Pressure Distribution, Orifice, Pipe & Pump Sizing

This design worksheet was developed by Alberta Municipal Affairs and Alberta Onsite Wastewater Management Association.

The completed installation is to comply with Alberta Private Sewage Standard of Practice 2015.

This worksheet is for use in Alberta to: size the orifices in distribution lateral pipes, size effluent delivery piping, and to calculate the required capacity and pressure head capability of the effluent pump.

It can be used for: calculating delivery of effluent to laterals in disposal fields, mounds and sand filters.

This worksheet does NOT consider all of the mandatory requirements of the Standard.

It is intended for use by persons having training in the private sewage discipline.

Note: Page numbers refer to the Private Sewage Systems Standard of Practice 2015.

Use only Imperial units of measurement throughout (feet, inches, Imperial gallons, etc…).

Step 1) Select the pressure head to be maintained at the orifices:

Minimum pressure at the orifice:
3/16" or less orifice = 5 ft. Minimum - 2.6.2.5 (1), (p 38)
larger than 3/16" orifice = 2 ft. Minimum - 2.6.2.5 (1) (p 38)

Design pressure at lateral orifices _____ **ft.** **P1**

Note: *worksheet will not provide an adequate design if laterals are at different elevations. Differing elevations will result in a different pressure head and volume of discharge at the orifices in each lateral. Additional considerations must be made for laterals at differing elevations.*

Step 2) Select the size of orifice in the laterals:

Minimum size: 2.6.1.5. (1)(e) p. 37 **1/8"**

Orifice Diameter selected _____ **in.** **P2**

Note: larger sizes are less likely to plug.

Step. 3) Select the spacing of orifices and determine the number of orifices to be installed in distribution laterals:

Length of Distribution Lateral From system design drawings		**Spacing of Orifices selected for design**		**Resulting number of orifices per lateral**	
_____	**ft.** ÷	_____	**ft.** =	_____	**P3a**

Select a spacing of orifices to attain even distribution over the treatment area:
Maximum spacings are determined for :
* 5 ft. Primary treated effluent: 2.6.1.5. (1)(e) p. 37
* 3 ft. Secondary treated effluent: 8.1.1.8 & 2.6.2.2 (c) (pp 77 & 38)
* 3 ft. On sandy textured soils: 8.1.1.8 (p. 77)

_____	X	_____	=	_____	**P3b**
From P3a		Number of Laterals		Total Number of Orifices All Laterals	

If laterals are of differing lengths, calculate each separately and add the number of orifices together.

Step 4) Determine the minumum pipe size of the distribution laterals:

Enter the system design information into the 3 boxes below. If distribution laterals are of differing lengths, each lateral must be considered separately.

Orifice Diameter		Length of Distribution Lateral		Total Orifices Each Lateral
	in.		ft.	
From P2		From System Design Drawings		From P3a

Use Table A.1.A. (pp 118 - 121) when applying the information entered in this step to determine the minimum size of the distribution lateral pipe.

Size of Distribution Lateral Pipe From Table A.1.A. _____ **in.** P4

Step 5) Determine the total flow from all orifices:

Total Number of Orifices in all laterals		Gal/min for each Orifice at Head Pressure Selected			Total flow from all lateral orifices		
	X		Imp. gal /min.	=		Imp. gal /min.	P5
From P3b		From Table A.1.B. (pp 122 & 123)					

Step 6) Select the type and size of effluent delivery pipe:

Use Tables A.1.C.1 to A.1.C.4 (pp 124 - 127) to aid in decision. A larger pipe will reduce pressure loss.

Type of pipe used for effluent delivery line	Pipe size selected		
		inch - NPS	P6

Choose a friction loss from Tables A.1.C.1 to A.1.C.4 in between the bolded lines to ensure a flow velocity between 2 to 5 feet per second. The pipe size selcted will affect the amount of friction loss the pump must overcome to deliver effluent.

Step 7) Calculate the equivalent length of pipe for pressure loss due to fittings:

Insert total from Worksheet "A" on last page (p.5) of this Pressure Distribution Worksheet

Equivalent Length of All Fittings _____ **ft.** P7

For Pressure Loss

Step 8) Calculate the equivalent length of pipe from pump to the farthest end of header of distribution laterals for pressure loss:

Length of Piping (ft)		Equivalent Length of Fittings (ft)		Length of Pipe for Friction Loss (ft)	
	+		=		P8
Length from pump to farthest end of distribution header supplying laterals.		Equivalent fitting length from **P7.**		Used to determine total pressure head loss due to friction loss in piping.	

Step 9) Calculate the pressure head loss in delivery pipe including fittings:

Total Length of Pipe for Friction Loss		Friction Loss per 100 feet of pipe		Delivery Piping Pressure Head Loss		
Divide by 100 ft.	x		**ft.** =		**ft.**	P9
From P8						
Don't forget to divide the length by 100 feet to match the factors in the tables.		Use Tables A.1.C. On pp 124 - 127 using flow volume from **P5.**				

Step 10) Calculate the total pressure head required at pump:

Delivery piping pressure loss		**ft.**	From **P9**
	+		
Lift distance of effluent from effluent level in tank to orifices		**ft.**	Measure from lowest effluent level in tank to elevation of orifices.
	+		
Design pressure at orifices		**ft.**	From **P1**
	+		
Head loss allowed if an inline filter is used in pressure piping		**ft.**	**Explain Pressure Loss Allowed if Applied**
	+		
Add 1 ft to allow for pressure loss along the distribution lateral	1	**ft.**	
Total minimum pressure head pump must provide at Imp. gal/min required to supply orifices		**ft.**	**P10**

Step 11) Select the size of the drain back orifice if used and determine the flow from the drain back orifice. Then calculate total flow requirement for pump:

Size of Drain Back Orifice		Determine flow using Head Pressure at Drain Back Orifice			Flow from all lateral orifices			Total Imp. Gallons per Minute from the pump		
	in.		Imp. gal /min	+		Imp. gal /min	=		Imp. gal /min	P11
		Use pressure head from P10 to find flow from Extended Table A.1.B.1			From P5					

Step 12) Details of the pump specifications required:

Required Flow Rate (Imp. gal/min)		Required Pressure Head (ft)
	@	
From P11		From P10

Imp. gal (P11) multiplied by 1.2 = U.S. gallons

Required Flow Rate (US gal/min)

Select the appropriate pump by reviewing the pump curve of available pumps. Select a pump that exceeds the requirments set out in this step by approximately 10% considering both pressure head and volume.

Step 13) Consider the pumping demands of the system. If they are considered excessive, redesign the pressure distribution system and recalculate the pump demands.

Worksheet "Appendix A" Determine Equivalent Length of Pipe due to fittings in piping system.

Determine the equivalent length of pipe to allow for friction loss due to fittings in the piping system:

	Number of Fittings		Friction loss as per Table A.1.C.5 or 6 (p. 128)		Total
90° Elbows		X		=	
				+	
45°Elbows		X		=	
				+	
Gate and Ball Valves		X		=	
				+	
Tee-on-Branch (TOB)		X		=	
				+	
Tee-on-Runs (TOR)		X		=	
				+	
Male Iron pipe Adaptors (MIP) (M/F Threaded Adaptors)		X		=	
				=	

Total Equivalent Length of pipe to allow for fittings in piping system **(Enter this total, Box P7)**