

Siphonic Roof Drainage



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Gravity vs. Siphonic Drainage
Siphonic Drains
Tailpipes
Pipework
LEED™ - Green Building Design
Applications
Why Siphonic?
Siphonix® Software



Introduction

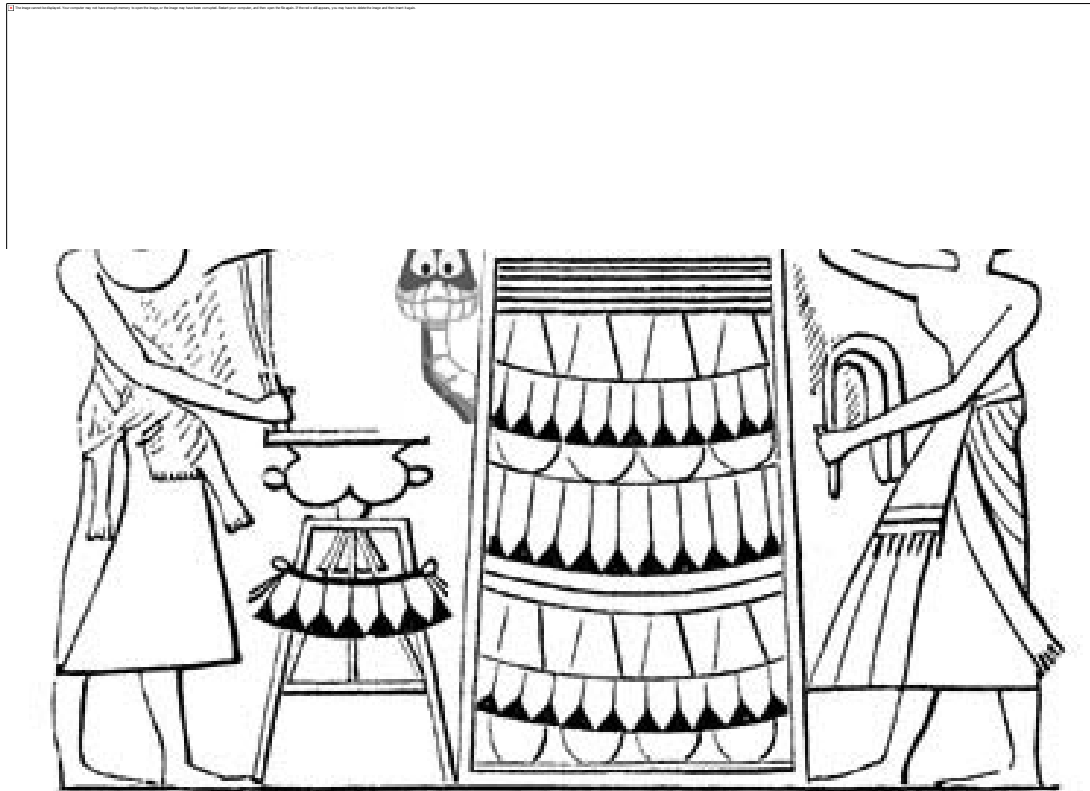


- Invented and patented 1968 by Olavi Ebeling
- A fully engineered and highly efficient system based on hydraulic principles
- Used throughout Europe since 1970s
- System design simplified by current generation of software

Siphonic Action



- First use documented in ancient Egypt



Siphonic Action



- Created by a pipe **completely** filled with fluid with one end lower than the other

Siphonic Action



- Created by a pipe **completely** filled with fluid with one end lower than the other
- Gravity will cause the fluid to drain through the lower end

Siphonic Action



- Created by a pipe **completely** filled with fluid with one end lower than the other
- Gravity will cause the fluid to drain through the lower end
- Cohesive forces between water molecules ensures the pipe remains full

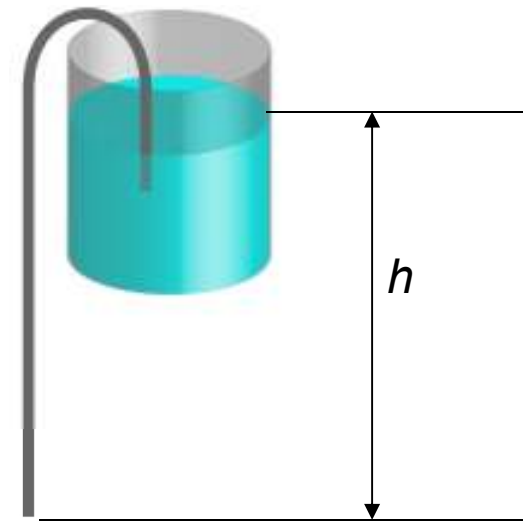
Siphonic Action

- The point of ingress must be higher than the exit point



Siphonic Action

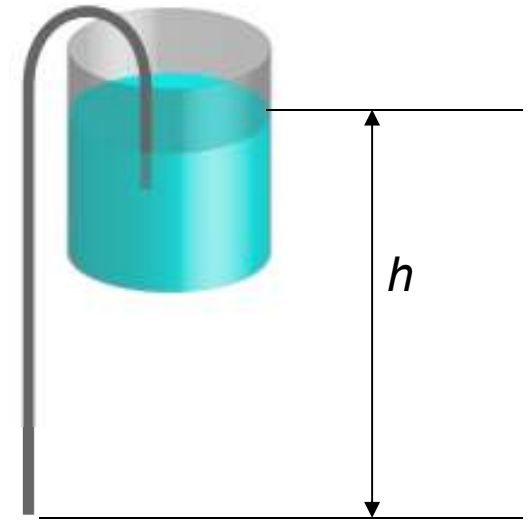
- The point of ingress must be higher than the exit point
- The greater the height difference, the greater the capacity



Siphonic Action



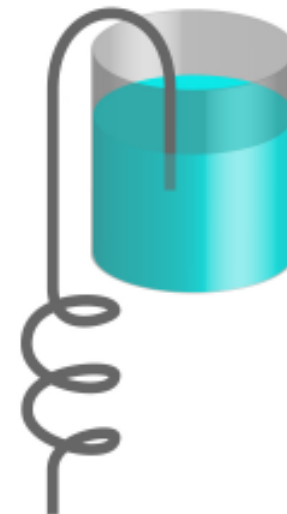
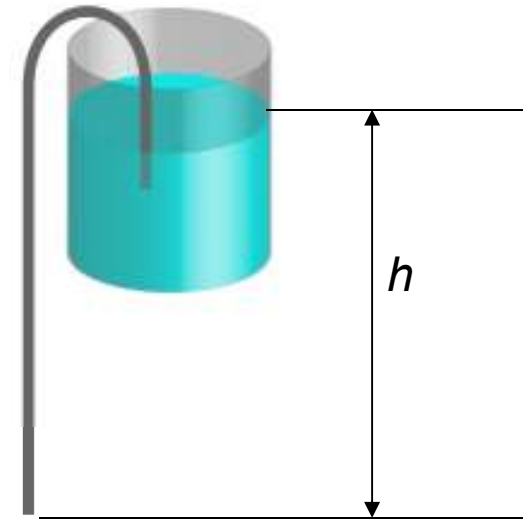
- The point of ingress must be higher than the exit point
- The greater the height difference, the greater the capacity
- The pipe must be completely full





Siphonic Action

- The point of ingress must be higher than the exit point
- The greater the height difference, the greater the capacity
- The pipe must be completely full
- Friction has a big impact



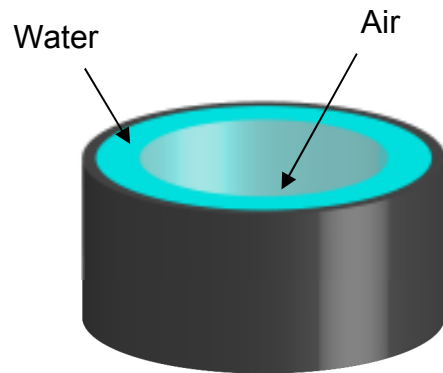
Gravity vs. Siphonic Systems



Gravity vs. Siphonic Systems



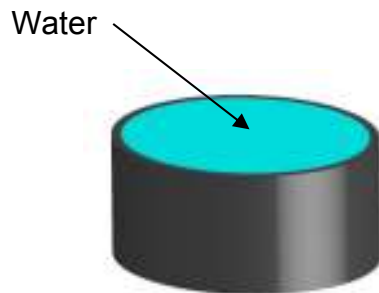
- Gravity



In gravity systems, water adheres to the wall of the pipe

Typically only 30% of the pipework is filled with water – 70% is air

- Siphonic



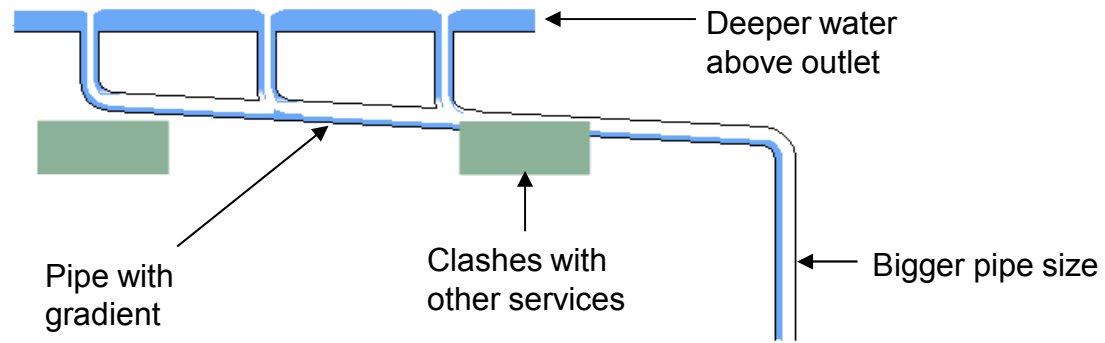
In a primed & working siphonic system, 100% of the pipe is filled with water

