WaReg

Overloading in sewage and drainage systems can be avoided by using an attenuation reservoir, or by directing flow to a less sensitive area. Using Wapro's flow regulating system, flow is controlled with the assistance of the current retained water levels in the pipe system. The throughput area in the pipe is regulated by the water level in the chamber. In normal situations the entire pipe is open, allowing the chamber to act as a normal manhole. In cases of increased flow the inlet is gradually closed to decrease the inflow into the chamber. The flotation pipe and sliding valves construction and action allows the flow to continue controlled through the WaReg.

The chamber is constructed to minimise the risk for pollution, sludge and other matter interrupting flow. The design of the WaReg makes it infinitely more efficient than the vortex design commonly used on attenuation systems. The fact that it is adjustable ensures that it is adaptable to changes in the requirements of the installation.

- Automatic flow control in gravity fed drainage systems to minimise the risk of overloading.
- Autonomous – flow is regulated by the dimensioned capacity of the outlet.
- Extremely low risk of blockage and obstructions as the pipe in normal situations is completely open for free flow.
- WaReg requires only minimal level differences, making the system easy to install, even in existing pipes.
- Uncomplicated and easily maintained construction which requires only a minimum level of maintenance.
- Precise flow through gravity fed systems regardless of retained water levels.
  Can be used in conjunction with any type of attenuation system.
- Available in both standard sizes and bespoke designs.
  Wide range of connections available.

TECHNICAL ASPECTS

WaReg operates according to figure 1:

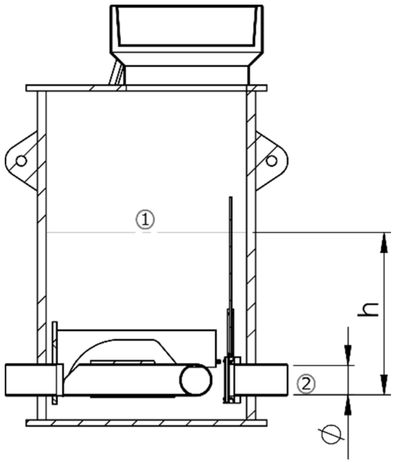


FIGURE 1 WAREG

The water level in the chamber (1) is kept constant by a float that regulates the inflow in to the chamber. Bernoulli states that:

$$p_1 + \frac{\rho V_1^2}{2} + \rho g z_1 = p_2 + \frac{\rho V_2^2}{2} + \rho g z_2$$

In our case the surrounding pressures at 1 and 2 are considered the same $p_1 = p_2$, the difference in height $z_1 - z_2 = h$, and the water level in the chamber is constant

i.e., $V_1 = 0$; results in $V_2 = \sqrt{2gh}$ known as Torricelli's law. Since $q_2 = A_2 \cdot V_2$; $A_2 = \pi \cdot \left(\frac{\emptyset}{2}\right)^2$; $\emptyset = const. and\ h = const.$ the volumetric flow q_2 is constant.

In practice the flow is slightly less due to friction, furthermore a sharp edged outlet will result in a *'vena contracta'* meaning that the diameter of the water stream is less than the diameter of the outlet. The resulting flow will be:

$q = \phi C_c A \sqrt{2gh}$

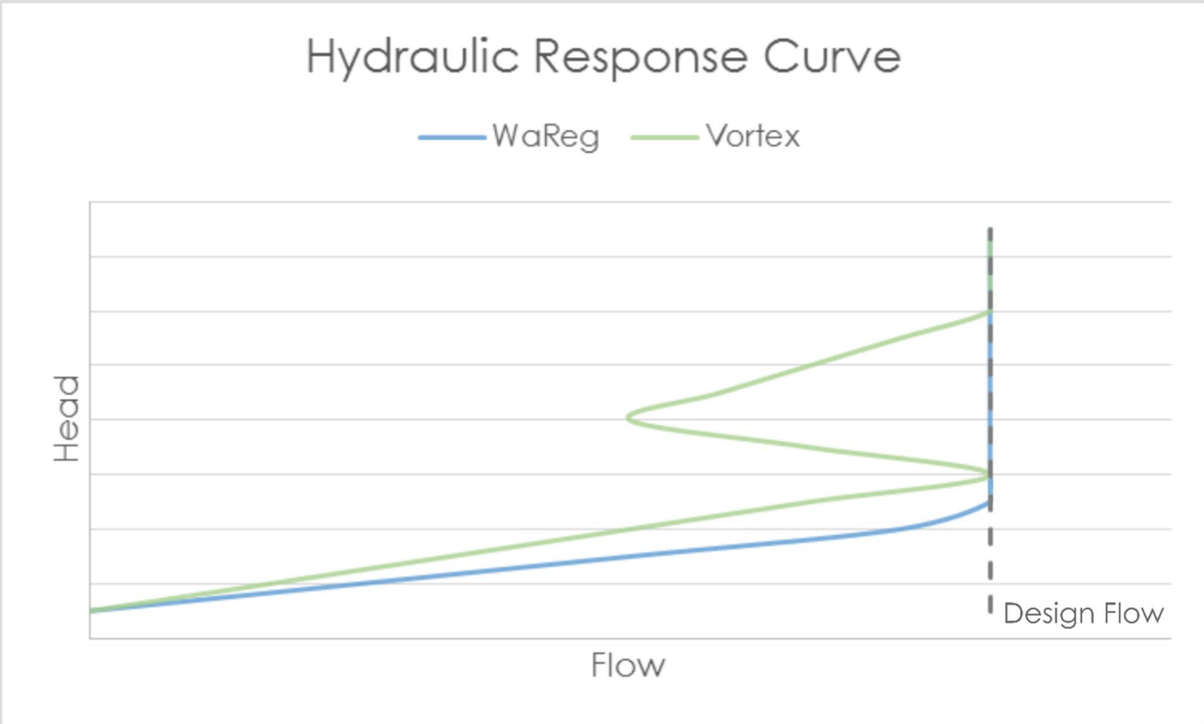
q: $Volumetric\ flow\ [m^3/s]$

ϕ: $0.95 - 1\ (Friction\ factor)$

C_c: $0.6 - 1\ (Contraction\ coefficient)$

Key is that the volumetric flow is constant if the water level in chamber and diameter of the outlet is constant.

Comparing the WaReg to other flow regulators operating with a vortex, the main benefit is that the WaReg produces a constant flow independent of the head upstream the chamber. A vortex needs to build up a certain head before it yields the designed flow. Compare the function in the diagram below. In practice it means that the WaReg can let through the design flow during longer periods meaning a more effective evacuation of water upstream.



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