

**CONSULTING CIVIL &
STRUCTURAL ENGINEERS**
The Barn, Keens Lodge, Worth Lane, Little Horsted, East Sussex, TN22 5TT
Tel: (01825) 750440

Project

PICKERAGE FARM

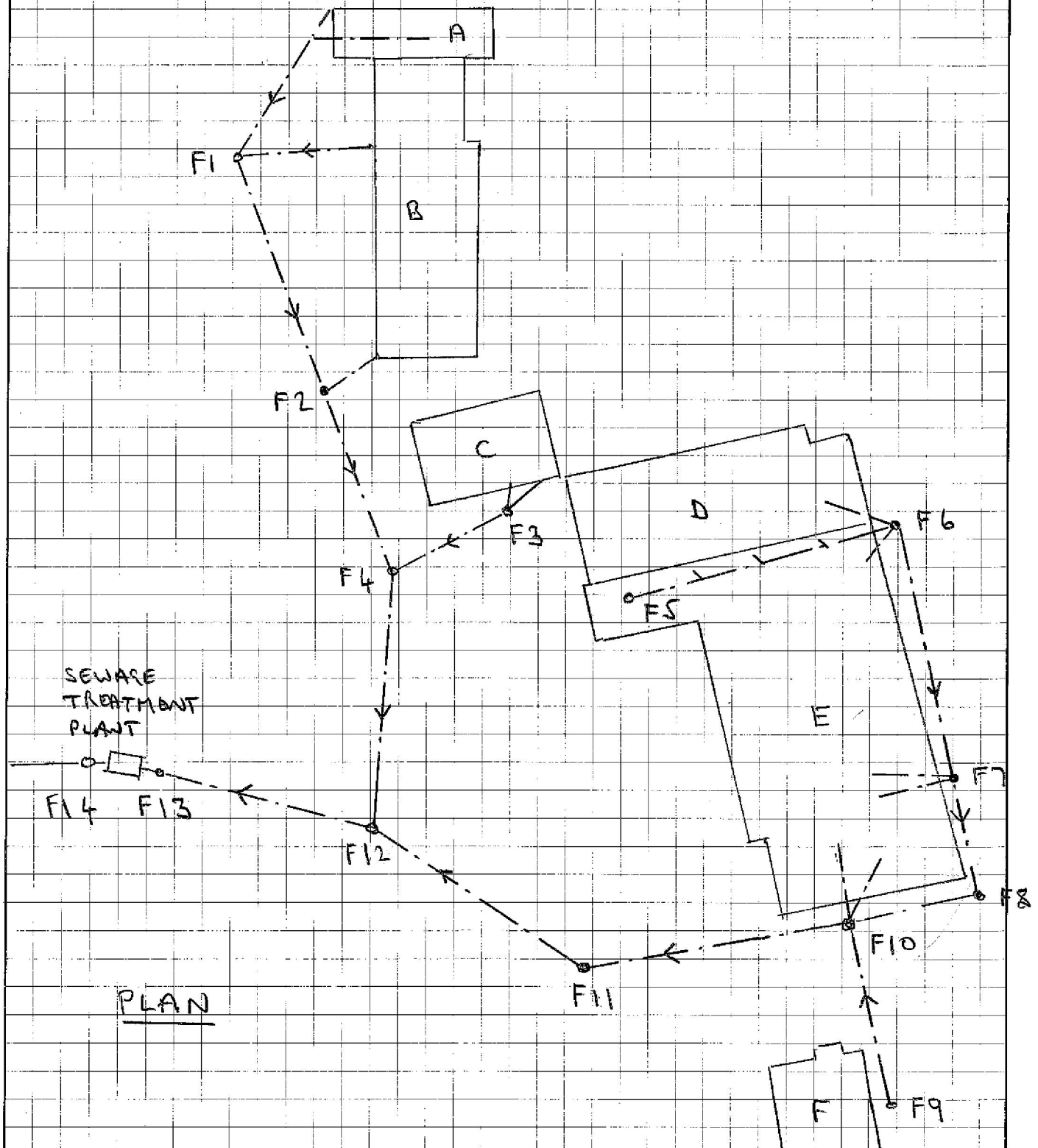
Project
No. 17007

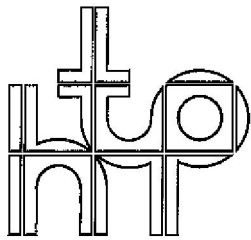
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9. FOUL WATER DRAINAGE





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PICKENASE FARM

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9.1 Design Parameters

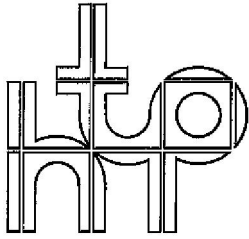
Design of F&W drainage to BS EN 752: 2008