Pipework can therefore be significantly smaller

Gravity vs. Siphonic Systems



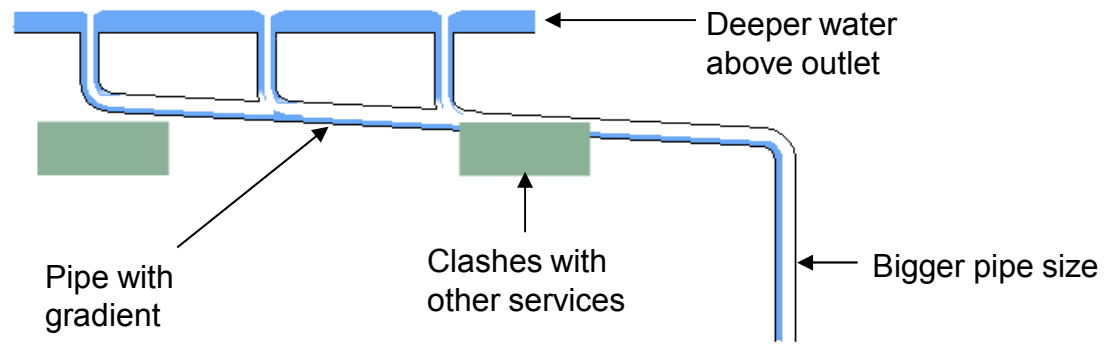
- Gravity



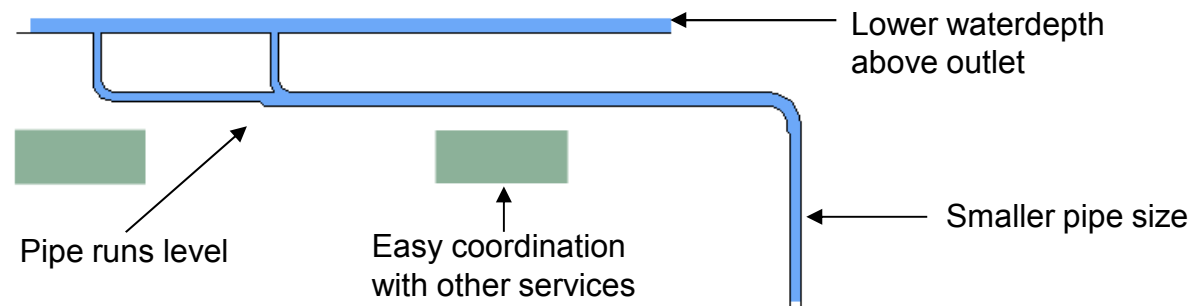
Gravity vs. Siphonic Systems



- Gravity



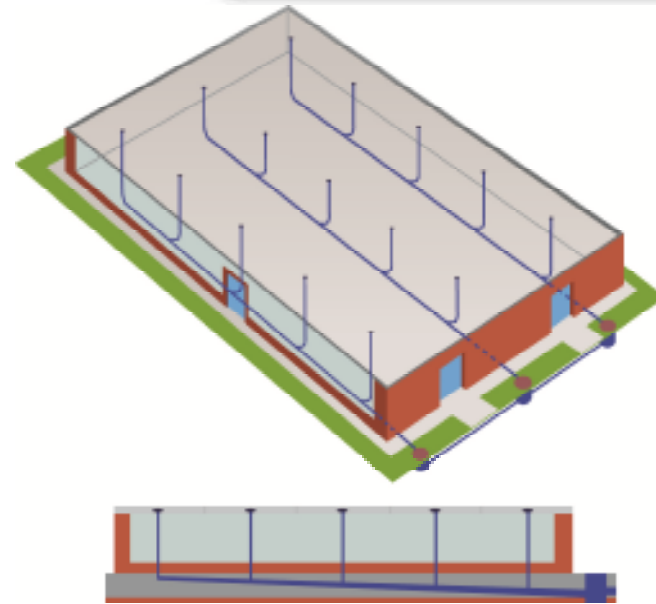
- Siphonic



Gravity vs. Siphonic Systems



- Gravity
 - Number of downpipes
 - Significant underground work
 - Intrusive piping

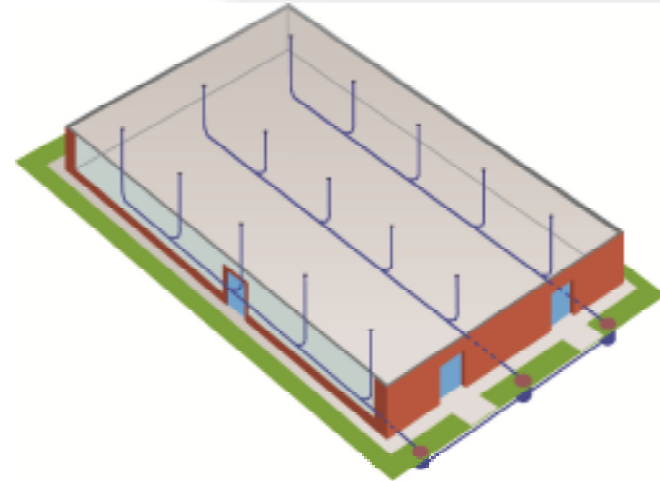


Gravity vs. Siphonic Systems



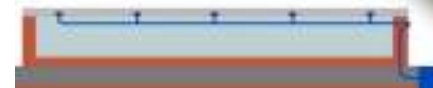
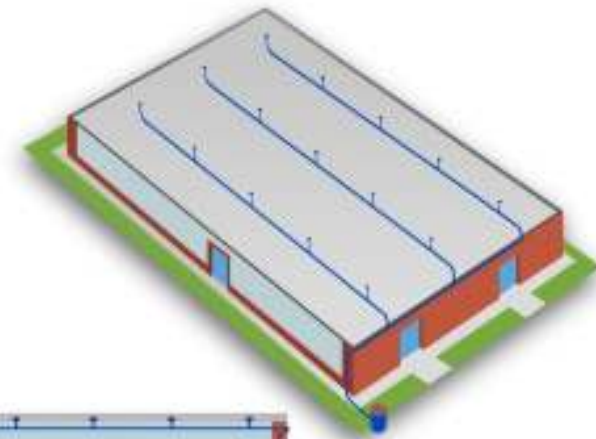
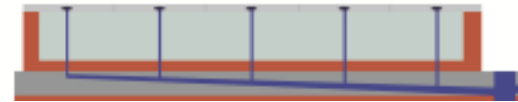
- Gravity

- Number of downpipes
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- Siphonic

