

MicroPurge Low-Flow Sampling

What is it?

The basic ideology of Low-Flow Purging and Sampling is to pump directly from the formation whilst leaving the stagnant water in the casing undisturbed. This is achieved by pumping at a low rate that is close to or less than the natural movement of groundwater flow through the well. Typical flow rates are 0.1 to 0.5 L/min.

Instead of pumping an arbitrary number of casing volumes, Low-Flow utilises two stability controls. Firstly, a stable water level (drawdown) during purging indicates that water is being pumped directly from the formation. This is further confirmed by the second control, which is indicator water quality parameter stabilisation.

Low-Flow samples represent a flow weighted average concentrations from typical monitoring wells and is the best approach for determining the true mobile contaminant load in most monitoring scenarios.



Low-Flow / MicroPurge sampling methods control turbidity and delivery higher quality samples.

Traditional Purging Vs the Low-Flow Solution

The traditional approach to groundwater sampling has focused on removing the stagnant water in the well casing prior to collecting a sample. The rationale is that once the stagnant water is removed, only fresh aquifer water remains, which may then be sampled. Purging of the stagnant water is normally achieved using bailers or a high-flow pump to remove an arbitrary volume of water such as 3-5 bore volumes.

Disadvantages

- High purge volumes can cause underestimation of contaminant load due to dilution or overestimation due to induced plume migration, contaminant mobilisation and increased sample turbidity
- Dewatering lower-yield wells causes losses of VOCs, affects DO and CO₂ levels and increases sample turbidity
- Excessive drawdown can cause overestimation ("false positives") from soil gas infiltration or from mobilisation of soil-bound contaminants in the overlying formation or smear zone
- Purge water generated can be hundreds of litres from each well, with the associated handling and disposal costs

Bailers or Footvalves

Stagnant water mixes into the sampling zone, requiring extensive purging to obtain formation water. Surging action increases turbidity, which can affect both metals and some organic compounds.

Insertion of the bailer and decanting samples causes aeration that can reduce VOCs and dissolved metals. Inability to reproduce the same purging rate and sampling position leads to data inaccuracy.

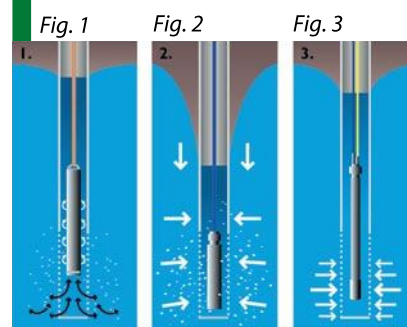
Electric Submersible Pumps

Excessive drawdown pulls stagnant water into sampling zone and mobilises smear zone contaminants. Water from chemically distinct ones above and below the screened one are pulled into the borehole. Less accurate samples result from effects on volatiles, turbidity, mixing and dilution.

Advantages of Low-Flow

- Samples which are representative of the mobile load of contaminants present (dissolved and colloid-associated)
- Minimal disturbance of the sampling point thereby minimising sampling artifacts
- Less operator variability, greater operator control
- Reduced stress on the formation (minimal drawdown)
- Less mixing of stagnant casing water with formation water
- Reduced need for filtration and therefore, less time required for sampling
- Smaller purging volume which decreases waste disposal costs and sampling time
- Better sample consistency, reduced artificial sample variability

Source: "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures", Robert J. Puls & Michael J. Barcelona, EPA Ground Water Issue, April 1996.



Bailers & portable pumps (Fig. 1) mix stagnant water, air and sediment into samples - even after purging 3 to 5 well volumes.

High-rate pumps (Fig. 2) reduce sampling precision due to high-flow effects on volatiles, turbidity and mixing.

