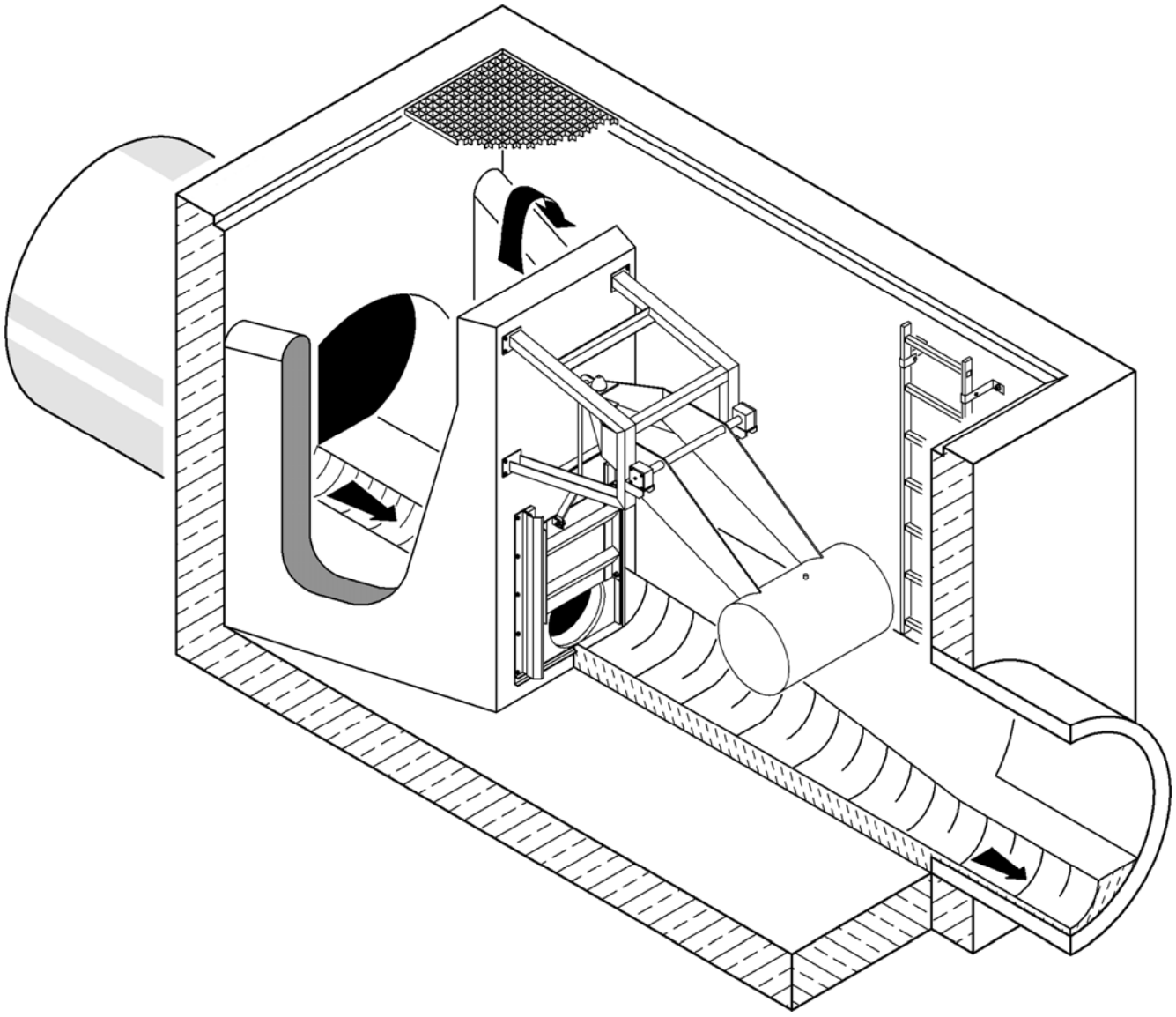
CSO/STORMWATER MANAGEMENT

# HYDROVEX®

## *Fluid*Casca Cascading Float Gate Valve



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# HYDROVEX® *FLUID*CASCA CASCADING FLOAT GATE VALVE

## APPLICATION

Very often, in combined or sanitary sewer systems, the layout includes oversized pipe sections that could be used as storage volume. At the output end of these pipes a regulator of one type or another limits the flow towards the Wastewater Treatment Plant. The section of pipe can have either a high or a low overflow weir.

