Appendix 6

Review of Sewerage Impact Assessment

TECHNICAL NOTE

Agreement No. CB20210450 Term Engineering Consultancy Services 2021-2023 for New Territories West Region, Instruction No..A02 – Public Housing Development at Long Bin Phase 2 & Phase 3

SUBJECT	PROJECT NO.	DATE
Technical Notes for Review of Sewerage Impact Assessment	5209833	09 April 2024

AUTHOR	DISTRIBUTION	REPRESENTING
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Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
1.0	Draft	Winson Cai	Atlas Fung	Daniel Spooner	Rex Liu	22/02/2024
2.0	Revised	Winson Cai	Atlas Fung	Daniel Spooner	Rex Liu	09/04/2024

Client signoff

Client			
Project	Agreement No. CB20210450 Term Engineering Consultancy Services 2021-2023 for New Territories West Region, Instruction No..A02 – Public Housing Development at Long Bin Phase 2 & Phase 3	Project No.	5209833

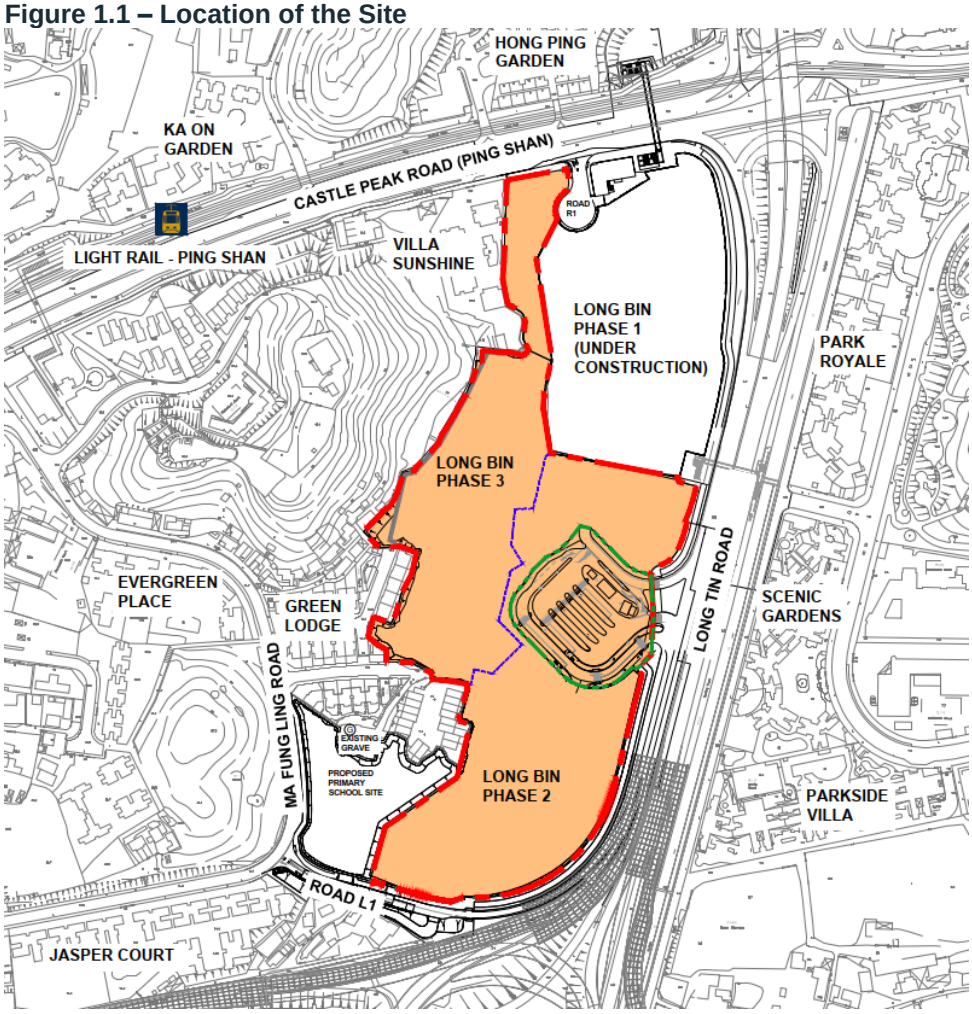
TECHNICAL NOTE

Client signature / date

1. Background

1.1.1 AtkinsRéalis was appointed by Hong Kong Housing Authority (HKHA) to carry out review on the approved Final SIA Report (*ref. REP-010-02*) under Agreement No. CE 75/2017 (CE) Site Formation and Infrastructure Works for Public Housing Developments at Long Bin, Yuen Long – Investigation, Design and Construction (thereafter as "CE 75/2017 (CE)"), due to the update of development parameters for non-domestic facilities. The site layout plan for the proposed development is shown in **Figure 1.1**.

Figure 1.1 – Location of the Site



2. Methodology

2.1.1 Unless otherwise specified in this Technical Note, the design/development parameters and estimation approach will be following those under CE 75/2017 (CE).

2.1.2 The updated sewage flow due to change of development parameters is estimated for Phase 1, 2 & 3 and compared with that under CE 75/2017 (CE).

2.1.3 Pro-rata method is adopted in determining the non-domestic GFA for different trades based on the total non-domestic GFA and the allocation under CE 75/2017 (CE).

3. Comparison of Development Parameters

3.1.1 According to the latest development parameters provided by HKHA, the parameters of the non-domestic facilities has been updated as compared to those in the approved SIA under CE 75/2017 (CE). The change of proposed development parameters is summarized in **Table 2.1** below.

