Sewage Retention Time Estimation:

Phase 4c

	Length (m)	Width (m)	Cut in (mPD)	Cut out level (mPD)	Height (m)
Wet Well Size:	-	-	-	-	-

Effective Volume (m3)	5.7	Total DWF	1136	m3/d
DWF (m3/s)	0.01315	DWF to each RM	1136	m3/d
Pump Rate (m3/s)	0.054	Peak Factor	4	
Length of Rising Main, L (m)	160			
Rising Main Diameter, D (mm)	250			
Flow Velocity (in rising main) (m/s)	1.10			

Accumulating time in Wet Well, t1 (s)

t1 = 5.7 / 0.013 = 433.5 s

Pumping Time, t2 (s)

t2 = 5.7 / 0.041 = 139.5 s

Taking t2 + t1 as one cycle, then the time for one cycle is

t2 + t1 = 573.0 s

9.6 mins

Volume of Rising Main, V (m3)

V = π (D/2)^2 x L = 7.9 m3

Volume of sewage per one cycle of pumping

V = DWF * (t2 + t1) = 7.5 m3

No. of cycle, C, through the rising main is

C = 7.9 / 7.5 = 2 cycles

Total Retention Time R (time between entry point of wet well and rising main discharge point)

R = 2 * (t2 + t1) = 1146.1 s

19.1 mins

Sewage Retention Time Estimation:

Phase 1a

	Length (m)	Width (m)	Cut in (mPD)	Cut out level (mPD)	Height (m)
Wet Well Size:	-	-	-	-	-

Effective Volume (m3)	7.6	Total DWF	1513	m3/d
DWF (m3/s)	0.018	DWF to each RM	1513	m3/d
Pump Rate (m3/s)	0.072	Peak Factor	4	
Length of Rising Main, L (m)	905			
Rising Main Diameter, D (mm)	250			
Flow Velocity (in rising main) (m/s)	1.47			

Accumulating time in Wet Well, t1 (s)

t1 = 7.6 / 0.018 = 434.0 s

Pumping Time, t2 (s)

t2 = 7.6 / 0.054 = 139.5 s

Taking t2 + t1 as one cycle, then the time for one cycle is

t2 + t1 = 573.5 s

9.6 mins

Volume of Rising Main, V (m3)

V = π (D/2)^2 x L = 44.4 m3

Volume of sewage per one cycle of pumping

V = DWF * (t2 + t1) = 10.0 m3

No. of cycle, C, through the rising main is

C = 44.4 / 10.0 = 5 cycles

Total Retention Time R (time between entry point of wet well and rising main discharge point)

R = 5 * (t2 + t1) = 2867.4 s

47.8 mins

Sewage Retention Time Estimation:

Phase 1b

	Length (m)	Width (m)	Cut in (mPD)	Cut out level (mPD)	Height (m)
Wet Well Size:	-	-	-	-	-

Effective Volume (m3)	4.3	Total DWF	854	m3/d
DWF (m3/s)	0.010	DWF to each RM	854	m3/d
Pump Rate (m3/s)	0.040	Peak Factor	4	
Length of Rising Main, L (m)	1377			
Rising Main Diameter, D (mm)	200			
Flow Velocity (in rising main) (m/s)	1.27			

Accumulating time in Wet Well, t1 (s)

t1 = 4.3 / 0.010 = 435.0 s

Pumping Time, t2 (s)

t2 = 4.3 / 0.030 = 142.8 s

Taking t2 + t1 as one cycle, then the time for one cycle is

t2 + t1 = 577.8 s

9.6 mins

Volume of Rising Main, V (m3)

V = π (D/2)^2 x L = 43.3 m3

Volume of sewage per one cycle of pumping

V = DWF * (t2 + t1) = 5.7 m3

No. of cycle, C, through the rising main is

C = 43.3 / 5.7 = 8 cycles

Total Retention Time R (time between entry point of wet well and rising main discharge point)

R = 8 * (t2 + t1) = 4622.5 s

77.0 mins

Sewage Retention Time Estimation:

Phase 1c

	Length (m)	Width (m)	Cut in (mPD)	Cut out level (mPD)	Height (m)
Wet Well Size:	-	-	-	-	-

Effective Volume (m3)	6.8	Total DWF	1369	m3/d
DWF (m3/s)	0.016	DWF to each RM	1369	m3/d
Pump Rate (m3/s)	0.064	Peak Factor	4	
Length of Rising Main, L (m)	417			
Rising Main Diameter, D (mm)	250			
Flow Velocity (in rising main) (m/s)	1.30			

