Appendix A: Pressurized Distribution Design Worksheet

Please enter the results of your calculations for each step.

Absorption Area Design

Absorption Area Design Notes:	Step:
For **residential systems**, determine the number of bedrooms for design. For **non-residential systems**, determine the number of gallons per day using guidance from R317-4. For **absorption systems** and **mound systems**, use 150 gallons per day per bedroom. For **packed bed systems**, use: A minimum of 300 gallons per day for two bedrooms 100 gallons per day for each additional bedroom.	1. **Daily flow rate** **Number of bedrooms:** ______ **Total gallons per day:** ______
For pressurized trenches for residential and non-residential systems **absorption system soil loading rate**, select the loading rate using guidance from R317-4 For pressurized distribution over **media in alternative treatment systems** consider the following (maximum) loading rates: For **mound systems**, use 1.0 gal/sq. ft./day For **packed bed systems**, select from: Intermittent sand filter: Sand media = 1.0 gal/sq. ft./day; Sand fill = 1.2 gal./sq. ft./day Recirculating sand filter = 5.0 gal/sq. ft./day Recirculating gravel filter: 15.0 gal/sq. ft./day Textile filter: 30.0 gal/sq. ft./day Peat filter: 5.0 gal/sq. ft./day Synthetic polystyrene media: 21 gal/sq. ft./day Synthetic open cell foam media: 20 gal/sq. ft./day and 6 gal/cu. ft./day	2. **Maximum loading rate** ______ **gal/sq. ft./day**

<table>
<tr><th>Absorption Area Design Notes:</th><th>Step:</th></tr>
<tr><td>Daily flow rate (from Step 1)/maximum loading rate (from Step 2) = required treatment absorption area.

For all soil absorption pressurized trenches, use absorption area soil loading rates found in sizing tables from R317-4

For absorption systems after packed bed systems, use absorption area sizing tables from R317-4 and allowable reduction factors.

For mound systems, use values of A (absorption area width) and B (absorption area length) from Mound Design Worksheet

For packed bed systems, use media loading rate to size required media treatment area.</td><td>3. Required absorption treatment area

______ sq. ft.</td></tr>
<tr><td>For pressurized trenches and packed bed systems, use:

Length x width = absorption treatment area

The layout will be dependent on the characteristics of the specific site.

For mound systems, use the values of A and B from the Mound Design Worksheet (available from the Utah On-Site Wastewater Treatment Training Program).

Sketch should include critical system details:
- Sizing dimensions (length, width)
- Pipe layout (number of laterals, pipe spacing)
- Piping (diameter, orifice diameter, orifice spacing)
- Manifold (diameter, length, orientation)
- Forcemain (diameter, length)
- Etc.</td><td>4. Sketch a proposed absorption treatment area for the system being designed, using the required absorption area</td></tr>
</table>

Pressure Network Design

Pressure Network Design Notes:	**Step:**
Select based on system layout configuration and pump calculations. 1/8 inch – Used on all **alternative systems & pressurized trenches** 5/32 inch – Common in **pressurized trenches** 3/16 inch – Common in **mounds** or **pressurized trenches** 1/4 inch – Historically used in **mounds** (but generally not recommended for use in pressurized system design).	**5. Orifice diameter** **______ inch**
Select the squirt height using orifice diameter (Step 5) 1/8 inch: 5 ft (≥3 ft ok for inspection) 5/32 inch: 4 ft. (≥2 ft ok for inspection) 3/16 inch: 3.5 ft. (≥2 ft ok for inspection) 1/4 inch: 2.5 ft. (≥2 ft ok for inspection)	**6. Minimum squirt height** **______ ft.**
Determine the orifice flow rate (See Appendix B *Table B-5: Orifice flow rates*) using the orifice diameter (Step 5) Examples of orifice flow rates include: 1/8 inch with 5 ft squirt = 0.41 gpm 5/32 inch with 4 ft squirt = 0.58 gpm 3/16 inch with 3.5 squirt = 0.78 gpm 1/4 inch with 2.5 ft squirt = 1.17 gpm	**7. Orifice flow rate in gallons per minute (GPM)** ______

Pressure Network Design Notes:	Step:
Select the orifice spacing: **Mounds** 1 orifice/6 – 9 ft^2 Preferred, < 12 ft^2 recommended **Intermittent sand filter** 1 orifice/2 – 4 ft^2 Typical, < 4 ft^2 preferred **Recirculating sand filter, recirculating gravel filter, textile filter** 1 orifice/1 – 2 ft^2 Typical, < 4 ft2 preferred For **pressurized trenches** 1 orifice / 2 to 6 Lineal feet along trench (based on pump calcs)	**8. Orifice spacing** **______ ft.**
Based on orifice spacing and shape of distribution area (from Step 4 sketch), determine number and length of laterals: **Number of laterals** is all laterals in the system **Number of laterals dosed by pump** is the number of laterals dosed when the pump runs. It is the same as above when zones are not used. It is the number of laterals within the zone when zones are used. This number is used for determining the design flow rate of the pump in Step 14. **For end feed**: lateral length = Absorption length minus 0.5 to 1 foot **For center feed**: lateral length = Absorption length divided by 2 minus 0.5 to 1 foot Laterals should extend to within 6 inches to 1 foot of the end of the absorption area. The distance from the laterals to the edge of the infiltrative area should be 6 inches to 1 foot for bed areas and 1 foot to 1.5 feet for trenches.	**9. Number and length of laterals** **Number of laterals:** **______** **Number of laterals dosed by pump** **______** **Length of laterals** **______ ft.** **Add the laterals to the sketch in Step 4**

<table>
<tr><th>Pressure Network Design Notes:</th><th>Step:</th></tr>
<tr><td>From Step 8 and Step 9:

Number of orifices = (lateral length/orifice spacing) + 1

If the calculation results in a fraction, add the one then disregard the fraction.</td><td>10. Number of orifices in each lateral

______</td></tr>
<tr><td>From Step 7 and Step 10:

(Orifice flow rate) x (Number of orifices)</td><td>11. Lateral flow rate

______ GPM</td></tr>
<tr><td>Size the lateral diameter to ensure flow within the lateral is within 10%.

Use orifice diameter from Step 5.

