7465 WATER SUPPLY AND DRAINAGE NETWORKS PROCESSES 2

CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

Technical and Vocational Education Examinations

JUNE XXXX **ADVANCED LEVEL**

Specialty Name (Specialty Code)	**PLUMBING HYDRAULICS AND SANITARY INSTALLATION**
Subject Title	**WATER SUPPLY AND DRAIANGE NETWORKS PROCESSES**
Paper No.	**2**
Subject Code No.	**7465**

Three Hours

INSTRUCTIONS TO CANDIDATES

1. ***You are reminded of the necessity for good English and orderly presentation in your answers.***
2. ***You are advised to read carefully through the question paper, before you begin your answers.***
3. ***This question paper has four sections which are independent. Each section carries equal marks and you are requested to treat three (03) of the four (04) sections.***
4. ***Sections 2 (Drainage) and section 3 (Cold and hot water distribution) are compulsory, while you are requested to choose one section either from section 1(Water supply) or section 4 (sewage and sewerage)***
5. ***Leave all answers at two decimals places***
6. ***Take g=10m/s^2***
7. ***This question paper has 04 appendixes, appendixes 01,02,03and 04 are design chart.***
8. ***Leave all answers in to two decimal places.***

SECTION I –WATER SUPPLY AND HYDRAULICS

1.1 Name two sources of fresh water. **(2x0.50=1marks)**

1.2 Define potabilisation. **(2 marks)**

1.3 Complete the table 1, by classifying the treatment given in the list below techniques by completing under the different treatment phases of potable water:

- Treatment phases; Pre-treatment, Physico-chemical, softening, bacteriological,
- Treatment techniques; reduction of hardness, coagulation, mechanical straining, flocculation, filtration on rapid sand filters, precipitation of solid matters in suspension, sedimentation, PH-treatment, oxidation(bleaching), chlorination.

Treatment techniques	Treatment techniques
Pre-treatment	
Physico-Chemical	
Bacteriological	
Softening	

(10x0.50=5marks)

1.4 A water supply scheme is to be constructed in a school by MTN foundation as part of it civil social responsibility. The school is entire a boarding school, with a student population of 2000 students and having teaching /administrative staff strength of 100. The daily consumption per student is 100 l/s and that of the teaching staff 50 l/s. 10% of the daily peak demand will be added for cleaning service and green spaces. The scheme will be constructed from an industrial bore hole. Water will be pump from the bored hole to a semi-buried concrete storage tank, constructed on the hill overlooking the school. Water will flow tank by gravity due to the water head to the different draw off points and services.

a) Define a bored hole. **(2 marks)**

b) Calculate the minimum water demand of the school in l/s. **(6marks)**

c) Find the diameter of the delivery line from the bored hole to the tank, if the authorized flow speed is 1.5 m/s. If the line has to be constructed in PE pipe. The available PE in the market are: PE 40, PE 50, PE 63. **(5 marks)**

d) If the tank should have a storing capacity of 10%, find the storage capacity of the tank. **(2 marks)**

e) If the tank is circular and useful height of water in the tank is 3m. Find the internal diameter of the tank. **(2 marks)**

(25 marks)

SECTION II- DRAINAGE NETWORKS

2.1 With the aid of an illustrative sketch explain the creation of hydraulic pistons in drainage networks. **(3 marks)**

2.2 Name two elements pressure created by hydraulic pistons in drainage networks. **(2x1=2 marks)**

2.3 Give the main consequence of the creation of hydraulic pistons in drainage networks. **(2 marks)**

2.4 ***Drainage network design:***

The fig. 1 is the single diagram drainage network of an apartment building GF +8, the drainage stack evacuate domestic waste water from a plumbing cell made up of; two bathroom place back to back. The hydraulic load of the branch drain evacuating the plumbing fixtures installed in each bathroom is 15 d.u. The branch drains are connected to the stack. The entire building is evacuated by two stacks, which is connected to the building drain. In order to facilitate the pattern of flow in the drainage network, vent stacks are installed nearer the drain stack.