Accumulating time in Wet Well, t1 (s)

t1 = 6.8 / 0.016 = 429.2 s

Pumping Time, t2 (s)

t2 = 6.8 / 0.048 = 141.2 s

Taking t2 + t1 as one cycle, then the time for one cycle is

t2 + t1 = 570.4 s

9.5 mins

Volume of Rising Main, V (m3)

V = π (D/2)^2 x L = 20.5 m3

Volume of sewage per one cycle of pumping

V = DWF * (t2 + t1) = 9.0 m3

No. of cycle, C, through the rising main is

C = 20.5 / 9.0 = 3 cycles

Total Retention Time R (time between entry point of wet well and rising main discharge point)

R = 3 * (t2 + t1) = 1711.1 s

28.5 mins

Sewage Retention Time Estimation:

Phase 2a

	Length (m)	Width (m)	Cut in (mPD)	Cut out level (mPD)	Height (m)
Wet Well Size:	-	-	-	-	-

Effective Volume (m3)	6.0		Total DWF	1202	m3/d
DWF (m3/s)	0.014		DWF to each RM	1202	m3/d
Pump Rate (m3/s)	0.056		Peak Factor	4	
Length of Rising Main, L (m)	1403				
Rising Main Diameter, D (mm)	225				
Flow Velocity (in rising main) (m/s)	1.41				

Accumulating time in Wet Well, t1 (s)

t1 = 6 / 0.014 = 431.3 s

Pumping Time, t2 (s)

t2 = 6 / 0.042 = 142.6 s

Taking t2 + t1 as one cycle, then the time for one cycle is

t2 + t1 = 573.8 s

9.6 mins

Volume of Rising Main, V (m3)

V = π (D/2)^2 x L = 55.8 m3

Volume of sewage per one cycle of pumping

V = DWF * (t2 + t1) = 8.0 m3

No. of cycle, C, through the rising main is

C = 55.8 / 8.0 = 7 cycles

Total Retention Time R (time between entry point of wet well and rising main discharge point)

R = 7 * (t2 + t1) = 4016.9 s

66.9 mins

Sewage Retention Time Estimation:

Phase 2b

	Length (m)	Width (m)	Cut in (mPD)	Cut out level (mPD)	Height (m)
Wet Well Size:	-	-	-	-	-

Effective Volume (m3)	6.9		Total DWF	1380	m3/d
DWF (m3/s)	0.016		DWF to each RM	1380	m3/d
Pump Rate (m3/s)	0.064		Peak Factor	4	
Length of Rising Main, L (m)	1249				
Rising Main Diameter, D (mm)	250				
Flow Velocity (in rising main) (m/s)	1.30				

Accumulating time in Wet Well, t1 (s)

t1 = 6.9 / 0.016 = 432.0 s

Pumping Time, t2 (s)

t2 = 6.9 / 0.048 = 143.7 s

Taking t2 + t1 as one cycle, then the time for one cycle is

t2 + t1 = 575.7 s

9.6 mins

Volume of Rising Main, V (m3)

V = π (D/2)^2 x L = 61.3 m3

Volume of sewage per one cycle of pumping

V = DWF * (t2 + t1) = 9.2 m3

No. of cycle, C, through the rising main is

C = 61.3 / 9.2 = 7 cycles

Total Retention Time R (time between entry point of wet well and rising main discharge point)

R = 7 * (t2 + t1) = 4029.7 s

67.2 mins

Sewage Retention Time Estimation:

Phase 3a

	Length (m)	Width (m)	Cut in (mPD)	Cut out level (mPD)	Height (m)
Wet Well Size:	-	-	-	-	-

Effective Volume (m3)	7.5	Total DWF	1508	m3/d
DWF (m3/s)	0.017	DWF to each RM	1508	m3/d
Pump Rate (m3/s)	0.070	Peak Factor	4	
Length of Rising Main, L (m)	708			
Rising Main Diameter, D (mm)	250			
Flow Velocity (in rising main) (m/s)	1.43			

Accumulating time in Wet Well, t1 (s)

t1 = 7.5 / 0.017 = 429.7 s

Pumping Time, t2 (s)

t2 = 7.5 / 0.053 = 142.7 s

Taking t2 + t1 as one cycle, then the time for one cycle is

t2 + t1 = 572.4 s

9.5 mins

Volume of Rising Main, V (m3)

V = π (D/2)^2 x L = 34.8 m3

Volume of sewage per one cycle of pumping

V = DWF * (t2 + t1) = 10.0 m3

No. of cycle, C, through the rising main is

C = 34.8 / 10.0 = 4 cycles

Total Retention Time R (time between entry point of wet well and rising main discharge point)