Assume system type III

Frequency factor $K = 0.5$ residential
 0.7 frequent use

Appliances:	Wash basin	0.3	D.45
	Sink	1.3	D.45
	W.C	1.5	D.45
	Bath	1.3	D.45
	Wash machine	1.2	D.45
	Dishwasher	0.2	D.45
	Shower	0.4	D.45

$$Q = K (\sum DV)^{1/4}$$



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9.2. Buildings

(i) Building A

1 WC
1 wash basin

(ii) Building B

1 sink	}	Downstairs
1 wash machine		
1 WC		
1 wash basin		
3 WCs	}	Upstairs
3 wash basins		
2 baths		
2 showers		

(iii) Building C
(Garage)

1 WC
1 wash basin

(iv) Building D

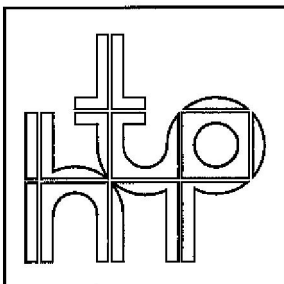
1 WC
1 wash basin

(v) Building E
(Post room)

6 WC
6 wash basin
3 bath
1 shower
2 sink
2 wash machine

(vi) Building F
(Cottage)

1 sink	}	Downstairs
1 wash machine		
1 WC		
1 wash basin		
1 WC	}	Upstairs
2 wash basins		
1 bath		



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9.3. Pitches F1 - F12

(i) F1 - F2:

Building A	1 WC	1	x	1.5	=	1.5
	1 wash basin	1	x	0.3	=	0.3
Building B	1 sink	1	x	1.3	=	1.3
	1 w/machine	1	x	1.2	=	1.2
	3 WC	3	x	1.5	=	4.5
	3 wash basin	3	x	0.3	=	0.9
	2 bath	2	x	1.3	=	2.6
					Σ	= 12.3 DM

$$Flow Q_u = K(\Sigma DU)^{1/2} = 0.5 \times (12.3)^{1/2} = \underline{1.75 \text{ l/sec}}$$

(ii) F2 - F4:

Upstream				Σ	=	12.3
Building B	1 WC	1	x	1.5	=	1.5
	1 wash basin	1	x	0.3	=	0.3
	1 bath	1	x	1.3	=	1.3
	1 shower	1	x	0.4	=	0.4
					Σ	= 15.8 DM

$$Flow Q_w = K(\Sigma DU)^{1/2} = 0.5 \times (15.8)^{1/2} = \underline{1.99 \text{ l/sec}}$$

(iii) F4 - F12:

Upstream				Σ	=	15.8
Building C	1 WC	1	x	1.5	=	1.5
	1 wash basin	1	x	0.3	=	0.3
					Σ	= 17.6 DM

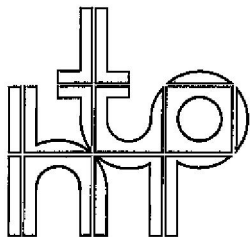
$$Flow Q_w = K(\Sigma DU)^{1/2} = 0.5 \times (17.6)^{1/2} = \underline{2.10 \text{ l/sec}}$$

For a 100mm dia pipe

For FW, $K_s = 1.50$

For gradient = 1:70

Capacity = 6.23 l/sec OK
Velocity = 0.79 m/sec OK



Use 100mm dia VC Pipe
Min gradient 1:70

9.4. Pipeline F5 - F10

Building D	1 WC	1	x	1.5	=	1.5
	1 Wash basin	1	x	0.3	=	0.3
Building E	1 sink	1	x	1.3	=	1.3
	1 w/machine	1	x	1.2	=	1.2
	4 WC	4	x	1.5	=	6.0
	4 wash basin	4	x	0.3	=	1.2
	1 bath	1	x	1.3	=	1.3
					Σ	= 11.0 DM

$$\text{Flow } Q_w = K (\Sigma DM)^{1/4} = 0.5 \times (11.0)^{1/4} = 1.16 \text{ L/sec}$$

For a 100mm dia pipe

$$\text{FW } K_s = 1.50$$

For gradient = 1:70

$$\text{Capacity} = 6.23 \text{ L/sec OK}$$

$$\text{Velocity} = 0.79 \text{ m/sec OK}$$

Use 100mm dia VC Pipe
Min gradient = 1:70

9.5. Pipeline F9 - F10

Building F	1 sink	1	x	1.3	=	1.3
	1 w/machine	1	x	1.2	=	1.2
	2 WC	2	x	1.5	=	3.0
	3 wash basins	3	x	0.3	=	0.9
	1 bath	1	x	1.3	=	1.3
					Σ	= 7.7 DM

$$\text{Flow } Q_w = K (\Sigma DM)^{1/4} = 0.5 \times (7.7)^{1/4} = 1.39 \text{ L/sec}$$

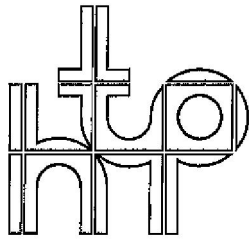
For a 100mm dia pipe

$$\text{FW } K_s = 1.50$$

For gradient = 1:70

$$\text{Capacity} = 6.23 \text{ L/sec OK}$$

$$\text{Velocity} = 0.79 \text{ m/sec OK}$$



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Use 100mm dia VC Pipe
Min gradient 1:70

