Drip Irrigation Systems Troubleshooting

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Drip Troubleshooting - Roadmap

- Needed Information
- Scenarios
- Problem Set
- Troubleshooting Quiz

Drip Irrigation Troubleshooting

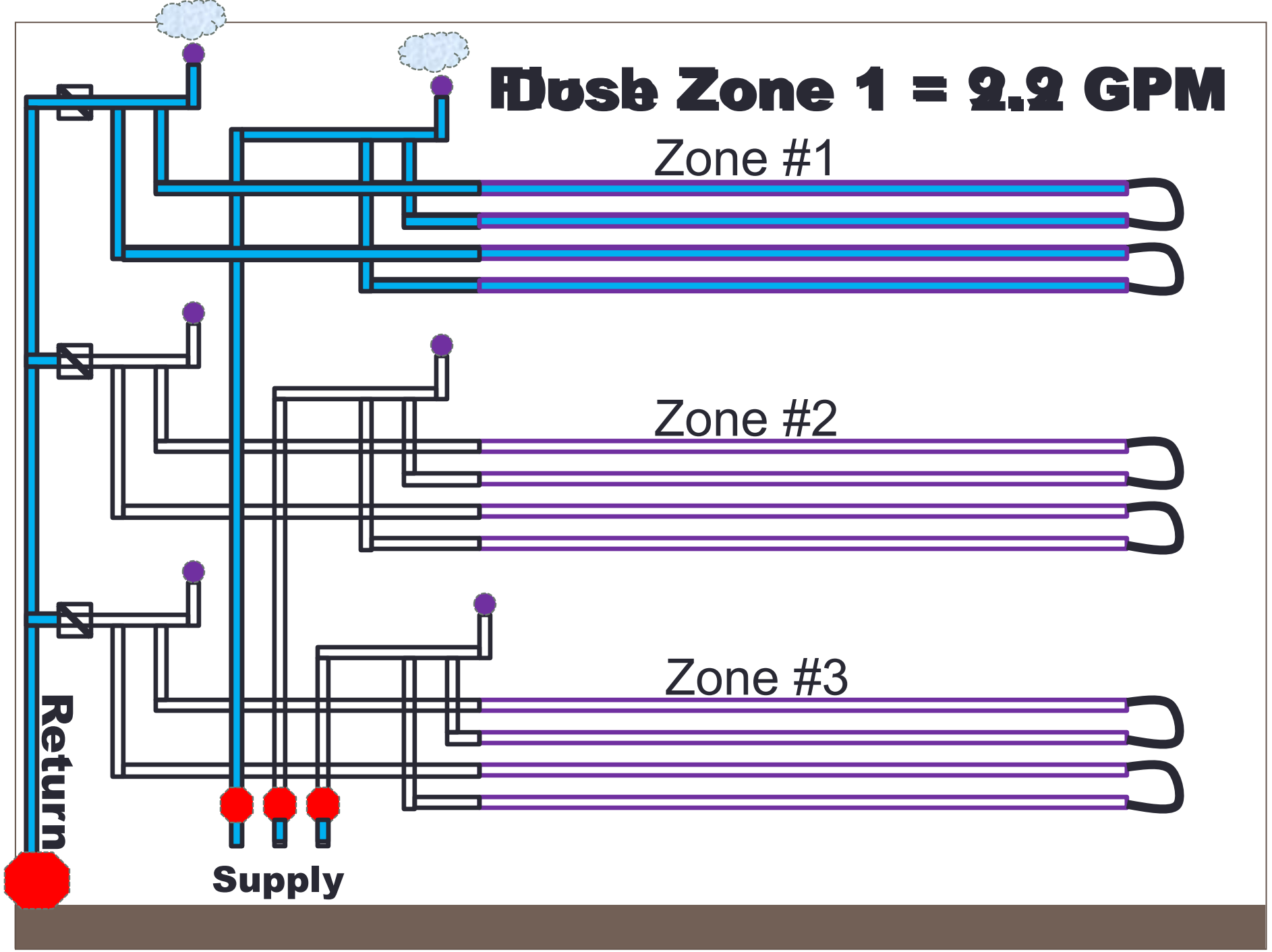
What do we need to get started?

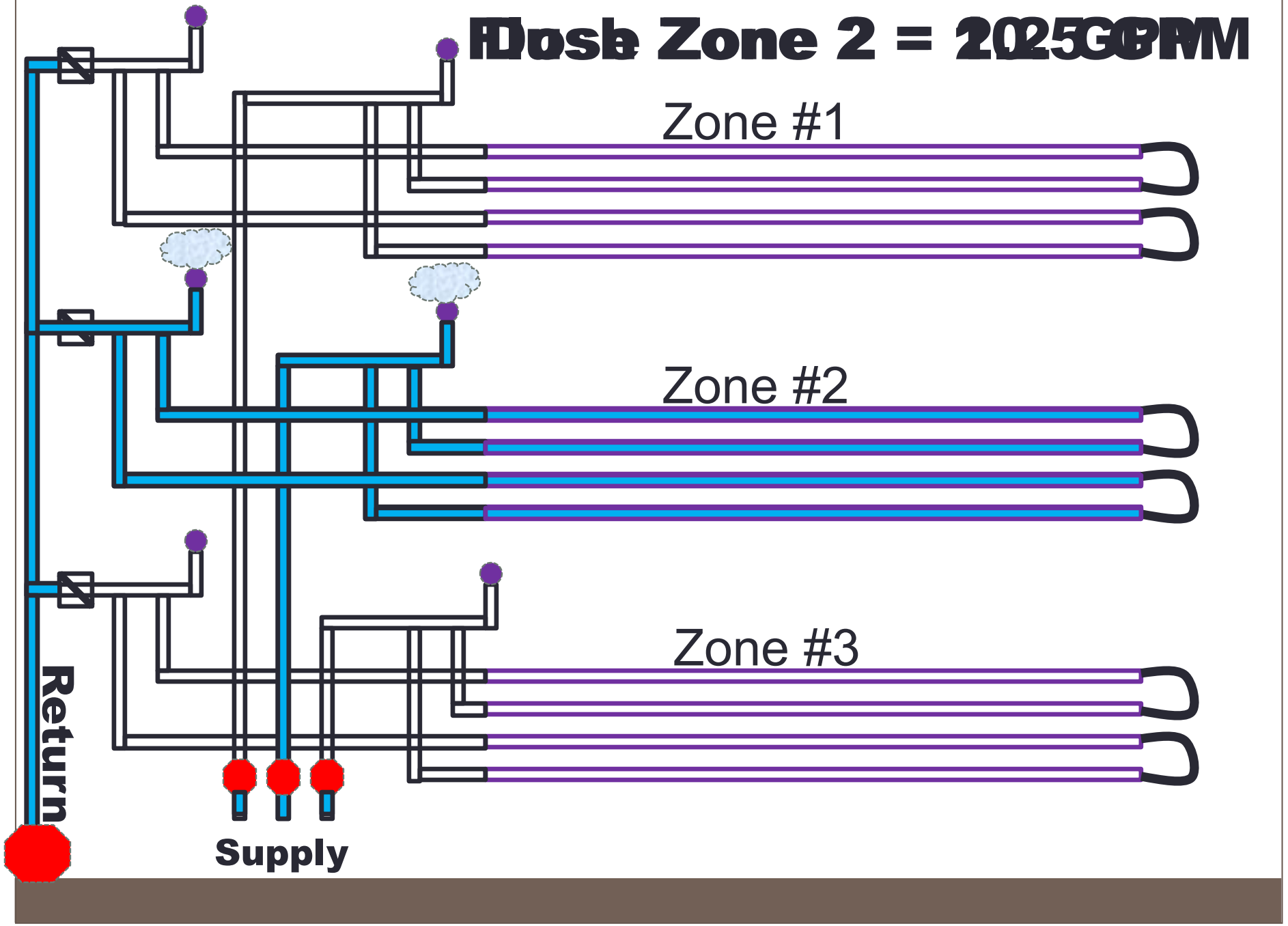
Drip Troubleshooting – Needed Information

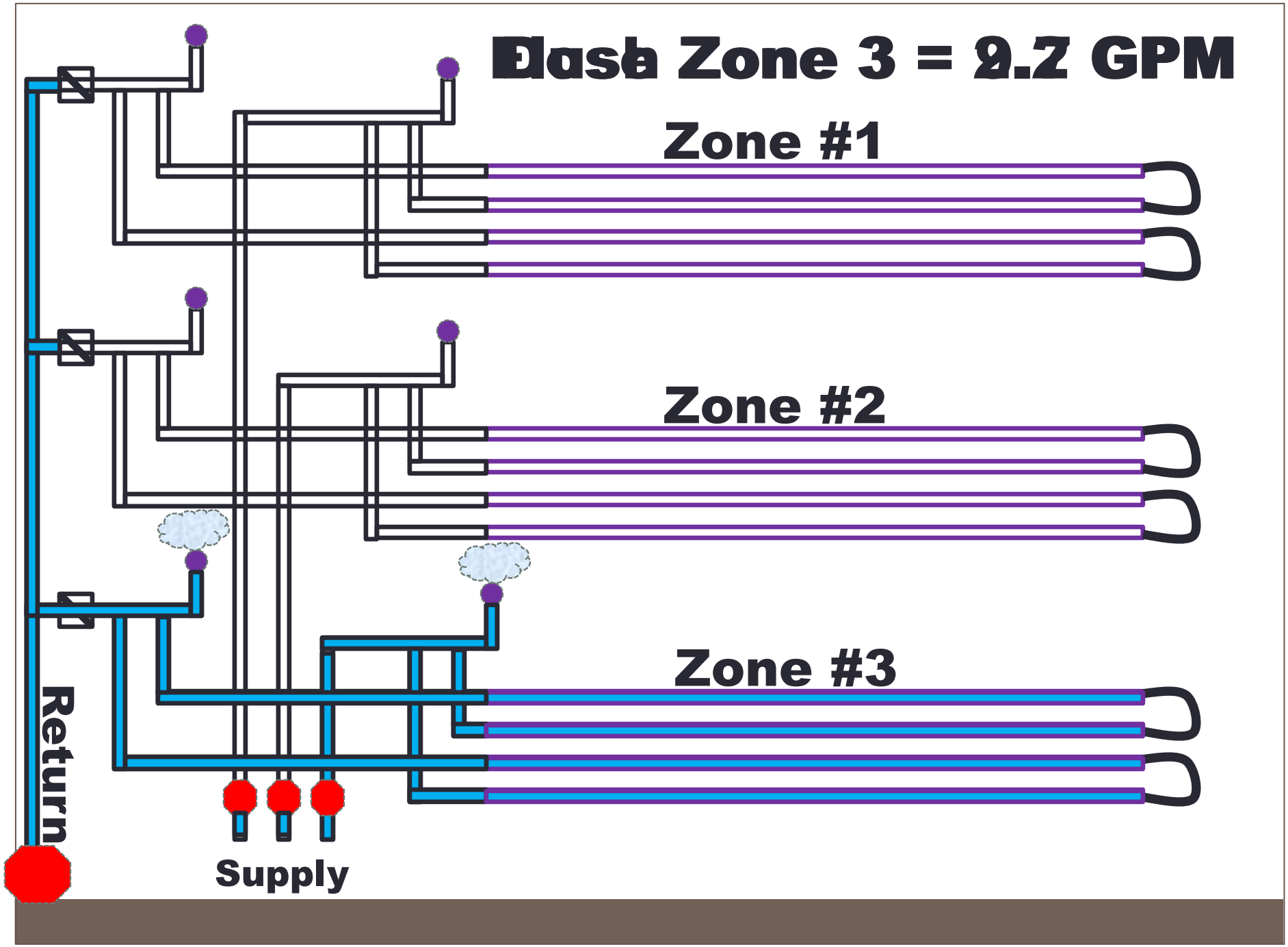
- To effectively troubleshoot you will need:
  1. Dosing flow for each zone
  2. Flushing flow for each zone
  3. Supply and return field pressure for dose and flush in each zone
  4. Pre and post filter pressure
  5. All data from start-up & design

