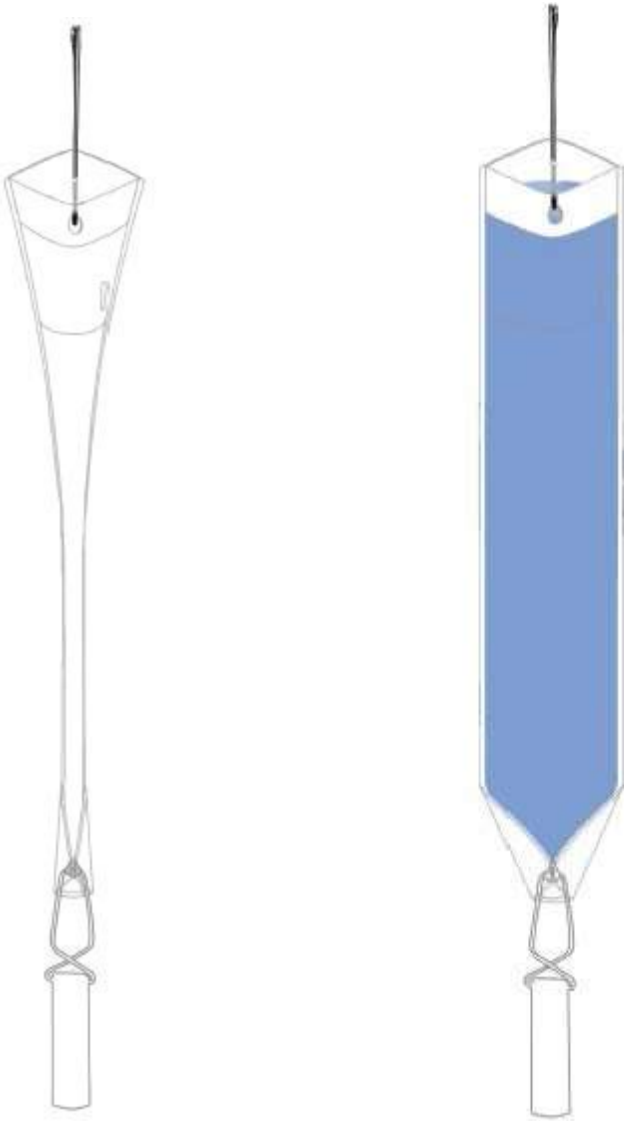
HYDRASleeve™

Simple by Design

US Patent No. 6,481,300; No. 6,837,120; No. 9,726,013; others pending

Standard Operating Procedure: Sampling Groundwater with a HydraSleeve™



This guide should be used in addition to field manuals and instructions appropriate to the chosen sampling device (i.e., HydraSleeve, SpeedBag or Super/Skinny Sleeve).

Find the appropriate field manual and instructions on the HydraSleeve website at http://www.hydrasleeve.com.

For more information about the HydraSleeve, or if you have questions, contact:
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Introduction

The HydraSleeve is classified as a passive (no-purge) grab sampling device, meaning that it is used to collect groundwater samples directly from the screened interval of a well without having to purge the well prior to sample collection. When it is used as described in this Standard Operating Procedure (SOP), the HydraSleeve causes no drawdown in the well (until the sample is withdrawn from the water column) and only minimal disturbance of the water column, because it has a very thin cross section and it displaces very little water (<100 ml) during deployment in the well. The HydraSleeve collects a sample from within the screen only. It excludes water from any other part of the water column in the well through the use of a self-sealing check valve at the top of the sampler. It is a single-use (disposable) sampler that is not intended for reuse, so there are no decontamination requirements for the sampler itself.

The use of passive sampling as a means of collecting representative groundwater samples depends on the natural movement of groundwater (under ambient hydraulic head) from the formation adjacent to the well screen through the screen. Robin and Gillham (1987) demonstrated the existence of a dynamic equilibrium between the water in a formation and the water in a well screen installed in that formation, which results in formation-quality water being available in the well screen for sampling at all times. Passive (no-purge) sampling devices like the HydraSleeve collect this formation-quality water, under undisturbed (non-pumping) natural flow conditions. Samples collected in this manner generally provide more conservative (i.e., higher concentration) values than samples collected using well-volume purging, and values equivalent to samples collected using low-flow purging and sampling (Parsons, 2005).

Applications of the HydraSleeve

The HydraSleeve can be used to collect representative samples of groundwater for all analytes (volatile organic compounds [VOCs], semi-volatile organic compounds [SVOCs], common metals, trace metals, major cations and anions, dissolved gases, total dissolved solids, radionuclides, pesticides, PCBs, explosive compounds, 1,4 Dioxane, PFAS, and all other analytical parameters).

Designs are available to collect samples from wells 1" inside diameter and larger. The HydraSleeve can collect samples from wells of any yield, including low-yield wells. (McAlary and Barker, 1987).

