Onsite Wastewater Mega-Conference

2023
Hampton, Virginia

NOWRA
National Onsite Wastewater Recycling Association

NAWT
National Association of Wastewater Technicians

SORA
State Onsite Regulators Association

VOWRA

The Onsite Event of the year!

The following presentation represent the views and opinions of Onsite Wastewater Professionals and NOT NOWRA

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Beyond the Distribution Box

Pressure Manifolds - For Precise Distribution

Onsite Wastewater Professionals

Beyond the Distribution Box

Agenda

- Why Precise Distribution Matters
- Distribution Boxes Exposed
- Pressure Manifold
  - Defined
  - Function
  - Construction
- Pressure Manifold O&M
- Pressure Manifold Design
  - Tools and Techniques

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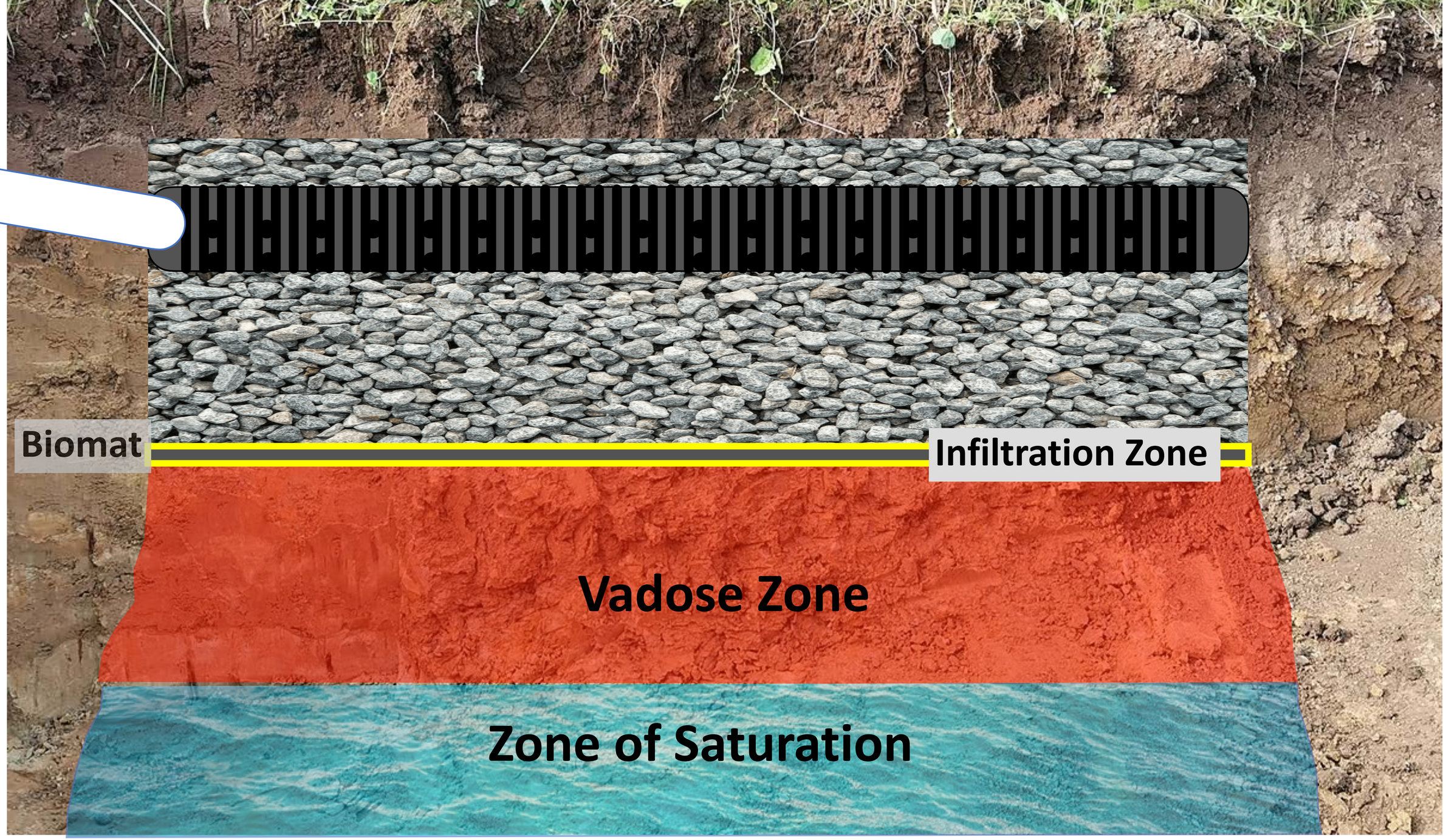
Why Does Precise Distribution Matter?

- Uneven Distribution Leads to
  - Hydraulic Overloading of Portions of the Trench
  - Organic Overloading of Portions of the Trench
    - Increases pounds of BOD per ft2 of trench bottom
- Increases in the Rate of Biomat Growth
- Premature Drainfield Failure

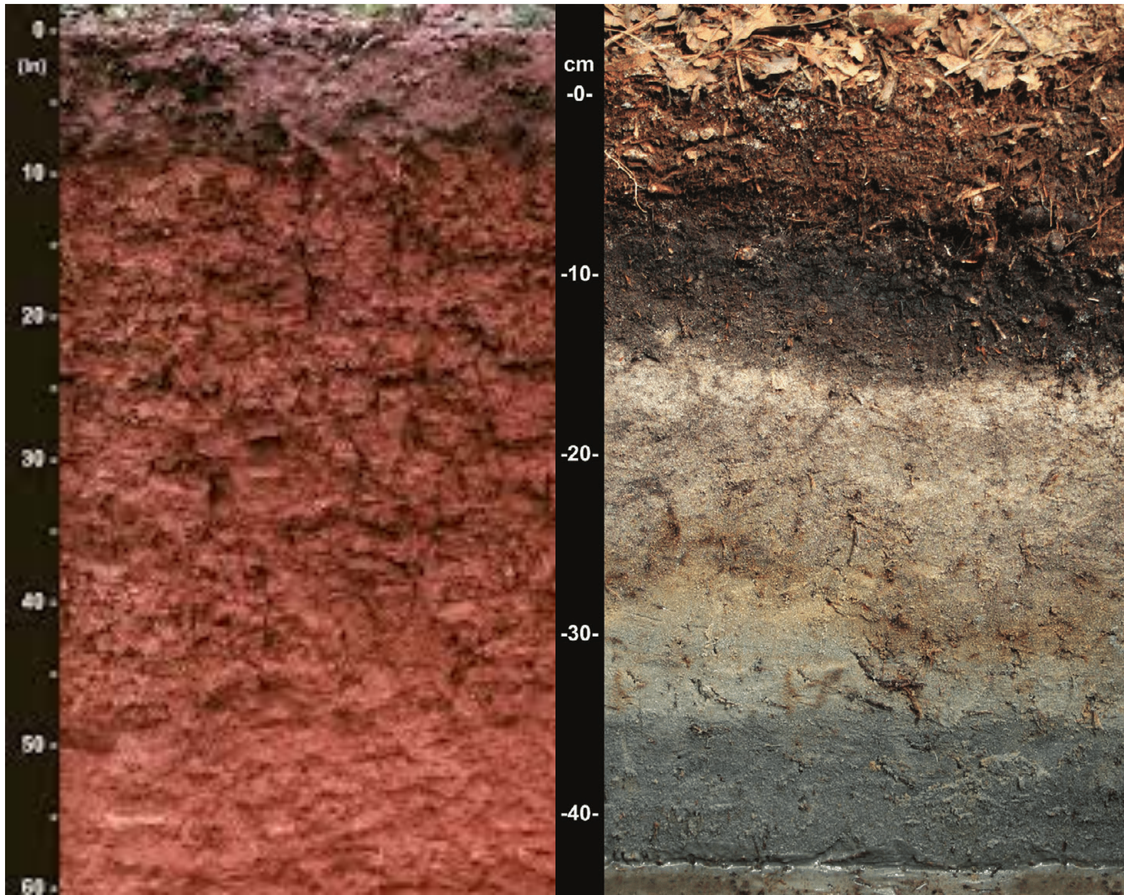
Factors Contributing to Biomat Growth

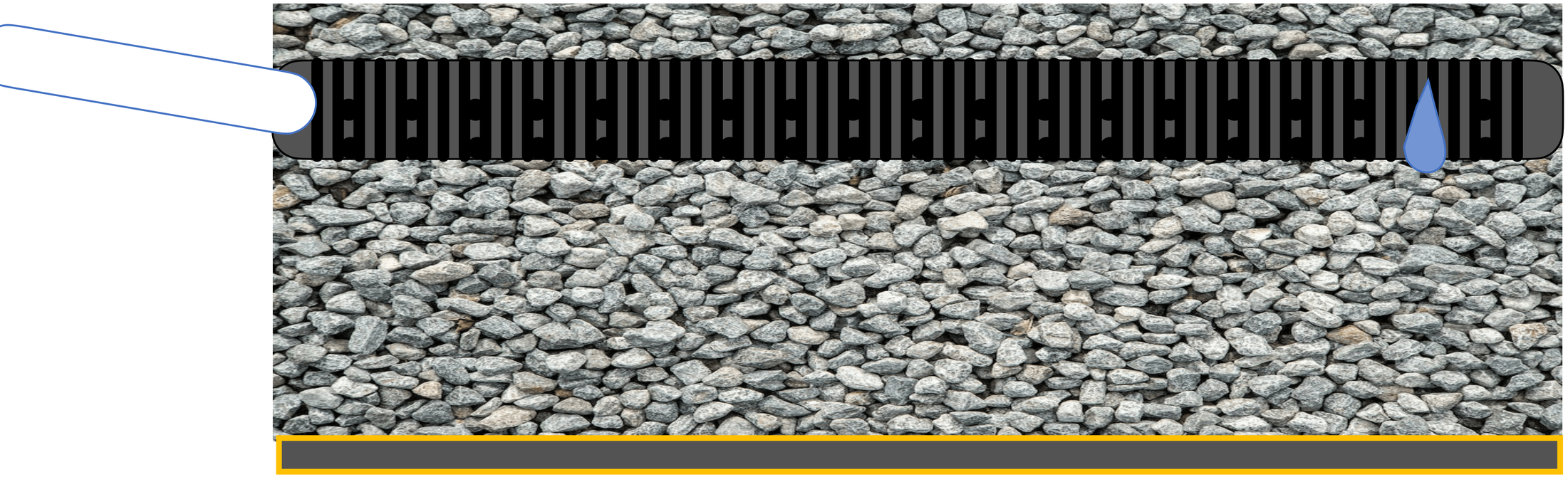
- Uneven Distribution
    - Hydraulically and organically overload portions of the trench
- Lack of Dose and Rest Cycles
    - Periodic return of Aerobic conditions = critical to deter rapid growth of biomat