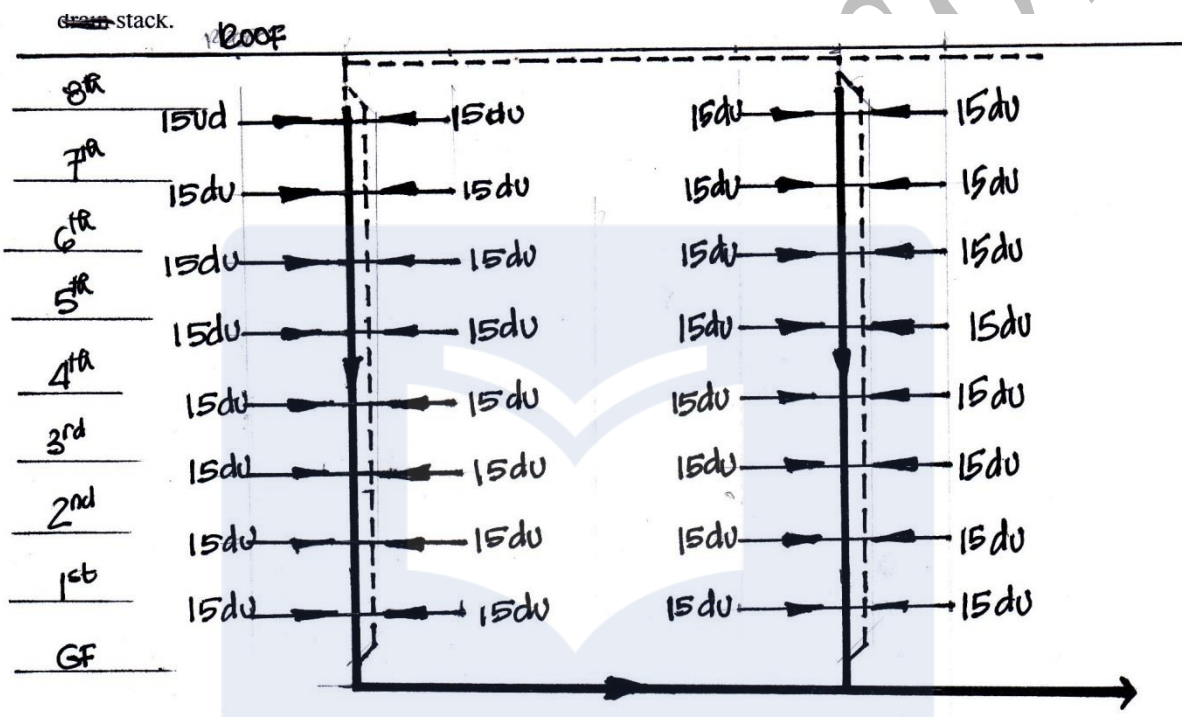


Figure 1

Work Requre;

a) Explain the purpose of placing plumbing fixtures back to back. **(3 marks)**
b) Calculate the hydraulic load of a stack. **(5 marks)**
c) Deduce its diameter, if the branch interval is 8. **(2 marks)**
d) Calculate the total hydraulic load of the building. **(4 marks)**
e) Design the building drain **AB**, if the slope is 1/200. **(2 marks)**
f) Find the diameter of vent stack, if its developed length is 24 m. **(2 marks)**

(25 marks)

SECTION III COLD AND HOT WATER DISTRIBUTION NETWORK

3.1 With the aid of illustrative sketches differentiate between a direct and an indirect supply distribution network. **(2 marks)**

3.2 In an agglomeration the water is ration, choose the type of supply network that will be most appropriate and justify your choice. **(1 mark)**

3.3 Name one device or mechanism to be use in solving the following network problems:

- Water hammer,
- Cross connection,
- Pressure build up in the water heater and heating system
- High pressure supplied to the installation. **(4x0.50=2 marks)**

3.4 Cold and hot water distribution network design

The fig. 2, is an illustration of the cold water distribution network of a building GF+3. The building's upper floors are supplied by 2 cold water risers. The floor supply pipe, supplies an apartment made up of the following plumbing spaces:

- 2 bathrooms,
- 1 visitor's restroom,
- 1 kitchen.

