVELOPMENT  
SEWERAGE IMPACT ASSESSMENT

**Title**  
EXISTING PUBLIC SEWERAGE SYSTEM AND SEWERAGE CATCHMENTS (SHEET 1 OF 6)

Drawing No.	Project No.	Issue
S001	EB000176/HCI/2017	01



**LOCATION PLAN**  
SCALE 1 : 7500

**LEGEND:**

- SEWER MANHOLE
- EXISTING PIPE (SEWER)
- CATCHMENT BOUNDARY
- SC-27a CATCHMENT ID

**NOTE:**

THE INCOMING PIPES ARE MARKED A1, A2, A3... COUNTING CLOCKWISE FROM THE FIRST OUTGOING PIPE X1. OUTGOING PIPES ARE MARKED X1, X2, X3... COUNTING CLOCKWISE FROM NORTH.

D2	MINOR REVISION	18-06-21
D1	FIRST ISSUE FOR SIA	17-10-17
Issue	Description	Date

Status: **PRELIMINARY**  
NOT TO BE USED FOR CONSTRUCTION

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Original Size	-	Checker	L. LEUNG
Height Datum	HKPD	Approver	B. IEONG
Grid	HK80	© Copyright reserved	

Filename: S002-EB000176-HCI-2017-02.DWG

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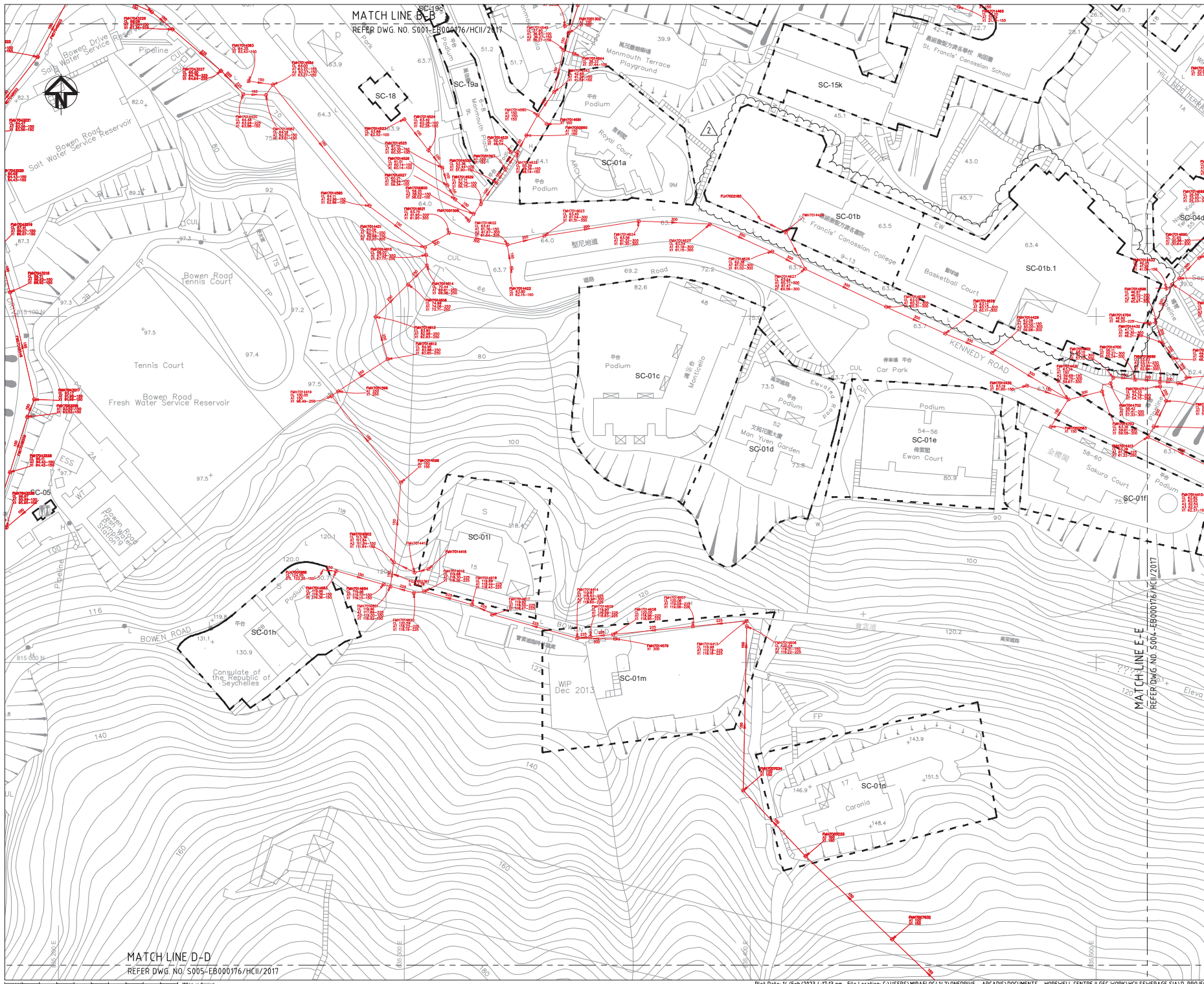
**WETHERALL INVESTMENTS LIMITED**



Project: **HOPEWELL CENTRE II DEVELOPMENT SEWERAGE IMPACT ASSESSMENT**

Title: **EXISTING PUBLIC SEWERAGE SYSTEM AND SEWERAGE CATCHMENTS (SHEET 2 OF 6)**

Drawing No.	Project No.	Issue
S002	EB000176/HCI/2017-02	02



**LOCATION PLAN**  
SCALE 1: 7500

- LEGEND:**
- SEWER MANHOLE
  - EXISTING PIPE (SEWER)
  - - - CATCHMENT BOUNDARY
  - SC-27a CATCHMENT ID

**NOTE:**  
THE INCOMING PIPES ARE MARKED A1, A2, A3... COUNTING CLOCKWISE FROM THE FIRST OUTGOING PIPE X1. OUTGOING PIPES ARE MARKED X1, X2, X3... COUNTING CLOCKWISE FROM NORTH.

02	ISSUE FOR SIA R10	10-02-23
01	FIRST ISSUE FOR SIA	17-10-17
Issue	Description	Date

**PRELIMINARY**  
NOT TO BE USED FOR CONSTRUCTION

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Original Size	-	Checker L. LEUNG
Height Datum	HKPD	Approver B. IEONG
Grid	HK80	© Copyright reserved
Filename	S003-EB000176-HCI-2017-02.DWG	
Client	WETHERALL INVESTMENTS LIMITED	

**WETHERALL INVESTMENTS LIMITED**

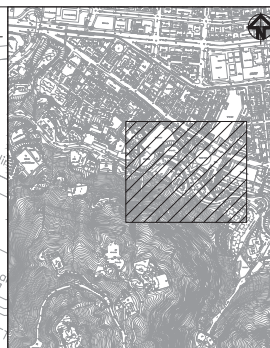
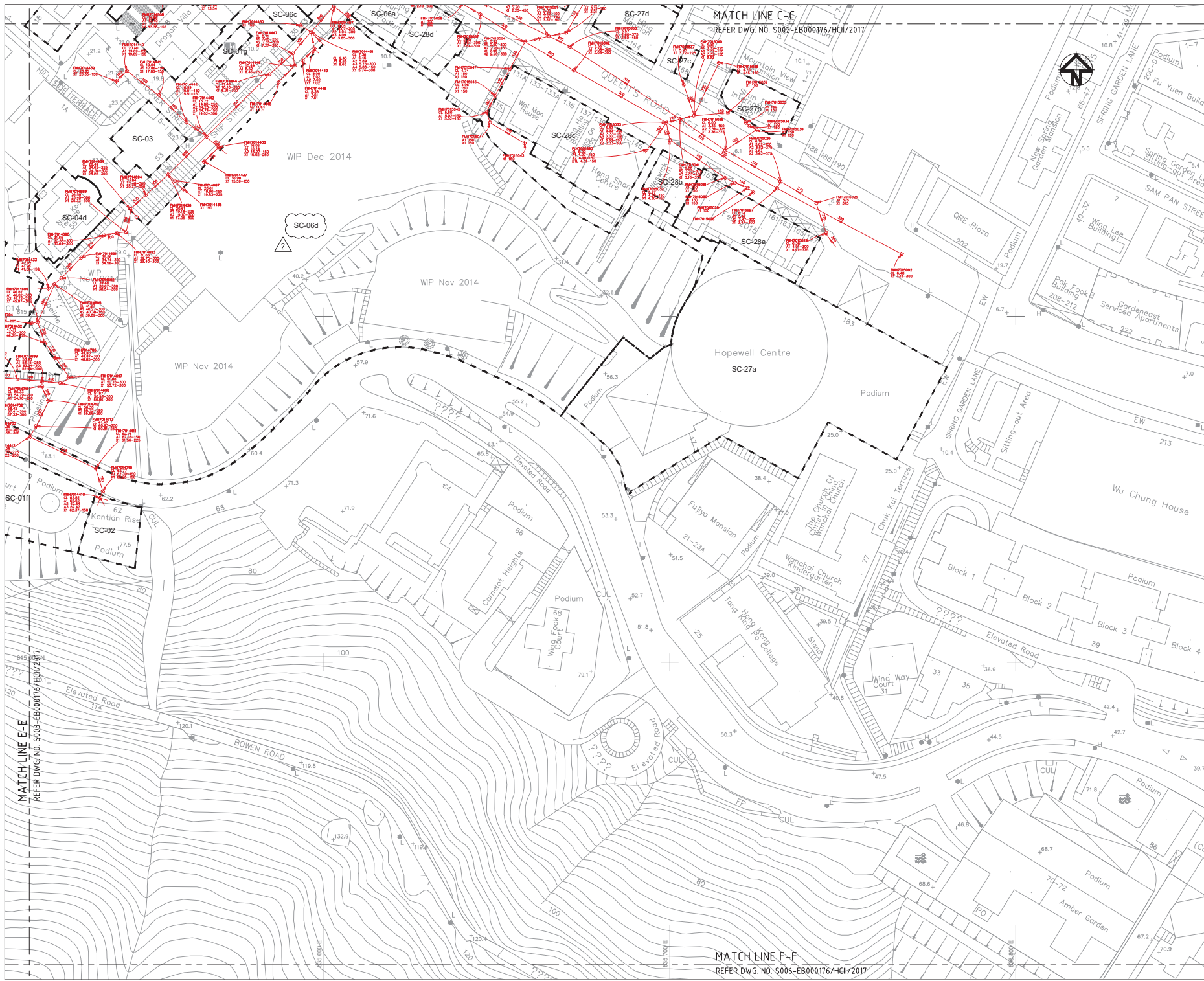


**Project**  
HOPEWELL CENTRE II  
DEVELOPMENT  
SEWERAGE IMPACT  
ASSESSMENT

**Title**  
EXISTING PUBLIC  
SEWERAGE SYSTEM AND  
SEWERAGE CATCHMENTS  
(SHEET 3 OF 6)

Drawing No.	Project No.	Issue
S003	EB000176/HCI/2017-02	02

MATCH LINE D-D  
REFER DWG. NO. S005-EB000176/HCI/2017



**LOCATION PLAN**  
SCALE 1 : 7500

- LEGEND:**
- SEWER MANHOLE
  - EXISTING PIPE (SEWER)
  - - - CATCHMENT BOUNDARY
  - SC-27a CATCHMENT ID

**NOTE:**  
THE INCOMING PIPES ARE MARKED A1, A2, A3... COUNTING CLOCKWISE FROM THE FIRST OUTGOING PIPE X1. OUTGOING PIPES ARE MARKED X1, X2, X3... COUNTING CLOCKWISE FROM NORTH.

D2	MINOR REVISION	15-01-18
D1	FIRST ISSUE FOR SIA	17-10-17
Issue	Description	Date

**PRELIMINARY**  
**NOT TO BE USED FOR CONSTRUCTION**

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Original Size	-	Approver	B. IEONG
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Filename	S004-EB000176-HCI-2017-02.DWG		
Client	WETHERALL INVESTMENTS LIMITED		

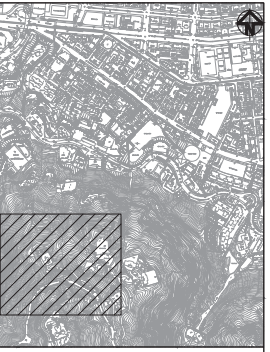
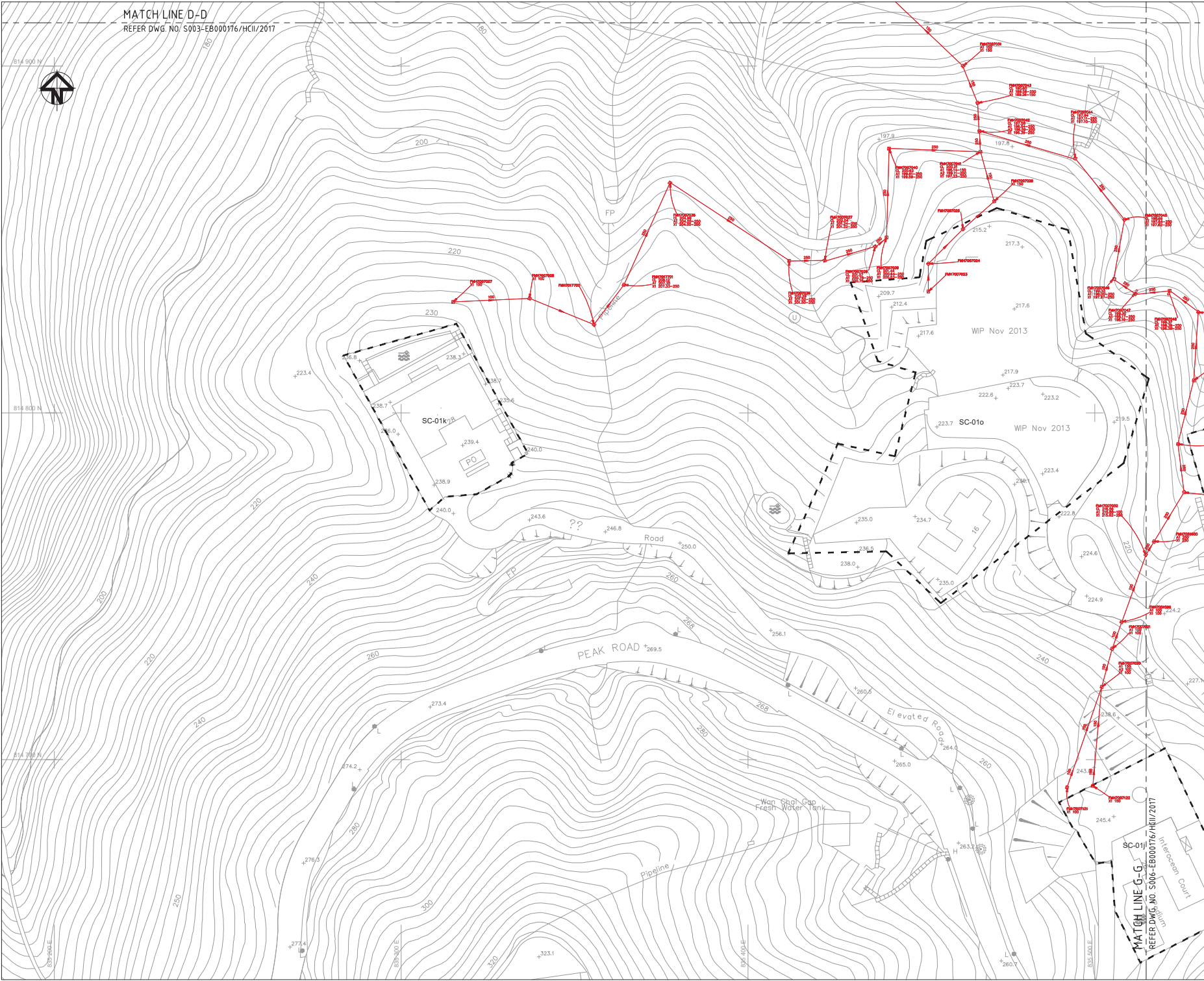
**WETHERALL INVESTMENTS LIMITED**



**Project**  
HOPEWELL CENTRE II DEVELOPMENT  
SEWERAGE IMPACT ASSESSMENT

**Title**  
EXISTING PUBLIC SEWERAGE SYSTEM AND SEWERAGE CATCHMENTS (SHEET 4 OF 6)

Drawing No.	S004	Project No.	EB000176/HCI/2017-02	Issue	02
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**LOCATION PLAN**

SCALE 1 : 7500

**LEGEND:**

- SEWER MANHOLE
- EXISTING PIPE (SEWER)
- - - CATCHMENT BOUNDARY
- SC-27a CATCHMENT ID

**NOTE:**

THE INCOMING PIPES ARE MARKED A1, A2, A3... COUNTING CLOCKWISE FROM THE FIRST OUTGOING PIPE X1. OUTGOING PIPES ARE MARKED X1, X2, X3... COUNTING CLOCKWISE FROM NORTH.

Issue	Description	Date
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**PRELIMINARY  
NOT TO BE USED FOR CONSTRUCTION**

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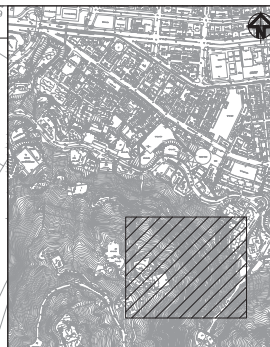
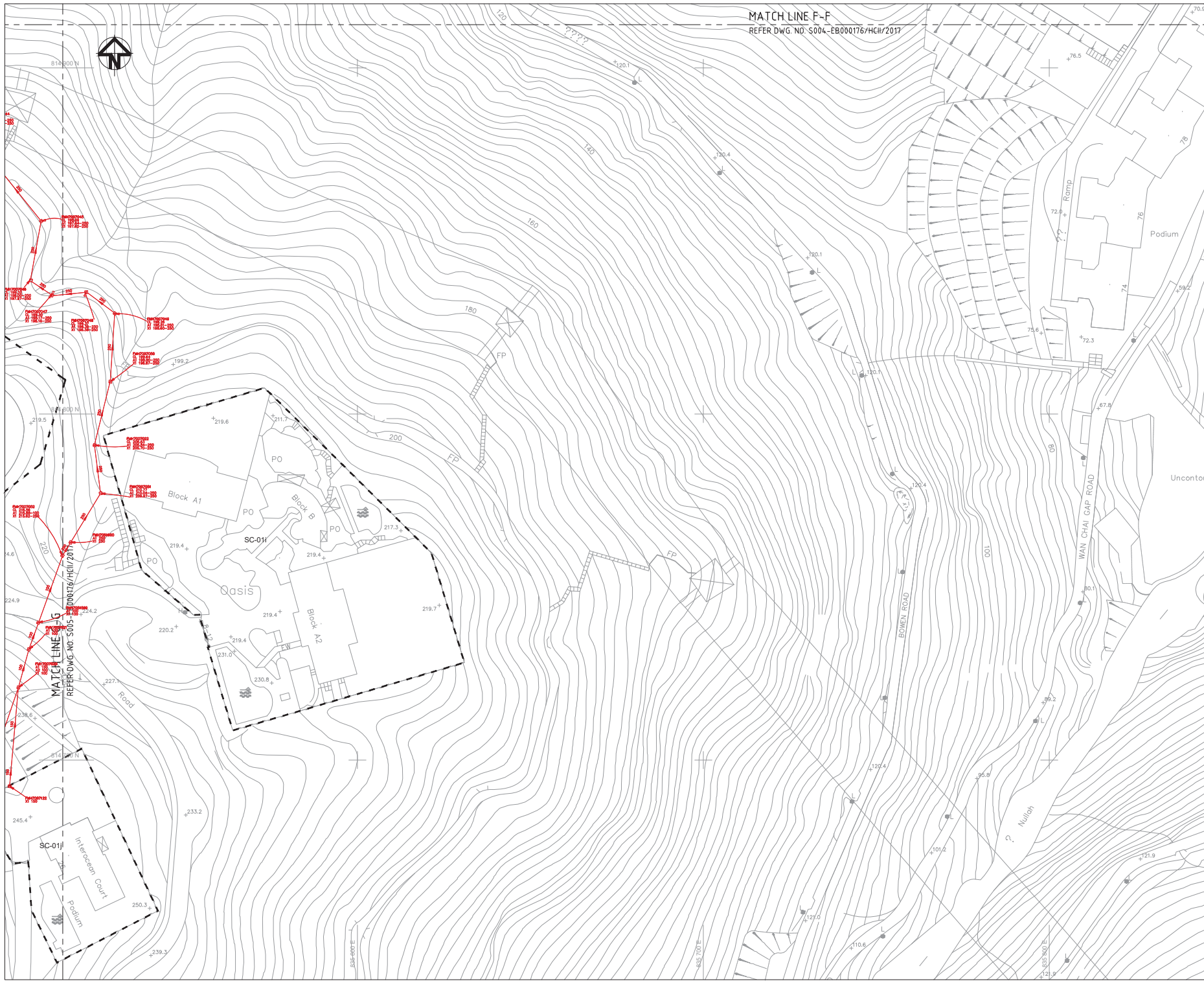
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Project: **HOPEWELL CENTRE II DEVELOPMENT SEWERAGE IMPACT ASSESSMENT**

Title: **EXISTING PUBLIC SEWERAGE SYSTEM AND SEWERAGE CATCHMENTS (SHEET 5 OF 6)**

Drawing No.	Project No.	Issue
S005	EB000176/HCI/2017	01



**LOCATION PLAN**  
 SCALE 1 : 7500

**LEGEND:**

- SEWER MANHOLE
- EXISTING PIPE (SEWER)
- - - CATCHMENT BOUNDARY
- SC-27a CATCHMENT ID

**NOTE:**

THE INCOMING PIPES ARE MARKED A1, A2, A3... COUNTING CLOCKWISE FROM THE FIRST OUTGOING PIPE X1. OUTGOING PIPES ARE MARKED X1, X2, X3... COUNTING CLOCKWISE FROM NORTH.

