

Sampling in Multilevels

Options & Helpful Hints

Introduction

Collecting groundwater samples, in either the Solinst Continuous Multichannel Tubing (CMT) or Waterloo Multilevel Systems, must be accomplished with devices that can sample in, or through, relatively narrow tubing. Sampling tubes placed within the Waterloo System are either 1/2"ID (12mm), 3/8"ID (10mm) or 1/4"ID (6mm) depending on the number of zones being monitored. These open tubes are usually used in place of dedicated pneumatic pumps in the Waterloo System, when the application is relatively shallow and the water level high.

Peristaltic Pump

Whether working in Waterloo System open tubes or directly within a CMT channel the most common means to collect a shallow groundwater sample is either using a Peristaltic Pump or Mini Inertial Pump. The Peristaltic Pump will draw a sample if the water level is within an estimated 25ft (7.6m) of ground surface at sea level. It should be noted that for every 1000ft (300m) increase in elevation the barometric pressure is reduced by about 1ft of head as water. Therefore at 1000ft (300m) above sea level a Peristaltic pump may only be able to pull a sample from 24ft (7.3m), also taking into account friction and efficiency losses. The Peristaltic Pump is most often used with 1/4" (6mm) LDPE tubing that is lowered into the channel of the CMT, or tubing from the Waterloo System port can be coupled directly to the silicone tubing of the Peristaltic Pump. It should be noted that although the pump can only draw water if the head is above 25ft (7.6m), at sea level, the intake of the pump tubing can be placed much deeper, drawing water from the port intake, if desired.

Mini Inertial Pump

In situations where the water level is too deep for a Peristaltic Pump, but no deeper than approximately 150ft (50m) below ground surface, the inexpensive and easy to operate Mini Inertial Pump is most often recommended. The Mini Inertial Pump is based on the same principle as all Inertial Pumps, in that it consists of a length of Polyethylene tubing with a check valve placed at its base. The tubing is lowered into the well and by raising and lowering the system, usually by hand and approximately 1ft (24mm), a pulse or slug of groundwater migrates up the tubing and can be collected at surface.

In the case of sampling the CMT System with the Mini Inertial Pump, the tubing is 1/4" (6mm) x 0.17" (4.3mm) Low Density Polyethylene (LDPE) or Teflon lined LDPE can be used for applications up to 50ft (15m) deep. At depths to water ranging from 50-150' (15m to 45m) pure Teflon is used to reduce the friction effects encountered at greater depth. Other tubing such as Kynar has also been tested but offers no advantage and is more expensive. The check valve of the Mini Inertial Pump has 3 separate components, two hollow stainless steel sleeves and a

stainless steel check ball that is placed between the sleeves. This valve assembly is pushed into the base of the 1/4" (6mm) tubing using an insertion tool that is similar to a short narrow diameter screwdriver. The base of the sleeve has a cross-hatch design that improves flow rates, up to approximately 150-200 ml/min. The Mini Inertial Pump can also be used successfully in collecting samples from open tubes installed in the Waterloo System.

Double Valve Pumps

Pneumatic (Gas Driven) Pumps are the most common sampling option of the Waterloo Multilevel System. The 5/8" (16mm) diameter Double Valve (DVP) or the 1" (24mm) diameter Bladder Pump are both constructed of stainless steel and built directly onto the sampling ports of the system. These pumps allow groundwater samples to be obtained from depths up to 1000ft. (300m). The DVP is often selected for deeper applications and for sampling in groundwater that may contain fine sediment, as they are easier to rehabilitate and samples can be obtained faster from depth and at greater volumes than with the Bladder Pump. Bladder Pumps are still most often the pump of choice for shallower applications, up to 500ft (150m), because there is no contact with air and therefore they are considered ideal for VOC monitoring.

The DVP has been re-designed in Micro form for use within the narrow channels of the CMT System. This pneumatic option is a much needed development to enable sampling within the Multichannel tubing at depths greater than 100ft (30m) and also for VOC sampling at sites where Inertial and Peristaltic Pumps are not considered appropriate. The Micro DVP is a viable sampling option that is capable of pumping at rates of 150 ml/min when placed within the narrow CMT channel. The Micro Double Valve Pump is constructed from stainless components and coaxial LDPE or Teflon Tubing. The Teflon is used at depths greater than 50ft (15m) to reduce friction effects during installation. A manifold at surface connects the pump to a drive gas (compressed air/N₂ source), and the pump is easily operated using the Solinst Electronic Control Unit, Model 466.

Vapor Sampling in the CMT

The CMT System is ideal for gas vapor sampling. The CMT System is constructed with ports and plugs to seal channels exactly as in a groundwater sampling application. The only additional component is another plug placed at surface to seal the top of the sampling channel. This upper plug has a push fit connection that is used with 1/4" (6mm) tubing to enable a gas sample to be drawn from the CMT port to surface using a Hand Vacuum pump or Peristaltic Pump.