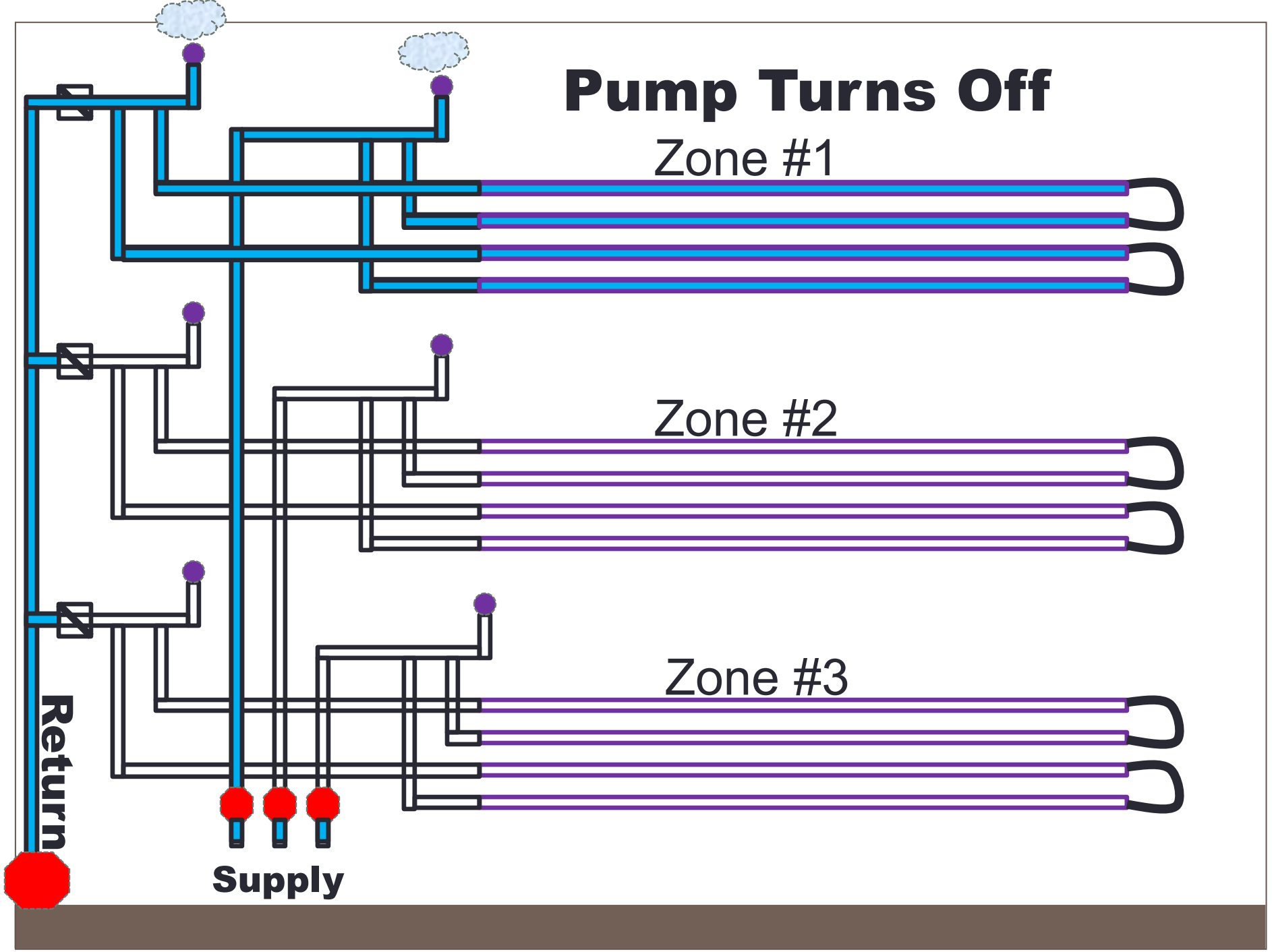
Scenario 1	Start-up	Measured
Zone 1 Dose	2.2	2.2
Zone 1 Flush	9.9	9.9
Zone 2 Dose	2.2	2.2
Zone 2 Flush	10.5	10.5
Zone 3 Dose	2.2	2.2
Zone 3 Flush	9.7	9.7

Scenario 1	Supply PSI	Return PSI
Zone 1 Dose	45	44
Zone 1 Flush	40	0
Zone 2 Dose	45	44
Zone 2 Flush	40	0
Zone 3 Dose	45	44
Zone 3 Flush	44	0


Zone 1 = 2.2 GPM
Zone #1
Zone #2
Zone #3
Return
Supply


Zone #1
Zone #2
Zone #3
Return
Supply


Flash Zone 3 = 9.2 GPM
Zone #1
Zone #2
Zone #3
Return
Supply


Pump Turns Off
Zone #1
Zone #2
Zone #3
Return
Supply

Drip Irrigation Troubleshooting

- Symptoms
- Needed Information
- Possible Causes
- Verify Then Repair

Scenario 1 - Symptoms

- Dosing And Flushing Rates Are Higher Than Expected For All Zones Except Zone 3
- Zone 3 Has A Normal Dosing Rate
- No Surfacing But Some Moist Areas In Zones 3

Scenario 1	Start-up	Measured
Zone 1 Dose	2.2	4.4
Zone 1 Flush	9.9	12.1
Zone 2 Dose	2.2	4.4
Zone 2 Flush	10.5	12.7
Zone 3 Dose	2.2	2.2
Zone 3 Flush	9.7	9.7

Scenario 1	Supply PSI	Return PSI
Zone 1 Dose	43	42
Zone 1 Flush	40	0
Zone 2 Dose	43	42
Zone 2 Flush	40	0
Zone 3 Dose	45	44
Zone 3 Flush	44	0

Scenario 1 – Possible Causes

- Break in Zones 1 & 2
- Inappropriately Open Zone 3 Supply Valve
  - Split Diaphragm
  - Faulty Solenoid
  - Manually Open
- Bad Check Valve on Common Return.

Scenario 1 – Possible Causes

- Break in Zones 1 & 2
  - Unlikely due to perfect doubling of flow rate
  - Separate breaks in zone 1 & 2 would have to each = 2.2 GPM
  - Unlikely due to wetness in Zone 3 not in 1 & 2

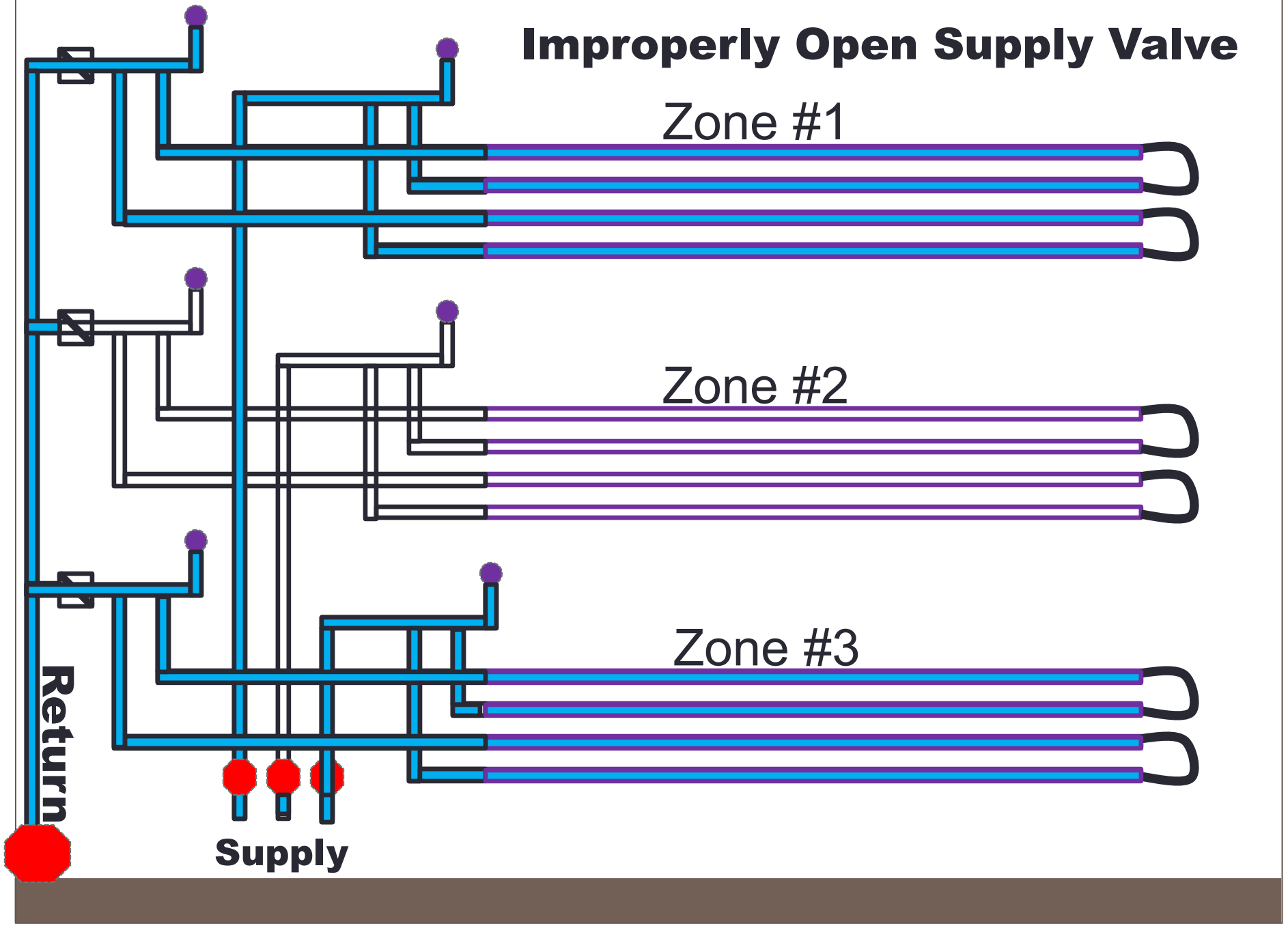
Scenario 1	Start-up	Measured
Zone 1 Dose	2.2	**4.4**
Zone 1 Flush	9.9	12.1
Zone 2 Dose	2.2	**4.4**
Zone 2 Flush	10.5	12.7
Zone 3 Dose	2.2	**2.2**
Zone 3 Flush	9.7	9.7