Issue	Description	Date
01	FIRST ISSUE FOR SIA	17-10-17

PRELIMINARY NOT TO BE USED FOR CONSTRUCTION			
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Original Size	Checker	L. LEUNG	
Height Datum	Approver	B. IEONG	
Grid	HK80	© Copyright reserved	

Filename: S006-EB000176-HCI-2017-01.DWG  
 Client:

**WETHERALL INVESTMENTS LIMITED**



Project: **HOPEWELL CENTRE II DEVELOPMENT SEWERAGE IMPACT ASSESSMENT**

Title: **EXISTING PUBLIC SEWERAGE SYSTEM AND SEWERAGE CATCHMENTS (SHEET 6 OF 6)**

Drawing No.	Project No.	Issue
S006	EB000176/HCI/2017	01



## **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	0.37	242.72	256.62	256.62	950	950	1.0	8	23.7611	23.7611	6	17.8208	17.8208	4	11.8806	11.8806	
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 Calculation Below																			1.8974	25.6585	-	1.8974	19.7182	-	1.8974	13.7779
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															

Flow Estimation for Public Lavatory

1. BS EN 12056-2:2000 - Gravity Drainage Systems Inside Buildings - Part 2: Sanitary Pipework, Layout and Calculation (British Standard)

no. WC	DU Factor (l/s)	DU (l/s)	No. Water Basin	DU Factor (l/s)	DU (l/s)	∑ DU (l/s)	Q <sub>uw</sub>	Q <sub>ww</sub> (m <sup>3</sup> /day)	Q <sub>ww</sub> (L <sup>3</sup> /s)
2	1.5	3	2	0.3	0.6	3.6	1.897366596	116.12	1.8974

For 6am- 11pm, public, (take k=1)

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

## **APPENDIX D**

**Excerpts of the Hopewell Centre II Development SIA Report No.  
EB000176/HCI2017/SIA/R10 (For information)**

# WETHERALL INVESTMENTS LIMITED HOPEWELL CENTRE II DEVELOPMENT

## Sewerage Impact Assessment

MAY 2023



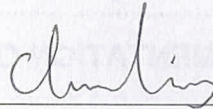


# WETHERALL INVESTMENTS LIMITED

## HOPEWELL CENTRE II DEVELOPMENT

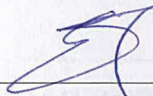
### Sewerage Impact Assessment

**Author** Claudius Tse



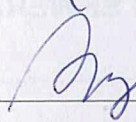
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**Reviewer** Eric Tam



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**Approver** Arthur Ng



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**Report No** EB000176/HCI2017/SIA/R10

**Date** May 2023

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**S003-EB000176/HCII/2017- Existing Public Sewerage System and Sewerage Catchments (Sheet 3 of 6)**

S004-EB000176/HCII/2017- Existing Public Sewerage System and Sewerage Catchments (Sheet 4 of 6)

S005-EB000176/HCII/2017- Existing Public Sewerage System and Sewerage Catchments (Sheet 5 of 6)

S006-EB000176/HCII/2017- Existing Public Sewerage System and Sewerage Catchments (Sheet 6 of 6)

**S007-EB000176/HCII/2017- Proposed Sewerage System (Western Side)**

**S008-EB000176/HCII/2017- Proposed Sewerage System (Eastern Side)**

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## APPENDIX A

Master Layout Plan of Comprehensive Development Area

## APPENDIX B

Master Layout Plan of Hopewell Centre II Development

## APPENDIX C

**Layout Plans of Stairway at Ship Street**

## APPENDIX D

**Approved Layout Plans of Public Open Space**

## APPENDIX E

DSD Drainage Record Sheet

## APPENDIX F

**Estimation of Sewage Flows from Existing Buildings, Proposed HCII Development and Indicative Development Scheme**

## APPENDIX G

**Proposed Sewerage Works Design and Manhole Schedule**

## APPENDIX H

Extracts from Mid-Levels East OZP Plan No. S/H12/12 and The Peak Area OZP No. S/H14/12

## APPENDIX I

**Proposed Sewerage Works Design (Eastern Side)**

## **APPENDIX J**

Topographical Survey of Sik On Street

## **APPENDIX K**

**InfoWorks Model Input and Output Data of Existing Public Sewers for Pre-Development and Post-Development Scenarios**

## **APPENDIX L**

BD Approved General Building Plans of Upstream Developments

## **APPENDIX M**

Excerpts of the Hopewell Centre II Development – SIA Report No. EA01425S103 Rev. 8 (For reference only)

## **APPENDIX N**

Excerpts of the Proposed Development at Nos. 153-167 Queen’s Road East – SIA Report No. EB000176/QRE2017/R01

## **APPENDIX O**

Excerpts of the Proposed Comprehensive Development Area Zone at Nam Koo Terrace, Hill Side Terrace, Miu Kang Terrace, Inland Lot No. 9048 and Adjoining Government Land, Wan Chai - SIA Report No. EA01425/R42/R04 dated June 2016

## **APPENDIX P**

Site Photo and GeoInfoMap Screen Capture of Existing Sewer Between Existing Manholes FMH7014502 to FMH7017300 Taken February 2022

## **APPENDIX Q**

Response to Comments

## **Appendix R**

Layout plan for SM2- SM4 Alignment

# 1 INTRODUCTION

## 1.1 Background

- 1.1.1 Arcadis Design and Consultancy was commissioned by Wetherall Investments Limited to prepare this Sewerage Impact Assessment report for the proposed Hopewell Centre II Development in Wan Chai (HCII).
- 1.1.2 The proposed development is located in Wan Chai and bounded by Queen's Road East to the north and Kennedy Road to the south – hereinafter referred to as "HCII Development" or "the Site".
- 1.1.3 In order to assess the technical feasibility of a proposed Comprehensive Development Area at Nam Koo Terrace, Hill Side Terrace, Miu Kang Terrace, Inland Lot No. 9048 and Adjoining Government Land, an "Indicative Development Scheme" was prepared. This proposed development falls within the catchment of the proposed sewer pipeline along Ship Street adjoining Hopewell Centre II Development. The Indicative Development Scheme has 21 storeys, including 17 storeys of residential use, 2 storeys of Ancillary Recreation, 1 storey of Shop & Services / Eating Place, and a Public Lavatory. The master layout plans of the Indicative Development Scheme are provided in Appendix A.
- 1.1.4 This SIA uses the BD approved General Building Plans of the proposed stairway at Ship Street dated 8 May 2020 (Appendix C refers).
- 1.1.5 This revision of the SIA takes into consideration the actual site conditions and site constraints which introduce changes and refinements to the HCII SIA Report (EB000176/HCII2017/SIA/R09/V1). Changes made under this revision are as follows:
- Due to space constraints along Kennedy Road, instead of connecting pipes from SM1 to SM3 and from SM2 to SM3 wherein each connection requires backdrop manhole at SM3, proposed manhole SM2A is introduced in order to redirect flow and one backdrop shall only be required at SM3. A layout plan presenting the alignment from existing foul water manhole FMH7014412 to proposed foul water manhole SM4 (located on ship street staircase) is attached for your review;
  - Recent survey confirms that the existing sewer connection from St. Francis' Canossian College which was proposed to be connected to manhole SM7 in previous versions of this SIA is not feasible.
  - Due to this, instead of connecting to SM7, a new manhole SM7A is introduced to collect sewage from St. Francis' Canossian College which then connects to SM8.
  - Revised alignments are shown in drawing S007/ EB000176/HCII/2017.
  - Latest General Building Plans (GBP) of proposed Ship Street stairway and Public Open Space are also incorporated in S007/ EB000176/HCII/2017 drawing. The latest GBP of proposed stairway at Ship Street dated 30 November 2022 was approved by BD on 27 January 2023 and is shown in

Appendix C. Latest GBP of Public Open Space dated 28 October 2022 was approved by BD on 24 November 2022 is shown in Appendix D.

- In previous versions of this report, sewage flow from St. Francis' Canossian College under sub-catchment SC-01b with population of 800 students and 70 staff members was assigned to discharge all sewage flow to existing manhole FMH7014431 in both baseline and proposed scenarios. With the introduction of proposed manhole SM7A, retaining this approach under this revision, the sewer connection from the College to SM7A in proposed scenario shall have no flow in the hydraulic model.
- For a more refined modelling approach, it is proposed that sewage flow from the College shall be split into two sub-catchments **SC-01b** and **SC-01b.1** with each sub-catchment discharging half of the total sewage flow from the College. Revised sub-catchments are shown in drawing S003/EB000176/HCI/2017.
- Discharge manhole assignment for SC-01b and SC-01b.1 are updated as follows.

	<b>Baseline Scenario</b>	<b>Proposed Scenario</b>
SC-01b	FMH7014431	FMH7014431
SC-01b.1	FMH7014696	SM7A

- Under baseline scenario, sewage flow from SC-01b and SC-01b.1 is discharged to FMH7014431 and FMH7014696 respectively. However, under proposed scenario, FMH7014696 shall be demolished. This requires sewage flow from SC-01b.1 to be reassigned to SM7A.
- According to St. Francis' Canossian College Annual Report 2020-2021, the College has 700 students and 70 staff members. This recent information shall supersede the population adopted in previous versions to estimate the sewage flow generated from the College. Since the sewage flow from the College shall be split into half and is dependent on the population, the population of each sub-catchment shall now be 350 students and 35 staff members.
- Revised population and sewage flow estimate for SC-01b and SC-01b.1 are shown in Appendix F.
- Hydraulic model is also revised following the changes summarized above. Updated InfoWorks results are shown in Appendix I and K.
- Pipe and manhole schedule in Appendix I are also revised accordingly.
- For the Eastern Side, the pipe alignments are revised to suit actual site conditions. Revised alignment is shown in S008/EB000176/HCI/2017. Hydraulic calculation in Appendix I is revised accordingly.

1.1.6 Amendments to the text are highlighted for easy reading.

## **1.2 Objectives**

- 1.2.1 This report outlined the existing sewerage system in the vicinity of the Site and investigated the potential sewage impacts arisen from the proposed and commercial development. It also proposed appropriate mitigation measures if necessary.
- 1.2.2 The objectives of Sewerage Impact Assessment (SIA) are as follow:
- Identify any potential sewerage impact arising from the Site;
  - Assess the performance of the existing sewerage system associated with the Site;
  - Identify design requirements of the sewerage system of the development;
  - Propose necessary changes of constructed sewerage network related to the Site.

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

- 1.3.1 The following information was reviewed for the Study:
- a. SIA report for Hopewell Centre II Development Rev.8 Dated June 2017;
  - b. SIA report for Proposed Commercial Development at Nos.153-167 Queen's Road East, Wan Chai, Hong Kong Dated August 2017;
  - c. SIA report for Proposed Comprehensive Development Area Zone at Nam Koo Terrace, Hill Side Terrace, Miu Kang Terrace, Inland Lot No. 9048 and Adjoining Government Land, Wan Chai (Report No. EA01425/R42/R04 dated June 2016);
  - d. DSD Drainage Record Sheets No. 11-SW-14A-4, 11-SW-14B-1, 11-SW-14B-2, 11-SW-14B-3, 11-SW-14B-4, 11-SW-14D-1 and 11-SW-14D-2;
  - e. DSD Sewerage Manual (Part I) – Key Planning Issues and Gravity Collection System (Part I) (Third Edition, May 2013);
  - f. EPD Technical Paper EPD/TP 1/05, Guidelines for Estimating Sewage Flows for Sewerage Infrastructure Planning Version 1.0 (March 2005) (GESF);
  - g. PlanD's Commercial and Industrial Floor Space Utilization Survey (CIFSUS);
  - h. Census and Statistics Department, 2011 Population Census – Fact Sheet for Tertiary Planning Unit 131;
  - i. Census and Statistics Department, 2016 Population Census – Fact Sheet for Tertiary Planning Unit 131;
  - j. BS EN 12056-2:2000 - Gravity drainage systems inside buildings - Part 2: Sanitary pipework, layout and calculation;

## **2 PROJECT OUTLINE**

### **2.1 Project Title**

- 2.1.1 The tentative project title is "Hopewell Centre II Development at Wanchai, Hong Kong."

### **2.2 Proponent**

2.2.1 The proponent of the project is Wetherall Investments Limited.

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

2.3.1 The Site is a Comprehensive Development Area according to the current Outline Zoning Plan. The Development consists of a hotel, amenities and commercial facilities up to 52 floors high, situated immediately west of the existing Hopewell Centre.

2.3.2 A section of the existing Kennedy Road in front of the Development will be widened, including construction of an overpass and an underpass across Kennedy Road, to accommodate the ingress-egress of the Development.

2.3.3 The existing steps along Ship Street bounded by Kennedy Road and Schooner Street will have refinements and enhancements. Layout plans of the proposed steps are contained in Appendix C.

2.3.4 The scope of this SIA comprises the sewers downstream of the Hopewell Center II Development down Ship Street to the sewerage system at Queen's Road East, and all of the upstream sewers affected by the works.

## **2.4 Location**

2.4.1 The Site is located in Wanchai and bounded by Queen's Road East to the north and Kennedy Road to the south. The existing Hopewell Centre is located east and Ship Street to the west of the Site. The steps of Hau Fung Lane are also within the Site boundary.

2.4.2 St. Francis Canossian College, Nam Koo Terrace, a public toilet and several private premises are situated at the west of the Site.

2.4.3 The Site is of predominantly demolished remnants of old houses and buildings constructed on a few terraces between which are some existing engineered slopes.

## **2.5 Area of Project Site**

2.5.1 The Site including the proposed HCII building, Private Park and Public Park has an area of approximately 12,150 m<sup>2</sup>.

## **2.6 Change in Level**

2.6.1 The existing levels of the Site vary between +5.2 mPD and +63.1 mPD. The levels within the Development will be designed to match the surrounding levels of the landscapes. The ingress / egress at Kennedy Road will be formed by local widening of the existing road between the existing retaining walls and the proposed Development. The proposed Development will incorporate a podium and a tower north of Kennedy Road.

### **3 PLANNING AND IMPLEMENTATION OF PROGRAMME**

#### **3.1 Planning and Implementation**

- 3.1.1 The Hopewell Centre II development will be carried out in one single phase, for about 4 to 5 years.
- 3.1.2 The proposed diversion of existing sewerage passing through the Site will be carried out prior to the construction phase. This is deemed to facilitate the subsequent site formation, foundation and building works over the Site.

#### **3.2 Project Interface**

- 3.2.1 This SIA has taken into account the future development of the site at Nam Koo Terrace, Hill Side Terrace, Miu Kang Terrace, Inland Lot No. 9048 and Adjoining Government Land, proposed Hopewell Centre II development and the proposed commercial development at Nos.153-167 Queen's Road East.
- 3.2.2 This SIA has also taken into account the sewage flows from the proposed sewer pipeline under the QRE SIA (Report No. EB000176/QRE2017/R01) at the public service lane on the south side of a row of buildings from Weswick Commercial Building in the east to Yan King Court in the west QRE Back Lane, and the proposed public toilet at the LCSD Park be discharged to the proposed upgraded sewerage pipeline under this submission.

## **4 EXISTING AND PROPOSED SEWERAGE SYSTEM**

### **4.1 Existing Sewerage System**

- 4.1.1 The existing sewerage system considered in this SIA study currently serves a number of the properties at Ship Street, Schooner Street, Sik On Street and Kennedy Road. The downstream ends of the sewerage pipelines along Ship Street and Sik On Street connect to the 600mm diameter public sewerage pipeline at Queen's Road East. As a result of the development a number of the existing sewers are under consideration for diversion. The existing sewers are shown in drawings no. S001-EB000176/HCI/2017, S002-EB000176/HCI/2017, S003-EB000176/HCI/2017, S004-EB000176/HCI/2017, S005-EB000176/HCI/2017, and S006-EB000176/HCI/2017.
- 4.1.2 A relatively new development at No 9 Sik On Street called The Hillside is taken into account in this SIA as subcatchment SC-23a. S002-EB000176/HCI/2017 shows the updated existing sewerage catchment, manhole and pipe related to SC-23a. Its sewage flow estimate is shown in Appendix F.
- 4.1.3 From the meeting with DSD on 26 May 2010, it was informed that the existing 225 mm diameter sewer (from manholes FMH7014706 in 11-SW-14B-3) running east at Kennedy Road in front of Nos. 64 and 66 are in use at present. In consideration of the future road works for the HCI Development, a section of the abovementioned 225 mm diameter sewer is proposed to shift north towards the proposed eastbound Kennedy Road.
- 4.1.4 The other diversion is an existing 300 mm diameter sewer (from FMH7014431 in 11-SW-14B-3) in front of Kennedy Road Nos. 58-60 (Sakura Court) down the existing Ship Street steps.
- 4.1.5 The capacities of the existing downstream sewers (DN600 and DN750 sewers from FMH7014502 to FMH7013911 in 11-SW-14B-3, 11-SW-14B-4 and 11-SW-14B-2), which collect the sewage from the HCI Development and the surrounding areas along Queen's Road East, have also been estimated and illustrated in Appendices E and J.

### **4.2 Proposed Sewerage System (Eastern Side)**

- 4.2.1 The existing DN225 sewer will be diverted to the proposed eastbound Kennedy Road before connecting to the existing sewer manhole FMH7015153 as mentioned in 4.1.3.
- 4.2.2 This is a simple diversion of the existing pipes and using the similar road profile, grades and identical pipe sizes. Proposed Eastern Side Sewerage System is shown in drawing no. S008-EB000176/HCI/2017.



### **4.3 Proposed Sewerage System (Western Side)**

- 4.3.1 The entire existing series of DN300 sewers mentioned in 4.1.4 along the existing Ship Street steps are proposed to be replaced by a new sewer pipeline along Ship Street, Schooner Street and Sik On Street connecting to existing sewerage system at Queen's Road East at manhole FMH7014499.
- 4.3.2 Proposed Western Side Sewerage System is shown in drawing no. S007-EB000176/HCI/2017.

### **4.4 Proposed Sewerage Connection for Hopewell Centre II with the Public Sewerage System**

- 4.4.1 A new 350 mm diameter sewer pipeline along the back lane of Yan King Court will be constructed to connect with the proposed terminal foul manhole of Hopewell Centre II and the reconstructed foul manhole no. FMH7014457 (see drawing no. S007-EB000176/HCI/2017).
- 4.4.2 Concurrent with the permanent diversion of the existing 300mm diameter sewer pipeline along Ship Street up to foul manhole no. FMH7014451, the remaining portion of the 300 mm diameter sewer pipeline from manholes no. FMH7014457 to FMH7014502 in between Greatmany Centre and Yan King Court will also be upgraded to 350 mm diameter to convey the sewage discharged from Hopewell Centre II to the proposed 700 mm diameter sewer pipeline along Queen's Road East (see drawing no. S007-EB000176/HCI/2017).

## **5 SEWERAGE IMPACT ASSESSMENT**

### **5.1 Sewage Flow Contributions**

- 5.1.1 DSD Drawings No. 11-SW-14A-4, 11-SW-14B-1, 11-SW-14B-2, 11-SW-14B-3, 11-SW-14B-4, 11-SW-14D-1 and 11-SW-14D-2 in Appendix E were reviewed for the existing sewerage system.
- 5.1.2 The buildings that have sewage flows contributions to the sewerage system along Ship Street Stairway between Kennedy Road and Queen's Road East are shown in Table 1 (Western Side). Detailed sewage flow calculations are contained in Appendix F.
- 5.1.3 The buildings that have sewage flows contributions to the existing sewerage system along Kennedy Road are shown in Table 2 (Eastern Side). Detailed sewage flow calculations are contained in Appendix F.

**Table 1. Sewage contributions (Western Side)**

<b>Contributions</b>
Buildings discharging to the existing 300 mm diameter sewer pipeline upstream of manhole FMH7014431
Kennedy Road No. 58-60 (Sakura Court)
Kennedy Road No. 62
Nam Koo Terrace
Miu Kang Terrace
Hill Side Terrace
Dragon Villa
Sik On Street No. 10, 12, 14-16
The Hillside
Hing On Mansion
QRE No. 99
Inland Lot No. 9048 and Adjoining Government Land
Proposed Public Park Toilet
Ship Street Nos. 33-35
Hopewell Centre II Tower
Hopewell Centre II Podium
Greatmany Centre
Queen's Road East No. 117
Yan King Court

**Table 2. Sewage contributions (Eastern Side)**

<b>Contributions</b>
Kennedy Road No. 64-68 (Camelot Heights)

- 5.1.4 The existing sewers to be checked cover a large sewage catchment along Queen's Road East, Ship Street, Schooler Street and Sik On Street.

## **5.2 Assumptions**

- 5.2.1 All sewage flow rates were estimated with the use of the global unit flow factors given in Tables T-1 and T-2, and the relevant peaking factors in Table T-5 of the EPD GESF, except for the existing public toilets.
- 5.2.2 The global unit flow factors adopted in this assessment are summarised in Table 3 below.
- 5.2.3 For the purpose of sewage estimate of the HCII Development, five categories of population are used: i) Community, Social, and Personal Services; ii) Hotel and

Boarding Houses; iii) Restaurants; iv) Retail Trade; and v) Storage. These five categories cover the entire population in HCII population.

5.2.4 The unit flow factors used in the estimation of sewage flows are summarized in the table below.

<b>Types of Population</b>	<b>Unit Flow Factor (m<sup>3</sup>/head/day)</b>
Residential R2	0.27
Residential R3	0.37
Commercial Employee	0.08
Community, Social, and Personal Services	0.20
Hotels and Boarding Houses	1.50
Restaurants	1.50
Retail Trade	0.20
Storage	0.10

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

5.2.5 The population for the HCII Development was estimated in accordance with Table 8 of PlanD’s CIFSUS. The worker density values used are summarized in the table below.

<b>Economic Activities</b>	<b>Worker Density (worker/100m<sup>2</sup> GFA)</b>
Community, Social, and Personal Services	2.3
Hotels and Boarding Houses	1.4
Restaurants	5.1
Retail Trade	2.1
Storage	-

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

5.2.6 For the purpose of estimation of the sewage flow of the residential portion of the Comprehensive Development Area at Nam Koo Terrace, Hill Side Terrace, Miu Kang Terrace, Inland Lot No. 9048 and Adjoining Government Land, the indicative development was considered as Residential R3 dwelling.

5.2.7 From the 2016 Population Census – Fact Sheet for Tertiary Planning Unit 1.3.1, the average domestic household size for Wan Chai area is 2.3 people/unit. The total estimated residential population figure for the Indicative Development Scheme is 587 people. The detailed calculations of the total residential population figure are contained in Appendix F.

