Plumbing Board
c/o Department of Labor and Industry
443 Lafayette Road North
St. Paul, MN 55155-4344
www.dli.mn.gov
Email: DLI.ccldboards@state.mn.us

Plumbing Board
Request for Action

PRINT IN INK or TYPE

NAME OF SUBMITTER	**PURPOSE OF REQUEST** (check all that apply): ☐ New Code
James Ellis	☑ Code Amendment ☐ Repeal of an existing Rule

The Minnesota Plumbing Code (MN Rules, Chapter 4714) is available at https://epubs.iapmo.org/2020/MPC/

Specify the purpose of the proposal: If recommendation for code change for appurtenance or method (check all that apply)

☐ Appurtenance (e.g., water conditioning equipment) ☐ Test Method

☑ Other (describe) No science behind code; only place in the US, Canada, or World with this clause.

Does your submission contain a Trade Secret? ☐ Yes ☑ No

If Yes, mark **"TRADE SECRET"** prominently on each page of your submission that you believe contains trade secret information. Minnesota Statutes, section 13.37, subdivision 1(b), defines "trade secret" as follows:

> "Trade secret information" means government data, including a formula, pattern, compilation, program, device, method, technique or process (1) that was supplied by the affected individual or organization, (2) that is the subject of efforts by the individual or organization that are reasonable under the circumstances to maintain its secrecy, and (3) that derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use.

Note that, although "trade secret" information is generally not public, the Board and its committees may disclose "trade secret" information at a public meeting of the Board or committee if reasonably necessary for the Board or committee to conduct the business or agenda item before it (such as your request.) The record of the meeting will be public.

Describe the proposed change. The Minnesota Plumbing Code (Minnesota Rules Chapter 4714) is available here: https://epubs.iapmo.org/2020/MPC/

NOTE:

- Please review the Minnesota Plumbing Code and include all parts of the Code that require revision to accomplish your purpose.
- The proposed change, including suggested rule language, should be *specific*. If modifying existing rule language, underline new words and ~~strike through deleted words~~.

Please list all areas of the Minnesota Plumbing Code that would be affected.

1101.12 Roof Drainage.
-->1101.12.2 Secondary Drainage. Secondary (emergency) roof drainage shall be provided in accordance with Minnesota Rules, chapter 1305.

-->-->1101.12.2.2 Engineered System. Engineered siphonic roof drainage systems must not be utilized in the design of a secondary roof drainage system.

For Office/Committee Use Only Proposal received completed? ☐ Yes ☐ No

Date Proposer notified of gaps:	Mode of notification (e.g., e-mail)	Date returned to Proposer:	Date materials re-received:

Office Use Only

RFA File No.	Date Received by DLI	Dated Received by Committee	Date of Forwarded to Board
PB0201	5/2/2025	6/4/2025	TBD

Title of RFA	:By
PB0201.RFA.James Ellis.MIFIB.Siphonic Drainage	

Committee Recommendation to the Board: ☐ Accept ☐ Reject ☐ Abstain

Board approved as submitted: ☐ Yes ☐ No | Board approved as modified: ☐ Yes ☐ No

Need and Reasons For the Change. Thoroughly explain the need and why you believe it is reasonable to make this change. During a rulemaking process, the need and reasonableness of all proposed rule changes must be justified; therefore, a detailed explanation is necessary to ensure the Board thoroughly considers all aspects of the proposal.

I had called into the 2020 session as a source expert to educate. The main claim at the time was concern in a clog scenario. Since that meeting I've been able to put together a 9-pg detailed paper to explain what would happen in that exact scenario: https://www.dropbox.com/t/pVfxdiYviRUXlgOF

What happens if only 1 siphonic drain engages but has pipework connected to more siphonic drains? Yes, air will enter the system which we ideally do not want, but each of the roof drain tailpipes acts as its own individual siphonic system, until entering a shared horizontal collector pipe, at which point the demand from single drain is not enough to create the design flow velocities reverting back to gravity flow in the pipe. Even with 1 drain a self-scouring effect on the roof level at only a 1/4" to a 1/2" of ponding occurs; it does NOT require full submersion for a siphonic drain to start entering siphonic mode. Any light rainfall, drizzle, it will act as a traditional gravity system until the rain event starts increasing or burst rain event happens to start entering that siphonic, self-scouring mode. Siphonic pipework is sized to the same a 100-year worst case scenario as gravity = 4" rainfall (per MN Code). Gravity needs 2/3rds air mixing with 1/3rd water; countless studies since the 1920's to show this. How is that taken into account by engineers when sizing gravity pipework? How are we ensuring that air mix in nature? Once submerged, gravity drains start being inefficient - leaks, reduced gpm flow, roof collapse.

MN State Plumbing Code cares about ponding (1101.12.2 shows this). Scuppers require more steel; Gravity fails.

If your product/method standard(s) is not currently listed in a national code, your Request For Action will not be considered by the Board or its committees, however, you are welcome to present at any Board meeting during the Open Forum section of the Agenda.

The proposal must be accompanied by copies of any published standards, the results of testing, and copies of any product listings, as documentation of the health, sanitation and safety performance of any materials, methods, fixtures, and/or appurtenances. If none are available, please explain:

PPT showing how gravity drains fail: https://www.dropbox.com/t/JhT7CL9sGkNfZjke

Current MN Siphonic items: https://www.dropbox.com/t/MbF79f3fspyPMifw

Here is a audio recording of the 2020 MN session where this initially was added to the Code:
https://www.dropbox.com/t/ZEs5PxuVm2gRlyHn

Zero siphonic roof collapses to look at for a case study. Plenty of installs, over 10+ years old now, to show case use.

Please attach electronic scanned copies of any literature, standards and product approvals or listings. Printed or copyrighted materials, ***along with written permission from the publisher to distribute the materials at meetings***, and email to DLI.ccldboards@state.mn.us

Primary reason for change: (check only one)

☒ Protect public, health, safety, welfare, or security	☐ Mandated by legislature
☒ Lower construction costs	☒ Provide uniform application
☒ Encourage new methods and materials	☐ Clarify provisions
☒ Change made at national level	☒ Situation unique to Minnesota
☐ Other (describe)	

Anticipated benefits: (check all that apply)

☒ Save lives/reduce injuries	☒ Provide more affordable construction
☒ Improve uniform application	☐ Provide building property
☐ Improve health of indoor environment	☐ Drinking water quality protection
☒ Provide more construction alternatives	☒ Decrease cost of enforcement
☒ Reduce regulation ☐ Other (describe)	

The Following Information is Optional. This Information can Assist in Evaluating a Request for Action and in Rulemaking and Should be Provided if Known.

