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Wastewater Sample Collection - Moore Swab and Grab Sample Methods

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We use this protocol and it's working

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Abstract

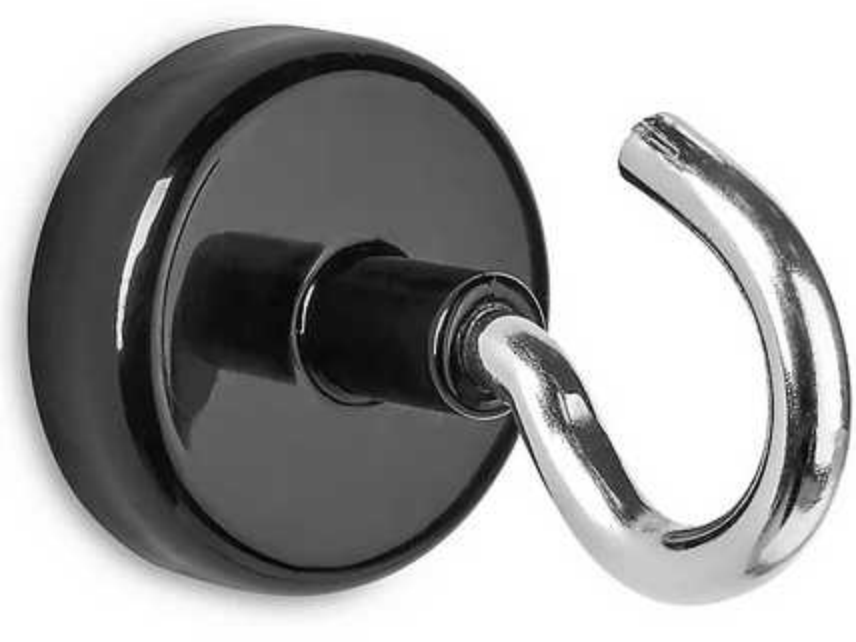
This protocol describes materials and methods that can be employed in the field to collect Moore swabs and/or grab samples for wastewater sample collection. The materials and methods described herein are meant to provide guidelines, examples, and tips for various methods of wastewater collection; however, these techniques can be adapted and modified depending on the setting and goals of the particular project or program.

This protocol makes note of composite sampling instructions but is focused on situations where installation and operation of a composite sampler is not feasible.

Materials

Moore Swab Materials:

- Fishing line (weighted for 50-lb)
- Cotton gauze
- May need additional items to secure fishing line holding the Moore swab in a manhole, such as: bendable metal (e.g., metal coat hanger), magnetic hook, and/or thin rope
- Collection bag (e.g., quart-size Ziploc bag, WhirlPak, Biohazard Specimen Transport Bag, etc.)
- Permanent marker
- Cooler
- Ice or ice pack(s)

