

## Supporting Report 12.2.2

# ISPS Process and Pressure Pipe Loss Calculation Sample

\* Note: All the ISPS calculations are compiled in the soft copy.

Kindly refer to the data file.

**Design Condition**

Item	Arehalli-ISPS				
(1) Design Flow for the year 2049	Flow Rate				
		m3/d	m3/h	m3/s	
	Average Daily	1,800	75	0.021	
	Max Dayly	1,800	75	0.021	
	Max Hourly Peak factor	3	5,400	225	0.063
(1) Design Flow for the year 2034	Flow Rate				
		m3/d	m3/h	m3/s	
	Average Daily	1,100	45.8	0.013	
	Max Dayly	1,100	45.8	0.013	
	Max Hourly Peak factor	3	3,300	138	0.038

**1. Inlet Chamber**

Item	Arehalli-ISPS			
[1] Design Condition				
(1) Design Flow for the year 2049	Max Hourly	=	5,400	m3/d
		=	0.063	m3/sec
(2) Inlet Pipe				
Pipe Diameter	·	×		
Gradient		‰		
Roughness Coefficient	n=	0.013	(Manning Formula)	
Full Pipe Flow Rate			m3/s	
(3) Influent Water Level	+		m	
[2] Geometry				
(1) Number of Basins	1	Basin		
(2) Depth of Basin	0.300	m	Approx.	
(3) Width of Basin	2.100	m	Approx.	
(4) Length of Basin	1.500	m	Approx.	
(5) Volume required of Basin	0.300	×	2.100	×
			1.500	=
				0.4
				m3
(6) Retention Time	0.300	×	2.100	×
			1.500	/
				0.063
				×
				1
	=	15.00	sec	
(7) Basin Demensions	Width	2.100	m	×
				Length
				1.500
				m
	×	Depth	0.300	m

Process Cal\_ Arehalli ISPS

**2. Coarse Screen Channel**

Item	Arehalli-ISPS					
[1] Geometry						
(1) Inlet Gate						
Number	1	Main	+	1	Bypass	
Width	0.400	m				
Height	0.600	m				
Floor Level	+	5.000	m			
Bottom	+	0.000	m			
Influent Water Level	+	0.300	m			
Velocity	0.063	/		0.400	/	0.300 / 1
wher Design Flow for the year 2049	=	0.525	<	1.000	m/sec	OK
Velocity	0.038	/		0.400	/	0.300 / 1
wher Design Flow for the year 2034	=	0.317	<	1.000	m/sec	OK
(2) Screen Channel						
Number	1.0	Main	+	1.0	Bypass	
Width	0.800	m				
Side Water Depth	0.600	m				
Velocity	0.063	/		0.800	/	0.600 / 1
wher Design Flow for the year 2049	=	0.131	<	0.450	m/sec	OK
Velocity	0.038	/		0.800	/	0.600 / 1
wher Design Flow for the year 2034	=	0.079	<	0.450	m/sec	OK
(3) Channel Dimensions	Width	0.8	m	×	Length	7.0 m
				×	SWD	0.6 m
[3] Equipment						
(1) Inlet Gate						
Number	2	Units				
Dimension	Width	0.4	m	×	Height	0.6 m
Design Water Level		m				
(2) Coarse Screens (Main Channel)						
Number	1	W	+	0	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	0.8	m				
Width of side plate	50	mm				
Side Water Depth	0.6	m				
Height of Blind Plate at the bottom	50	mm				
Velocity through screen	0.063	/		0.700	/	0.550 / 1
	×	(	20	+	9	)/
	×	(	20	+	9	)/
	=	0.237	<	0.800	m/sec	OK
Velocity through screen	0.038	/		0.700	/	0.550 / 1
wher Design Flow for the year 2034	=	0.143	<	0.800	m/sec	OK
(3) Coarse Screens (Bypass Channel)						
Number	0	W	+	1	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	0.8	m				
Side Water Depth	0.3	m				
Velocity through screen	0.063	/		0.800	/	0.300 / 1
wher Design Flow for the year 2049	=	0.381	<	0.800	m/sec	OK
Velocity through screen	0.038	/		0.800	/	0.300 / 1
wher Design Flow for the year 2034	=	0.230	<	0.800	m/sec	OK

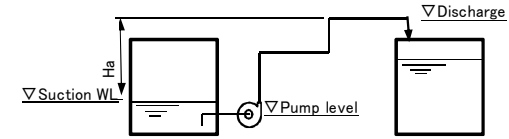
Coarse Screen 2/3

**3. Raw Sewage Sump**

Item	Arehalli-ISPS			
[2] Geometory				
(1) Raw Sewage Sump				
Number	1	Basin		
Dia	6.00	m		
Pump Operating Depth	0.600	m		
Retention Time whe Design Flow for the year 2049	(	$6.00^2 \times \pi / 4$	$\times$	$0.600 \text{ )} / 0.063 / 60$
	=	4.49	>	3.75 min (=minimum time of one pump cycle ' OK
Retention Time whe Design Flow for the year 2034	(	$6.00^2 \times \pi / 4$	$\times$	$0.600 \text{ )} / 0.038 / 60$
	=	7.44	>	3.75 min (=minimum time of one pump cycle ' OK
High Water Level	+	0.000	m	
Pump Off Level	+	-0.600	m	
[3] Equipment				
(1) Sewage Pumps 1				
Number	1	W	+	1 S
Bore Diameter	150	mm		
Discharge Flow : Q whe Design Flow for the year 2034	=	$0.038 \times 3600$	/	1.0
		138	⇒	138 m3/Hr
Total Head	25.0	m		
(2) Sewage Pumps 2				
Number		W	+	S
Bore Diameter		mm		
Discharge Flow : 0.5 whe Design Flow for the year 2034	=	/	⇒	m3/Hr
Total Head		m		

## Pipe losses calculation sheet

Project : Bengaluru Water Supply and Sewerage  
 : Project (Phase III)  
 Location : Arehalli ISPS  
 :

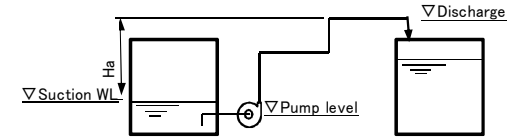


Pump Name Sewage Pump Discharge 100 m<sup>3</sup>/h Altitude 847.000 m Total Head 26 mH > Total Hea 23.916 mH **OK**  
 (spec.) (result)  
 Discharge WL FL+ 867.000 m Suction WL FL+ 848.000 m Pump Installation le FL+ 847.000 m Statific Head 19.000 mH  
 Specific Gravity ### Temperature 36 °C Saturated Vapor Pressu 0.604 m NPSHav 9.730 m > NPSHreq 8.000 m **OK**

No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	150 mm	Belmouth	DIP	100 m <sup>3</sup> /h	1.573 m/s	ζ : 0.1500	1 No.	0.020 m	
7				m <sup>3</sup> /h	m/s	:	No.	m	Suction loss 0.020 m
<b>Discharge</b>									
2	150 mm	Pipe	DIP	100 m <sup>3</sup> /h	1.573 m/s	λ : 120.0000	1 m	0.021 m	
4	150 mm	Check Valve	DIP	100 m <sup>3</sup> /h	1.573 m/s	ζ : 1.5000	1 No.	0.205 m	
4	150 mm	Gate Valve	DIP	100 m <sup>3</sup> /h	1.573 m/s	ζ : 0.1450	1 No.	0.020 m	
5	150 mm	Pipe	DIP	100 m <sup>3</sup> /h	1.573 m/s	λ : 120.0000	3 m	0.062 m	
4	250 mm	T-shape	DIP	100 m <sup>3</sup> /h	0.566 m/s	ζ : 3.0000	1 No.	0.053 m	
7	250 mm	Pipe	DIP	200 m <sup>3</sup> /h	1.132 m/s	λ : 120.0000	722 m	4.465 m	
14	250 mm	Discharge	DIP	200 m <sup>3</sup> /h	1.132 m/s	ζ : 1.0000	1 No.	0.071 m	
14				m <sup>3</sup> /h	m/s	:	No.	m	
<b>Total</b>								<u>4.916 m</u>	

## Pipe losses calculation sheet

Project : Bengaluru Water Supply and Sewerage  
 : Project (Phase III)  
 Location : Arehalli ISPS  
 :



Pump Name Sewage Pump Discharge 138 m<sup>3</sup>/h Altitude 847.000 m Total Head 25 mH > Total Hea 21.998 mH **OK**  
 (spec.) (result)  
 Discharge WL FL+ 867.000 m Suction WL FL+ 848.000 m Pump Installation le FL+ 847.000 m Statific Head 19.000 mH  
 Specific Gravity ### Temperature 36 °C Saturated Vapor Pressu 0.604 m NPSHav 9.708 m > NPSHreq 8.000 m **OK**

No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks	
<b>Suction</b>										
1	150	mm	Belmouth	DIP	138 m <sup>3</sup> /h	2.170 m/s	ζ : 0.1500	1 No.	0.039 m	
7		mm			m <sup>3</sup> /h	m/s	:	No.	m	Suction loss 0.039 m
<b>Discharge</b>										
2	150	mm	Pipe	DIP	138 m <sup>3</sup> /h	2.170 m/s	λ : 120.0000	1 m	0.037 m	
4	150	mm	Check Valve	DIP	138 m <sup>3</sup> /h	2.170 m/s	ζ : 1.5000	1 No.	0.390 m	
4	150	mm	Gate Valve	DIP	138 m <sup>3</sup> /h	2.170 m/s	ζ : 0.1450	1 No.	0.038 m	
5	150	mm	Pipe	DIP	138 m <sup>3</sup> /h	2.170 m/s	λ : 120.0000	3 m	0.112 m	
4	250	mm	T-shape	DIP	138 m <sup>3</sup> /h	0.781 m/s	ζ : 3.0000	1 No.	0.101 m	
7	250	mm	Pipe	DIP	138 m <sup>3</sup> /h	0.781 m/s	λ : 120.0000	722 m	2.248 m	
14	250	mm	Discharge	DIP	138 m <sup>3</sup> /h	0.781 m/s	ζ : 1.0000	1 No.	0.034 m	
14		mm			m <sup>3</sup> /h	m/s	:	No.	m	
<b>Total</b>								2.998 m		