5.2.8 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 Restaurants & Hotels, Community, Social and Personal Services, and Retail. The Master Layout Plans are contained in Appendix A.

5.2.9 According to PlanD’s Commercial and Industrial Floor Space Utilization Survey, the estimated total employment population figures for the Indicative Development

Scheme are 29 employees. The detailed calculations of the total employment population figures are contained in Appendix F.

- 5.2.10 The existing Nam Koo Terrace is proposed to be used on a non-profit making basis, e.g. venue for wedding ceremony; museum; social, cultural and/or community related services, activities, functions; tourist related attraction etc.
- 5.2.11 The employment population figure for the non-profit making usage of the existing Nam Koo Terrace in the sites 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. The detailed calculation of the total employment population figure of Nam Koo Terrace is contained in Appendix F.
- 5.2.12 An appropriate global 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.
- 5.2.13 The peak sewage flows from existing and public toilets were estimated in accordance with the criteria presented on BS EN 12056-2:2000 - Gravity drainage systems inside buildings - Part 2: Sanitary pipework, layout and calculation. The exact numbers of existing sanitary fitments of the toilets were surveyed on Site. The detailed calculations of estimated peak sewage flows from public toilets are contained in Appendix F.
- 5.2.14 The peak sewage flow from the proposed public toilet at LCSD Park was estimated in accordance with the criteria presented on BS EN 12056-2:2000 – Gravity drainage systems inside buildings – Part 2: Sanitary pipework, layout and calculation. The number of sanitary fitments was estimated using the Handbook on Standard Features for Public Toilets – Planning & Development Section, Food and Environmental Hygiene Department (December 2011), and Building (Standards of Sanitary Fitments, Plumbing, Drainage Works, and Latrines) Amendment Regulation 2015. The detailed calculations of the estimation of the number of sanitary fittings and estimated peak sewage flows from public toilets are contained in Appendix F.
- 5.2.15 The average dry weather flow generated by swimming pools was estimated using the data given in the Guidelines for Safe Recreational Water Environments (Volume 2) from the World Health Organization. Accordingly, the average backwash water volume is 2.5 cubic meters of water per square metre of filter area. The filter area was estimated based on the design filter flow rate and turnover periods given in Table 5.1 and Box 5.1 of the guidelines respectively. Detailed calculations of the average volume of backwash water discharged in the sewerage system are contained in Appendix F.
- 5.2.16 A sewage flow was also considered for the car parks of the existing developments. The average daily volume of sewage generated by the cleansing of the car parks was estimated by considering 1 tap point with a flow rate of 0.3 l/s operating for 1 hour. Detailed calculations of the average volume of sewage generated during the washing of the car parks are contained in Appendix F.

### 5.3 Estimation of Sewage Flow Rate

5.3.1 The sewage flow rate estimate is contained in Appendix F of this report. The average dry weather flows (i.e. average sewage flow rate) for the proposed foul sewer and the existing downstream foul sewer were calculated with the global unit flow factor as follows:

**Average Dry Weather Flow (ADWF)** (m<sup>3</sup>/day) =

$$\Sigma [\text{Population (head)} \times \text{global unit flow factor (m}^3/\text{head/day)}]$$

5.3.2 The peak flow was calculated with peaking factor as follows:

**Peak Flow** (m<sup>3</sup>/day) = ADWF x Peaking Factor

5.3.3 The contributing population was calculated with total average flow as follows:

**Contributing Population** =

$$\text{Calculated total average flow (m}^3/\text{day)} / 0.27(\text{m}^3/\text{person/day})$$

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

5.3.5 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)

5.3.6 The design sewage flows of the public toilets were estimated by the approach stipulated in BS EN 12056-2:2000 "Gravity Drainage Systems based on Buildings – Part 2: Sanitary pipework, layout and calculation".

5.3.7 Accordingly, the sewage flow rate is determined as follows:

5.3.8 Sewage Flow Rate (L/s) =

$$K\sqrt{\sum DU}$$

where: K = Frequency factor  
 $\sum DU$  = Sum of discharge units

## **6 ASSESSMENT**

### **6.1 Existing Sewage Flow**

6.1.1 According to existing sewerage network, it is assumed that Nam Koo Terrace discharges sewage to the nearest existing manhole FMH7014690, Hill Side Terrace discharges sewage to existing manhole FMH7014440, while Miu Kang Terrace discharges sewage to existing manhole FMH7014436.

6.1.2 The estimated peak sewage flows from the existing buildings upstream of the junction of Ship Street and Schooner Street were derived from BD approved general building plans and average household sizes of individual TPUs of Hong Kong Census 2012 and maximum allowable GFAs of proposed new buildings stated in Mid-Levels East and The Peak Area Outline Zoning Plans (OZP No. S/H12/12 and OZP No. S/H14/12 respectively).

6.1.3 For estimation of the number of flats associated with new buildings the values of average GFA per flat (m<sup>2</sup>) presented in Table 8 of Chapter 2 of Hong Kong Planning Standards and Guidelines were used.

6.1.4 The calculation of the estimated peak sewage flows from the existing buildings are contained in Appendix E.

6.1.5 Extracts of Mid-Levels East Outline Zoning Plan No. S/H12/12 and The Peak Area Outline Zoning Plans No. S/H14/12 are contained in Appendix H.

6.1.6 Approved BD General Building Plans of the buildings upstream of the junction of Ship Street and Schooner Street are contained in Appendix L.

### **6.2 Design Sewage Flow and Assessment**

6.2.1 The existing public branch sewer identified for this assessment is shown in the InfoWorks Model in Appendix K.

6.2.2 The peak sewage flow rates are estimated for the following three scenarios:

Scenario	Description
<p style="text-align: center;">1 (Peaking Factor = 6)</p>	<p>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</p> <p>The total contributing populations for assessing the sewage flow from FMH7014431 to FMH7014499 and SM_A1 to SM24 are 3784 and 1623 respectively. Therefore a peaking factor of 6 (including storm water allowance) is used to assess the sewerage impact on the pipelines between these manholes.</p>
<p style="text-align: center;">2 (Peaking Factor = 5)</p>	<p>Assessment of sewerage impact from existing foul manholes FMH7015024 to FMH7015169 and FMH7015092 to FMH7015059 at Queen's Road East.</p> <p>The total contributing population for assessing the sewage flow from existing foul manholes FMH7015024 to FMH7015169 and FMH7015092 to FMH7015059 is 7508 and therefore a peaking factor of 5 (including storm water allowance) is used to assess the sewerage impact on the pipeline between these manholes.</p>
<p style="text-align: center;">3 (Peaking Factor = 4)</p>	<p>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.</p> <p>The total contributing population for assessing the sewage flow from existing foul manhole FMH7014499 to existing foul manhole FMH7013912 is 43925 and therefore a peaking factor of 4 (including storm water allowance) is used to assess the sewerage impact on the pipeline between these manholes.</p>

- 6.2.3 Layout plans showing the extent of the sewerage networks under each scenario are contained in Appendix F.
- 6.2.4 The estimated Average Dry Weather Flow of the HCII Development is 2757.37m<sup>3</sup>/d. Detail calculations are contained in Appendix F.
- 6.2.5 The estimated Average Dry Weather Flow of the Indicative Development Scheme is 255.83m<sup>3</sup>/d. Detail calculations are contained in Appendix F.
- 6.2.6 Total peak sewage flow generated from the Indicative Development Scheme is more than the total peak sewage flow generated from the existing buildings within the Site.

### 6.3 Hydraulic Modelling of Existing Public Sewerage System

- 6.3.1 Computer hydraulic models using Version 7.5 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 proposed commercial development at Nos.153-167 Queen's Road East SIA study.
- 6.3.3 The hydraulic model includes a network comprising the existing sewer from existing DSD manholes no. FMH7014431 to FMH7013912.
- 6.3.4 The hydraulic models include the proposed sewer pipes and manholes 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 Road and the proposed LCSD Park layout.
- 6.3.6 It is also noted that there are no existing terminal manhole connections with manholes no. FMH7014511, FMH70151637 and FMH7014512. As recommend in Section 6.3.20 below, the existing pipeline between these manholes can be abandoned and replaced by connecting the existing manholes no. FMH7014510 and FMH7014497 with a new 350mm diameter pipe and upgrading of the pipeline between manholes no. FMH7014508 and FMH7014499 from 150mm diameter to 350mm diameter.
- 6.3.7 The average dry weather flow from the Commercial Development at Nos.153-167 Queen's Road East is 438.08 m<sup>3</sup>/day (Refer to Appendix D of SIA Report No. EB000176/QRE2017/R01).
- 6.3.8 The abovementioned information was incorporated into this model and the sewage generated from each of the proposed Hopewell Centre II development, proposed Commercial Development at Nos.153-167 Queen's Road East and future Comprehensive Development Area at Nam Koo Terrace, Hill Side Terrace, Miu Kang Terrace, Inland Lot No. 9048 and Adjoining Government Land was input in the InfoWorks hydraulic model as an inflow.
- 6.3.9 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)**

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



- 6.3.11 Sewage flows from individual buildings discharged to corresponding manholes as shown in the sewerage record plan were modelled as inflows to corresponding manhole nodes.
- 6.3.12 Normal headloss types were used in the model. Normal headloss pipe coefficients were derived using the automated inference routine built into the InfoWorks ICM software.
- 6.3.13 The following reduction of pipe flow area were adopted to simulate the pipe hydraulic performance of both existing and proposed sewerage systems:
- i) a 5% reduction in flow area if the pipe gradient is greater than 1 in 25 and
  - ii) a 10% reduction in flow area for all other pipes.
- 6.3.14 In order to take into consideration the effect of the downstream system on the hydraulic capacity of the proposed sewer pipes, the water level at the outfall node was fixed at 2.030mPD in the InfoWorks model. This level was estimated by assuming that the flow inside the 900mm diameter downstream pipe from manhole FMH7013912 to manhole FMH7013919 is at full bore condition.
- 6.3.15 The water levels at the outfall nodes FMH7014499 and SM24 in Scenario 1 were extracted from the simulated water levels at those nodes in Scenario 3 hydraulic simulation.
- 6.3.16 The water levels at the outfall nodes FMH7015059 and FMH7015169 in Scenario 2 were extracted from the simulated water levels at those nodes in Scenario 3 hydraulic simulation.
- 6.3.17 The hydraulic model was validated without error. Model data and results outputs for pre and post development are included in Appendix K.
- 6.3.18 It is recommended that sewage generated from the Hopewell Centre II Development be discharged to the proposed manhole SM25.
- 6.3.19 It is recommended that sewage generated from the Indicative Development Scheme and exiting Nam Koo Terrace be discharged to the proposed manhole SM16 and SM10 respectively.
- 6.3.20 The output results of InfoWorks hydraulic simulations demonstrated that the existing public sewage pipes along Sik On Street and Schooner Street would not have sufficient capacity to cater for the peak design flow from the Indicative Development Scheme. It is recommended to consolidate two existing 150mm diameter sewer pipelines to a single 350mm diameter sewer pipeline for the conveyance of the additional sewage discharged from the Indicative Development Scheme.

## **6.4 Proposed Sewerage Upgrading Works and Hydraulic Assessment**

- 6.4.1 Based on the estimated design flows from the Indicative Development Scheme, the proposed Hopewell Centre II development; the approved development at Nos. 153-167 Queen's Road East; and the existing buildings, upgrading works for the existing sewer pipes and manholes and new sewer pipes were designed and are presented in Appendix G.
- 6.4.2 The output result of InfoWorks hydraulic simulation for the proposed upgrading works is contained in Appendix K.
- 6.4.3 The proposed sewerage system is shown in drawings no. S004-EB000176/HCI/2017 and S005-EB000176/HCI/2017.
- 6.4.4 Wetherall Investments Limited will be responsible for the design and construction of the proposed upgrading works to the prevailing statutory standard and to the satisfaction of EPD and DSD.
- 6.4.5 A summary table comparing the differences in freeboards between the baseline scenario and proposed development scenario is presented in Appendix G.
- 6.4.6 All sections of the proposed upgraded sewerage system have a hydraulic capacity higher than the respective design flows.
- 6.4.7 All existing manholes under this assessment satisfy a minimum freeboard of 1m except manholes FMH7015043, FMH7015044, FMH7015045 and FMH7015046. These manholes are part of a shallow 150mm diameter pipeline and have depths lower than 1m.
- 6.4.8 All proposed new manholes satisfied a minimum freeboard of 1m.
- 6.4.9 Overflowing will not occur for a flow rate of 1.15 times the peak design flow rate.
- 6.4.10 A summary of the sewerage diversion and upgrading works proposed under this SIA report, the approved SIA report for Hopewell Centre II Development (Report EB000176/HCI/2017/SIA/R03 dated March 2018), SIA report for the commercial development at Nos.153-167 Queen's Road East (Report No EB000176/QRE2017/R01 dated August 2017) and this SIA report is presented in Tables 4 and 5 respectively.

U/S Manhole	D/S Manhole	Existing Pipe Size (mm)	Proposed Pipe Size under this SIA (mm)
Proposed Sewerage Diversion at Ship Street Stairway (between Kennedy Road and Schooner Street)			
FMH7014431	SM1	Replace existing 300mm dia. pipeline from manholes FMH7014703 to FMH7014447	300
SM1	SM2		300
SM2	SM2A		250
SM2A	SM3		300
SM3	SM4		300
SM4	SM5		300
SM5	SM6		300
SM6	SM7		300
SM7	SM8		300
SM7A	SM8		300
SM8	SM9		300
SM9	SM10		300
SM10	SM11		300
SM11	SM12		300
SM12	SM13	300	
SM13	SM14	300	
Schooner Street			
SM14	SM15	-	350
SM15	SM15A	-	350
SM15A	SM16	-	350
SM16	SM17	-	350
SM17	SM19	-	350
Sik On Street			
SM19	FMH7014508	-	350

**Table 4 – Summary of proposed sewerage diversion**

U/S Manhole	D/S Manhole	Existing Pipe Size (mm)	Proposed Pipe Size under this SIA (mm)
FMH7014457	FMH7014461	300	350
FMH7014461	FMH7014604	300	350
FMH7014604	FMH7014502	300	350
FMH7014508	FMH7014509	150	350
FMH7014509	FMH7063380	150	350
FMH7063380	FMH7014510	150	350
FMH7014510	FMH7014497	150	350
FMH7014497	FMH7014498	150	350
FMH7014498	FMH7014611	150	350
FMH7014611	FMH7014499	300	350
FMH7014502	FMH7017300	600	600 (existing retained) 250 (additional)
SM24	SM25	-	250
SM25	SM26	-	350
SM26	SM27	-	350

**Table 5 – Summary of proposed sewerage upgrading works**

## 7 CONCLUSIONS

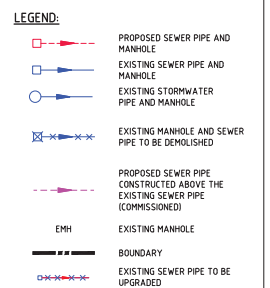
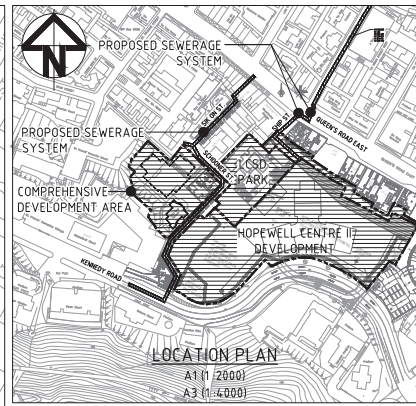
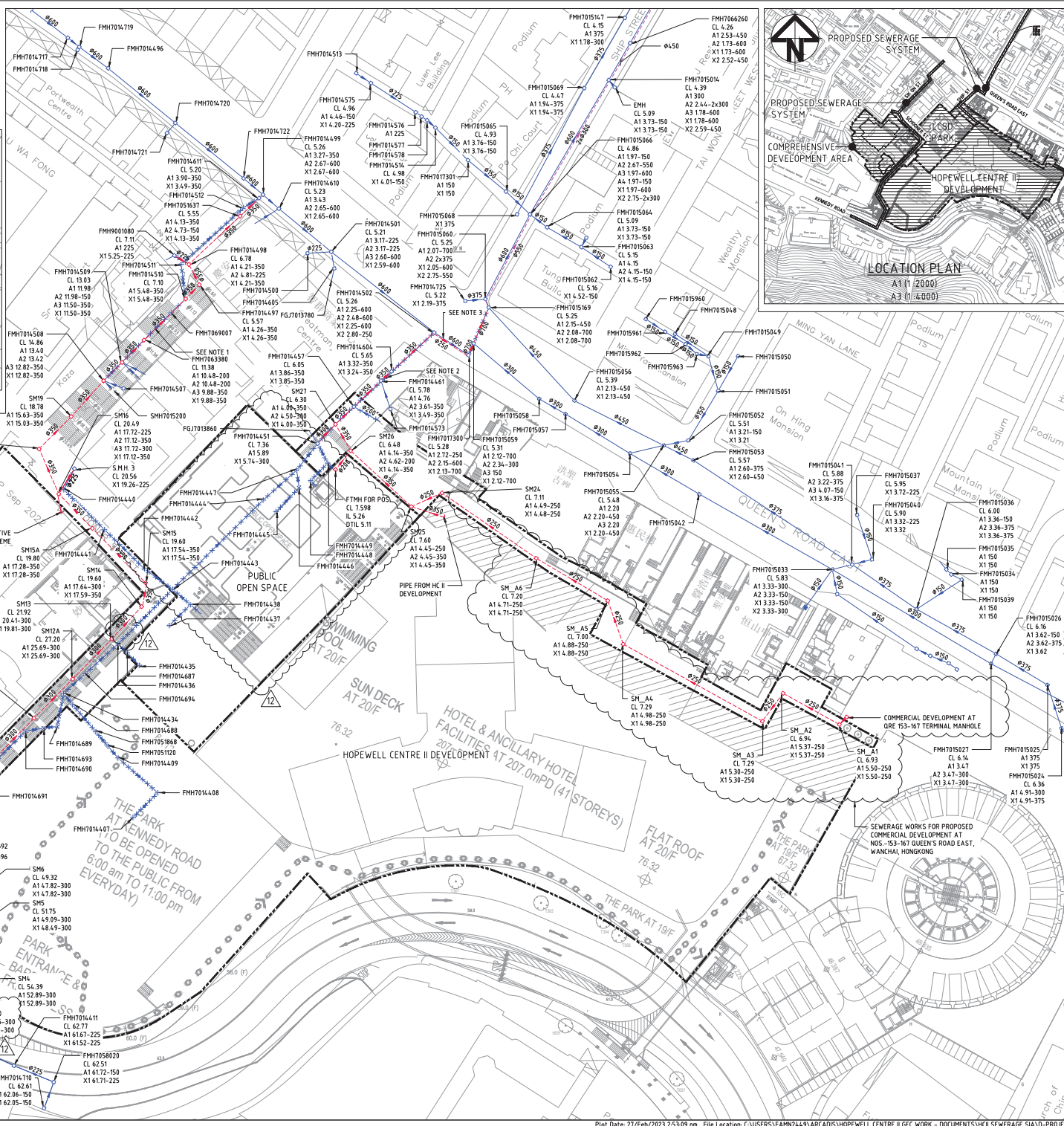
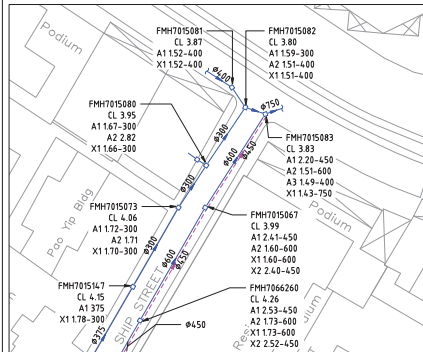
- 7.1.1 The proposed Hopewell Centre II development is located in Wan Chai and bounded by Queen's Road East to the north and Kennedy Road to the south. The Development consists of a hotel, amenities and commercial facilities up to 52 floors high, situated immediately west of the existing Hopewell Centre.
- 7.1.2 In order to assess the technical feasibility of a proposed Comprehensive Development Area at Nam Koo Terrace, Hill Side Terrace, Miu Kang Terrace, Inland Lot No. 9048 and Adjoining Government Land, an "Indicative Development Scheme" was prepared. This proposed development falls within the catchment of the proposed sewer pipeline along Ship Street adjoining Hopewell Centre II Development. The Indicative Development Scheme has 21 storeys, including 17 storeys of residential use, 2 storeys of Ancillary Recreation, 1 storey of Shop & Services / Eating Place, and a Public Lavatory. The master layout plans of the Indicative Development Scheme are provided in Appendix A.
- 7.1.3 This SIA uses the BD approved General Building Plans of the proposed stairway at Ship Street dated 8 May 2020 (Appendix C refers).
- 7.1.4 New sewer pipes and manholes are proposed along Schooner Street and Sik On Street to cater for the peak design flow from the Indicative Development Scheme.
- 7.1.5 According to the analyses in this report, the peak sewer flow from the Indicative Development Scheme will be greater than the total peak sewage flow from the existing buildings within the Site. The output results of InfoWorks hydraulic simulations demonstrated that the existing public sewer pipes along Sik On Street and Schooner Street do not have sufficient capacity to cater for the peak design flow from the Indicative Development Scheme. It is necessary to upgrade the pipe sizes and gradients of the existing 150mm diameter sewer pipelines at Sik On Street and Schooner Street.
- 7.1.6 There are no existing terminal manhole pipe connections linking with manholes no. FMH7014511, FMH7014512 and FMH7014611. The existing pipeline between these manholes can be removed and replaced with a new 350mm diameter pipeline connecting existing manholes no. FMH7014510 and FMH7014497. It is recommended to upgrade the downstream pipeline between manholes no. FMH7014508 and FMH7014499 from 150mm diameter to 350mm diameter (refer to drawing no. S007-EB000176/HCII/2017).
- 7.1.7 According to the assessment of this report, which takes into account the future development of the site at Nam Koo Terrace, Hill Side Terrace, Miu Kang Terrace, Inland Lot No. 9048 and Adjoining Government Land, proposed Hopewell Centre II development and the proposed commercial development at Nos. 153-167 Queen's Road East, all proposed pipes have a hydraulic capacity greater than the respective design flow.
- 7.1.8 All existing manholes under this assessment have satisfied a minimum freeboard of 1m except manholes FMH7015043, FMH7015044, FMH7015045 and

FMH7015046. These manholes are part of a shallow 150mm diameter pipeline and have depths less than 1m and, therefore, it is not possible to ensure a minimum freeboard of 1m.