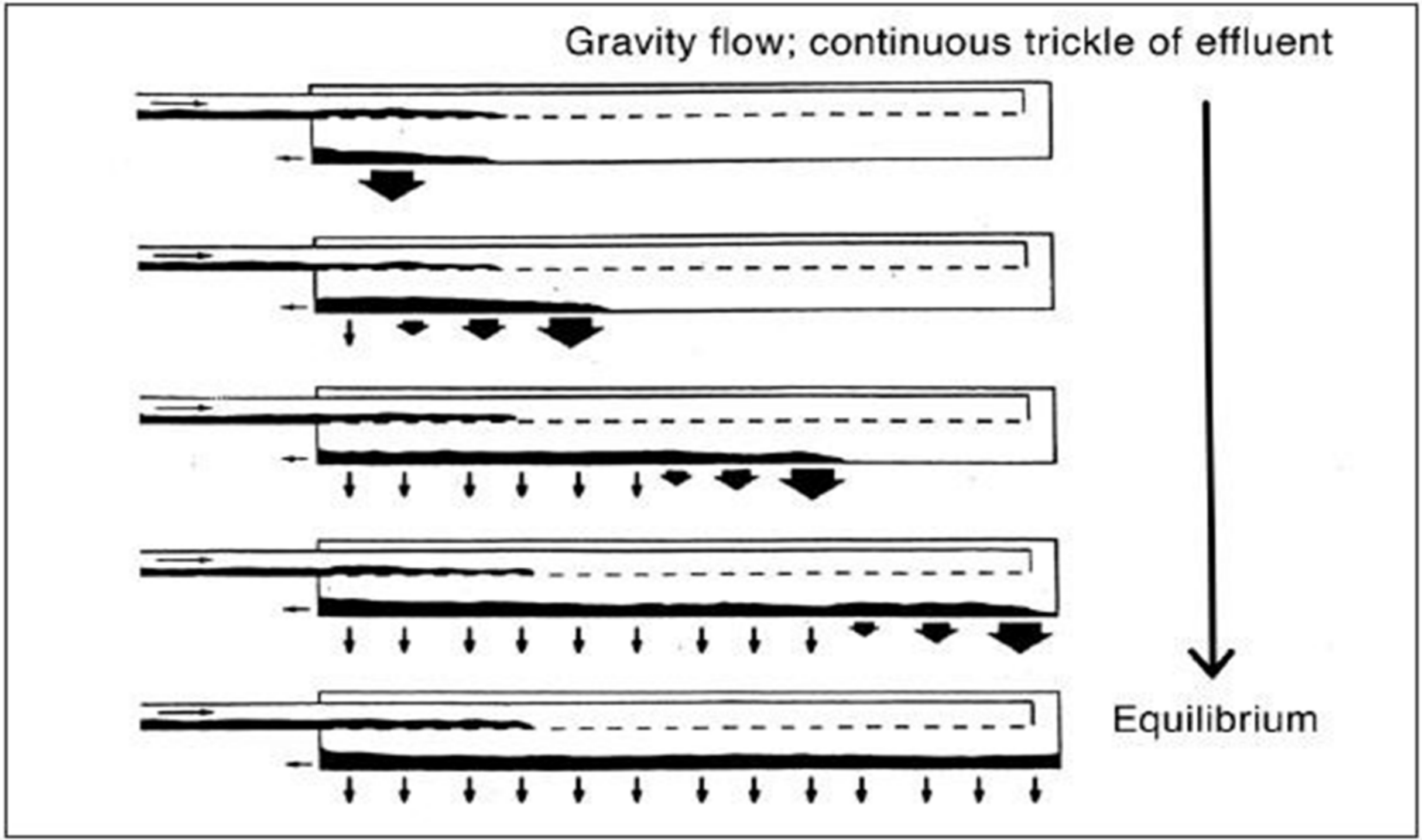

Biomat
Infiltration Zone
Vadose Zone
Zone of Saturation

Understanding Soil Treatment Zones

- **Vadose Zone**
  - Unsaturated conditions beneath the trench
    - Aerobic Conditions
    - Aerobic Bacteria
  - Pathogens and Organics Reduced
    - Predation
    - Adsorption
    - Nutrient Cycling
    - Anaerobe Die OFF






Gravity flow; continuous trickle of effluent
Equilibrium

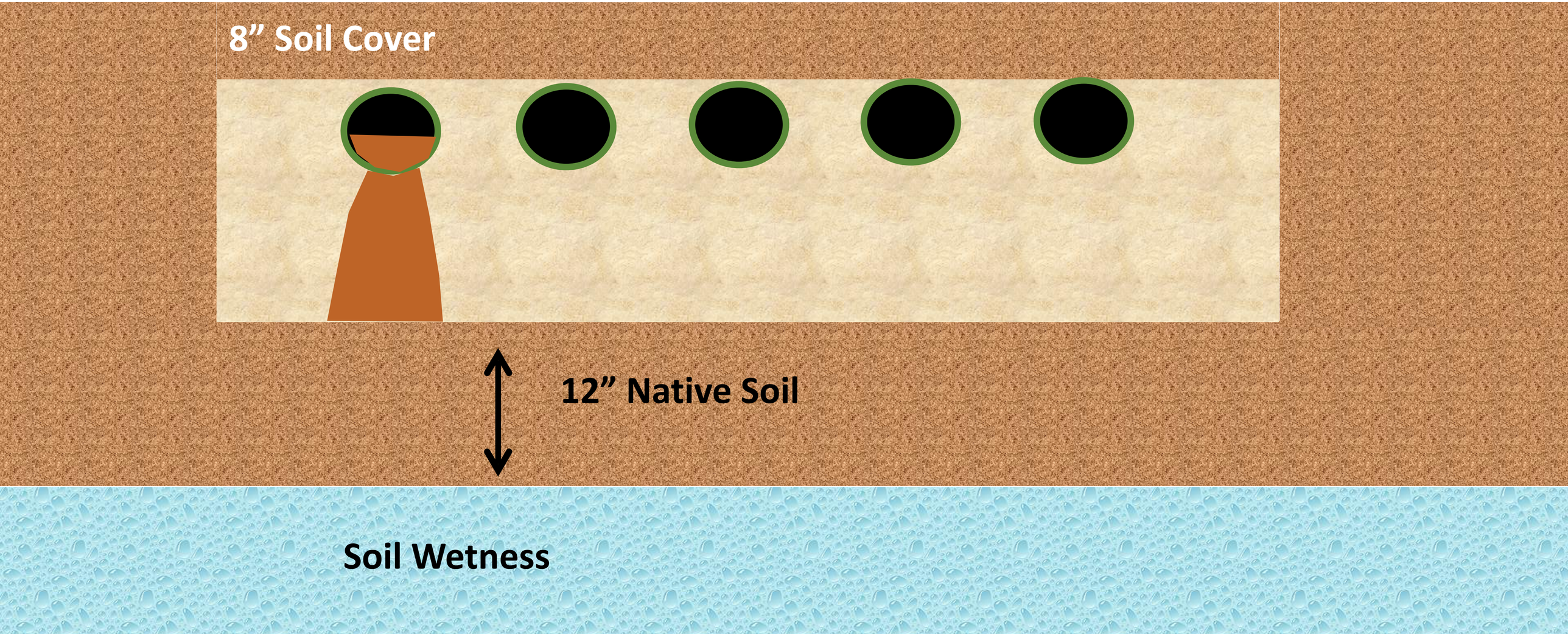
Impact of Distribution on Trench Bottom

- **Serial Distribution**
  - Throw away all your work to appropriately assign an LTAR
  - Concentrates flow
  - Maintains saturated conditions at beginning of trench

Impact of Distribution on Trench Bottom

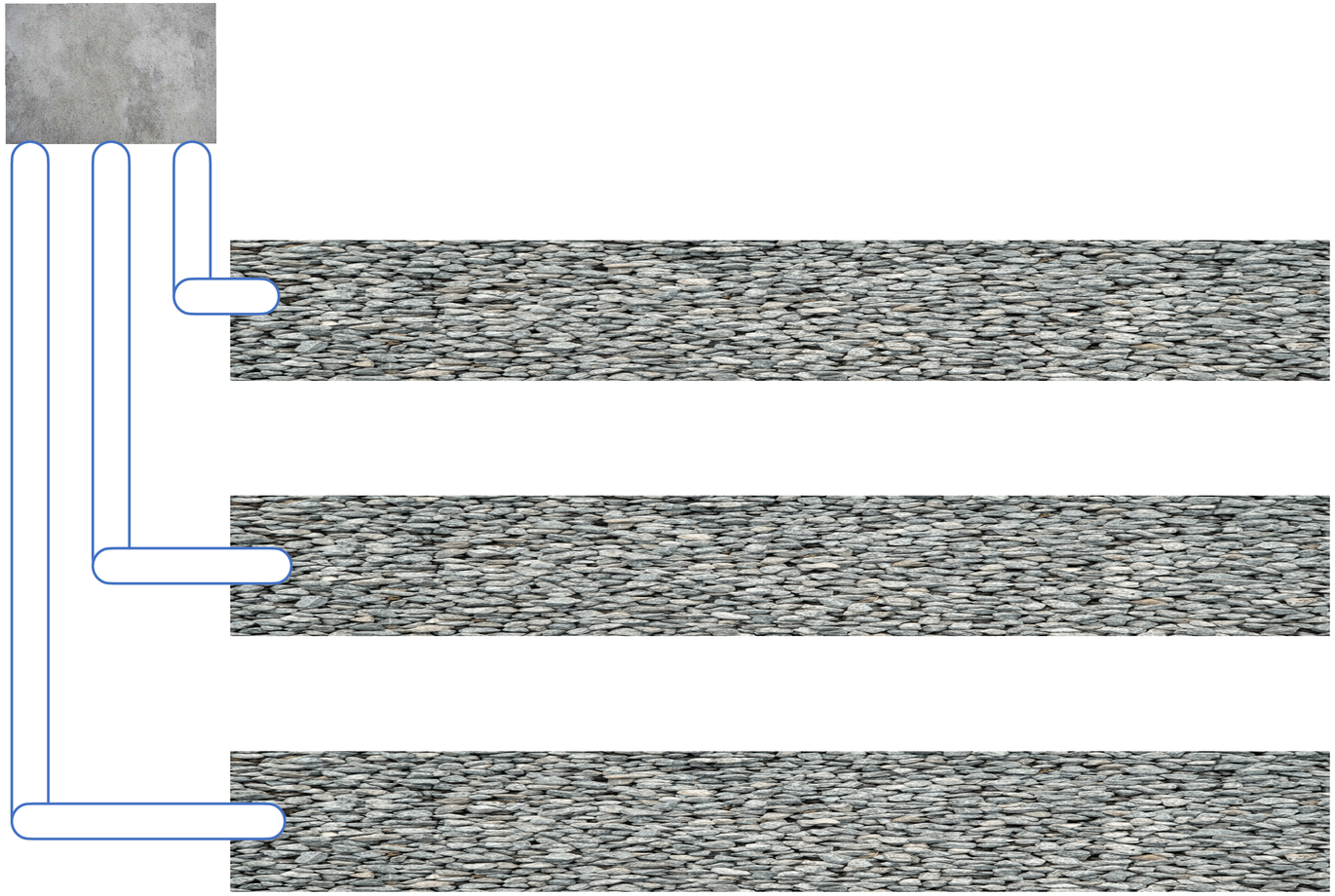
- **Serial Distribution**
  - Combined Treatment and Disposal (Sand Filters)
  - 80 years of research
  - Channelized flow = Fail
  - Must distribute across surface area