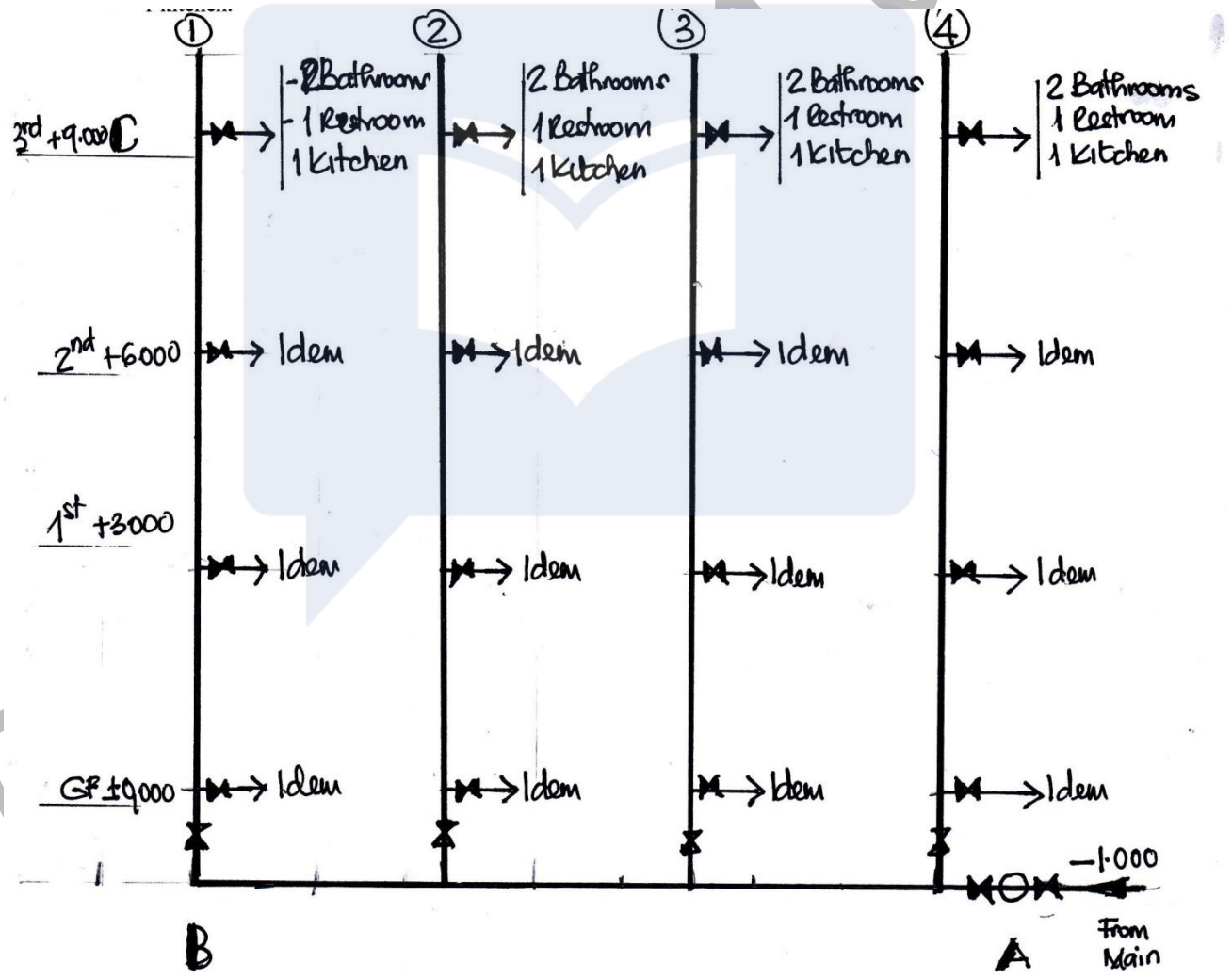


Figure 2. Cold water distribution network

The plumbing fixtures install in each apartment and their hydraulic characteristics are given in the table 1.