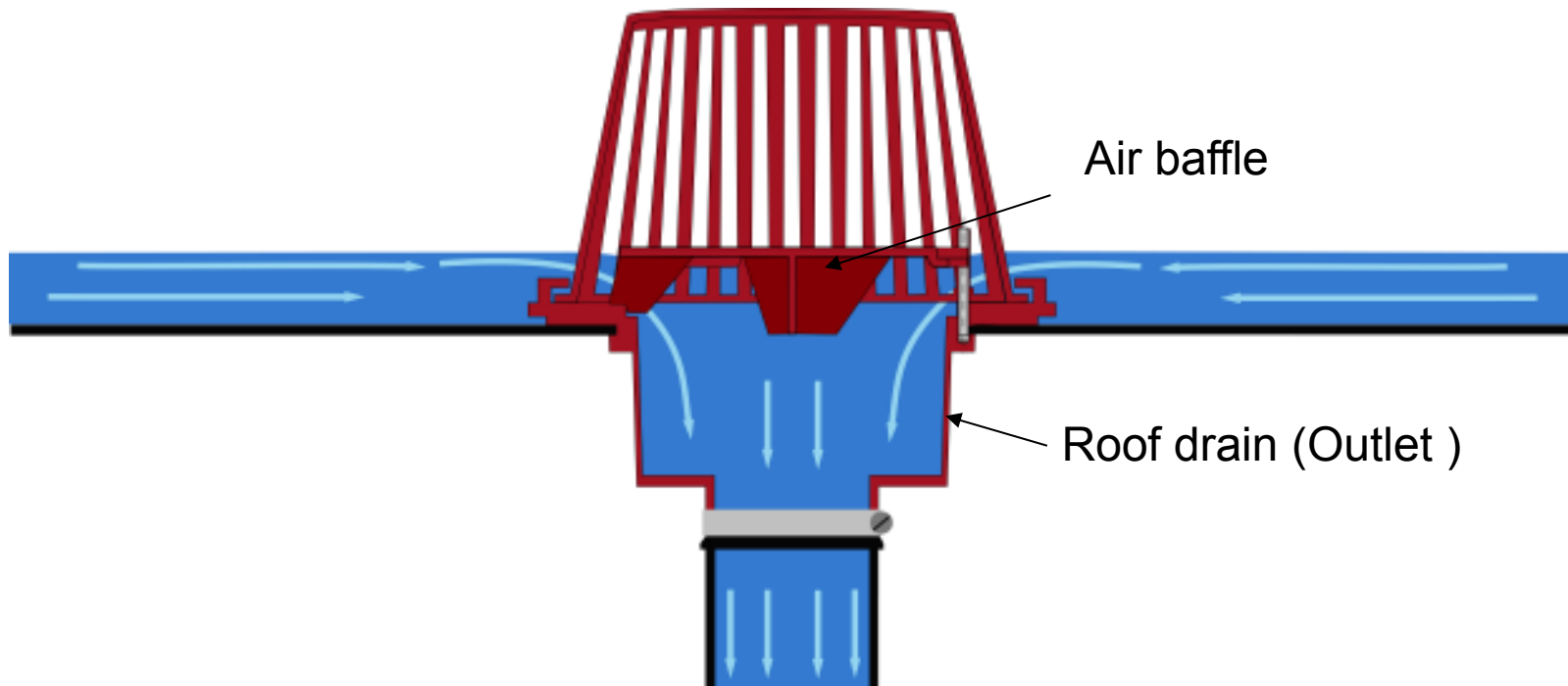
- Fewer downpipes
- Minimised underground work
- High level pipes
- Horizontal pipes



Siphonic Drains



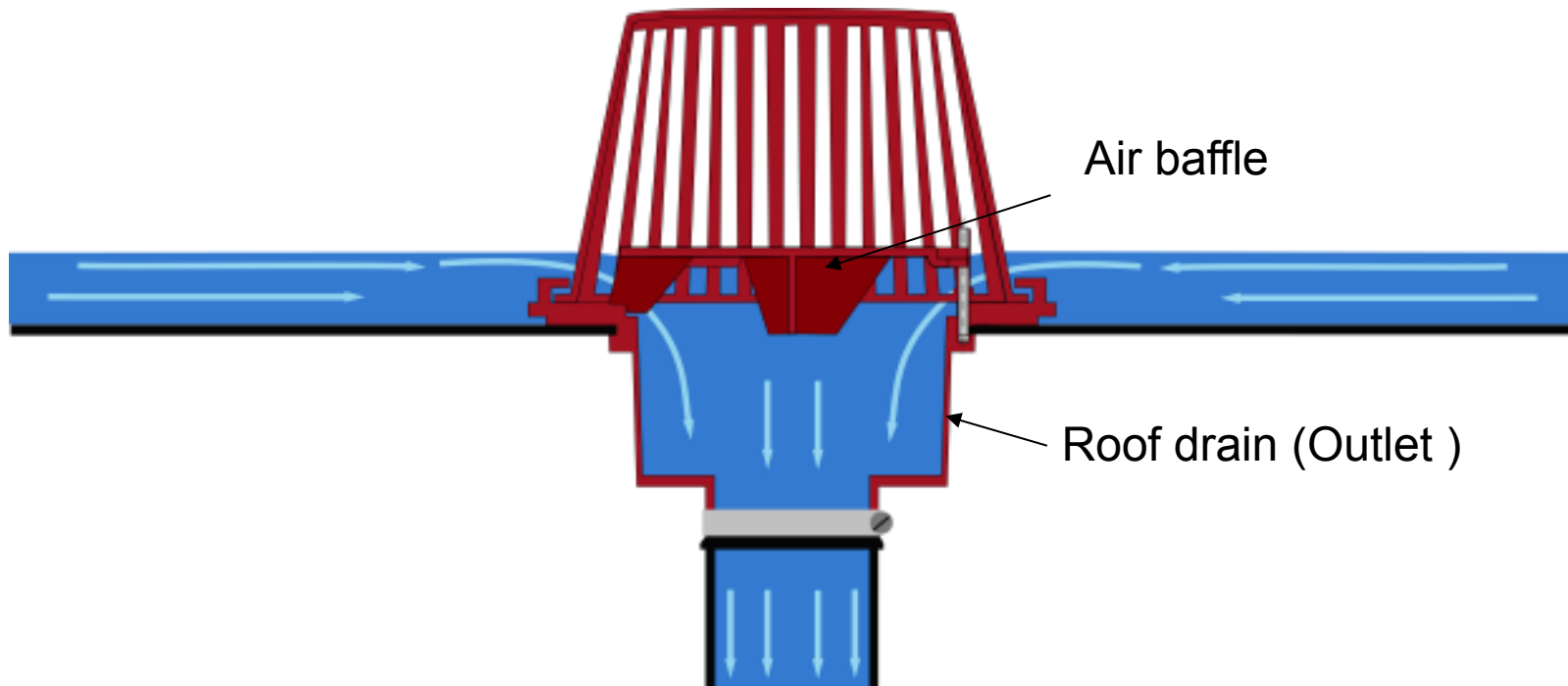
- Outlet: it's just a controlled hole in the roof!



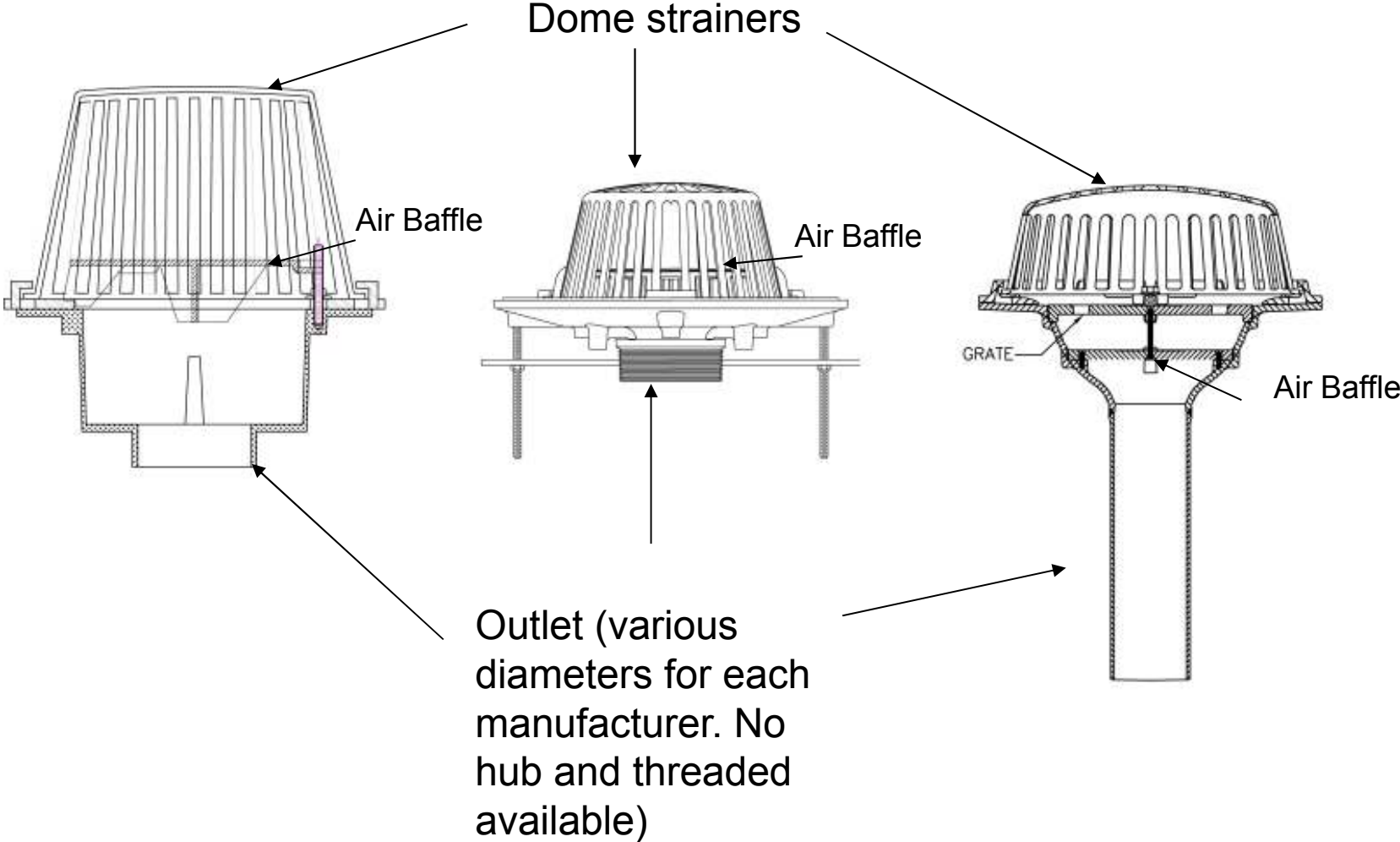
Siphonic Drains



- Outlet: it's just a controlled hole in the roof!
- Siphonic action only occurs when the air baffle is completely submerged