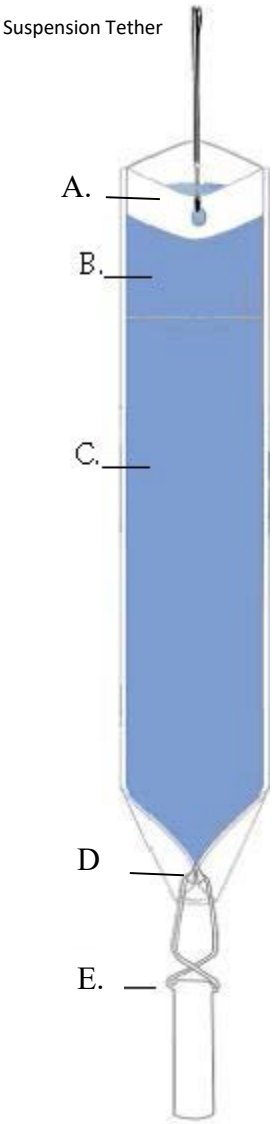
The HydraSleeve can collect samples from wells of any depth, and it can be used for single-event sampling or long-term groundwater monitoring programs. Because of its thin cross section and flexible construction, it can be used in narrow, constricted or damaged wells where rigid sampling devices may not fit. Using multiple HydraSleeves deployed in series along a single suspension line or tether, it is also possible to conduct in-well vertical profiling in wells in which contaminant concentrations are thought to be stratified.

As with all groundwater sampling devices, HydraSleeves should not be used to collect groundwater samples from wells in which separate (non-aqueous) phase hydrocarbons (i.e., gasoline, diesel fuel or jet fuel) are present because of the possibility of incorporating some of the separate-phase hydrocarbon into the sample.

Description of the HydraSleeve

The basic HydraSleeve (Figure 1) consists of the following components*:

- Just above the self-sealing check valve at the top of the sleeve are two white strips with holes (A.) to provide attachment points for the spring clip or suspension tether.
- A suspension line or tether is fixed to a reusable spring clip that attaches to the holes in the white strips to deploy the device into and recover the device from the well. (Factory assembled, custom tethers can be purchased from the manufacturer or tethers can be field assembled using suspension cord. Suspension cord with depth indicators marked in 1-foot intervals is available from the manufacturer.)
- A long, flexible, 4-mil thick lay-flat polyethylene sample sleeve (C.) sealed at the bottom (this is the sample chamber), which comes in different sizes, as discussed below with a transparent, self-sealing, reed-type flexible polyethylene check valve built into the top of the sleeve (B.) to prevent water from entering or exiting the sampler except during sample acquisition.
- At the bottom of the sample sleeve are two holes (D) which provide attachment points for the weight clip and weight.
- A reusable stainless-steel weight with clip (E) or disposable zip-tie is attached to the bottom of the sleeve to carry it down the well to its intended depth in the water column. Bottom weights are available from the manufacturer in sizes from 0.75" OD to 1.5" OD and are available in a variety of lengths. An optional top weight may be attached to the top of the HydraSleeve to carry it to depth and to compress it at the bottom of the well (not shown in Figure 1).
- A discharge tube is included and is used to puncture the HydraSleeve after it is recovered from the well so the sample can be decanted into sample bottles (not shown).



Note: The sample sleeve and the discharge tube are designed for one-time use and are disposable. The Spring Clip, Weight, Weight-Clip and factory-built Suspension Tethers are dedicated to the well and may be reused.

Selecting the HydraSleeve Size to Meet Site-Specific Sampling Objectives

It is important to understand that each HydraSleeve collects a finite volume of sample based on the well diameter, length of saturated screen, and size of HydraSleeve because, after the HydraSleeve is deployed, there is only one opportunity to collect an undisturbed sample, without waiting again for the well to recover and return to natural flow conditions again. Thus, the volume of sample required to meet site-specific sampling and analytical requirements will dictate the size of HydraSleeve needed to meet these requirements.

There are three types of HydraSleeve, Standard HydraSleeve, Super/SkinnySleeve, and Speedbag. All three are identical in operation however,

- **Standard HydraSleeves** have white reinforced strips at the top for connecting to a Spring Clip fastened to the tether, and are available in Low Density Polyethylene (LDPE)
- **SuperSleeves** have reusable rigid top collars, are available in longer lengths for additional volume, and they are available in LDPE for general sampling, or High Density Polyethylene (HDPE) for PFAS sampling.
- **SpeedBags** have white reinforcing strips at the top for connecting to a Spring Clip and they have a pair of 1-inch diameter holes above the top valve and below the reinforcing strips that allows the Speedbags to be used immediately after installation. They are available in LDPE. SpeedBags require a longer saturated screen to fill than other HydraSleeves.

The volume of sample collected by the HydraSleeve varies with the diameter and length of the HydraSleeve. Dimensions and volumes of available HydraSleeve models are detailed in Table 1.

Considerations:

- The length of saturated screen required to fill a HydraSleeves is based on using the correct size HydraSleeve to match the well diameter. Using a HydraSleeve that is smaller in diameter than recommended will increase the length of saturated screen necessary to fill the sleeve. For example, 1.5-inch and 1.75-inch diameter HydraSleeves are the optimum size for two-inch wells and will fill in about the length of saturated screen listed in Table 1. If one of these samplers is used in a 4-inch well the saturated screen requirements could be 1.5 or more times the optimum screen lengths listed.

- When using SuperSleeves in wells 4-inch diameter or larger it is recommended to substitute 4x2 Top Collar Adapters instead of the standard Top Collar Assemblies, so that the SuperSleeve fills in the shortest saturated screen interval.

- The outside diameter of the Heavy-Duty Universal Super/SkinnySleeves is 1.75" however some Top Collar Assemblies are larger in diameter. 1.66” Top Collars are recommended for most cases and must be used for 2-inch sch80 wells. 1.9” Top Collars are used for special applications and require 2-inch sch 40 well casing and larger.