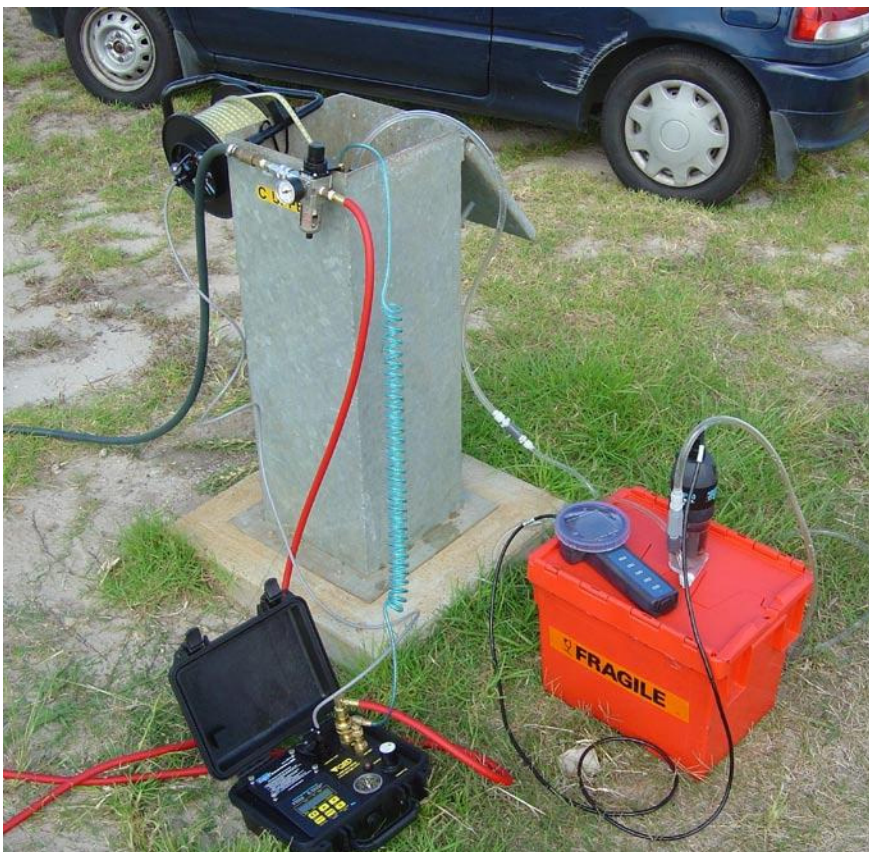
Low-flow sampling methods with MicroPurge® equipment (Fig. 3) deliver precise samples with minimal purging; natural aquifer flow brings representative water to the sampling zone with no mixing or excess turbidity.

Which pump is best for Low-Flow sampling?

The pump should have variable speed control down to approximately 0.1 litres per minute, and its operation should be consistent at low rates. Dedicated pumps are preferred over portable pumps because they do not disturb the stagnant water column and eliminate cross contamination between monitoring wells. However, it is often not cost-effective to install dedicated pumps for short-term projects. Portable pumps may be used for low-flow sampling but care should be taken when inserting into the water column in order to minimise mixing and agitation.

Peristaltic pumps may be evaluated for suitability for shallow applications. Keep in mind however that their operation induces a vacuum that may cause degassing resulting in changes in pH and VOC losses. Peristaltics are therefore generally not recommended for VOC sampling.

Electric/12V submersible pumps may be used but care should be taken that they do not heat up or cause loss or gain of dissolved gasses due to highspeed rotating impellers and air/water interface in the device.



Bladder pumps are generally recommended for sampling all inorganic, organic (including volatiles) and biological groundwater parameters.

Source Appendix A EPA Victoria Groundwater Sampling Guidelines 2000.

Pneumatic Bladder Pumps are specifically designed to deliver precise, accurate samples and dependable, economical service. Their simple design with only three moving parts - two check balls and a flexible bladder - provides superior durability and wear resistance.

Bailers and grab samplers are not suited to low-flow purging and sampling since they cause disturbance and mixing of stagnant water. Inertial lift devices (eg footvalves) are also not recommended because of the fact that they cause disturbance to the sampling point. Use of these devices also tends to introduce uncontrolled and unacceptable operator variability.

Source: "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures", Robert J. Puls & Michael J. Barcelona, EPA Ground Water Issue, April 1996.

QED Micropurge Basics - What do I need?