Presby AES in Native Soil

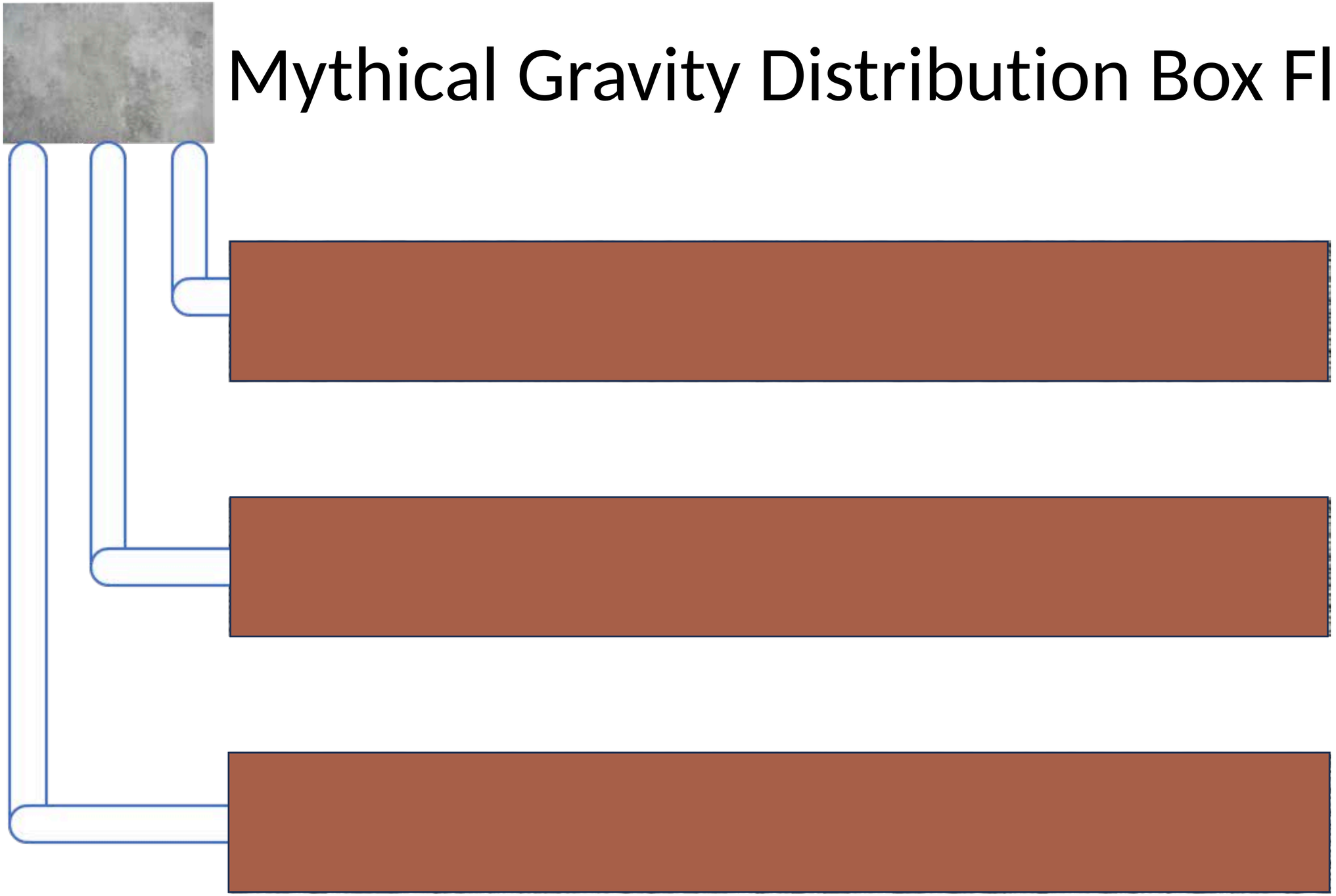


Impact of Distribution on Trench Bottom

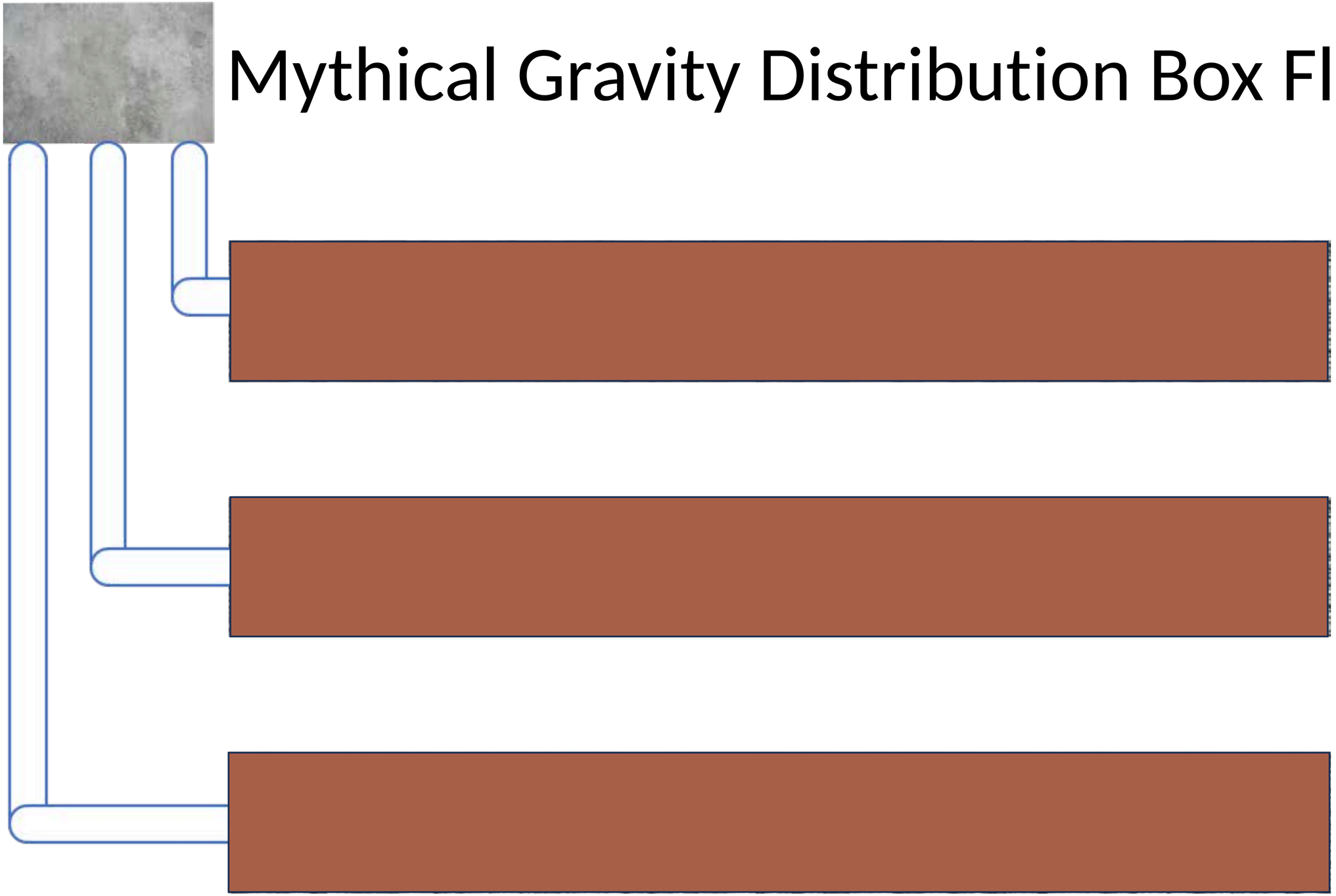
- **Parallel Distribution**
  - Gravity to Dbox = Mythical Distribution
  - Socialism for Septic Systems