Scenario 1 – Split Diaphragm

- Split Diaphragm on supply valves allows flow even when valve is turned off

Scenario 1 – Faulty Solenoid

- Faulty Solenoid on supply valves allows flow even when valve is turned off


Improperly Open Supply Valve
Zone #1
Zone #2
Zone #3
Return
Supply

Scenario 3 Verify then Repair

To Eliminate or Confirm Zone 3 Supply Valve Manually Open

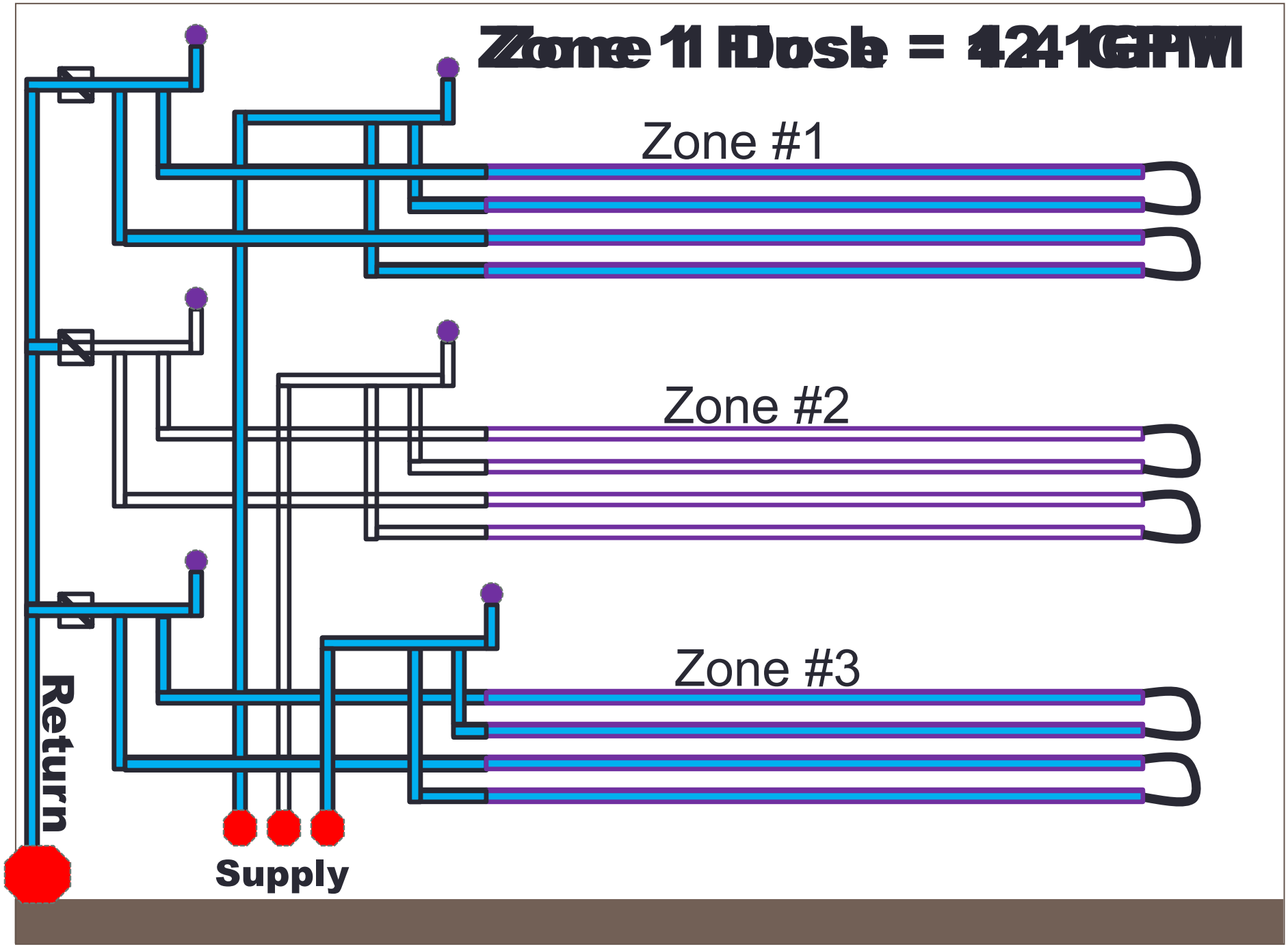
Check the position of the manual lever

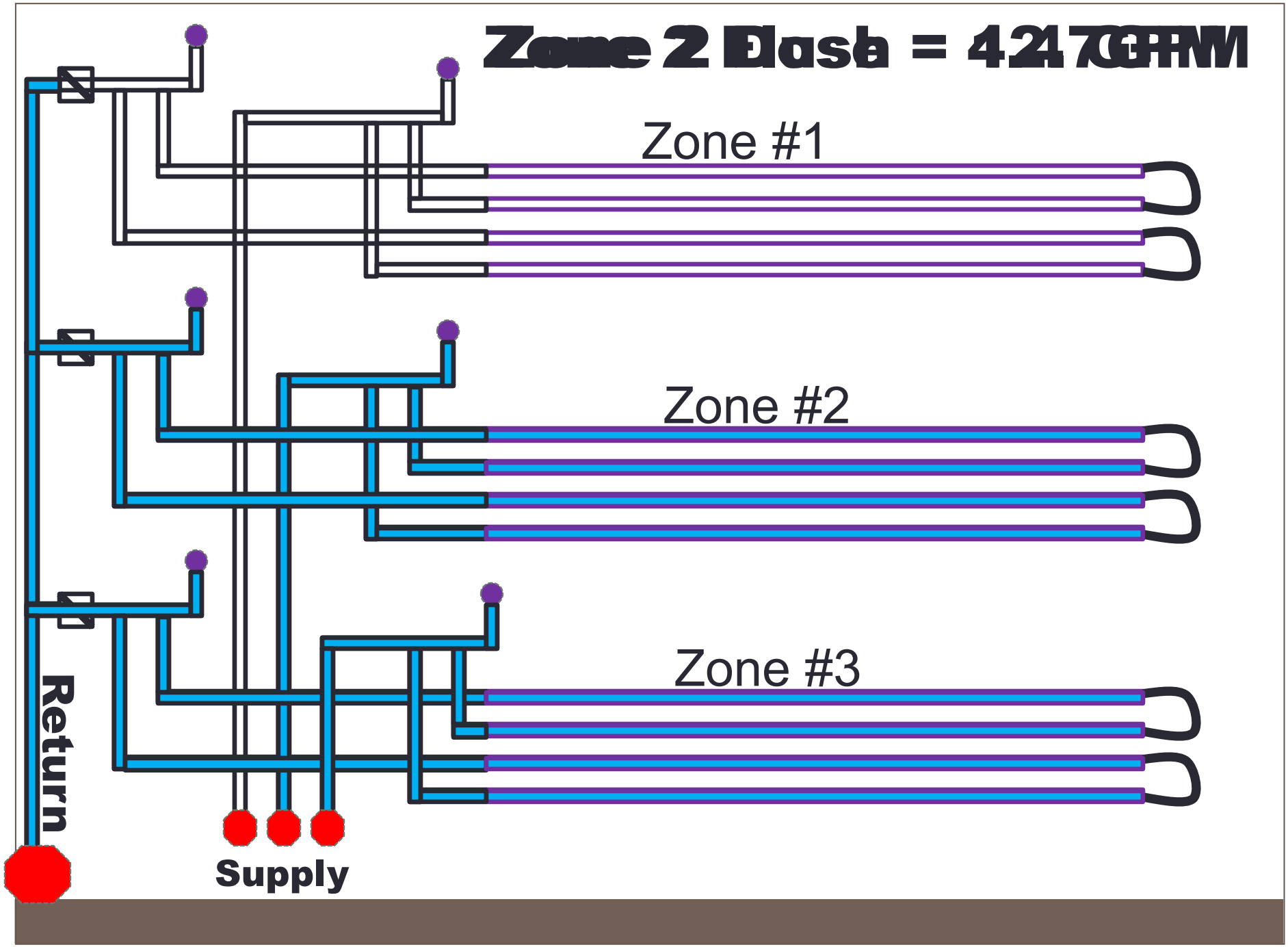
Scenario 1 – Verify then Repair

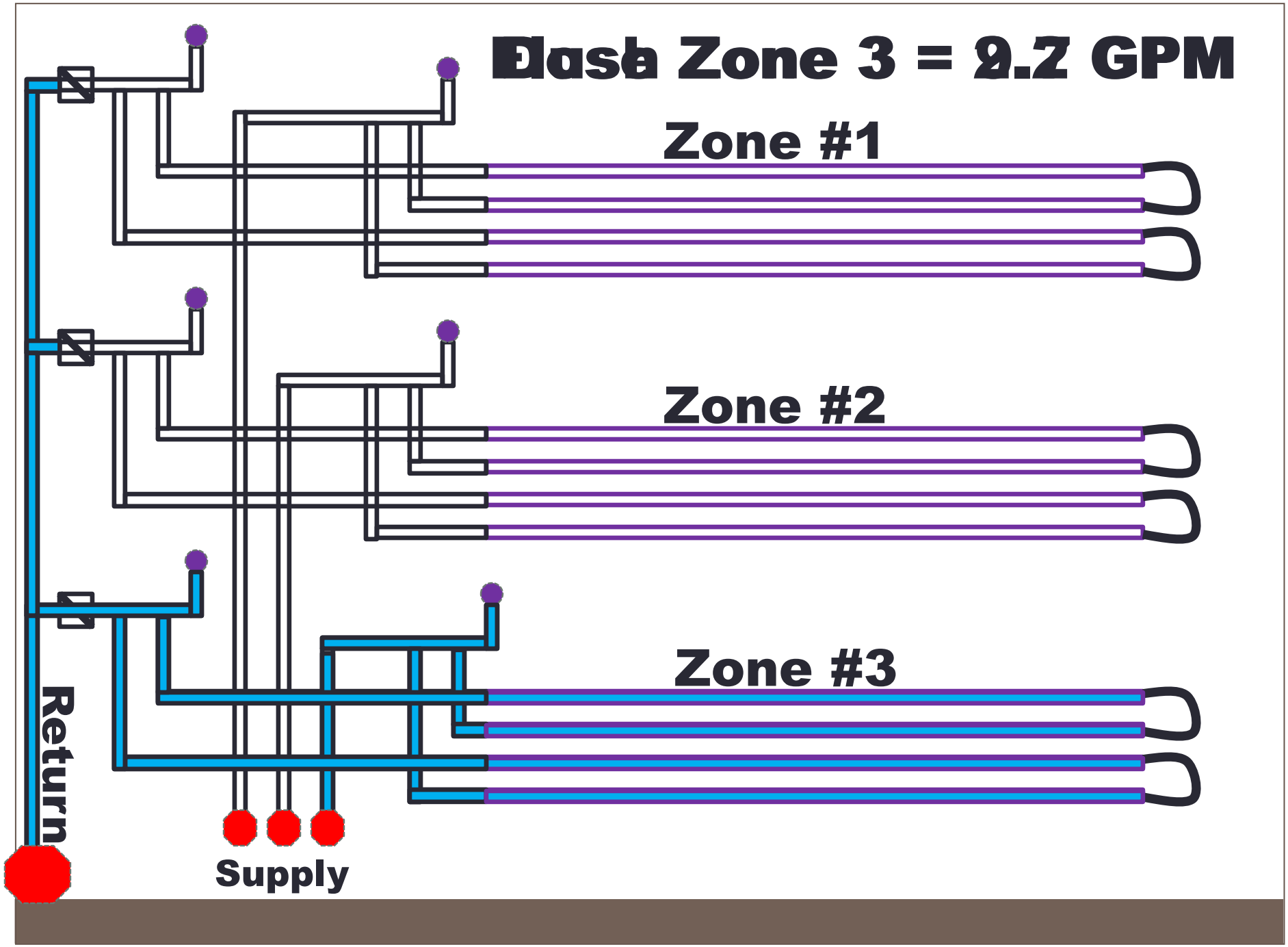
- To Eliminate or Confirm “Split Diaphragm / Faulty Solenoid”:
  - Leave all zone supply solenoids closed and engage the pump
  - Watch the flow meter
  - If the meter does not move you can eliminate “split diaphragm” or “faulty solenoid”

Scenario 3 Verify then Repair

Faulty Check Valve Will Allow Effluent to Back-feed the zone


Zone #1
Zone #2
Zone #3
Return
Supply


Zone #1
Zone #2
Zone #3
Return
Supply


Flash Zone 3 = 9.2 GPM
Zone #1
Zone #2
Zone #3
Return
Supply

Scenario 1 – Verify then Repair

- To Eliminate or Confirm “Bad Check Valve”:
  - Dose Zone 1 & then dose Zone 2
  - During Zone 1 & 2 dose check for pressure or flow at Zone 3 return
  - If Zone 3 is receiving effluent during Zone 1 & Zone 2 dose = Bad Check Valve in Zone 3

Scenario 1 – Verify then Repair

- To Eliminate or Confirm “Bad Check Valve”:
  - Dose Zone 1
  - During Zone 1 dose unscrew the air vent in Zone 3
  - If Zone 3 receives effluent during Zone 1 dose, Zone 3 check valve is faulty

Scenario 1 – Verify then Repair

- Locate Check Valve for Zone 3
  - Replace or clean as needed
- Best Practices
  - Install unions / quick disconnects
  - Install valve box over check valve

Scenario 2 - Symptoms

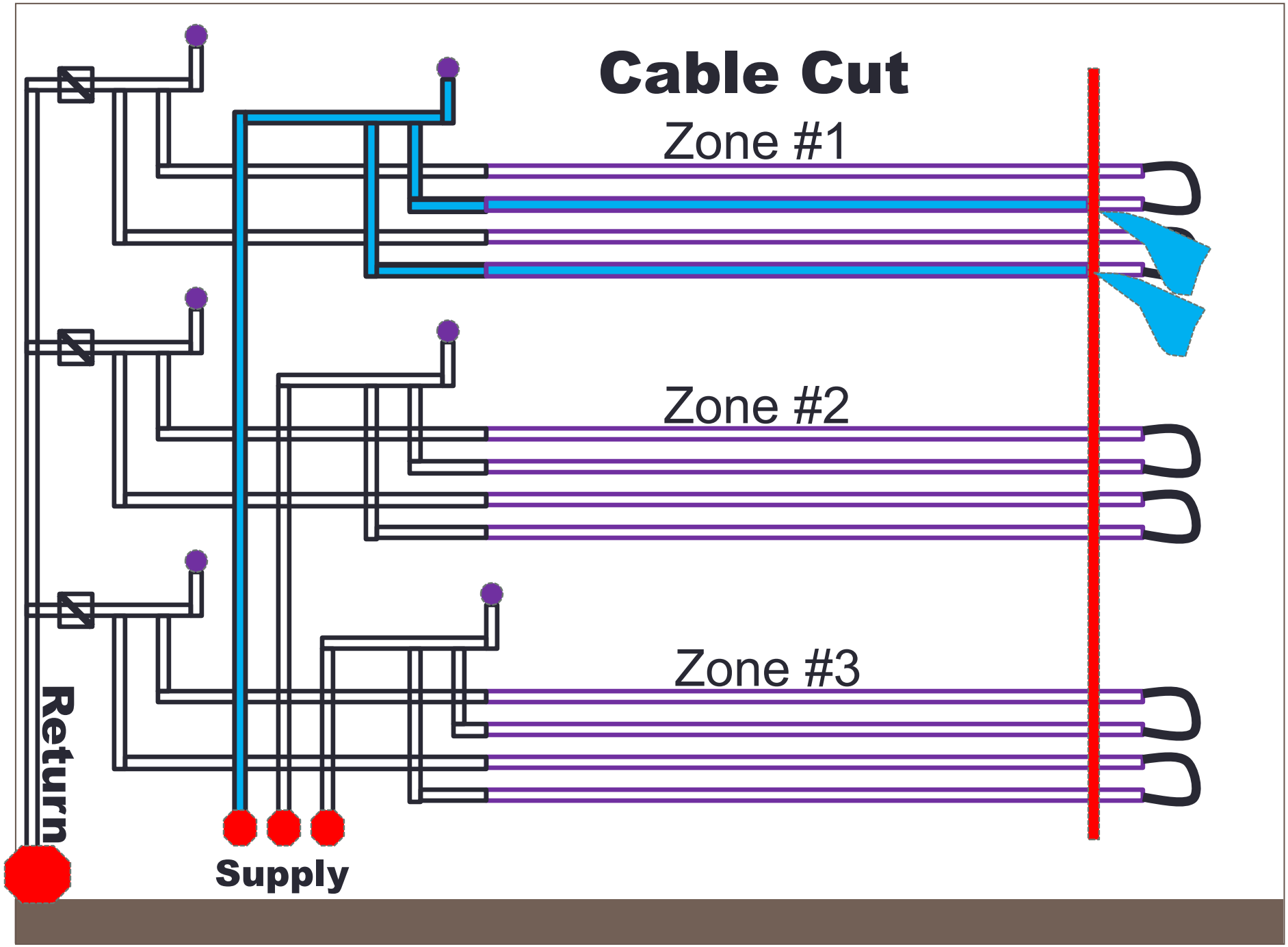
- Dosing Rates Are Higher Than Expected For All Zones.
- Return Pressures Are Low For All Zones During Dose
- No Surfacing, All Zones Seem Dry / Ok

