

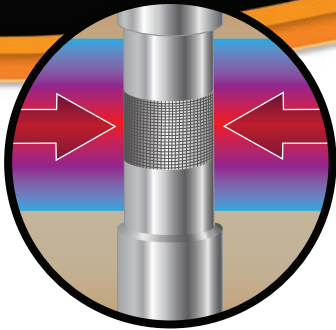


Solinst[®]

**Multilevel Systems,
Remediation & Drive-Points**

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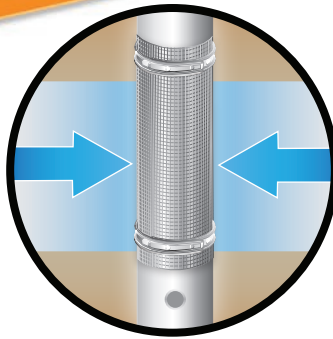
High Resolution Monitoring



- 1** *Target and identify the extent of contamination*

Use Drive-Point Piezometers to determine the existence and location of contaminants in temporary boreholes. Drive-Points provide an inexpensive, minimal disturbance option to quickly assess a site. Samples can be taken from multiple depths providing discrete and detailed sampling across a site.

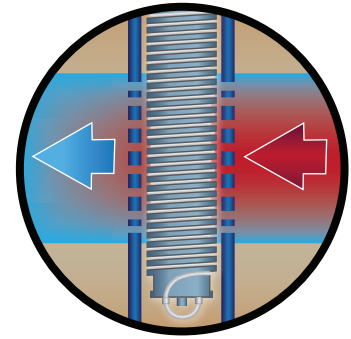
Drive-Points do not require large drill rigs. Their narrower design means there is less purge water to manage, and sampling times are reduced. Because of their low cost and ease of installation, adding more sampling locations, as required, takes little effort. As screening tools they help decide on placement of longer-term monitoring systems and also pin-point areas that require immediate remedial action.



- 2** *Quantify and detail the movement of contaminants*

Use Multilevel Systems to accurately verify and delineate the extent and movement of contaminants. CMT® and Waterloo Multilevel Systems provide long-term sampling and water level monitoring at multiple depths across a site. They allow a number of discrete zones in one well. Long-term measurements are critical in determining the overall hydrogeological conditions of a site, including groundwater flow and direction, contaminant distribution, concentration gradients, and contaminant fluxes. They can also track naturally occurring chemical reactions or attenuation processes.

Transects of Multilevels allow for 4D characterization of a site, providing high resolution data. The more accurate site characterization, allows remediation strategies to be targeted more precisely, and efforts focused in the most beneficial manner.



- 3** *Resolve contaminated site issues*

The Waterloo Emitter™ is one option for resolving contaminated groundwater issues. The Waterloo Emitter uses a patented technology that releases oxygen into contaminated groundwater in a controlled and uniform manner. This enhances the conditions to stimulate aerobic microbial degradation.

The Waterloo Emitter is a low cost device, which can be used on its own, or as part of a multi-phase approach to attenuate contamination in groundwater. The Waterloo Emitter works with equipment that is readily available, is easy to install, and has no power requirements. It speeds up the natural attenuation process without injecting any slurry or chemicals, and there are no by-products produced. Contaminants are reduced in place, with minimal disturbance or disruption to on-going activities.



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™Waterloo Emitter is a trademark of Solinst Canada Ltd.

Convenient Drive-Points

Model 615 Drive-Point Piezometers consist of a 3/4" diameter perforated stainless steel body with a 50 mesh cylindrical screen inside. The stainless steel body connects to inexpensive 3/4" (20 mm) steel NPT drive pipe. Standard lengths are 6" and 1 ft. (15 and 30 cm). Drive-Point Piezometers can be installed to depths of 7 m (25 ft.) in suitable soils. This can be done with a Manual Slide Hammer. A convenient tubing bypass assembly is available for installing piezometers with tubing connected.

The standard 615 has a 5/8" OD barbed fitting that allows a sample tube to be attached for obtaining groundwater samples. The 615 C provides an airtight connection with a 1/4" compression fitting, ideal for vapour sampling. The 615 N, designed without a tubing barb, is most ideal for water level measurements using Water Level Meters. To ensure that the screen does not clog or smear, 615 S shielded versions are available for sites with high silt or clay content.