ISPS 3 arehalli (2034)

Process Cal., Bellahalli ISPS

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**Design Condition**

Item	Bellahalli-ISPS				
(1) Design Flow for the year 2049	Flow Rate				
		m <sup>3</sup> /d	m <sup>3</sup> /h	m <sup>3</sup> /s	
	Average Daily	1,500	62.5	0.017	
	Max Dayly	1,500	62.5	0.017	
	Max Hourly Peak factor	3	4,500	188	0.052
(1) Design Flow for the year 2034	Flow Rate				
		m <sup>3</sup> /d	m <sup>3</sup> /h	m <sup>3</sup> /s	
	Average Daily	1,000	41.7	0.012	
	Max Dayly	1,000	41.7	0.012	
	Max Hourly Peak factor	3	3,000	125	0.035

**1. Inlet Chamber**

Item	Bellahalli-ISPS			
[1] Design Condition				
(1) Design Flow for the year 2049	Max Hourly	=	4,500	m <sup>3</sup> /d
		=	0.052	m <sup>3</sup> /sec
(2) Inlet Pipe				
Pipe Diameter	•	×		
Gradient			%	
Roughness Coefficient	n=	0.013	(Manning Formula)	
Full Pipe Flow Rate			m <sup>3</sup> /s	
(3) Influent Water Level	+		m	
[2] Geometory				
(1) Number of Basins	1	Basin		
(2) Depth of Basin	0.400	m	Approx.	
(3) Width of Basin	2.100	m	Approx.	
(4) Length of Basin	1.500	m	Approx.	
(5) Volume required of Basin	0.400	×	2.100	×
			1.500	=
				0.6
				m <sup>3</sup>
(6) Retention Time	0.400	×	2.100	×
			1.500	/
				0.052
				×
				1
	=	24.23	sec	
(7) Basin Demensions				
	Width	2.100	m	×
				Length
				1.500
				m
	×	Depth	0.400	m

Process Cal., Bellahalli ISPS

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2****2. Coarse Screen Channel**

Item	Bellahalli-ISPS					
[1] Geometry						
(1) Inlet Gate						
Number	1	Main	+	1	Bypass	
Width	0.400	m				
Height	0.600	m				
Floor Level	+	5.000	m			
Bottom	+	0.000	m			
Influent Water Level	+	0.300	m			
Velocity	0.052	/		0.400	/	0.300 / 1
where Design Flow for the year 2049	=	0.433	<	1.000	m/sec	OK
Velocity	0.035	/		0.400	/	0.300 / 1
where Design Flow for the year 2034	=	0.292	<	1.000	m/sec	OK
(2) Screen Channel						
Number	1.0	Main	+	1.0	Bypass	
Width	0.800	m				
Side Water Depth	0.600	m				
Velocity	0.052	/		0.800	/	0.600 / 1
where Design Flow for the year 2049	=	0.108	<	0.450	m/sec	OK
Velocity	0.035	/		0.800	/	0.600 / 1
where Design Flow for the year 2034	=	0.073	<	0.450	m/sec	OK
(3) Channel Dimensions	Width	0.8	m	×	Length	7.0 m
				×	SWD	0.6 m
[3] Equipment						
(1) Inlet Gate						
Number	2	Units				
Dimension	Width	0.4	m	×	Height	0.6 m
Design Water Level	5.2	m				
(2) Coarse Screens (Main Channel)						
Number	1	W	+	0	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	0.8	m				
Width of side plate	50	mm				
Side Water Depth	0.6	m				
Height of Blind Plate at the bottom	50	mm				
Velocity through screen	0.052	/		0.700	/	0.550 / 1
	×	(	20	+	9	)/
	20					
	=	0.196	≅	0.800	m/sec	OK
Velocity through screen	0.035	/		0.700	/	0.550 / 1
where Design Flow for the year 2034	×	(	20	+	9	)/
	20					
	=	0.132	<	0.800	m/sec	OK
(3) Coarse Screens (Bypass Channel)						
Number	0	W	+	1	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	0.8	m				
Side Water Depth	0.3	m				
Velocity through screen	0.052	/		0.800	/	0.300 / 1
where Design Flow for the year 2049	×	(	20	+	9	)/
	20					
	=	0.314	<	0.800	m/sec	OK
Velocity through screen	0.035	/		0.800	/	0.300 / 1
where Design Flow for the year 2034	×	(	20	+	9	)/
	20					
	=	0.211	<	0.800	m/sec	OK

Coarse Screen 1/1



**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**3. Raw Sewage Sump**

Item	Bellahalli-ISPS
[2] Geometory	
(1) Raw Sewage Sump	
Number	1 Basin
Dia	6.00 m
Pump Operating Depth	0.500 m
Retention Time whe Design Flow for the year 2049	$( \frac{6.00^2 \times \pi}{4} \times 0.500 ) / 0.052 / 60$ = 4.53 > 3.75 min (=minimum time of one pump cycle OK
Retention Time whe Design Flow for the year 2034	$( \frac{6.00^2 \times \pi}{4} \times 0.500 ) / 0.035 / 60$ = 6.73 > 3.75 min (=minimum time of one pump cycle OK
High Water Level	+ 0.000 m
Pump Off Level	+ -0.500 m
[3] Equipment	
(1) Sewage Pumps 1	
Number	1 W + 1 S
Bore Diameter	150 mm
Discharge Flow : Q whe Design Flow for the year 2034	$0.035 \times 3600 / 1.0$ = 125 ⇒ 125 m3/Hr
Total Head	35.0 m
(2) Sewage Pumps 2	
Number	W + S
Bore Diameter	mm
Discharge Flow : 0.5 whe Design Flow for the year 2034	= ⇒ m3/Hr
Total Head	m

Process Cal. Hagdur ISPS

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**Design Condition**

Item	Bommanahalli-ISPS			
(1) Design Flow for the year 2049	Flow Rate			
	m3/d	m3/h	m3/s	
	Average Daily	####	1000	0.278
	Max Dayly	####	1000	0.278
Max Hourly Peak factor 2.25	####	2250	0.625	
(1) Design Flow for the year 2034	Flow Rate			
	m3/d	m3/h	m3/s	
	Average Daily	####	625	0.174
	Max Dayly	####	625	0.174
Max Hourly Peak factor 2.25	####	1406	0.391	

**1. Inlet Chamber**

Item	Bommanahalli-ISPS		
[1] Design Condition			
(1) Design Flow for the year 2049	Max Hourly	=	54,000 m3/d
		=	0.625 m3/sec
(2) Inlet Pipe			
Pipe Diameter	·	×	
Gradient		%	
Roughness Coefficient	n=	0.013	(Manning Formula)
Full Pipe Flow Rate		m3/s	
(3) Influent Water Level	+	m	
[2] Geometory			
(1) Number of Basins	1	Basin	
(2) Depth of Basin	0.400	m	Approx.
(3) Width of Basin	3.400	m	Approx.
(4) Length of Basin	2.000	m	Approx.
(5) Volume required of Basin	0.400	×	3.400
		×	2.000
		=	0.7 m3
(6) Retention Time	0.400	×	3.400
		×	2.000
		/	0.625
	=	4.35	sec
(7) Basin Demensions	Width	3.400 m	×
		×	Length 2.000 m
	×	Depth 0.450 m	

Process Cal. Hagdur ISPS

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2****2. Coarse Screen Channel**

Item	Bommanahalli-ISPS					
[1] Geometry						
(1) Inlet Gate						
Number	2	Main	+	1	Bypass	
Width	0.600	m				
Height	0.900	m				
Floor Level	+	5.000	m			
Bottom	+	0.000	m			
Influent Water Level	+	0.700	m			
Velocity	0.625	/	0.600	/	0.700	/ 2
where Design Flow for the year 2049	=	0.744	<	1.000	m/sec	OK
Velocity	0.391	/	0.600	/	0.700	/ 1
where Design Flow for the year 2034	=	0.931	<	1.000	m/sec	OK
(2) Screen Channel						
Number	2.0	Main	+	1.0	Bypass	
Width	1.200	m				
Side Water Depth	0.700	m				
Velocity	0.625	/	1.200	/	0.700	/ 2
where Design Flow for the year 2049	=	0.372	<	0.450	m/sec	OK
Velocity	0.391	/	1.200	/	0.700	/ 1
where Design Flow for the year 2034	=	0.465	>	0.450	m/sec	OK
(3) Channel Dimensions	Width	1.2	m	×	Length	8.0 m
			×	SWD	0.7	m
[3] Equipment						
(1) Inlet Gate						
Number	2	Units				
Dimension	Width	0.6	m	×	Height	0.9 m
Design Water Level		m				
(2) Coarse Screens (Main Channel)						
Number	2	W	+	0	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	1.2	m				
Width of side plate	50	mm				
Side Water Depth	0.7	m				
Height of Blind Plate at the bottom	50	mm				
Velocity through screen	0.625	/	1.100	/	0.650	/ 2
	× (	20	+	9	) /	20
	=	0.634	<	0.800	m/sec	OK
Velocity through screen	0.391	/	1.100	/	0.650	/ 1
where Design Flow for the year 2034	× (	20	+	9	) /	20
	=	0.793	<	0.800	m/sec	OK
(3) Coarse Screens (Bypass Channel)						
Number	0	W	+	1	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	1.2	m				
Side Water Depth	0.7	m				
Velocity through screen	0.625	/	1.200	/	0.700	/ 2
where Design Flow for the year 2049	× (	20	+	9	) /	20
	=	0.539	<	0.800	m/sec	OK
Velocity through screen	0.391	/	1.200	/	0.700	/ 1
where Design Flow for the year 2034	× (	20	+	9	) /	20
	=	0.675	<	0.800	m/sec	OK

Coarse Screen 2/3

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**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**3. Raw Sewage Sump**