Economical use of a maximum storage capacity for the pipe section can be a problem for very long sewer runs or sewer presenting a strong slope. For cases where high overflow weirs are present, the lateral connections, chambers and flow regulating devices are subject to very high water pressures. Good ventilation of the storage pipe section, preventing excessive humidity and dangerous gas accumulation, is very difficult. Under those humid conditions, water droplets are easily formed and corrosion attacks the equipment and the accessories installed at control stations. If a low overflow weir is present, the actual elevation must be checked in order to create the maximum storage volume.

All these technical and design problems can be addressed by exploiting the pipe's storage volume in the form of a "cascade". To achieve that, the sewer volume has to be cut in sections. At the end of each section, a **Hydrovex® *Fluid*Casca** Cascading Float Gate Valve regulates perfectly the flow and water height.

## ADVANTAGES

- Adjustment to the downstream water level
- No external energy required
- Better use of the storage volume
- Downstream flow regulating device pressure head is reduced
- Good ventilation of all the segments of the storage volume
- No need to limit the number of inspection manholes to provide high water lines in the sewer

## OPERATION

A system designed to operate in "cascade" includes one or several discharge weirs for the limitation of the water level equipped with **Hydrovex® *Fluid*Casca** Cascading Float Gate Valve**.** These units include valves driven by a float. The two elements are connected together through a lever system - see **Figure 1**. The valve and the float are located downstream, on the airside of the overflow weir. The **Hydrovex® *Fluid*Casca** Cascading Float Gate Valve can be also defined as a volumetric flow regulator. In dry weather flow, the float hangs freely in the air and the valve is completely open - see **Figure 1.**

The function of the **Hydrovex® *Fluid*Casca** Cascading Float Gate Valve is detailed for two precise cases: drainage of storage with high overflow weir **(Figures 2a, 2b, 2c)** and drainage of storage with low overflow weir **(Figures 3a, 3b, 3c)**.

### High Outfall Storage

In rain conditions, the flow and water level increase in the storage pipe. The flow regulating device at the low point lets the design flow pass to the Wastewater Treatment Facility, then retaining the extra water in the last low section of the "cascade". When the water level reaches the first **Hydrovex® *Fluid*Casca** activation elevation, the float starts to close the valve. The water level upstream from the unit increases quickly, while some water still passes through the valve - see **Figure 2a**. All the **HYDROVEX® *Fluid*Casca** close one after the other upstream in the same way, until only the design flow Qb is circulating down the "cascade" through the slightly open valves.

If the maximum storage volume is reached while more water than the design flow still arrives, emergency overflow weir of the system, located in the upstream section of the retention facility starts to overflow. However, in the mean time, the **Hydrovex® *Fluid*Casca** always lets the design flow pass through the partially closed valves - see **Figure 2b**. This constant flow circulation always allows the transport of sludge and sediments towards the downstream flow regulator and to the Wastewater Treatment Facility.

In case valve gets obstructed, the emergency weir of the blocked unit enters in action, see **Figure 2c**. The obstructions will be released at the end of the rain even, when the downstream water level recesses and the float is lowered, thus opening the control valve to its maximum.

1. Float
2. Valve
3. Lever
4. Discharge weir
5. Low thrust
6. High thrust
7. Bearing
8. Support

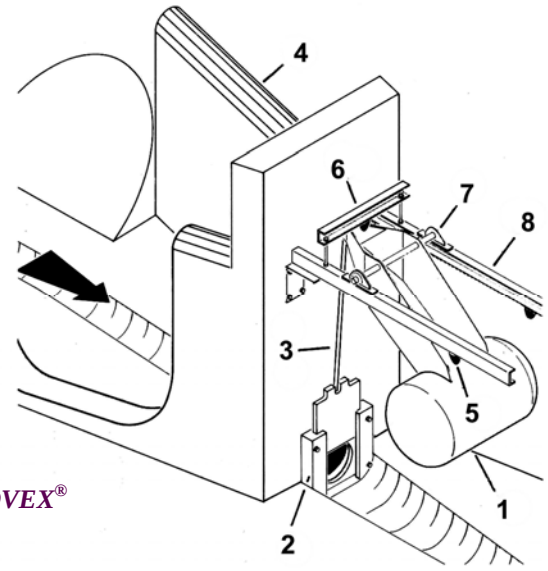


***Figure 1:*** ***«Cascade » type installation with HYDROVEX® FluidCasca Cascading Float Valve***

**Low Storage Outfall**

In the case of a cascade with a low overflow weir location and reaching the maximum regulated flow for the station, the water accumulates until it activates the first **Hydrovex®** ***Fluid*Casca**. The unit's valve is completely closed in this case. The trapped water will accumulate in the upstream basin until the next ***Fluid*Casca** is activated. The water constantly escapes from the closed ***Fluid*Casca** by the overflow weir of the unit, thus feeding the downstream flow regulator and its emergency weir. This action reflects on the regulator located downstream and thus causes the emergency overflow of the low overflow weir - see **Figure 3b**. Based on the fact that all the ***Fluid*Casca** valves are closed completely during the process, each basin will see sludge accumulation in the gate valve area of the cascade. This accumulation will severely limit the amount of sludge discharged at the station overflow weir, which is a very strong operating bonus in the environmental performance of the station.