- 7.1.9 All proposed new manholes satisfied a minimum freeboard of 1m and overflowing will not occur for a flow rate of 1.15 times the peak design flow rate.
- 7.1.10 A new 350 mm diameter sewer pipeline along the back lane of Yan King Court will be constructed to connect with the proposed terminal foul manhole of Hopewell Centre II and the reconstructed foul manhole no. FMH7014457 (see drawing no. S007- EB000176/HCII/2017).
- 7.1.11 Concurrent with the permanent diversion of the existing 300mm diameter sewer pipeline along Ship Street up to foul manhole no. FMH7014451, the remaining portion of the 300 mm diameter sewer pipeline from manholes no. FMH7014457 to FMH7014502 in between Greatmany Centre and Yan King Court will also be upgraded to 350 mm diameter to convey the sewage discharged from Hopewell Centre II to the proposed 700 mm diameter sewer pipeline along Queen's Road East (see drawing no. S007- EB000176/HCII/2017).
- 7.1.12 In the cases where it is not possible to avoid velocities greater than 3m/s the maximum velocity is relaxed to 6 m/s. In these cases, a continuous, smooth, durable and abrasion resistant pipe will be adopted. In addition, all junctions, bends and manholes will be designed with appropriate erosion measures.
- 7.1.13 In cases that velocities are lesser than 0.7m/s for small diameter sewers of diameter less than 300mm, pipe gradient of at least 1: DN (i.e. nominal diameter of the sewer in mm) is specified. It is also taken into consideration that a flow of 2 ADWF is assumed to occur at least once daily.
- 7.1.14 In consideration of the future road works for the HCII Development, a section of the existing 225 mm diameter sewer running east at Kennedy Road in front of Nos. 64 and 66 is proposed to shift north towards the proposed eastbound Kennedy Road (from manhole FMH7014706 to manhole FMH7015053 in 11-SW-14B-3).
- 7.1.15 Wetherall Investments Limited will be responsible for the design and construction of the proposed upgrading works to the prevailing statutory standard and to the satisfaction of the DSD.

## **APPENDIX E**

**Proposed Sewerage Works under the Hopewell Centre II Development  
(For Information, extracted from Hopewell Centre II Development SIA  
Report No. EB000176/HCII2017/SIA/R10)**



**NOTE:**

- EXISTING 150mm SEWERS BETWEEN EXISTING MANHOLES FMH7014508 AND FMH7014599 TO BE UPGRADED TO 350mm DIA. SEWERS, MANHOLE TO BE RECONSTRUCTED.
- EXISTING SEWERS FROM MANHOLES FMH7014570 TO FMH7014604 ARE TO BE UPGRADED TO 350mm DIA. SEWERS, MANHOLE TO BE RECONSTRUCTED.
- EXISTING 600mm DIA. SEWER BETWEEN EXISTING MANHOLES FMH7014502 TO FMH7017300 IS TO BE RETAINED. ADDITIONAL 250mm DIA. SEWER IS TO BE CONSTRUCTED PARALLEL TO THE EXISTING SEWER.

Issue	Description	Date
12	ISSUE FOR SIA R10	07-02-23
11	SIA R09 REVISION	14-02-22
10	SIA R08 RfC	23-11-21
09	MINOR REVISION	18-06-21
08	MINOR REVISION	07-05-20
07	MINOR REVISION	03-03-20
06	MINOR REVISION	13-11-19
05	MINOR REVISION	15-08-19
04	MINOR REVISION	11-12-18
03	MINOR REVISION	30-02-18
02	MINOR REVISION	14-02-18
01	FIRST ISSUE FOR SIA	17-10-17

**PRELIMINARY NOT TO BE USED FOR CONSTRUCTION**

Scale	Current Issue Signatures
A1 (1:400) A3 (1:800)	Author: F. COUTINHO Checker: L. LEUNG Approver: A. NG

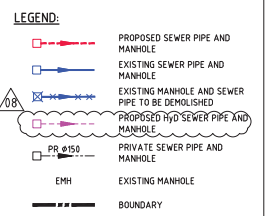
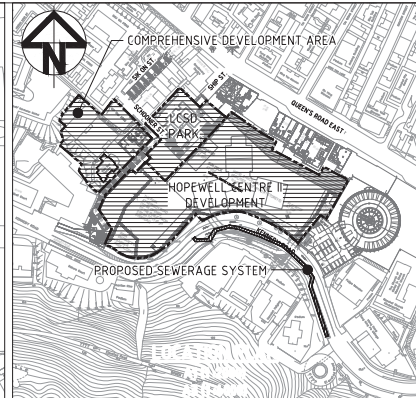
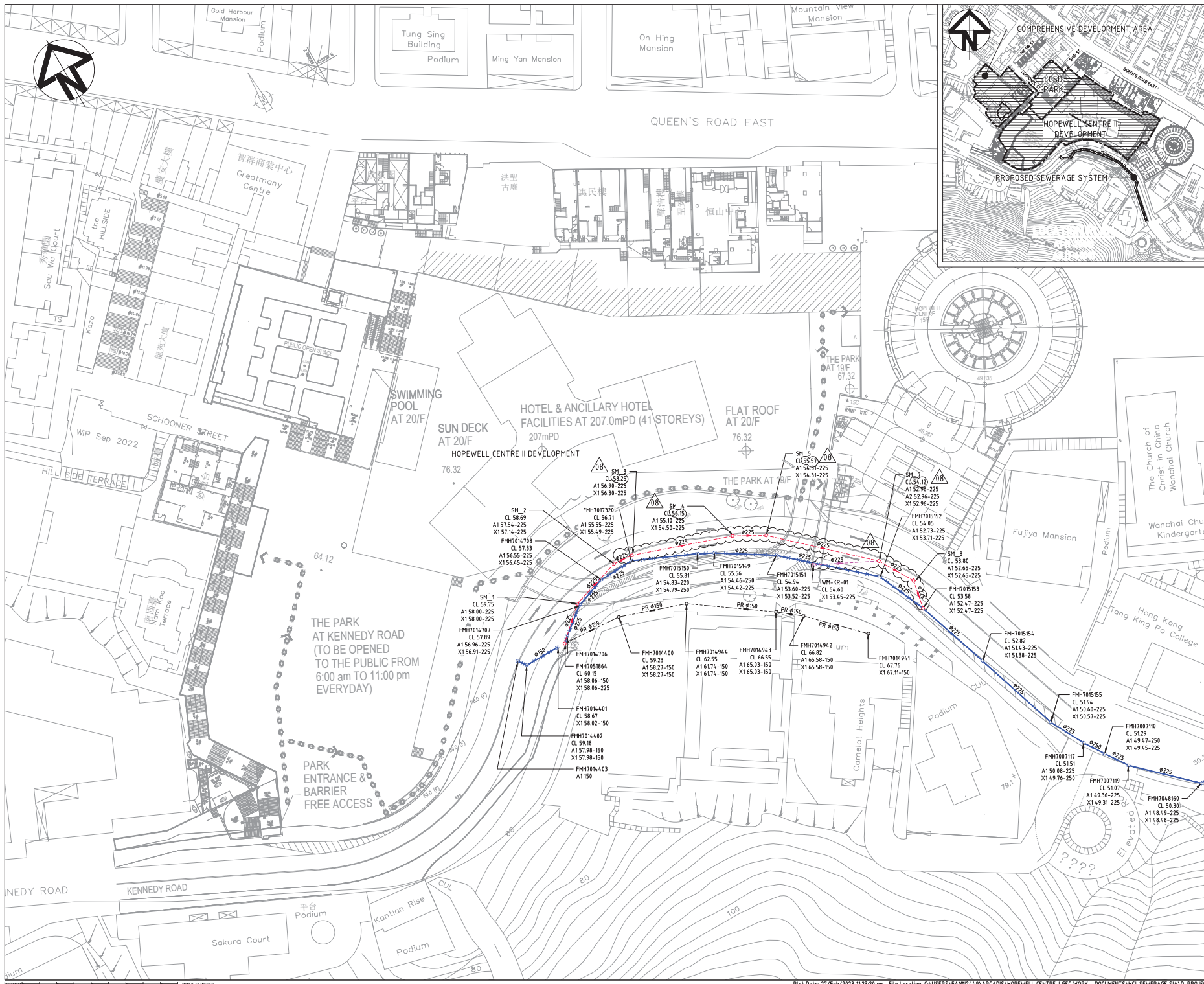
Filename: S007-EB000176-HCI-2017-12.DWG

**WETHERALL INVESTMENTS LIMITED**



**Project**  
HOPEWELL CENTRE II DEVELOPMENT  
SEWERAGE IMPACT ASSESSMENT

**Title**  
PROPOSED SEWERAGE NETWORK (WESTERN SIDE)



Issue	Description	Date
08	ISSUE FOR SIA R10	07-02-23
07	SIA AMENDMENT	10-05-21
06	MINOR REVISION	05-02-21
05	MINOR REVISION	10-08-20
04	MINOR REVISION	07-05-20
03	MINOR REVISION	15-08-19
02	MINOR REVISION	11-12-18
01	FIRST ISSUE FOR SIA	17-10-17

**PRELIMINARY NOT TO BE USED FOR CONSTRUCTION**

Scale	A1 (1:400)	A3 (1:800)	Current Issue Signatures
Original Size			Author: F. COUTINHO
Height			Checker: L. LEUNG
Datum	HKPD		Approver: J. KWOK
Grid	HK80		Copyright reserved
Filename	S008-EB000176-HCI-2017-08DWG		
Client	WETHERALL INVESTMENTS LIMITED		

**WETHERALL INVESTMENTS LIMITED**



**HOPEWELL CENTRE II DEVELOPMENT SEWERAGE IMPACT ASSESSMENT**

**PROPOSED SEWERAGE NETWORK (EASTERN SIDE)**

Drawing No.	Project No.	Issue
S008	EB000176/HCI/2017-	08



## **APPENDIX F**

### **Proposed Terminal Manhole to SM16 Pipe Calculation**



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

Date: July 2024

Designed By: Kelvin Liu

Checked By: Arthur Ng

Proposed Terminal Manhole to SM16 Pipe Calculation

Assumed Constants	
Kinematic Viscosity (m <sup>2</sup> /s)	1.000E-06
Pipe Hydraulic Roughness (Ks) (mm) [uPVC, Slimed Sewer]	0.15

**Equation used for Hydraulic Assessment**

Colebrook-White equation for circular pipes:

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

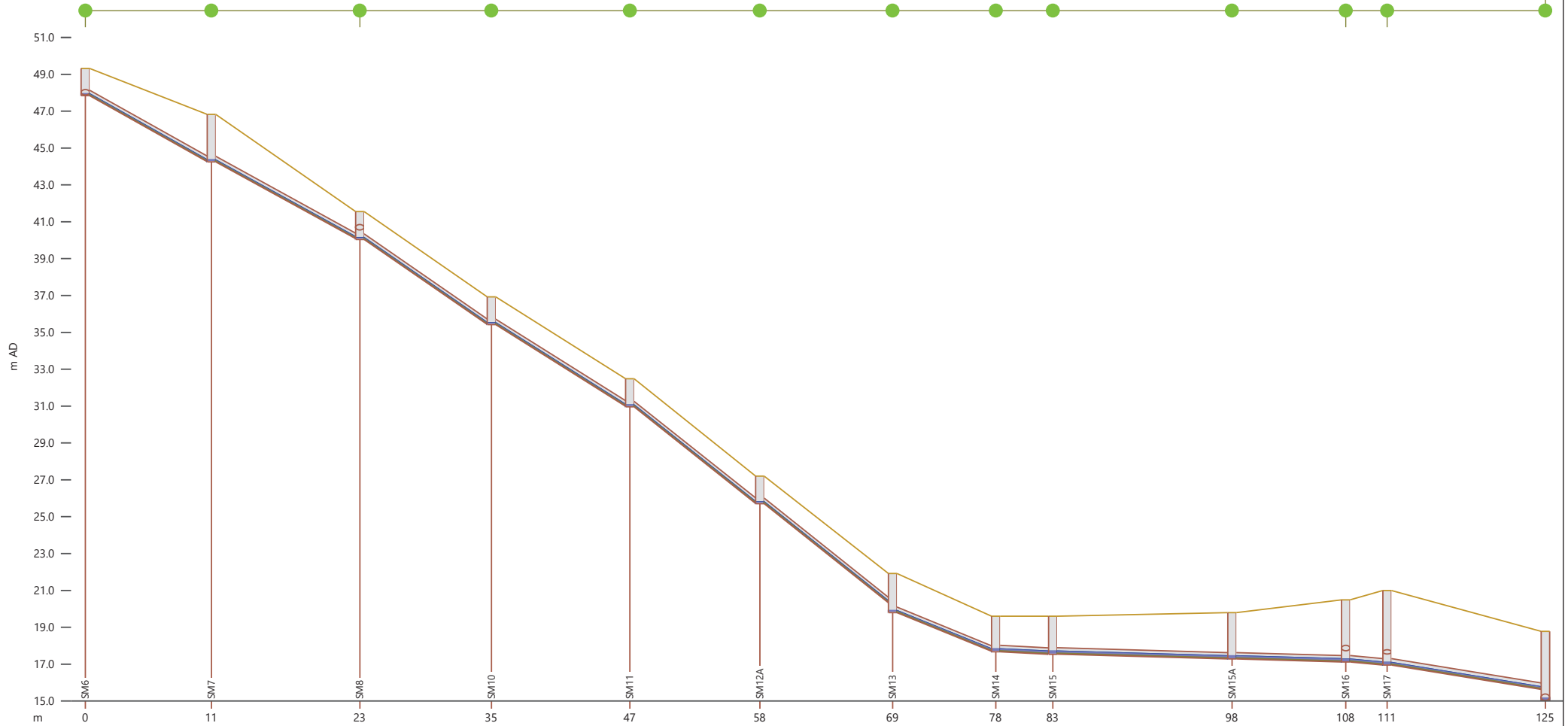
- where :
- V = mean velocity (m/s)
  - g = gravitational acceleration (m/s<sup>2</sup>)
  - R = hydraulic radius (m)
  - D = pipe diameter (m)
  - k<sub>s</sub> = equivalent sand roughness (m)
  - v = kinematic viscosity of fluid (m<sup>2</sup>/s)
  - s = frictional slope (energy gradient due to frictional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

US MH	DS MH	US GL	DS GL	US IL	DS IL	Length	Diameter	Gradient	Roughness, Ks	Peak Flow, Q	Full Bore Velocity, Vc	Full Bore Capacity, Qc	Proportional Capacity	Pipe Capacity Check
		(mPD)	(mPD)	(mPD)	(mPD)	(m)	(mm)	(1 in)	(mm)	(m <sup>3</sup> /s)	(m/s)	(m <sup>3</sup> /s)	Q/Qc	
TERMINAL MANHOLE	SM16	19.80	20.49	17.81	17.72	3.72	300	41.33	0.150	0.0257	2.87	0.183	0.14	OK

## **APPENDIX G**

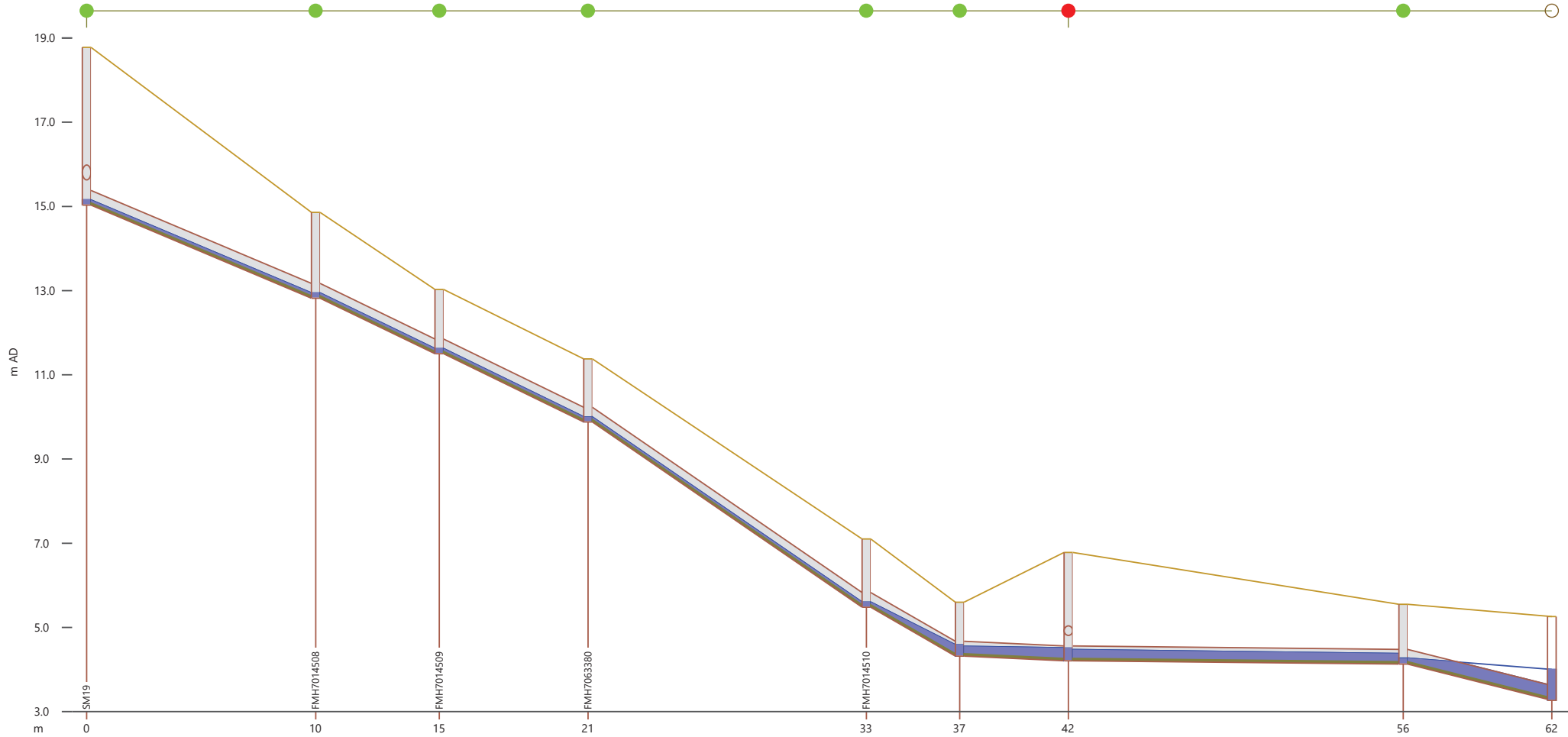
**InfoWorks Model Output Data Downstream of SM16 in Proposed Scenarios 1 and 3 under the Hopewell Centre II Development (For Information, extracted from Hopewell Centre II Development SIA Report No. EB000176/HCII2017/SIA/R10)**