Item	Bommanahalli-ISPS	
[2] Geometory		
(1) Raw Sewage Sump		
Number	1	Basin
Dia	10.00	m
Pump Operating Depth	2.000	m
Retention Time whe Design Flow for the year 2049	$( 10.00^2 \times \pi / 4 \times 2.000 ) / 0.625$	$/ 60$ = 4.19 > 3.75 min (=minimum time of one pump cycle) OK
Retention Time whe Design Flow for the year 2034	$( 10.00^2 \times \pi / 4 \times 2.000 ) / 0.391$	$/ 60$ = 6.70 > 3.75 min (=minimum time of one pump cycle) OK
High Water Level	+ 0.000	m
Pump Off Level	+ -2.000	m
[3] Equipment		
(1) Sewage Pumps 1		
Number	2 W	+ 1 S
Bore Diameter	250	mm
Discharge Flow : 0.4 Q whe Design Flow for the year 2034	$0.391$	$3600 \times 0.4$ = 563 $\Rightarrow$ 564 m <sup>3</sup> /Hr
Total Head	15.0	m
(2) Sewage Pumps 2		
Number	1 W	+ 1 S
Bore Diameter	150	mm
Discharge Flow : 0.2 Q whe Design Flow for the year 2034	$0.391$	$3,600.0 \times 0.2$ = 281 $\Rightarrow$ 282 m <sup>3</sup> /Hr
Total Head	15.0	m

Process Cal., Naganathapura ISPS

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**Design Condition**

Item	Naganathapura-ISPS				
(1) Design Flow for the year 2049	Flow Rate				
		m3/d	m3/h	m3/s	
	Average Daily	####	542	0.150	
	Max Dayly	####	542	0.150	
	Max Hourly Peak factor	2.25	####	1219	0.339
(1) Design Flow for the year 2034	Flow Rate				
		m3/d	m3/h	m3/s	
	Average Daily	9,000	375	0.104	
	Max Dayly	9,000	375	0.104	
	Max Hourly Peak factor	2.25	####	844	0.234

**1. Inlet Chamber**

Item	Naganathapura-ISPS			
[1] Design Condition				
(1) Design Flow for the year 2049	Max Hourly	=	29,250	m3/d
		=	0.339	m3/sec
(2) Inlet Pipe				
Pipe Diameter	•	×		
Gradient			%	
Roughness Coefficient	n=	0.013	(Manning Formula)	
Full Pipe Flow Rate			m3/s	
(3) Influent Water Level	+		m	
[2] Geometory				
(1) Number of Basins	1	Basin		
(2) Depth of Basin	0.400	m	Approx.	
(3) Width of Basin	3.400	m	Approx.	
(4) Length of Basin	2.000	m	Approx.	
(5) Volume required of Basin	0.400	×	3.400	×
			2.000	=
				0.7
				m3
(6) Retention Time	0.400	×	3.400	×
			2.000	/
				0.339
				×
				1
	=	8.02	sec	
(7) Basin Demensions	Width	3.400	m	×
				Length
				2.000
				m
	×	Depth	0.450	m

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**2. Coarse Screen Channel**

Item	Naganathapura-ISPS					
[1] Geometry						
(1) Inlet Gate						
Number	2	Main	+	1	Bypass	
Width	0.500	m				
Height	0.750	m				
Floor Level	+	5.000	m			
Bottom	+	0.000	m			
Influent Water Level	+	0.500	m			
Velocity	0.339	/	0.500	/	0.500	/ 2
where Design Flow for the year 2049	=	0.678	<	1.000	m/sec	OK
Velocity	0.234	/	0.500	/	0.500	/ 1
where Design Flow for the year 2034	=	0.936	<	1.000	m/sec	OK
(2) Screen Channel						
Number	2.0	Main	+	1.0	Bypass	
Width	0.800	m				
Side Water Depth	0.700	m				
Velocity	0.339	/	0.800	/	0.700	/ 2
where Design Flow for the year 2049	=	0.303	<	0.450	m/sec	OK
Velocity	0.234	/	0.800	/	0.700	/ 1
where Design Flow for the year 2034	=	0.418	<	0.450	m/sec	OK
(3) Channel Dimensions	Width	0.8	m	×	Length	8.0 m
			×	SWD	0.7	m
[3] Equipment						
(1) Inlet Gate						
Number	2	Units				
Dimension	Width	0.5	m	×	Height	0.8 m
Design Water Level						
(2) Coarse Screens (Main Channel)						
Number	2	W	+	0	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	0.8	m				
Width of side plate	50	mm				
Side Water Depth	0.7	m				
Height of Blind Plate at the bottom	50	mm				
Velocity through screen	0.339	/	0.700	/	0.650	/ 2
	× (	20	+	9	)/	20
	=	0.540	<	0.800	m/sec	OK
Velocity through screen	0.234	/	0.700	/	0.650	/ 1
where Design Flow for the year 2034	× (	20	+	9	)/	20
	=	0.746	<	0.800	m/sec	OK
(3) Coarse Screens (Bypass Channel)						
Number	0	W	+	1	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	0.8	m				
Side Water Depth	0.7	m				
Velocity through screen	0.339	/	0.800	/	0.700	/ 2
where Design Flow for the year 2049	× (	20	+	9	)/	20
	=	0.439	<	0.800	m/sec	OK
Velocity through screen	0.234	/	0.800	/	0.700	/ 1
where Design Flow for the year 2034	× (	20	+	9	)/	20
	=	0.606	<	0.800	m/sec	OK

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**3. Raw Sewage Sump**

Item	Naganathapura-ISPS	
[2] Geometory		
(1) Raw Sewage Sump		
Number	1	Basin
Dia	10.00	m
Pump Operating Depth	1.000	m
Retention Time whe Design Flow for the year 2049	$( 10.00^2 \times \pi / 4 \times 1.000 ) / 0.339$	$/ 60$ = 3.86 > 3.75 min (=minimum time of one pump cycle) OK
Retention Time whe Design Flow for the year 2034	$( 10.00^2 \times \pi / 4 \times 1.000 ) / 0.234$	$/ 60$ = 5.59 > 3.75 min (=minimum time of one pump cycle) OK
High Water Level	+ 0.000	m
Pump Off Level	+ -1.000	m
[3] Equipment		
(1) Sewage Pumps 1		
Number	2 W + 1 S	
Bore Diameter	250	mm
Discharge Flow : 0.4 Q whe Design Flow for the year 2034	$0.234$	$3600 \times 0.4$ = 337.50 ⇒ 338 m <sup>3</sup> /Hr
Total Head	15.0	m
(2) Sewage Pumps 2		
Number	1 W + 1 S	
Bore Diameter	150	mm
Discharge Flow : 0.2 Q whe Design Flow for the year 2034	$0.234$	$3,600.0 \times 0.2$ = 168.75 ⇒ 169 m <sup>3</sup> /Hr
Total Head	15.0	m

Process Cal., Arehalli ISPS

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**Design Condition**

Item	Arehalli-ISPS			
(1) Design Flow for the year 2049	Flow Rate			
		m3/d	m3/h	m3/s
	Average Daily	1,800	75	0.021
	Max Dayly	1,800	75	0.021
Max Hourly	Peak factor 3	5,400	225	0.063
(1) Design Flow for the year 2034	Flow Rate			
		m3/d	m3/h	m3/s
	Average Daily	1,100	45.8	0.013
	Max Dayly	1,100	45.8	0.013
Max Hourly	Peak factor 3	3,300	138	0.038

**1. Inlet Chamber**

Item	Arehalli-ISPS			
[1] Design Condition				
(1) Design Flow for the year 2049	Max Hourly	=	5,400	m3/d
		=	0.063	m3/sec
(2) Inlet Pipe				
Pipe Diameter	•	×		
Gradient			%	
Roughness Coefficient	n=	0.013	(Manning Formula)	
Full Pipe Flow Rate			m3/s	
(3) Influent Water Level	+		m	
[2] Geometory				
(1) Number of Basins	1	Basin		
(2) Depth of Basin	0.300	m	Approx.	
(3) Width of Basin	2.100	m	Approx.	
(4) Length of Basin	1.500	m	Approx.	
(5) Volume required of Basin	0.300	×	2.100	×
			1.500	=
				0.4
				m3
(6) Retention Time	0.300	×	2.100	×
			1.500	/
			0.063	×
				1
	=	15.00	sec	
(7) Basin Demensions	Width	2.100	m	×
				Length
				1.500
				m
	×	Depth	0.300	m



**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**2. Coarse Screen Channel**

Item	Arehalli-ISPS					
[1] Geometry						
(1) Inlet Gate						
Number	1	Main	+	1	Bypass	
Width	0.400	m				
Height	0.600	m				
Floor Level	+	5.000	m			
Bottom	+	0.000	m			
Influent Water Level	+	0.300	m			
Velocity	0.063	/	0.400	/	0.300	/ 1
where Design Flow for the year 2049	=	0.525	<	1.000	m/sec	OK
Velocity	0.038	/	0.400	/	0.300	/ 1
where Design Flow for the year 2034	=	0.317	<	1.000	m/sec	OK
(2) Screen Channel						
Number	1.0	Main	+	1.0	Bypass	
Width	0.800	m				
Side Water Depth	0.600	m				
Velocity	0.063	/	0.800	/	0.600	/ 1
where Design Flow for the year 2049	=	0.131	<	0.450	m/sec	OK
Velocity	0.038	/	0.800	/	0.600	/ 1
where Design Flow for the year 2034	=	0.079	<	0.450	m/sec	OK
(3) Channel Dimensions	Width	0.8	m	×	Length	7.0 m
	×	SWD	0.6	m		
[3] Equipment						
(1) Inlet Gate						
Number	2	Units				
Dimension	Width	0.4	m	×	Height	0.6 m
Design Water Level		m				
(2) Coarse Screens (Main Channel)						
Number	1	W	+	0	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	0.8	m				
Width of side plate	50	mm				
Side Water Depth	0.6	m				
Height of Blind Plate at the bottom	50	mm				
Velocity through screen	0.063	/	0.700	/	0.550	/ 1
	×	( 20	+	9 )/	20	
	=	0.237	<	0.800	m/sec	OK
Velocity through screen	0.038	/	0.700	/	0.550	/ 1
where Design Flow for the year 2034	×	( 20	+	9 )/	20	
	=	0.143	<	0.800	m/sec	OK
(3) Coarse Screens (Bypass Channel)						
Number	0	W	+	1	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	0.8	m				
Side Water Depth	0.3	m				
Velocity through screen	0.063	/	0.800	/	0.300	/ 1
where Design Flow for the year 2049	×	( 20	+	9 )/	20	
	=	0.381	<	0.800	m/sec	OK
Velocity through screen	0.038	/	0.800	/	0.300	/ 1
where Design Flow for the year 2034	×	( 20	+	9 )/	20	
	=	0.230	<	0.800	m/sec	OK