Mythical Gravity Distribution Box Flow



Mythical Gravity Distribution Box Flow



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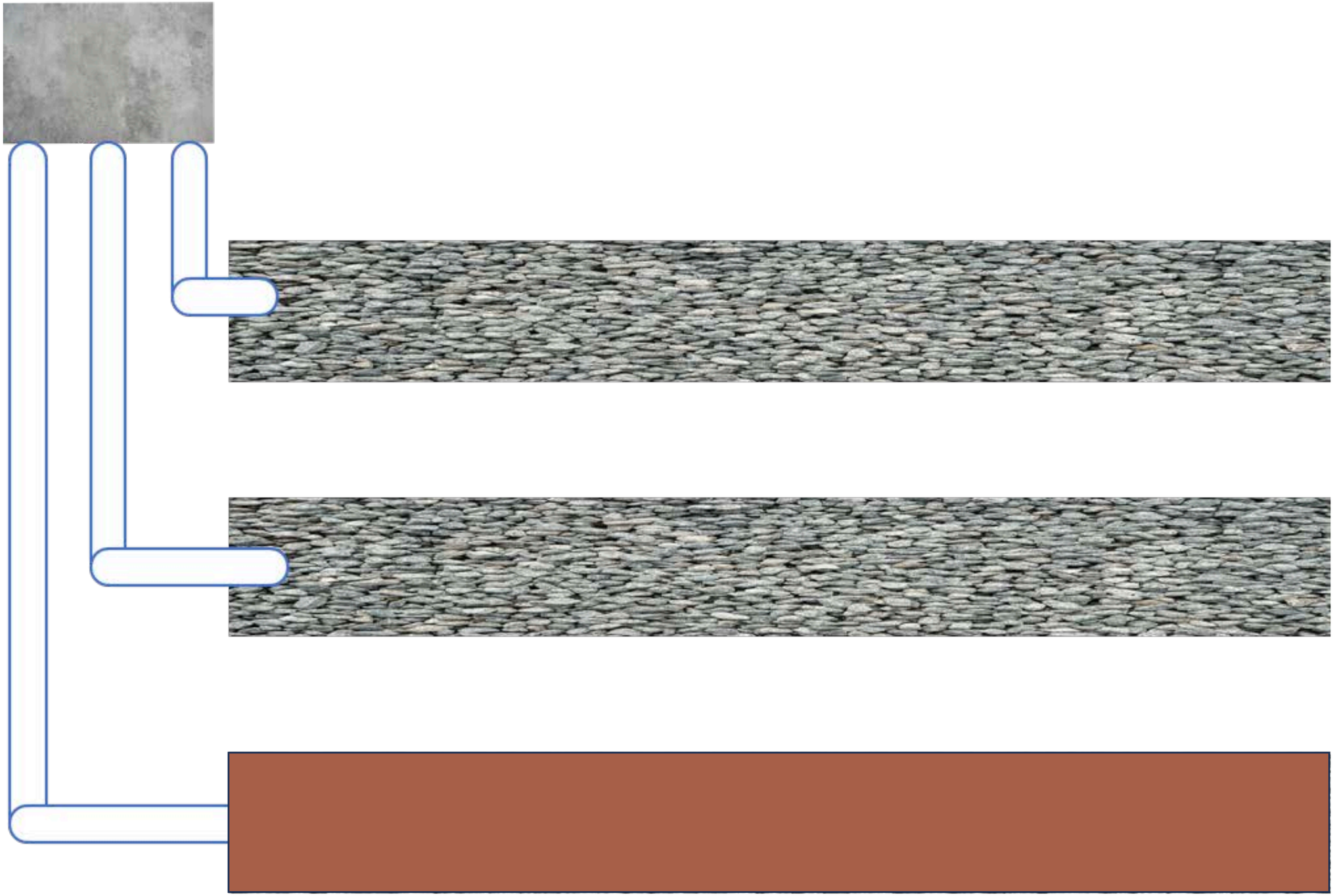
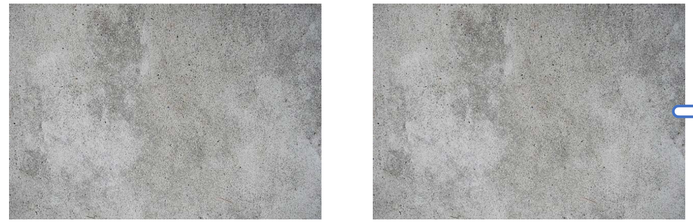
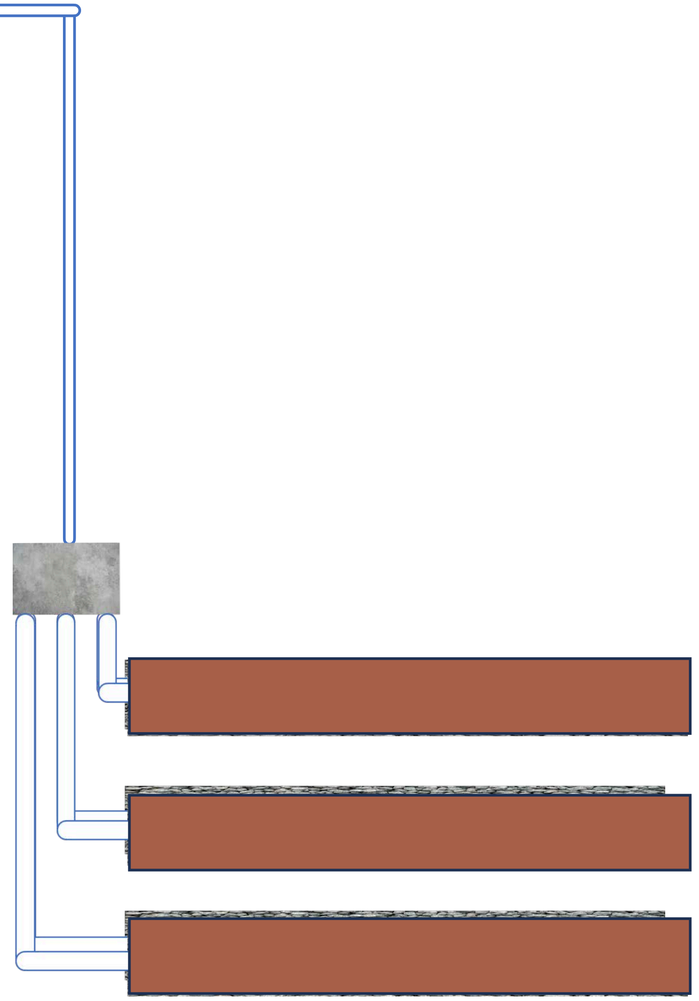


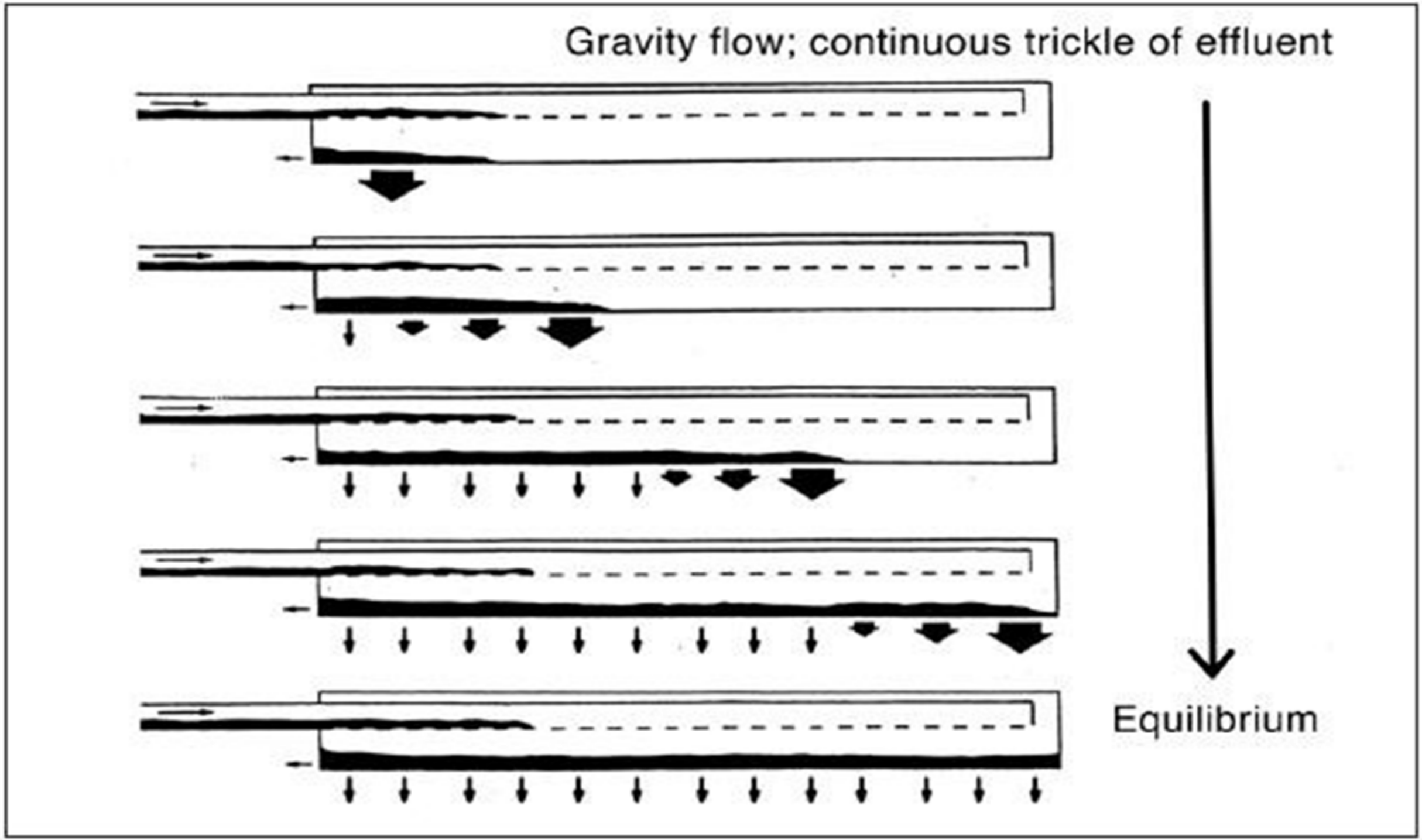
Impact of Distribution on Trench Bottom

- **Pressure Distribution**





  - The only way to get reliable uniform distribution
  - LTAR’s are real
  - Dose and rest cycles
    - Media Filters
    - Nature
  - Achieve and maintain biomat equilibrium


Gravity flow; continuous trickle of effluent
Equilibrium

Beyond the Dbox

Distribution Box Limitations

- Roots
- Groundwater
- Decay / Distortion
- Not capable of dosing laterals of different length
- Lack Accuracy and Control

Beyond the Distribution Box

Pressure Manifolds Defined

- **What is a pressure manifold?**
  - A device to accurately control the flow of effluent
  - A simple distribution device that allows effluent flow to be precisely regulated by adjusting the head pressure
  - A pressurized section of pipe with one or more smaller outlets (taps)
  - System is dosed with pressure but distribution is accomplished l

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Beyond the Distribution Box

Pressure Manifolds Basic Function

- **How Do Pressure Manifolds Achieve Precise Distribution**

  - Effluent is pumped into a section of larger diameter pipe (3” to 6”)
  - Effluent is placed under a measured amount of pressure, typically 2-5’
  - A series of smaller diameter outlet pipes restrict / control the flow of effluent that is then directed to the head of each lateral / trench
  - A formula for the flow of effluent through an orifice or hole is used the flow based on the inside diameter of the outlet pipe (tap)