# Longitudinal Scenario 1 w/ 1.15 Safety Factor (SM6 to SM19)



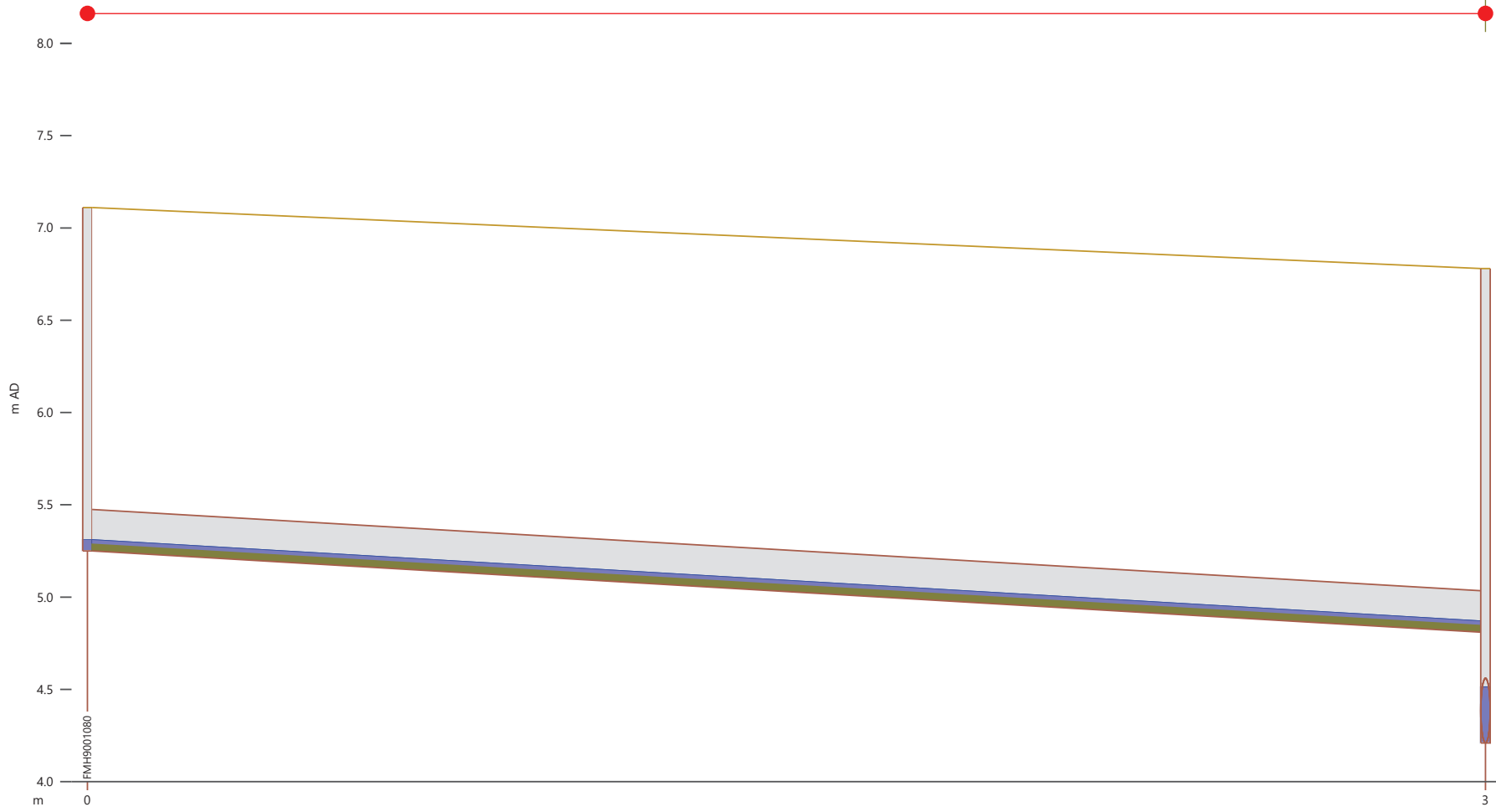
Link	SM6.1	SM7.1	SM8.1	SM10.1	SM11.1	SM12A.1	SM13.1	SM14.1	SM15.1	SM15A.1	-	SM17.1	
US node ID	SM6	SM7	SM8	SM10	SM11	SM12A	SM13	SM14	SM15	SM15A	SM16	SM17	
ds node	SM7	SM8	SM10	SM11	SM12A	SM13	SM14	SM15	SM15A	SM16	SM17	SM19	
length (m)	10.8	12.7	11.2	11.8	11.1	11.3	8.8	4.9	15.3	9.7	3.5	13.5	
width (mm)	300	300	300	300	300	300	300	350	350	350	350	350	
us inv (m AD)	47.840	44.250	40.040	35.420	30.960	25.710	19.800	17.670	17.540	17.280	17.120	16.950	
ds inv (m AD)	44.260	40.080	35.430	30.990	25.720	20.330	17.700	17.535	17.280	17.120	16.950	15.630	
grad (m/m)	0.33245	0.32899	0.40998	0.37448	0.47207	0.47449	0.23815	0.02771	0.01699	0.01646	-	0.09770	
r.pfc (m <sup>3</sup> /s)	0.483	0.480	0.536	0.512	0.575	0.577	0.409	0.209	0.164	0.161	0.276	0.394	
surc	0.35	0.35	0.34	0.34	0.33	0.33	0.43	0.51	0.49	0.49	0.45	0.41	
US flow (m <sup>3</sup> /s)	0.05669	0.05669	0.05802	0.05820	0.05820	0.05820	0.05820	0.05820	0.05820	0.05820	-	0.08274	
US velocity (m/s)	3.938	3.928	4.196	4.110	4.347	4.352	3.662	1.806	1.573	1.557	2.462	3.084	
DS flow (m <sup>3</sup> /s)	0.05669	0.05669	0.05802	0.05820	0.05820	0.05820	0.05820	0.05820	0.05820	0.05820	-	0.08274	
DS velocity (m/s)	3.938	3.928	4.196	4.110	4.347	4.352	2.684	1.491	1.555	1.557	2.462	3.084	
Node	SM6	SM7	SM8	SM10	SM11	SM12A	SM13	SM14	SM15	SM15A	SM16	SM17	SM19
ground (m AD)	49.320	46.830	41.550	36.930	32.480	27.200	21.920	19.600	19.600	19.800	20.490	21.000	18.780
Ch floor lev (m AD)	47.840	44.250	40.040	35.420	30.960	25.710	19.800	17.670	17.535	17.280	17.120	16.950	15.030
flood dep (m)	-1.375	-2.472	-1.406	-1.406	-1.419	-1.389	-2.010	-1.771	-1.888	-2.347	-3.210	-3.905	-3.623
level (m AD)	47.945	44.358	40.144	35.524	31.061	25.811	19.910	17.829	17.712	17.453	17.280	17.095	15.157

# Longitudinal Scenario 1 w/ 1.15 Safety Factor (SM19 to FMH7014499)



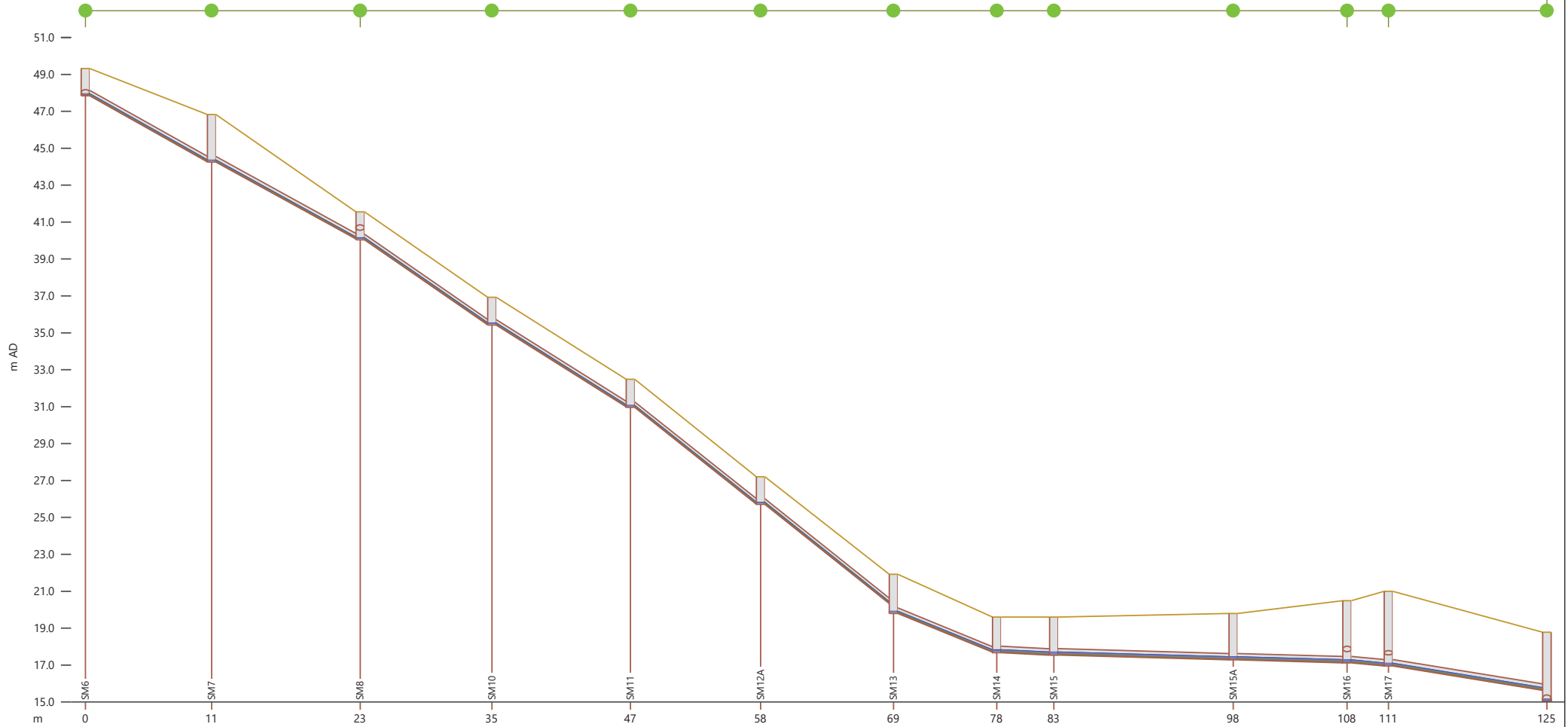
Link	SM19.1	FMH7014508.1	FMH7014509.2	FMH7063380.2	FMH7014510.1	FMH7014497.1	FMH7014498.1	FMH7051637.1	
US node ID	SM19	FMH7014508	FMH7014509	FMH7063380	FMH7014510	FMH7014497	FMH7014498	FMH7051637	
ds node	FMH7014508	FMH7014509	FMH7063380	FMH7014510	FMH7014497	FMH7014498	FMH7014498	FMH7051637	FMH7014499
length (m)	9.7	5.2	6.3	11.8	4.0	4.6	14.2	6.3	
width (mm)	350	350	350	350	350	350	350	350	350
us inv (m AD)	15.030	12.820	11.500	9.880	5.480	4.320	4.210	4.130	4.130
ds inv (m AD)	12.820	11.500	9.880	5.480	4.320	4.210	4.130	3.270	3.270
grad (m/m)	0.22752	0.25179	0.25684	0.37265	0.29305	0.02386	0.00563	0.13647	
r.pfc (m3/s)	0.601	0.632	0.638	0.769	0.682	0.194	0.094	0.465	
surc	0.36	0.36	0.35	0.35	0.77	0.87	0.76	1.00	
US flow (m3/s)	0.08274	0.08274	0.08314	0.08344	0.08344	0.08464	0.08648	0.08708	
US velocity (m/s)	3.895	3.999	4.029	4.430	4.173	1.464	1.266	3.266	
DS flow (m3/s)	0.08274	0.08274	0.08314	0.08344	0.08344	0.08464	0.08648	0.08708	
DS velocity (m/s)	3.895	3.947	4.029	4.099	1.193	1.069	1.366	0.943	
Node	SM19	FMH7014508	FMH7014509	FMH7063380	FMH7014510	FMH7014497	FMH7014498	FMH7051637	-
ground (m AD)	18.780	14.860	13.030	11.380	7.100	5.600	6.780	5.550	5.260
Ch floor lev (m AD)	15.030	12.820	11.500	9.880	5.480	4.320	4.210	4.130	3.270
flood dep (m)	-3.623	-1.915	-1.405	-1.380	-1.497	-1.012	-2.267	-1.278	
level (m AD)	15.157	12.945	11.625	10.000	5.603	4.588	4.513	4.272	4.004

# Longitudinal Scenario 1 w/ 1.15 Safety Factor (FMH9001080 to FMH7014498)



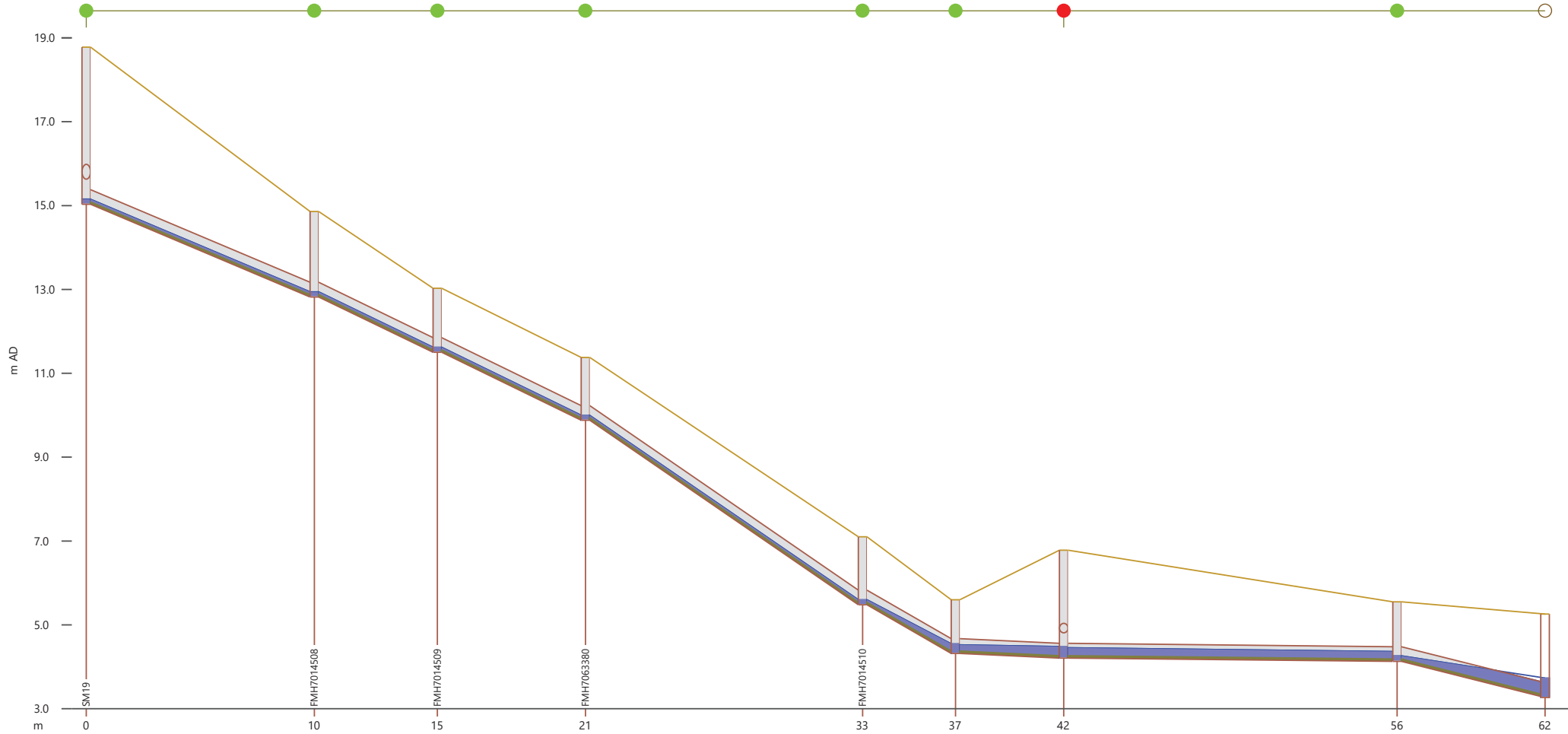
Link	FMH9001080.1	
US node ID	FMH9001080	
ds node	FMH7014498	
length (m)	3.4	
width (mm)	225	
us inv (m AD)	5.250	
ds inv (m AD)	4.810	
grad (m/m)	0.12810	
r.pfc (m3/s)	0.139	
surc	0.26	
US flow (m3/s)	0.00184	
US velocity (m/s)	0.435	
DS flow (m3/s)	0.00184	
DS velocity (m/s)	0.435	
Node	FMH9001080	FMH7014498
ground (m AD)	7.110	6.780
Ch floor lev (m AD)	5.250	4.210
flood dep (m)	-1.801	-2.267
level (m AD)	5.309	4.513

# Longitudinal Scenario 1 (SM6 to SM19)



Link	SM6.1	SM7.1	SM8.1	SM10.1	SM11.1	SM12A.1	SM13.1	SM14.1	SM15.1	SM15A.1	-	SM17.1	
US node ID	SM6	SM7	SM8	SM10	SM11	SM12A	SM13	SM14	SM15	SM15A	SM16	SM17	
ds node	SM7	SM8	SM10	SM11	SM12A	SM13	SM14	SM15	SM15A	SM16	SM17	SM19	
length (m)	10.8	12.7	11.2	11.8	11.1	11.3	8.8	4.9	15.3	9.7	3.5	13.5	
width (mm)	300	300	300	300	300	300	300	350	350	350	350	350	
us inv (m AD)	47.840	44.250	40.040	35.420	30.960	25.710	19.800	17.670	17.540	17.280	17.120	16.950	
ds inv (m AD)	44.260	40.080	35.430	30.990	25.720	20.330	17.700	17.535	17.280	17.120	16.950	15.630	
grad (m/m)	0.33245	0.32899	0.40998	0.37448	0.47207	0.47449	0.23815	0.02771	0.01699	0.01646	-	0.09770	
r.pfc (m <sup>3</sup> /s)	0.483	0.480	0.536	0.512	0.575	0.577	0.409	0.209	0.164	0.161	0.276	0.394	
surc	0.33	0.34	0.33	0.33	0.32	0.32	0.40	0.48	0.47	0.47	0.43	0.39	
US flow (m <sup>3</sup> /s)	0.04930	0.04930	0.05050	0.05065	0.05065	0.05065	0.05065	0.05065	0.05065	0.05065	-	0.07201	
US velocity (m/s)	3.666	3.657	3.900	3.825	4.035	4.040	3.424	1.715	1.495	1.480	2.332	2.905	
DS flow (m <sup>3</sup> /s)	0.04930	0.04930	0.05050	0.05065	0.05065	0.05065	0.05065	0.05065	0.05065	0.05065	-	0.07201	
DS velocity (m/s)	3.666	3.657	3.900	3.825	4.035	4.040	2.614	1.412	1.479	1.480	2.332	2.905	
Node	SM6	SM7	SM8	SM10	SM11	SM12A	SM13	SM14	SM15	SM15A	SM16	SM17	SM19
ground (m AD)	49.320	46.830	41.550	36.930	32.480	27.200	21.920	19.600	19.600	19.800	20.490	21.000	18.780
Ch floor lev (m AD)	47.840	44.250	40.040	35.420	30.960	25.710	19.800	17.670	17.535	17.280	17.120	16.950	15.030
flood dep (m)	-1.379	-2.476	-1.409	-1.409	-1.422	-1.392	-2.014	-1.779	-1.897	-2.356	-3.218	-3.911	-3.628
level (m AD)	47.941	44.354	40.141	35.521	31.058	25.808	19.906	17.821	17.703	17.444	17.272	17.089	15.152

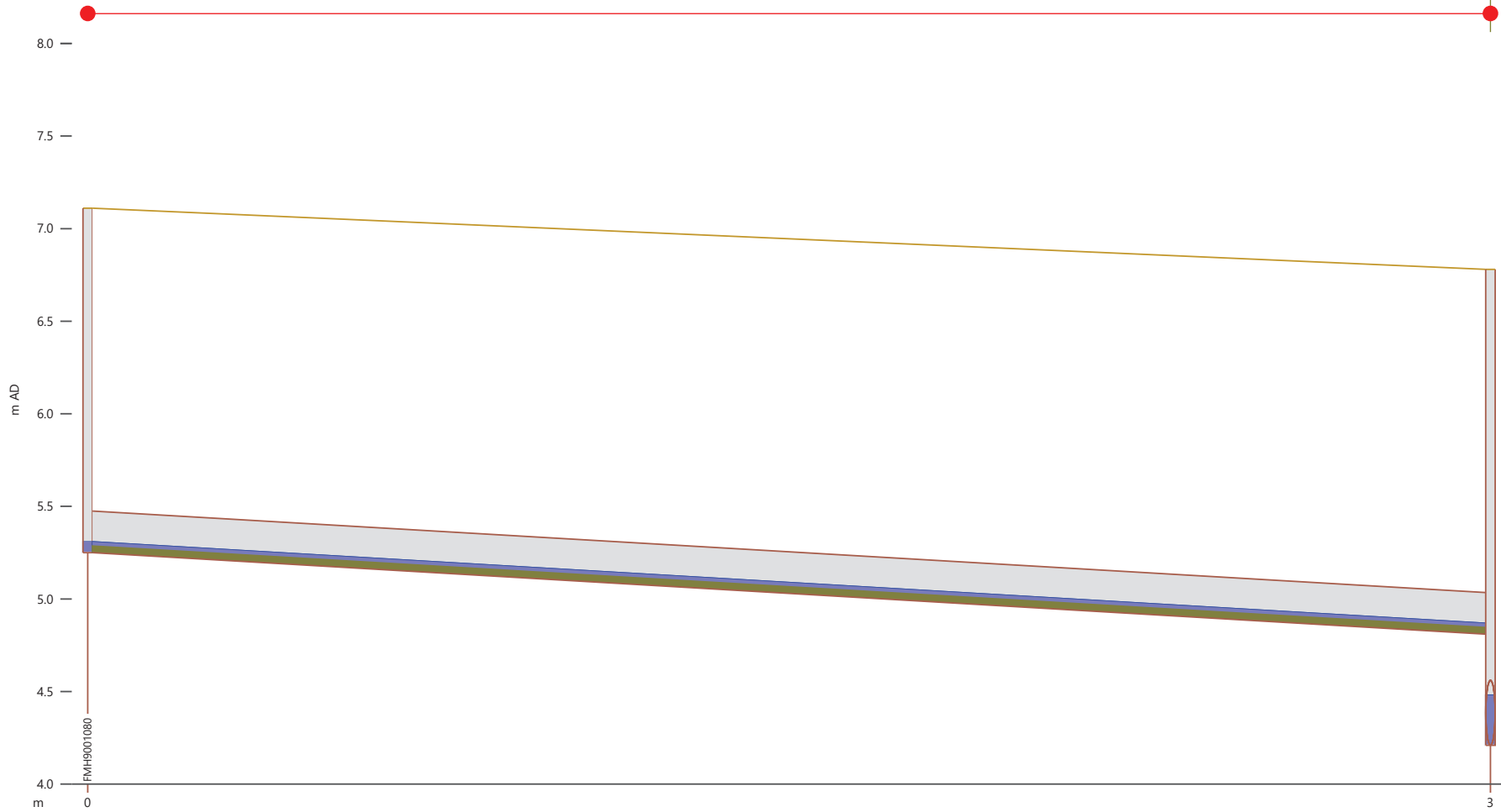
# Longitudinal Scenario 1 (SM19 to FMH7014499)



Link	SM19.1	FMH7014508.1	FMH7014509.2	FMH7063380.2	FMH7014510.1	FMH7014497.1	FMH7014498.1	FMH7051637.1	
US node ID	SM19	FMH7014508	FMH7014509	FMH7063380	FMH7014510	FMH7014497	FMH7014498	FMH7051637	
ds node	FMH7014508	FMH7014509	FMH7063380	FMH7014510	FMH7014497	FMH7014498	FMH7014498	FMH7051637	FMH7014499
length (m)	9.7	5.2	6.3	11.8	4.0	4.6	14.2	6.3	
width (mm)	350	350	350	350	350	350	350	350	350
us inv (m AD)	15.030	12.820	11.500	9.880	5.480	4.320	4.210	4.130	4.130
ds inv (m AD)	12.820	11.500	9.880	5.480	4.320	4.210	4.130	3.270	3.270
grad (m/m)	0.22752	0.25179	0.25684	0.37265	0.29305	0.02386	0.00563	0.13647	
r.pfc (m3/s)	0.601	0.632	0.638	0.769	0.682	0.194	0.094	0.465	
surc	0.35	0.35	0.34	0.34	0.65	0.78	0.70	1.00	
US flow (m3/s)	0.07201	0.07201	0.07231	0.07258	0.07258	0.07368	0.07528	0.07578	
US velocity (m/s)	3.640	3.733	3.759	4.117	3.889	1.510	1.213	3.252	
DS flow (m3/s)	0.07201	0.07201	0.07231	0.07258	0.07258	0.07368	0.07528	0.07578	
DS velocity (m/s)	3.640	3.690	3.759	3.825	1.278	1.044	1.285	0.838	
Node	SM19	FMH7014508	FMH7014509	FMH7063380	FMH7014510	FMH7014497	FMH7014498	FMH7051637	-
ground (m AD)	18.780	14.860	13.030	11.380	7.100	5.600	6.780	5.550	5.260
Ch floor lev (m AD)	15.030	12.820	11.500	9.880	5.480	4.320	4.210	4.130	3.270
flood dep (m)	-3.628	-1.919	-1.409	-1.384	-1.501	-1.052	-2.299	-1.287	
level (m AD)	15.152	12.941	11.621	9.996	5.599	4.548	4.481	4.263	3.732