Table 2.1 – Comparison of Proposed Development Parameters

Development Parameters	Adopted parameters under approved SIA of CE 75/2017 (CE)	HKHA latest parameters
Plot Ratio (non-domestic)	0.5	0.3 for Phase 1 0.8 for Phase 2 & 3
Intake Year	PRH: 2028/29	PRH: 2030/31
GFA for Welfare	1,191 s.q.m for Phase 1 9,316 s.q.m for Phase 2 & 3	1,329 s.q.m for Phase 1 17,256 s.q.m for Phase 2 & 3
GFA for Retail	1,889 s.q.m for Phase 1 8,871 s.q.m for Phase 2 & 3	1,360 s.q.m for Phase 1 7,353 s.q.m for Phase 2 & 3
GFA for Office	238 s.q.m for Phase 2 & 3	1,444 s.q.m for Phase 2 & 3
Proposed Social Welfare Facilities	1.Children Care Centre (CCC) 2.Special Child Care Centre (SCCC) 3.Integrated Vocational Rehabilitation Services Centre (IVRSC) 4.Residential Care Homes for The Elderly (RCHE) cum Day Care Unit for Elderly (DCU) 5.OPRS Office Base 6.Supported Hostel for Mentally Handicapped Persons (SHOS(MH)) 7.Hostel for Severely Handicapped Persons (HSPH) 8.Hostel for Moderately Mentally Handicapped Persons (HMMH)	1.On-site Pre-school Rehabilitation Services (OPRS) Office Base 2.60-p Special Child Care Centre (SCCC) 3.100-p Aided Standalone Child Care Centre (CCC) 4.50-p Hostel for Moderately Mentally Handicapped Persons (HMMH) 5.50-p Hostel for Severely Physically Handicapped Persons (HSPH) 6. 120-p Integrated Vocational Rehabilitation on Services Centre (IVRSC) 7. 40-p Supported Hostel for Mentally Handicapped Persons (SHOS(MH)) 8. 200-p Residential Care Home for the Elderly (RCHE) cum 30-p Day Care Unit (DCU) 9. School Social Work Unit 10. Home Care Services (HCS) for Frail Elderly Persons (1-team size non-kitchen based)

Development Parameters	Adopted parameters under approved SIA of CE 75/2017 (CE)	HKHA latest parameters
		11. Multi-disciplinary Outreaching Support Team for the Elderly (MOSTE) 12. 100-p Long Stay Care Home (LSCH)

3.1.2 According to the updated development parameter as summarized in **Table 2.1**, the updated Average Dry Weather Flow (ADWF) are estimated and compared with those under CE 75/2017 (CE) in **Table 2.2a** and **Table 2.2b** for Phase 1 and Phase 2&3 respectively.