Scenario 2	Start-up	Measured
Zone 1 Dose	2.2	12
Zone 1 Flush	9.9	12.1
Zone 2 Dose	2.2	10.5
Zone 2 Flush	10.5	10.5
Zone 3 Dose	2.2	10
Zone 3 Flush	9.7	10.5

Scenario 2	Supply PSI	Return PSI
Zone 1 Dose	45	0
Zone 1 Flush	40	0
Zone 2 Dose	45	0
Zone 2 Flush	40	0
Zone 3 Dose	45	0
Zone 3 Flush	40	0

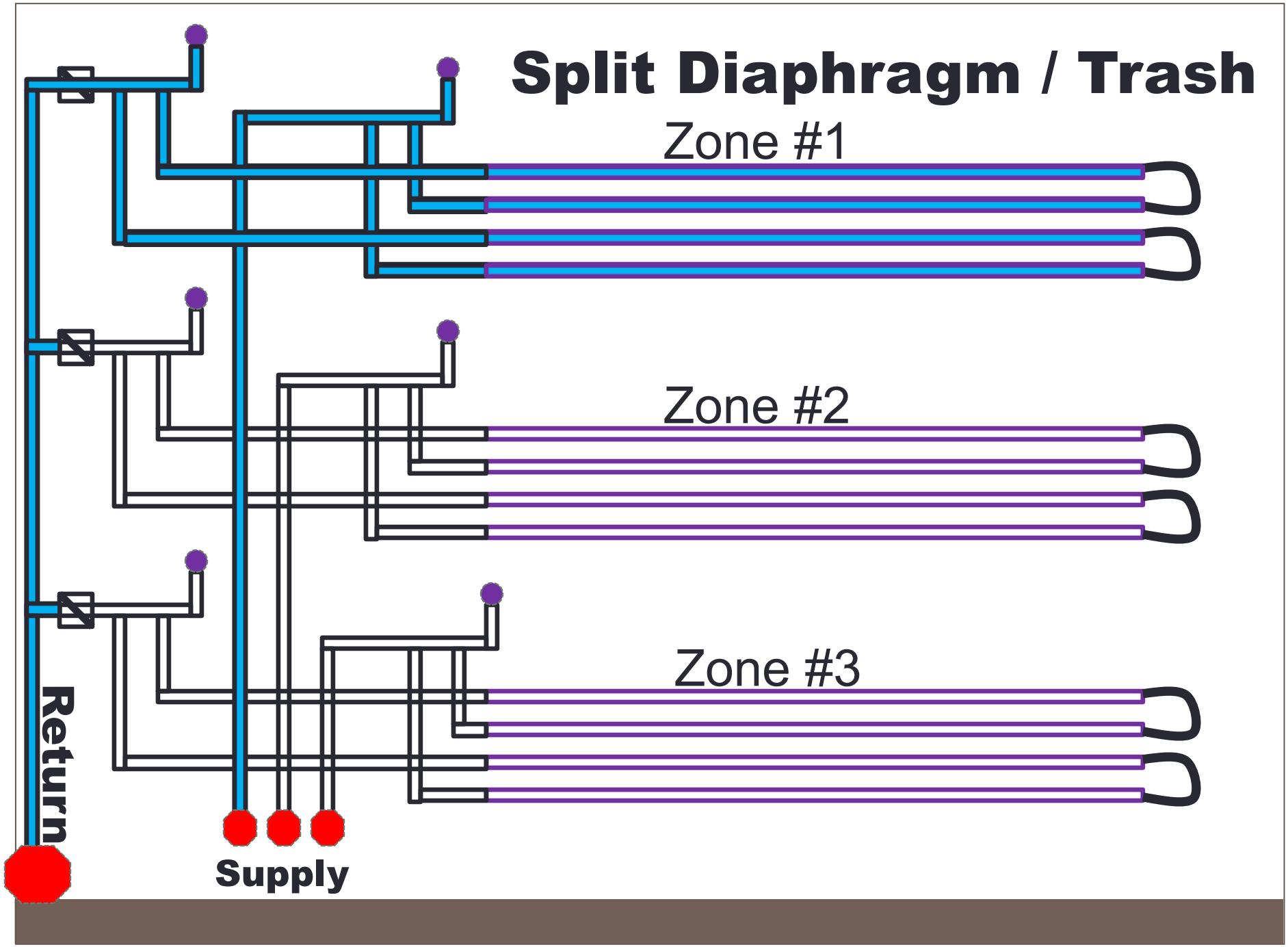
Scenario 2 – Possible Causes

- Split Diaphragm or Trash in Field Flush Valve
- Break in the Common Return
- Break in all three zones, “Cable Cut”


Cable Cut
Zone #1
Zone #2
Zone #3
Return
Supply

Scenario 2 – Verify then Repair

- Break in all three zones, “Cable Cut”
  - Unlikely due to no surfacing over zones
  - Walk field during dose to double check for wet spots
    - Difficult in Sandy Soils
  - Remove air release from Return Manifold
  - Dig to perform “Squeeze Test”


Split Diaphragm / Trash
Zone #1
Zone #2
Zone #3
Return
Supply

Scenario 2 – Verify then Repair

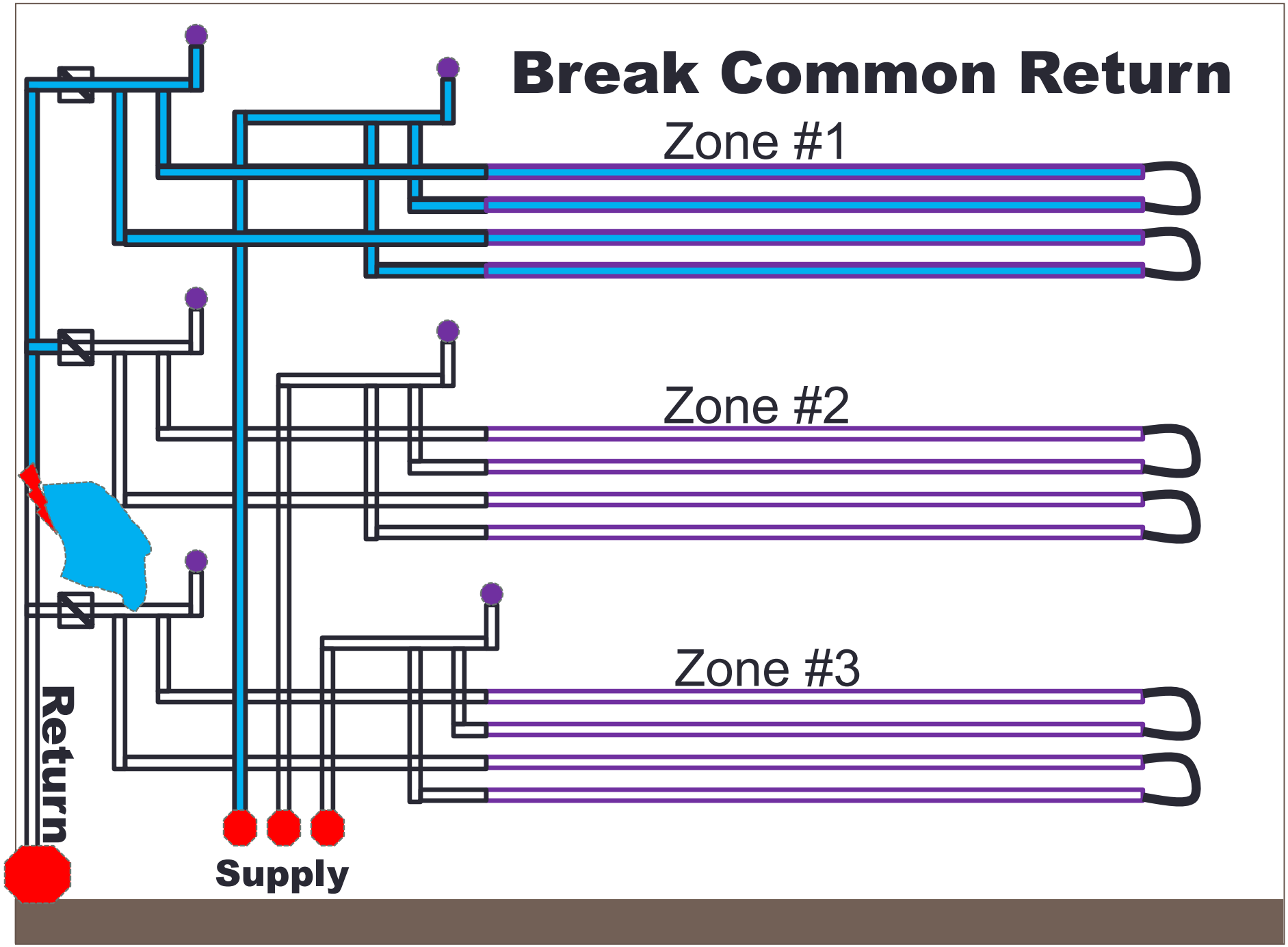
- To Eliminate or Confirm “Split Diaphragm / Trash in the Field Flush Valve
  - Dose Zone 1
  - Look into the inlet end of the septic tank
  - Return flow = Diaphragm is split / trash
  - Look into plumbing cleanout to verify no flow coming from the home

Scenario 2 – Verify then Repair

- To Eliminate or Confirm “Split Diaphragm / Trash in the Field Flush Valve
  - Remove air release from Return Manifold to verify flow to that point
  - Manually inspect diaphragm if unable to determine incoming flow
    - Look for split in diaphragm or trash that is not allowing the diaphragm to properly seat

Scenario 2 – Verify then Repair

- To Eliminate or Confirm “Split Diaphragm / Trash in the Field Flush Valve
  - Jack Harman’s “Dollar Bill” Test
    - Used to determine if the field flush valve is inappropriately open


Break Common Return
Zone #1
Zone #2
Zone #3
Return
Supply

Scenario 2 – Verify then Repair

- To Eliminate or Confirm “Break in Common Return”
  - Dose Zone 1
  - Confirm that there is no return flow into tank
  - Remove air release valve at zone 1 return to verify flow to return end of tubing
  - Walk the Return Path to Look for Wet Spots
    - What if site is sandy?

Scenario 3 - Symptoms

- Dosing And Flushing Flow Are Extremely Low To Zero For Zone 1
- No Pressure On Supply Or Return Zone 1
- Pump Runs But No Flow
- All Other Zones Appear Normal

Scenario 3	Start-up	Measured
Zone 1 Dose	2.2	0
Zone 1 Flush	9.9	0
Zone 2 Dose	2.2	2.2
Zone 2 Flush	10.5	10.5
Zone 3 Dose	2.2	2.2
Zone 3 Flush	9.7	9.7

Scenario 3	Supply PSI	Return PSI
Zone 1 Dose	0	0
Zone 1 Flush	0	0
Zone 2 Dose	45	44
Zone 2 Flush	40	0
Zone 3 Dose	45	44
Zone 3 Flush	40	0

Scenario 3 – Possible Causes

- Zone 1 Supply Solenoid Plunger “Stuck Closed”
- Clog or Blockage in Supply Line