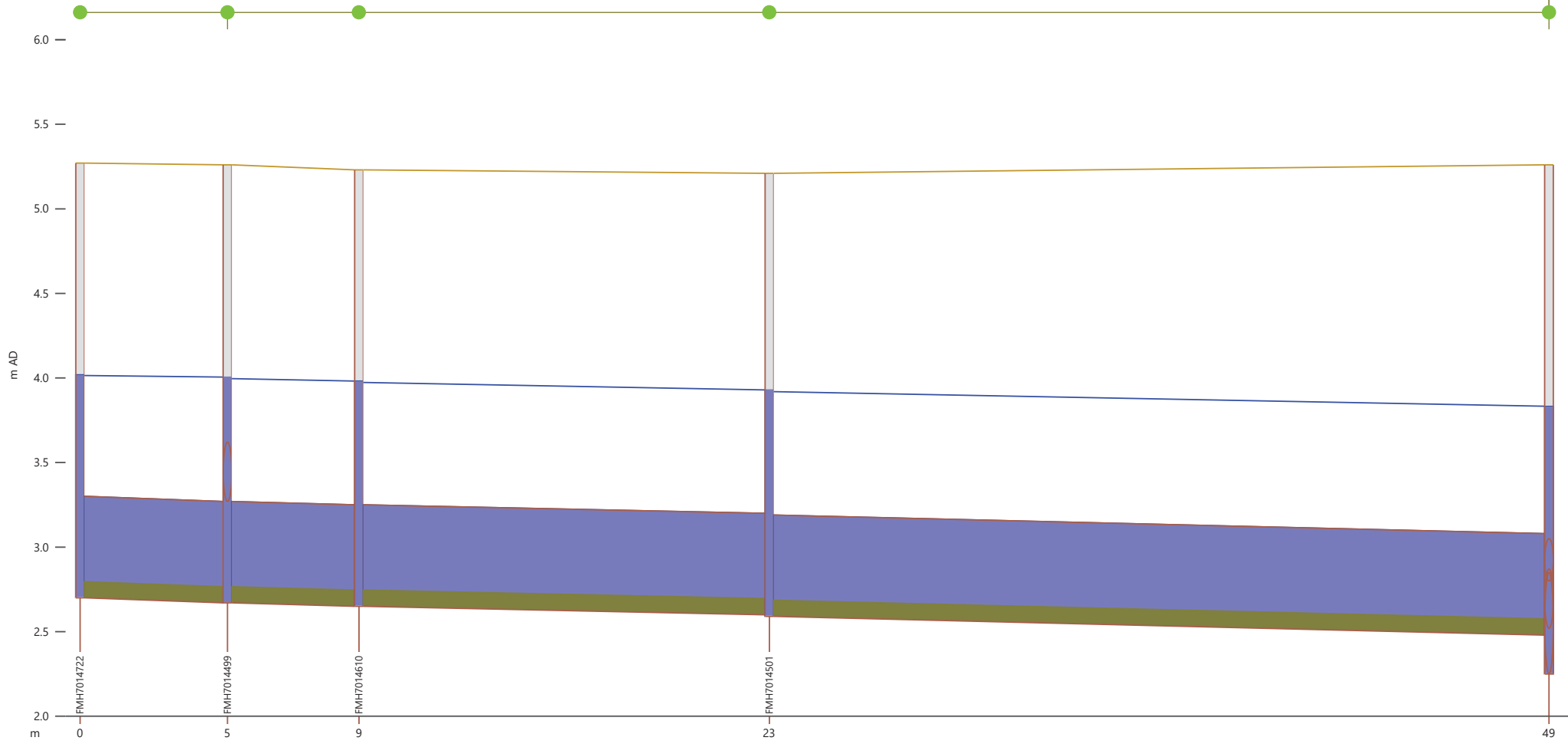


# Longitudinal Scenario 1 (FMH9001080 to FMH7014498)



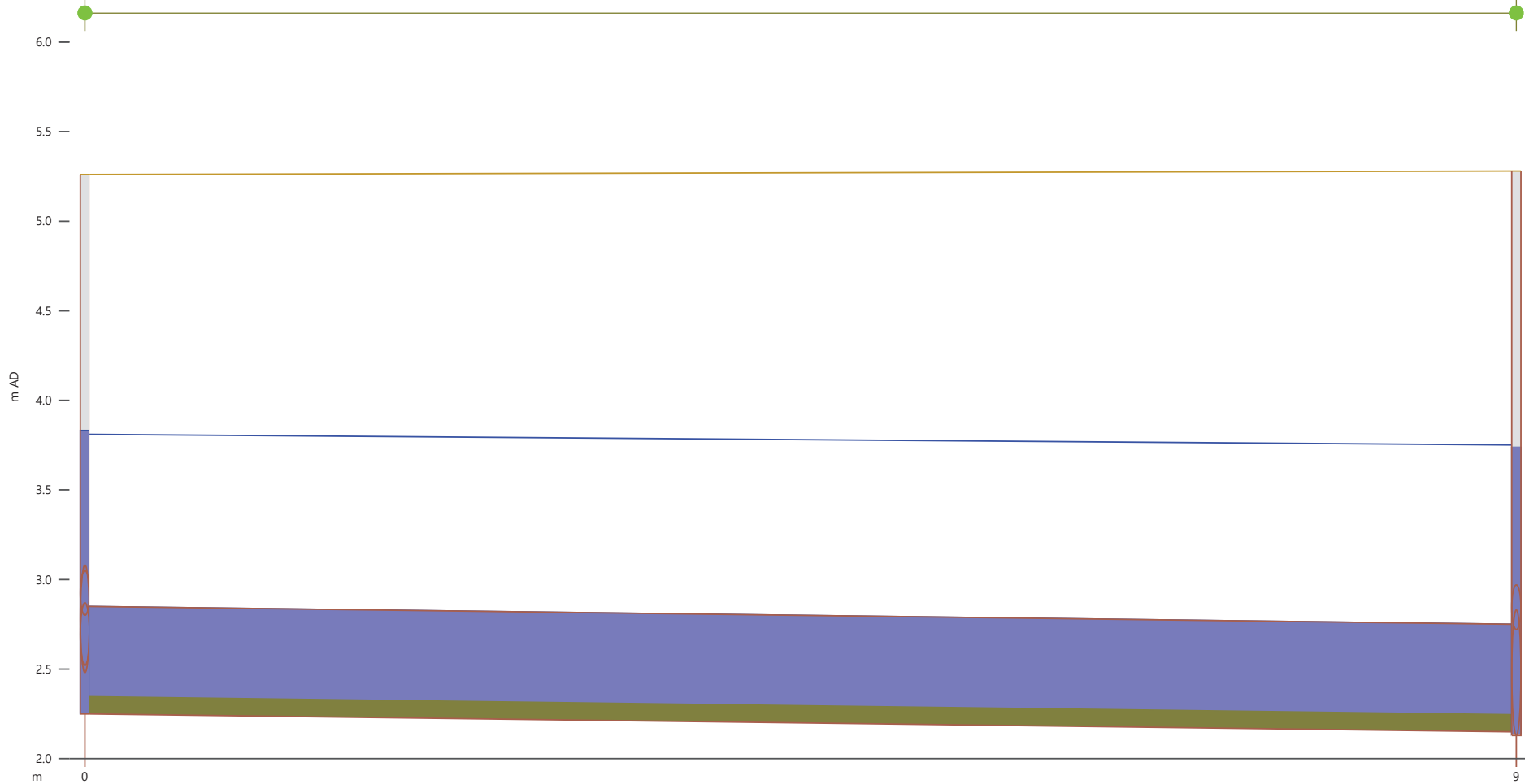
Link	FMH9001080.1	
US node ID	FMH9001080	
ds node	FMH7014498	
length (m)	3.4	
width (mm)	225	
us inv (m AD)	5.250	
ds inv (m AD)	4.810	
grad (m/m)	0.12810	
r.pfc (m3/s)	0.139	
surc	0.26	
US flow (m3/s)	0.00160	
US velocity (m/s)	0.384	
DS flow (m3/s)	0.00160	
DS velocity (m/s)	0.384	
Node	FMH9001080	FMH7014498
ground (m AD)	7.110	6.780
Ch floor lev (m AD)	5.250	4.210
flood dep (m)	-1.801	-2.299
level (m AD)	5.309	4.481

# Longitudinal Scenario 3 w/ 1.15 Safety Factor (FMH7014722 to FMH7014502)



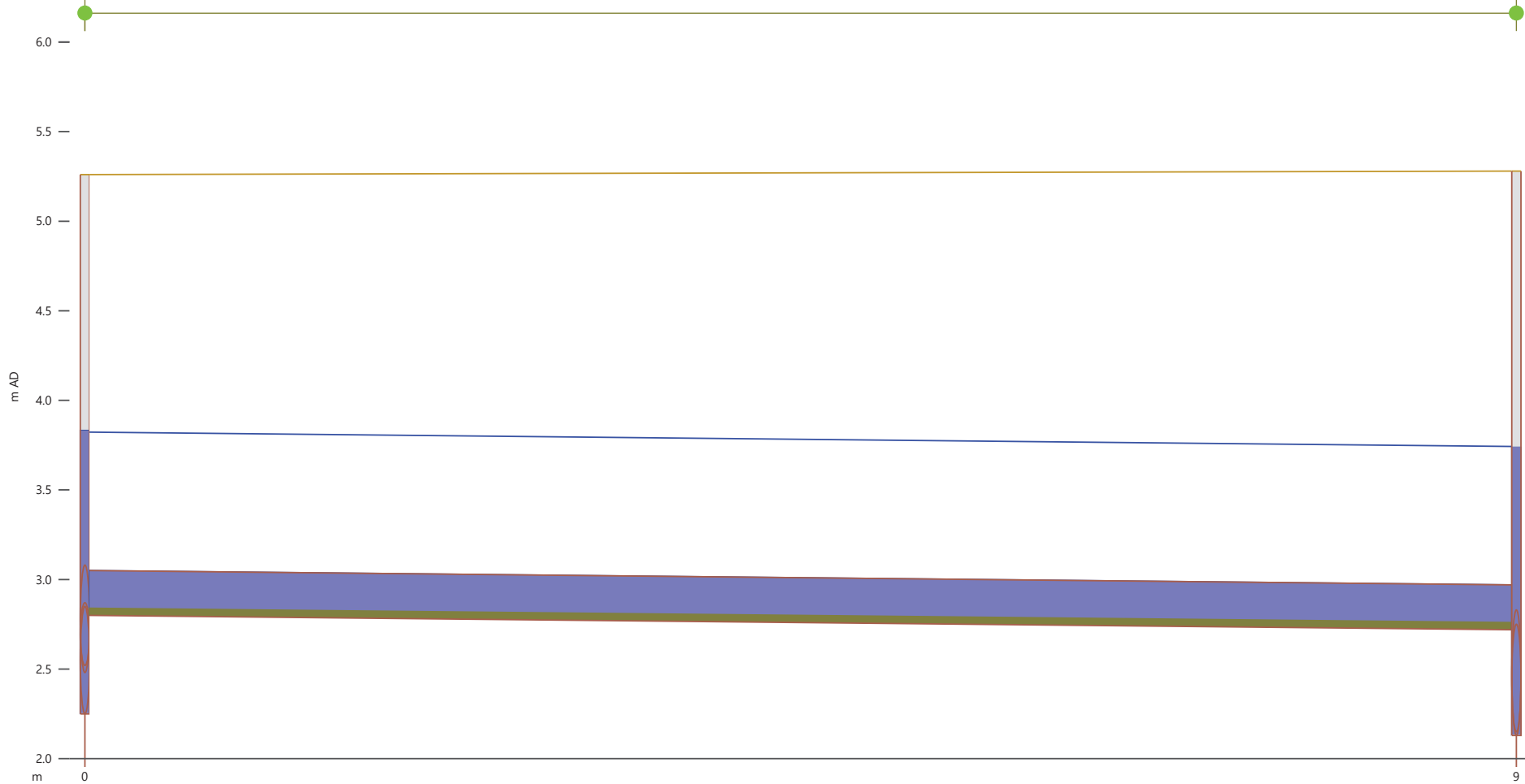
Link	FMH7014722.1	FMH7014499.1	FMH7014610.1	FMH7014501.1	
US node ID	FMH7014722	FMH7014499	FMH7014610	FMH7014501	
ds node	FMH7014499	FMH7014610	FMH7014501	FMH7014502	
length (m)	4.9	4.4	13.8	26.1	
width (mm)	600	600	600	600	
us inv (m AD)	2.700	2.670	2.650	2.590	
ds inv (m AD)	2.670	2.650	2.600	2.480	
grad (m/m)	0.00607	0.00454	0.00363	0.00421	
r.pfc (m3/s)	0.369	0.319	0.285	0.307	
surc	1.00	1.00	1.00	1.00	
US flow (m3/s)	0.20355	0.26507	0.26507	0.26830	
US velocity (m/s)	0.749	0.974	0.975	0.986	
DS flow (m3/s)	0.20355	0.26507	0.26507	0.26830	
DS velocity (m/s)	0.748	0.974	0.974	0.985	
Node	-	FMH7014499	FMH7014610	FMH7014501	FMH7014502
ground (m AD)	5.270	5.260	5.230	5.210	5.260
Ch floor lev (m AD)	2.700	2.670	2.650	2.590	2.250
flood dep (m)	-1.251	-1.256	-1.249	-1.282	-1.428
level (m AD)	4.019	4.004	3.981	3.928	3.832

# Longitudinal Scenario 3 w/ 1.15 Safety Factor (FMH7014502 to FMH7017300) - bottom pipe



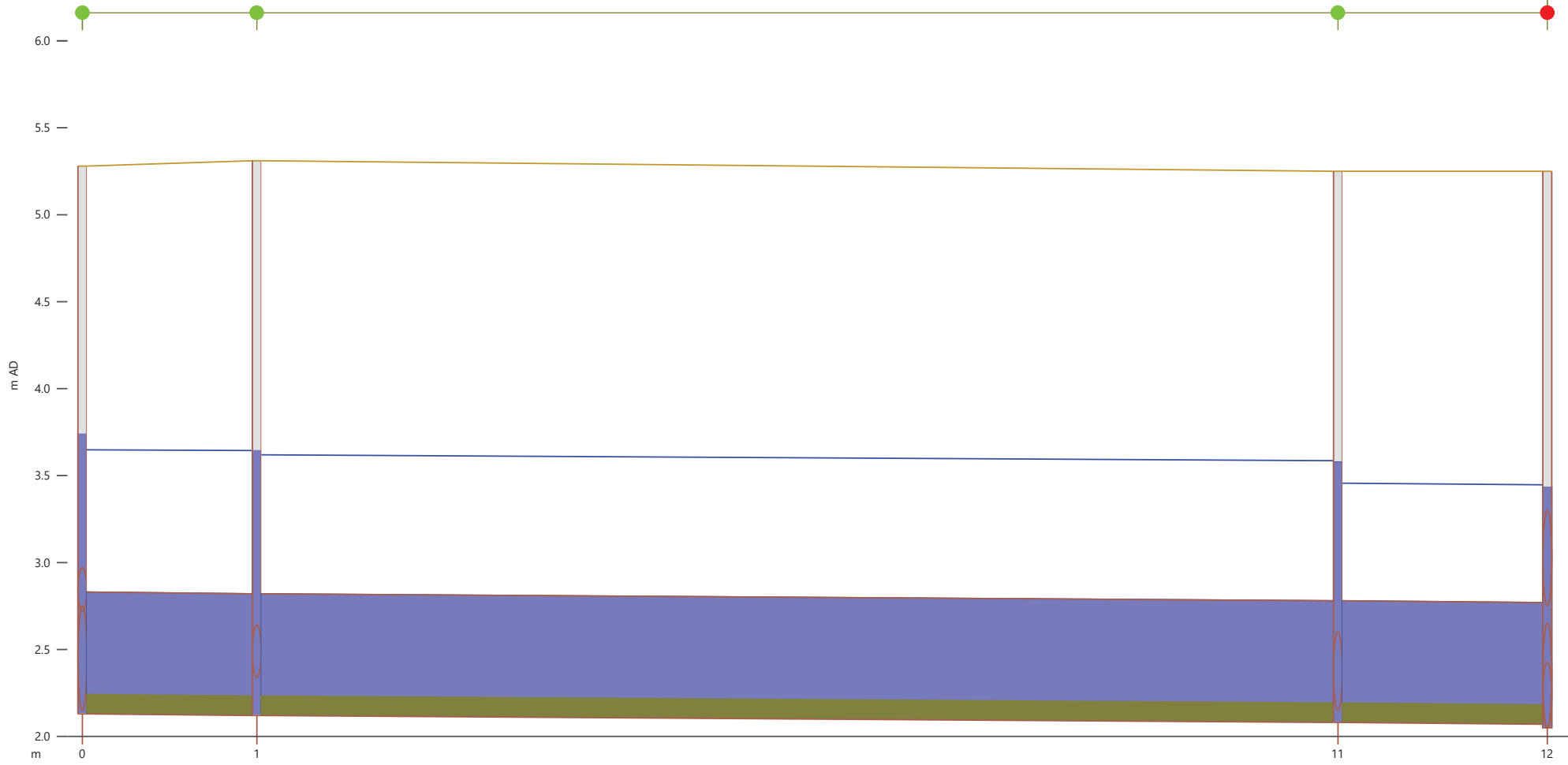
Link	FMH7014502.1	
US node ID	FMH7014502	
ds node	FMH7017300	
length (m)	9.1	
width (mm)	600	
us inv (m AD)	2.250	
ds inv (m AD)	2.150	
grad (m/m)	0.01104	
r.pfc (m3/s)	0.549	
surc	1.00	
US flow (m3/s)	0.39980	
US velocity (m/s)	1.455	
DS flow (m3/s)	0.39980	
DS velocity (m/s)	1.452	
Node	FMH7014502	FMH7017300
ground (m AD)	5.260	5.280
Ch floor lev (m AD)	2.250	2.130
flood dep (m)	-1.428	-1.542
level (m AD)	3.832	3.738

# Longitudinal Scenario 3 w/ 1.15 Safety Factor (FMH7014502 to FMH7017300) - top pipe



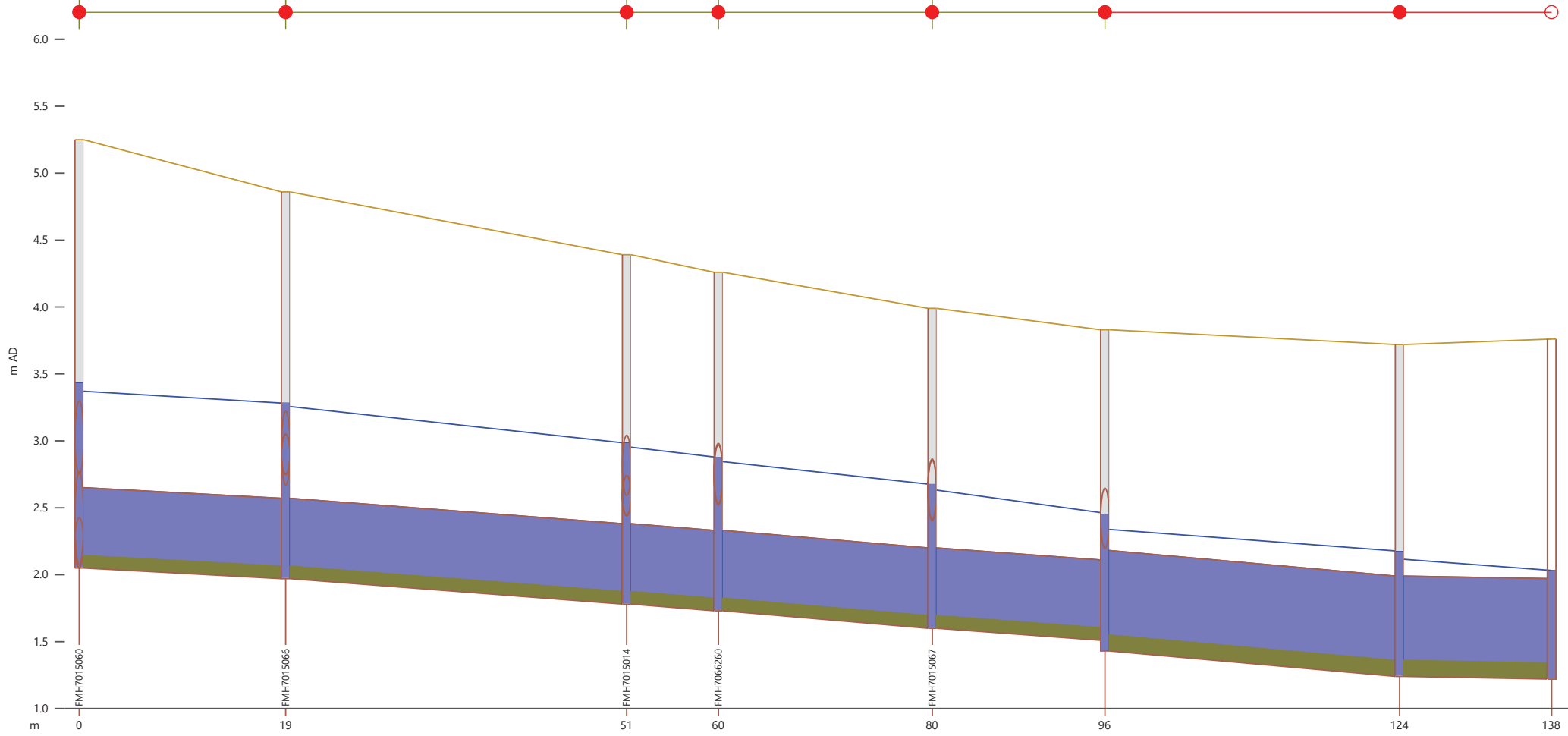
Link	FMH7014502.2	
US node ID	FMH7014502	
ds node	FMH7017300	
length (m)	9.1	
width (mm)	250	
us inv (m AD)	2.800	
ds inv (m AD)	2.720	
grad (m/m)	0.00884	
r.pfc (m3/s)	0.048	
surc	1.00	
US flow (m3/s)	0.04632	
US velocity (m/s)	0.935	
DS flow (m3/s)	0.04632	
DS velocity (m/s)	0.935	
Node	FMH7014502	FMH7017300
ground (m AD)	5.260	5.280
Ch floor lev (m AD)	2.250	2.130
flood dep (m)	-1.428	-1.542
level (m AD)	3.832	3.738