Process Cal., Arehalli ISPS

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**3. Raw Sewage Sump**

Item	Arehalli-ISPS
[2] Geometory	
(1) Raw Sewage Sump	
Number	1 Basin
Dia	6.00 m
Pump Operating Depth	0.600 m
Retention Time whe Design Flow for the year 2049	$( \frac{6.00^2 \times \pi}{4} \times 0.600 ) / 0.063 / 60$ = 4.49 > 3.75 min (=minimum time of one pump cycle) OK
Retention Time whe Design Flow for the year 2034	$( \frac{6.00^2 \times \pi}{4} \times 0.600 ) / 0.038 / 60$ = 7.44 > 3.75 min (=minimum time of one pump cycle) OK
High Water Level	+ 0.000 m
Pump Off Level	+ -0.600 m
[3] Equipment	
(1) Sewage Pumps 1	
Number	1 W + 1 S
Bore Diameter	150 mm
Discharge Flow : Q whe Design Flow for the year 2034	$0.038 \times 3600 / 1.0$ = 138 ⇒ 138 m <sup>3</sup> /Hr
Total Head	25.0 m
(2) Sewage Pumps 2	
Number	W + S
Bore Diameter	mm
Discharge Flow : 0.5 whe Design Flow for the year 2034	= ⇒ m <sup>3</sup> /Hr
Total Head	m

Process Cal. Hemigepura ISPS

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**Design Condition**

Item	Hemigepura-ISPS				
(1) Design Flow for the year 2049	Flow Rate				
		m3/d	m3/h	m3/s	
	Average Daily	2,500	104	0.029	
	Max Dayly	2,500	104	0.029	
	Max Hourly Peak factor	3	7,500	313	0.087
(1) Design Flow for the year 2034	Flow Rate				
		m3/d	m3/h	m3/s	
	Average Daily	1,700	70.8	0.020	
	Max Dayly	1,700	70.8	0.020	
	Max Hourly Peak factor	3	5,100	213	0.059

**1. Inlet Chamber**

Item	Hemigepura-ISPS			
[1] Design Condition				
(1) Design Flow for the year 2049	Max Hourly	=	7,500	m3/d
		=	0.087	m3/sec
(2) Inlet Pipe				
Pipe Diameter	•	×		
Gradient			%	
Roughness Coefficient	n=	0.013	(Manning Formula)	
Full Pipe Flow Rate			m3/s	
(3) Influent Water Level	+		m	
[2] Geometory				
(1) Number of Basins	1	Basin		
(2) Depth of Basin	0.300	m	Approx.	
(3) Width of Basin	2.100	m	Approx.	
(4) Length of Basin	1.500	m	Approx.	
(5) Volume required of Basin	0.300	×	2.100	×
			1.500	=
				0.4
				m3
(6) Retention Time	0.300	×	2.100	×
			1.500	/
				0.087
				×
				1
	=	10.86	sec	
(7) Basin Demensions	Width	2.100	m	×
				Length
				1.500
				m
	×	Depth	0.300	m

Process Cal., Hemigepura ISPS

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**2. Coarse Screen Channel**

Item	Hemigepura-ISPS					
[1] Geometry						
(1) Inlet Gate						
Number	1	Main	+	1	Bypass	
Width	0.400	m				
Height	0.600	m				
Floor Level	+	5.000	m			
Bottom	+	0.000	m			
Influent Water Level	+	0.300	m			
Velocity	0.087	/	0.400	/	0.300	/ 1
where Design Flow for the year 2049	=	0.725	<	1.000	m/sec	OK
Velocity	0.059	/	0.400	/	0.300	/ 1
where Design Flow for the year 2034	=	0.492	<	1.000	m/sec	OK
(2) Screen Channel						
Number	1.0	Main	+	1.0	Bypass	
Width	0.800	m				
Side Water Depth	0.600	m				
Velocity	0.087	/	0.800	/	0.600	/ 1
where Design Flow for the year 2049	=	0.181	<	0.450	m/sec	OK
Velocity	0.059	/	0.800	/	0.600	/ 1
where Design Flow for the year 2034	=	0.123	<	0.450	m/sec	OK
(3) Channel Dimensions	Width	0.8	m	×	Length	7.0 m
				×	SWD	0.6 m
[3] Equipment						
(1) Inlet Gate						
Number	2	Units				
Dimension	Width	0.4	m	×	Height	0.6 m
Design Water Level		m				
(2) Coarse Screens (Main Channel)						
Number	1	W	+	0	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	0.8	m				
Width of side plate	50	mm				
Side Water Depth	0.6	m				
Height of Blind Plate at the bottom	50	mm				
Velocity through screen	0.087	/	0.700	/	0.550	/ 1
	× (	20	+	9	)/	20
	=	0.328	<	0.800	m/sec	OK
Velocity through screen	0.059	/	0.700	/	0.550	/ 1
where Design Flow for the year 2034	× (	20	+	9	)/	20
	=	0.222	<	0.800	m/sec	OK
(3) Coarse Screens (Bypass Channel)						
Number	0	W	+	1	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	0.8	m				
Side Water Depth	0.3	m				
Velocity through screen	0.087	/	0.800	/	0.300	/ 1
where Design Flow for the year 2049	× (	20	+	9	)/	20
	=	0.526	<	0.800	m/sec	OK
Velocity through screen	0.059	/	0.800	/	0.300	/ 1
where Design Flow for the year 2034	× (	20	+	9	)/	20
	=	0.356	<	0.800	m/sec	OK

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**3. Raw Sewage Sump**

Item	Hemigepura-ISPS	
[2] Geometory		
(1) Raw Sewage Sump		
Number	1	Basin
Dia	7.00	m
Pump Operating Depth	0.600	m
Retention Time whe Design Flow for the year 2049	$( 7.00^2 \times \pi / 4 \times 0.600 ) / 0.087$	$/ 60$ = 4.42 > 3.75 min (=minimum time of one pump cycle) OK
Retention Time whe Design Flow for the year 2034	$( 7.00^2 \times \pi / 4 \times 0.600 ) / 0.059$	$/ 60$ = 6.52 > 3.75 min (=minimum time of one pump cycle) OK
High Water Level	+ 0.000	m
Pump Off Level	+ -0.600	m
[3] Equipment		
(1) Sewage Pumps 1		
Number	1	W + 1 S
Bore Diameter	150	mm
Discharge Flow : Q whe Design Flow for the year 2034	$0.059 \times 3600$	$/ 1.0$ = 212.50 $\Rightarrow$ 213 m <sup>3</sup> /Hr
Total Head	23.0	m
(2) Sewage Pumps 2		
Number	W	+ S
Bore Diameter	mm	
Discharge Flow : 0.5 whe Design Flow for the year 2034		$/$ = $\Rightarrow$ m <sup>3</sup> /Hr
Total Head	m	

Process Cal., Herohalli ISPS

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**Design Condition**

Item	Herohalli-ISPS				
(1) Design Flow for the year 2049	Flow Rate				
		m3/d	m3/h	m3/s	
	Average Daily	800	33.3	0.009	
	Max Dayly	800	33.3	0.009	
	Max Hourly Peak factor	3	2,400	100	0.028
(1) Design Flow for the year 2034	Flow Rate				
		m3/d	m3/h	m3/s	
	Average Daily	500	20.8	0.006	
	Max Dayly	500	20.8	0.006	
	Max Hourly Peak factor	3	1,500	62.5	0.017

**1. Inlet Chamber**

Item	Herohalli-ISPS			
[1] Design Condition				
(1) Design Flow for the year 2049	Max Hourly	=	2,400	m3/d
		=	0.028	m3/sec
(2) Inlet Pipe				
Pipe Diameter	•	×		
Gradient			%	
Roughness Coefficient	n=	0.013	(Manning Formula)	
Full Pipe Flow Rate			m3/s	
(3) Influent Water Level	+		m	
[2] Geometory				
(1) Number of Basins	1	Basin		
(2) Depth of Basin	0.200	m	Approx.	
(3) Width of Basin	2.100	m	Approx.	
(4) Length of Basin	1.500	m	Approx.	
(5) Volume required of Basin	0.200	×	2.100	×
			1.500	=
				0.3
				m3
(6) Retention Time	0.200	×	2.100	×
			1.500	/
				0.028
				×
				1
	=	22.50	sec	
(7) Basin Demensions	Width	2.100	m	×
				Length
				1.500
				m
	×	Depth	0.200	m

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**2. Coarse Screen Channel**

Item	Herohalli-ISPS					
[1] Geometry						
(1) Inlet Gate						
Number	1	Main	+	1	Bypass	
Width	0.300	m				
Height	0.300	m				
Floor Level	+	5.000	m			
Bottom	+	0.000	m			
Influent Water Level	+	0.200	m			
Velocity	0.028	/		0.300	/	0.200 / 1
where Design Flow for the year 2049	=	0.467	<	1.000	m/sec	OK
Velocity	0.017	/		0.300	/	0.200 / 1
where Design Flow for the year 2034	=	0.283	<	1.000	m/sec	OK
(2) Screen Channel						
Number	1.0	Main	+	1.0	Bypass	
Width	0.800	m				
Side Water Depth	0.600	m				
Velocity	0.028	/		0.800	/	0.600 / 1
where Design Flow for the year 2049	=	0.058	<	0.450	m/sec	OK
Velocity	0.017	/		0.800	/	0.600 / 1
where Design Flow for the year 2034	=	0.035	<	0.450	m/sec	OK
(3) Channel Dimensions	Width	0.8	m	×	Length	7.0 m
	×	SWD	0.6	m		
[3] Equipment						
(1) Inlet Gate						
Number	2	Units				
Dimension	Width	0.3	m	×	Height	0.3 m
Design Water Level		m				
(2) Coarse Screens (Main Channel)						
Number	1	W	+	0	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	0.8	m				
Width of side plate	50	mm				
Side Water Depth	0.6	m				
Height of Blind Plate at the bottom	50	mm				
Velocity through screen	0.028	/		0.700	/	0.550 / 1
	×	( 20	+	9 )/	20	
	=	0.105	<	0.800	m/sec	OK
Velocity through screen	0.017	/		0.700	/	0.550 / 1
where Design Flow for the year 2034	×	( 20	+	9 )/	20	
	=	0.064	<	0.800	m/sec	OK
(3) Coarse Screens (Bypass Channel)						
Number	0	W	+	1	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	0.8	m				
Side Water Depth	0.3	m				
Velocity through screen	0.028	/		0.800	/	0.300 / 1
where Design Flow for the year 2049	×	( 20	+	9 )/	20	
	=	0.169	<	0.800	m/sec	OK
Velocity through screen	0.017	/		0.800	/	0.300 / 1
where Design Flow for the year 2034	×	( 20	+	9 )/	20	
	=	0.103	<	0.800	m/sec	OK