- Do Not use Top Weights with SpeedBags

Table 1. Dimensions and Volumes of HydraSleeve Models.

Table 1. Standard HydraSleeve Dimensions, Sample Volume and Saturated Screen Requirements*.					Minimum Saturated Screen Required**		Minimum Saturated Screen Required Above each Additional HydraSleeve**
Item ID	**Sampler Type**	**Maximum Sampler Volume**	**Sampler Dimensions (Diameter When Filled with Sample)**	**Minimum Well Diameter**	**WITH Top Weight in 2-inch Diameter Sch 40 Well. (FEET)**	**WITHOUT Top Weight in 2-inch Diameter Sch 40 Well. (FEET)**	**2-inch Diameter Sch 40 Well (FEET)**
GSH110	HydraSleeve	600mL	1.5" Diameter x 30" Length	1.5" Sch 40 Wells	4.0	5.5	3.0
GSH130	HydraSleeve	1.1L	1.75" Diameter x 37" Length	2" Sch 80 Wells	5.0	6.5	3.5
GSH430	HydraSleeve SuperSleeve	1.1L	1.75" Diameter x 37" Length	2" Sched 80; (50mm) Wells	5.0	7.0	3.5
GSH435	HydraSleeve SuperSleeve	1.5L	1.75" Diameter x 52" Length	2" Sched 80; (50mm) Wells	7.0	9.5	5.0
GSH440	HydraSleeve SuperSleeve	2.1L	1.75" Diameter x 66" Length	2" Sched 80; (50mm) Wells	8.5	12.0	6.5
GSH470	HDPE HydraSleeve SuperSleeve (For PFAS Sampling)	1.1L	1.75" Diameter x 37" Length	2" Sched 80; (50mm) Wells	5.0	7.5	4.0
GSH475	HDPE HydraSleeve SuperSleeve (For PFAS Sampling)	2.0L	1.75" Diameter x 67" Length	2" Sched 80; (50mm) Wells	9.0	12.5	7.0
GSH515	HydraSleeve SpeedBag	500mL	1.5" Diameter x 30" Length	1.5" Sch 40 Wells	Do Not Use Top Weight	6.5 with Oscillation 7.5 without Oscillation	4.0 with Oscillation 5.0 without Oscillation
GSH510	HydraSleeve SpeedBag	900mL	1.75" Diameter x 37" Length	2" Sched 80; (50mm) Wells	Do Not Use Top Weight	7.5 with Oscillation 9.0 without Oscillation	4.5 with Oscillation 6.25 without Oscillation
					4-inch Diameter Sch 40 Well. (FEET)	**4-inch Diameter Sch 40 Well. (FEET)**	**4-inch Diameter Sch 40 Well (FEET)**
GSH230	HydraSleeve	3L	2.9" Diameter x 37" Length	4" Sch 80 Wells	4.0	6.4	3.3
					1.25-inch Diameter Sch 40 Well. Oscillation Recommended (FEET)	**1.25-inch Diameter Sch 40 Well. Oscillation Recommended (FEET)**	**1.25-inch Diameter Sch 40 Well. Oscillation Recommended (FEET)**
GSH405	HydraSleeve SuperSleeve	300mL	0.9" Diameter x 48" Length	1" Sch 40 Wells	7.0	9.5	5.5

* Custom Length HydraSleeves, Custom "TurboSleeves" and "Armored HydraSleeves" are available for special applications.
** All Saturated Screen Lengths are approximate.

Sample Volume and Custom HydraSleeves

HydraSleeves can be custom-fabricated by EON in varying diameters and lengths to meet specific volume requirements. HydraSleeves can also be deployed in series (i.e., multiple HydraSleeves attached to one tether) to collect additional samples to meet specific volume requirements, as described in **"Multi Sampler Deployment"**, page 16.

If you have questions regarding the availability of sufficient sample volume to satisfy laboratory requirements for analysis, it is recommended that you contact the laboratory to discuss the minimum volumes needed for each suite of analytes. Laboratories often require only 10% to 25% of the volume they specify to complete analysis for specific suites of analytes, so they can often work with much smaller sample volumes that can easily be acquired using HydraSleeves.

Information Required Before Deploying a HydraSleeve

Before installing a HydraSleeve in any well, you will need to know the following:

- The inside diameter of the well
- The total depth of the well
- The length of the well screen
- The position of the well screen in the well
- The water level in the well
- The sample volume required by the laboratory

The inside diameter of the well is used to determine the appropriate HydraSleeve diameter for use in the well. The other information is used to determine the proper placement of the HydraSleeve in the well to collect a representative sample from the screen (see "**HydraSleeve Placement"**, below), and to determine the appropriate length of tether to attach to the HydraSleeve to deploy it at the intended position in the well.