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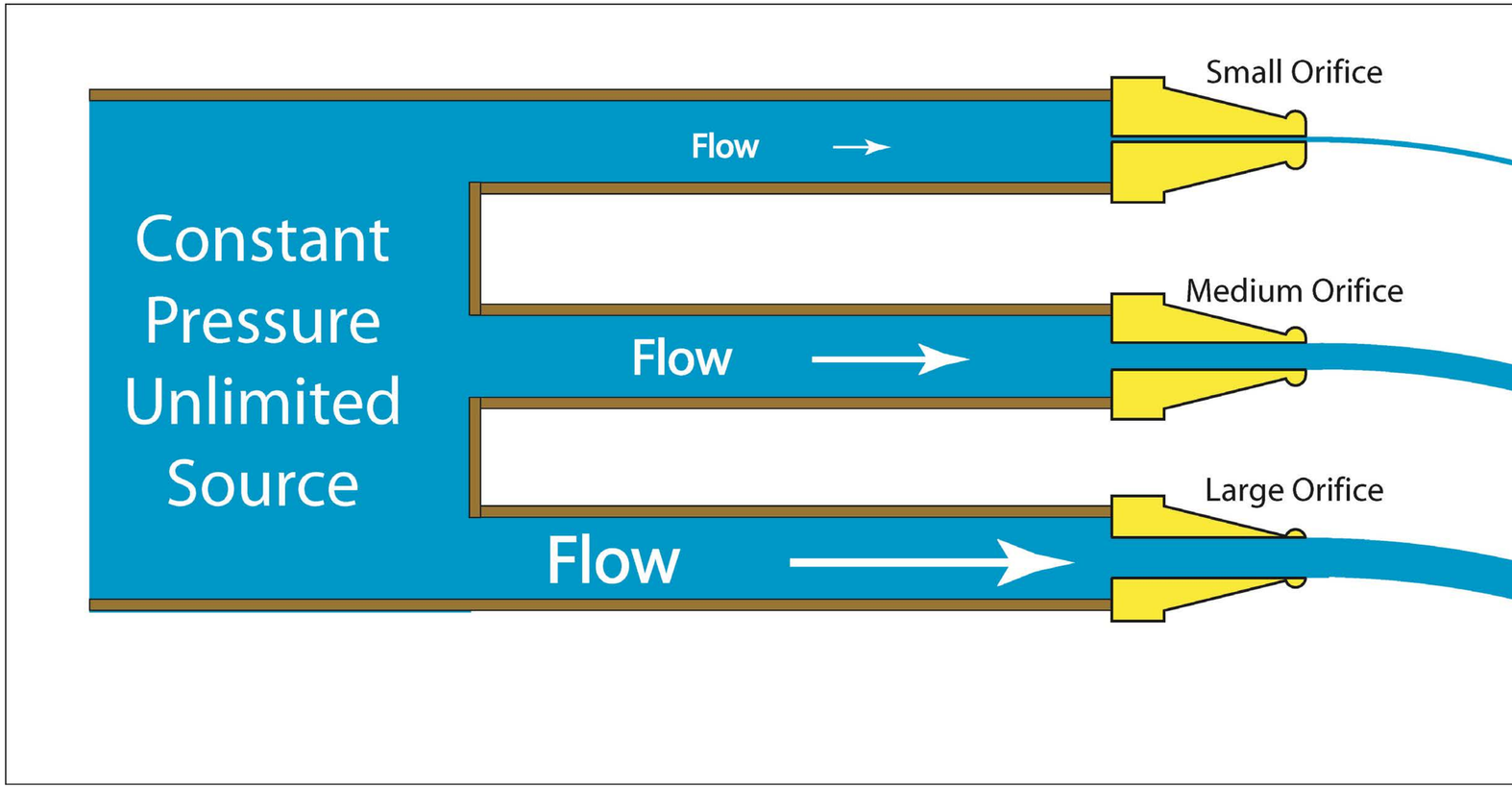
Pressure Manifold

Function

- $Q = 13 \times d^2 \times h^{1/2}$
- Where Q = flow per orifice (gpm)
- d = diameter of orifice (inches)
- h = Pressure Head (feet)



Pressure Manifold

Function

Sch 80 PVC

Head (ft)	½ -inch (.546)	3/4-inch (.742)	1-inch (.957)
1.5	4.75	8.77	14.6
2	5.48	10.1	16.8
2.5	6.13	11.3	18.8
3	6.71	12.4	20.6
3.5	7.25	13.4	22.3
4	7.75	14.3	23.8

Pressure Manifold

Function

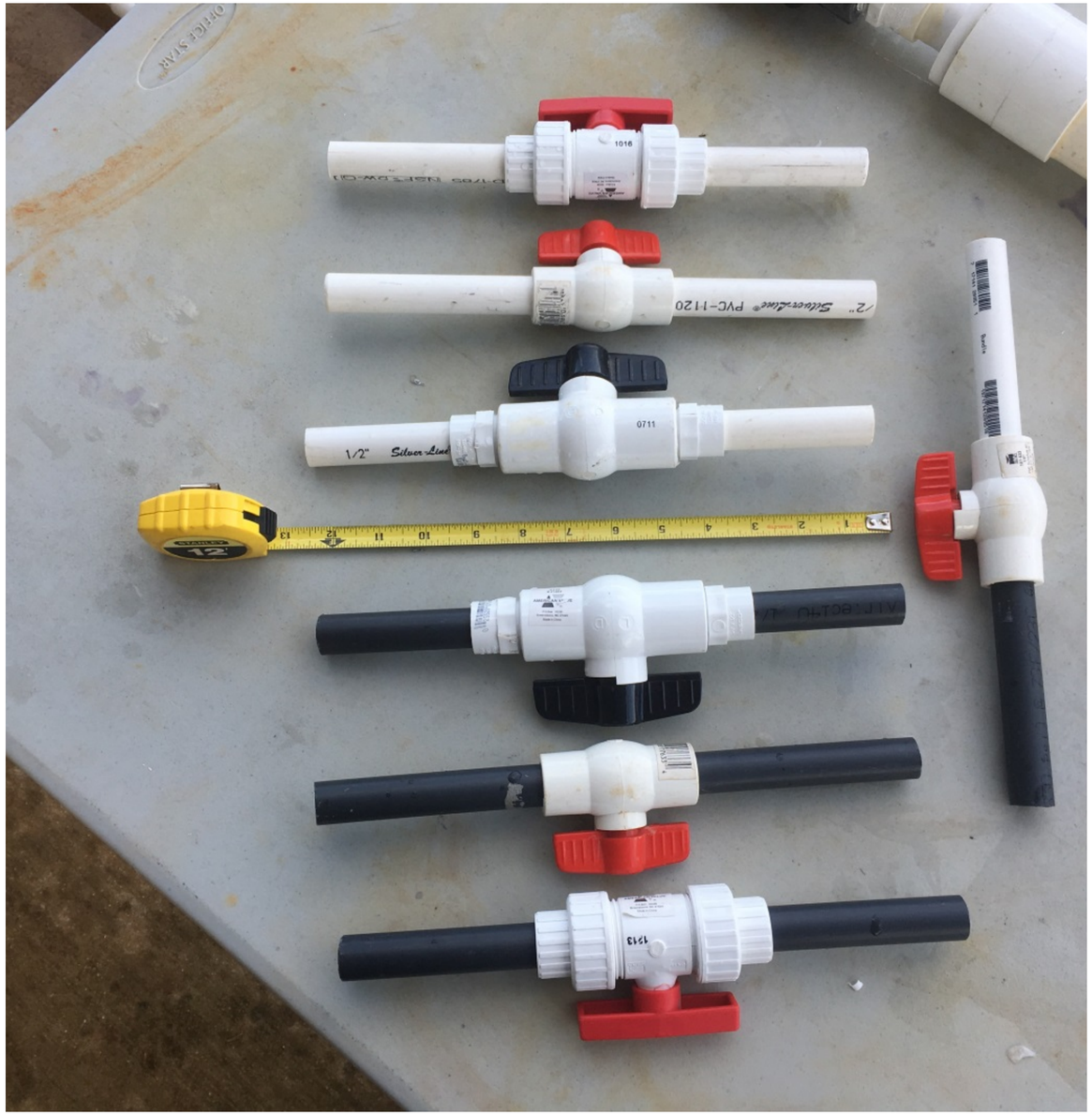
Sch 40 PVC

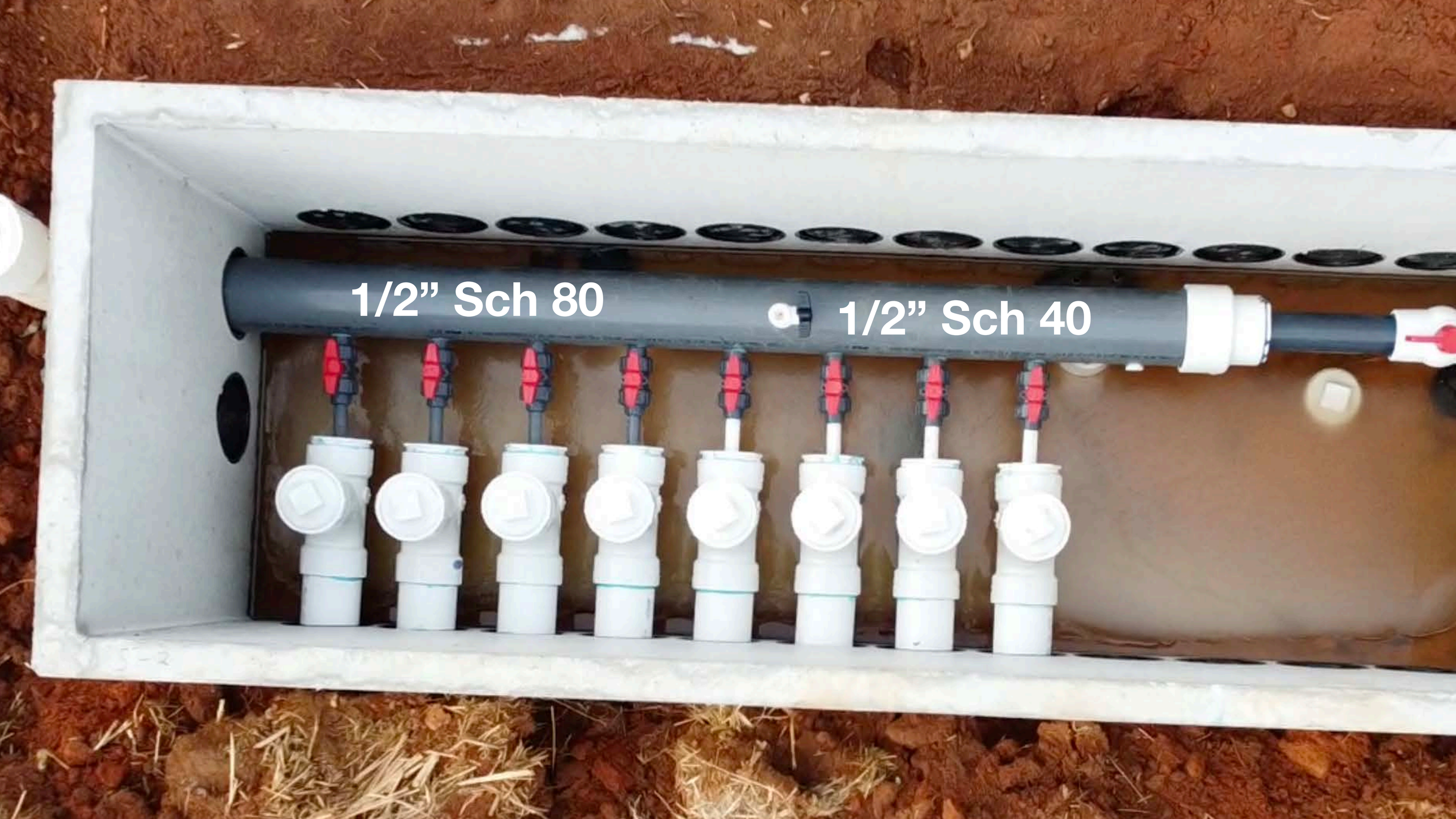
Head (ft)	½ -inch (.622)	3/4-inch (.824)	1-inch (1.049)
1.5	6.16	10.8	17.5
2	7.11	12.5	20.2
2.5	7.95	14.0	22.6
3	8.71	15.3	24.8
3.5	9.41	16.5	26.8
4	10.1	17.7	28.6