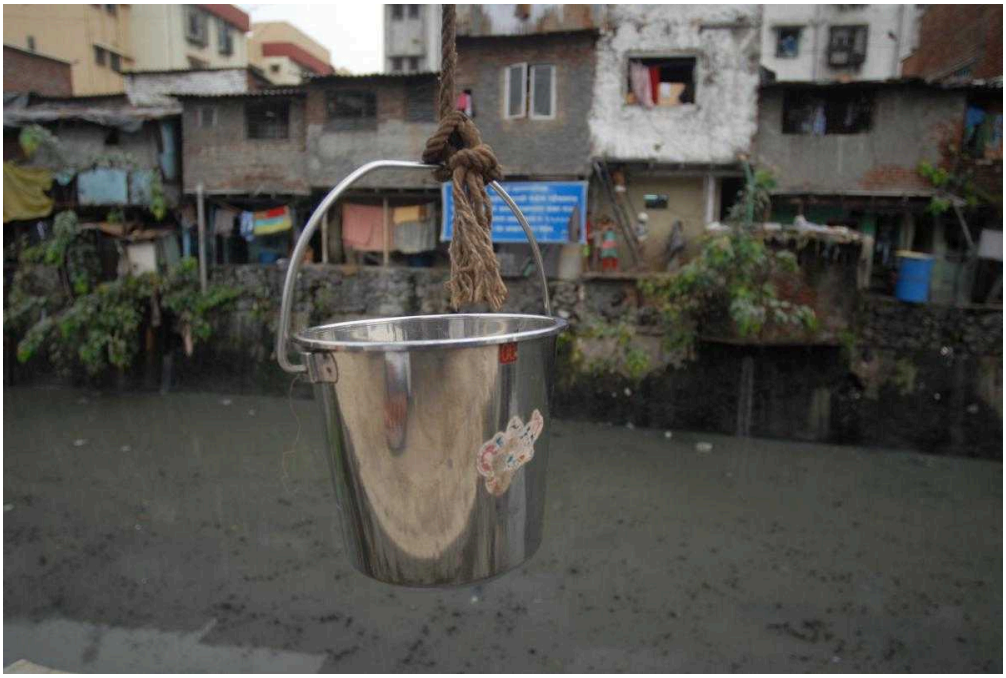


Magnetic hooks can be placed inside manholes and fishing line can be secured to the hook to hold Moore swabs in place for 24-72 hours.

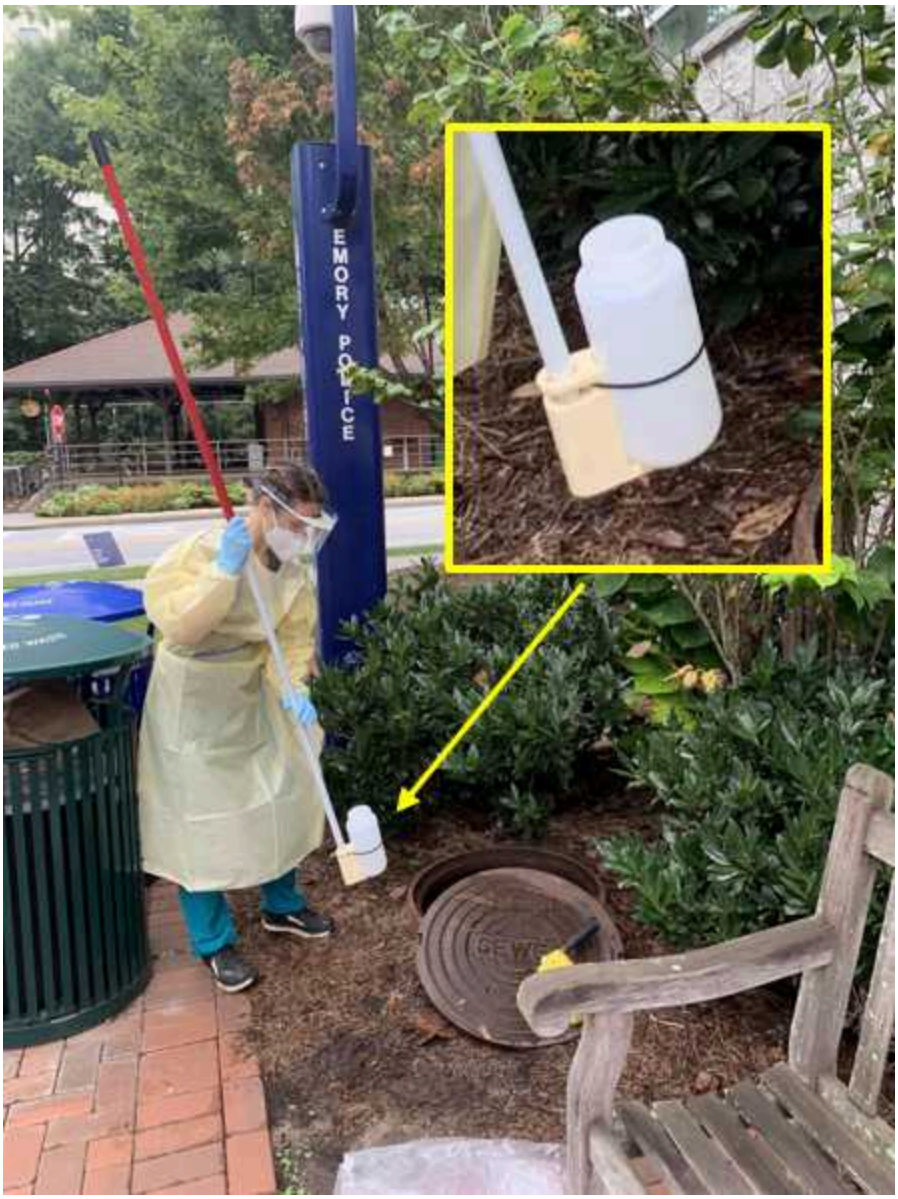
Grab Sample Materials:

- 1-liter autoclavable bottles (number will depend on the number of sites)
- Collection device
- Metal bucket (with handle) and rope
- Long-handled water sample dipper or a painter's pole rigged with a "seat" for the 1-L bottle to sit in
- Composite sampler or peristaltic pump and tubing (note: a composite sampler is expensive and is not necessary for grab sample collection, but if a team already owns this device or has access to one, it can be very useful).
- Tape (for labeling collection bottles)
- Permanent marker

- Cooler
- Ice or ice pack(s)



Metal bucket with rope tied to handle for grab sample collection (photo credit: https://pulitzercenter.org/stories/sewage-science-anatomy-grab-sample)



Painter's pole that is able to hold a 1-L bottle to collect wastewater within a sewer manhole. The enlarged photo shows a close-up image of the "seat" attachment designed to hold a 1-L collection bottle.

Personal Protective Equipment (PPE):

- Disposable gowns
- N-95 face mask
- Face shield
- Disposable gloves
- Biohazard bag (for disposable items)
- Steel-toe shoes if removing manhole covers

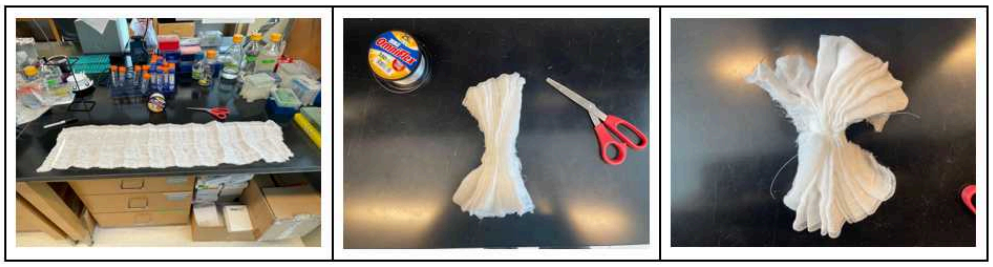
Troubleshooting

Moore Swab Assembly

1 Cut pieces of cotton gauze approximately 120 cm long by 15 cm wide.

2 Push the ends of the rectangle into an accordion shape.

3 Firmly tie the center with a segment of fishing line to form a butterfly shape.



Pictures of Steps 1 - 3 show how to assemble a Moore swab.

Moore Swab Sample Collection - Day 1

4 Remove the manhole cover using a manhole cover hook or magnetic manhole lifter.

Safety information

Manholes are very heavy and moving them may cause strain or injuries could be incurred if they are dropped. In some cases, two people may be required to safely open a manhole.

5 Tie fishing line around a clean Moore swab.

Note

Wrap the fishing line tightly around the swab several times and tie several knots to ensure the fishing line is securely fastened to the swab.