Table 2.2a – Comparison of Estimated Sewage Flow for Phase 1

Proposed Phase 1 Development	Estimation under CE 75/2017 (CE)		Estimation under SIA Review	
Residential (SSF)				
Flat No.	3,080	nos	3,080	nos
Size of household/flat	2.8	persons	2.8	persons
Per Capita Flow	0.19	m^3/day	0.19	m^3/day
Total Population	8,624	persons	8,624	persons
Estimated Dry Weather Flow	1,638.6	m^3/day	1,638.6	m^3/day
Welfare				
Non Domestic GFA	1,191	m^2	1,329	m^2
Area (m^2)/employee	30	m^2	30	m^2
Per Employee Flow	0.28	m^3/day	0.28	m^3/day
Employee Population	40	persons	44	persons
Estimated Dry Weather Flow	11.1	m^3/day	12.4	m^3/day
Food and Beverage				
Area of restaurant	844	m^2	608	m^2
Area (m^2)/employee	30	m^2	30	m^2
Per Employee Flow	1.58	m^3/day	1.58	m^3/day
Employee Population	28	persons	20	persons
Estimated Dry Weather Flow	44.5	m^3/day	32.0	m^3/day
Bakery				
Non Domestic GFA	133	m^2	96	m^2
Area (m^2)/employee	60	m^2	60	m^2
Per Employee Flow	1.58	m^3/day	1.58	m^3/day
Employee Population	2	persons	2	persons
Estimated Dry Weather Flow	3.5	m^3/day	2.5	m^3/day
Retail				
Non Domestic GFA	845	m^2	608	m^2
Area (m^2)/employee	40	m^2	40	m^2
Per Employee Flow	0.28	m^3/day	0.28	m^3/day
Employee Population	21	persons	15	persons
Estimated Dry Weather Flow	5.9	m^3/day	4.3	m^3/day

Proposed Phase 1 Development	Estimation under CE 75/2017 (CE)		Estimation under SIA Review	
Laundry				
Non Domestic GFA	67	m^2	48	m^2
Area (m^2)/employee	20	m^2	20	m^2
Per Employee Flow	2	m^3/day	2	m^3/day
Employee Population	3	persons	2	persons
Estimated Dry Weather Flow	6.7	m^3/day	4.8	m^3/day
Office				
Non Domestic GFA	238	m^2	238	m^2
Area (m^2)/employee	20	m^2	20	m^2
Per Employee Flow	0.08	m^3/day	0.08	m^3/day
Employee Population	12	persons	12	persons
Estimated Dry Weather Flow	1.0	m^3/day	1.0	m^3/day
Kindergarten				
No of Classroom	6	nos	6	nos
Student/classroom	30	nos	30	nos
No of Student	180	persons	180	persons
No of Employee	22	persons	22	persons
Per Student Flow	0.04	m^3/day/student	0.04	m^3/day/student
Per Employee Flow	0.28	m^3/day/employee	0.28	m^3/day/employee
Estimated Dry Weather Flow	13.4	m^3/day	13.4	m^3/day
Total ADWF	**1,724.6**	**m^3/day**	**1,708.9**	**m^3/day**