Process Cal., Herohalli ISPS

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**3. Raw Sewage Sump**

Item	Herohalli-ISPS
[2] Geometory	
(1) Raw Sewage Sump	
Number	1 Basin
Dia	5.00 m
Pump Operating Depth	0.500 m
Retention Time whe Design Flow for the year 2049	$( \frac{5.00^2 \times \pi}{4} \times 0.500 ) / 0.028 / 60$ = 5.84 > 3.75 min (=minimum time of one pump cycle) OK
Retention Time whe Design Flow for the year 2034	$( \frac{5.00^2 \times \pi}{4} \times 0.500 ) / 0.017 / 60$ = 9.62 > 3.75 min (=minimum time of one pump cycle) OK
High Water Level	+ 0.000 m
Pump Off Level	+ -0.500 m
[3] Equipment	
(1) Sewage Pumps 1	
Number	1 W + 1 S
Bore Diameter	100 mm
Discharge Flow : Q whe Design Flow for the year 2034	$0.017 \times 3600 / 1.0$ = 63 ⇒ 63 m3/Hr
Total Head	15.0 m
(2) Sewage Pumps 2	
Number	W + S
Bore Diameter	mm
Discharge Flow : Q whe Design Flow for the year 2034	$0.5$ = ⇒ m3/Hr
Total Head	m



Process Cal. Doddabi ISPS

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**Design Condition**

Item	Doddabidarakallu-ISPS				
(1) Design Flow for the year 2049	Flow Rate				
		m3/d	m3/h	m3/s	
	Average Daily	####	533	0.148	
	Max Dayly	####	533	0.148	
Max Hourly	Peak factor	2.25	####	1200	0.333
(1) Design Flow for the year 2034	Flow Rate				
		m3/d	m3/h	m3/s	
	Average Daily	8,100	338	0.094	
	Max Dayly	8,100	338	0.094	
Max Hourly	Peak factor	2.25	####	759	0.211

**1. Inlet Chamber**

Item	Doddabidarakallu-ISPS			
[1] Design Condition				
(1) Design Flow for the year 2049	Max Hourly	=	28,800	m3/d
		=	0.333	m3/sec
(2) Inlet Pipe				
Pipe Diameter	•	×		
Gradient			%	
Roughness Coefficient	n=	0.013	(Manning Formula)	
Full Pipe Flow Rate			m3/s	
(3) Influent Water Level	+		m	
[2] Geometory				
(1) Number of Basins	1	Basin		
(2) Depth of Basin	0.400	m	Approx.	
(3) Width of Basin	3.400	m	Approx.	
(4) Length of Basin	2.000	m	Approx.	
(5) Volume required of Basin	0.400	×	3.400	×
			2.000	=
				0.7
				m3
(6) Retention Time	0.400	×	3.400	×
			2.000	/
				0.333
				×
				1
	=	8.17	sec	
(7) Basin Demensions	Width	3.400	m	×
				Length
				2.000
				m
	×	Depth	0.450	m

Process Cal., Doddabi ISPS

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**2. Coarse Screen Channel**

Item	Doddabidarakallu-ISPS					
[1] Geometry						
(1) Inlet Gate						
Number	2	Main	+	1	Bypass	
Width	0.500	m				
Height	0.750	m				
Floor Level	+	5.000	m			
Bottom	+	0.000	m			
Influent Water Level	+	0.500	m			
Velocity	0.333	/	0.500	/	0.500	/ 2
where Design Flow for the year 2049	=	0.666	<	1.000	m/sec	OK
Velocity	0.211	/	0.500	/	0.500	/ 1
where Design Flow for the year 2034	=	0.844	<	1.000	m/sec	OK
(2) Screen Channel						
Number	2.0	Main	+	1.0	Bypass	
Width	0.800	m				
Side Water Depth	0.700	m				
Velocity	0.333	/	0.800	/	0.700	/ 2
where Design Flow for the year 2049	=	0.297	<	0.450	m/sec	OK
Velocity	0.211	/	0.800	/	0.700	/ 1
where Design Flow for the year 2034	=	0.377	<	0.450	m/sec	OK
(3) Channel Dimensions	Width	0.8	m	×	Length	8.0 m
	×	SWD	0.7	m		
[3] Equipment						
(1) Inlet Gate						
Number	2	Units				
Dimension	Width	0.5	m	×	Height	0.8 m
Design Water Level		m				
(2) Coarse Screens (Main Channel)						
Number	2	W	+	0	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	0.8	m				
Width of side plate	50	mm				
Side Water Depth	0.7	m				
Height of Blind Plate at the bottom	50	mm				
Velocity through screen	0.333	/	0.700	/	0.650	/ 2
	×	( 20	+	9 )/	20	
	=	0.531	<	0.800	m/sec	OK
Velocity through screen	0.211	/	0.700	/	0.650	/ 1
where Design Flow for the year 2034	×	( 20	+	9 )/	20	
	=	0.672	<	0.800	m/sec	OK
(3) Coarse Screens (Bypass Channel)						
Number	0	W	+	1	S	
Open Space	20	mm				
Bar Thickness	9	mm				
Channel Width	0.8	m				
Side Water Depth	0.7	m				
Velocity through screen	0.333	/	0.800	/	0.700	/ 2
where Design Flow for the year 2049	×	( 20	+	9 )/	20	
	=	0.431	<	0.800	m/sec	OK
Velocity through screen	0.211	/	0.800	/	0.700	/ 1
where Design Flow for the year 2034	×	( 20	+	9 )/	20	
	=	0.546	<	0.800	m/sec	OK

Process Cal., Doddabai ISPS

**ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2**

**3. Raw Sewage Sump**

Item	Doddabidarakallu-ISPS	
[2] Geometyory		
(1) Raw Sewage Sump		
Number	1	Basin
Dia	10.00	m
Pump Operating Depth	1.000	m
Retention Time whe Design Flow for the year 2049	$( 10.00^2 \times \pi / 4 \times 1.000 ) / 0.333 / 60$ = 3.93	> 3.75 min (=minimum time of one pump cycle) OK
Retention Time whe Design Flow for the year 2034	$( 10.00^2 \times \pi / 4 \times 1.000 ) / 0.211 / 60$ = 6.20	> 3.75 min (=minimum time of one pump cycle) OK
High Water Level	+ 0.000	m
Pump Off Level	+ -1.000	m
[3] Equipment		
(1) Sewage Pumps 1		
Number	2 W + 1 S	
Bore Diameter	250	mm
Discharge Flow : 0.4 Q whe Design Flow for the year 2034	$0.211 \times 3600 \times 0.4$ = 303.75	⇒ 304 m <sup>3</sup> /Hr
Total Head	36.0	m
(2) Sewage Pumps 2		
Number	1 W + 1 S	
Bore Diameter	150	mm
Discharge Flow : 0.2 Q whe Design Flow for the year 2034	$0.211 \times 3,600.0 \times 0.2$ = 151.88	⇒ 152 m <sup>3</sup> /Hr
Total Head	36.0	m

ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2

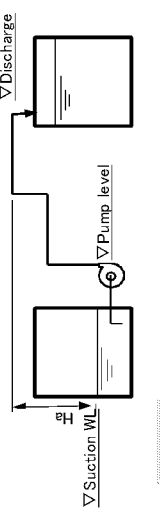
<b>Pipe losses calculation sheet</b>		<b>Project : Bengaluru Water Supply and Sewerage</b>	
		<b>Project (Phase III)</b>	
		<b>Location : Bellahalli ISPS</b>	
<b>Pump Name</b>	Sewage Pump	<b>Discharge</b>	94 m <sup>3</sup> /h
		<b>Altitude</b>	893.000 m
		<b>Total Head (spec.)</b>	54 mH
		<b>Total Head (result)</b>	37.011 mH
		<b>Statiffic Head</b>	29.000 mH
<b>Discharge WL</b>	FL+ 923.000 m	<b>Suction WL</b>	FL+ 893.000 m
<b>Specific Gravity</b>	###	<b>Temperature</b>	36 °C
		<b>Saturated Vapor Pressur</b>	0.604 m
		<b>NPSHav</b>	9.683 m
		<b>NPSHreq</b>	8.000 m
			OK

No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	150 mm	Belmouth	DIP	94 m <sup>3</sup> /h	1.478 m/s	ζ : 0.1500	1 No.	0.018 m	
7	mm			m <sup>3</sup> /h	m/s	:	No.	m	Suction loss 0.018 m
<b>Discharge</b>									
2	150 mm	Pipe	DIP	94 m <sup>3</sup> /h	1.478 m/s	λ : 120.0000	1 m	0.018 m	
4	150 mm	Check Valve	DIP	94 m <sup>3</sup> /h	1.478 m/s	ζ : 1.5000	1 No.	0.181 m	
4	150 mm	Gate Valve	DIP	94 m <sup>3</sup> /h	1.478 m/s	ζ : 0.1450	1 No.	0.017 m	
5	150 mm	Pipe	DIP	94 m <sup>3</sup> /h	1.478 m/s	λ : 120.0000	3 m	0.055 m	
4	250 mm	T-shape	DIP	94 m <sup>3</sup> /h	0.532 m/s	ζ : 3.0000	1 No.	0.047 m	
7	250 mm	Pipe	DIP	188 m <sup>3</sup> /h	1.064 m/s	λ : 120.0000	1380 m	7.611 m	
14	250 mm	Discharge	DIP	188 m <sup>3</sup> /h	1.064 m/s	ζ : 1.0000	1 No.	0.062 m	
14	mm			m <sup>3</sup> /h	m/s	:	No.	m	
<b>Total</b>								8.011 m	