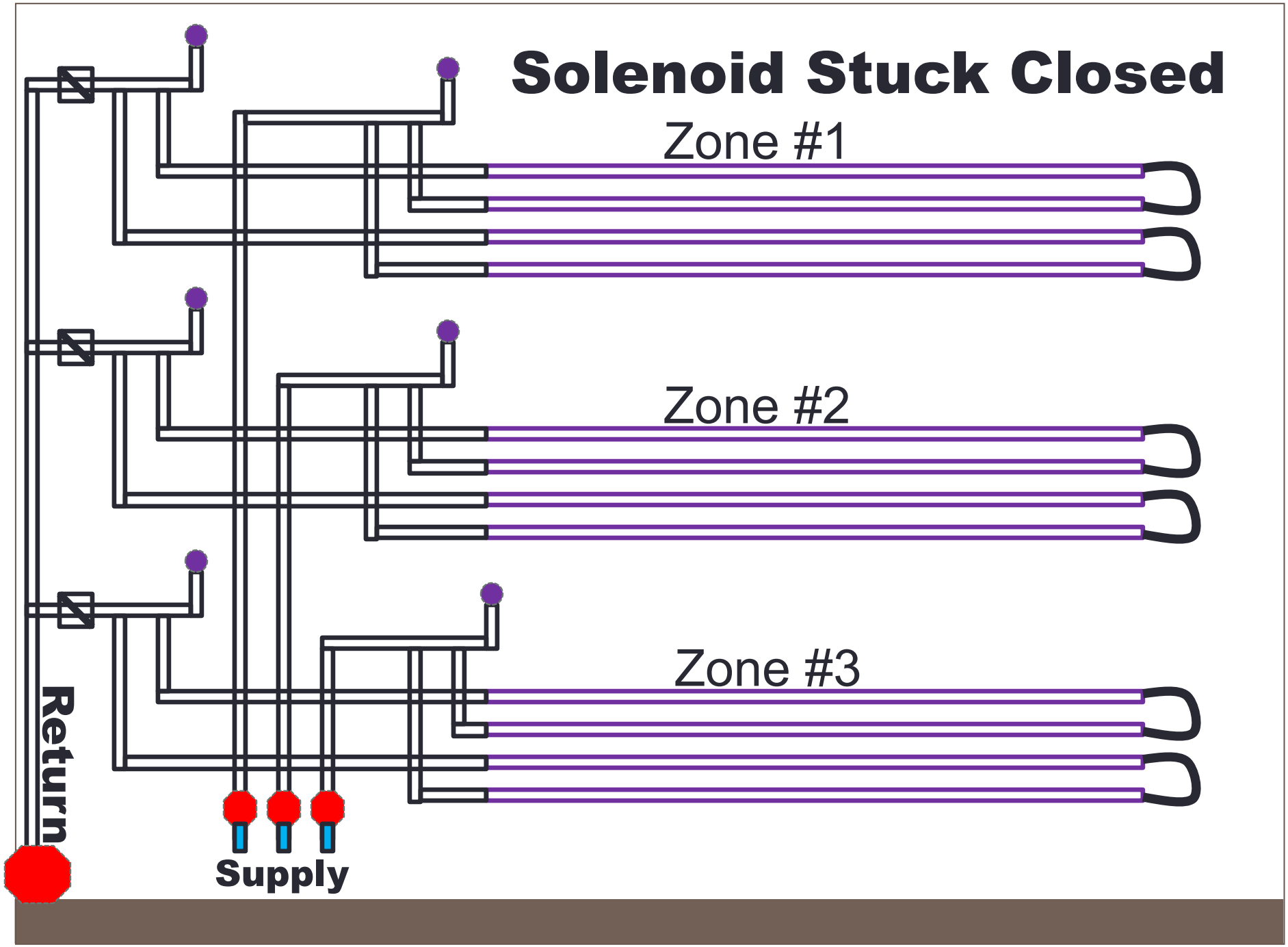
Scenario 3 Verify then Repair

To Eliminate or Confirm Zone 1 Supply Solenoid “Stuck Closed”

Perform Thump Test

Unscrew Solenoid

Energized & observe for proper function


Solenoid Stuck Closed
Zone #1
Zone #2
Zone #3
Return
Supply

Scenario 3 Verify then Repair

To Eliminate or Confirm Zone 1 Supply Line Clog / Blockage

Unscrew Air Release on Zone 1 Supply Manifold

Scenario 3 – Verify then Repair

- To Eliminate or Confirm Clog / Blockage in Zone 1 Supply
  - You may have to dig and cut
  - Other Suggestions?

Scenario 4 - Symptoms

- Dosing And Flushing Flow Are Extremely Low For All Zones.
- No Pressure On Supply Or Return
- Pump Runs But No Flow
- No Surfacing, All Zones Seem Dry / Ok

Scenario 4	Start-up	Measured
Zone 1 Dose	2.2	0
Zone 1 Flush	9.9	0
Zone 2 Dose	2.2	0
Zone 2 Flush	10.5	0
Zone 3 Dose	2.2	0
Zone 3 Flush	9.7	0

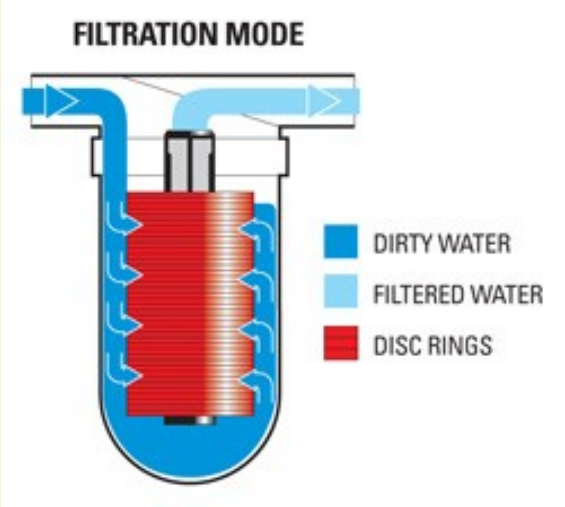
Scenario 4	Supply PSI	Return PSI
Zone 1 Dose	0	0
Zone 1 Flush	0	0
Zone 2 Dose	0	0
Zone 2 Flush	0	0
Zone 3 Dose	0	0
Zone 3 Flush	0	0

Scenario 4 – Possible Causes

- Disc / Screen Filter Clogged
- Pump Looses Prime due to Bad Foot Valve
- Faulty Control Panel / PCB
- Pump Screen Clogged
- Impellers Clogged

Scenario 4 – Verify then Repair

- To Eliminate or Confirm Disc / Screen Filter Clogged
  - Check Pre & Post Filter Pressure
  - If > 5 PSI difference in Pre & Post Pressure inspect and clean filter
  - Replace filter and retest



Scenario 4 – Verify then Repair

- To Eliminate or Confirm Bad Foot Valve
  - System must have a jet pump / centrifugal pump
  - Prime Pump & Retest

Scenario 4 – Verify then Repair

- To Eliminate or Confirm Faulty Control Panel
  - Perform “Thump” Test
  - Check fuses
  - Call control panel manufacturer

Scenario 4 – Verify then Repair

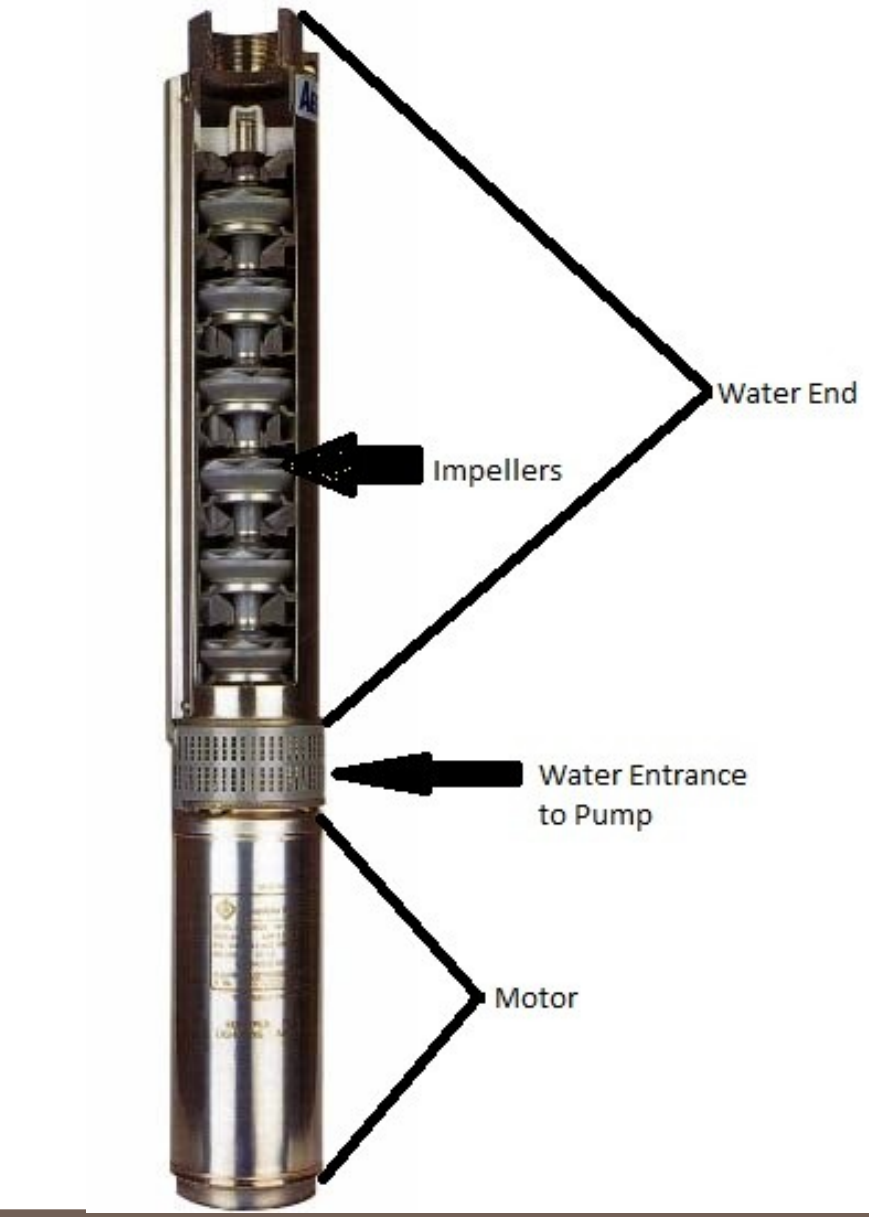
- To Eliminate or Confirm Clogged Pump Screen
  - Inspect Pump Intake Screen
  - Check for “growth” in Field Dose Tank

Scenario 4 Verify then Repair

If Impellers clog with solids the motor will run but it will not move water.

Buy New Pump

Replace Water End



Scenario 5 - Symptoms

- Dosing And Flushing Flow Are Low For Zone 1
- High Pressure on Zone 1 Supply
- No/Low Pressure on Zone 1 Return
- All Other Zones Appear Normal

Scenario 5	Start-up	Measured
Zone 1 Dose	2.2	1.0
Zone 1 Flush	9.9	1.0
Zone 2 Dose	2.2	2.2
Zone 2 Flush	10.5	10.5
Zone 3 Dose	2.2	2.2
Zone 3 Flush	9.7	9.7

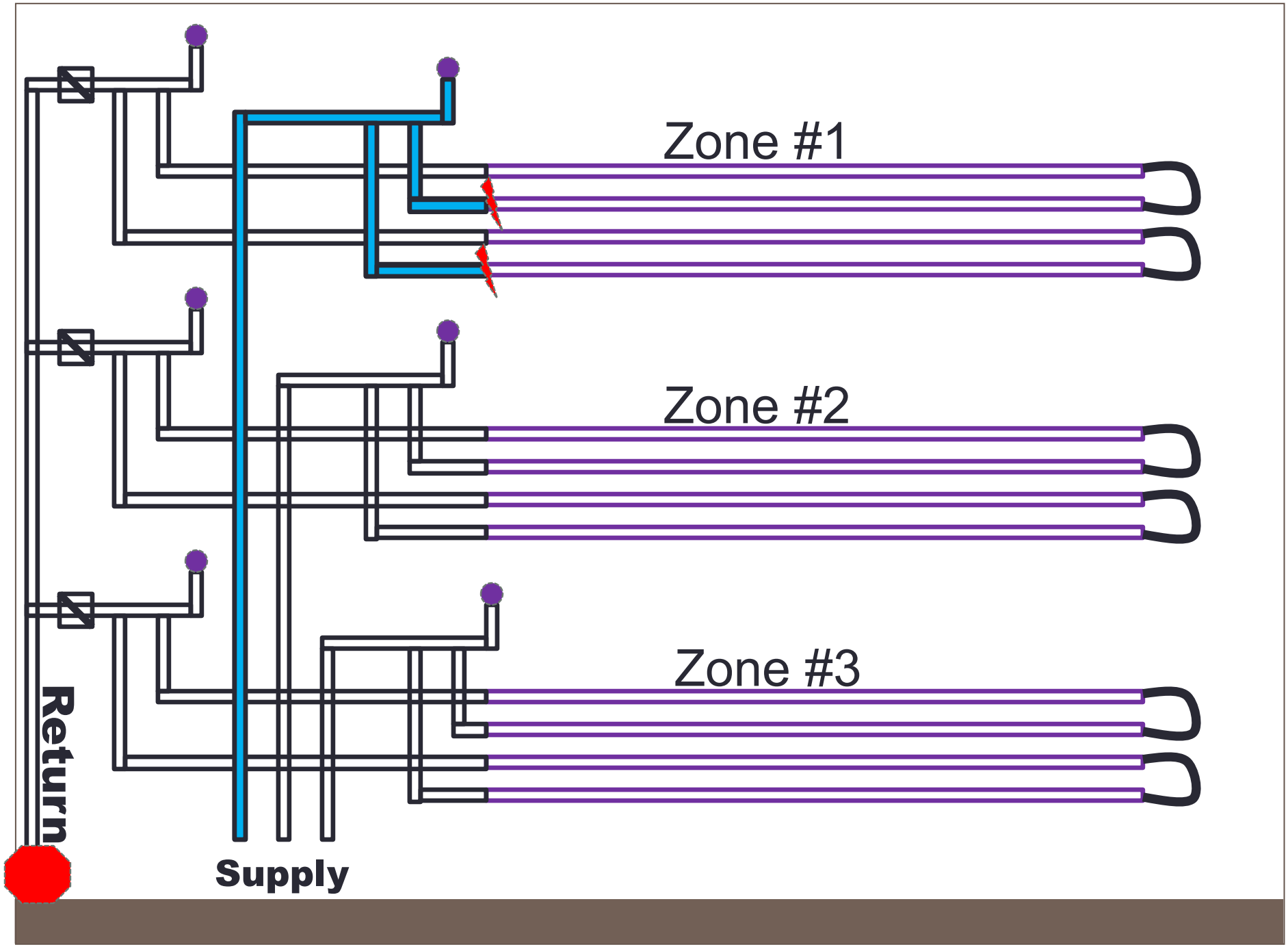
Scenario 5	Supply PSI	Return PSI
Zone 1 Dose	60	0
Zone 1 Flush	60	0
Zone 2 Dose	45	22
Zone 2 Flush	40	0
Zone 3 Dose	45	22
Zone 3 Flush	40	0