Economic impact: (explain all answers marked "yes")

1. Does the proposed change increase or decrease the cost of enforcement? ☒ Yes ☐ No If yes, explain

Decrease Siphonic overflow drains are anti-clog at only a 1/4" to a 1/2" of water head. Less roof leaks, less enforcement of upkeep or concern to public safety of collapse.

2. Does the proposed change increase or decrease the cost of compliance? ☒ Yes ☐ No If yes, explain Include the estimated cost increase or decrease, and who will bear the cost increase or experience the cost decrease:

Decrease - as an engineered system the engineer signs off, not the state inspector saving labor. Siphonic pipe is 1/2 diameter to traditional gravity and runs flat to combine drains for less vertical pipework and less building penetrations plus the ability to select the downspout location.

3. Are there less costly or intrusive methods to achieve the proposed change? ☐ Yes ☒ No If yes, explain

4. Were alternative methods considered? ☒ Yes ☐ No If no, why not? If yes, explain what alternative methods were considered and why they were rejected.

Yes, I called into the 2020 session as the source matter expert but strongly feel the board did not have a reasonable amount of time to investigate/educate before making the motion. MN is the only State in the entire US with this Code requirement; no white papers to support it, AND gravity solution will fail when submerged = look at the data.

5. If there is a fiscal impact, try to explain any benefit that will offset the cost of the change. If there is no impact, mark "N/A."

COST SAVINGS - Smaller storm pipe, less storm pipe, less state inspector labor, less maintenance, improved building life.

6. Provide a description of the classes of persons affected by a proposed change, who will bear the cost, and who will benefit.

Cost savings to the owner and the state. Can be others in the construction chain depending on how early in design siphonic is considered.

7. Does the proposed rule affect farming operations? (Agricultural buildings are exempt from the Minnesota Building Code under Minnesota Statutes, Section 326B.121.) ☐ Yes ☒ No If yes, explain

Are there any existing Federal Standards? ☒ Yes ☐ No If yes, list:

Approved by both IPC and UPC. Neither have this call out.

Are there any differences between the proposed change and existing federal regulations? ☐ Yes ☒ No ☐ Not applicable ☐ Unknown If yes, describe each difference & explain why each difference is needed & reasonable.

Minnesota Statutes, section 14.127, requires the Board to determine if the cost of complying with proposed rule changes in the first year after the changes take effect will exceed $25,000 for any small business or small city. A small business is defined as a business (either for profit or nonprofit) with less than 50 full-time employees and a small city is defined as a city with less than ten full-time employees.

During the first year after the proposed changes go into effect, will it cost more than $25,000 for any small business or small city of comply with the change? ☐ Yes ☒ No If yes, identify by name the small business(es or small city(ies).

Will this proposed plumbing code amendment require any local government to adopt or amend an ordinance or other regulation in order to comply with the proposed plumbing code amendment? ☒ Yes ☐ No, If yes, identify by name the government(s) and ordinances(s) that will need to be amended in order to comply with the proposed plumbing code amendment.

-->-->1101.12.2.2 Engineered System. Engineered siphonic roof drainage systems must not be utilized in the design of a secondary roof drainage system.

Should approved the use of siphonic overflow drains and systems. Siphonic systems all require balanced calculations to get approved (similar to fire protection except using negative pressure instead of positive pressure).

Additional supporting documentation may also be attached to this form. Are there any additional comments you feel the Committee/Board may need to consider? If so, please state them here:

"The annular ratio is significant to the flow capacities in vertical pipes. The annular ratio of 1/3 is the maximum ratio for pneumatic reasons with lesser annular (water/air) ratios as an optional limiting factor" - June 2024 IAMPO/ASPE White Paper titled "Capacities of Stacks and Horizontal Drains in Storm Drainage Systems"

Gravity needs air to move. What sizing math is currently being done to account for this? (None)
Drains matter, review the PPT I sent, MN is VERY UNSAFE with using charts to size gravity roofs. VERY.

Information regarding submitting this form:

- Submissions are received and heard by the Committee on an "as received" basis. **Any missing documentation will delay the process, and your proposal will be listed as the date it was received "Complete."**
- **Submit any supporting documentation to be considered,** such as manufacturer's literature, approvals by other states, and engineering data electronically to DLI.CCLDBOARDS@state.mn.us. Once your Request For Action form has been received, it will be assigned a file number. Please reference this file number on any correspondence and supplemental submissions.
- For copyrighted materials that must be purchased from publishers, such as published standards, product approvals or testing data, listings by agencies (IAPMO, ASSE, ASTM, etc.,) you may send (or email) two copies, *along with written permission from the publisher to distribute the materials at meetings*, via U.S. Mail to: Plumbing Board, c/o Department of Labor and Industry, 443 Lafayette Road No., St. Paul, MN 55155-4344.
- For materials that must be submitted by U.S. Mail, please include a copy of your "Request For Action" form originally submitted and reference your assigned RFA file number.

Information for presentation to the Committee and/or Board:

- Limit presentations to 5 minutes or less.
- Be prepared to answer questions regarding the proposal and any documentation.

Information regarding Committee and/or Board function:

- The Plumbing Board or designated Committee.

I understand that any action is a recommendation to the Plumbing Board and is not to be considered final action.

NAME	EMAIL ADDRESS	FIRM NAME
Brennan Doherty	bdoherty@mifab.com	MIFAB, Inc.

NAME, PHONE NUMBER AND E-MAIL ADDRESS OF PRESENTER TO THE COMMITTEE (if different):

Brennan Doherty, 312-241-5224, bdoherty@mifab.com

MAILING STREET ADDRESS	CITY	STATE	ZIP CODE
1321 W 119th St	Chicago	IL	60643

PHONE	SIGNATURE (original or electronic)	DATE
312-241-5224	B. Doherty	4-21-2025

For Assistance or questions on completing this form, contact Mike Westemeier, Department of Labor and Industry at michael.westemeier@state.mn.us or by phone 651-284-5898.

How to Design to Worst Case Scenario:
SIPHONIC STORM DRAINAGE – Clogged Primary Roof Drain

Brennan Doherty, MIFAB Inc

During one of my education sessions, I had an engineer pose the question to me: “What would happen if the primary drain became clogged, and only the overflow drain could function?”