Table 2.2b – Comparison of Estimated Sewage Flow for Phase 2 & 3

Proposed Phase 2&3 Development	Estimation under CE 75/2017 (CE)		Estimation under SIA Review	
Residential (PRH)				
Flat No.	8,860	no	8,860	no
Size of household/flat	2.8	persons	2.8	persons
Per Capita Flow	0.19	m^3/day	0.19	m^3/day
Total Population	24,808	persons	24,808	persons
Estimated Dry Weather Flow	4,713.5	m^3/day	4,713.5	m^3/day
Welfare				
Non Domestic GFA	9,316	m^2	17,256	m^2
Area (m^2)/employee	30	m^2	30	m^2
Per Employee Flow	0.28	m^3/day	0.28	m^3/day
Employee Population	311	persons	575	persons
Estimated Dry Weather Flow	86.9	m^3/day	161.1	m^3/day
Food and Beverage				
Area of restaurant	2,951	m^2	2,446	m^2
Area (m^2)/employee	30	m^2	30	m^2

Proposed Phase 2&3 Development	Estimation under CE 75/2017 (CE)		Estimation under SIA Review	
Per Employee Flow	1.58	m^3/day	1.58	m^3/day
Employee Population	98	persons	82	persons
Estimated Dry Weather Flow	155.4	m^3/day	128.8	m^3/day
Bakery				
Non Domestic GFA	131	m^2	109	m^2
Area (m^2)/employee	60	m^2	60	m^2
Per Employee Flow	1.58	m^3/day	1.58	m^3/day
Employee Population	2	persons	2	persons
Estimated Dry Weather Flow	3.4	m^3/day	2.9	m^3/day
Wet Market				
Non Domestic GFA	1,625	m^2	1,347	m^2
Area (m^2)/employee	30	m^2	30	m^2
Per Employee Flow	0.28	m^3/day	0.28	m^3/day
Employee Population	54	persons	45	persons
Estimated Dry Weather Flow	15.2	m^3/day	12.6	m^3/day
Retail				
Non Domestic GFA	3,327	m^2	2,758	m^2
Area (m^2)/employee	40	m^2	40	m^2
Per Employee Flow	0.28	m^3/day	0.28	m^3/day
Employee Population	83	persons	69	persons
Estimated Dry Weather Flow	23.3	m^3/day	19.3	m^3/day
Clinic				
Non Domestic GFA	197	m^2	163	m^2
Area (m^2)/employee	60	m^2	60	m^2
Per Employee Flow	0.28	m^3/day	0.28	m^3/day
Employee Population	3	persons	3	persons
Estimated Dry Weather Flow	0.9	m^3/day	0.8	m^3/day
Salon				
Non Domestic GFA	263	m^2	218	m^2
Area (m^2)/employee	20	m^2	20	m^2
Per Employee Flow	0.28	m^3/day	0.28	m^3/day
Employee Population	13	persons	11	persons
Estimated Dry Weather Flow	3.7	m^3/day	3.1	m^3/day
Education				
Non Domestic GFA	295	m^2	245	m^2
Area (m^2)/employee	20	m^2	20	m^2
Per Employee Flow	0.12	m^3/day	0.12	m^3/day
Employee Population	15	persons	12	persons
Estimated Dry Weather Flow	1.8	m^3/day	1.5	m^3/day
Laundry				

Proposed Phase 2&3 Development	Estimation under CE 75/2017 (CE)		Estimation under SIA Review	
Non Domestic GFA	82	m^2	68	m^2
Area (m^2)/employee	20	m^2	20	m^2
Per Employee Flow	2	m^3/day	2	m^3/day
Employee Population	4	persons	3	persons
Estimated Dry Weather Flow	8.2	m^3/day	6.8	m^3/day
Office				
Non Domestic GFA	238	m^2	1444	m^2
Area (m^2)/employee	20	m^2	20	m^2
Per Employee Flow	0.08	m^3/day	0.08	m^3/day
Employee Population	12	persons	72	persons
Estimated Dry Weather Flow	1.0	m^3/day	5.8	m^3/day
Kindergarten				
No of Classroom	15	nos	15	nos
Student/classroom	30	nos	30	nos
No of Student	450	persons	450	persons
No of Employee	50	persons	50	persons
Per Student Flow	0.04	m^3/day/student	0.04	m^3/day/student
Per Employee Flow	0.28	m^3/day/employee	0.28	m^3/day/employee
Estimated Dry Weather Flow	32.0	m^3/day	32.0	m^3/day
PTI				
Per Employee Flow	0.18	m^3/day	0.18	m^3/day
Employee Population	14	persons	14	persons
Estimated Dry Weather Flow	2.5	m^3/day	2.5	m^3/day
Total ADWF	**5,047.8**	**m^3/day**	**5,090.5**	**m^3/day**