Plumbing Space	Fixture install	Number	Flow rate (l/s)
Bathroom	Water closet	1	0.12
	Bath tub	1	0.33
	Bidet	1	0.20
	Lavatory	1	0.20
Visitor's restroom	WC	1	0.12
	Wash hand basin	1	0.20
Kitchen	Kitchen sink	1	0.20

a) Calculate the gross flow rate of the plumbing fixtures installed in an apartment. **(4 marks)**

b) Deduce the probable flow rate that will satisfy the water demand of the building. **(8 marks)**

c) Determine the friction loss in the most critical circuit in m/m , if the following design parameters are given:

- Hydrostatic pressure in the main: 40 m
- Local loss in water meter: 5m
- The static height Z= 10 m
- The developed length of the critical circuit: ABC Ld=30 m

The residual pressure at the farthest faucet at point C: 10m **(4 marks)**

d) Find the diameter of the service pipe, to be applied from the service provider (CAMWATER Utilities). **(2 marks)**

e) The domestic hot water in each apartment is produced from an electric hot water. The hourly flow rate per plumbing fixture consuming hot water is given in the table 2.

Fixtures	Flow rate (l/h)
Bathtub	76
Bidet	8
Lavatory	8
Wash hand basin	8
Kitchen sink	38

Table 2

Find the capacity of the electric hot water heater to be installed in each apartment, if the demand factor is 0.30 and the storage factor 1.25. The capacity is given by the expression; $C(l) = \sum gross\ flow\ rate\ of\ fixtures x\ demand\ factor x storage\ factor$

NB: You are to select the heater from the following standard COR-EMAIL: 50l; 75l; 100l; 150l; 200l **(2 marks)**

(25 marks)

SECTION IV SEWEAGE AND SEWERAGE

4.1 Name four types of sewage and their source of origin that could be evacuated from an agglomeration. **(4x0.50x2 =4 marks)**

4.2 Describe briefly the digestion treatment process of domestic waste water in an activated sludge digester. **(6 mark)**

4.3 Describe briefly the digestion treatment process of domestic waste water in a septic installation. **(6 marks)**

4.3 The hydraulic load from a private residential area is 320 d.u, this volume has to be evacuated by a sewer in PVC drainage pipe. The sewer has a self-cleansing speed of 1m/s. using the design chart find:

a) The slope of the sewer. **(3 marks)**

b) The internal diameter of the sewer. **(3 marks)**

(25 marks)

APPENDIX 1 - DRAIN STACKS

Diamètre de la colonne (mm)	(po)	Nombre d'intervalles de branchements															
		3 ou moins		4		5		6		7		8		9		10	
		intervalle	colonne	intervalle	colonne	intervalle	colonne	intervalle	colonne	intervalle	colonne	intervalle	colonne	intervalle	colonne	intervalle	colonne
32	1¼	1	2														
38	1½	2	4														
51	2	4	9	3	13	3	16	3[b]	18[c]								
64	2½	8	18	7	27	6	32	6[b]	36[c]								
76	3[a]	16[a]	48[a]	15[a]	60[a]	14[a]	70[a]	13[a]	78[a]	12[ab]	84[ac]						
102	4	100	240	90	360	84	420	80	480	76[b]	530[c]						
127	5	225	540	205	820	190	950	180	1,080	175	1,215	170	1,360	155[b]	1,400[c]		
152	6	385	930	350	1,400	325	1,625	310	1,860	299	2,090	290	2,320	285	2,560	280	2,800
203	8	875	2,100	785	3,140	735	3,675	700	4,200	675	4,725	655	5,240	640	5,780	630	6,300
254	10	1,560	4,680	1,405	5,620	1,310	6,550	1,200	7,500	1,205	8,435	1,170	9,360	1,145	10,310	1,125	11,250
305	12	2,435	7,305	2,195	8,780	2,045	10,225	1,950	11,700	1,880	13,160	1,825	14,600	1,790	16,090	1,755	17,550
381	15	4,375	13,125	3,935	15,740	3,675	18,375	3,500	21,000	3,375	23,620	3,280	26,240	3,210	28,880	3,150	31,500

