

Flow Measurement – The Principle

Measurement of flow in piped drainage systems and open channels is an essential consideration across several environmental applications including agriculture, water management, emissions, and contamination management. Depending on the application the purpose of flow measurement may be to quantify the discharge from a site to assess associated impacts or alternatively to quantify flow into an irrigation system or peatland.

Flow or discharge (Q) is a function of fluid velocity (V) and cross-sectional area (A) whether that be an open channel or pipe. It is commonly expressed in L/s or cumecs (m^3/s). Fluid flow in pipes can be readily determined through measurement of pipe CSA and fluid velocity. Calculating flows in open channels is however more complex due to the inherent changes in channel cross section, orientation and construction along its length.

How do we measure it?

To measure flow in open channels we must install a flow control structure such as a weir or flume. Weirs are ideally suited for measuring flows from a headwater or within channels with a moderate to steep gradient. With small channels it is often unfeasible to create a headwater and a flume is required. Flumes are engineered structures designed to measure the flow of water in open channels. They are a simple flow control structure with no moving parts.

Flumes rely on the principle of establishing critical flow within a section of the flume and at this point a relationship is derived between water level (stage) and flow. Critical flow conditions are achieved by constricting flume side walls, creating a ramped section within the flume throat or a combination of the two.



Figure 1 - 86L/s Van Walt RBC Flume

The water level is measured in a stilling well which connected to the main body of water by a small capillary. Use of a stilling well avoids inaccuracies associated with turbulent flow and avoids inaccuracies introduced by placing a measuring gauge or similar into the channel. The relationship between the water level at the point of measurement and the flow rate can be obtained using the rating curve equation supplied with the flume.

RBC Flumes

There are a huge range of flume designs suitable for a wide range of applications covering low to high flow rates. For small channels Van Walt recommend **RBC flumes** which are the most accurate model when compared to other designs such as Parshall, Montana or cutthroat flumes.

Van Walt RBC flumes are designed and manufactured in house by our engineers. At the design stage each flume is flow modelled with the use of computer modelling software (WinFlume & SolidWorks) avoiding the need for field or laboratory calibration.

Van Walt offer RBC flumes in various sizes covering flow ranges up to 145L/s. For larger flows beyond this we recommend alternative flume designs or weir plates. Please contact us to discuss options for flow measurement beyond those listed within the following table.

ID	Throat Width (mm)	Min. flow (L/s)	Max.Flow (L/s)	Length (mm)	Width (mm)	Height (mm)
VWRBC50	50	0.03	1.5	400	275	100
VWRBC75	75	0.07	4.3	525	338	150
VWRBC100	100	0.16	8.7	675	450	200
VWRBC150	150	0.4	24	950	575	300
VWRBC200	200	0.94	50	1250	700	400
VWRBC250	250	1.8	86	1460	1008	582
VWRBC300	300	2.9	145	1700	1150	675

Data Reporting

Continuous flow measurement and reporting is possible using Van Walt Data Collection Systems. For a single flume installation the Van Walt DataHub collects sensor data at the configured interval and transmits the data to Van Walt CONNECT via GSM. Additional sensors for water or soil quality monitoring may be connected to the same DataHub.

Where several flumes are to be installed within the same site or area we can establish sensor networks using our DataSlaves.

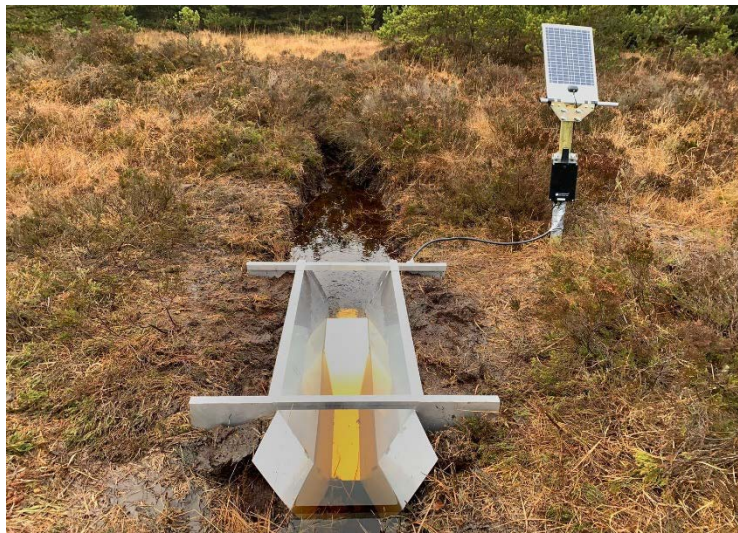


Figure 2 - Typical flume installation with Van Walt DataHub

Van Walt CONNECT allows users to view continuous flow monitoring data in tabular format and also illustrated graphically.



Figure 3 - Example flow output from flume with Van Walt Data Collection system

Flume Selection

Selecting the most appropriate flume for open channels can be a complex task. Van Walt engineers have extensive experience with flume design and can assist customers identify the most appropriate flume for their application. It is recommended that customers contact Van Walt to discuss their flow monitoring requirements in the first instance.