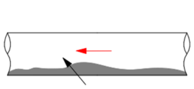
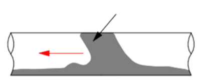
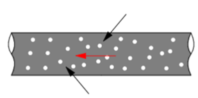
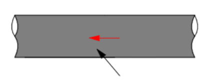
Easy answer here, compared to a traditional gravity drain, a siphonic drain won’t clog. The drain itself creates a ‘siphon’ effect which pulls any debris through the drain and clean out of the system, so we don’t need to be concerned with that scenario. Another major point, our MIFAB HydroMax® siphonic roof drains have a tremendous track record of proven reliability with 1,000+ installs and zero system failures, but more importantly zero roof collapses.

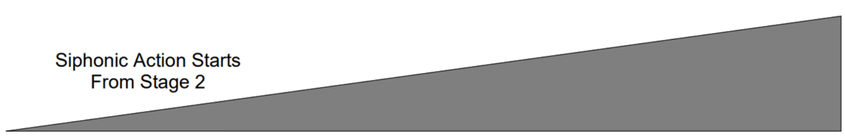
Here is a video showcasing how a siphonic system interacts with debris:
www.tinyurl.com/siphonicvsdebris

In all other instances the conversation has stopped at that point, but the engineer challenged my critical thinking: “What if there was a bag of cement poured down the primary drain, and it was truly clogged? How would the overflow system function during a rain event when only 1 overflow drain was engaged?”

Two basic pieces of education we need to introduce for this conversation are the 4 basic flow patterns a siphonic system follows and the reason behind the design of a siphonic drain:

Priming and Four Flow Patterns of Siphonic Drainge

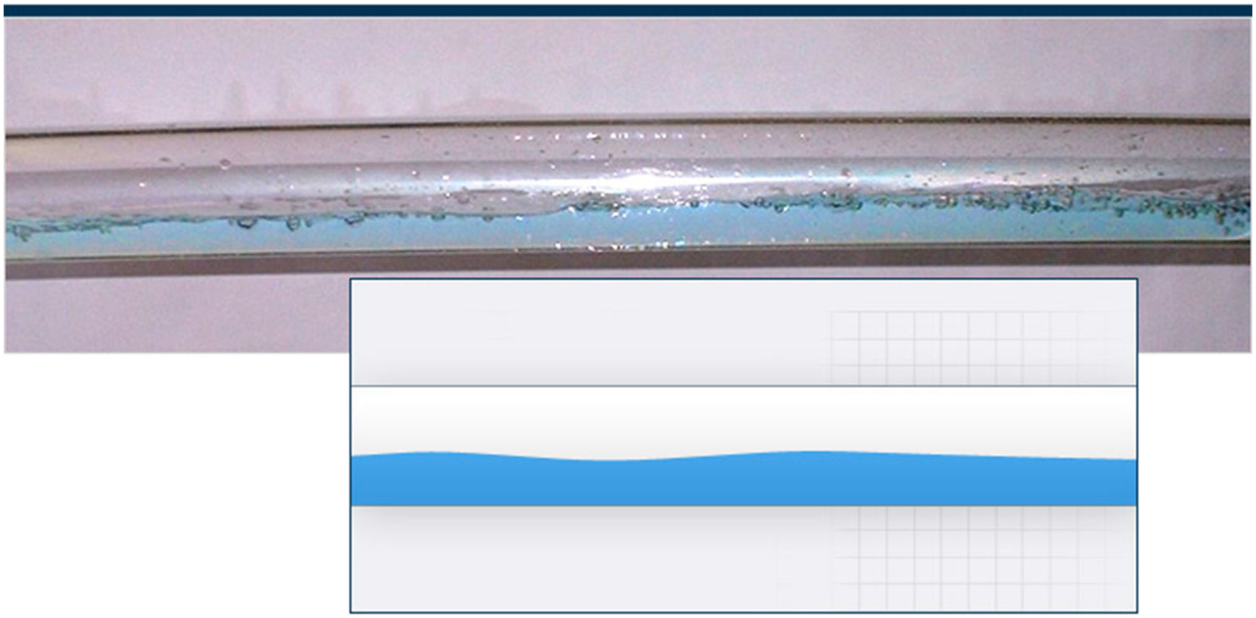
Stage 1 : Gravity Flow	Stage 2 : Plug Flow	Stage 3 Bubble Flow	Stage 4 : Full-Bore Flow
Light Rainfall Approx. 0-10% of design	Moderate Rainfall Approx. 10-40% of design	Heavy Rainfall Approx. 40-70% of design	Intense Rainfall Approx. 70-100% of design
Gravity flow in pipework	Plug of water filling whole pipe at high velocities which achieves self-cleansing.	Water filling whole pipe	No more air entry
			
Air above water	Air pockets deiven down pipework	Air bubbles in suspension carried at high velocity	Air within pipe now fully purged
Water finds its way to the vertical and runs down the pipe.	Tests have shown that **self-cleansing** can be achieved at as low as **10% to 15**% of the design rainfall rate.		



Siphonic action intensity increases with rainfall intensity.