Siphonic Drains



Siphonic Drains



- Design & testing performed with CRM Drainage Consultants



Siphonic Drains



- Design & testing performed with CRM Drainage Consultants
- Full siphonic test rig



Siphonic Drains



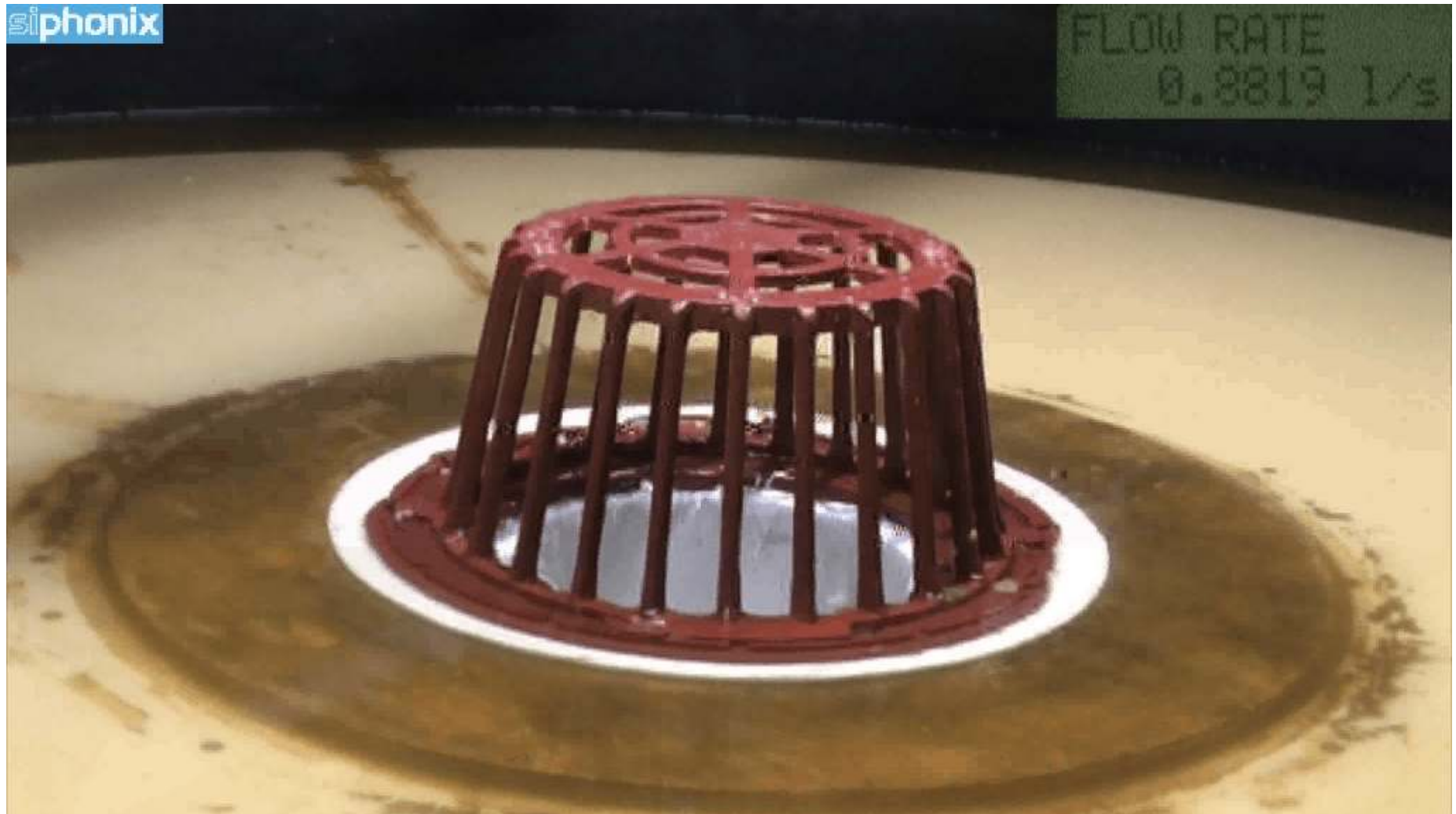
- Design & testing performed with CRM Drainage Consultants
- Full siphonic test rig
- Conforms to ASME Standard A112.6.9-2005