R = 4 * (t2 + t1) = 2289.8 s

38.2 mins

Sewage Retention Time Estimation:

Phase 3b

	Length (m)	Width (m)	Cut in (mPD)	Cut out level (mPD)	Height (m)
Wet Well Size:	-	-	-	-	-

Effective Volume (m3)	6.7	Total DWF	1342	m3/d
DWF (m3/s)	0.016	DWF to each RM	1342	m3/d
Pump Rate (m3/s)	0.064	Peak Factor	4	
Length of Rising Main, L (m)	978			
Rising Main Diameter, D (mm)	250			
Flow Velocity (in rising main) (m/s)	1.30			

Accumulating time in Wet Well, t1 (s)

t1 = 6.7 / 0.016 = 431.4 s

Pumping Time, t2 (s)

t2 = 6.7 / 0.048 = 138.2 s

Taking t2 + t1 as one cycle, then the time for one cycle is

t2 + t1 = 569.6 s

9.5 mins

Volume of Rising Main, V (m3)

V = π (D/2)^2 x L = 48.0 m3

Volume of sewage per one cycle of pumping

V = DWF * (t2 + t1) = 8.8 m3

No. of cycle, C, through the rising main is

C = 48.0 / 8.8 = 6 cycles

Total Retention Time R (time between entry point of wet well and rising main discharge point)

R = 6 * (t2 + t1) = 3417.6 s

57.0 mins

Sewage Retention Time Estimation:

Phase 4a

	Length (m)	Width (m)	Cut in (mPD)	Cut out level (mPD)	Height (m)
Wet Well Size:	-	-	-	-	-

Effective Volume (m3)	2.3	Total DWF	463 m3/d
DWF (m3/s)	0.00536	DWF to each RM	463 m3/d
Pump Rate (m3/s)	0.022	Peak Factor	4
Length of Rising Main, L (m)	207		
Rising Main Diameter, D (mm)	160		
Flow Velocity (in rising main) (m/s)	1.09		

Accumulating time in Wet Well, t1 (s)

t1 = 2.3 / 0.005 = 429.2 s

Pumping Time, t2 (s)

t2 = 2.3 / 0.017 = 138.2 s

Taking t2 + t1 as one cycle, then the time for one cycle is

t2 + t1 = 567.4 s

9.5 mins

Volume of Rising Main, V (m3)

V = π (D/2)^2 x L = 4.2 m3

Volume of sewage per one cycle of pumping

V = DWF * (t2 + t1) = 3.0 m3

No. of cycle, C, through the rising main is

C = 4.2 / 3.0 = 2 cycles

Total Retention Time R (time between entry point of wet well and rising main discharge point)

R = 2 * (t2 + t1) = 1134.8 s

18.9 mins

Sewage Retention Time Estimation:

Phase 4b

	Length (m)	Width (m)	Cut in (mPD)	Cut out level (mPD)	Height (m)
Wet Well Size:	-	-	-	-	-

Effective Volume (m3)	6.5	Total DWF	1309 m3/d
DWF (m3/s)	0.01515	DWF to each RM	1309 m3/d
Pump Rate (m3/s)	0.062	Peak Factor	4
Length of Rising Main, L (m)	415		
Rising Main Diameter, D (mm)	250		
Flow Velocity (in rising main) (m/s)	1.26		

Accumulating time in Wet Well, t1 (s)

t1 = 6.5 / 0.015 = 429.0 s

Pumping Time, t2 (s)

t2 = 6.5 / 0.047 = 138.7 s

Taking t2 + t1 as one cycle, then the time for one cycle is

t2 + t1 = 567.8 s

9.5 mins

Volume of Rising Main, V (m3)

V = π (D/2)^2 x L = 20.4 m3

Volume of sewage per one cycle of pumping

V = DWF * (t2 + t1) = 8.6 m3

No. of cycle, C, through the rising main is

C = 20.4 / 8.6 = 3 cycles

Total Retention Time R (time between entry point of wet well and rising main discharge point)

R = 3 * (t2 + t1) = 1703.3 s

28.4 mins

Ultimate SPS Retention Time Estimation:

Case 1

Effective Volume (m3)	90.5		Total DWF	3736	m3/d
DWF (m3/s)	0.04		DWF to each RM	1868	m3/d
Pump Rate (m3/s)	0.42		Peak Factor	3	
Length of Rising Main, L (m)	852				
Rising Main Diameter, D (mm)	450				
Flow Velocity (in rising main) (m/s)	1.320				