6 Lower the Moore swab into the open manhole until it is submerged in the wastewater stream.

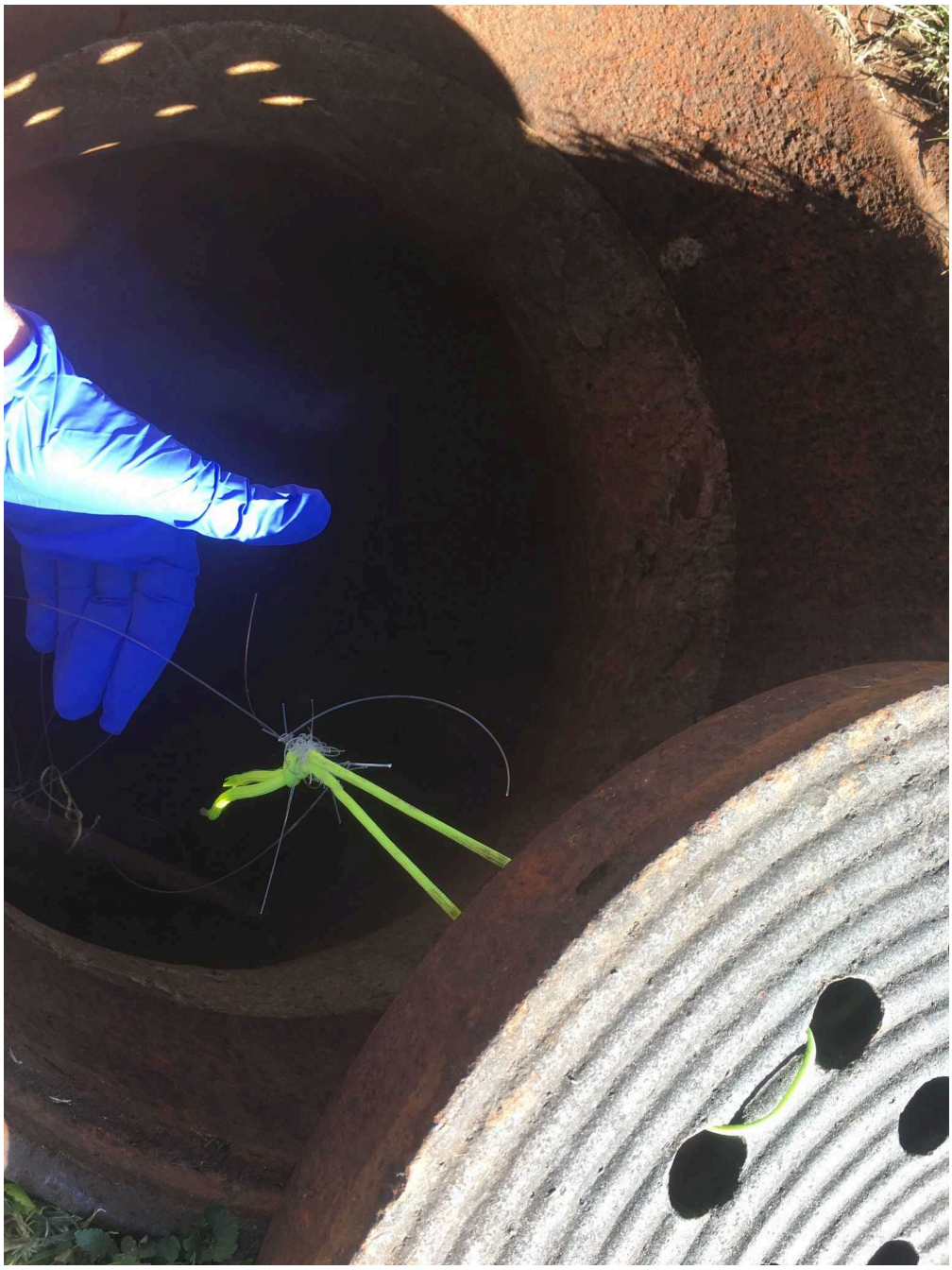
7 Secure the other end of the fishing line so that it is easy and safe to retrieve during the next visit when the swab will be collected.

