

Guidance on Streamflow Observations at time of Water Quality Sampling of Rivers and Streams

VT DEC

Flow (discharge magnitude) is an essential observation to be made during the collection of water samples from rivers and streams. The water quality of a river or stream can change dramatically during and immediately following a precipitation or snow melt event. Numerous water quality standards are based on the discharge of a river or stream at the time of sample collection by considering the concentration of a parameter and the duration of that condition. Examples in Vermont are the bacteria standards, proposed nutrient standards, and all potentially toxic parameters including those in Vermont's Water Quality Standards and Part C list of priority pollutants. A quantitative discharge measurement in a gaged stream is the most precise method and necessary when collecting water quality samples for loading studies. However, a two-part qualitative streamflow observation can greatly increase the value of a water sample when this is not possible.

The VTDEC records the following two stream flow related observations (flow level and category) during the collection of a river or stream water quality sample, and strongly recommends its use in conjunction with all stream water quality sampling. The VTDEC will have the ability to incorporate this information into VT DEC's WQX database.

Identify flow level - *Low, Moderate, High, or Flood*

Low - Streamflow conditions are believed to be low relative to the entire range of flows experienced at the site. Streamflow conditions are generally expected to be greater than or equal to these levels 75% of the time ($>Q_{75}$). Such low flows often occur during the late winter (January-February) and late summer (July-September). Often, the streambed is partially dry with channel bars exposed and it is possible to walk along the edge of a dry streambed.

Moderate - Stream is believed to be at a mid-level or average streamflow conditions 25-75% of the time (Q_{25} -75). This level can occur at any time of the year, and are the most typical flows experienced in the stream. Approximately 90-100% of the stream bed is under water, and the stream bed will be almost full, but not up the sharp incline of the stream bank.

High - Stream is well-above an average level of flow. Streamflow conditions are generally expected to be greater than or equal to these levels only 25% of the time ($<Q_{25}$). These flows generally occur for extended durations in the spring and fall, but can also occur for shorter periods of time in direct response to large rain events at any time of year. The stream may be full from bank to bank ("bankfull

flows”), but is neither over its banks nor spilling onto the floodplain along most of its course. This streamflow level is never considered a “base flow” (see below).

Flood – The stream is experiencing “flood” conditions, as indicated by water levels exceeding bankfull elevation and accessing the floodplain (should a well-defined floodplain exist at the site). Should there be no obvious floodplain feature adjacent to the channel, submergence of terrestrial and woody vegetation or active transport of large woody debris are other indicators of flood conditions. Flows of this magnitude are generally expected to occur less than 5% of the time.

Identify flow category – Baseflow, Freshet, or Hydro

Base flow – A stream’s flow is considered to be at a relatively constant level at the time of sampling, not rising nor dramatically falling in direct response to a rainfall event or snow melt runoff. Subsurface flows account for almost all water reaching streams. The hydrographs of nearby gaged streams have not begun to rise, have fallen to a similar level of that before the flow level rise began, or have leveled off to a steady but higher flow level. A base flow can exist under both low and sometimes moderate flows, but not under a “high” or “flood” streamflow level. The USGS maintains real-time streamflow data at <http://waterwatch.usgs.gov/?m=real&r=vt>. This map and the hydrographs of current and recent conditions are a useful tool in identifying baseflow conditions.

Freshet flow – A stream is actively rising or falling in response to a rain event or snow melt. The hydrograph of a stream shows an increase in flow, has not leveled off to the pre-event flow levels or stabilized to slightly higher than pre-event levels. Streams can be turbid under these conditions due to stormwater runoff and increased re-suspension of stream bed sediments.

Hydro flow – A stream’s flow level is rapidly rising or falling solely due to the abrupt release of water from an upstream dam. A rise in streamflow with no recent precipitation or snowmelt events and when similar rises are not observed for local stream gages are good indicators of artificial releases from dams. The Vermont Natural Resources Atlas, available at <http://anrmaps.vermont.gov/websites/anra/>, also contains a *watershed protection* layer depicting known dams throughout the state, including whether they are operated for generation of electricity. Note: the occurrence of natural freshet flows in direct response to rainfall or snowmelt are still possible below such facilities.