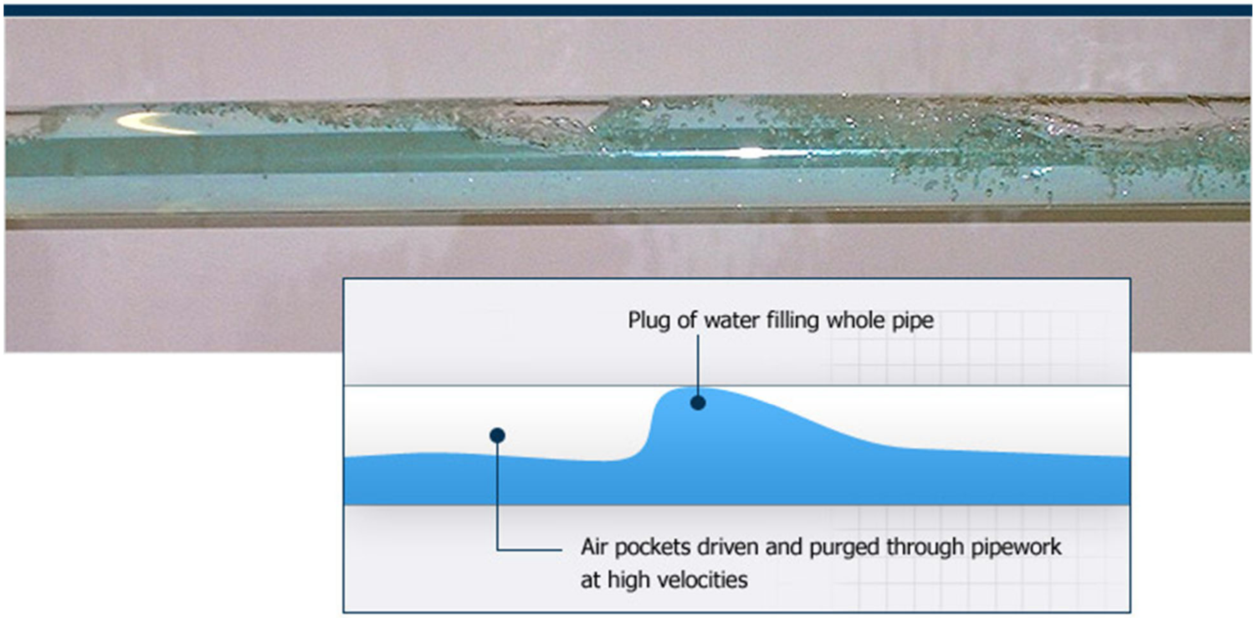
Here is a video to help better understand the 4 flow patterns visually:
www.tinyurl.com/SiphonicFlowPatterns

AIR ABOVE WATER: GRAVITY FLOW



Under light rainfall, the systems are going to run in what is termed gravity flow. There are air and water in the pipe and as water finds its own level, it runs to the main vertical stack out of the system.

PLUG FLOW

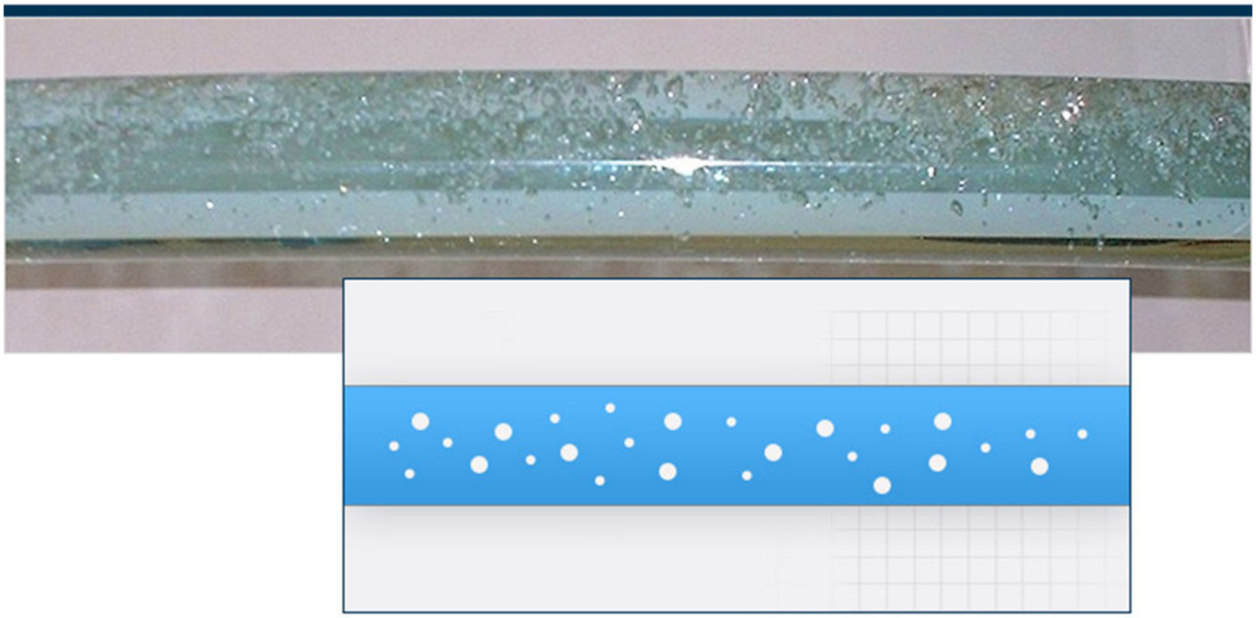


If the inflow is slightly greater, it will transition into plug flow where the water fills up in the horizontal pipe (the main reason for flat level piping is to promote the filling of the pipes). The water falls down the main vertical stack and accelerates creating negative pressure. When this occurs, the water in the pipe is now pulled towards the main vertical downpipe and moves into plugs that flow through to create a self-scouring effect.

Often under light to moderate GPM flows, the system will circle through gravity and plug flow pattern. The vacuum from the downpipe empties the pipework, then the continuous inflow through the roof drain(s) starts the cycle repeating with water priming the pipe, dropping down the main vertical stack creating vacuum and emptying the pipework again.

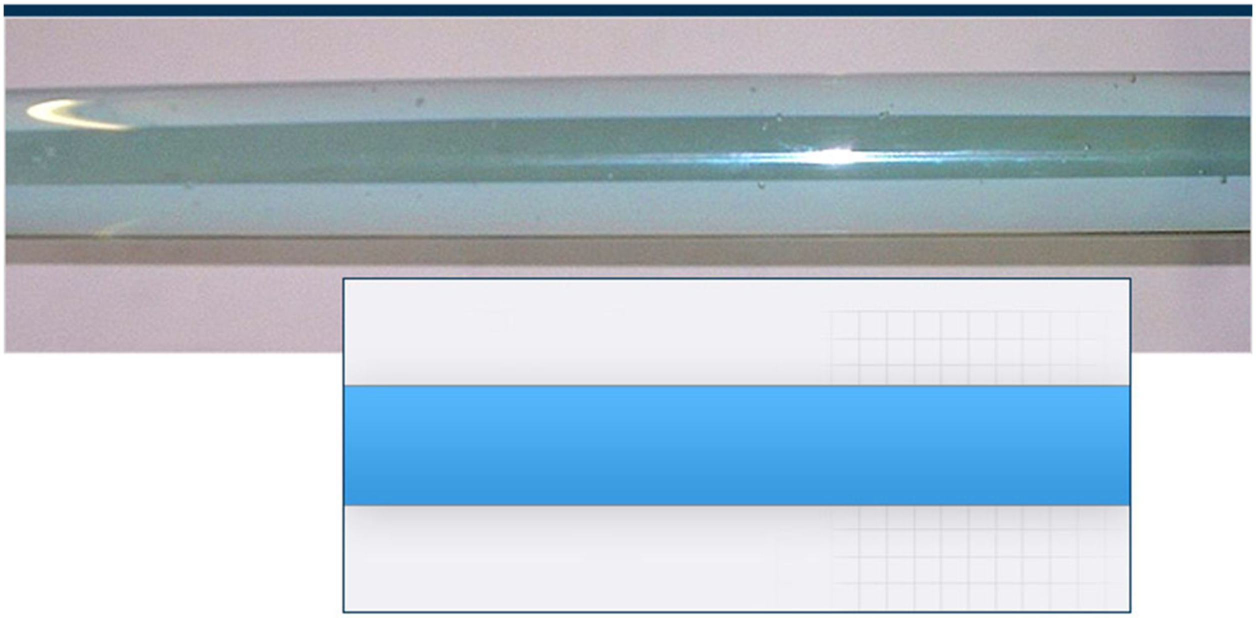
The other flow patterns are created when higher rainfall inflow is achieved.