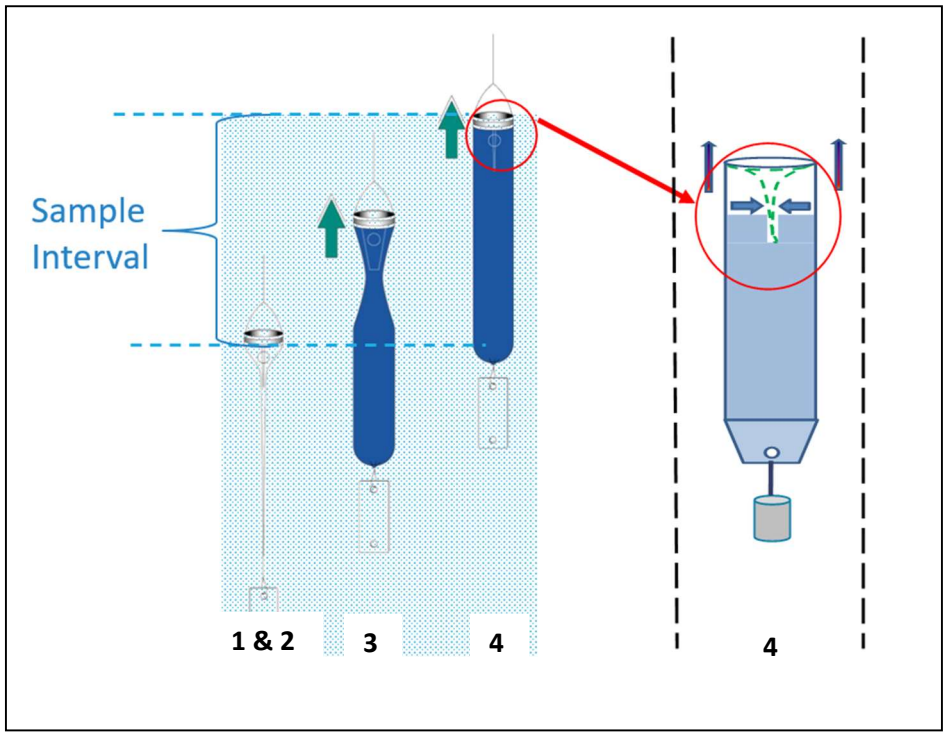
Most of this information (with the exception of the water level) should be available from the well log; if not, it will have to be collected by some other means. The inside diameter of the well can be measured at the top of the well casing, and the total depth of the well can be measured by sounding the bottom of the well with a weighted tape. The position and length of the well screen may have to be determined using a down-hole camera if a well log is not available. The water level in the well can be measured using any commonly available water-level gauge.

Overview: HydraSleeve Operation & Placement

The HydraSleeve is first installed to a position below the intended sample interval. It is activated by pulling upward at a rate of ~1 ft per second*, which causes water in the column to be captured through the top opening and past the check-valve at the same rate the sampler is pulled upward. As the HydraSleeve moves upward the sides of the sleeve are pulled around the stationary core of water in the sample interval. The sample interval begins at the installed position of the top of the HydraSleeve, upward for a distance approximately equal to the length of the HydraSleeve, when correctly sized to the well diameter.

Operation

1. HydraSleeve is installed empty, on a suspension tether below the sample interval in the saturated screen.
2. Left in-place (still empty) until the well restabilizes / equilibrates.
3. To sample, pull upward rapidly on the tether (~1-ft per sec) to fill the HydraSleeve
4. Valve at the top automatically closes and seals when HydraSleeve is full.



*~1 ft per second is about the speed that a person can quickly move their straightened arm in an arc from alongside their leg to over their head. Some have also compared this to the motion used to “set the hook” when fishing.

HydraSleeve Placement

The HydraSleeve is designed to collect a sample directly from the saturated well screen. Since the HydraSleeve is installed empty and flat, it displaces a negligible volume of water and remains empty until activated.

In all cases, the installed position of the top of the HydraSleeves must be in the saturated screen and the length of saturated screen above the HydraSleeve must be at least as long as the HydraSleeve, preferably at least 6-inches longer. This should allow the sampler to fill before the top of the device reaches the top of the saturated screen as it is pulled up through the water column and ensures that only water from the screen is collected as the sample.

To optimize sample recovery in wells with short saturated screen length (5 feet or less), it is recommended that the HydraSleeve be placed in the well so that the bottom weight rests on the bottom of the well and the top of the HydraSleeve is as close to the bottom of the well screen as necessary to leave at least one sampler length between the position of the top of the installed sampler and the top of the saturated screen.

In short-screen wells, or wells with a short water column, it may be necessary to use a top-weight on the HydraSleeve to compress the top of the sleeve toward the bottom of the well, leaving sufficient saturated screen to fill the sleeve before it reaches the top of the screen (Figure 4). In wells where multiple intervals are sampled (profiling) only the bottom HydraSleeve is compressed by a top-weight.

Example Installations in 10-foot & 5-foot Long Screens

Example 1 (Fig 2): 2” ID SCH 40 PVC well, 50’ total depth, **10’ screen** at the bottom of the well, with water level above the screen (the entire screen contains water). Sampling will be done using,

- One Standard HydraSleeve for a 2-in well. (3-in flat width, 1.75-in filled OD, 38-in long, 1-L volume)
- One Standard Weight (1.5-in OD, 2-in long, 8oz).

Example 2 (Figs 3 & 3a): 2” ID SCH 40 PVC well, 50’ total depth, **5’ screen** at the bottom of the well, with water level above the screen (the entire screen contains water). Sampling will be done using,

- One Standard HydraSleeve for a 2-in well. (3-in flat width, 1.75-in filled OD, 38-in long, 1-L volume)
- One Standard Weight (1.5-in OD, 2-in long, 8oz).