Diamètre de la colonne (mm)	(po)	Nombre d'intervalles de branchements															
		11		12		13		14		15		16		17		18	
		intervalle	colonne	intervalle	colonne	intervalle	colonne	intervalle	colonne	intervalle	colonne	intervalle	colonne	intervalle	colonne	intervalle	colonne
152	6	265[b]	2,900[c]														
203	8	620	6,830	610	7,350	585[b]	7,600[c]										
254	10	1,110	12,200	1,095	13,100	1,080	14,070	1,070[b]	15,000[c]								
305	12	1,730	19,020	1,705	20,500	1,690	21,960	1,670	23,410	1,655	24,800	1,680[b]	26,000[c]				
381	15	3,100	34,160	3,060	36,700	3,030	39,390	3,000	42,015	2,975	44,600	2,955	47,280	2,935	49,870	2,780[b]	50,000[c]

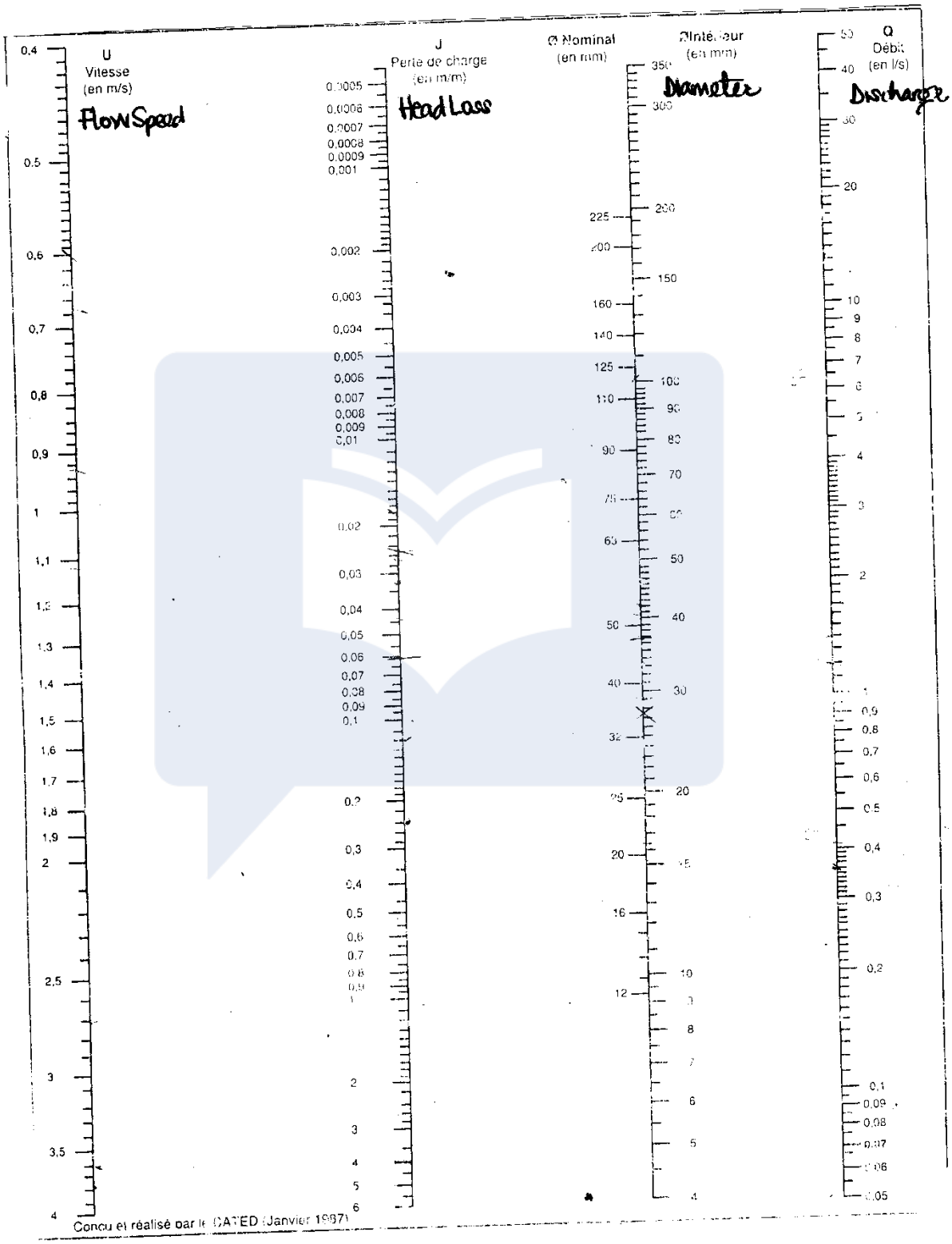
APPENDIX 2 - DRAINS

Diamètre du tuyau (mm)	(po)	Branchement d'appareils	Drain de bâtiments, égouts . . .											
			Pente 1/200			Pente 1/100			Pente 1/50			Pente 1/25		
		Unités	Unités	m²	L/s	Unités	m²	L/s	Unités	m²	L/s	Unités	m²	L/s
32	1¼	1												
38	1½	3							21			26		
51	2	6							24			31		
64	2½	12							27[a]	107	3	36[a]	152	4,3
76	3	20[a]				20[a]	76	2,1	216	246	6,9	250	350	9,8
102	4	160				180	174	4,9	480	440	12,3	575	620	17,5
127	5	360				390	310	8,7	840	700	19,8	1000	990	28
152	6	620				700	500	14	1920	1510	42	2300	2130	60
203	8	1400	1400	750	21,5	1600	1070	30	3500	2710	76	4200	3840	108
254	10	2500	2500	1360	39	2900	1920	54	5600	4360	123	6700	6180	174
305	12	3900	3900	2200	63	4600	3100	87	10000	7800	220	12000	11000	311
381	15	7000	7000	4000	114	8300	5500	155		9570	270			
406	16			4790	135		6900	195		12540	354			
457	18			6360	180		8780	248		17400	491			