Siphonic Drains



Conventional Roof Drain

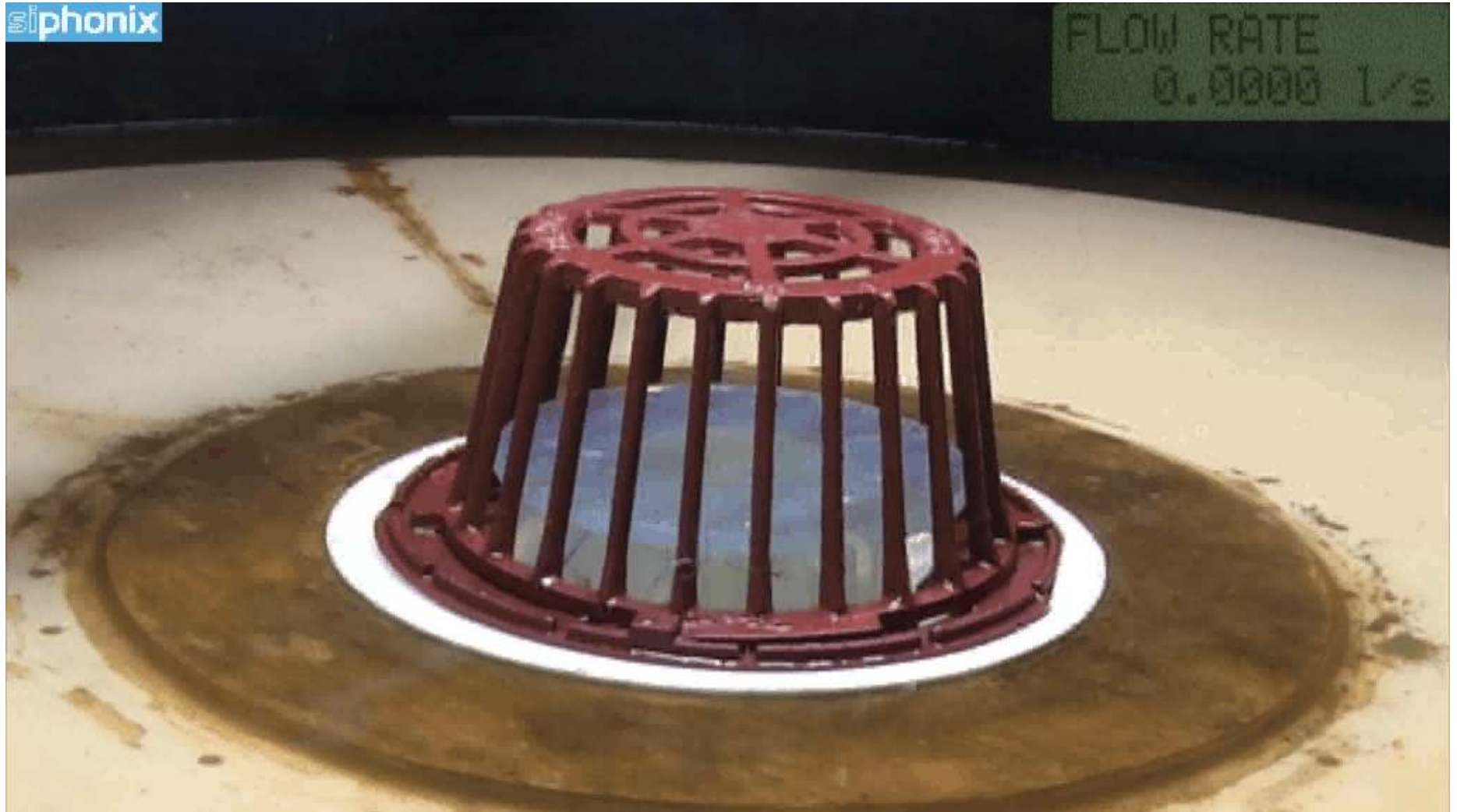


Siphonic Drains



Siphonic Roof Drain

iphonix



Tailpipes



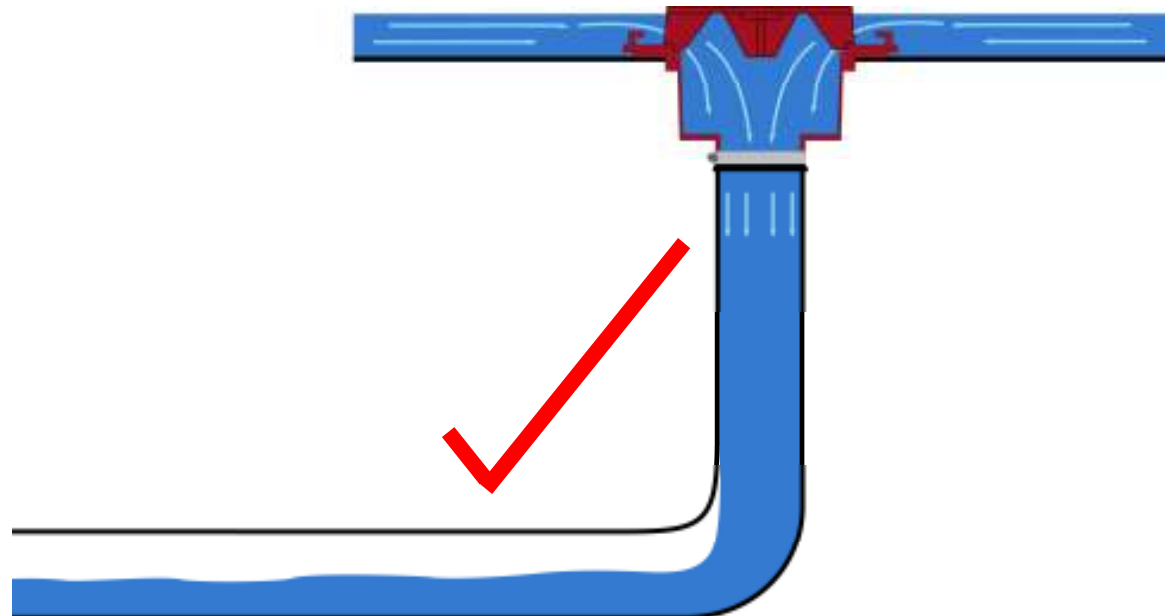
- Connects the roof drain to the horizontal collector



Tailpipes



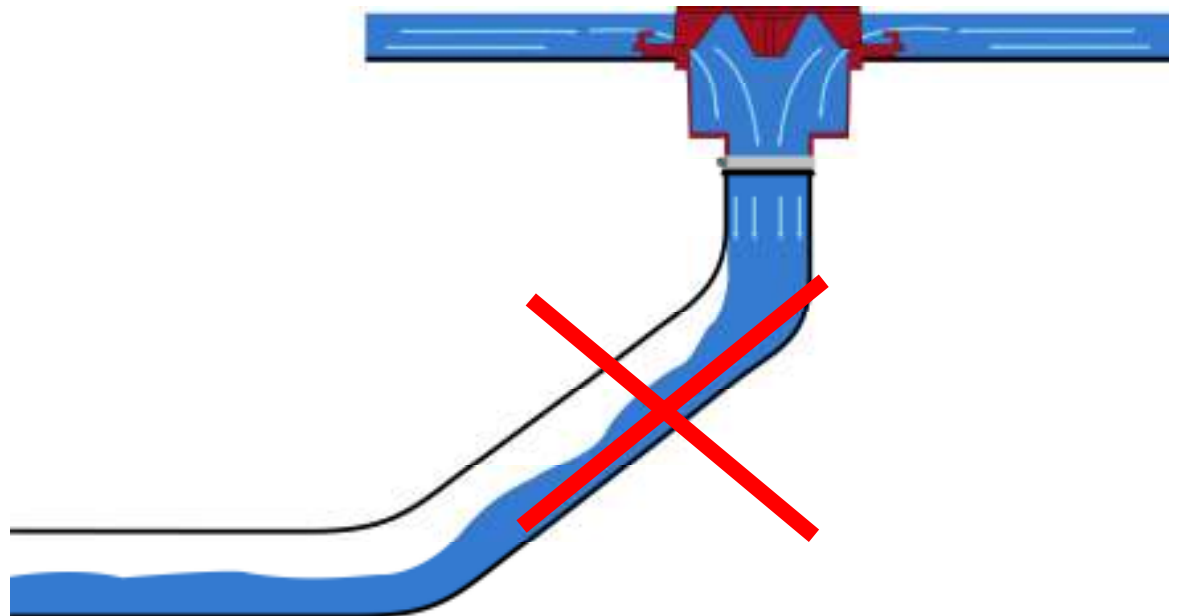
- Connects the roof drain to the horizontal collector
- Pipes must be vertical and horizontal – not inclined



Tailpipes



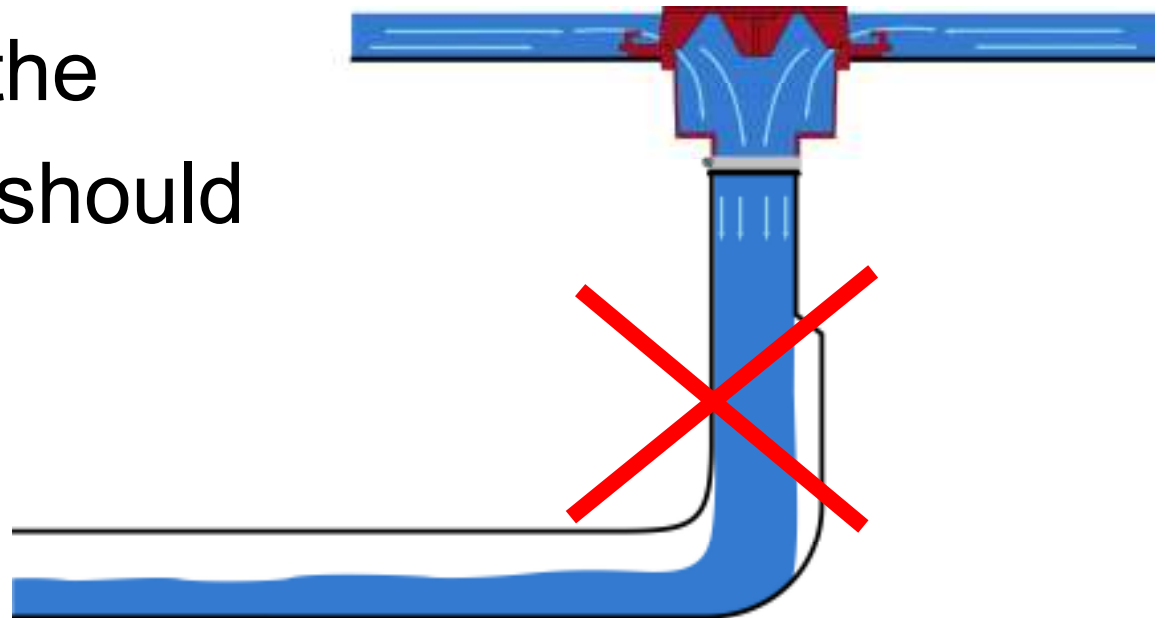
- Connects the roof drain to the horizontal collector
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Tailpipes



- Connects the roof drain to the horizontal collector
- Pipes must be vertical and horizontal – not inclined
- Expansion in the vertical plane should be avoided