BUBBLE FLOW



When more inflow comes and the roof drain prevents air ingress, the flow mostly fills the pipe but any air that does enter is transported in what is called bubble flow pattern.

WATER FILLS THE WHOLE PIPE: FULL BORE

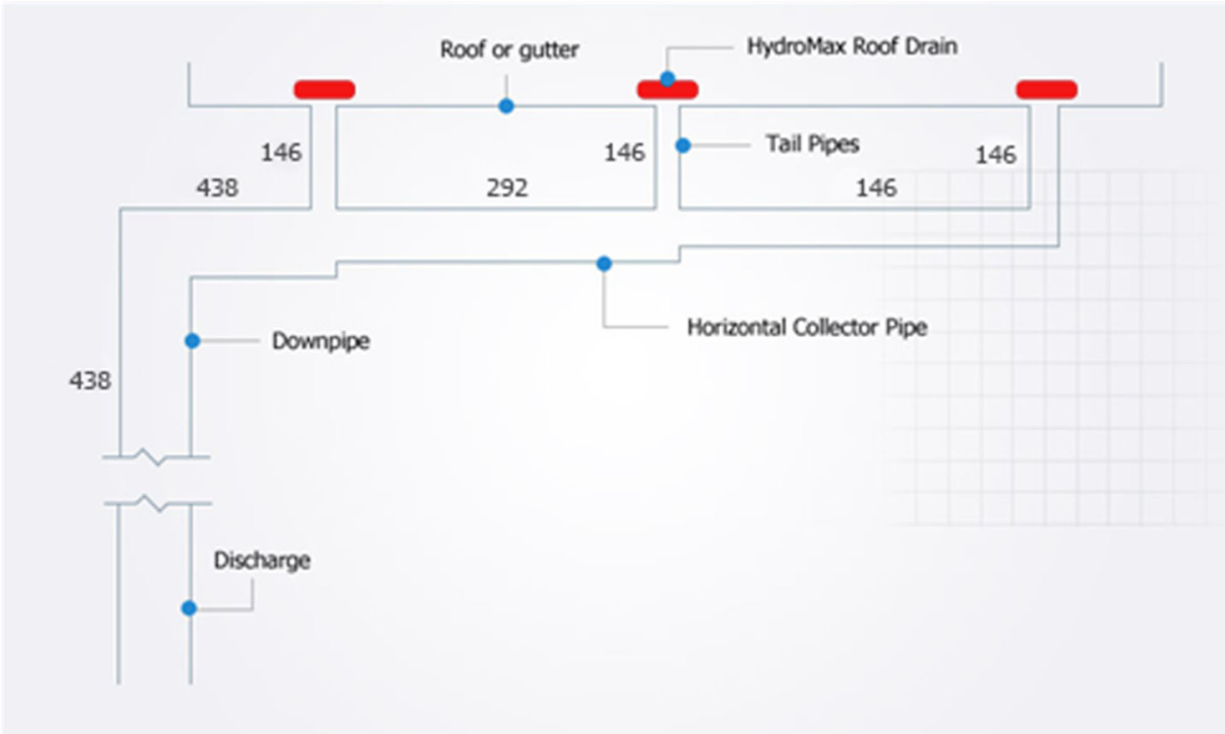


When the inflow is sufficient to maintain a water level above the roof drain air baffle, no air comes in and the system flows in full bore water flow; the pipework is 100% full of water.

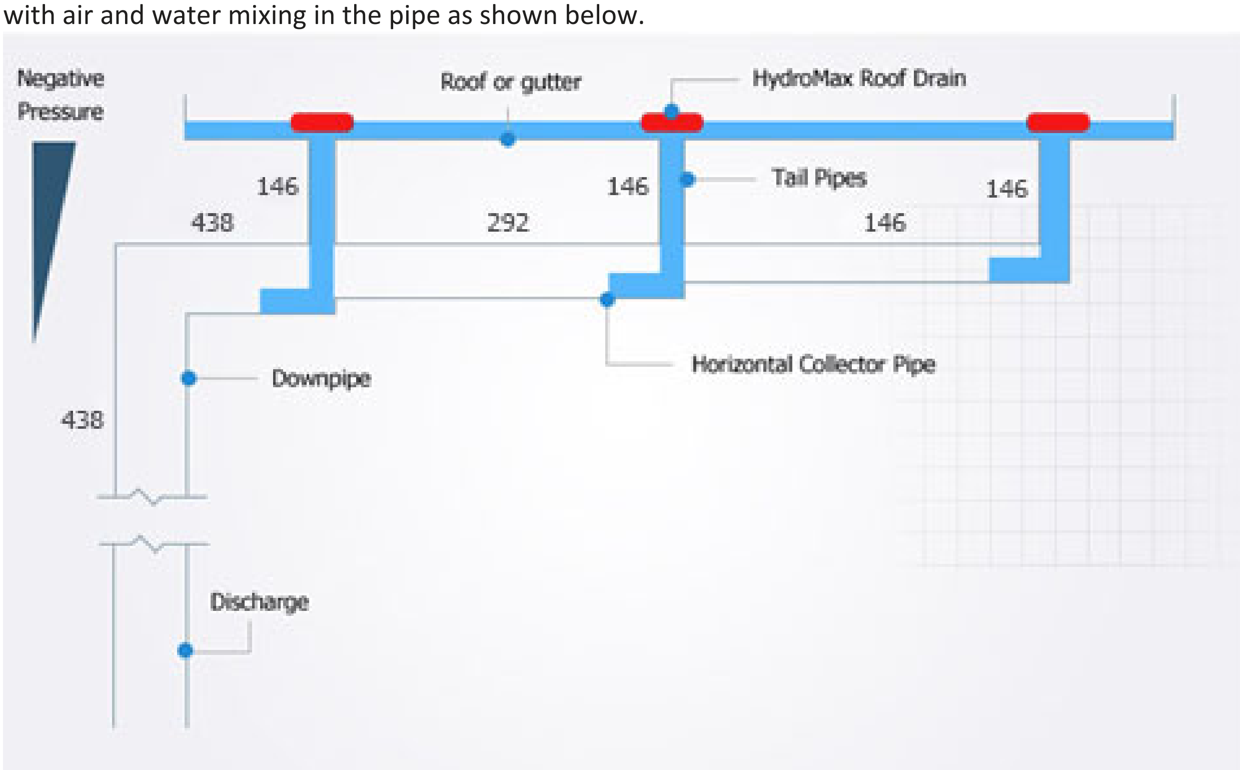
The one-piece inducer on the MIFAB HydroMax® overflow siphonic roof drain, seals off air ingress to only permit water to enter the pipework. The anti-vortex fins around the inducer plate eliminate the ‘tornado’ from forming which also draws air into the pipework (same concept of pulling the plug in a bathtub, but larger vortex).