615 ML Multilevel Drive-Points have a barbed port stem to allow the connection of 3/8"OD or 1/4" OD tubing. They allow multilevel monitoring for up to 6 zones in one drive. Water from the monitoring zone enters the port, passes into the stem, and up the attached tubing to static level. The 615 ML is ideal for high-resolution vertical profiling of soil gas or groundwater..

Model 601 Standpipe Piezometers are composed of a 3/4" diameter PVC body, which is perforated to expose the preformed Vyon filter inside. The PVC tip connects to plain end 3/4" Sch. 40 PVC riser pipe with push-fit couplings. Standpipe Piezometers are available in standard lengths of 6", 1 ft., 2 ft. and 3 ft. (15 cm, 30 cm, 60 cm and 90 cm).

The Standpipe Piezometer is primarily used to provide a filtered inlet point when backfilled in place within a pre-drilled hole or test pit. The pointed tip can also be pushed into very loose sands at the base of a borehole, stream, or into loose tailings pond sediments.. Standpipe Piezometers are great for water level monitoring, permeability measurements, slope stability investigation, dewatering operations, air sparging and metals sampling.



615
Drive-Point
Piezometers



601
Standpipe
Piezometers



Multilevel Systems



The Model 403 CMT® Multilevel System consists of continuously extruded polyethylene tubing with three or seven separate channels running the length of the tubing. Monitoring zones are manually constructed, sealed-off, and screened, one in each channel, at different vertical intervals. This allows the System to monitor up to seven depth discrete zones in a single groundwater monitoring well. Designing these systems is very flexible; construction of monitoring ports can be done right at the drilling site.

The narrow 3-Channel System is 1.1" (28 mm) in diameter; the 7-Channel System is 1.7" (43 mm) in diameter. Backfilling around these single tube systems is simple, compared to multiple clustered or nested wells at various depths.

The 3 and 7-Channel Systems can be backfilled with standard methods of bentonite seals and sand packs. The 3-Channel System has the option of using pre-formed bentonite and sand cartridges, which can be positioned on the CMT and installed using direct push methods.

CMT Systems can be used to accurately measure water levels and take water samples. Solinst offers narrow diameter, portable Water Level Meters and samplers that can be used in the CMT. A wellhead seal is available to allow vapour sampling.

The CMT System provides many benefits to site assessors.

- Inexpensive and easy to install and use
- No joints - smooth surface for easy sealing
- Up to 7 depth-discrete monitoring zones
- Locate ports and seals exactly where needed
- Installs quickly using direct push methods or in boreholes
- Lowers risk of cross contamination and new contaminant pathways
- **Provides a 4D view of groundwater flow and distribution of contaminants in the subsurface**

Solinst offers courses for CMT construction and installation. Contractors who complete the course are "Trained CMT Contractors" and can be listed on the Solinst website.



Typical 3 or 7-Channel CMT Installation using layers of bentonite and sand backfilled from surface.

Patented.





Waterloo System
in Bedrock Using
Permanent Packers

401 Waterloo Multilevel System uses modular components of various casing lengths, 316 stainless steel sampling ports, and packers. The engineered components are pushed together to form a reliably sealed casing string. Pumps and/or transducers can be dedicated to each port at each sampling zone. Open tubes can also be used to monitor each port. All instrument tubing and cabling is contained within these modules and collected at the top of the system at a wellhead manifold.

Based on borehole logs, Waterloo Systems can be customized for each site. The number of monitoring zones depends on the sampling and monitoring options chosen, and the number of cables and tubes that can fit in the well casing. Systems can monitor from 2 to 24 depth-discrete zones in one well.

Systems have been installed in overburden and bedrock applications up to 1000 ft. (300 m). Typical Systems use 2" (50 mm) Sch. 80 PVC casing that fits in 3-4" (75 - 100 mm) boreholes and 3 ft. (915 mm) long packers. The sampling ports are made from 316 stainless steel, with dual and single stem options.

The ports can be fitted with dedicated bladder pumps or double valve pumps, pressure transducers, or both on a dual port. Dedicated equipment allows for fast and efficient monitoring, as decontamination requirements are eliminated and sampling times reduced. Dedicating equipment is ideal for long-term monitoring.

Ports fitted with open tubes can be monitored using small diameter portable equipment, such as Solinst Model 102 Water Level Meters, Model 410 Peristaltic Pump, or Model 408M Micro Double Valve Pump.

Compared to conventional monitoring wells, Waterloo Systems have many advantages:

- Fewer holes to drill for multiple depth-discrete monitoring zones
- Less site disturbance
- Less purge water to deal with when sampling
- Reduced project costs with quick sampling times
- **Transects of Multilevels provide the high resolution data needed to calculate mass flux and estimate risks to receptors at contaminated sites**

Patented.