Use Graphs B1 through B8 in Appendix B to determine minimum lateral diameters:

Use Graph B-1A or B-1B for 1/8 inch orifice

Use Graph B-2A or B-2B for 5/32 inch orifice

Use Graph B-3A or B-3B for 3/16 inch orifice

Use Graph B-4A or B-4B for 1/4 inch orifice</td><td>12. Lateral sizing

______ in.</td></tr>
<tr><td>Determine lateral head loss using Method 1 or 2:

Method 1: Use 1/3 of the squirt height from Step 6:

(squirt height) x (0.33)

Method 2: Calculate the head loss based on solid pipe 1/3 the length of the perforated lateral from Step 9, using the lateral flow rate from Step 11 and the diameter of the lateral from Step 12. See Appendix B Table B-6, Frictional Head Loss per 100 feet of Solid Pipe.</td><td>13. Lateral head loss

______ ft.</td></tr>
<tr><td>Calculate flow rate from all laterals dosed at one time. This will be the total flow rate for all laterals or all laterals within a zone:

(No. of laterals from Step 9) x (Lateral flow rate from Step 11) = Design Flow Rate.</td><td>14. Design flow rate

______GPM</td></tr>
</table>

Pressure Network Design Notes:	Step:
Determine the size of the manifold using Method 1 or 2: **Method 1:** Use the same size pipe used for the force main in Step 18. **Method 2:** Use **½ of the total design flow** from Step 14 to calculate the head loss within the manifold. Calculate for multiple pipe sizes then select best fit. Use Appendix B *Table B-6: Frictional Head Loss per 100 feet of Solid Pipe.* Select an "acceptable" head loss - usually select the smallest possible pipe that works for pump selected. Manifold head loss should be <40% of total dynamic head (TDH) from Step 23.	**15. Manifold sizing** **______ in.**
Based on pipe sized selected in Step 15. Use the head loss calculated during manifold pipe size selection process in Step 15.	**16. Manifold head loss** **______ ft.**
Length of pipe from the pump discharge to the beginning of the manifold (site-specific). Add manifold length if Method 1 was selected in Step 15.	**17. Force main length** **______ ft.** **Manifold Length** **______ ft.** **Total Length** **______ ft.**
Use Appendix B *Table B-6: Frictional Head Loss per 100 feet of Solid Pipe* to determine the pipe diameter. Pick a pipe diameter with an acceptable range of head loss. May be an iterative process.	**18. Force main diameter** **______ in.**

Pressure Network Design Notes:	Step:
Based on Step 18, use head loss for pipe size selected.	**19. Head loss in force main** **______ ft.**
Estimate additional head loss for fittings, valves, etc. Use Method 1 or 2 **Method 1:** Use 50% of the force main head loss from Step 19 to account for fittings, valves, etc. **Method 2:** Determine the “equivalent” pipe lengths for fittings, valves, etc. and determine the head loss from Appendix B *Table B-7: Frictional losses through plastic fittings.*	**20. Miscellaneous head loss** **______ ft.**
Determine the head loss through automatic distributing valve. This information is usually supplied by the manufacturer.	**21. Head loss for systems with multiple zones (if used)** **______ ft.**
The vertical distance (elevation difference) from the water level in the pump tank to the water level at the discharge point (site-specific).	**22. Elevation head difference** **______ ft.**

Pressure Network Design Notes:	Step:
To determine the Total Dynamic Head (TDH), add together: Squirt Height (Step 6) ___________ Lateral Head Loss (Step 13) ___________ Manifold Head Loss (Step 16) ___________ Force Main Head Loss (Step 19) ___________ Miscellaneous Head Loss (Step 20) ___________ Zone Valve Head Loss (Step 21) ___________ Elevation head difference (Step 22) ___________ Result in feet = TDH ___________	**23. Total Dynamic Head (TDH)** **______ ft.**
Design Flow Rate (Step 14) gpm___________ Total Dynamic Head (Step 23) ft.___________	**24. Pump Selection** **USE PUMP CURVES TO SELECT THE CORRECT PUMP**
The dose volume should not exceed 10% of the daily design flow. Smaller dose volumes are preferred. 1/48 – 1/24 preferred (based on one dose per half hour or hour) For systems that drain back to the pump tank after each cycle, the volume of the force main should be added to the dose volume. Pipe volumes are calculated using Appendix B *Table B-8: Void volume for various diameter pipes.*	**25. Dose Volume** **System Dose Volume** **______ gal.** **Pipe Volume** **______ gal.** **Total Dose Volume** **______ gal.**

Pressure Network Design Notes:	Step:
Using the total dose volume from Step 25 and the design flow rate from Step 14, determine the pump run time per dose From Step 25 and Step 14 (total dose volume) / (design flow rate)	**26. Pump Dose Run Time** **______ min**