A MIFAB HydroMax® overflow siphonic roof drainage system does not use any moving parts to create the full-bore flow conditions - only hydraulics.

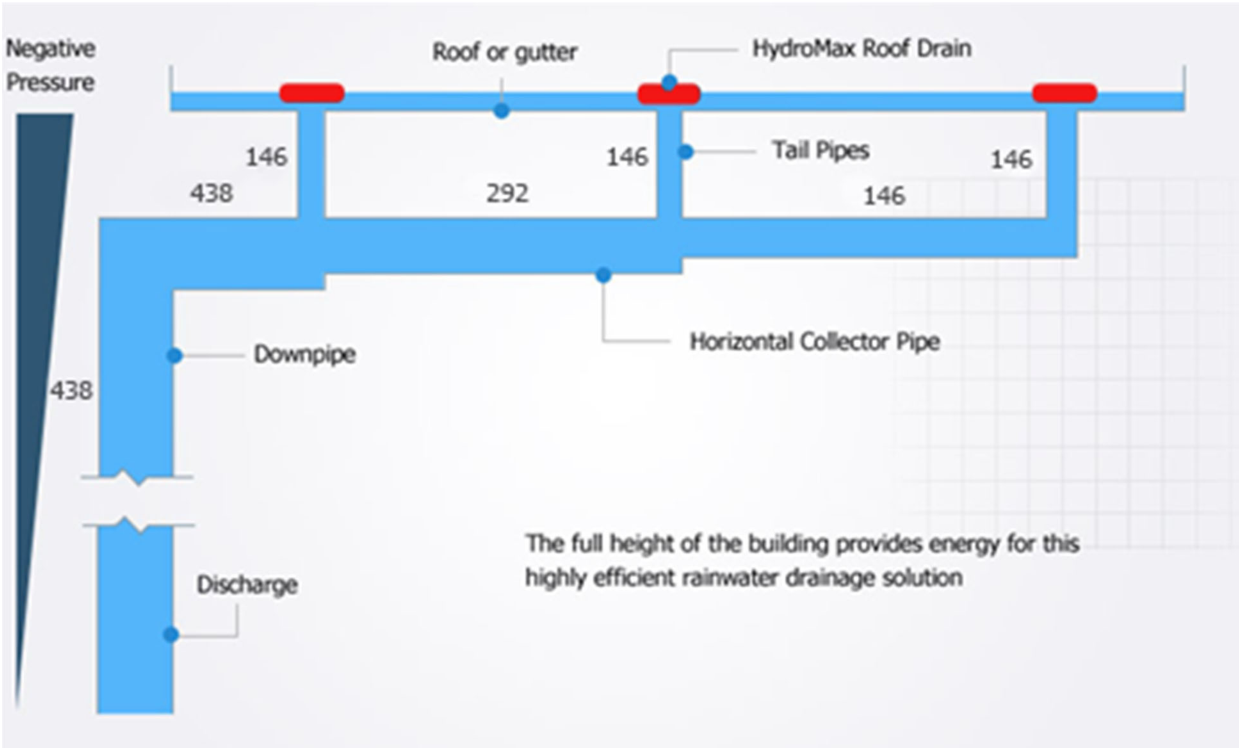
Being a self-draining system, at the start of a rainstorm the pipework is empty as shown below.



As the rain enters the HydroMax® roof drain, the tailpipes will quickly fill and supply water into the horizontal collector pipe. The tailpipe will continue to discharge water into the main horizontal collector pipe. As more water is supplied to the main horizontal collector pipe, the water will be in gravity flow with air and water mixing in the pipe as shown below.