# Longitudinal Scenario 3 w/ 1.15 Safety Factor (FMH7017300 to FMH7015060)



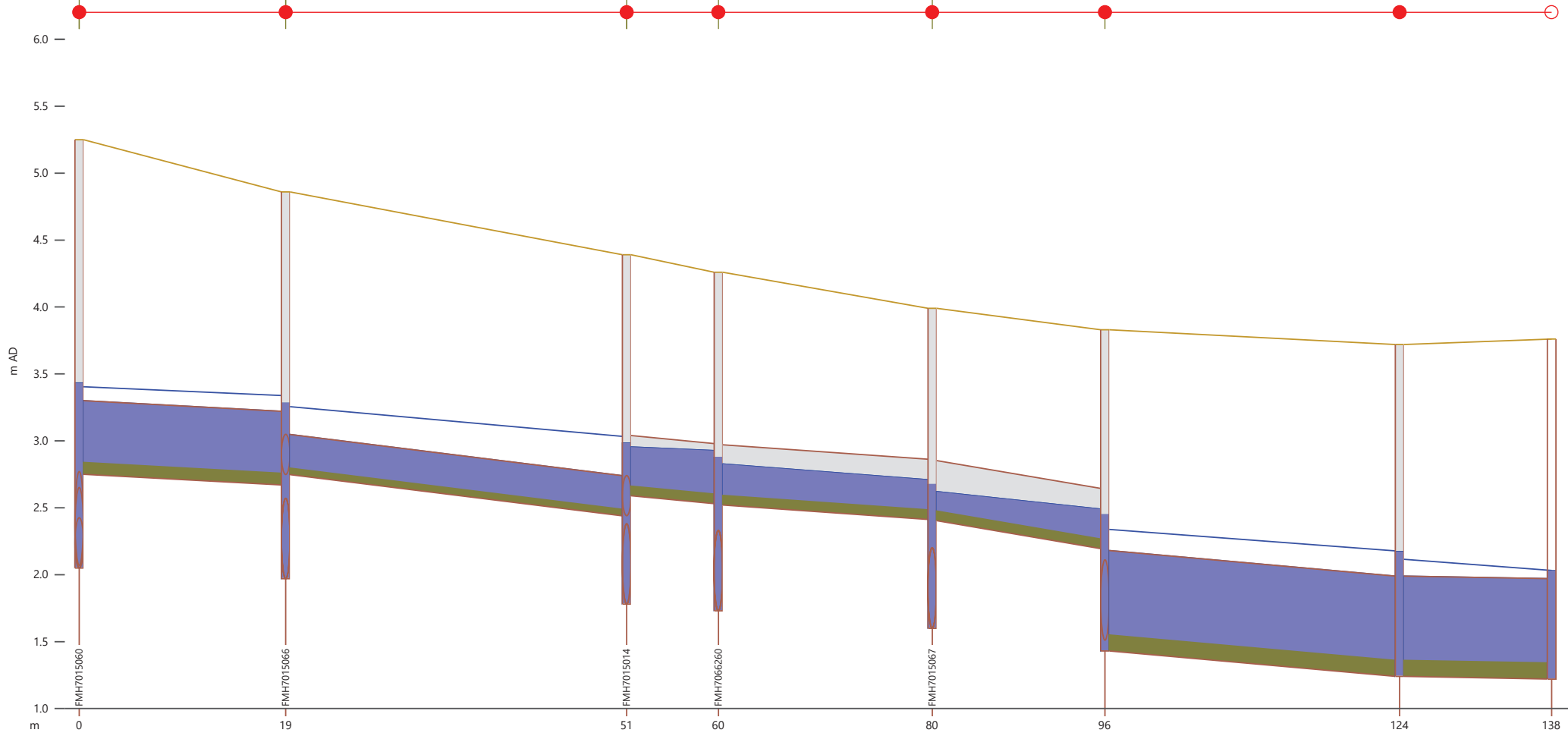
Link	FMH7017300.1		FMH7015059.1		FMH7015169.1	
US node ID	FMH7017300		FMH7015059		FMH7015169	
ds node	FMH7015059		FMH7015169		FMH7015060	
length (m)	1.5		9.2		1.8	
width (mm)	700		700		700	
us inv (m AD)	2.130		2.120		2.080	
ds inv (m AD)	2.120		2.080		2.070	
grad (m/m)	0.00676		0.00437		0.00564	
r.pfc (m3/s)	0.645		0.518		0.589	
surc	1.00		1.00		1.00	
US flow (m3/s)	0.44612		0.47005		0.55324	
US velocity (m/s)	1.206		1.272		1.504	
DS flow (m3/s)	0.44612		0.47005		0.55324	
DS velocity (m/s)	1.206		1.271		1.504	
Node	FMH7017300	FMH7015059			FMH7015169	FMH7015060
ground (m AD)	5.280	5.310			5.250	5.250
Ch floor lev (m AD)	2.130	2.120			2.080	2.050
flood dep (m)	-1.542	-1.668			-1.673	-1.817
level (m AD)	3.738	3.642			3.577	3.433

# Longitudinal Scenario 3 w/ 1.15 Safety Factor (FMH7015060 to FMH7013912) - bottom pipes



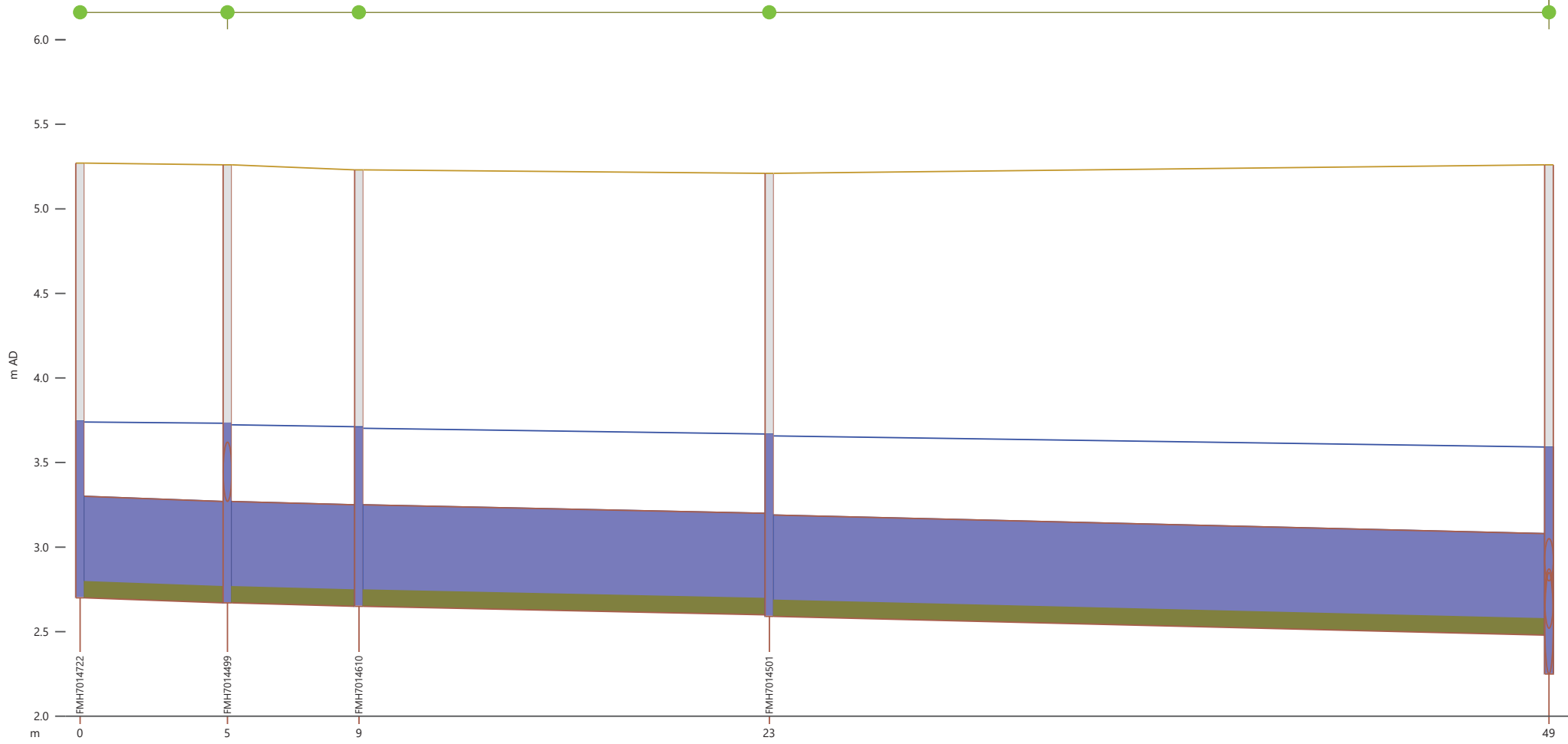
Link	FMH7015060.1		FMH7015066.1		FMH7015014.1		FMH7066260.1		FMH7015067.1		FMH7015083.1		FMH7013911.1	
US node ID	FMH7015060		FMH7015066		FMH7015014		FMH7066260		FMH7015067		FMH7015083		FMH7013911	
ds node	FMH7015066		FMH7015014		FMH7066260		FMH7015067		FMH7015083		FMH7013911		FMH7013912	
length (m)	19.3		31.9		8.6		20.0		16.2		27.6		14.2	
width (mm)	600		600		600		600		600		750		750	
us inv (m AD)	2.050		1.970		1.780		1.730		1.600		1.430		1.240	
ds inv (m AD)	1.970		1.780		1.730		1.600		1.510		1.240		1.220	
grad (m/m)	0.00414		0.00596		0.00583		0.00650		0.00557		0.00689		0.00141	
r.pfc (m3/s)	0.306		0.367		0.363		0.383		0.355		0.710		0.320	
surc	2.00		2.00		2.00		2.00		2.00		1.00		2.00	
US flow (m3/s)	0.31633		0.43273		0.43537		0.42987		0.48071		0.64283		0.64283	
US velocity (m/s)	1.159		1.588		1.606		1.590		1.784		1.553		1.555	
DS flow (m3/s)	0.31633		0.43273		0.43537		0.42987		0.48071		0.64283		0.64283	
DS velocity (m/s)	1.160		1.594		1.607		1.592		1.790		1.551		1.565	
Node	FMH7015060		FMH7015066		FMH7015014		FMH7066260		FMH7015067		FMH7015083		FMH7013911	
ground (m AD)	5.250		4.860		4.390		4.260		3.990		3.830		3.720	
Ch floor lev (m AD)	2.050		1.970		1.780		1.730		1.600		1.430		1.240	
flood dep (m)	-1.817		-1.579		-1.407		-1.384		-1.316		-1.383		-1.548	
level (m AD)	3.433		3.281		2.983		2.876		2.674		2.447		2.030	

# Longitudinal Scenario 3 w/ 1.15 Safety Factor (FMH7015060 to FMH7013912) - top pipes



Link	FMH7015060.2		FMH7015066.2		FMH7015014.2		FMH7066260.2		FMH7015067.2		FMH7015083.1		FMH7013911.1	
US node ID	FMH7015060		FMH7015066		FMH7015014		FMH7066260		FMH7015067		FMH7015083		FMH7013911	
ds node	FMH7015066		FMH7015014		FMH7066260		FMH7015067		FMH7015083		FMH7013911		FMH7013912	
length (m)	19.3		31.9		8.6		20.0		16.2		27.6		14.2	
width (mm)	550		300		450		450		450		750		750	
us inv (m AD)	2.750		2.748		2.590		2.520		2.403		1.430		1.240	
ds inv (m AD)	2.670		2.440		2.530		2.413		2.195		1.240		1.220	
grad (m/m)	0.00414		0.00966		0.00699		0.00535		0.01288		0.00689		0.00141	
r.pfc (m3/s)	0.267		0.082		0.204		0.178		0.277		0.710		0.320	
surc	1.00		1.00		0.88		0.68		0.66		1.00		2.00	
US flow (m3/s)	0.23691		0.06710		0.13156		0.13705		0.08622		0.64283		0.64283	
US velocity (m/s)	1.065		1.000		1.086		1.379		1.446		1.553		1.555	
DS flow (m3/s)	0.23691		0.06710		0.13156		0.13705		0.08622		0.64283		0.64283	
DS velocity (m/s)	1.064		0.993		0.997		1.447		0.917		1.551		1.565	
Node	FMH7015060		FMH7015066		FMH7015014		FMH7066260		FMH7015067		FMH7015083		FMH7013911	
ground (m AD)	5.250		4.860		4.390		4.260		3.990		3.830		3.720	
Ch floor lev (m AD)	2.050		1.970		1.780		1.730		1.600		1.430		1.240	
flood dep (m)	-1.817		-1.579		-1.407		-1.384		-1.316		-1.383		-1.548	
level (m AD)	3.433		3.281		2.983		2.876		2.674		2.447		2.030	

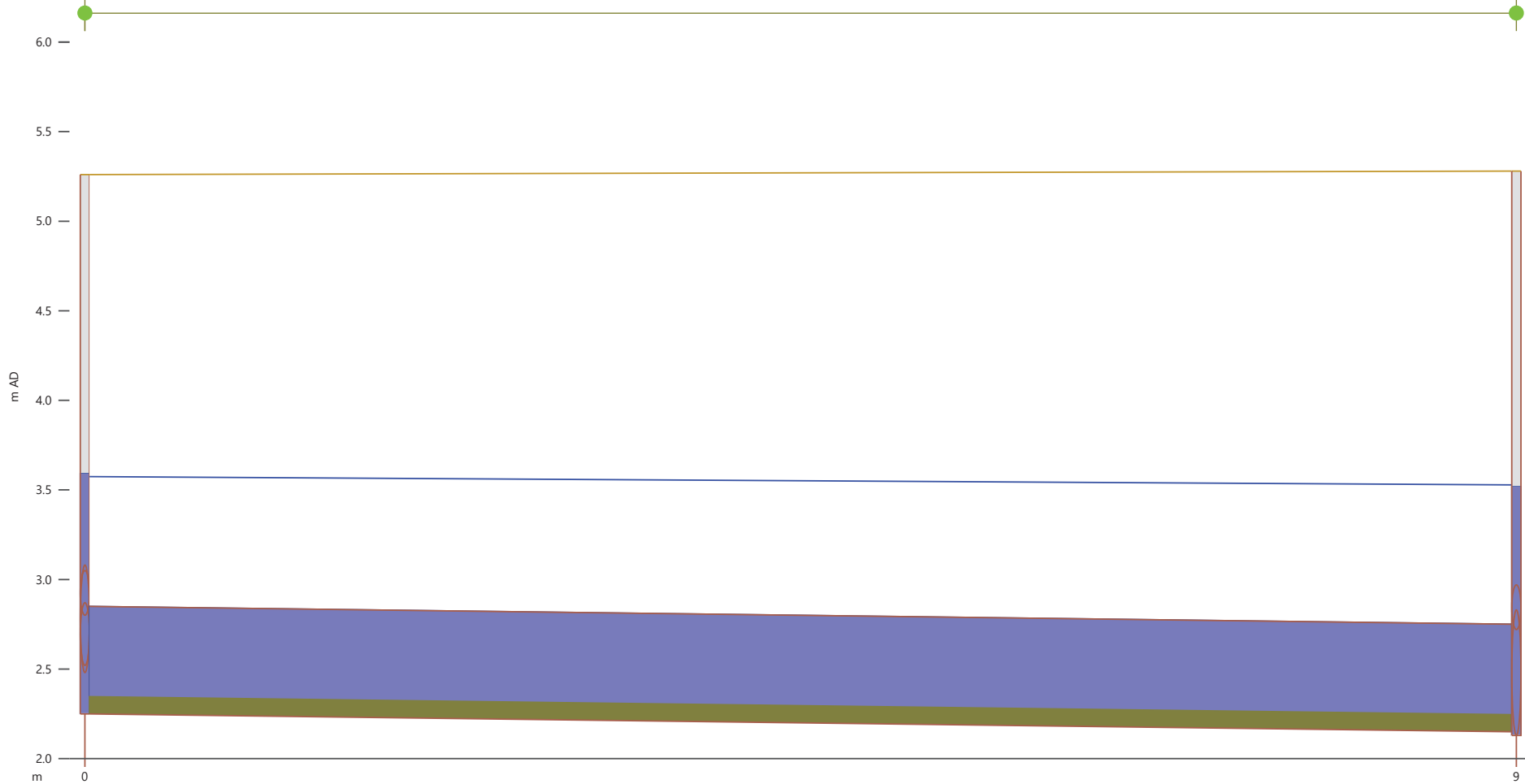
# Longitudinal Scenario 3 (FMH7014722 to FMH7014502)



Link	FMH7014722.1	FMH7014499.1	FMH7014610.1	FMH7014501.1	
US node ID	FMH7014722	FMH7014499	FMH7014610	FMH7014501	
ds node	FMH7014499	FMH7014610	FMH7014501	FMH7014502	
length (m)	4.9	4.4	13.8	26.1	
width (mm)	600	600	600	600	
us inv (m AD)	2.700	2.670	2.650	2.590	
ds inv (m AD)	2.670	2.650	2.600	2.480	
grad (m/m)	0.00607	0.00454	0.00363	0.00421	
r.pfc (m3/s)	0.369	0.319	0.285	0.307	
surc	1.00	1.00	1.00	1.00	
US flow (m3/s)	0.17700	0.23061	0.23061	0.23341	
US velocity (m/s)	0.659	0.858	0.858	0.868	
DS flow (m3/s)	0.17700	0.23061	0.23061	0.23341	
DS velocity (m/s)	0.658	0.858	0.857	0.866	
Node	-	FMH7014499	FMH7014610	FMH7014501	FMH7014502
ground (m AD)	5.270	5.260	5.230	5.210	5.260
Ch floor lev (m AD)	2.700	2.670	2.650	2.590	2.250
flood dep (m)	-1.525	-1.528	-1.519	-1.542	-1.669
level (m AD)	3.745	3.732	3.711	3.668	3.591

