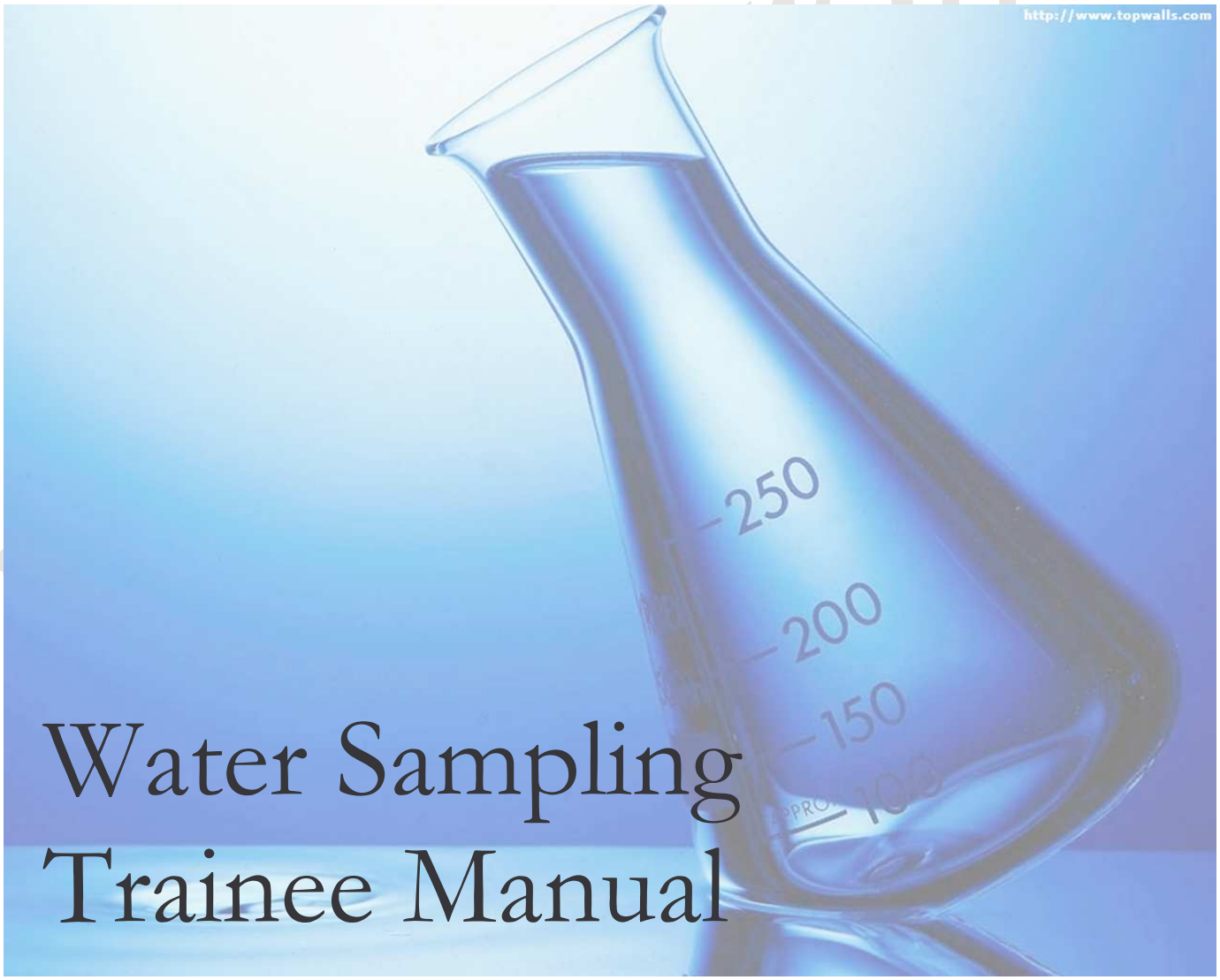
Trainee Manual

A01

CITY OF SASKATOON

Water and Sewer Section



Water Sampling Trainee Manual

CITY OF SASKATOON

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Introduction

The objective of this manual is to train staff on how to test water quality in a timely and efficient manner while, minimizing disruption in service.