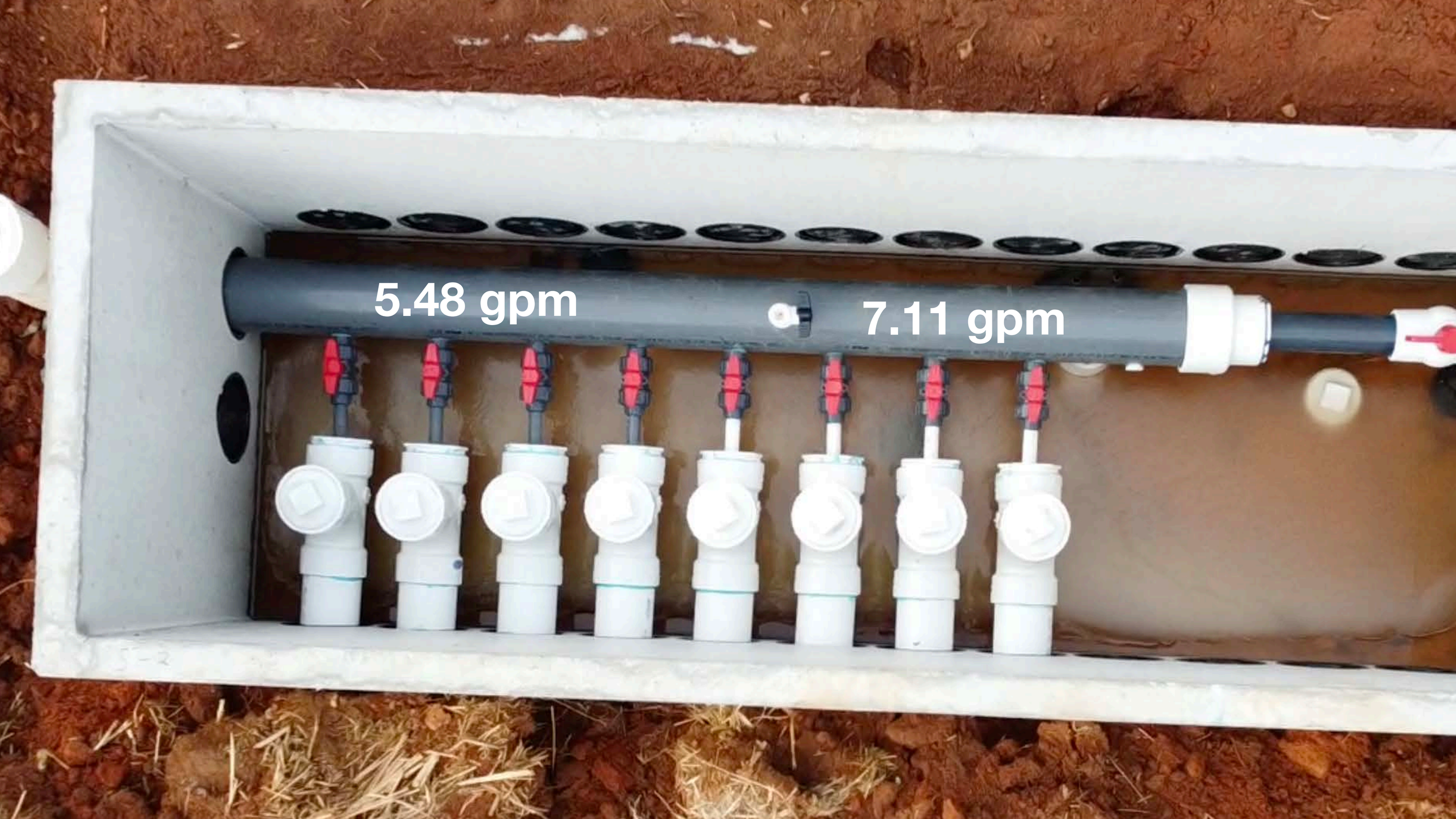
Pressure Manifolds

Function

- Taps
  - Sch 80 or Sch 40
  - 1/2”, 3/4”, 1”…
- Flow Increases as
  - Orifice size increases
  - Pressure Increases




1/2” Sch 80
1/2” Sch 40


5.48 gpm
7.11 gpm

Pressure Manifold

Variations

- Drilled & Tapped
  - Sch 80 PVC
  - Threaded PVC Taps
  - In a Concrete or Fiberglass Vault
  - Taps on One or Both Sides of Manifold

Pressure Manifold

Variations

- Series of PVC Tees “Mani-tee”
  - Sch 40 PVC Tees

Pressure Manifold

Required Components

Pressure Regulating Valve

- Pressure Regulating Valve can be either:
  - Inside the Manifold Box
    - Or
  - On the supply line immediately preceding the pressure manifold

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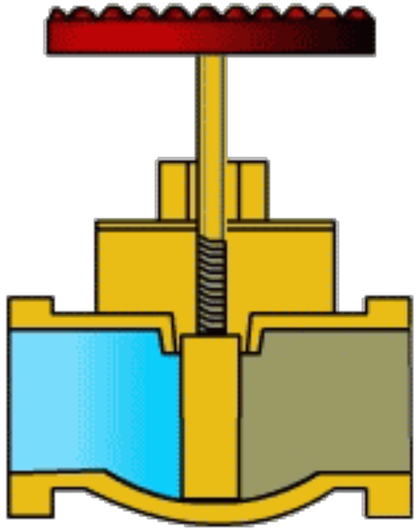
Pressure Manifolds

Required Components

- The pressure regulating valve should be a gate valve
- Not a ball valve
- Should be 1/2 size smaller than supply line in most cases.



Gate Valve Closed

Gate Valve Opened

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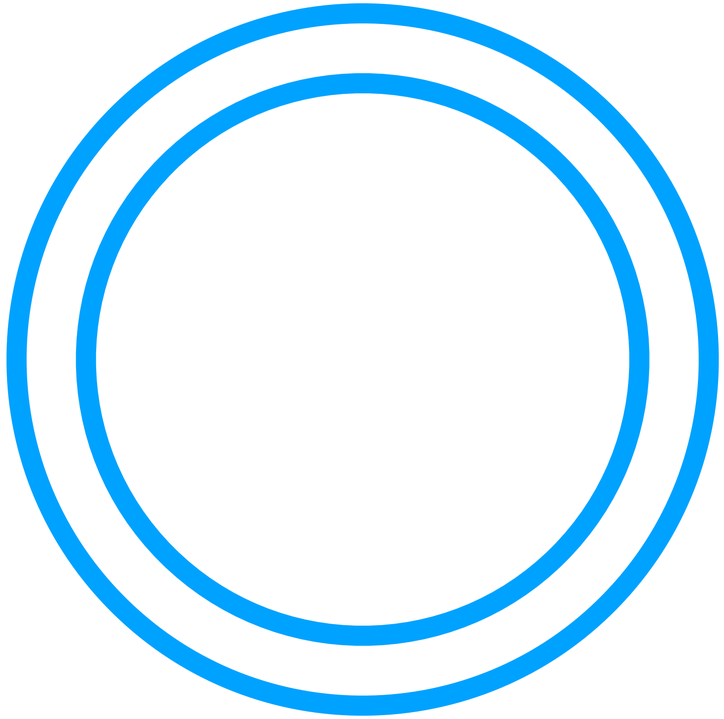
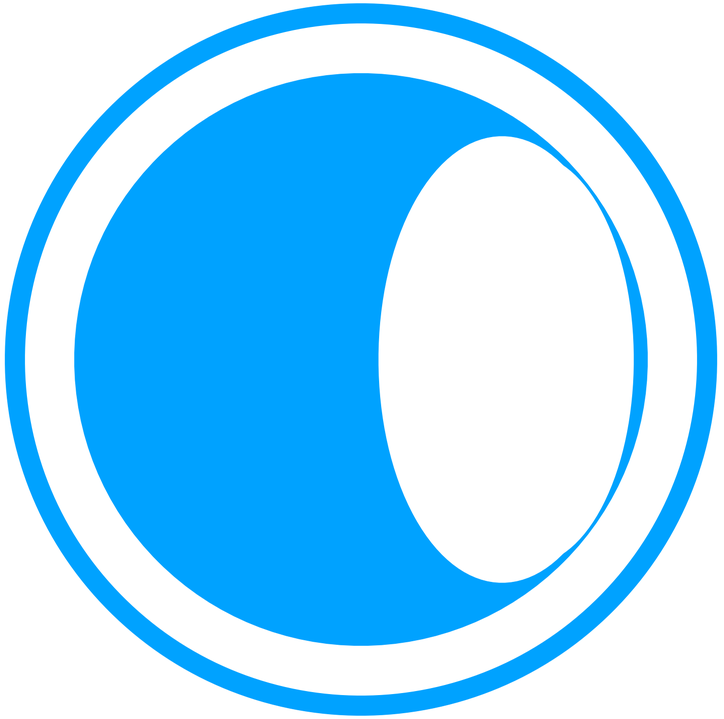
OPEN