Example 1:

10-ft Saturated Screen

Correct Placement (Fig 2)

Deploy the sampler so the weight rests at the bottom of the well. The top of the sleeve is thus set at ~40-in above the bottom of the well.

When the sampler is recovered, it will be pulled upward approximately 38-in before it is filled and the check-valve at the top closes, which is a distance of approximately 78-in (6.5 feet) above the bottom of the well, and far below the top of the saturated screen.

In this example, only water flowing through the screen is collected as a sample.

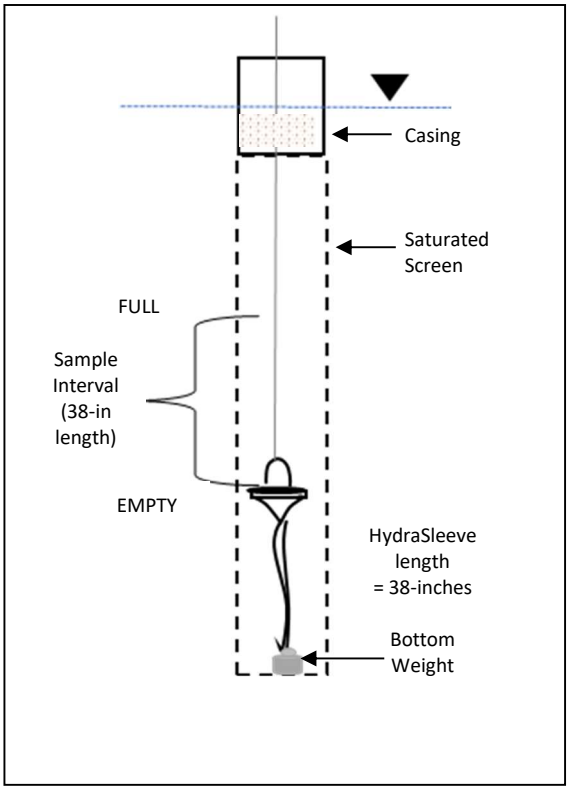


Figure 2. Correct placement of HydraSleeve

Example 2:

5-ft Saturated Screen

INCORRECT Placement (Fig 3)

If the saturated well screen in this example was only 5' long, and the 38-in long HydraSleeve was placed with the weight resting on the bottom of the well, the HydraSleeve would not fill within the saturated screen and the sample would include water from the casing above the screen, which may not have the same chemistry.

The solution?

Deploy the HydraSleeve with a top weight.
See Figure 3a.

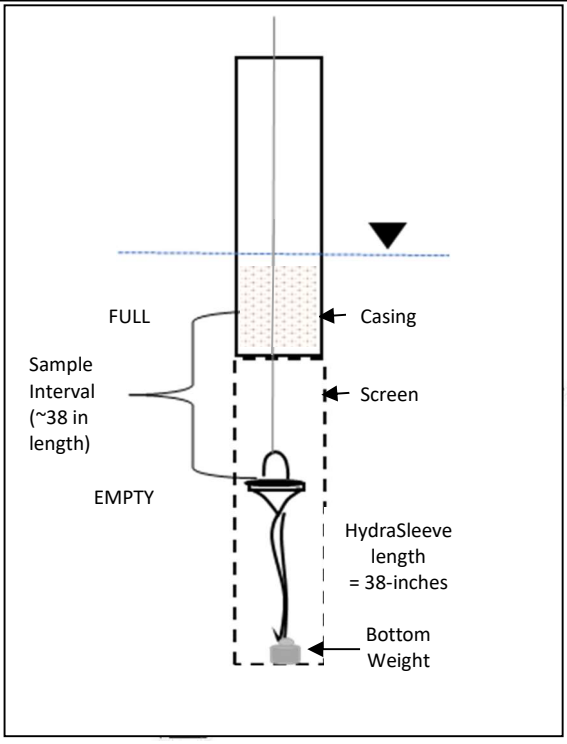


Figure 3. INCORRECT placement of HydraSleeve

Example 2: **The Solution**

5-ft Saturated Screen

Use a Top Weight (Fig 3a)

Deploy the HydraSleeve with a top weight, so that the sleeve is collapsed to within 12-in of the bottom of the well.

Starting at 12 inches from the bottom and travelling another ~38-in upward to fill the sleeve is a total of ~54 inches from the well bottom (4.5ft), so it collects only water from the screen as the sample.

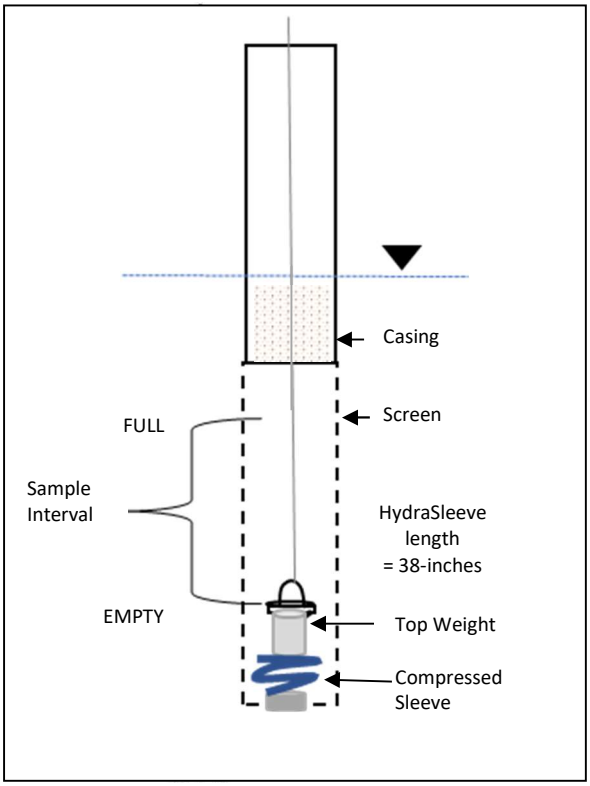


Figure 3a. Correct placement of HydraSleeve using a Top Weight to Compress the HydraSleeve.