3.1.3 According to **Table 2.2a**, the AWDF has been changed from 1,724.6 to 1,708.9 m^3/day for Phase 1, with a decrease in ADWF of 15.7 m^3/day.

3.1.4 According to **Table 2.2b**, the AWDF has been changed from 5,047.8 to 5,090.5 m^3/day for Phase 2 & 3, with an increase in ADWF of 42.7 m^3/day.

3.1.5 The total ADWF of Phase 1, 2 & 3 is 6772.4 m^3/day under CE 75/2017 (CE) and 6799.4 m^3/day under this SIA review. There is therefore a slight increase of ADWF 27 m^3/day due to the change of development parameters, which constitutes around 0.4% additional total ADWF of Phase 1, 2 & 3 than determined under CE 75/2017 (CE). The impact due to the change of development parameters is therefore considered negligible.

3.1.6 The hydraulic assessment for the proposed and existing sewers under the revised ADWF is shown in **Appendix A**. No adverse impact is found.

4. Summary

4.1.1 The increase of ADWF due to the change of development parameters is 27 m^3/day, which is around 0.4% additional total ADWF of Phase 1, 2 & 3 than determined under CE 75/2017 (CE). The impact is therefore considered negligible.

Appendix A

Technical Notes for Review of Sewerage Impact Assessment

Calculation of Proposed Sewer Capacity

	Phase 1	Phase 2&3	Total	Unit
Total Estimated ADWF	1709	5090	6799	m3/d
Contributing Population	6329	18854	25183	-
Peaking Factor	5	4	4	-
Total Estimated Peak Flow	98.9	235.7	314.8	L/s

Colebrook White equation to calculate propsoed sewer capacity

For foul sewer:

u = 1.00E-06

ks = 0.15 (clay ks poor condition adopted for assessment)

	Flow	Unit	Contributing Population	Peaking Factor
Total Peak Flow from Long Bin Phase 1 (To FTMH 1)=	98.9	L/s	6329	5
Total Peak Flow from Long Bin Phase 2&3 (To FTMH 2)=	147.3	L/s	9427	5
Total Peak Flow from Long Bin Phase 2&3 (To FTMH 2A)=	147.3	L/s	9427	5
Total Peak Flow from School (To FTMH 3)=	5.27	L/s	211	8
Total Peak Flow from PTI (To FTMH 4)=	0.23	L/s	9	8
Total Peak Flow from Long Bin Phase 2&3 (From FTMH 2A) + Long Bin Phase 2&3 (From FTMH2)=	235.7	L/s	18854	4
Total Peak Flow from Villa Sunshine, Fiori & Hong Ping Villa=	11.1	L/s	446	8
Total Peak Flow from Villa Sunshine, Fiori & Hong Ping Villa + Long Bin Phase 2&3=	241.3	L/s	19301	4
Total Peak Flow from Villa Sunshine, Fiori & Hong Ping Villa + Long Bin Phase (2&3) + Long Bin Phase 1=	320.4	L/s	25630	4