PARTIAL



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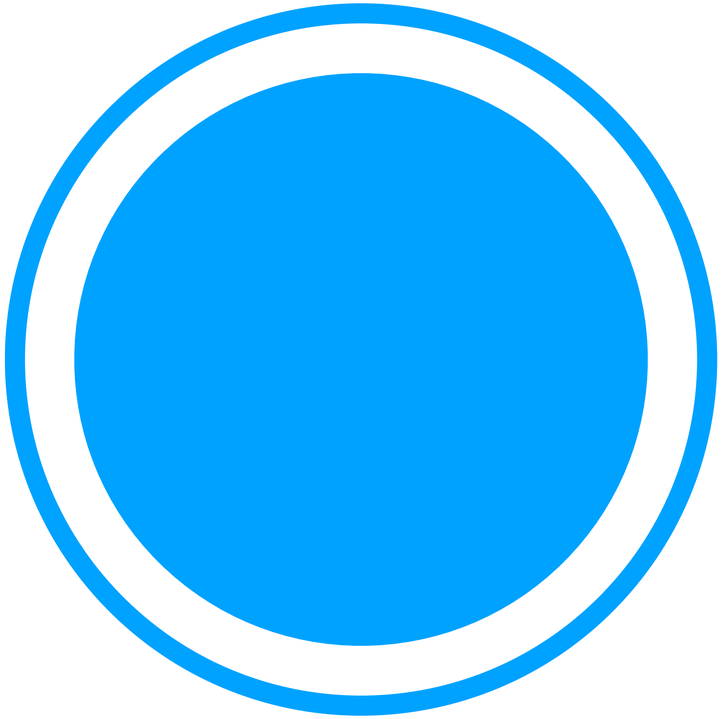
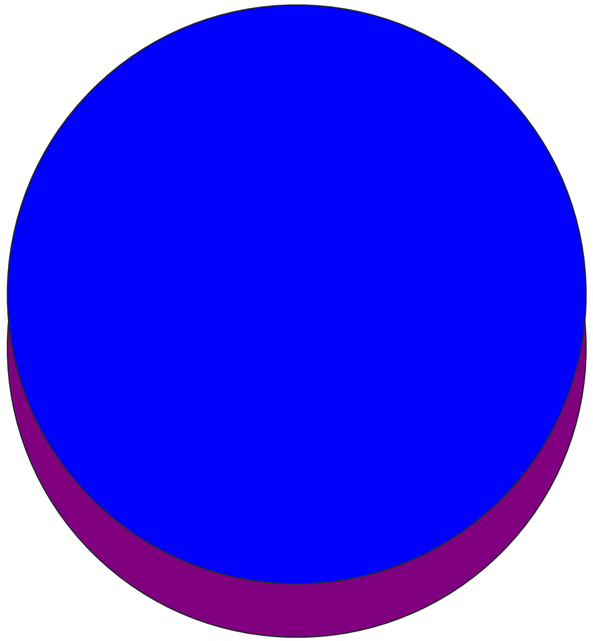
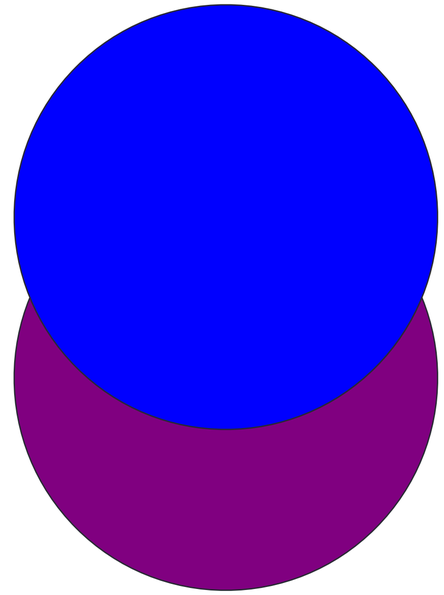


Gate Valves will “work closed” or “work open”

2”



1.5”



25 GPM

Pressure Manifolds

Required Compents

- Mechanism to measure pressure
  - Flex Tubing
  - Cleanout Combo
  - Diameter does not matter

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Pressure Manifolds

Required Components

- **Shutoff Valves on Taps**
  - Mechanism to stop flow to individual laterals;

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Allows for Emergency Shutoff and Flushing

Pressure Manifolds

Required Components

- **Observation Ports**
  - Method to visually verify the flow to each individual lateral;

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BROOKS
PRODUCTS


DEWALT

Pressure Manifolds

Required Components

- **Method to visually verify the flow to each individual lateral;**

  - Inside Manifold Box
  - Outside Manifold Box

- Could a true union ball valve on the tap be used to meet the requirement

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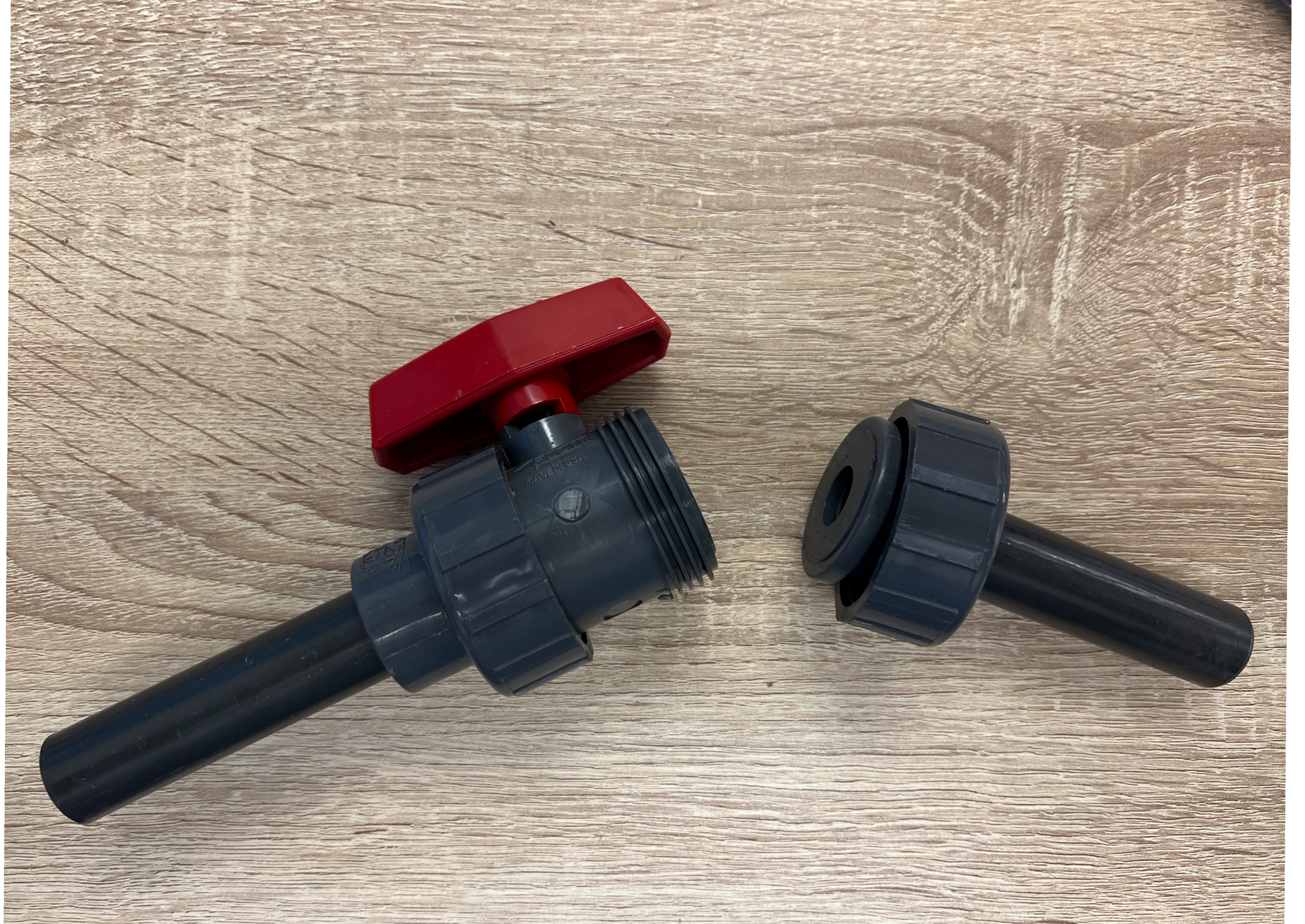
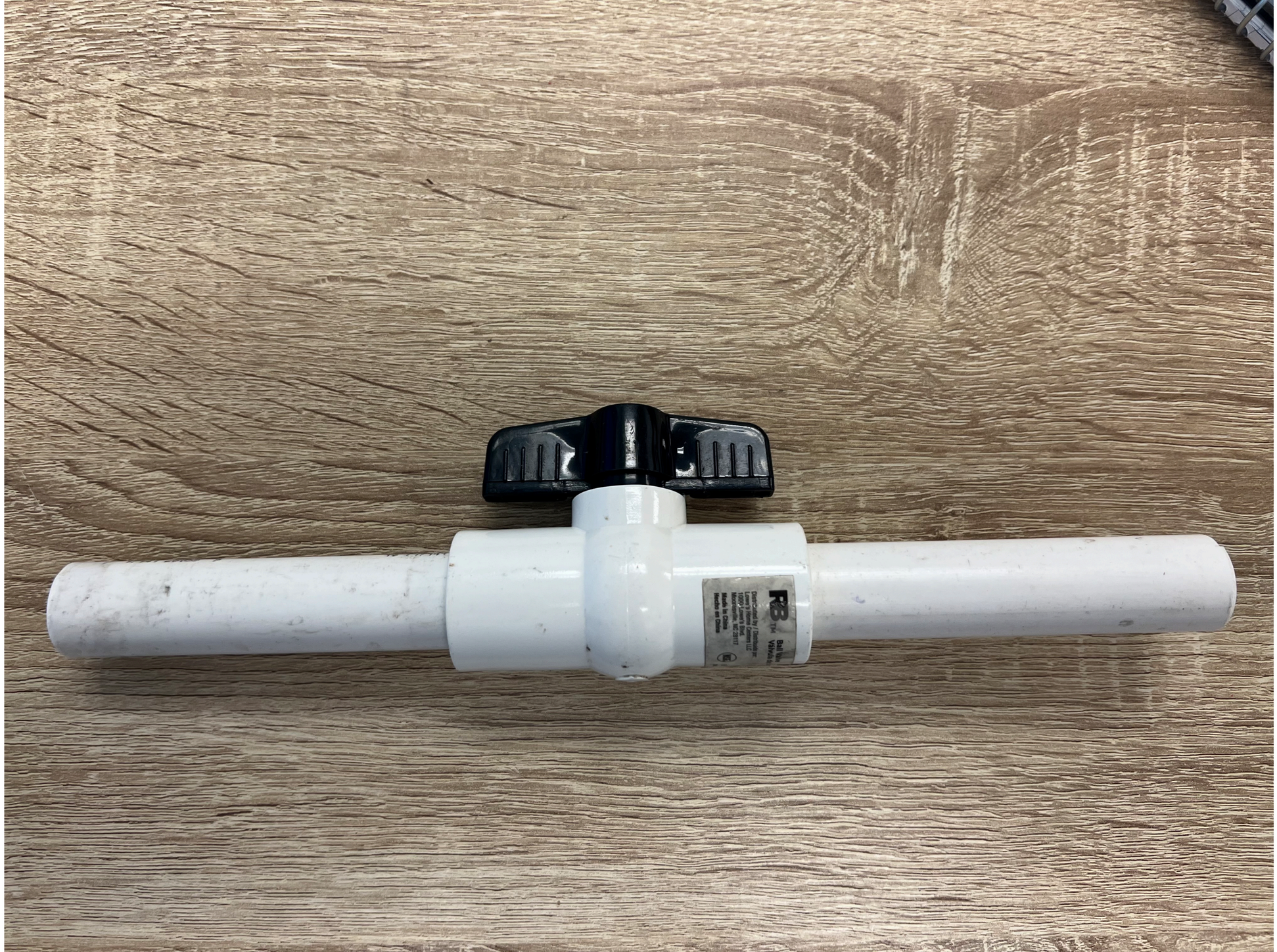