ISPS 1 bellahalli (2049)

ISPS Process and Pressure Pipe Loss Calculation\_Supporting Report 12.2.2

<b>Pipe losses calculation sheet</b>		<b>Project : Bengaluru Water Supply and Sewerage</b>	
		<b>Project (Phase III)</b>	
		<b>Location : Bellahalli ISPS</b>	
<b>Pump Name</b>	Sewage Pump	<b>Discharge</b>	125 m <sup>3</sup> /h
		<b>Altitude</b>	893.000 m
		<b>Total Head (spec.)</b>	42 mH
		<b>Total Hea (result)</b>	33.195 mH
		<b>Statiffic Head</b>	29.000 mH
<b>Discharge WL</b>	FL+ 923.000 m	<b>Suction WL</b>	FL+ 893.000 m
<b>Specific Gravity</b>	###	<b>Saturated Vapor Pressur</b>	0.604 m
		<b>NPSHav</b>	9.666 m
		<b>NPSHreq</b>	8.000 m
			OK

No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	150 mm	Belmouth	DIP	125 m <sup>3</sup> /h	1.966 m/s	ζ : 0.1500	1 No.	0.032 m	
7	mm			m <sup>3</sup> /h	m/s	:	No.	m	Suction loss 0.032 m
<b>Discharge</b>									
2	150 mm	Pipe	DIP	125 m <sup>3</sup> /h	1.966 m/s	λ : 120.0000	1 m	0.031 m	
4	150 mm	Check Valve	DIP	125 m <sup>3</sup> /h	1.966 m/s	ζ : 1.5000	1 No.	0.320 m	
4	150 mm	Gate Valve	DIP	125 m <sup>3</sup> /h	1.966 m/s	ζ : 0.1450	1 No.	0.031 m	
5	150 mm	Pipe	DIP	125 m <sup>3</sup> /h	1.966 m/s	λ : 120.0000	3 m	0.094 m	
4	250 mm	T-shape	DIP	125 m <sup>3</sup> /h	0.708 m/s	ζ : 3.0000	1 No.	0.083 m	
7	250 mm	Pipe	DIP	125 m <sup>3</sup> /h	0.708 m/s	λ : 120.0000	1380 m	3.377 m	
14	250 mm	Discharge	DIP	125 m <sup>3</sup> /h	0.708 m/s	ζ : 1.0000	1 No.	0.028 m	
14	mm			m <sup>3</sup> /h	m/s	:	No.	m	
<b>Total</b>								4.195 m	

ISPS 1 bellahalli (2034)

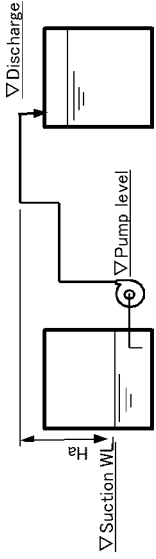
**Pipe losses calculation sheet**

**Project** : Bengaluru Water Supply and Sewerage  
**Project (Phase III)**  
**Location** : Hagadur ISPS

**Pump Name** : Sewage Pump      **Discharge** : 564 m<sup>3</sup>/h      **Altitude** : 848.000 m      **Total Head** : 30 mH      **Total Hea** : 28.567 mH      **OK**

**Discharge WL** : FL + 866.000 m      **Discharge WL** : FL + 849.000 m      **Pump Installation le FL +** : 848.000 m      **Static Head** : 17.000 mH

**Specific Gravity** : ##      **Temperature** : 36 °C      **Saturated Vapor Pressur** : 0.604 m      **NPSHav** : 9.652 m      **NPSHreq** : 8.000 m      **OK**



No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	250 mm	Belmouth	DIP	564 m <sup>3</sup> /h	3.193 m/s	ζ : 0.1500	1 No.	0.084 m	
							No.		Suction loss 0.084 m
<b>Discharge</b>									
1	250 mm	Pipe	DIP	564 m <sup>3</sup> /h	3.193 m/s	λ : 120.0000	2 m	0.084 m	
2	250 mm	Check Valve	DIP	564 m <sup>3</sup> /h	3.193 m/s	ζ : 1.5000	1 No.	0.843 m	
3	250 mm	Gate Valve	DIP	564 m <sup>3</sup> /h	3.193 m/s	ζ : 0.0470	1 No.	0.026 m	
4	250 mm	Pipe	DIP	564 m <sup>3</sup> /h	3.193 m/s	λ : 120.0000	3 m	0.126 m	
5	250 mm	T-shape	DIP	564 m <sup>3</sup> /h	3.193 m/s	ζ : 3.0000	1 No.	1.687 m	
6	800 mm	Pipe	DIP	2256 m <sup>3</sup> /h	1.247 m/s	λ : 120.0000	4550 m	8.630 m	
7	800 mm	Discharge	DIP	2256 m <sup>3</sup> /h	1.247 m/s	ζ : 1.0000	1 No.	0.086 m	
							No.		
<b>Total</b>								11.567 m	

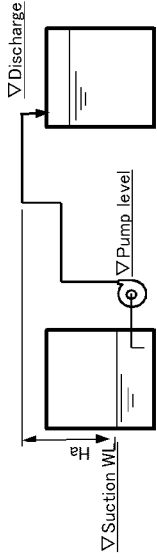
**Pipe losses calculation sheet**

**Project :** Bengaluru Water Supply and Sewerage  
**Project (Phase III)**  
**Location :** Hagadur ISPS

**Pump Name** Sewage Pump **Discharge** 564 m<sup>3</sup>/h **Altitude** 848.000 m **Total Head** 25 mH **Total Hea** 23.502 mH **OK**

**Discharge WL** FL+ 866.000 m **Discharge WL** FL+ 849.000 m **Pump Installation le FL+** 848.000 m **Static Head** 17.000 mH

**Specific Gravity** ### **Temperature** 36 °C **Saturated Vapor Pressur** 0.604 m **NPSHav** 9.652 m **NPSHreq** 8.000 m **OK**



No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	250 mm	Belmouth	DIP	564 m <sup>3</sup> /h	3.193 m/s	ζ : 0.1500	1 No.	0.084 m	
							No.		Suction loss 0.084 m
<b>Discharge</b>									
1	250 mm	Pipe	DIP	564 m <sup>3</sup> /h	3.193 m/s	λ : 120.0000	2 m	0.084 m	
2	250 mm	Check Valve	DIP	564 m <sup>3</sup> /h	3.193 m/s	ζ : 1.5000	1 No.	0.843 m	
3	250 mm	Gate Valve	DIP	564 m <sup>3</sup> /h	3.193 m/s	ζ : 0.0470	1 No.	0.026 m	
4	250 mm	Pipe	DIP	564 m <sup>3</sup> /h	3.193 m/s	λ : 120.0000	3 m	0.126 m	
5	250 mm	T-shape	DIP	564 m <sup>3</sup> /h	3.193 m/s	ζ : 3.0000	1 No.	1.687 m	
6	800 mm	Pipe	DIP	1410 m <sup>3</sup> /h	0.780 m/s	λ : 120.0000	4550 m	3.617 m	
7	800 mm	Discharge	DIP	1410 m <sup>3</sup> /h	0.780 m/s	ζ : 1.0000	1 No.	0.034 m	
							No.		
<b>Total</b>								6.502 m	

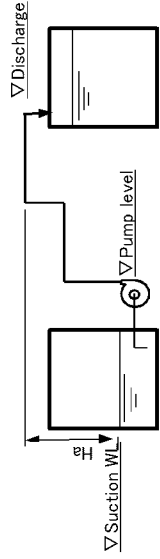
**Pipe losses calculation sheet**

**Project** : Bengaluru Water Supply and Sewerage  
**Project (Phase III)**  
**Location** : Naganathapura ISPS

**Pump Name** : Sewage Pump      **Discharge** : 305 m<sup>3</sup>/h      **Altitude** : 893.000 m      **Total Head (spec.)** : 37 mH > **Total Hea** : 35.746 mH **OK**

**Discharge WL** : FL+ 925.000 m      **Suction WL** : FL+ 894.000 m      **Pump Installation le FL+** : 893.000 m      **Static Head** : 31.000 mH

**Specific Gravity** : ##      **Temperature** : 36 °C      **Saturated Vapor Pressur** : 0.604 m      **NPSHav** : 9.675 m > **NPSHreq** : 8.000 m **OK**

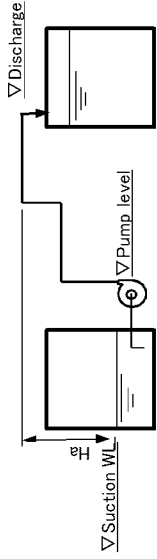


No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	250 mm	Belmouth	DIP	305 m <sup>3</sup> /h	1.727 m/s	ζ : 0.1500	1 No.	0.025 m	
				m <sup>3</sup> /h			No.	m	Suction loss 0.025 m
<b>Discharge</b>									
1	250 mm	Pipe	DIP	305 m <sup>3</sup> /h	1.727 m/s	λ : 120.0000	2 m	0.027 m	
2	250 mm	Check Valve	DIP	305 m <sup>3</sup> /h	1.727 m/s	ζ : 1.5000	1 No.	0.247 m	
3	250 mm	Gate Valve	DIP	305 m <sup>3</sup> /h	1.727 m/s	ζ : 0.0470	1 No.	0.008 m	
4	250 mm	Pipe	DIP	305 m <sup>3</sup> /h	1.727 m/s	λ : 120.0000	3 m	0.041 m	
5	250 mm	T-shape	DIP	305 m <sup>3</sup> /h	1.727 m/s	ζ : 3.0000	1 No.	0.493 m	
6	600 mm	Pipe	DIP	1220 m <sup>3</sup> /h	1.199 m/s	λ : 120.0000	1550 m	3.827 m	
7	600 mm	Discharge	DIP	1220 m <sup>3</sup> /h	1.199 m/s	ζ : 1.0000	1 No.	0.079 m	
				m <sup>3</sup> /h			No.	m	
<b>Total</b>								4.746 m	



**Pipe losses calculation sheet**

Project : Bengaluru Water Supply and Sewerage  
 Project (Phase III)  
 Location : Naganathapura ISPS