Procedural Overview

Coordinate, select and acquire all required equipment and materials. All equipment will be calibrated and the results logged. Before any work begins all staff must be wearing the safety equipment required. WHMIS procedures must be followed. Perform the water quality testing in accordance with regulations. Clean hands prior to sampling and testing. Open valve slowly and completely (attain a high velocity flow). Remove aerator from tap. Disinfect tap as per the Tool Disinfection SOP. Flush watermain though hydrant or tap. Flush through hydrant or tap until turbidity ≤ 1 and total chlorine ≥ 0.7 mg/L & ≤ 1.7 mg/L. Record turbidity and chlorine levels. Record chlorine test type (Total or Free)

Take water samples for bacteriological testing with the sample jar. Identification number must be put on the sample jar Inspect the site for cleanliness before leaving the site. Complete the Standard Distribution System Flushing And Sampling form. Deliver water samples and Standard Distribution System Flushing and Sampling form to the Water Treatment Plant for analysis. The Water Treatment Plant will test the water samples for bacteria. Submit a plan of the closed valves to the Supervisor VI (Water Distribution). The bacteriological test results will be forwarded to the required agencies. The bacteriological samples will be re-tested as required. Receive and relay the bacteriological test results. Re-flush and re-sample the watermain if required. Circulate the water i.e. open the second valve. All required forms and documentation are completed and submitted; at the end of the day the work is completed.

Methods and Techniques

Flushing Through a Hydrant

Flushing a water line through a hydrant will require opening or closing valves in the system.

Notes:

Figure 1 - Valve Key

Determine the most effective procedure and direction for flushing the water line. A map of the distribution system can be used to determine which valve(s) must be operated and which hydrant will be used for flushing.

Notes:

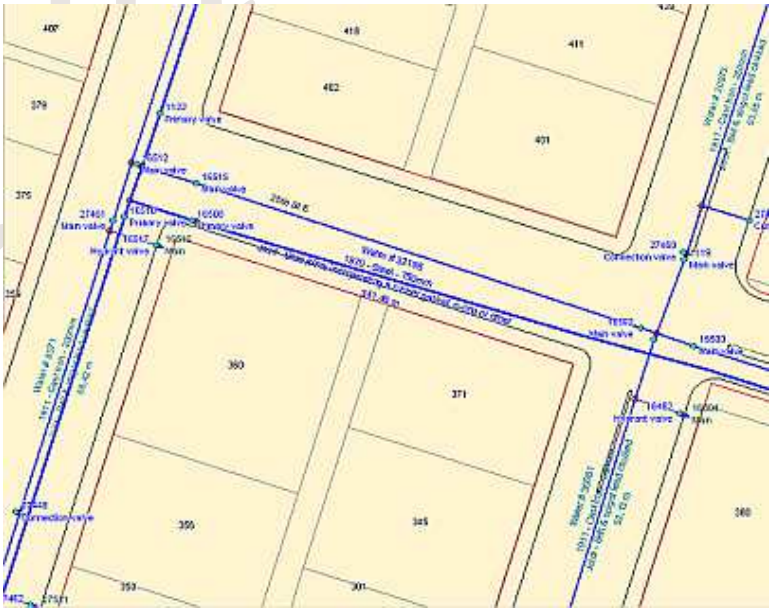

Figure 2 - Valve Map

Install a gate valve onto the hydrant nozzle.

Notes:

Figure 3 - Gate Valve Installation

Disinfect gate valve, hydrant hose coupling and hydrant nozzle using the procedure in A02 Tool Disinfection SOP.

Notes:

Figure 4 - Disinfect gate-ball valve

Install hydrant hose or diffuser onto gate valve, making sure the gate valve is open. Put the lead hose into storm manhole, sanitary manhole or catch basin. Ensure that if the sanitary sewer is used, manhole levels are monitored to prevent surcharging.

Notes:

Figure 5 - Hydrant Hose

Open the required valve and bleed the air slowly from the system. When opening the valve ensure it is opened slowly to avoid water hammer. Open the valve, which will cause water to flow past the repair point, but not re-circulate with the rest of the system.

Notes:

Figure 6 – Opening a Valve

Let the hydrant flush for 15 minutes or until water runs clear. Turn down the gate valve to a trickle and take the required chlorine, turbidity and bacteria samples.

Notes:

Figure 7 - Flushing

Flushing Through a Tap

A watermain be flushed through a private tap if a hydrant is unavailable or the private connection has been contaminated.

Notes:

Figure 8 - Running Faucet

If water samples are taken at a private tap, remove the aerator and disinfect spout as per A02 Tool Disinfection SOP.

Notes:

Figure 9 - Removing Tap Aerator

Flush through the tap for approximately 15 minutes or as required. Due to the smaller volume through a tap it may require longer flushing times. Perform water quality tests as with hydrant flushing.

Notes:

Figure 10 - Flushing Through a Tap

Turbidity Testing

With a Hach 2100P Turbidimeter, press the "i/o" button to turn the instrument on. Do not test in direct sunlight and ensure the turbidimeter is on a level surface.