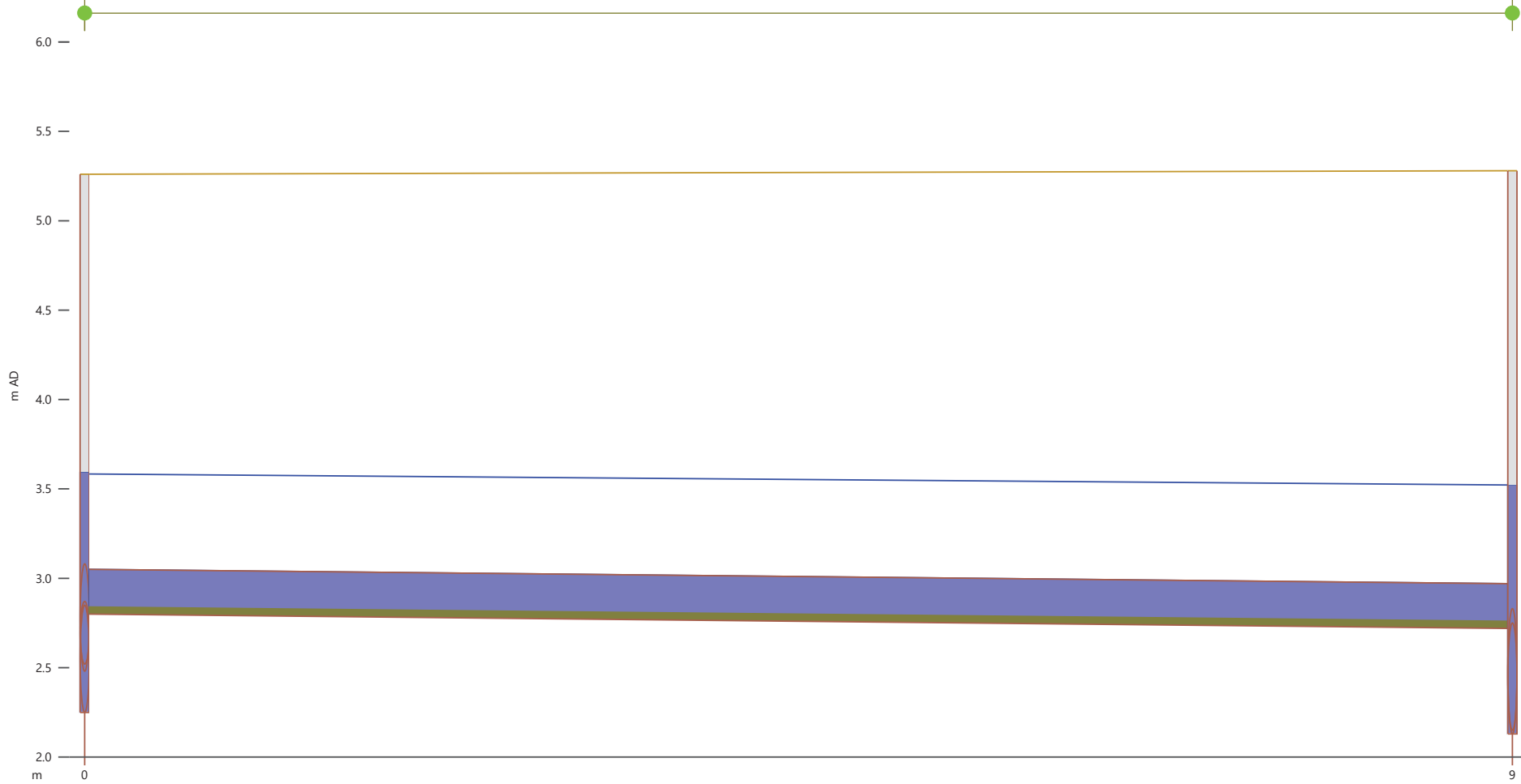


# Longitudinal Scenario 3 (FMH7014502 to FMH7017300) - bottom pipe



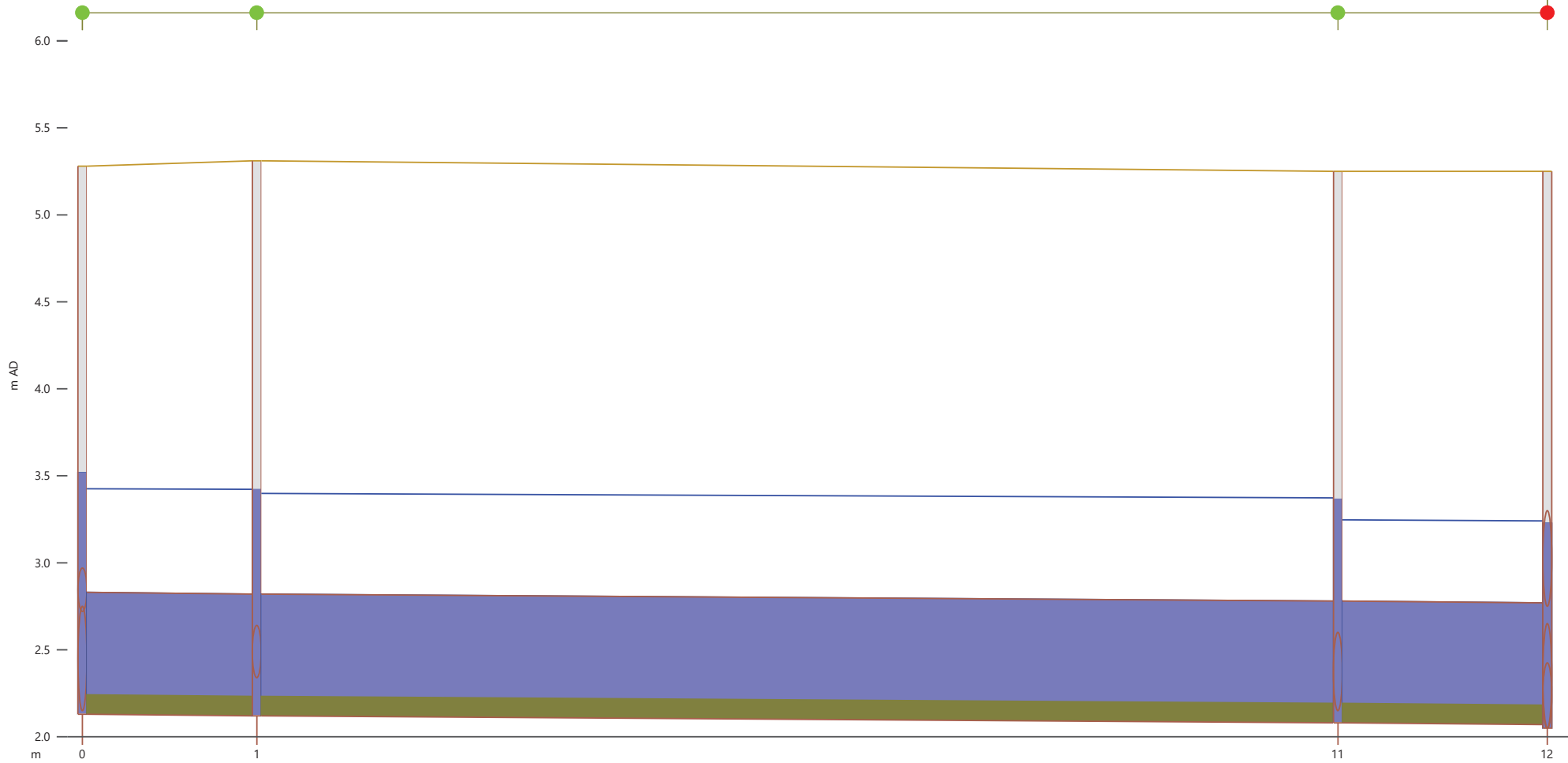
Link	FMH7014502.1	
US node ID	FMH7014502	
ds node	FMH7017300	
length (m)	9.1	
width (mm)	600	
us inv (m AD)	2.250	
ds inv (m AD)	2.150	
grad (m/m)	0.01104	
r.pfc (m3/s)	0.549	
surc	1.00	
US flow (m3/s)	0.34766	
US velocity (m/s)	1.278	
DS flow (m3/s)	0.34766	
DS velocity (m/s)	1.275	
Node	FMH7014502	FMH7017300
ground (m AD)	5.260	5.280
Ch floor lev (m AD)	2.250	2.130
flood dep (m)	-1.669	-1.762
level (m AD)	3.591	3.518

# Longitudinal Scenario 3 (FMH7014502 to FMH7017300) - top pipe



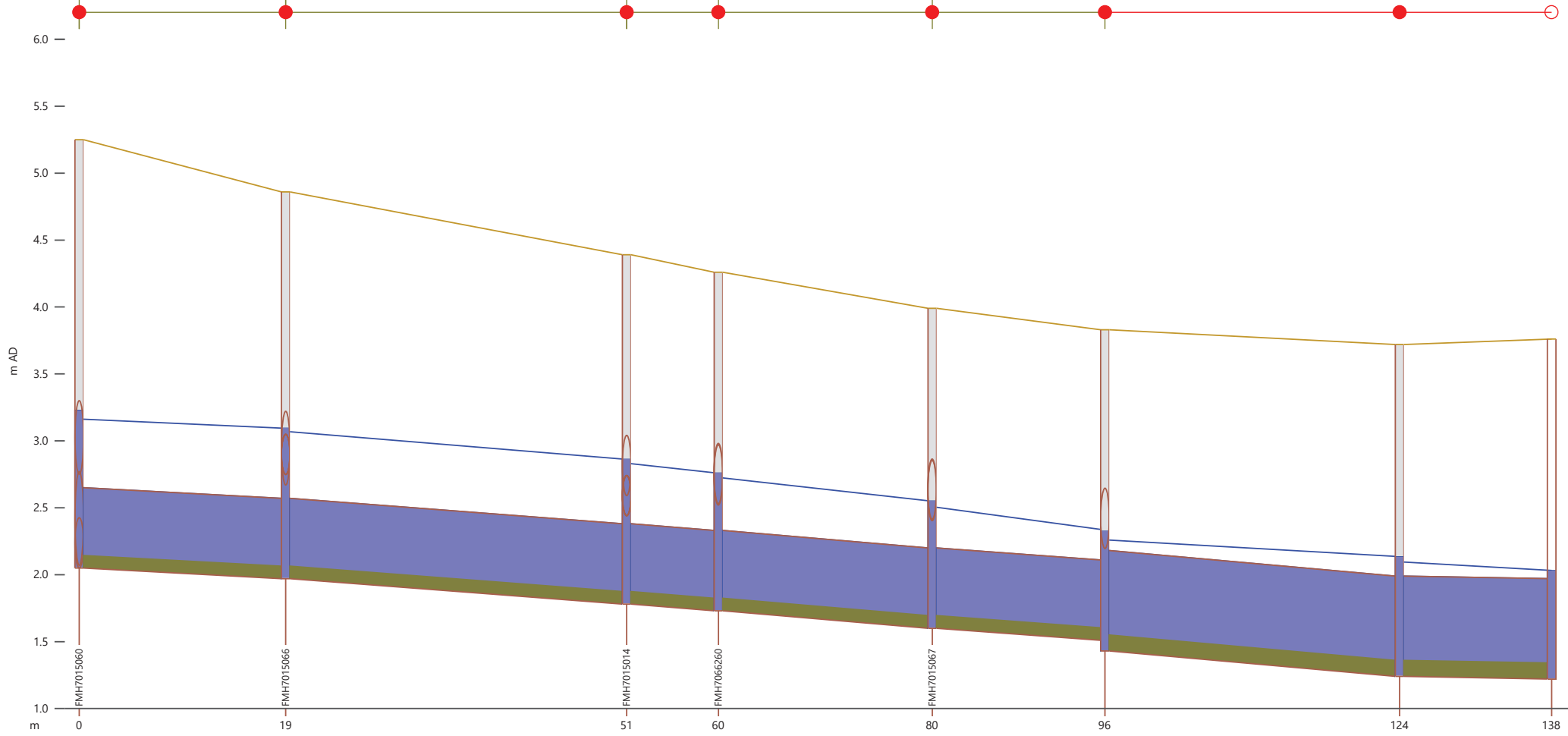
Link	FMH7014502.2	
US node ID	FMH7014502	
ds node	FMH7017300	
length (m)	9.1	
width (mm)	250	
us inv (m AD)	2.800	
ds inv (m AD)	2.720	
grad (m/m)	0.00884	
r.pfc (m3/s)	0.048	
surc	1.00	
US flow (m3/s)	0.04038	
US velocity (m/s)	0.835	
DS flow (m3/s)	0.04038	
DS velocity (m/s)	0.833	
Node	FMH7014502	FMH7017300
ground (m AD)	5.260	5.280
Ch floor lev (m AD)	2.250	2.130
flood dep (m)	-1.669	-1.762
level (m AD)	3.591	3.518

# Longitudinal Scenario 3 (FMH7017300 to FMH7015060)



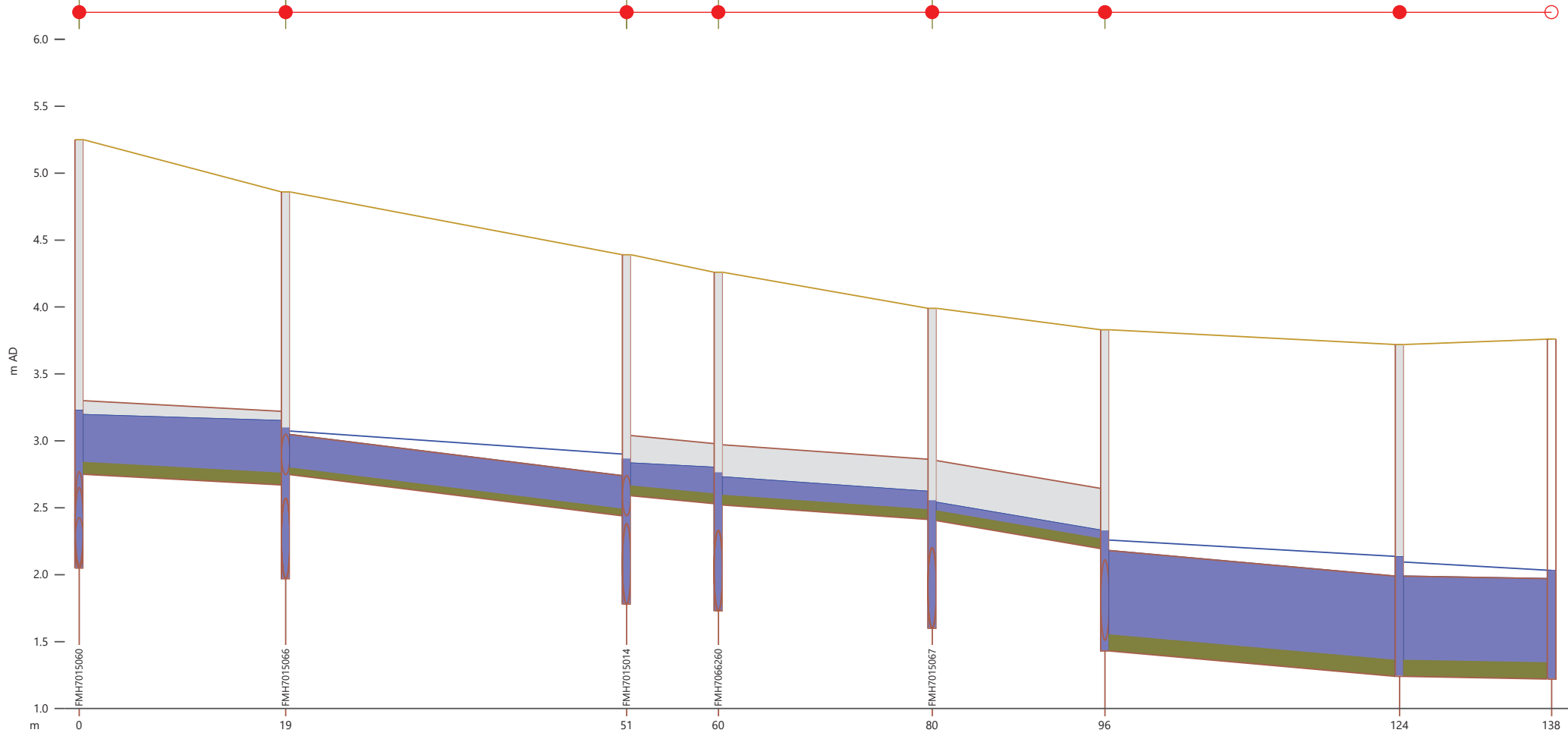
Link	FMH7017300.1		FMH7015059.1		FMH7015169.1	
US node ID	FMH7017300		FMH7015059		FMH7015169	
ds node	FMH7015059		FMH7015169		FMH7015060	
length (m)	1.5		9.2		1.8	
width (mm)	700		700		700	
us inv (m AD)	2.130		2.120		2.080	
ds inv (m AD)	2.120		2.080		2.070	
grad (m/m)	0.00676		0.00437		0.00564	
r.pfc (m3/s)	0.645		0.518		0.589	
surc	1.00		1.00		1.00	
US flow (m3/s)	0.38805		0.40113		0.48119	
US velocity (m/s)	1.058		1.094		1.318	
DS flow (m3/s)	0.38805		0.40113		0.48119	
DS velocity (m/s)	1.058		1.094		1.318	
Node	FMH7017300	FMH7015059			FMH7015169	FMH7015060
ground (m AD)	5.280	5.310			5.250	5.250
Ch floor lev (m AD)	2.130	2.120			2.080	2.050
flood dep (m)	-1.762	-1.890			-1.885	-2.023
level (m AD)	3.518	3.420			3.366	3.227

# Longitudinal Scenario 3 (FMH7015060 to FMH7013912) - bottom pipes



Link	FMH7015060.1		FMH7015066.1		FMH7015014.1		FMH7066260.1		FMH7015067.1		FMH7015083.1		FMH7013911.1	
US node ID	FMH7015060		FMH7015066		FMH7015014		FMH7066260		FMH7015067		FMH7015083		FMH7013911	
ds node	FMH7015066		FMH7015066		FMH7015014		FMH7066260		FMH7015067		FMH7015083		FMH7013911	
length (m)	19.3		31.9		8.6		20.0		16.2		27.6		14.2	
width (mm)	600		600		600		600		600		750		750	
us inv (m AD)	2.050		1.970		1.780		1.730		1.600		1.430		1.240	
ds inv (m AD)	1.970		1.780		1.730		1.600		1.510		1.240		1.220	
grad (m/m)	0.00414		0.00596		0.00583		0.00650		0.00557		0.00689		0.00141	
r.pfc (m3/s)	0.306		0.367		0.363		0.383		0.355		0.710		0.320	
surc	1.00		2.00		2.00		2.00		2.00		1.00		2.00	
US flow (m3/s)	0.27542		0.37565		0.41744		0.43279		0.47559		0.55909		0.55909	
US velocity (m/s)	1.019		1.390		1.548		1.609		1.775		1.357		1.353	
DS flow (m3/s)	0.27542		0.37565		0.41744		0.43279		0.47559		0.55909		0.55909	
DS velocity (m/s)	1.018		1.391		1.549		1.612		1.781		1.351		1.362	
Node	FMH7015060		FMH7015066		FMH7015014		FMH7066260		FMH7015067		FMH7015083		FMH7013911	
ground (m AD)	5.250		4.860		4.390		4.260		3.990		3.830		3.720	
Ch floor lev (m AD)	2.050		1.970		1.780		1.730		1.600		1.430		1.240	
flood dep (m)	-2.023		-1.767		-1.528		-1.501		-1.441		-1.506		-1.587	
level (m AD)	3.227		3.093		2.862		2.759		2.549		2.324		2.030	

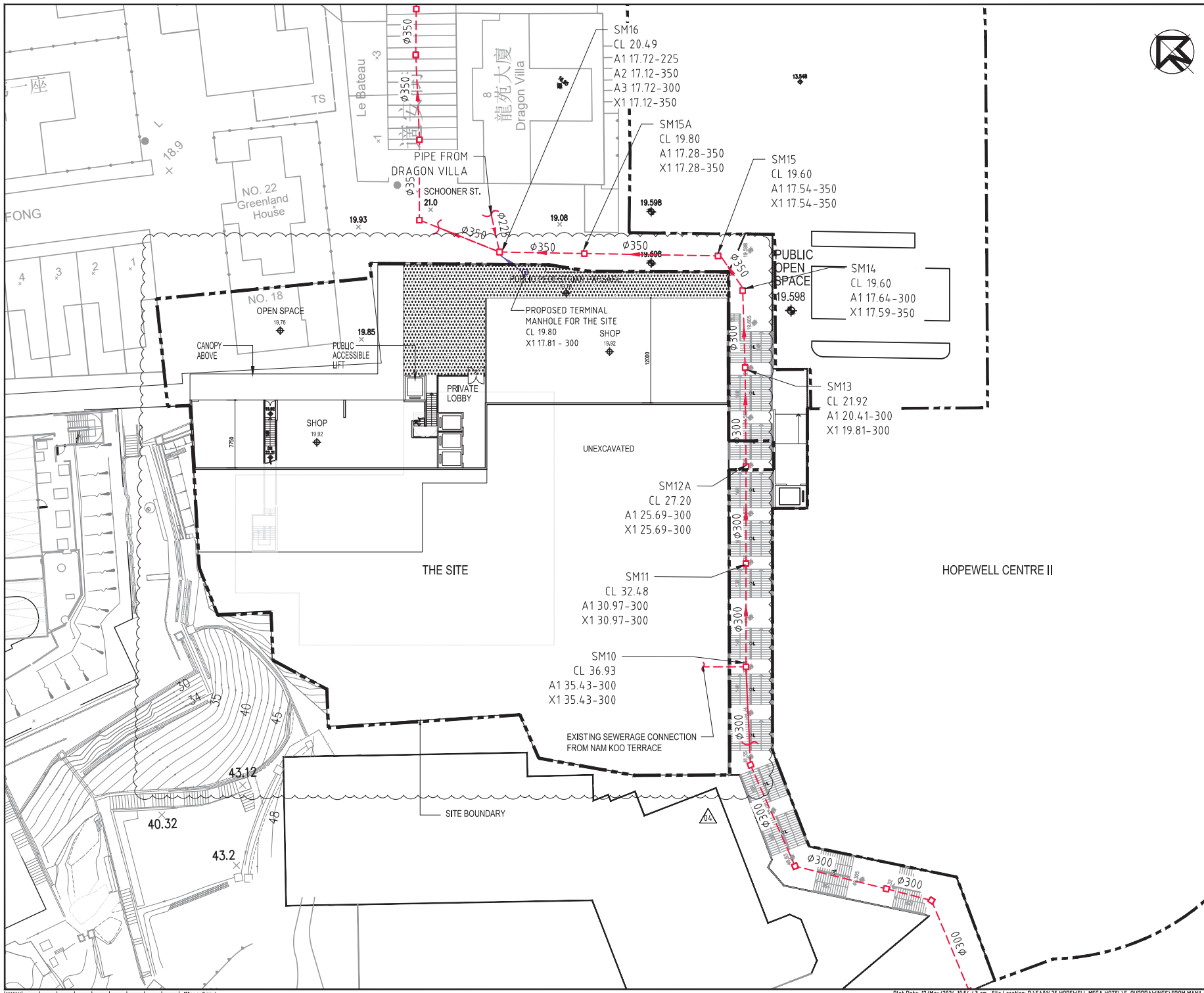
# Longitudinal Scenario 3 (FMH7015060 to FMH7013912) - top pipes



Link	FMH7015060.2		FMH7015066.2		FMH7015014.2		FMH7066260.2		FMH7015067.2		FMH7015083.1		FMH7013911.1	
US node ID	FMH7015060		FMH7015066		FMH7015014		FMH7066260		FMH7015067		FMH7015083		FMH7013911	
ds node	FMH7015066		FMH7015066		FMH7015014		FMH7066260		FMH7015067		FMH7015083		FMH7013911	
length (m)	19.3		31.9		8.6		20.0		16.2		27.6		14.2	
width (mm)	550		300		450		450		450		750		750	
us inv (m AD)	2.750		2.748		2.590		2.520		2.403		1.430		1.240	
ds inv (m AD)	2.670		2.440		2.530		2.413		2.195		1.240		1.220	
grad (m/m)	0.00414		0.00966		0.00699		0.00535		0.01288		0.00689		0.00141	
r.pfc (m3/s)	0.267		0.082		0.204		0.178		0.277		0.710		0.320	
surc	0.87		1.00		0.60		0.46		0.30		1.00		2.00	
US flow (m3/s)	0.20578		0.05872		0.07566		0.06030		0.01750		0.55909		0.55909	
US velocity (m/s)	1.136		0.894		1.064		1.077		0.715		1.357		1.353	
DS flow (m3/s)	0.20578		0.05872		0.07566		0.06030		0.01750		0.55909		0.55909	
DS velocity (m/s)	1.053		0.879		0.906		1.077		0.715		1.351		1.362	
Node	FMH7015060		FMH7015066		FMH7015014		FMH7066260		FMH7015067		FMH7015083		FMH7013911	
ground (m AD)	5.250		4.860		4.390		4.260		3.990		3.830		3.720	
Ch floor lev (m AD)	2.050		1.970		1.780		1.730		1.600		1.430		1.240	
flood dep (m)	-2.023		-1.767		-1.528		-1.501		-1.441		-1.506		-1.587	
level (m AD)	3.227		3.093		2.862		2.759		2.549		2.324		2.030	

## **APPENDIX H**

### **Proposed Sewerage Connection for Indicative Development Scheme**



**LEGEND:**

- BOUNDARY
- SEWERAGE SYSTEM UNDER HOPEWELL CENTRE II PROJECT
- PROPOSED TERMINAL MANHOLE AND CONNECTION PIPE

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-	FIRST ISSUE	DEC 2020

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**YUBA COMPANY LIMITED**



Project: INDICATIVE DEVELOPMENT SCHEME AT HILLSIDE & NAM KOO TERRACE, WAN CHAI, HONG KONG

Title: PROPOSED SEWERAGE CONNECTION

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