When the rain event is over, each storage section will be emptied, starting form upstream to downstream. All the valves open one after the other until they let the design flow pass again to the downstream flow regulator. When the storage sections are all drained to the last cascade and the only flow is the dry-weather flow, all the valves are opened again, see **Figure 3c**. The downstream flow regulator evacuates the sludge accumulated throughout storage system to the Wastewater Treatment Plant.

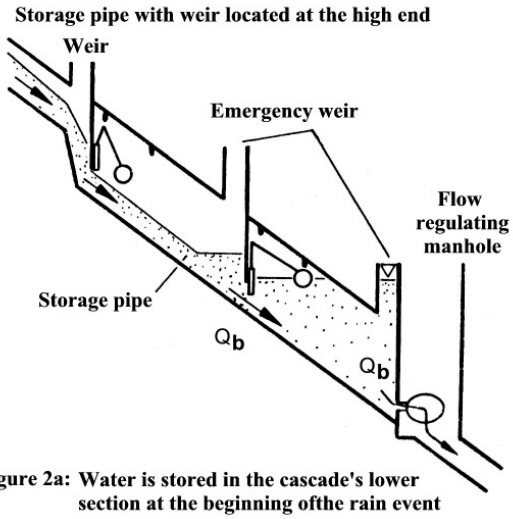


**Figure 2a: Water is stored in the cascade's lower section at the beginning ofthe rain event**

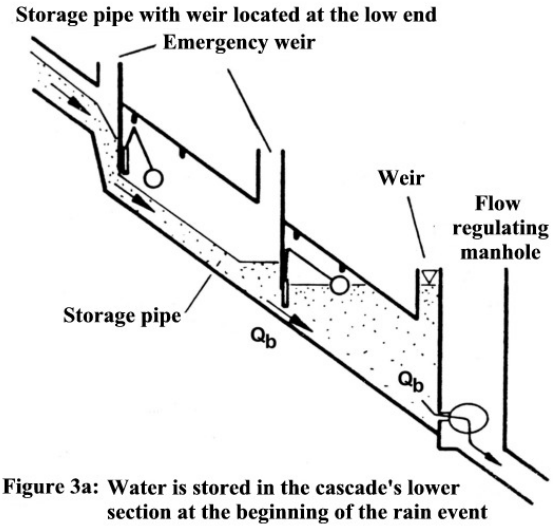


**Figure 3a: Water is stored in the cascade's lower section at the beginning of the rain event**

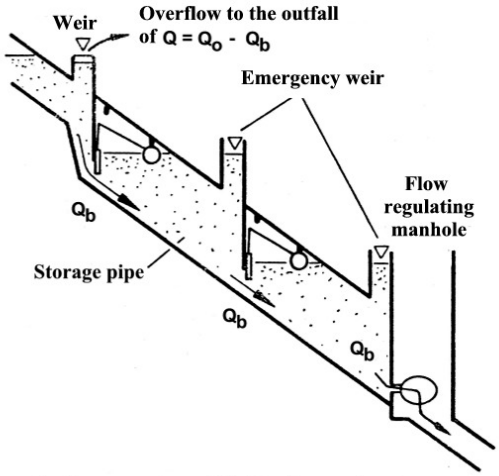


Figure 2b: Storage volume filled for large rain events

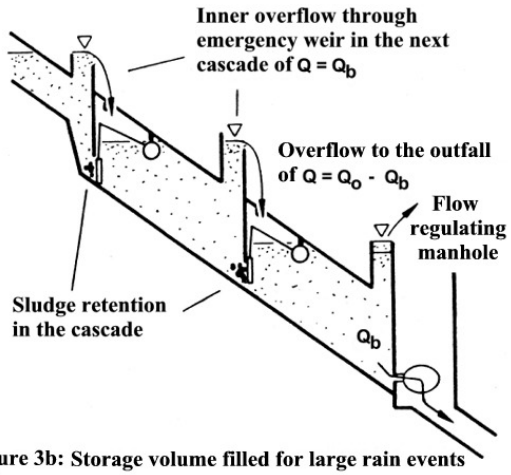


Figure 3b: Storage volume filled for large rain events

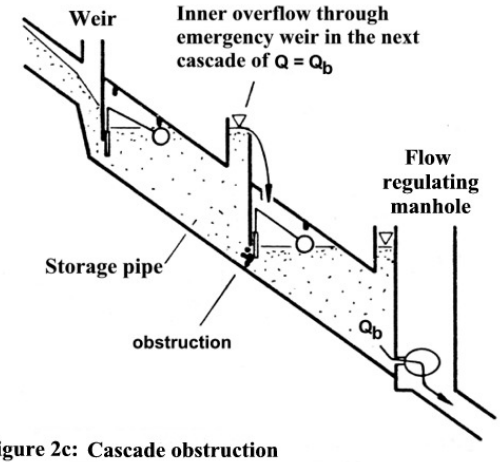


Figure 2c: Cascade obstruction

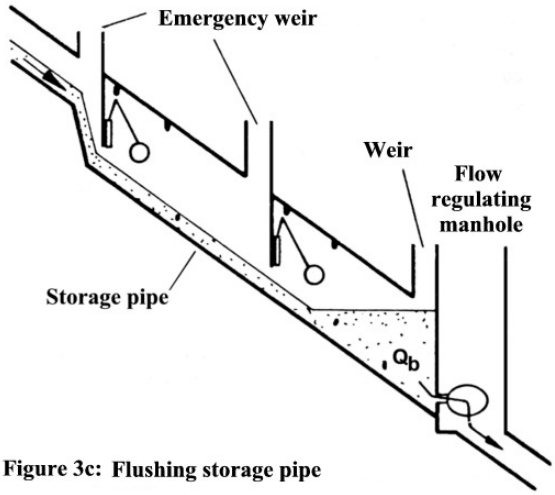


Figure 3c: Flushing storage pipe

## DIMENSIONING

The valve of the **Hydrovex**® ***Fluid*Casca** Cascading Float Gate Valve must, with a load upstream of 2 DN, let pass a minimum flow $Q_{Kas,}$ which according to our experience is:

- Five times the design flow $Q_b$ sent to the Wastewater Treatment Plant
- The fifth of the critical flow $Q_{crit}$ to be overflowed by the station