MADE IN USA



Pressure Manifolds

Required Components

- **Vault or Protective Box**
  - the pressure manifold and appurtenances should be designed and installed to be accessible for inspection, operation, maintenance, and monitoring.

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Factors Impacting Performance

5 things that matter

- What factors influence uniform distribution?
  - Inconsistent Tap Length
  - Inconsistent Valve Selection
  - Tap Spacing / Tap Position
  - Sloppy Cuts
  - Imprecise Flow Numbers

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Impacting Performance

Things that matter

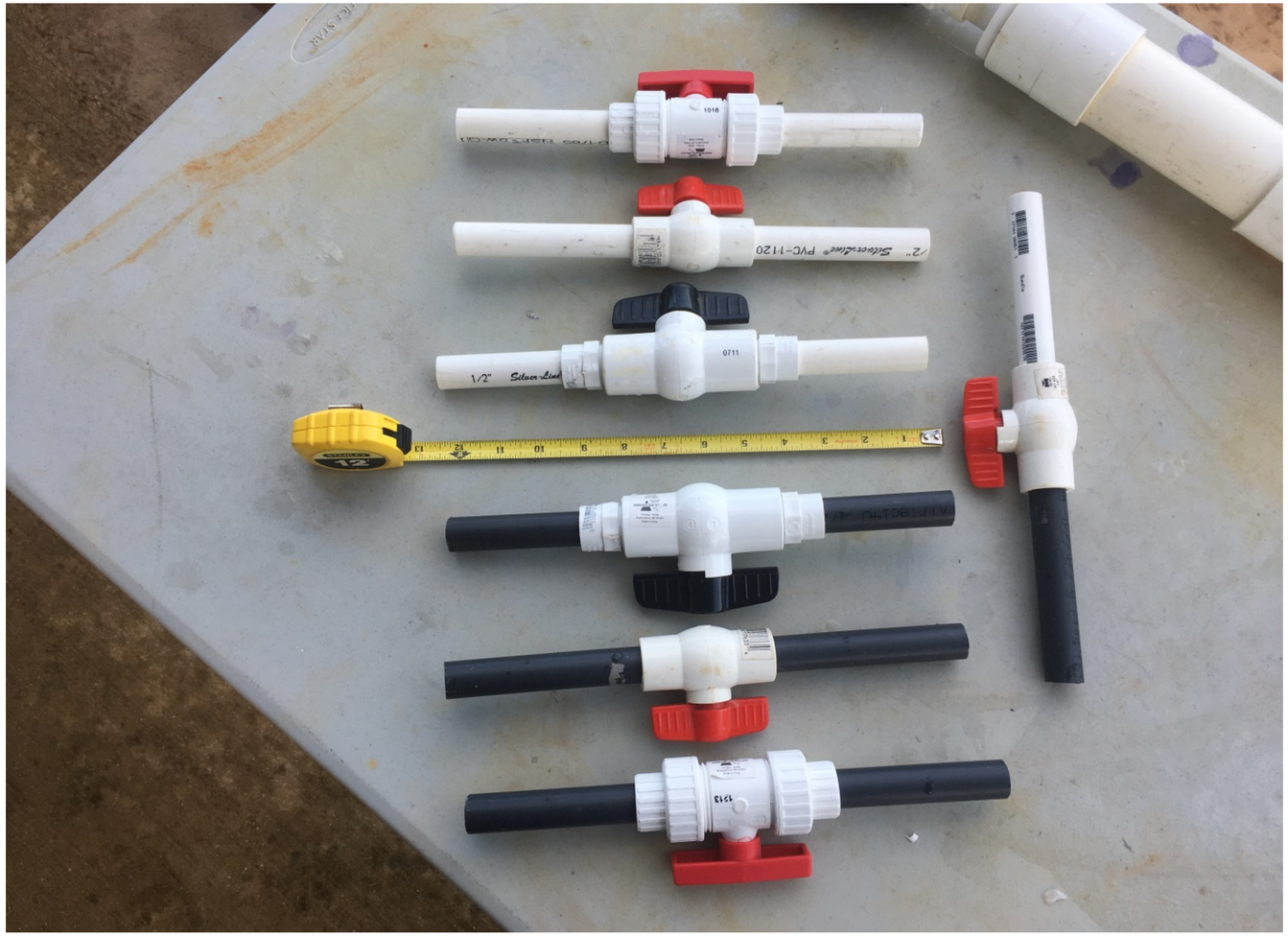
- Inconsistent Tap Length
  - 6” vs 12” tap
  - Can change flow by >10%
  - Biggest impact on 1/2” such 80


Oatey
HANDY PACK
CONJUNTO UTILITARIO

Impacting Performance

Things that matter

- Inconsistent Valve Selection
  - Do not upsize on 1/2” sch 80
  - It will reduce flow instead of reducing friction



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4400 4" IPS SCH 40 COEX
PVC-DWV PIPE
891-16

Factors Impacting Performance

Things that matter

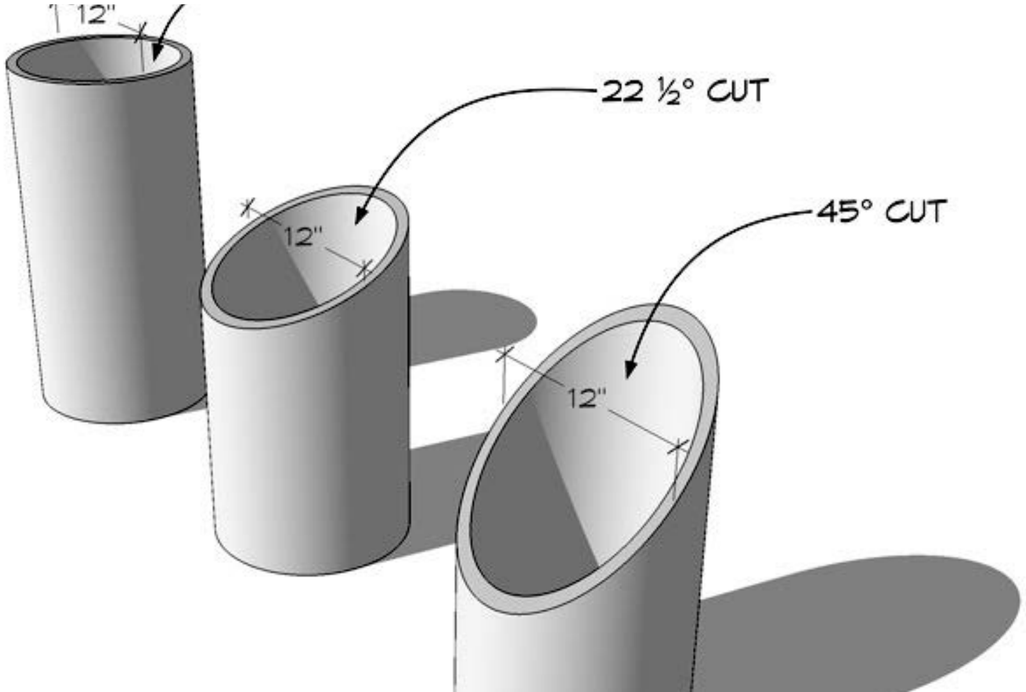
- Inconsistent Tap Spacing / Poor Tap Position
  - Keep consistent spacing
  - 4” minimum
  - Avoid danger zones
    - 1st 6” after valve
    - 1st 4” of manifold
    - Last 4” of manifold

Factors Impacting Performance

Things that matter

- Sloppy Cuts

- Angled Cuts on the distal ends of a tap will change the diameter of the terminal orifice



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Gallons Per Day	360
L.T.A.R	0.3
Gallons Per Inch in Pump Tank	20
Pressure Head	2'

		line	length	Tap size	flow/tap	gal/day	trench area	LINE LTAR		25% Red LTAR	
		1	75	1/2 inch Sch 80	5.48	70	225	0.311		0.311	5.48
		2	75	1/2 inch Sch 80	5.48	70	225	0.311		0.311	5.48
		3	100	1/2 inch Sch 40	7.11	91	300	0.303		0.303	7.11
		4	150	3/4 inch Sch 80	10.1	129	450	0.287		0.287	10.1
		5		NA	0	0	0	#DIV/0!		#DIV/0!	0
		6		NA	0	0	0	#DIV/0!		#DIV/0!	0
		7		NA	0	0	0	#DIV/0!		#DIV/0!	0
		8		NA	0	0	0	#DIV/0!		#DIV/0!	0
		Total Length	400	gal/min =	28.17		LTAR =	0.30	(ltar W/ Red)	0.40	
% of Dose Vol.	68		Des. Flow	360			(ltar + 5%)	0.315	(ltar + 5%)	0.42	
Dose Volume	177		Daily Pump Run	12.78							
Dose Pump Time	6.28		Tank Gal/IN	20							
Drawdown in Inches	8.8										

66.00		
67.00	2'	NA
68.00	2.5'	1/2 inch Sc
69.00	3'	1/2 inch Sc
70.00	3.5'	3/4 inch Sc
71.00	4'	3/4 inch Sc
72.00		1 inch Sch
73.00		1 inch Sch
74.00		
75.00		