These examples illustrate two of the many types of HydraSleeve placements. Multiple HydraSleeve installations and more complex placements are discussed in a later section.

NOTE: Using smaller diameter HydraSleeves in larger diameter wells causes a slower fill rate. (For example: 2-inch HydraSleeves in 4-inch wells) Special retrieval methods are necessary if this is your set up. See "Oscillation", Section IV, Item 4b. "HydraSleeve Recovery and Sample Collection".

Field Procedures for Sampling with the HydraSleeve

Collecting a groundwater sample with a HydraSleeve is usually a simple one-person operation.

Note: Before deploying the HydraSleeve in the well, collect the depth-to-water measurement that you will use to determine the preferred position of the HydraSleeve in the well. This measurement may also be used with measurements from other wells to create a groundwater contour map. If necessary, also measure the depth to the bottom of the well to verify actual well depth to confirm your decision on placement of the HydraSleeve in the water column.

Use a factory manufactured suspension tether or measure the correct amount of tether needed to suspend the HydraSleeve in the well so that the weight will rest on the bottom of the well (or at the preferred position in the well). Allow extra slack in the line if a Top Weight is used and consider adding a few extra feet of tether at the top of the well to aid in recovery of the sleeve.

Note: Always wear clean protective gloves and safety glasses when handling and discharging the HydraSleeve.

I. Assembling the Basic HydraSleeve*

1. Remove the HydraSleeve from its packaging, unfold it, and hold it by its top.

2. Crimp the white reinforcing strips at top of the HydraSleeve by folding the hard polyethylene reinforcing strips toward each other so that the strips are creased in the middle (at the holes) and the top of the HydraSleeve is open.

3. Attach the wide end of the spring clip to the holes from inside the HydraSleeve to ensure that the top will remain open until the sampler is retrieved.

4. Attach the tether to the spring clip with zip-ties or by tying a knot in the tether.

Note: Alternatively, if spring clips are not being utilized, attach the tether to one (NOT both) of the holes at the top of the HydraSleeve using a zip-tie from the hole to the tether or by threading the tether through the hole and tying a knot in the tether.

5. Fold the flaps at the bottom of the HydraSleeve so the two holes align, then slide a zip-tie or weight clip through the holes.

6. Attach a weight to the zip-tie or to the bottom of the weight clip to ensure that the HydraSleeve will descend to the bottom of the well.

**See Super/SkinnySleeve assembly manual and HydraSleeve Field Manual for specific instruction for these models.*

II. Deploying the HydraSleeve

1. Using the tether, carefully lower the HydraSleeve to the bottom of the well, or to the preferred depth in the water column.

   During installation, hydrostatic pressure in the water column will keep the self-sealing check valve at the top of the HydraSleeve closed, and ensure that it retains its flat, empty profile for an indefinite period prior to recovery.

Note: Make sure that the HydraSleeve is not pulled upward at any time during its descent. If the HydraSleeve is pulled upward at a rate greater than 0.5 ft per second at any time prior to recovery, the top check valve will open and some water from the interval where the sampler was pulled upward will enter the HydraSleeve prematurely.

2. Secure the tether at the top of the well by attaching it to a ring, tab, or hook on the bottom of the well cap . If the weight is resting on the well bottom, leave a few inches of slack in the line to avoid pulling the sampler up as the cap is removed at the next sampling event.

III. Allowing the Well to Equilibrate

The installed HydraSleeve should be left undisturbed for some time before sampling to allow the well to return to its pre-installation flow conditions. This "equilibration time" ensures that flow dynamics and contaminant distribution restabilize to natural flow conditions to represent the aquifer conditions after vertical mixing occurs which may be caused by installation of a sampling device in the well.

- **Situation: The HydraSleeve is deployed for the first time in a well or for only one sampling event.**

  The basic HydraSleeve is very thin in cross section and displaces very little water (<100 ml) during deployment so, unlike most other sampling devices, it does not disturb the water column to the point where long equilibration times are necessary to ensure recovery of a representative sample.

  When the SpeedBag version of the HydraSleeve is used, it can be recovered immediately, or within a few hours with no equilibration time. In regulatory jurisdictions that impose specific requirements for equilibration times prior to recovery of no-purge sampling devices, the regulatory requirements should be followed.

Note: If using top weights, additional equilibration time is needed to allow the top weight time to compress the HydraSleeve into the bottom of the well. Allow up to 24 hours in a 2-inch well and less in a 4-inch well.

- **Situation: The HydraSleeve is being deployed for ongoing monitoring or for recovery during a future sampling event.**

  In periodic (i.e., quarterly, semi-annual, or annual) sampling programs, the sampler for the current sampling event can be recovered and a new sampler (for the next sampling event) deployed immediately thereafter, so the new sampler remains in the well until the next sampling event.