508	20			8730	247		12550	355		19790	559			
533	21			9940	280		13900	394		27130	771			
610	24			13500	382		19000	538		38700	1093			
686	27			19400	548		27900	788		49000	1383			
762	30			24500	693		54370	971		81500	2296			
914	36			40700	1150		57100	1614						
Colonnes		A	B	C	D	B	C	D	B	C	D	B	C	D

APPENDIX 3 – VENTILLATION PIPES

Diamètre colonne chute ou renvoi (pouces)	Nombre d'unités raccordées	Longueur développée maximale (mètres)										
		Diamètre des évents (pouces)										
		1¼	1½	2	2½	3	4	5	6	8	10	12
1¼	2	9										
1½	8	15	45									
1½	10	9	30									
2	12	9	22	60								
2	20	5	15	45								
2½	42		9	30	90							
3	10		13	45	110	317						
3	21		10	37	82	247						
3	53		8	28	70	207						
3	84		7	26	64	190						
4	43			10	26	76	300					
4	140			8	20	66	230					
4	320			7	17	52	195					
4	530			6	15	45	177					
5	190				9	25	98	300				
5	490				6	19	76	230				
5	940				5	16	64	204				
5	1,400				5	15	58	180				
6	500					10	40	122	305			
6	1,100					8	30	95	240			
6	2,000					7	25	80	200			
6	2,900					6	24	73	182			
8	1,800						10	29	73	287		
8	3,400						7	22	58	220		
8	5,600						6	19	48	186		
8	7,600						5	17	42	170		
10	4,000							10	24	95	292	
10	7,200							7	18	73	225	
10	11,000							6	15	60	192	
10	15,000							5	14	55	174	
12	7,300								10	36	115	287
12	13,900								7	28	92	220
12	20,000								6	24	75	186
12	26,000								5	22	70	152
15	15,000									12	40	95
15	25,000									10	30	73
15	38,000									8	25	60
15	50,000									7	22	55

APPENDIX 4 – COLD WATER PIPES



APPENDIX 5

DESIGN OF SEWERS