Accumulating time in Wet Well, t1 (s)

t1 = 90.5 / 0.043 = 2092.9 s

Pumping Time, t2 (s)

t2 = 90.5 / 0.377 = 240.2 s

Taking t2 + t1 as one cycle, then the time for one cycle is

t2 + t1 = 2333.1 s

38.9 mins

Volume of Rising Main, V (m3)

V = π (D/2)^2 x L x 2 = 271.0 m3

*considering both the duty RM and standby RM, each of volume 135.5m3

Volume of sewage per one cycle of pumping

V = DWF * (t2 + t1) = 100.9 m3

No. of cycle, C, through the rising main is

C = 271.0 / 100.9 = 3 cycles

Total Retention Time R (time between entry point of wet well and rising main discharge point)

R = 3 * (t2 + t1) = 6999.4 s

116.7 mins

Ultimate SPS Retention Time Estimation:

Case 2

Effective Volume (m3)	90.5		Total DWF	6318	m3/d
DWF (m3/s)	0.07		DWF to each RM	3159	m3/d
Pump Rate (m3/s)	0.42		Peak Factor	3	
Length of Rising Main, L (m)	852				
Rising Main Diameter, D (mm)	450				
Flow Velocity (in rising main) (m/s)	1.320				

Accumulating time in Wet Well, t1 (s)

t1 = 90.5 / 0.073 = 1237.6 s

Pumping Time, t2 (s)

t2 = 90.5 / 0.347 = 260.9 s

Taking t2 + t1 as one cycle, then the time for one cycle is

t2 + t1 = 1498.5 s

25.0 mins

Volume of Rising Main, V (m3)

V = π (D/2)^2 x L x 2 = 271.0 m3

*considering both the duty RM and standby RM, each of volume 135.5m3

Volume of sewage per one cycle of pumping

V = DWF * (t2 + t1) = 109.6 m3

No. of cycle, C, through the rising main is

C = 271.0 / 109.6 = 3 cycles

Total Retention Time R (time between entry point of wet well and rising main discharge point)

R = 3 * (t2 + t1) = 4495.5 s

74.9 mins

Ultimate SPS Retention Time Estimation:

Case 3

Effective Volume (m3)	90.5		Total DWF	9168	m3/d
DWF (m3/s)	0.11		DWF to each RM	4584	m3/d
Pump Rate (m3/s)	0.42		Peak Factor	3	
Length of Rising Main, L (m)	852				
Rising Main Diameter, D (mm)	450				
Flow Velocity (in rising main) (m/s)	1.320				

Accumulating time in Wet Well, t1 (s)

t1 = 90.5 / 0.106 = 852.9 s

Pumping Time, t2 (s)

t2 = 90.5 / 0.314 = 288.3 s

Taking t2 + t1 as one cycle, then the time for one cycle is

t2 + t1 = 1141.2 s

19.0 mins

Volume of Rising Main, V (m3)

V = π (D/2)^2 x L x 2 = 271.0 m3

*considering both the duty RM and standby RM, each of volume 135.5m3

Volume of sewage per one cycle of pumping

V = DWF * (t2 + t1) = 121.1 m3

No. of cycle, C, through the rising main is

C = 271.0 / 121.1 = 3 cycles

Total Retention Time R (time between entry point of wet well and rising main discharge point)

R = 3 * (t2 + t1) = 3423.6 s

57.1 mins

Ultimate SPS Retention Time Estimation:

Case 4

Effective Volume (m3)	90.5		Total DWF	12076	m3/d
DWF (m3/s)	0.14		DWF to each RM	6038	m3/d
Pump Rate (m3/s)	0.42		Peak Factor	3	
Length of Rising Main, L (m)	852				
Rising Main Diameter, D (mm)	450				
Flow Velocity (in rising main) (m/s)	1.320				

Accumulating time in Wet Well, t1 (s)

t1 = 90.5 / 0.140 = 647.5 s

Pumping Time, t2 (s)

t2 = 90.5 / 0.280 = 322.9 s

Taking t2 + t1 as one cycle, then the time for one cycle is

t2 + t1 = 970.4 s

16.2 mins

Volume of Rising Main, V (m3)

V = π (D/2)^2 x L x 2 = 271.0 m3

*considering both the duty RM and standby RM, each of volume 135.5m3

Volume of sewage per one cycle of pumping

V = DWF * (t2 + t1) = 135.6 m3

No. of cycle, C, through the rising main is

C = 271.0 / 135.6 = 2 cycles

Total Retention Time R (time between entry point of wet well and rising main discharge point)

R = 2 * (t2 + t1) = 1940.9 s

32.3 mins