

Sewage Flow Estimates from Area A

Lok Ma Chau Loop

Date: 1/5/2012

Area No.	Domestic		Commercial and Institutional					Type of Facilities	Unit Flow of Facilities (m³/d)	Total AWF (m³/d)
	Students Residences 0.19	Total	Higher Education 0.28	High-tech R & D / C&C Industries 0.28	Supporting Commercial 1.58	Government Uses 0.08	Non-resident Students 0.04			
A-1									0	
A-2									0	
A-3									0	
A-4									0	
A-5									0	
A-6									0	
A-7									0	
BCF						134			11	
C-1				1544					432	
C-2					1126				1779	
DCS-1						3	DCS Bleed Off	11	11	
DCS-2						3	DCS Bleed Off	11	11	
E-1	1110		113						243	
E-2	1395		6						267	
E-3			420			933			155	
E-4			587			1306			217	
E-5			960			2136			354	
E-6			513			1142			189	
E-7	2422		246						529	
E-8	2926		12						559	
E-9			467			1039			172	
E-10			717			1594			265	
E-11			1084			2411			400	
E-12			647			1439			239	
E-13	2307		223						501	
E-14	1840		5						351	
ESS-1									0	
ESS-2									0	
FSAD									0	
R&D-1				1527					428	
R&D-2				3245					909	
R&D-3				5050					1414	
R&D-4				3554					995	
R&D-5				2619					733	
R&D-6				2393					670	
R&D-7				1598					447	
R&D-8				564					158	
STW						10			1	
Sub-total									12439	
							Kitchen/Canteen	2250	2250	
Sub-total									2250	
Total pop.	12000	12000	6000	22094	1126	150	12000	41370		
Total flow	2280	2280	1680	6186	1779	12	480	10137	14689	

Total residential student population	=	=	12000	person
Total domestic AWF	=	=	2280	m³/d
Total higher education employment population	=	=	6000	person
Total high education AWF	=	=	1680	m³/d
Total high-tech R&D/C&C Industries Population	=	=	22094	person
Total high-tech R&D /C & C Industries AWF	=	=	6186	m³/d
Total supporting commercial facilities	=	=	1126	person
Total supporting commercial	=	=	1779	m³/d
Total Government use population	=	=	150	person
Total Government use AWF	=	=	12	m³/d
Non-resident Student population	=	=	12000	person
Total Government use AWF	=	=	480	m³/d
Sewage flow from Kitchen	=	=	2250	m³/d
Total population	=	=	53370	person
Total AWF	=	=	14689	m³/d

NOTES:

- (1) UFF for student residences includes sewage flow generated while residing and working
- (2) total UFF for commercial activities assuming to hotel category (trade J10 of Table T2 of GESF) as a worst case = UFF of employee + UFF of hotel activity = 0.08 + 1.50 where 1.50 is for restaurant and hotel average UFF
- (3) total UFF for commercial employee = UFF of employee + UFF of commercial activity = 0.08 + 0.2 where 0.2 is for general-territorial average UFF
- (4) Assume DCS bleed twice a day with maximum 15 l/s for 15 minutes.

Design of Gravity Sewers for LMC Loop

Design Criteria:

1. Unit flow factors based on EPD's Guidelines for Estimating Sewage Flows (GESF)

2. a) Peaking factor for sewers =	8.0	for population	0	1000
	6.0	for population	1000	5000
	5.0	for population	5000	10000
	4.0	for population	10000	50000
	Max (7.3/N ^{0.15} , 2.4)	for population	50000	where N is contributing population in thousand, N = total AWF/0.27
b) Peaking factor for SPSs and rising mains =	4.0	for population	0	10000
	3.5	for population	10000	25000
	3.0	for population	25000	50000
	Max (3.9/N ^{0.065} , 2.4)	for population	50000	where N is contributing population in thousand, N = total AWF/0.27

(In reference to Table T-5, EPD's Guidelines for Estimating Sewage Flows)