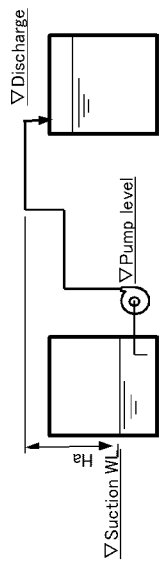
Pump Name Sewage Pump Discharge 338 m<sup>3</sup>/h Altitude 893.000 m Total Head (spec.) 36 mH > Total Hea 34.008 mH OK  
 Discharge WL FL+ 925.000 m Suction WL FL+ 894.000 m Pump Installation le FL+ 893.000 m Statific Head 31.000 mH  
 Specific Gravity ### Temperature 36 °C Saturated Vapor Pressur 0.604 m NPSHav NPSHreq 8.000 m OK

No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	250 mm	Belmouth	DIP	338 m <sup>3</sup> /h	1.914 m/s	ζ : 0.1500	1 No.	0.030 m	
							No.		Suction loss 0.030 m
<b>Discharge</b>									
1	250 mm	Pipe	DIP	338 m <sup>3</sup> /h	1.914 m/s	λ : 120.0000	2 m	0.033 m	
2	250 mm	Check Valve	DIP	338 m <sup>3</sup> /h	1.914 m/s	ζ : 1.5000	1 No.	0.303 m	
3	250 mm	Gate Valve	DIP	338 m <sup>3</sup> /h	1.914 m/s	ζ : 0.0470	1 No.	0.009 m	
4	250 mm	Pipe	DIP	338 m <sup>3</sup> /h	1.914 m/s	λ : 120.0000	3 m	0.049 m	
5	250 mm	T-shape	DIP	338 m <sup>3</sup> /h	1.914 m/s	ζ : 3.0000	1 No.	0.606 m	
6	600 mm	Pipe	DIP	845 m <sup>3</sup> /h	0.831 m/s	λ : 120.0000	1550 m	1.940 m	
7	600 mm	Discharge	DIP	845 m <sup>3</sup> /h	0.831 m/s	ζ : 1.0000	1 No.	0.038 m	
							No.		
<b>Total</b>								<b>3.008 m</b>	

**Pipe losses calculation sheet**

Project : Bengaluru Water Supply and Sewerage  
 Project (Phase III)  
 Location : Arehalli ISPS

Pump Name Sewage Pump Discharge 100 m<sup>3</sup>/h Altitude 847.000 m Total Head 26 mH > Total Hea 23.916 mH OK  
 (spec.)  
 Discharge WL FL+ 867.000 m Suction WL FL+ 848.000 m Pump Installation le FL+ 847.000 m Statific Head 19.000 mH  
 Specific Gravity ### Temperature 36 °C Saturated Vapor Pressur 0.604 m NPSHav 9.730 m > NPSHreq 8.000 m OK

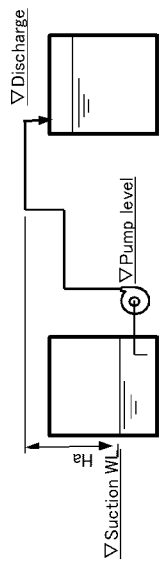


No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	150 mm	Belmouth	DIP	100 m <sup>3</sup> /h	1.573 m/s	ζ : 0.1500	1 No.	0.020 m	
7	mm			m <sup>3</sup> /h		:	No.	m	Suction loss 0.020 m
<b>Discharge</b>									
2	150 mm	Pipe	DIP	100 m <sup>3</sup> /h	1.573 m/s	λ : 120.0000	1 m	0.021 m	
4	150 mm	Check Valve	DIP	100 m <sup>3</sup> /h	1.573 m/s	ζ : 1.5000	1 No.	0.205 m	
4	150 mm	Gate Valve	DIP	100 m <sup>3</sup> /h	1.573 m/s	ζ : 0.1450	1 No.	0.020 m	
5	150 mm	Pipe	DIP	100 m <sup>3</sup> /h	1.573 m/s	λ : 120.0000	3 m	0.062 m	
4	250 mm	T-shape	DIP	100 m <sup>3</sup> /h	0.566 m/s	ζ : 3.0000	1 No.	0.053 m	
7	250 mm	Pipe	DIP	200 m <sup>3</sup> /h	1.132 m/s	λ : 120.0000	722 m	4.465 m	
14	250 mm	Discharge	DIP	200 m <sup>3</sup> /h	1.132 m/s	ζ : 1.0000	1 No.	0.071 m	
14	mm			m <sup>3</sup> /h		:	No.	m	
<b>Total</b>								4.916 m	

**Pipe losses calculation sheet**

Project : Bengaluru Water Supply and Sewerage  
 Project (Phase III)  
 Location : Arehalli ISPS

Pump Name : Sewage Pump Discharge : 138 m<sup>3</sup>/h Altitude : 847.000 m Total Head : 25 mH > Total Hea : 21.998 mH OK  
 (spec.)  
 Discharge WL : FL + 867.000 m Suction WL : FL + 847.000 m Pump Installation le FL + : 19.000 mH  
 Static Head : 19.000 mH  
 Saturated Vapor Pressur : 0.604 m NPSHav : 9.708 m > NPSHreq : 8.000 m OK  
 Temperature : 36 °C



No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	150 mm	Belmouth	DIP	138 m <sup>3</sup> /h	2.170 m/s	ζ : 0.1500	1 No.	0.039 m	
7	mm			m <sup>3</sup> /h		:	No.	m	Suction loss 0.039 m
<b>Discharge</b>									
2	150 mm	Pipe	DIP	138 m <sup>3</sup> /h	2.170 m/s	λ : 120.0000	1 m	0.037 m	
4	150 mm	Check Valve	DIP	138 m <sup>3</sup> /h	2.170 m/s	ζ : 1.5000	1 No.	0.390 m	
4	150 mm	Gate Valve	DIP	138 m <sup>3</sup> /h	2.170 m/s	ζ : 0.1450	1 No.	0.038 m	
5	150 mm	Pipe	DIP	138 m <sup>3</sup> /h	2.170 m/s	λ : 120.0000	3 m	0.112 m	
4	250 mm	T-shape	DIP	138 m <sup>3</sup> /h	0.781 m/s	ζ : 3.0000	1 No.	0.101 m	
7	250 mm	Pipe	DIP	138 m <sup>3</sup> /h	0.781 m/s	λ : 120.0000	722 m	2.248 m	
14	250 mm	Discharge	DIP	138 m <sup>3</sup> /h	0.781 m/s	ζ : 1.0000	1 No.	0.034 m	
14	mm			m <sup>3</sup> /h		:	No.	m	
<b>Total</b>								<b>2.998 m</b>	

Pipe losses calculation sheet		Project : Bengaluru Water Supply and Sewerage	
		Project (Phase III)	
Location : Hemigapura ISPS			
Pump Name	Sewage Pump	Discharge	313 m <sup>3</sup> /h
		Altitude	775.000 m
		Total Head (spec.)	26 mH
		Total Hea	25.016 mH
			OK
Discharge WL	FL+ 796.000 m	Pump Installation le FL+	775.000 m
		Static Head	20.000 mH
Specific Gravity	###	Temperature	36 °C
		Saturated Vapor Pressur	0.604 m
		NPSHav	9.757 m
		NPSHreq	8.000 m
			>
			OK

No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	200 mm	Belmouth	DIP	313 m <sup>3</sup> /h	2.769 m/s	ζ : 0.1500	1 No.	0.063 m	
				m <sup>3</sup> /h	m/s	:	No.	m	Suction loss 0.063 m
<b>Discharge</b>									
1	200 mm	Pipe	DIP	313 m <sup>3</sup> /h	2.769 m/s	λ : 120.0000	2 m	0.084 m	
2	200 mm	Check Valve	DIP	313 m <sup>3</sup> /h	2.769 m/s	ζ : 1.5000	1 No.	0.634 m	
3	200 mm	Gate Valve	DIP	313 m <sup>3</sup> /h	2.769 m/s	ζ : 0.1030	1 No.	0.044 m	
4	200 mm	Pipe	DIP	313 m <sup>3</sup> /h	2.769 m/s	λ : 120.0000	3 m	0.126 m	
5	200 mm	T-shape	DIP	313 m <sup>3</sup> /h	2.769 m/s	ζ : 3.0000	1 No.	1.268 m	
6	350 mm	Pipe	DIP	313 m <sup>3</sup> /h	0.904 m/s	λ : 120.0000	1000 m	2.751 m	
7	350 mm	Discharge	DIP	313 m <sup>3</sup> /h	0.904 m/s	ζ : 1.0000	1 No.	0.045 m	
				m <sup>3</sup> /h	m/s	:	No.	m	
<b>Total</b>								5.016 m	

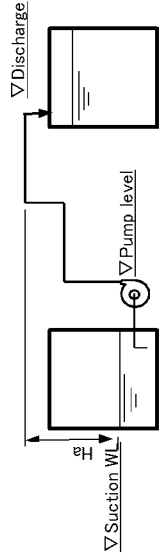
**Pipe losses calculation sheet**

Project : Bengaluru Water Supply and Sewerage  
 Project (Phase III)  
 Location : Hemigepura ISPS

Pump Name Sewage Pump Discharge 213 m<sup>3</sup>/h Altitude 775.000 m Total Head 23 mH > Total Hea 22.404 mH OK

Discharge WL FL+ 796.000 m Pump Installation le FL+ 775.000 m Statific Head 20.000 mH

Specific Gravity ### Temperature 36 °C Saturated Vapor Pressur 0.604 m NPSHav 9.798 m > NPSHreq 8.000 m OK



No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	200 mm	Belmouth	DIP	213 m <sup>3</sup> /h	1.884 m/s	ζ : 0.1500	1 No.	0.029 m	
				m <sup>3</sup> /h	m/s	:	No.	m	Suction loss 0.029 m
<b>Discharge</b>									
1	200 mm	Pipe	DIP	213 m <sup>3</sup> /h	1.884 m/s	λ : 120.0000	2 m	0.041 m	
2	200 mm	Check Valve	DIP	213 m <sup>3</sup> /h	1.884 m/s	ζ : 1.5000	1 No.	0.294 m	
3	200 mm	Gate Valve	DIP	213 m <sup>3</sup> /h	1.884 m/s	ζ : 0.1030	1 No.	0.020 m	
4	200 mm	Pipe	DIP	213 m <sup>3</sup> /h	1.884 m/s	λ : 120.0000	3 m	0.062 m	
5	200 mm	T-shape	DIP	213 m <sup>3</sup> /h	1.884 m/s	ζ : 3.0000	1 No.	0.587 m	
6	350 mm	Pipe	DIP	213 m <sup>3</sup> /h	0.615 m/s	λ : 120.0000	1000 m	1.350 m	
7	350 mm	Discharge	DIP	213 m <sup>3</sup> /h	0.615 m/s	ζ : 1.0000	1 No.	0.021 m	
				m <sup>3</sup> /h	m/s	:	No.	m	
<b>Total</b>								<b>2.404 m</b>	

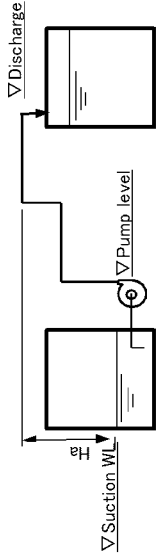
**Pipe losses calculation sheet**

Project : Bengaluru Water Supply and Sewerage  
 : Project (Phase III)  
 Location : Herohalli ISPS

Pump Name Sewage Pump Discharge 100 m<sup>3</sup>/h Altitude 878.000 m Total Head 17 mH > Total Hea 15.140 mH OK  
 (spec.)