Scenario 5 – Possible Causes

- Clog in Zone 1 Drip Tubing
- Drip Tubing Kinked in Zone 1

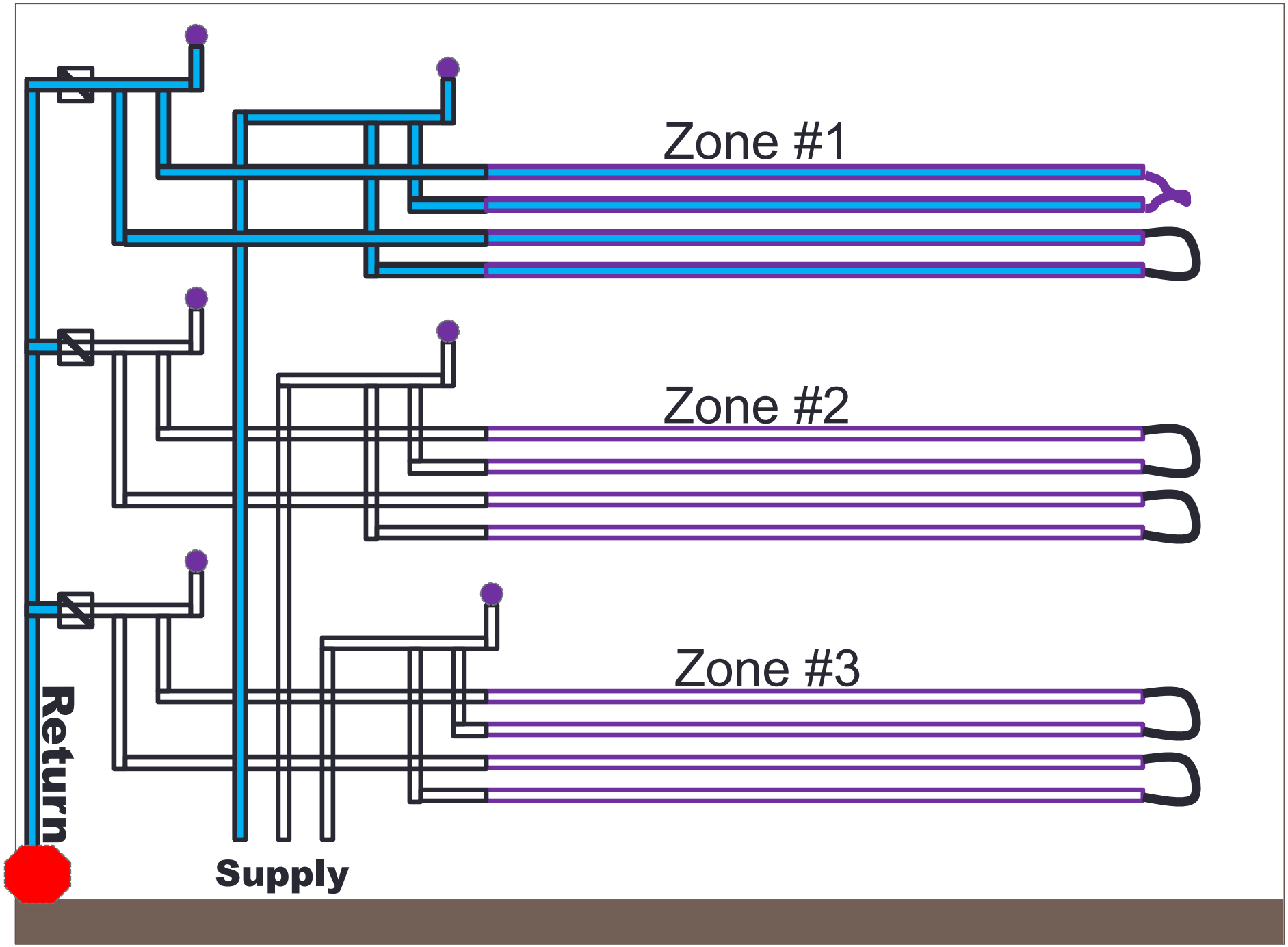
Scenario 5 – Verify then Repair

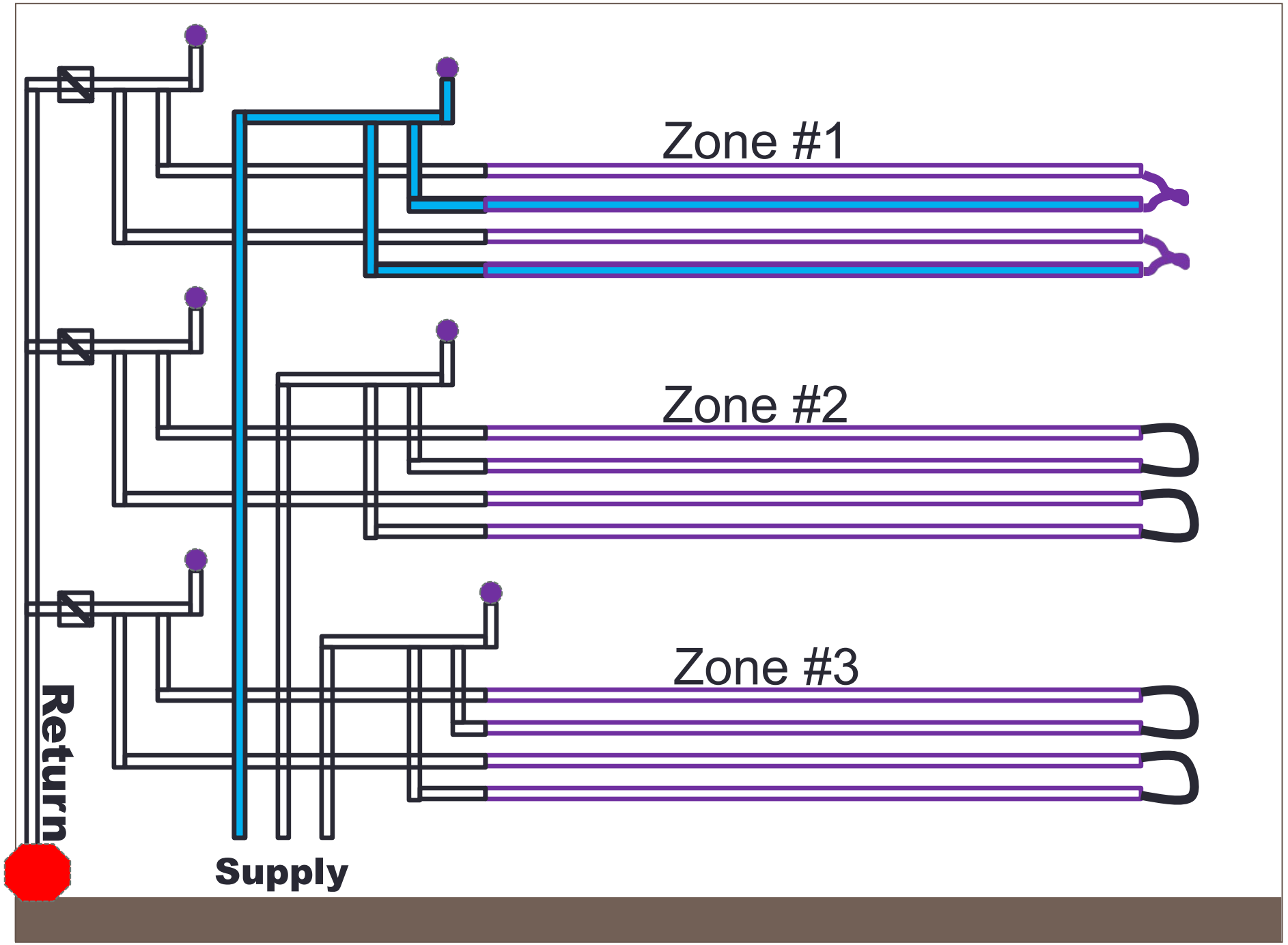
- To Eliminate or Confirm Clog in Zone 1 Drip Tubing
  - Dose Zone 1
  - Dig to expose Zone 1 drip tubing
  - Squeeze Test


Zone #1
Zone #2
Zone #3
Return
Supply

Scenario 5 – Verify then Repair

- To Eliminate or Confirm Kink in Zone 1 Drip Tubing
  - Investigate possibility that drip tubing was used for lateral “loops” in Zone 1
  - Investigate kinking at the manifold connection
  - Dig to expose Zone 1 drip tubing
  - Squeeze Test


Zone #1
Zone #2
Zone #3
Return
Supply


Zone #1
Zone #2
Zone #3
Return
Supply

Scenario 6 - Symptoms

- Dosing And Flushing Flow Are High For Zone 1
- Lower Than Expected Pressure on Zone 1 Supply
- All Other Zones Appear Normal

Scenario 6	Start-up	Measured
Zone 1 Dose	2.2	10.1
Zone 1 Flush	9.9	14
Zone 2 Dose	2.2	2.2
Zone 2 Flush	10.5	10.5
Zone 3 Dose	2.2	2.2
Zone 3 Flush	9.7	9.7

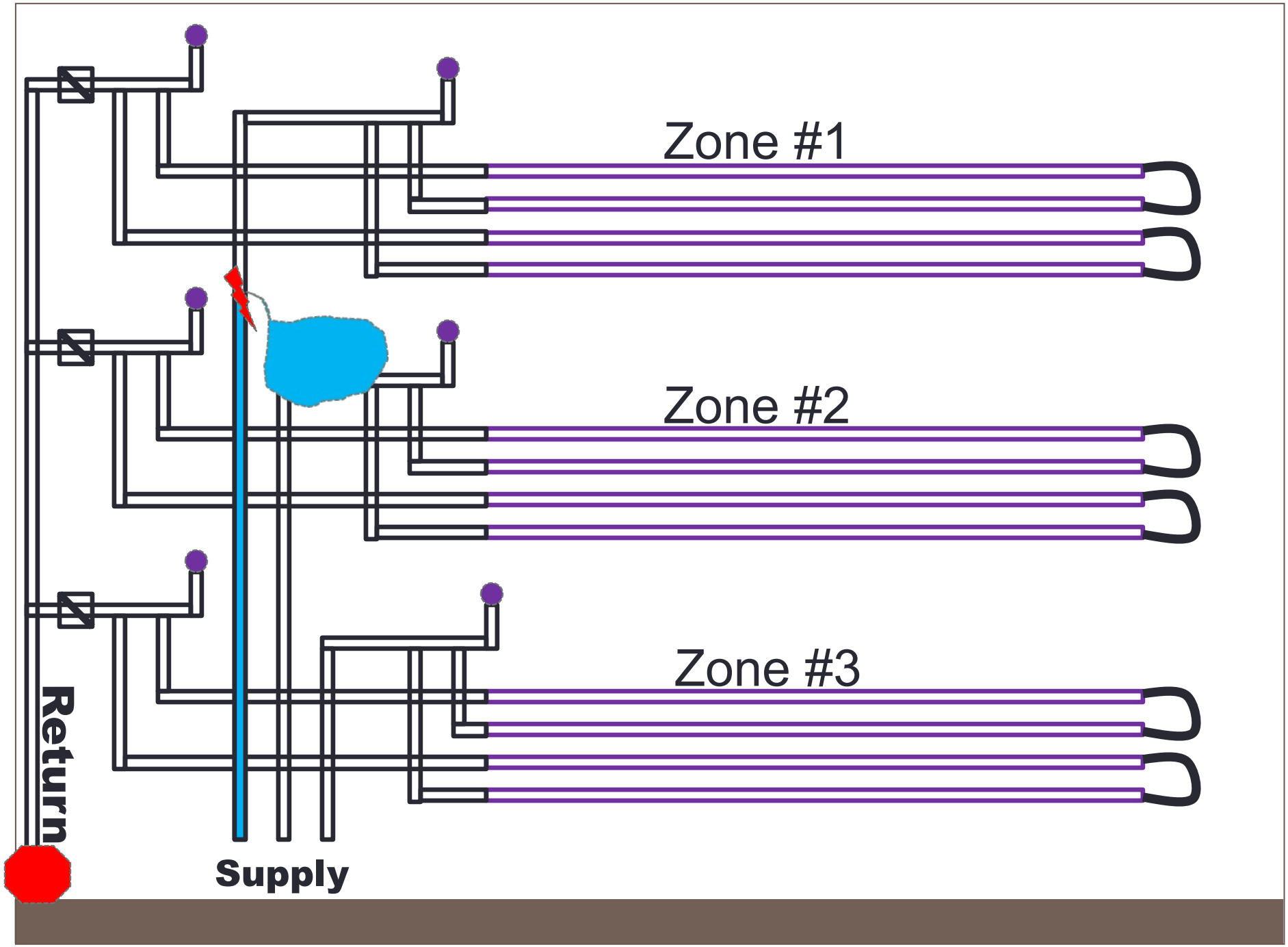
Scenario 6	Supply PSI	Return PSI
Zone 1 Dose	15	0
Zone 1 Flush	10	0
Zone 2 Dose	45	44
Zone 2 Flush	40	0
Zone 3 Dose	45	44
Zone 3 Flush	40	0