Pipework

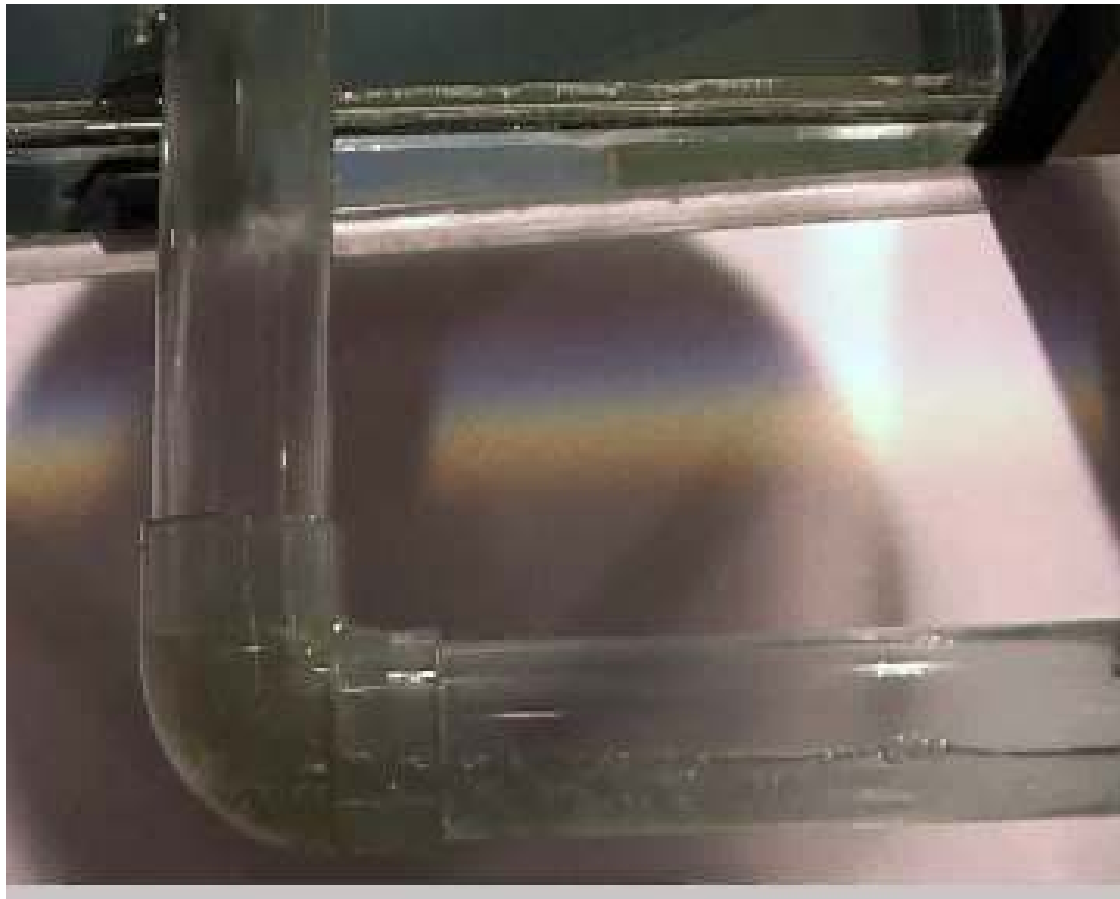


- Most materials are suitable
 - Cast Iron
 - Ductile Iron
 - Stainless Steel
 - Galvanised steel
 - Copper
 - ABS
 - HDPE
 - PVC
- Check ASPE Guide for details
- Remember pressure is negative!

Siphonic Drains



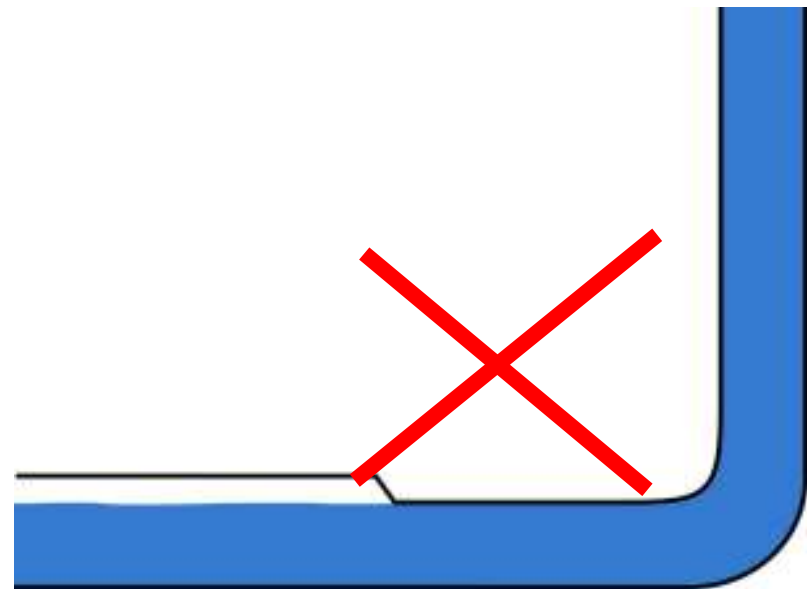
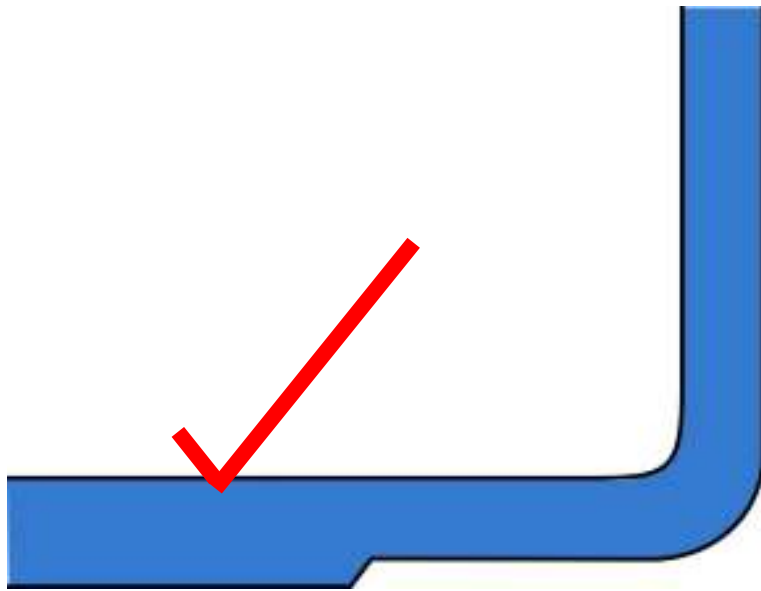
- Water drains normally before siphonic action



Pipework



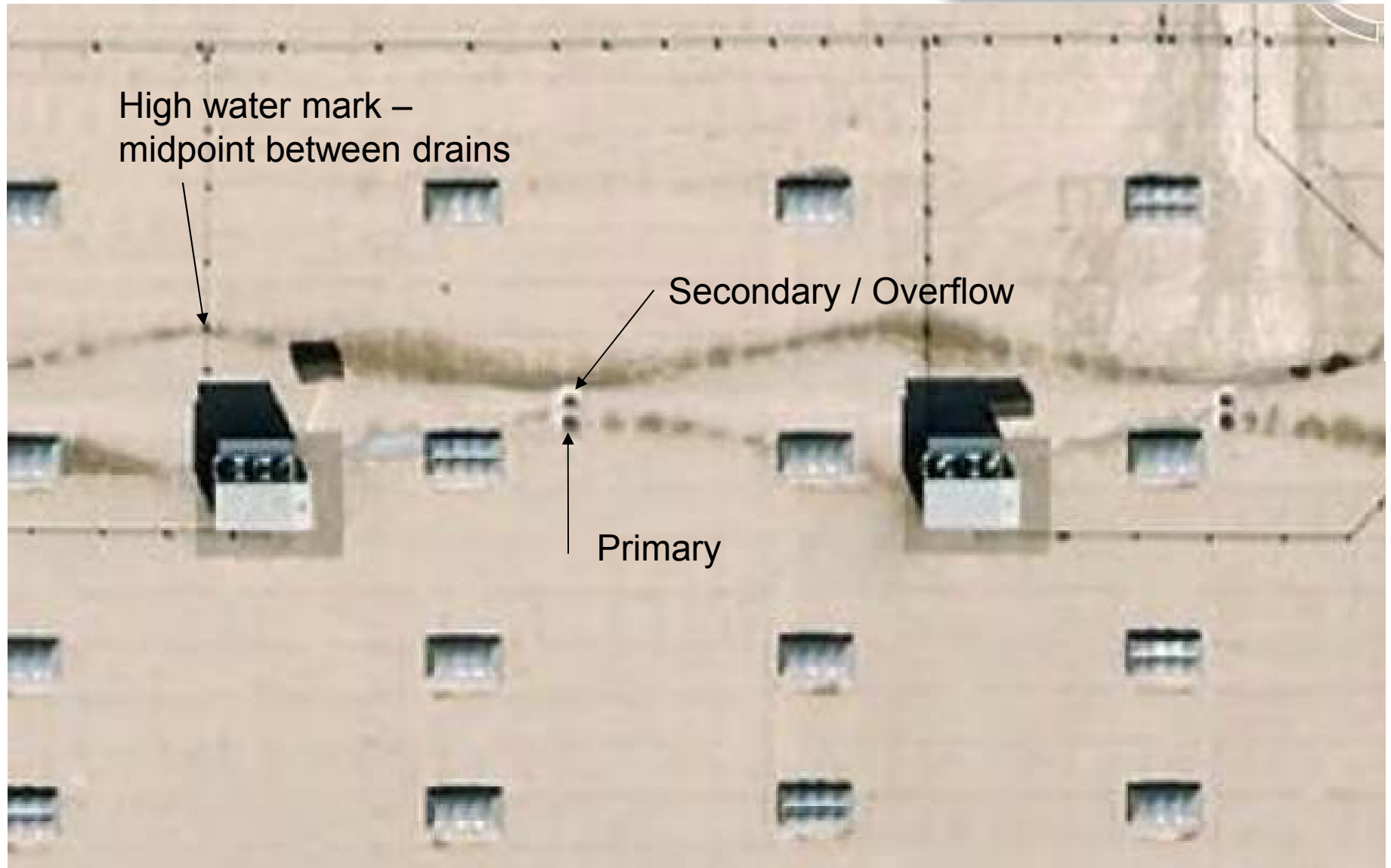
- Pipes are installed horizontal & vertical
- Eccentric fittings should be used – where possible