Remediation

Enhanced Bioremediation

The Model 703 Waterloo Emitter™ is an in-situ bioremedial device used to enhance the natural attenuation of contaminated groundwater. Using patented technology based on diffusion principles, it supplies oxygen or other bioenhancing amendments into an aquifer.

- Oxygen release for aerobic bioremediation of BTEX and MTBE
- Hydrogen release for anaerobic reductive dechlorination of solvents
- Release of CO₂ for pH adjustment
- Light alkane release to promote co-metabolic biodegradation of MTBE

The Waterloo Emitter comes in three diameters, 1.8", 3.8", and 5.8", which fit into 2, 4, or 6" (50, 100, or 150 mm) wells. They consist of a 51" (130 cm) long PVC frame that is uniformly coiled with LDPE or silicone tubing. The frame has an opening down the centre that allows the installation of monitoring devices to track the remediation process.

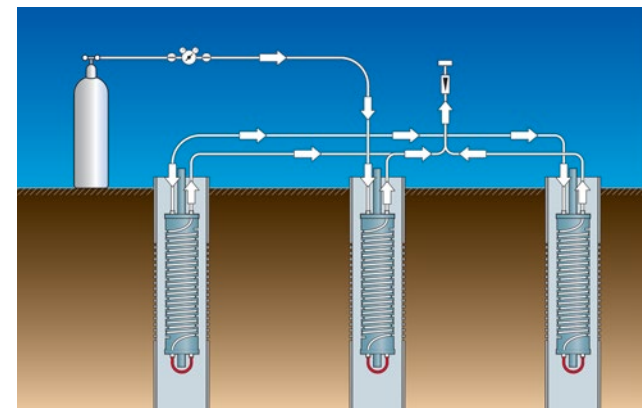
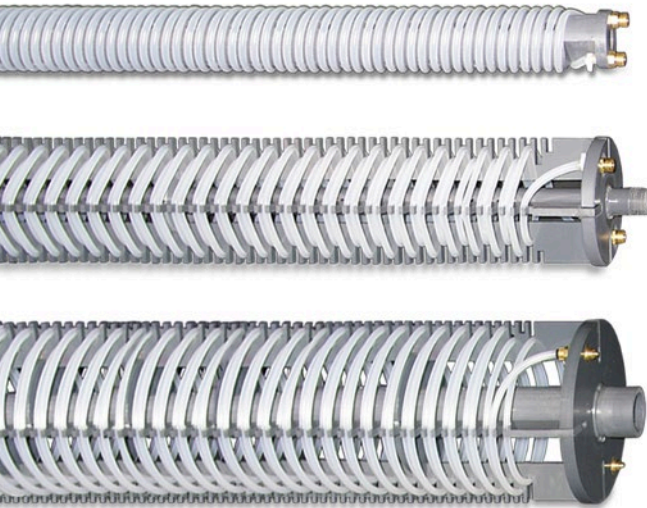
There is no minimum hydraulic head required for the Emitters to work, as a result, they can be installed at any angle or depth. They can be stacked or linked together in a series of wells.

When using oxygen to stimulate aerobic bioremediation, the gas can be supplied using a pressurized tank or cylinder. When the gas is introduced into the Emitter tubing, a concentration gradient results between the inside of the tubing and the groundwater. The Emitter works following Fick's Law, by which diffusion occurs from high concentration to low. Since oxygen is replenished constantly using the Emitter, and groundwater flow around the Emitter is continuous, equilibration is never reached. This results in steady, controlled diffusion into the groundwater — without any decrease in concentration due to bubbling. The oxygen is supplied to the groundwater at a molecular level, therefore it is immediately available to the microbial population.

The Waterloo Emitter has many benefits:

- Low cost
- Easy installation and removal
- Minimal maintenance and operating effort
- No hazardous substances handled, injected or produced
- No electricity required

Patented.



Multiple Well Installation with a Single Gas Supply



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FREE Support
+1 (905) 873-2255
+1 (800) 661-2023
instruments@solinst.com



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35 Todd Road
Georgetown, ON
Canada L7G 4R8



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Solinst Canada Ltd., 35 Todd Road, Georgetown, Ontario, Canada L7G 4R8

Tel: +1 (905) 873-2255; (800) 661-2023 Fax: +1 (905) 873-1992; (800) 516-9081 E-mail: instruments@solinst.com