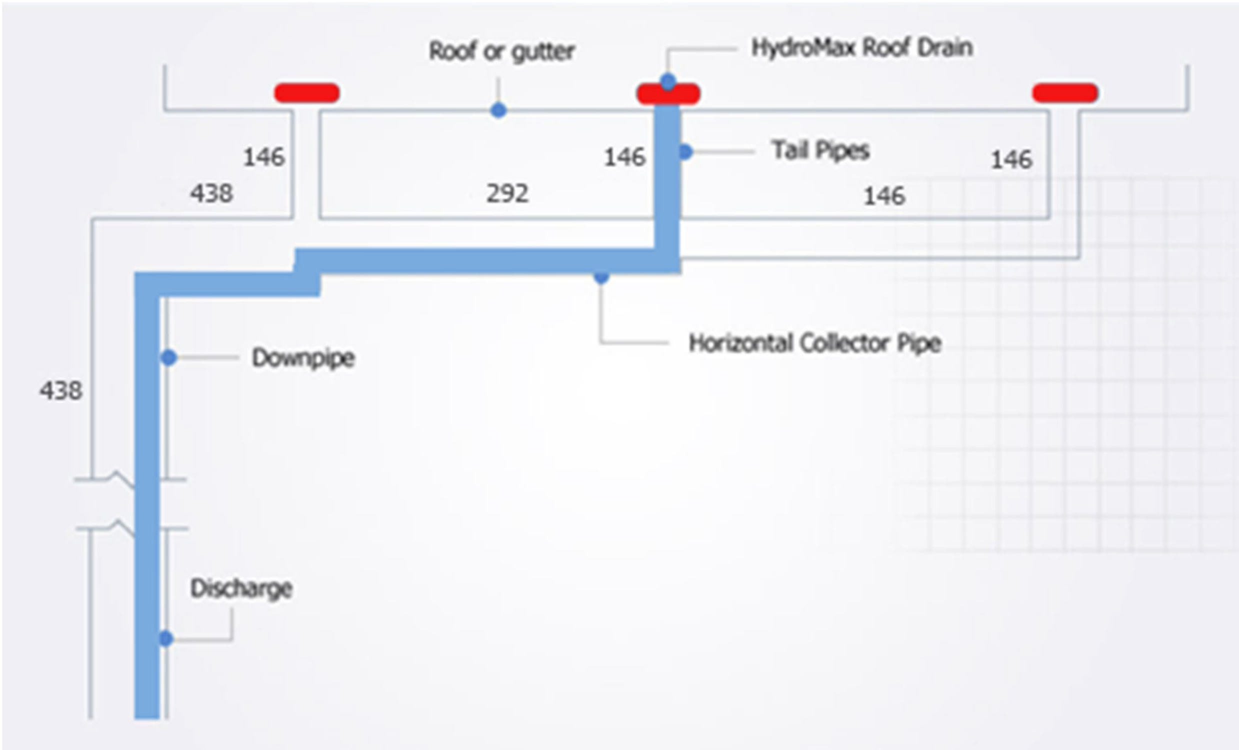
The pipe is installed flat without slope to quickly fill up with water. Once all of the pipework in the system is completely full of water **<u>the main vertical stack creates negative pressure</u>** which starts pulling the water off the roof level in every direction.



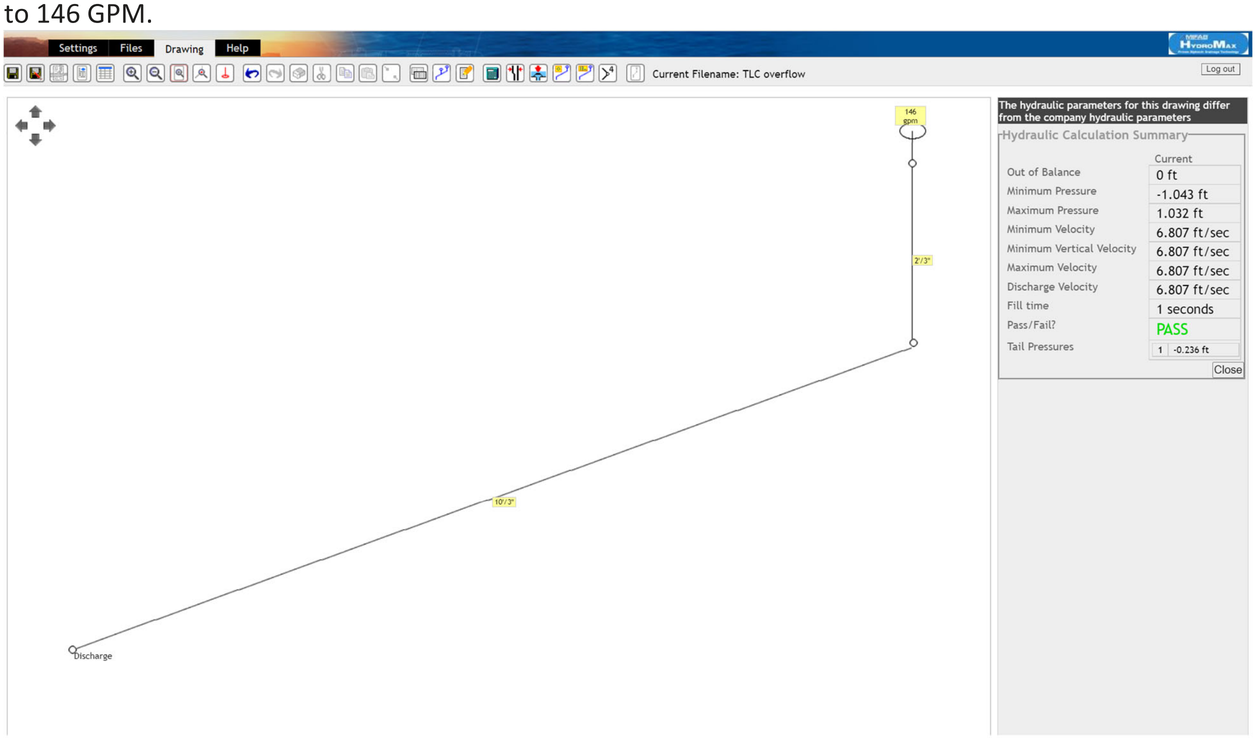
Now that we have some basic background, back to the question at hand: **"What would happen if the primary drain became clogged, and only the overflow drain could function?"**

A potential solution could be to design each siphonic overflow as an individual system; but having common collector pipes for siphonic overflow systems is a proven solution so designing single drain systems is not the only avenue.

In the occurrence of a single siphonic overflow drain operating, the tailpipe portion would enter siphonic mode, but once entering the main horizontal collector pipe it is likely to only experience gravity flow or some limited plug flow through the remainder of the system – still 100% fully functional as intended.