Thus, a long equilibration time is ensured and at the next sampling event the sampler can be recovered immediately. This eliminates the need for separate mobilizations to deploy and then to recover. HydraSleeves can be left in a well indefinitely and will represent the aquifer conditions at the time the sampler is pulled upward and recovered.

IV. HydraSleeve Recovery and Sample Collection

1. Slowly remove the well cap a few inches to provide access for a water level measurement.
2. Secure the tether at the top of the well while maintaining tension on the tether (but without pulling the tether upwards)
3. Measure the water level in the well.
4. Use one of the following 3 retrieval methods. In all 3 scenarios, when the HydraSleeve is full, the top check valve will close. You should begin to feel the weight of the HydraSleeve on the tether as it is raised out of the water. The closed check valve prevents loss of sample and entry of water from zones above the well screen as the HydraSleeve is recovered.

a. **Single Pull:** In one smooth motion, rapidly pull the tether up a distance of at least the length of the sampler (30"to 60") at a rate of about 1-foot per second (or faster). This is about the speed one can quickly raise a straightened arm in an arc from their side to above their head. The motion will open the top check valve and allow the HydraSleeve to fill in a distance approximately equal to the length of the HydraSleeve if the sleeve is sized to fit the well.

b. **Oscillation:** When the length of available sample interval is very close to the length of the sampler or when a smaller diameter HydraSleeve is used in a larger well it may be recommended that the HydraSleeve is oscillated in the screen zone to ensure it is full before leaving the screen area. Pull up rapidly 1-3 feet (about half the sampler length), let the sleeve assembly drop back down, and repeat 3-5 times before pulling the sleeve to the surface. The collection zone will be the oscillation zone. When in doubt use this retrieval method.

c. **Speedbag:** SpeedBags **require check valve activation and oscillation during recovery**: When retrieving the SpeedBag, pull up hard 1-2 feet (about half the length of the sampler) to open the check valve; let the assembly drop back down to the starting point; REPEAT THIS PROCESS 4 TIMES; and then quickly recover the SpeedBag through the well screen to the surface.

5. Once the sampler is out of the sample interval it is not necessary to pull rapidly. Pull the tether upward until the HydraSleeve is at the top of the well.
6. Discard the small volume of water trapped above the HydraSleeve check valve by pinching the across the top of the HydraSleeve under the stiffeners (above the check valve) and letting the water spill out.

V. Sample Discharge

Note: Sample collection should be done immediately after the HydraSleeve has been brought to the surface to preserve sample integrity.

Be sure you have discarded the water above the check valve – see step #6 above.

1. Remove the discharge tube from the packaging. *If the HydraSleeves were installed at a previous sampling event the tubes may have been stored separately until the recovery date.
2. Hold the HydraSleeve at the check valve.
3. Use the pointed end of the discharge tube to puncture the HydraSleeve at least 3-4 inches below the reinforcement strips. NOTE: For some contaminants (VOC's/sinkers) the best location for discharge is the middle to bottom of the sampler. This would be representative of the deeper portion of the well screen.
4. Discharge water from the HydraSleeve into the sample containers. Control the discharge from the HydraSleeve by either raising the bottom of the sleeve, by squeezing it like a tube of toothpaste, and/or manipulating the discharge tube.
5. Continue filling sample containers until all are full.

VI. Measurement of Field Indicator Parameters

Field indicator parameter measurement is generally done during well purging and or low-flow sampling to confirm when parameters are stable, and sampling can begin. Because no-purge sampling does not require purging, field indicator parameter measurement is not necessary for the purpose of confirming when purging is complete.

If field indicator parameter measurement is required to meet a specific non-purging regulatory requirement, it can be done by taking measurements from water within a HydraSleeve ***after the lab sample has been collected.*** Alternatively, a second HydraSleeve may be installed in conjunction with the primary sample collection HydraSleeve [see Multiple Sampler Deployment below]).

Note: A lightweight portable tripod may be helpful to hold the HydraSleeve during single-person sampling. (Contact EON)

VII. Alternate Deployment Strategies

Deployment in Wells with Limited (Short) Water Columns

For wells in which only a limited water column needs to be sampled, the HydraSleeve can be deployed with an optional top weight in addition to a bottom weight. The top weight will collapse/compress the HydraSleeve to a very short (approximately 6" to 24") length at the bottom of the well. This allows the HydraSleeve to fill in a water column that is only 3' to 10' in height, depending on the sampler size. Note: SuperSleeves can be manufactured in longer lengths to provide greater sample volume and can also be Top Weighted.

Multiple Sampler Deployment

Multiple sampler deployment in a single well screen can accomplish two purposes:

1. It can collect additional sample volume to satisfy site or laboratory-specific sample volume requirements.
2. It can be used to collect samples from multiple intervals in the screen to allow identification of possible contaminant stratification.