Based on these information, we define the nominal diameters of valves required - see **Table 1 and Figure 4.**

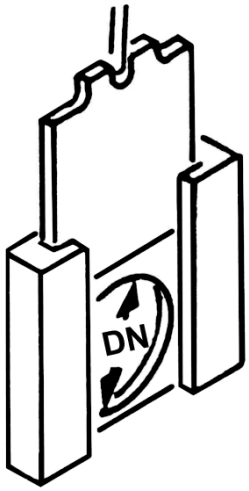


*Figure 4: Nominal diameter of HYDROVEX® FluidCasca Cascading Float Gate Valve*

| Nominal Diameter DN<br>mm (in.) | Flow for H = 2 DN $Q_{kas}$<br>l/s (cfs) |
|---|---|
| 200 (8") | 53 (1.9) |
| 250 (10") | 92 (3.3) |
| 300 (12") | 145 (5.1) |
| 400 (16") | 300 (10.6) |
| 500 (20") | 522 (18.4) |
| 600 (24") | 823 (29.1) |
| 700 (28") | 1200 (42.4) |
| 800 (32") | 1690 (59.7) |
| 900 (36") | 2270 (80.2) |
| 1000 (40") | 2950 (104.2) |

*Table 1: HYDROVEX® FluidCasca Cascading Float Gate Valve flows of various nominal diameters*

## Example

$Q_{crit}$ = 1200 l/s Critical flow
$Q_b$ = 40 l/s Flow of instruction of the regulator

5 $Q_b$ = < $Q_{kas}$ > = 0.2 $Q_{crit}$

5 $Q_b$ = 200 l/s
0.2 $Q_{krit}$ = 240 l/s

The flow through the valve must be at least of 240 l/s. We will select a nominal diameter DN 400 according to **Table1**.

## MATERIAL

1. Float, levers, supports: 304 stainless steel
2. Valve: synthetic material, PVC

## TYPICAL SPECIFICATION

The regulator is a **HYDROVEX®** ***Fluid*Casca** Cascading Float Gate Valve, control valve immersed with float. Construction: 304 stainless steel, synthetic matter and PVC

| | | | |
|---|---|---|---|
| Nominal valve diameter: | DN | = | …mm, |
| Flow: | $Q_{kas}$ | = | …l/s |
| Difference in height of water between upstream and downstream (total load): | h | = | …m |

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