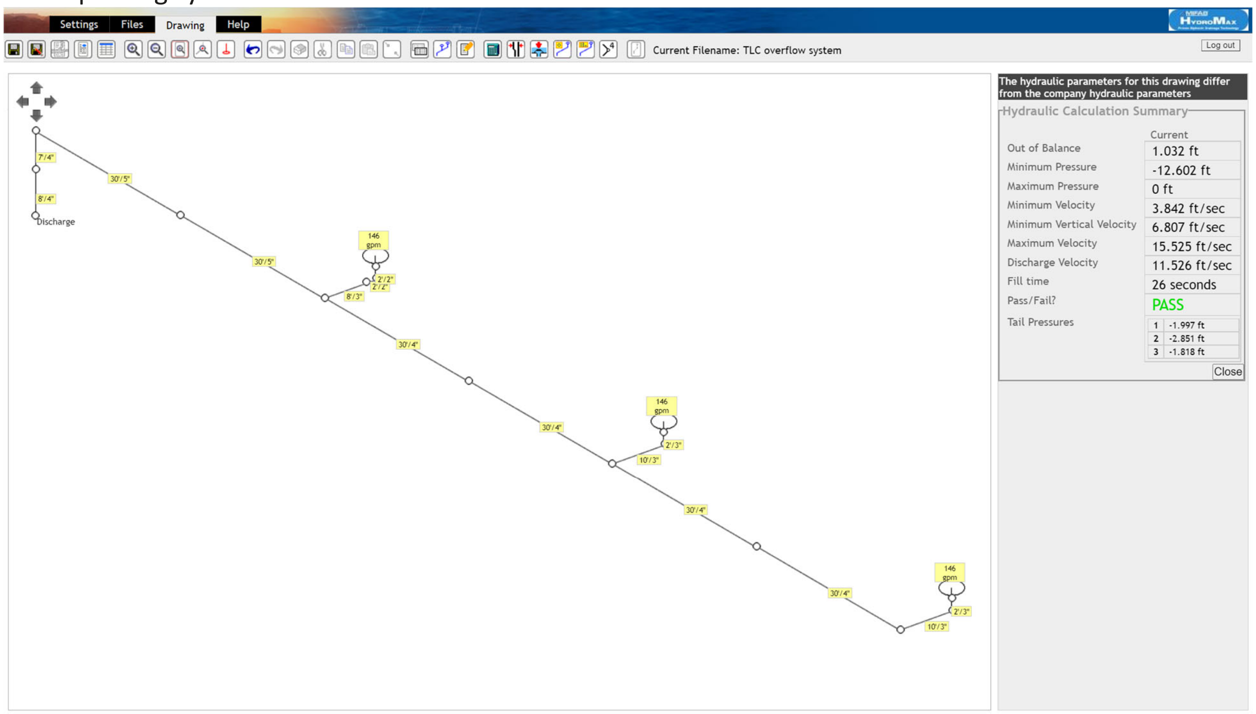
To prove this logic, we created a siphonic system on our MIFAB HydroTechnic Balancing Software using common tailpipe measurements the Engineer asked us to test: 24” initial vertical drop followed by 10’ of horizontal pipe to discharge. For this calculation we are using a MH-301: 3” overflow siphonic drain sized to 146 GPM.



(Note: MH-301 can handle MAX 415 GPM which is just under 10,000 sq ft @ 4” rainfall rate.)

After creating this system, we can see the green ‘PASS’ on the right-hand side of the picture. This ‘PASS’ lets the user know the system is 100% functional, and fully compliant with the ASPE 45 Standard –

The next test we ran was looking at that tailpiece/drain setup using the same diameter and lengths, but in a repeating system.



Again, we can see the green ‘PASS’, letting us know the system is 100% function, and fully compliant with the ASPE 45 Standard.

MIFAB’s HydroTechnic Balancing Software has been independently tested by CRM to show full ASPE 45 compliance with a ‘PASS’. That letter, along with the calculation reports for both systems can be download in this link: https://www.dropbox.com/t/kwx4ge5WpzKNAP7k

Conclusion: In the event there was only the siphonic overflow engaging, the tailpiece alone would create an efficient siphonic system itself before discharging into any main horizontal collector pipe for a larger system.

Now that we have the calculations to reference, we can also look at the practical theory of this real-life scenario. If the primary drain were fully blocked, there would likely be 2” of standing water in the area to match the height of the water dam. As a rain event begins, a siphonic overflow drain would immediately be submerged creating a siphon effect right off the bat.

In the same scenario, a gravity overflow drain would experience drastically different effects. Gravity drainage requires 2/3^{rds} air to 1/3^{rds} water to efficiently flow through the pipework. As the water level increases on the roof the gravity overflow drain will become completely submerged.

In 2012 ASPE Research Foundation did a study where they took at the major manufacturer's roof drains, and blind tested them – we don't know whose drain is whose, but we do know they were all tested using the same procedure.

The data directly below was taken from that study. What it shows is at given levels of ponding (water depth) what the GPM discharge will be for the drain: in this example a 6" cast iron gravity drain with cast iron dome.

Test No.	Model No.	Description	Type of Strainer	Flow Rate (gpm) Based on Head Height					
				1"	2"	3"	4"	5"	6"
5	A-5	6" cast iron drain	cast iron dome	10	185	199	238	267	218

As can be seen above, when the water goes from 5" to 6" on the roof, the GPM flow actually becomes less efficient. The ponding depth as to when this occurs does vary between different drain models. There are many theories as to why this happens. Our belief is that what ends up happening is the water level on the roof gets to a height where the weir collapses in on itself no longer allowing air to enter the gravity drain. The smaller diameter the gravity drain, the quicker the weir will collapse on itself. Gravity pipework requires 2/3rds volume of air. If that air cannot enter the pipework, the flow is not achieved.

Bringing everything together, **"What would happen if the primary drain became clogged, and only the overflow drain could function?"**

For a siphonic overflow system, nothing at all, the tailpiece would act siphonically as it was designed, then once entering the main horizontal collector pipe it would function exactly as a gravity system would.

For a gravity overflow system, not only is there a very serious concern of the overflow drain also becoming clogged if the primary had already succumbed to it, but the gravity overflow drain would also experience more ponding on the roof compared to a siphonic overflow drain. A siphonic system can evacuate water from the roof roughly 3-4x faster than traditional gravity drainage.

	3" Drain			4" Drain			5" Drain			6" Drain	
Ponding	Gravity	HydroMax	Ponding	Gravity	HydroMax	Ponding	Gravity	HydroMax	Ponding	Gravity	HydroMax
1"	25 GPM	75 GPM	1"	25 GPM	93 GPM	1"	27 GPM	115 GPM	1"	15 GPM	140 GPM
2"	87 GPM	310 GPM	2"	90 GPM	350 GPM	2"	100 GPM	345 GPM	2"	75 GPM	400 GPM
3"	214 GPM		3"	215 GPM	785 GPM	3"	230 GPM	890 GPM	3"	210 GPM	990 GPM
4"	225 GPM		4"	232 GPM		4"	295 GPM		4"	250 GPM	1580 GPM
5"	231 GPM		5"	240 GPM		5"	440 GPM		5"	490 GPM	
6"	247 GPM		6"	252 GPM		6"	720 GPM		6"	715 GPM	

When designing an overflow system, a siphonic design will provide much better performance on the front end, as well as protect the building better than traditional gravity drains in the worst-case scenario.