Discharge WL FL+ 891.000 m Suction WL FL+ 879.000 m Pump Installation le FL+ 878.000 m Statific Head 12.000 mH

Specific Gravity ### Temperature 36 °C Saturated Vapor Pressur 0.604 m NPSHav 9.696 m > NPSHreq 8.000 m OK



No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	150 mm	Belmouth	DIP	100 m <sup>3</sup> /h	1.573 m/s	ζ : 0.1500	1 No.	0.020 m	
				m <sup>3</sup> /h	m/s	:	No.	m	Suction loss 0.020 m
<b>Discharge</b>									
1	150 mm	Pipe	DIP	100 m <sup>3</sup> /h	1.573 m/s	λ : 120.0000	2 m	0.041 m	
2	150 mm	Check Valve	DIP	100 m <sup>3</sup> /h	1.573 m/s	ζ : 1.5000	1 No.	0.205 m	
3	150 mm	Gate Valve	DIP	100 m <sup>3</sup> /h	1.573 m/s	ζ : 0.1450	1 No.	0.020 m	
4	150 mm	Pipe	DIP	100 m <sup>3</sup> /h	1.573 m/s	λ : 120.0000	3 m	0.062 m	
5	150 mm	T-shape	DIP	100 m <sup>3</sup> /h	1.573 m/s	ζ : 3.0000	1 No.	0.409 m	
6	200 mm	Pipe	DIP	100 m <sup>3</sup> /h	0.885 m/s	λ : 120.0000	460 m	2.339 m	
7	200 mm	Discharge	DIP	100 m <sup>3</sup> /h	0.885 m/s	ζ : 1.0000	1 No.	0.043 m	
				m <sup>3</sup> /h	m/s	:	No.	m	
<b>Total</b>								3.140 m	

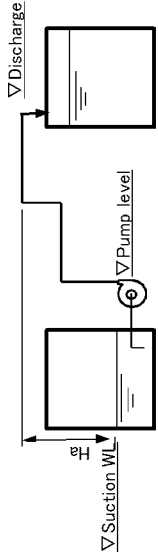
**Pipe losses calculation sheet**

Project : Bengaluru Water Supply and Sewerage  
 : Project (Phase III)  
 Location : Herohalli ISPS

Pump Name Sewage Pump Discharge 100 m<sup>3</sup>/h Altitude 878.000 m Total Head 17 mH > Total Hea 13.316 mH OK

Discharge WL FL+ 891.000 m Discharge WL FL+ 879.000 m Pump Installation le FL+ 878.000 m Statific Head 12.000 mH

Specific Gravity ### Temperature 36 °C Saturated Vapor Pressur 0.604 m NPSHav 9.711 m > NPSHreq 8.000 m OK



No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	150 mm	Belmouth	DIP	63 m <sup>3</sup> /h	0.991 m/s	ζ : 0.1500	1 No.	0.008 m	
				m <sup>3</sup> /h	m/s	:	No.	m	Suction loss 0.008 m
<b>Discharge</b>									
1	150 mm	Pipe	DIP	63 m <sup>3</sup> /h	0.991 m/s	λ : 120.0000	2 m	0.018 m	
2	150 mm	Check Valve	DIP	63 m <sup>3</sup> /h	0.991 m/s	ζ : 1.5000	1 No.	0.081 m	
3	150 mm	Gate Valve	DIP	63 m <sup>3</sup> /h	0.991 m/s	ζ : 0.1450	1 No.	0.008 m	
4	150 mm	Pipe	DIP	63 m <sup>3</sup> /h	0.991 m/s	λ : 120.0000	3 m	0.026 m	
5	150 mm	T-shape	DIP	63 m <sup>3</sup> /h	0.991 m/s	ζ : 3.0000	1 No.	0.162 m	
6	200 mm	Pipe	DIP	63 m <sup>3</sup> /h	0.557 m/s	λ : 120.0000	460 m	0.995 m	
7	200 mm	Discharge	DIP	63 m <sup>3</sup> /h	0.557 m/s	ζ : 1.0000	1 No.	0.017 m	
				m <sup>3</sup> /h	m/s	:	No.	m	
<b>Total</b>								1.316 m	

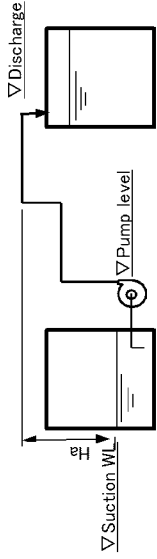
**Pipe losses calculation sheet**

Project : Bengaluru Water Supply and Sewerage  
 : Project (Phase III)  
 Location : Doddabidarakallu ISPS

Pump Name Sewage Pump Discharge 304 m<sup>3</sup>/h Altitude 849.000 m Total Head 34 mH > Total Hea 32.821 mH OK

Discharge WL FL+ 878.000 m Suction WL FL+ 851.000 m Pump Installation le FL+ 849.000 m Statific Head 27.000 mH

Specific Gravity ### Temperature 36 °C Saturated Vapor Pressur 0.604 m NPSHav 10.723 m > NPSHreq 8.000 m OK



No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	250 mm	Belmouth	DIP	304 m <sup>3</sup> /h	1.721 m/s	ζ : 0.1500	1 No.	0.025 m	
				m <sup>3</sup> /h	m/s	:	No.	m	Suction loss 0.025 m
<b>Discharge</b>									
1	250 mm	Pipe	DIP	304 m <sup>3</sup> /h	1.721 m/s	λ : 120.0000	2 m	0.027 m	
2	250 mm	Check Valve	DIP	304 m <sup>3</sup> /h	1.721 m/s	ζ : 1.5000	1 No.	0.245 m	
3	250 mm	Gate Valve	DIP	304 m <sup>3</sup> /h	1.721 m/s	ζ : 0.0470	1 No.	0.008 m	
4	250 mm	Pipe	DIP	304 m <sup>3</sup> /h	1.721 m/s	λ : 120.0000	3 m	0.040 m	
5	250 mm	T-shape	DIP	304 m <sup>3</sup> /h	1.721 m/s	ζ : 3.0000	1 No.	0.490 m	
6	600 mm	Pipe	DIP	1216 m <sup>3</sup> /h	1.195 m/s	λ : 120.0000	2000 m	4.908 m	
7	600 mm	Discharge	DIP	1216 m <sup>3</sup> /h	1.195 m/s	ζ : 1.0000	1 No.	0.079 m	
				m <sup>3</sup> /h	m/s	:	No.	m	
<b>Total</b>								<b>5.821 m</b>	



Pipe losses calculation sheet		Project : Bengaluru Water Supply and Sewerage	
		Project (Phase III)	
Location : Doddabidarakallu ISPS			
Pump Name	Sewage Pump	Discharge	304 m <sup>3</sup> /h
		Altitude	849.000 m
		Total Head (spec.)	34 mH
		Total Hea (result)	29.923 mH
		OK	
Discharge WL	FL + 878.000 m	Suction WL	FL + 849.000 m
		Pump Installation le FL +	27.000 mH
		Static Head	
Specific Gravity	###	Temperature	36 °C
		Saturated Vapor Pressur	0.604 m
		NPSHav	10.723 m
		NPSHreq	8.000 m
		OK	

No.	Diameter	Name	Material	Flow rate	Velocity	Coefficient	Number	Losses	Remarks
<b>Suction</b>									
1	250 mm	Belmouth	DIP	304 m <sup>3</sup> /h	1.721 m/s	ζ : 0.1500	1 No.	0.025 m	
				m <sup>3</sup> /h	m/s	:	No.	m	Suction loss 0.025 m
<b>Discharge</b>									
1	250 mm	Pipe	DIP	304 m <sup>3</sup> /h	1.721 m/s	λ : 120.0000	2 m	0.027 m	
2	250 mm	Check Valve	DIP	304 m <sup>3</sup> /h	1.721 m/s	ζ : 1.5000	1 No.	0.245 m	
3	250 mm	Gate Valve	DIP	304 m <sup>3</sup> /h	1.721 m/s	ζ : 0.0470	1 No.	0.008 m	
4	250 mm	Pipe	DIP	304 m <sup>3</sup> /h	1.721 m/s	λ : 120.0000	3 m	0.040 m	
5	250 mm	T-shape	DIP	304 m <sup>3</sup> /h	1.721 m/s	ζ : 3.0000	1 No.	0.490 m	
6	600 mm	Pipe	DIP	760 m <sup>3</sup> /h	0.747 m/s	λ : 120.0000	2000 m	2.057 m	
7	600 mm	Discharge	DIP	760 m <sup>3</sup> /h	0.747 m/s	ζ : 1.0000	1 No.	0.031 m	
				m <sup>3</sup> /h	m/s	:	No.	m	
<b>Total</b>								2.923 m	