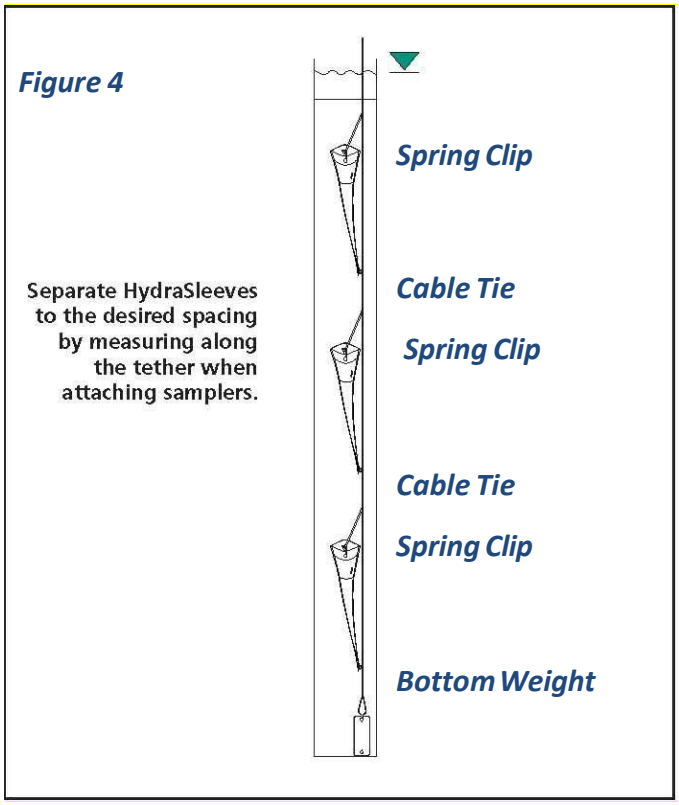


Figure 4. Multiple HydraSleeve deployment

NOTES:

- **Be sure the top HydraSleeve has a saturated screen length of at least the length of the sampler (plus at least 6 inches is preferred) above the top of the HydraSleeve initial position to ensure complete filling within the screen.**
- **Contact EON for custom suspension tethers for multiple HydraSleeves and for sampler spacing guidance.**

Optional: 2-Sampler Deployment

If there is a need for only 2 samplers, they can be installed as shown in figure 4 or as follows. The first sampler can be attached to the tether as described above, a second attached to the bottom of the first using your desired length of tether between the two and the weight attached to the bottom of the second sampler (figure 5). This method can only be used with 2 samplers; 3 or more HydraSleeves in tandem need to be attached as described in "Multi-Sampler Deployment" above.

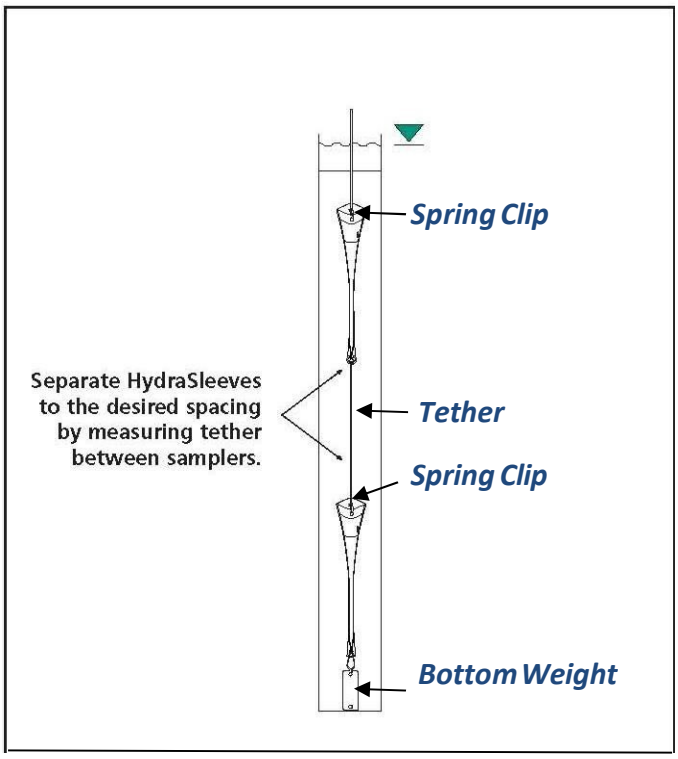


Figure 5. Alternative method for deploying two HydraSleeves.

In either case, when attaching multiple HydraSleeves in series, more weight will be required to hold the samplers in place in the well than would be required with a single sampler. Recovery of multiple samplers and collection of samples is done in the same manner as for single sampler deployments.

Optional Configurations for Bottom HydraSleeves in Multi-Sampler Installations:

In installations having multiple HydraSleeves, the bottom HydraSleeve can be attached to hang from the bottom of the suspension tether, in which case the Bottom Weight is attached to the bottom HydraSleeve. This is the preferred method, especially if the bottom HydraSleeve is compressed using a Top Weight.

Alternatively, the bottom HydraSleeve can be installed alongside the tether so that a length of tether hangs down below the bottom HydraSleeve. In this case, the Bottom Weight is attached to the bottom of the suspension tether and a Top Weight isn't recommended.

Post-Sampling Activities

The recovered HydraSleeve and the sample discharge tubing should be disposed as per the solid waste management plan for the site.

To prepare for the next sampling event, a new HydraSleeve can be deployed in the well (as described previously) and left in the well until the next sampling event, at which time it can be recovered. The weight and weight clip can be reused on this sampler after cleaning as needed per the site equipment decontamination plan.

The tether may be dedicated to the well and reused or discarded at the discretion of sampling personnel.

Questions & Assistance

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