3. Pipe hydraulics is based on Colebrook-White Equation with ks = 1.5mm and v = 0.000001m²/s.

(In reference to Table 5, DSD's Sewerage Manual Part 1)

ks = 1.50 v = 0.000001

Sewer Ref.	Average Flow and Peak Flow						Sewer Size and Capacity								Manholes Arrangement						Velocity Check		
	Contributing Zones	Section AWF m ³ /d	Total AWF m ³ /d	Contributing Population	Peaking Factor	Peak Flow l/s	Length m	Dia mm	R=A/P m	Gradient 1 in	(32gRS) ^{0.5}	Full Flow Velocity m/s	Capacity l/s	% Full Flow	USMH	DSMH	USGL	DSGL	USIL	DSIL		US Cover (m)	DS Cover (m)
FMH_LMCL_01001.1	R&D/C&C-1	427.56	1353.19	5011.83	5.00	78.31	193.00	450.00	0.11	300.00	0.34	1.04	165.34	0.47	FMH_LMCL_01001	FMH_LMCL_01002	5.78	5.77	4.26	3.62	1.01	1.64	OK
	R&D/C&C-2	454.30													FMH_LMCL_01001	FMH_LMCL_01002							
	R&D/C&C-3	471.33													FMH_LMCL_01001	FMH_LMCL_01002							
FMH_LMCL_01102.1	DCS-1	11.00	482.33	1786.42	6.00	33.50	156.00	300.00	0.08	175.00	0.37	1.05	74.02	0.45	FMH_LMCL_01102	FMH_LMCL_01202	5.77	5.77	4.40	3.51	1.01	1.90	OK
	E-1	242.54													FMH_LMCL_01102	FMH_LMCL_01202							
FMH_LMCL_01202.1	E-2	266.73	991.60	3672.60	6.00	68.86	145.00	300.00	0.08	175.00	0.37	1.05	74.02	0.93	FMH_LMCL_01202	FMH_LMCL_01002	5.77	5.77	3.51	2.68	1.90	2.73	OK
	FMH_LMCL_01001.1	1353.19													FMH_LMCL_01202.1	991.60							
FMH_LMCL_01002.1	Kitchen	750.00	4020.43	14890.48	4.00	186.13	170.00	600.00	0.15	450.00	0.32	1.02	288.47	0.65	FMH_LMCL_01002	FMH_LMCL_01003	5.77	5.79	2.68	2.30	2.43	2.83	OK
	R&D/C&C-2	454.30													FMH_LMCL_01002	FMH_LMCL_01003							
	R&D/C&C-3	471.33													FMH_LMCL_01002	FMH_LMCL_01003							
FMH_LMCL_01003.1	E-4	108.30	4305.85	15947.59	4.00	199.34	154.00	750.00	0.19	600.00	0.31	1.02	449.75	0.44	FMH_LMCL_01003	FMH_LMCL_01004	5.79	5.80	2.30	2.05	2.68	2.94	OK
	E-5	177.12													FMH_LMCL_01003	FMH_LMCL_01004							
	E-6	189.32													FMH_LMCL_01003	FMH_LMCL_01004							
FMH_LMCL_01104.1	E-5	177.12	2204.80	8165.93	5.00	127.59	220.00	375.00	0.09	150.00	0.44	1.31	144.52	0.88	FMH_LMCL_01104	FMH_LMCL_01004	5.79	5.80	4.30	2.83	1.05	2.53	OK
	Kitchen	750.00													FMH_LMCL_01104	FMH_LMCL_01004							
	E-8	559.30													FMH_LMCL_01104	FMH_LMCL_01004							
FMH_LMCL_02104.1	E-3	154.92	263.22	974.89	8.00	24.37	98.00	225.00	0.06	100.00	0.42	1.15	45.64	0.53	FMH_LMCL_02104	FMH_LMCL_01004	5.71	5.80	4.25	3.27	1.17	2.24	OK
	E-4	108.30													FMH_LMCL_02104	FMH_LMCL_01004							