On the roof



On the roof



High water mark –
midpoint between drains

Secondary / Overflow

Primary

LEED™ - Green Building Design



- Siphonic Roof Drainage can gain points

LEED™ - Green Building Design



- Siphonic Roof Drainage can gain points
 - ✓ Reduced site disturbance (SS Credit 5.1)

LEED™ - Green Building Design



- Siphonic Roof Drainage can gain points
 - ✓ Reduced site disturbance (SS Credit 5.1)
 - ✓ Controlled flow roof drainage (SS Credit 6.1)

LEED™ - Green Building Design



- Siphonic Roof Drainage can gain points
 - ✓ Reduced site disturbance (SS Credit 5.1)
 - ✓ Controlled flow roof drainage (SS Credit 6.1)
 - ✓ Rainwater harvesting (WE Credit 3.1/3.2)

LEED™ - Green Building Design



- Siphonic Roof Drainage can gain points
 - ✓ Reduced site disturbance (SS Credit 5.1)
 - ✓ Controlled flow roof drainage (SS Credit 6.1)
 - ✓ Rainwater harvesting (WE Credit 3.1/3.2)
 - ✓ Innovation in design (ID Credit 1.1)

Applications

- Large footprint buildings!
 - Warehouses
 - Distribution Units
 - Airports
 - Sports Stadiums
 - Shopping Malls
 - Factories



Why Siphonic?



- **Greater efficiency**
 - Smaller pipes
 - Fewer outlets
 - Easier maintenance

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- **Lower groundwork costs**
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 - Fewer outlets
 - Easier maintenance
- **Lower groundwork costs**
 - Less underground pipework
- **Reduced installation time**
 - Easier to install
- **Greater architectural freedom**
 - Fewer downpipes
 - Level installation of pipework
 - Smaller pipes

Siphonix[®] Software



Siphonix Vers. 3 - [New Siphon Wizard]

File View Tools Help

Core Settings

System Identifier: [] Rainfall: 2674 in/yr Preferred Material: PVC

System Type: Primary Overflow

Maximum Pipe Length: [] Min pipe diameter: [] Max pipe diameter: []

Buttons: Load Defaults, Safety Check, Quick Build, Balance, Edit

Underground

Downpipe

Stacked Downpipe Downpipe Height: 30 ft

Swan Hook

Branches

Transporter/Offset

Stepped Offset Transporter Length: 8.2 ft

Wiggled Offset

Collector

Stepped Collector Collector Length: 380 ft

No. Tails: [] or Tailpipe Spacing: 33 ft [Add Additional Collector Main](#)

Collectors: []

Tail Pipes

Branch to bend: [] ft Length: 6.6 ft Height: 3.3 ft Cranked Use Orifice Plates

Drain Size: Mifab 4" Drain Type: [] Overflow Height: []

[Move to Next Branch](#)

Loaded Project: [] Loaded Siphon: []

Siphonix[®] Software



Siphonix Vers. 3 - [Edit Current Siphon]

File View Tools Help

System Section Part Rotate Zoom Pan Front Plan Side Isometric

System Details

- Out of Balance Head: 0.01 ft
- Minimum Pressure: -21.81 ft
- Maximum Pressure: 4.65 ft
- Minimum Velocity: 4.48 ft/s
- Maximum Velocity: 21.91 ft/s
- Discharge Velocity: 21.25 ft/s
- Rainfall: 2718.35 gal/m
- System Volume: 1390.6 gallons
- Fill Time: 45 - 53 sec
- Start-up + cv: 271C.05 gal/m
- Estimated Piping Cost: 832C.02

System

Name	Rate (gal/min)	Residual Head (feet)	Description	Length	Diameter	Rate	Head Loss	Frass	Velh	Supplier	Supplier Refere
Branch 1											
Tail Pipe 1	224.671	0									
Tail Pipe 2	232.33	0									
Tail Pipe 3	225.333	0									
Tail Pipe 4	227.000	0									
Tail Pipe 5	224.225	0									
Tail Pipe 6	225										
Tail Pipe 7	226										
Tail Pipe 8	224										
Tail Pipe 9	226										
Tail Pipe 10	223										
Tail Pipe 11	226										
Tail Pipe 12	225										
Tail Pipe 5											
Residual Head, C feet											
Joint (branch)				1'0"	2.5"	224.3	6.440	-15.770	21.37	Spears	475-622F
End 45					2.5"	224.3	1.990	-13.780	21.37	Spears	417-025
Pipe (1 line)				3'3.3"	2.5"	224.3	0.500	-10.200	21.37	Harvel	C400300-PG-100
Pipe (1 line)				3'3.3"	3"	224.3	1.280	-3.560	14.43	Harvel	C400300-PG-100
Pipe (1 line)				3'3.5"	3"	224.3	0.910	-2.650	14.43	Spears	4CF-030
Pipe (1 line)				3'3.5"	3"	224.3	1.280	-4.670	14.43	Harvel	C400300-PG-100
Residual Head, C feet											
Pipe (1 line)				0'	2.5"	225.76	6.390	-16.000	21.5	Spears	475-622F
Pipe (1 line)				2.5'	2.5"	225.76	2.010	-13.990	21.5	Spears	417-025
Pipe (1 line)				3'3.3"	2.5"	225.76	3.630	10.360	21.5	Harvel	C400300-PG-100
Pipe (1 line)				3'3.3"	3"	225.76	1.300	-3.630	14.53	Harvel	C400300-PG-100
Pipe (1 line)				3'	3"	225.76	0.920	-2.710	14.53	Spears	4CF-030
Pipe (1 line)				3'3.5"	3"	225.76	1.300	-4.710	14.53	Harvel	C400300-PG-100
Pipe (1 line)				3'	3"	225.76	1.610	-2.960	14.53	Mifab	MIFAB-3"

Print System Details
Rename Branch
Rename Tailpipe
-ip Tail(s)
Change Branch Axis
Adjust k Value of Drain
Adjust k Value of Pipes
Adjust Fcfs
Auto Adjust Rate
Set Equal Rates

Siphonix[®] Software



Siphonix Vers. 3 - [Edit Current Siphon]