Safety information

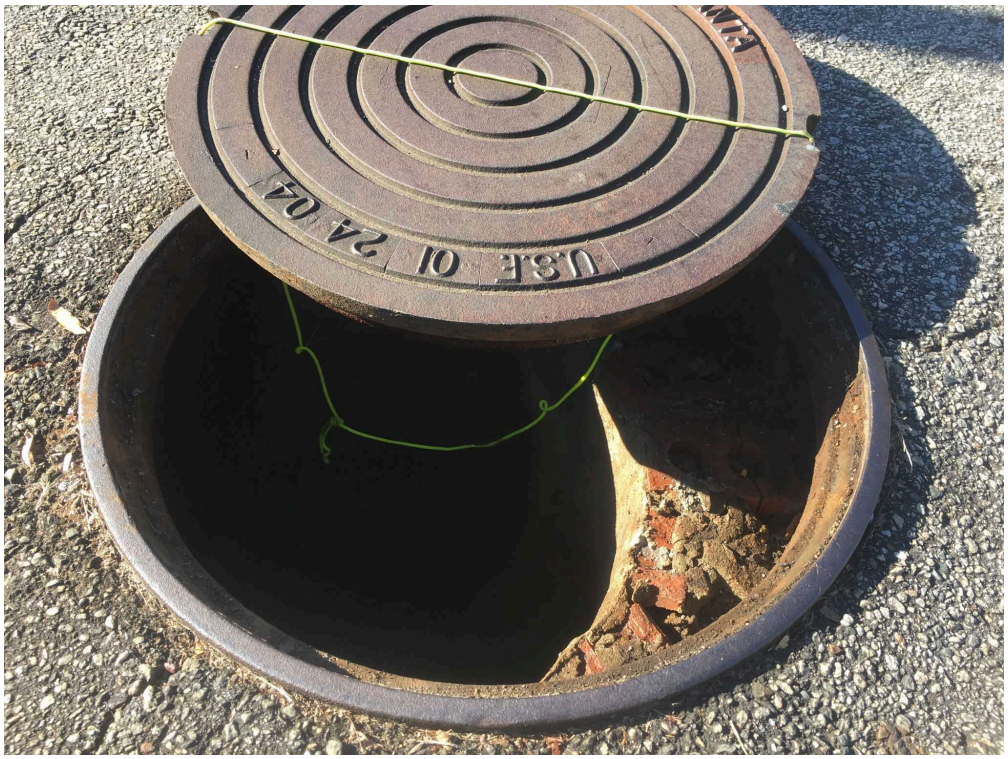
It is important that the sampler does NOT go into the manhole as this is dangerous and would require a confined space entry permit. If ladder rungs are out of reach to attach swabs, do not enter the manhole to reach them.

Note

Manholes vary in their configuration, so it is possible that the sampler will need to be resourceful and creative when determining how to secure the other end of the fishing line. A common approach is to use a magnetic hook. The magnet will adhere to the metal rim within the manhole cover and the fishing line can be tied to the hook. If the metal rim inside the manhole is too rusty for a solid magnetic connection or if the wastewater stream is too strong for the magnet to stay attached, a hook can also be fashioned from bendable wire (such as a wire coat hanger) and placed on a ladder rung within the manhole (Note: ladder rungs are not always inside the manholes, or they may be out of reach). If there is not a ladder rung, the sampler can use thin rope and secure it to the manhole (if there are holes) or around the manhole if holes are not present.



When a manhole cover has holes in it, a thin rope can be tied around the holes to form a loop, and a Moore swab can be suspended from this loop with a segment of fishing line.



When a manhole cover does not contain holes or there is nothing within the manhole to hold the Moore swab in place, a piece of thin rope can be tied around the manhole to form a loop. The Moore swab can then be suspended from this loop with a segment of fishing line.