9.6. Pipeline F10 - F12

Building E	1 sink	1 x 1.3	= 1.3
	1 w/machine	1 x 1.2	= 1.2
	2 W/C	2 x 1.5	= 3.0
	2 wash basin	2 x 0.3	= 0.6
	2 bath	2 x 1.3	= 2.6
		Σ	= 8.7 DU

Pipeline F5 - F10 = 11.0 DU

Pipeline F9 - F10 = 7.7 DU

Total Σ DU = 8.7 + 11.0 + 7.7 = 27.4 DU

Flow $Q_w = K (\Sigma DU)^{1/2} = 0.5 \times (27.4)^{1/2} = 2.62 \text{ L/sec}$

For 100mm dia pipe

FW $K_s = 1.50$

For gradient = 1:70

Capacity = 6.23 L/sec OK
Velocity = 0.79 m/sec OK

Use 100mm dia VC Pipe
Min gradient 1:70

9.7. Pipeline F12 - F14

Pipeline F1 - F12 = 17.6 DU

Pipeline F10 - F12 = 27.4 DU

Total Σ DU = 17.6 + 27.4 = 45.0 DU

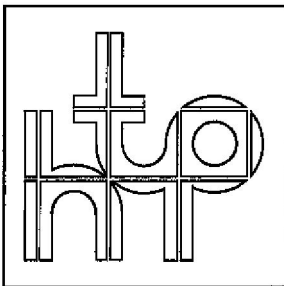
Flow $Q_w = K (\Sigma DU)^{1/2} = 0.5 (45.0)^{1/2} = 3.35 \text{ L/sec}$

For 100mm dia pipe

FW $K_s = 1.50$

For gradient 1:70

Capacity = 6.23 L/sec OK
Velocity = 0.79 m/sec OK



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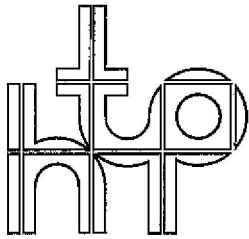
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Use 100mm dia VC Pipe
Main gradient 1:70



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9.6 Pipeline Schedule

S.V.P. G.L. = 101.60 I.L. = 100.84 d = 760mm

Pipe length = 13.25m, Grad = 1:65 Fall = 200mm

M.H.F1 C.L. = 101.35 I.L. = 100.64 d = 710mm

Pipe length = 18.92m, Grad = 1:28 Fall = 690mm

M.H.F2 C.L. = 100.55 I.L. = 99.95 d = 600mm

Pipe length = 14.47m, Grad = 1:21 Fall = 700mm

M.H.F4 C.L. = 100.55 I.L. = 99.25 d = 1300mm

M.H.F3 C.L. = 100.64 I.L. = 100.09 d = 550mm

Pipe length = 9.84m, Grad = 1:12 Fall = 840mm

M.H.F4 C.L. = 100.55 I.L. = 99.25

Pipe length = 16.63m, Grad = 1:15 Fall = 1130mm

M.H.F12 C.L. = 99.29 I.L. = 98.12 d = 1170mm

Pipe length = 14.62m, Grad = 1:70 Fall = 210mm

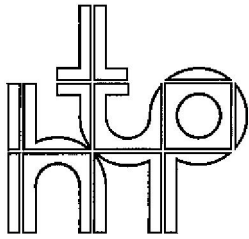
M.H.F13 C.L. = 98.90 I.L. = 97.91 d = 990mm

Pipe length = 1.50m Grad = 1:70 Fall = 20mm

Sewage plant C.L. = 98.80 I.L. = 97.89 inlet
+ M.H.F14 I.L. = 97.80 outlet

Pipe length = 82.75m, Grad = 1:70 Fall = 1180

Headwall G.L. = I.L. = 96.62



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Schedule (cont)

MHF5 FFL = 101.30 IL = 100.60 d = 700mm

Pipe length = 24.37m Grad = 1:60 Fall = 400mm

MHF6 SL = 101.30 IL = 100.20 d = 1100mm

Pipe length = 20.27m Grad = 1:37 Fall = 550mm

MHF7 SL = 100.61 IL = 99.65 d = 960mm

Pipe length = 7.67m Grad = 1:37 Fall = 210mm

MHF8 SL = 100.41 IL = 99.44 d = 970mm

Pipe length = 10.39m Grad = 1:16 Fall = 680mm

MHF10 SL = 100.24 IL = 98.73 d = 1510mm

MHF9 SL = 99.60 IL = 98.93 d = 670mm

Pipe length = 14.04m Grad = 1:70 Fall = 200mm

MHF10 SL = 100.24 IL = 98.73 d = 1510mm

Pipe length = 20.98m Grad = 1:70 Fall = 300mm

MHF11 SL = 99.62 IL = 98.43 d = 1190mm

Pipe length = 21.55m Grad = 1:70 Fall = 310mm

MHF12 SL = 99.29 IL = 98.12 d = 1170mm