Sewer Dia. (mm)	US DSD MH Ref.	DS DSD MH Ref.	Length (m)	USGL (mPD)	DSGL (mPD)	US IL (mPD)	DS IL (mPD)	Gradient (1 in)	Pipe Area (m2)	Perimeter (m)	R =A/P	32gRS	Velocity at full bore (m/sec)	Sewer Capacity (l/sec)	Peak Sewage Flow	% Peak Flow to Sewer	US MH Type	Remarks
Terminal Manhole																		
375	FTMH1	FMH2.13	8.4	7	7.8	**2.06**	2.02	200	0.1104	1.1775	0.09	0.38	1.47	162.81	98.90	60.7%	TM	Terminal manhole designed by others
450	FTMH2	FMH2.1	6	5.5	6	**0.65**	0.61	164	0.159	1.413	0.11	0.46	1.83	291.16	147.29	50.6%	TM	Terminal manhole designed by others
450	FTMH2A	FMH5.1	2.8	6.5	6.5	**1.96**	1.95	200	0.159	1.413	0.11	0.42	1.65	262.73	147.29	56.1%	TM	Terminal manhole designed by others
225	FTMH3	FMH3.1	12.4	11	11.5	**7.87**	7.81	200	0.0397	0.7065	0.06	0.3	1.07	42.43	5.27	12.4%	TM	Terminal manhole designed by others
225	FMH3.1	FMH3.2	51.8	11.5	9.3	7.81	7.55	200	0.0397	0.7065	0.06	0.3	1.07	42.43	5.27	12.4%	F1	-
225	FMH3.2	FMH1008847	19.2	9.3	7.7	6.95	6.85	200	0.0397	0.7065	0.06	0.3	1.07	42.43	5.27	12.4%	E1	Partial concrete surround is required
225	FTMH4	FMH5.7	4.7	6	6	**4.58**	4.55	200	0.0397	0.7065	0.06	0.3	1.07	42.43	0.23	0.5%	TM	Terminal manhole designed by others
Gravity Sewer to Proposed SPS																		
450	FMH5.1	FMH5.2	22.8	6.5	6.4	1.95	1.83	200	0.159	1.413	0.11	0.42	1.65	262.73	147.29	56.1%	L	-
450	FMH5.2	FMH5.3	23.5	6.4	6.2	1.83	1.71	200	0.159	1.413	0.11	0.42	1.65	262.73	147.29	56.1%	L	-
450	FMH5.3	FMH5.4	26.4	6.2	6.4	1.71	1.58	200	0.159	1.413	0.11	0.42	1.65	262.73	147.29	56.1%	L	-
450	FMH5.4	FMH5.5	57.7	6.4	6.3	1.58	1.29	200	0.159	1.413	0.11	0.42	1.65	262.73	147.29	56.1%	L	-
450	FMH5.5	FMH5.6	20.6	6.3	6.1	1.29	1.19	200	0.159	1.413	0.11	0.42	1.65	262.73	147.29	56.1%	L	-
450	FMH5.6	FMH5.7	60	6.1	6	1.19	0.89	200	0.159	1.413	0.11	0.42	1.65	262.73	147.29	56.1%	L	-
450	FMH5.7	FMH5.8	16.9	6	6	0.89	0.81	200	0.159	1.413	0.11	0.42	1.65	262.73	147.29	56.1%	L	-
450	FMH5.8	FMH5.9	14.9	6	6	0.81	0.73	200	0.159	1.413	0.11	0.42	1.65	262.73	147.29	56.1%	L	-
450	FMH5.9	FMH2.1	23.8	6	5.5	0.73	0.61	200	0.159	1.413	0.11	0.42	1.65	262.73	147.29	56.1%	L	-
525	FMH2.1	FMH2.2	59.1	5.5	5.4	0.61	0.35	224	0.2164	1.6485	0.13	0.43	1.72	371.75	235.67	63.4%	L	-