8 Return the manhole cover to its original closed position to prevent accidents or injuries from occurring.

9 Leave the Moore swab in the wastewater stream for 24:00:00 +/- 6 hours. 1d

Note

Aim for consistency in the duration you leave the swab in the wastewater stream.

Moore Swab Sample Collection - Day 2

10 Using the permanent marker, label the collection bag with appropriate identifying information (e.g., manhole ID, address, nearby landmark, etc.) and collection date to ensure the sample is matched with the correct site and collection date.

11 Remove the manhole cover.

12 Retrieve the Moore swab by pulling up the fishing line.

Note

Oftentimes, items will be stuck to the swab, such as paper towels, baby wipes, trash, etc. This debris can usually be detached from the swab by bouncing the fishing line while it is still in the manhole.

13 Place the swab inside the labeled collection bag.

14 Cut the fishing line from the swab.

15 Seal the collection bag.

16 Place the collection bag in a cooler with ice or ice pack(s).

17 Return the manhole cover to its original closed position.

18 Store all the samples in a cooler throughout the collection day and during transport to the laboratory.

Grab Sample Collection

19 Label the collection bottle using a permanent marker and removable tape with appropriate identifying information (e.g., manhole ID, address, nearby landmark, etc.) and collection date to ensure the sample is matched with the correct site and collection date.

20 Remove the manhole cover using a manhole cover hook or magnetic manhole lifter.

21 The actual sample collection process will depend on the sampling apparatus that the group decides to use. Three different methods are provided herein for groups in different settings and with various resources: Step 22) Metal bucket and rope; Step 23) Long-handled water sample dipper; and 24) Composite sampler or peristaltic pump.

22 **Metal bucket and rope method:**

22.1 Lower the metal bucket into the manhole until it is submerged in the wastewater stream.

22.2 Slowly raise the bucket until it is out of the manhole.

22.3 Pour wastewater into a clean, autoclaved 1-L bottle.

22.4 Repeat until the 1-L bottle is full.

22.5 Wipe the inside and outside of the metal bucket with disinfectant wipes, bleach, and 70% ethanol.

22.6 Place the metal bucket in a clean bag until it is time to collect the next grab sample.

23 **Long-handled water sample dipper or a painter's pole rigged with a "seat" for the 1-L bottle to sit in:**

23.1 Place the 1-L bottle into the seat attached to the painter's pole.

23.2 Unscrew the lid of the 1-L bottle and set aside in a safe location where it will not accidentally fall into the manhole.

23.3 Holding the painter's pole securely, lower the bottle into the wastewater stream until it is full.

23.4 Slowly lift the painter's pole up out of the manhole.

23.5 Screw the lid onto the 1-L bottle until it is fully closed.

23.6 Wipe the outside of the 1-L bottle with disinfectant wipes.

23.7 Remove 1-L bottle from the seat attachment.

23.8 Disinfect the seat attached to the painter's pole with disinfectant wipes.

23.9 Tie a bag around the end of the painter's pole to prevent drippage during transport until it is time to collect the next grab sample.

24 **Composite sampler or peristaltic pump**

24.1 Secure clean tubing in the tubing housing of the composite sampler or peristaltic pump. Note: there should be one long end of tubing that will be lowered into the wastewater stream and one short end that will pump wastewater into the 1-L bottle.

24.2 Lower the long end of the tubing down into the wastewater stream.

24.3 Begin pumping the wastewater using the controls on the composite sampler or peristaltic pump.

24.4 Place the short end of the tubing in the 1-L bottle.

24.5 Pump until the 1-L bottle is full.

24.6 Turn off the pump using the controls.

24.7 Dispose of the tubing in a biohazard bag or safely seal the tubing in a bag and store until the next sample collection event at that particular site. Note: do not use the same tubing

for a different site due to cross-contamination.

25 Place the labeled 1-L bottle in a cooler with ice or ice pack(s).

26 Return the manhole cover to its original closed position.

27 Store all the samples in a cooler throughout the collection day and during transport to the laboratory.