File View Tools Help

System 3D Section 3D Part Parts List

Rotate Zoom Pan Front Plan Side Isometric

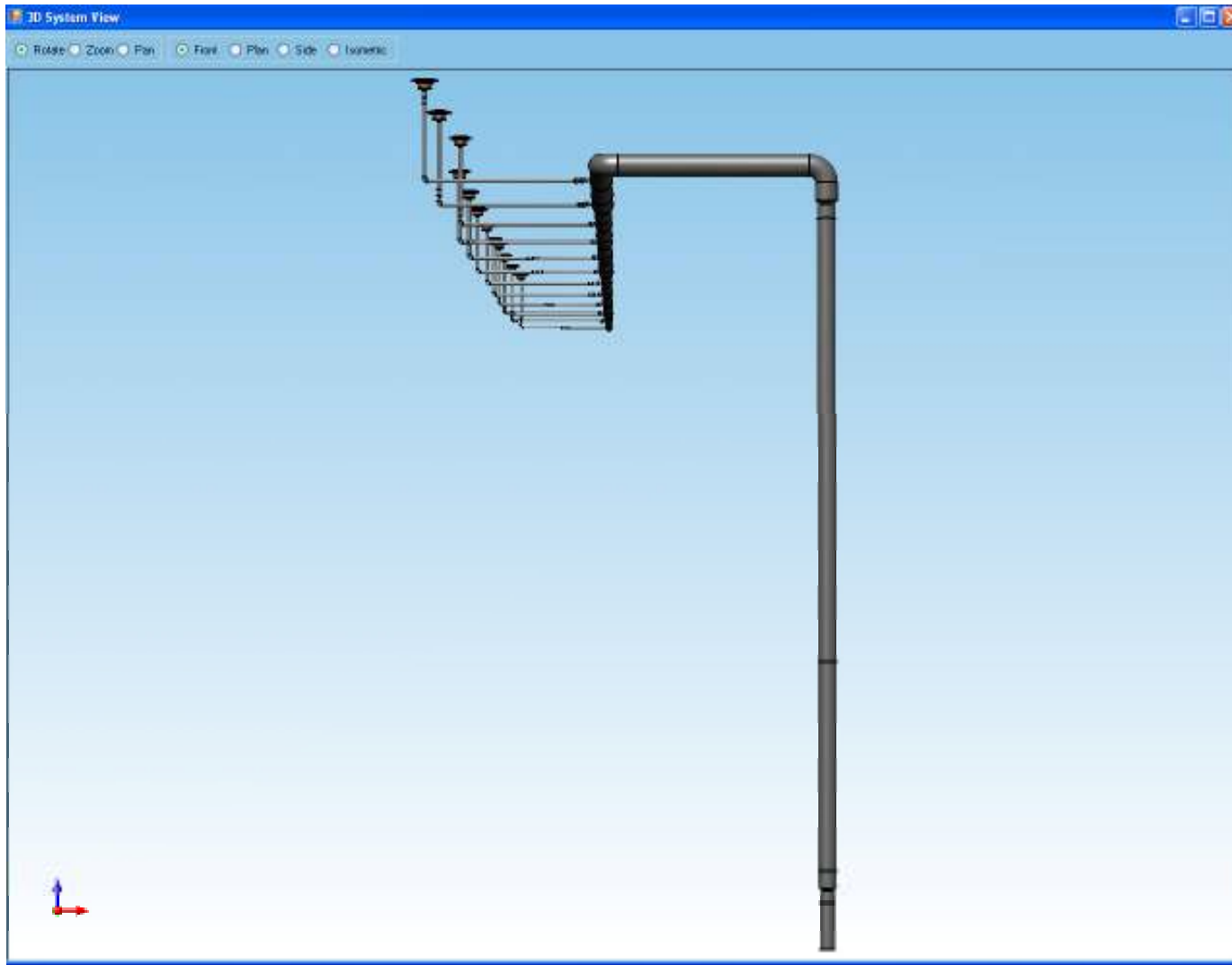
System Details

Total Balance Head: 0.01
 Minimum Pressure: -22.28
 Maximum Pressure: 9.96
 Minimum Velocity: 3.55
 Maximum Velocity: 22.16
 Discharge Velocity: 20.56
 Residual: 2629.74
 System Volume: 1276.4
 Fill Time: 26.34
 Start-Up Flow: 890.08
 Extended Pump-Off: 8264.72

Name	Rate	Residual Head	Description	Length	Diameter	Flow	Head Loss	Press.	Vel.	Supplier	Supplier Reference
Te Pipe 5							Residual Head: 0 feet				
Joint (zooch)			10" (2.5")		2.5"	5.20		-10.00	21.40	Spinn	475-227
Resid 45			2.0"		2.0"	2.00		-14.80	21.40	Spinn	475-227
Flow (zooch)			6" (1.5")		1.5"	7.30		-7.90	21.40	Favall	880258-FS-1808
Resid 43			2"		2"	1.00		-1.90	14.40	Spinn	406-330
Flow (zooch)			2" (0.5")		0.5"	1.30		-3.00	14.40	Favall	880258-FS-1808
Outlet			4"		2.0"	0.10		0.50	0.50	Mfab	MIFAB-F
Te Pipe 6							Residual Head: 0 feet				
Joint (zooch)			10" (2.5")		2.5"	0.90		-18.00	22.16	Spinn	475-227
Resid 45			2.0"		2.0"	2.00		-18.00	22.16	Spinn	475-227
Flow (zooch)			6" (1.5")		1.5"	2.40		-4.50	22.16	Favall	880258-FS-1808
Resid 43			2"		2"	0.90		-1.00	14.80	Spinn	406-330
Flow (zooch)			2" (0.5")		0.5"	1.00		-3.00	14.80	Favall	880258-FS-1808
Outlet						0.10		0.50	0.50	Mfab	MIFAB-F
Te Pipe 7							Residual Head: 0 feet				
Joint (zooch)			10" (2.5")		2.5"	18.50		-18.50	26.16	Spinn	475-227
Resid 45			2.0"		2.0"	2.00		-18.50	26.16	Spinn	475-227
Flow (zooch)			6" (1.5")		1.5"	10.00		-15.00	26.16	Favall	880258-FS-1808
Resid 43			2"		2"	0.90		-1.00	10.70	Spinn	406-330
Flow (zooch)			2" (0.5")		0.5"	1.00		-3.00	10.70	Favall	880258-FS-1808
Outlet						0.10		0.40	4.42	Mfab	MIFAB-F
Te Pipe 8							Residual Head: 0 feet				
Joint (zooch)			10" (2.5")		2.5"	19.60		-19.60	26.16	Spinn	475-227
Resid 45			2.0"		2.0"	2.00		-19.60	26.16	Spinn	475-227
Flow (zooch)			6" (1.5")		1.5"	10.00		-15.00	26.16	Favall	880258-FS-1808
Resid 43			2"		2"	0.90		-1.00	10.70	Spinn	406-330
Flow (zooch)			2" (0.5")		0.5"	1.00		-3.00	10.70	Favall	880258-FS-1808
Outlet						0.10		0.10	5.18	Mfab	MIFAB-F

Created: 1/2/2007 Loaded: 1/2/2007

Siphonix[®] Software



Siphonix[®] Software



Description	Part Details	Qty	Unit Cost	Unit Price	Quantity	Trade Unit	Trade Price
Drains							
Outlet	Mileb 3'	12	\$5.00	\$60.00			
Air Baffle		12	\$0.39	\$4.68			
No Hub Coupler		12	\$3.35	\$40.20			
			Cost of Outlets	\$104.88			
Pipes							
Pipe	Harva - 0400250-PG-130C - 2.5"	53 4.9'	\$4.57 (per ft)	\$18.28			
Pipe	Harva - 0400300-PG-1100 - 3"	77 3.7'	\$3.92 (per ft)	\$23.28			
Pipe	Harva - 0400500-PG-1100 - 3"	32 12'	\$11.25 (per ft)	\$23.18			
Pipe	Harva - 0400600-PG-130C - 3"	13 3.2'	\$14.35 (per ft)	\$14.59			
Pipe	Harva - 0400000-PG-130C - 3"	47 11.1'	\$21.30 (per ft)	\$65.70			
Pipe	Harva - 0401000-PG-130C - 10'	133 4.1'	\$31.53 (per ft)	\$3 6.30			
Pipe	Harva - 0401200-PG-1100 - 12'	117 1'	\$41.75 (per ft)	\$250.74			
			Cost of Pipes:	\$7 2.07			
Joints (45 degrees)							
Bend 45	Spears - 4774025 - 2.5"	8	\$1.39	\$7.52			
Bend 45	Spears - 4774030 - 3"	3	\$1.73	\$4.76			
			Cost of Bends 45 deg...	\$12.51			
Bends (90 degrees)							
Bend 90	Spears - 405025 - 2.5"	7	\$0.98	\$6.86			
Bend 90	Spears - 405030 - 3"	6	\$1.18	\$7.08			
Bend 90	Spears - 405100F - 10'	1	\$396.58	\$396.58			
Bend 90	Spears - 405120F - 12'	1	\$396.44	\$396.44			
			Cost of Bends 90 deg...	\$926.96			
Branches							
Joint	Spears - 475487F - 5'1/2 5'	1	\$53.69	\$53.69			
Joint	Spears - 475588F - 8'1/3'	2	\$495.40	\$970.80			
Joint	Spears - 475622F - 10'1/2 5'	4	\$537.03	\$2148.12			
Joint	Spears - 475623F - 10'1/3'	1	\$575.43	\$575.43			
Joint	Spears - 475661F - 12'1/2'	3	\$728.97	\$2186.91			
			Cost of Branches:	\$7940.95			
Reducers							
Reducer	Spears - 429338FE - 3'1/2 3'	12	\$26.83	\$321.96			
Reducer	Spears - 429628FE - 10'1/8"	1	\$162.73	\$162.73			
			Cost of Reducers:	\$484.69			
Increases							
Increase	Spears - 429338FE - 2'5'1/3'	4	\$26.83	\$107.32			
Increase	Spears - 429488FE - 3'1/5'	1	\$57.30	\$57.30			
Increase	Spears - 429533FE - 5'1/6"	1	\$39.51	\$39.51			
Increase	Spears - 429628FE - 8'1/10"	1	\$162.73	\$162.73			
Increase	Spears - 429670FE - 10'1/12"	1	\$165.46	\$165.46			
			Cost of Increases:	\$532.32			
			Initial Total	\$8,608.50			
					Trade Total	\$0.00	
					Difference:	\$0.00	