Scenario 6 – Possible Causes

- Break in Zone 1 Supply Line
- Break in Zone 1 Drip Tubing

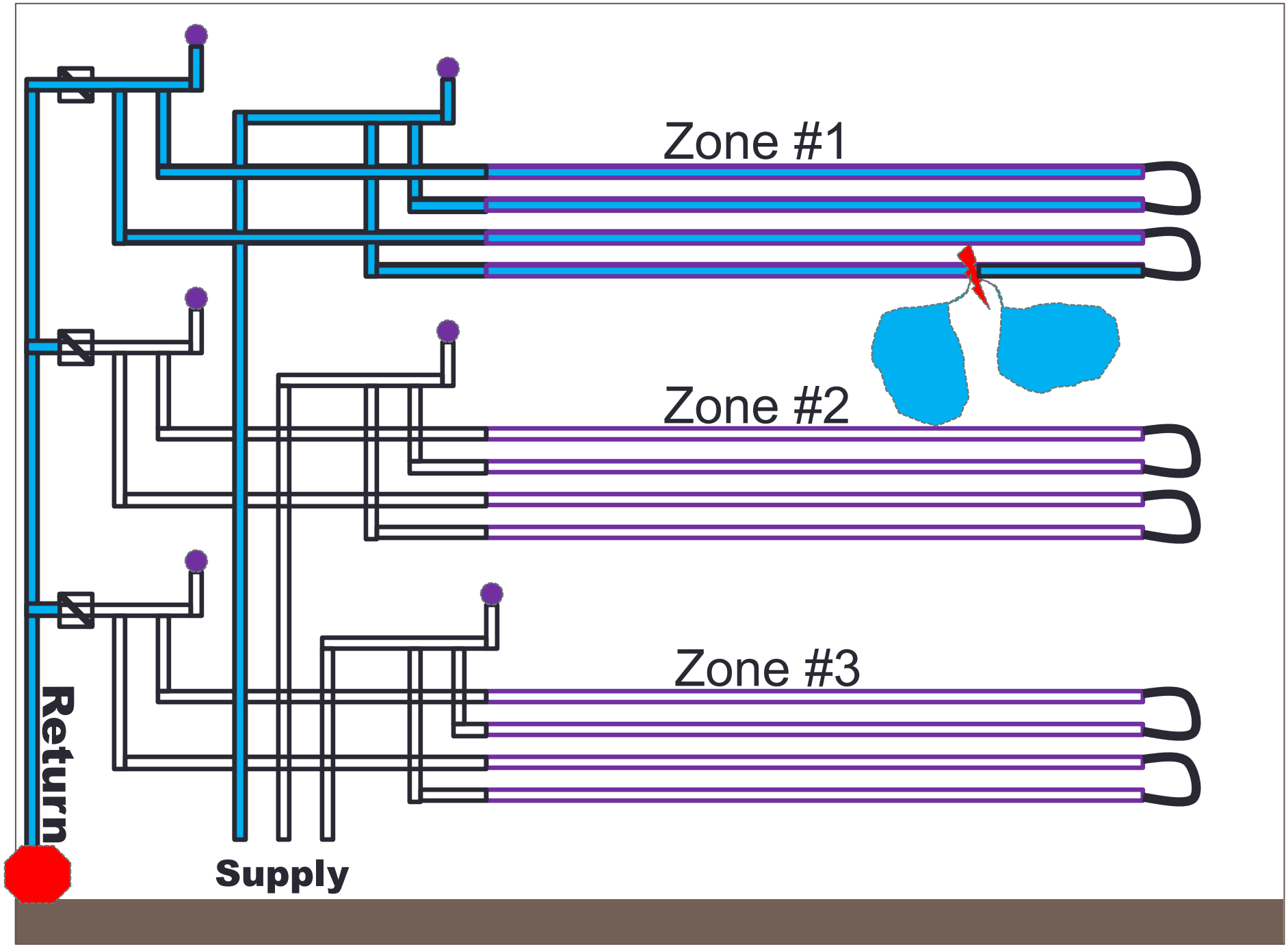
Scenario 6 – Verify then Repair

- To Eliminate or Confirm Break in Zone 1 Supply Line
  - Dose Zone 1
  - Remove air release on Zone 1 supply manifold to verify flow


Zone #1
Zone #2
Zone #3
Return
Supply

Scenario 6 – Verify then Repair

- To Eliminate or Confirm Break in Zone 1 Drip Tubing
  - Dose Zone 1
  - Dig to expose Zone 1 drip tubing
  - Squeeze Test
  - Look for Wet Spots

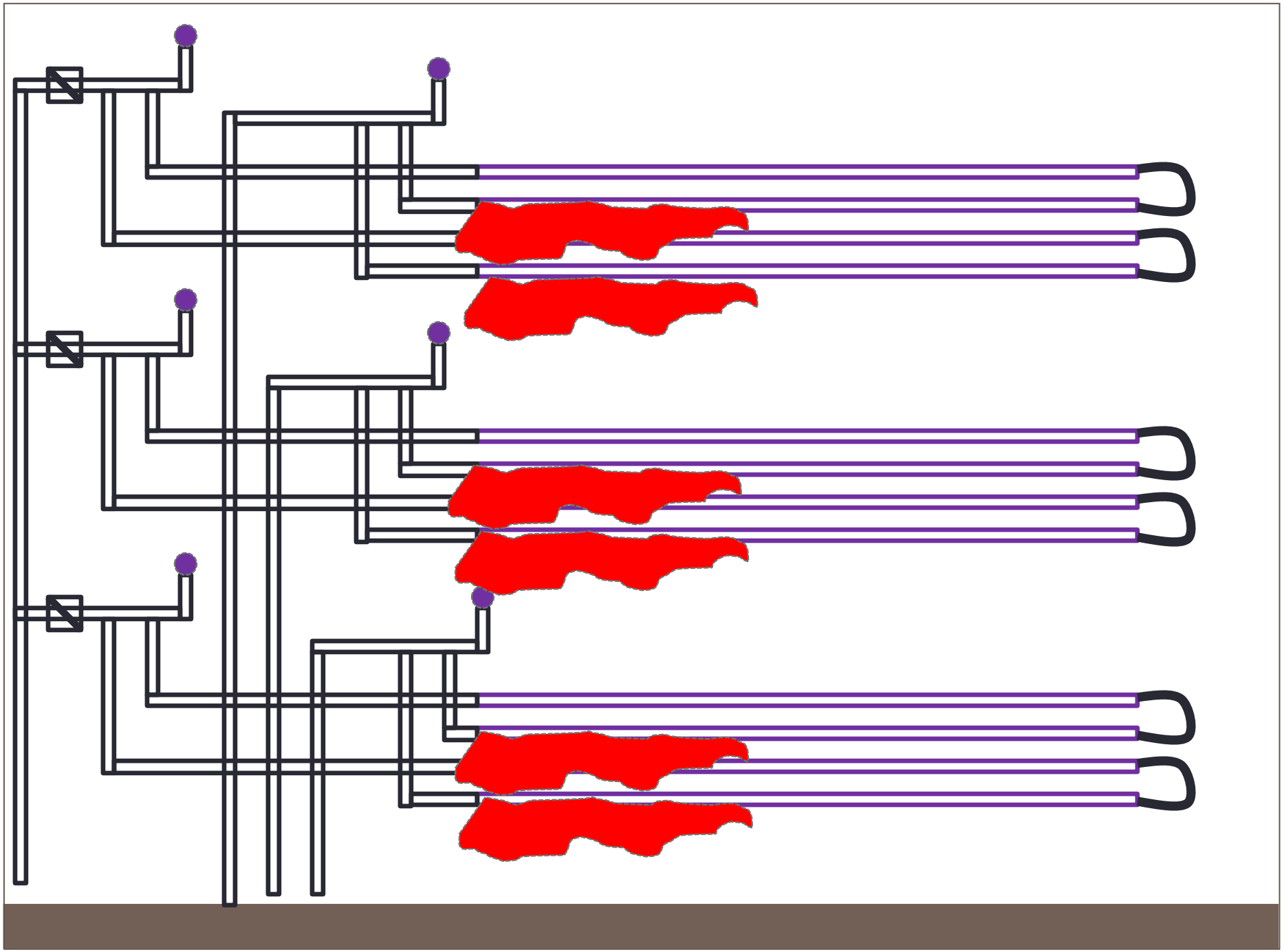

Zone #1
Zone #2
Zone #3
Return
Supply

Scenario 7 - Symptoms

- All Zones Are Surfacing Near Supply Manifold
- Dosing And Flushing Flow Are Normal For All Zones (During O&M Inspection)
- Pressures Are Normal on All Zones (During O&M Inspection)

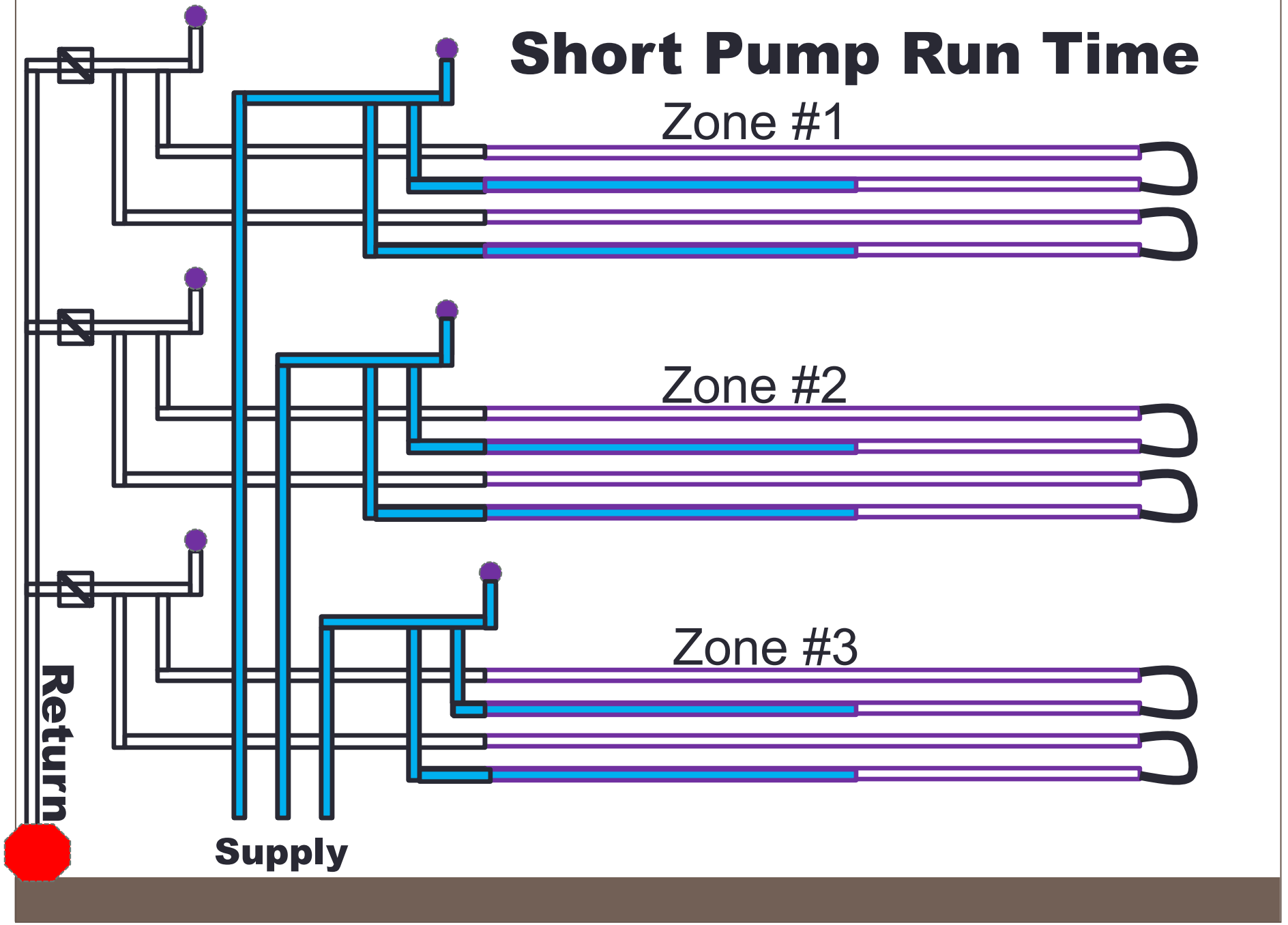
Scenario 7	Start-up	Measured
Zone 1 Dose	2.2	2.2
Zone 1 Flush	9.9	9.9
Zone 2 Dose	2.2	2.2
Zone 2 Flush	10.5	10.5
Zone 3 Dose	2.2	2.2
Zone 3 Flush	9.7	9.7