525	FMH2.2	FMH2.3	39.2	5.4	5.3	0.35	0.17	224	0.2164	1.6485	0.13	0.43	1.72	371.75	235.67	63.4%	L	-
525	FMH2.3	FMH2.4	16.4	5.3	5.2	0.17	0.1	224	0.2164	1.6485	0.13	0.43	1.72	371.75	235.67	63.4%	L	Drainage Connection across at IL = 2.31mPD
525	FMH2.4	FMH2.5	14.6	5.2	5.2	0.1	0.03	224	0.2164	1.6485	0.13	0.43	1.72	371.75	235.67	63.4%	L	-
525	FMH2.5	FMH2.6	33.3	5.2	5.3	0.03	-0.11	224	0.2164	1.6485	0.13	0.43	1.72	371.75	235.67	63.4%	L	-
525	FMH2.6	FMH2.7	31.8	5.3	5.5	-0.11	-0.26	224	0.2164	1.6485	0.13	0.43	1.72	371.75	235.67	63.4%	L	-
525	FMH2.7	FMH2.8	15	5.5	5.7	-0.26	-0.32	224	0.2164	1.6485	0.13	0.43	1.72	371.75	235.67	63.4%	L	-
525	FMH2.8	FMH2.9	47.9	5.7	5.8	-0.32	-0.54	224	0.2164	1.6485	0.13	0.43	1.72	371.75	235.67	63.4%	L	-
525	FMH2.9	FMH2.10	30	5.8	6	-0.54	-0.67	224	0.2164	1.6485	0.13	0.43	1.72	371.75	235.67	63.4%	L (Special Design)	-
525	FMH2.10	FMH2.11	34.7	6	7	-0.67	-0.83	224	0.2164	1.6485	0.13	0.43	1.72	371.75	235.67	63.4%	L (Special Design)	-
525	FMH2.11	FMH2.12	3.3	7	7	-0.83	-0.84	224	0.2164	1.6485	0.13	0.43	1.72	371.75	235.67	63.4%	L (Special Design)	-
525	FMH2.12	FMH2.13	19.9	7	7	-0.84	-0.93	224	0.2164	1.6485	0.13	0.43	1.72	371.75	241.26	64.9%	L (Special Design)	-
600	FMH2.13	FMH2.14	7.8	7	7	-0.93	-0.97	224	0.2826	1.884	0.15	0.46	1.87	527.42	320.37	60.7%	L (Special Design)	
600	FMH2.14	Proposed SPS	3.2	7	7	-0.97	-0.98	224	0.2826	1.884	0.15	0.46	1.87	527.42	320.37	60.7%	L (Special Design)	
Gravity Sewer along Castle Peak Road - Ping Shan																		
600	FMH4.1	FMH4.2	18.75	12.1	13	10.27	10.18	200	0.2826	1.884	0.15	0.49	1.98	558.31	295.14	52.9%	-	Pressure Break Chamber
600	FMH4.2	FMH4.3	38.2	13	13	10.18	9.99	200	0.2826	1.884	0.15	0.49	1.98	558.31	295.14	52.9%	E1	-
600	FMH4.3	FMH4.4	49.6	13	13.2	9.99	9.74	200	0.2826	1.884	0.15	0.49	1.98	558.31	295.14	52.9%	F1	-
600	FMH4.4	FMH4.5	57.3	13.2	13.8	9.74	9.45	200	0.2826	1.884	0.15	0.49	1.98	558.31	295.14	52.9%	F1	-
600	FMH4.5	FMH4.6	35.5	13.8	13.8	9.45	9.27	200	0.2826	1.884	0.15	0.49	1.98	558.31	295.14	52.9%	L	-
600	FMH4.6	FMH4.7	45.5	13.8	14	9.27	9.05	200	0.2826	1.884	0.15	0.49	1.98	558.31	295.14	52.9%	L	-
600	FMH4.7	Ex FMH1022490	29.4	14	14	9.05	8.9	200	0.2826	1.884	0.15	0.49	1.98	558.31	295.14	52.9%	L	-