FMH_LMCL_01004.1	FMH_LMCL_02104.1	263.22	7523.87	27866.19	4.00	348.33	115.00	750.00	0.19	600.00	0.31	1.02	449.75	0.77	FMH_LMCL_01004	FMH_LMCL_01005	5.80	5.80	2.05	1.85	2.94	3.13	OK
	FMH_LMCL_01003.1	4305.85													FMH_LMCL_01004	FMH_LMCL_01005							
	FMH_LMCL_01104.1	2204.80													FMH_LMCL_01004	FMH_LMCL_01005							
FMH_LMCL_01105.1	Kitchen	750.00	1090.49	4038.85	6.00	75.73	116.00	375.00	0.09	150.00	0.44	1.31	144.52	0.52	FMH_LMCL_01105	FMH_LMCL_01005	5.80	5.80	4.35	3.58	1.01	1.79	OK
	E-13	500.77													FMH_LMCL_01105	FMH_LMCL_01005							
	E-14	351.00													FMH_LMCL_01105	FMH_LMCL_01005							
FMH_LMCL_02105.1	E-9	172.32	436.84	1617.93	6.00	30.34	255.00	225.00	0.06	100.00	0.42	1.15	45.64	0.66	FMH_LMCL_02105	FMH_LMCL_01005	5.79	5.80	4.48	1.93	1.02	3.58	OK
	E-10	264.52													FMH_LMCL_02105	FMH_LMCL_01005							
	FMH_LMCL_01105.1	1090.49													FMH_LMCL_02105	FMH_LMCL_01005							
FMH_LMCL_01005.1	FMH_LMCL_01004.1	7523.87	9014.32	33386.37	4.00	417.33	230.00	900.00	0.23	600.00	0.34	1.14	727.06	0.57	FMH_LMCL_01005	FMH_LMCL_01006	5.80	5.83	1.85	1.47	2.98	3.40	OK
	E-11	399.96													FMH_LMCL_01005	FMH_LMCL_01006							
	FMH_LMCL_01006.1	9014.32													FMH_LMCL_01005	FMH_LMCL_01006							
FMH_LMCL_01107.1	R&D/C&C-4	995.12	1438.16	5326.52	5.00	83.23	137.00	375.00	0.09	200.00	0.38	1.13	125.08	0.67	FMH_LMCL_01107	FMH_LMCL_01007	5.84	5.83	4.38	3.70	1.02	1.70	OK
	BCF	10.72													FMH_LMCL_01107	FMH_LMCL_01007							
	C-1	432.32													FMH_LMCL_01107	FMH_LMCL_01007							
FMH_LMCL_01007.1	C-2	1779.08	12964.88	48018.07	4.00	600.23	148.00	900.00	0.23	500.00	0.38	1.25	796.77	0.75	FMH_LMCL_01007	FMH_LMCL_01008	5.83	5.82	1.27	0.97	3.60	3.88	OK
	FMH_LMCL_01107.1	1438.16													FMH_LMCL_01007	FMH_LMCL_01008							
	FMH_LMCL_01006.1	9014.32													FMH_LMCL_01007	FMH_LMCL_01008							
FMH_LMCL_01008.1	FSAD	0.00	13645.92	50540.44	4.05	640.13	130.00	900.00	0.23	500.00	0.38	1.25	796.77	0.80	FMH_LMCL_01008	FMH_LMCL_01009	5.82	5.80	0.97	0.71	3.88	4.12	OK
	DCS-2	11.00													FMH_LMCL_01008	FMH_LMCL_01009							
	R&D/C&C-6	670.04													FMH_LMCL_01008	FMH_LMCL_01009							
FMH_LMCL_01109.1	R&D/C&C-8	157.92	157.92	584.89	8.00	14.62	97.00	225.00	0.06	100.00	0.42	1.15	45.64	0.32	FMH_LMCL_01109	FMH_LMCL_01209	5.78	5.80	3.70	2.73	1.79	2.78	OK
FMH_LMCL_01209.1	R&D/C&C-7	447.44	605.36	2242.07	6.00	42.04	128.00	300.00	0.08	150.00	0.40	1.13	79.98	0.53	FMH_LMCL_01209	FMH_LMCL_01009	5.80	5.80	2.73	1.88	2.71	3.56	OK