Scenario 7	Supply PSI	Return PSI
Zone 1 Dose	45	44
Zone 1 Flush	40	0
Zone 2 Dose	45	44
Zone 2 Flush	40	0
Zone 3 Dose	45	44
Zone 3 Flush	44	0



Scenario 7 – Possible Causes

- Break in all Zones – “Cable Cut”
  - NO
    - Dose & Flush Rates Would be High
    - Pressures Would be Low
- Clogging of Drip Tubing
  - NO
    - Dose & Flush Rates Would be Low
    - Pressures Would be High
- Pump Run Time Not Long Enough to Pressurize
- Tubing Not Installed on Contour

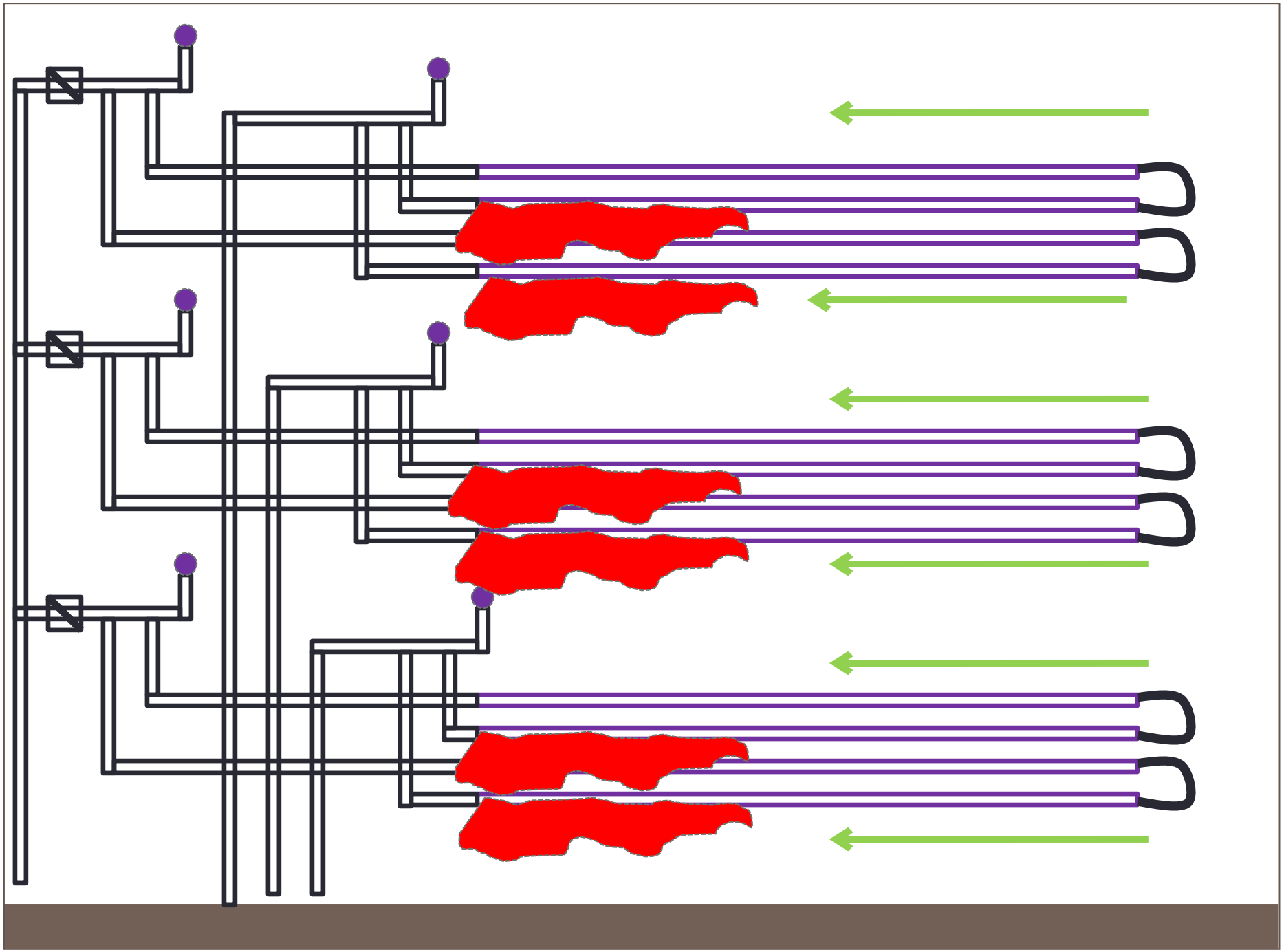

Short Pump Run Time
Zone #1
Zone #2
Zone #3
Return
Supply

Scenario 7 – Verify then Repair

- To Eliminate or Confirm Improper Pump Run Time
  - Observe the System During an Automatic Dose
  - Compare Pump Run Time Settings to Design
  - Double Check Design
  - Reset Pump Run Time if Too Short

Scenario 7 – Verify then Repair

- To Eliminate or Confirm Drip Tubing Not Installed on Contour
  - Dig and expose drip tubing in several locations along a run
  - Use Laser Level to compare elevations
  - Under Pressurized flow all emission will be even but under unpressurized conditions effluent will drain back to the lowest point



Scenario 8 - Symptom

- Lower Than Expected Flow During Dose For All Zones
- Dosing Pressure Very High For All Zones
- High Water Level in Field Dose Tank

Scenario 8	Start-up	Measured
Zone 1 Dose	2.2	.4
Zone 1 Flush	9.9	7.9
Zone 2 Dose	2.2	.2
Zone 2 Flush	10.5	10.7
Zone 3 Dose	2.2	.5
Zone 3 Flush	9.7	10.1

Scenario 8	Supply PSI	Return PSI
Zone 1 Dose	90	90
Zone 1 Flush	60	0
Zone 2 Dose	95	90
Zone 2 Flush	60	0
Zone 3 Dose	90	90
Zone 3 Flush	60	0

Scenario 8 – Possible Causes

- Clogged Emitters in Drip Tubing
  - Due to improper air release function
  - Due to solids in field dose tank
- Pump is Oversized for System

Scenario 8 – Verify then Repair

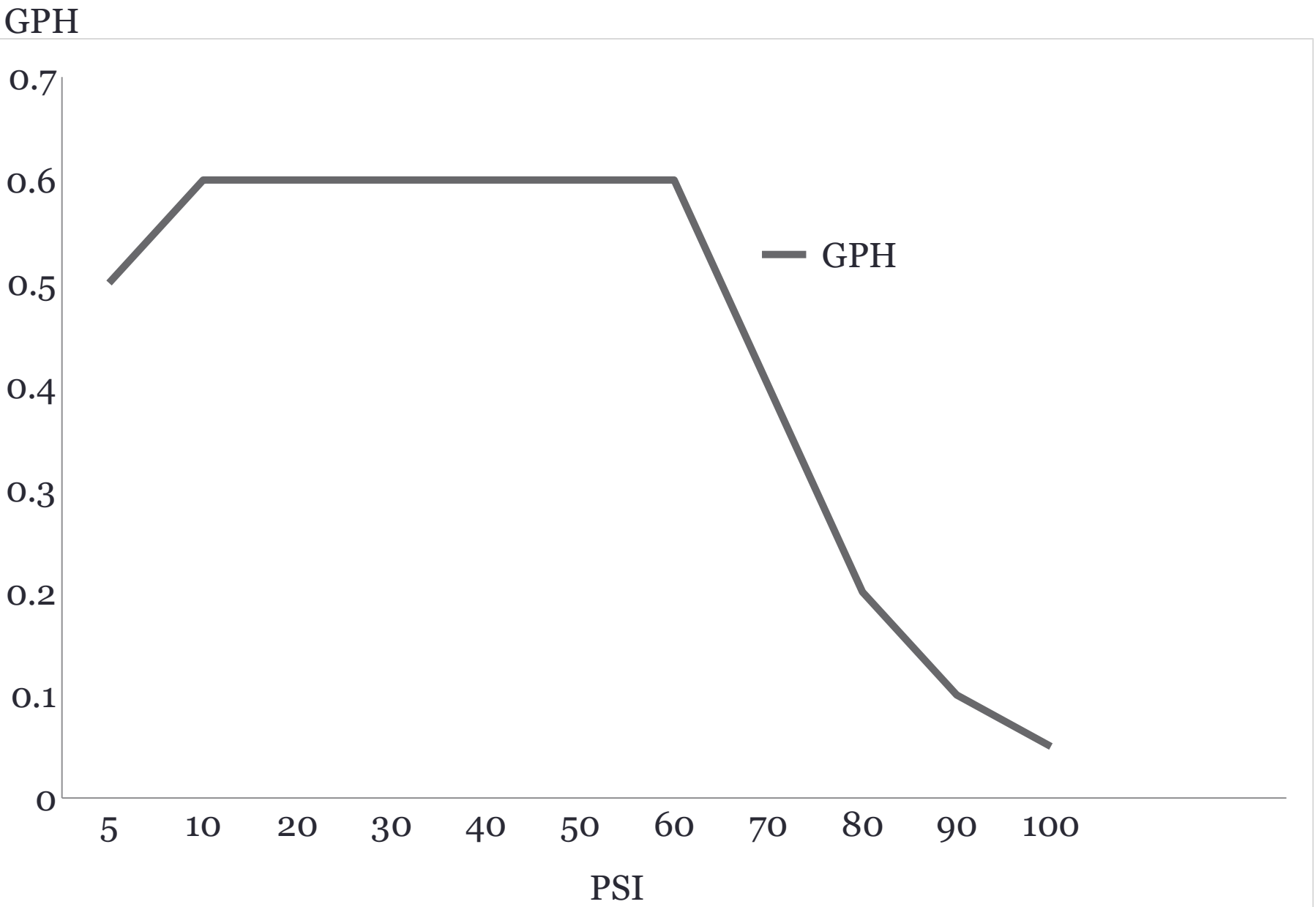
- To Eliminate or Confirm Drip Emitters Clogged
  - Dig to expose drip tubing at several places in the field
  - Cut Tubing
  - Look inside tubing for growth / scum
  - Look for problems with Filter, Effluent Screen, Pretreatment or Effluent Strength if emitters are clogged

Scenario 8 – Verify then Repair

- To Eliminate or Confirm Drip Emitters Clogged
  - Make sure air release valve is installed on the return line at the highest point
  - Check air release valve for proper function

Scenario 8 – Verify then Repair

- To Eliminate or Confirm Oversized Pump
  - Check to see if pump has been replaced
  - Double check design for proper pump sizing
  - Check design to see if a pressure reducer was specified
  - Is the pressure reducing valve in place and working?


GPH
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
GPH
5
10
20
30
40
50
60
70
80
90
100
PSI

Scenario 9 - Symptoms

- Pump Will Not Run
- High Water Level In All Tanks

Scenario 9 – Possible Causes

- Bad Pump
- Faulty Low Level Float
- Faulty PCB / Control Panel

Scenario 9 – Verify then Repair

- To Eliminate or Confirm Bad Pump
  - Check Voltage to Pump
  - Check Breakers

Scenario 9 – Verify then Repair

- To Eliminate or Confirm Faulty Low Level Float
  - Pull Float Tree
  - While Operating Low Level Float Watch Control Panel
  - Test Continuity in Float

Scenario 10 - Symptoms

- Septic Tank Filled With Foamy Scum
- Effluent Filter Clogged
- Dosing Rates High On All Zones
- Dosing Pressures Low On All Zones

Scenario 10 – Possible Causes

- Solenoid Faulty Solenoid on Field Flush Valve
- Split Diaphragm on Field Flush Valve
- Trash in Field Flush Valve Preventing the Valve from Seating Properly
- Filter Flush Constantly Backwashing

Scenario 10 – Verify then Repair

- To Eliminate or Confirm Faulty Field Flush Solenoid
  - Observe inlet end of septic tank for return flow during dose
  - Unscrew solenoid and energize
    - Does if function properly?

Scenario 10 – Verify then Repair

- To Eliminate or Confirm Split Diaphragm or Trash in Field Flush Valve
  - Observe inlet end of septic tank for return flow during dose
  - Disassemble field flush valve to inspect diaphragm
    - Make sure valve is free of trash that would prevent it from properly seating
    - You may have to flex the diaphragm to see cracks or splits