Notes:

Figure 11 - Turbidimeter I/O

Insert the lowest value Gelex Secondary Standard into the cell compartment with the diamond oriented to the raised reference mark in front of the cell compartment.

Notes:

Figure 12 - Gelex Standard

Gently close the lid so that no outside light enters the compartment.

Notes:

Figure 13 - Closed Lid

Press the "read" button.

Notes:

Figure 14 - Turbidimeter Key Pad

The only items that should appear on the screen are a small light bulb icon in the bottom left corner and "- - - - ntu" in the centre of the screen.

Notes:

Figure 15 - Light Bulb

When the reading is complete, a numeric value will replace the dashes on the screen. Repeat this with the other two Gelex samples. Compare these readings with the values given. If they are significantly different, the turbidimeter should be taken for service. Record the test values on the sample form.

Notes:

Figure 16 - Turbidimeter Reading 5.10

After the Gelex standards have been confirmed, fill an empty 15 mL sample cell. Tightly cap the cell. Wipe the outside of the cell with the soft, lint free cloth to remove fingerprints and water spots.

Notes:

Figure 17 - Fill Turbidity Sample

Gently roll the sample bottle to remove any air bubbles.

Notes:

Figure 18 - Roll Sample Bottle

Apply a couple drops of the silicone oil to the outside of the sample cell. Wipe with a cloth to spread the oil over the entire exterior surface of the cell. This will help to fill in small scratches and minor imperfections in the sample cells to allow a more accurate reading.

Notes:

Figure 19 - Clean Turbidity Sample Bottle

Place the cell into the compartment in the same manner you did for the Gelex cells. If the power has shut off, press the "i/o" button to turn the unit on again.

Notes:

Figure 20 - Sample Alignment

The turbidity in a potable water sample must be below 1.0 NTU. Record the value and turn the unit off.

Notes:

Figure 21 - Turbidity Reading

If the turbidity value is over 1.0 NTU continue flushing and retest.

Notes:

Figure 22 - Turbidity Reading

Chlorine Testing

To test for chlorine, a pocket colorimeter will be used. The chlorine meters will test for free chlorine or total chlorine depending on the reagent used.

Notes:

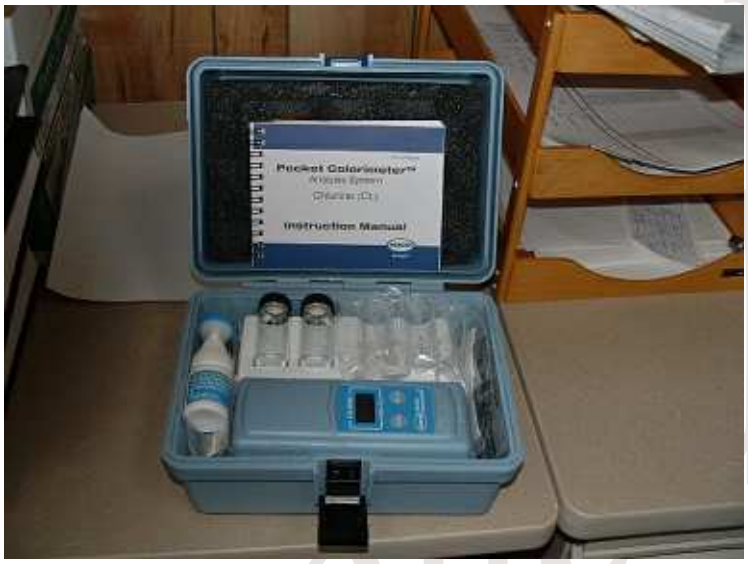

Figure 23 - Chlorine Meter

Using a Hach Pocket Colorimeter kit, fill two 10-mL bottles to the line below the white diamond with the sample water.

Notes:

Figure 24 - 10 ml Sample

If the chlorine test is being preformed following chlorination of the water main, it will need to be diluted.

Notes:

To dilute, take a 10mL sample and mix with 175mL distilled water. Cap and gently invert to mix. Fill two chlorine sample bottles with the diluted solution.

Notes:

Add the contents of one Chlorine reagent pillow pack (or one squeeze of the pop dispenser) to one of the bottles.

Notes:

Figure 25 – Reagent

The DPD reagent (is used for either) Free Chlorine or Total Chlorine. Make a note on the Standard Distribution System Flushing and Sampling Form which reagent is used.

Notes:

Figure 26 - Reagent Close up

A reagent dispenser can be used instead of the pillow pack.

Notes:

Figure 27 - Reagent Dispenser

Cap the bottle and gently roll it for 20 seconds to dissolve the DPD and release any trapped gasses.

Notes:

Figure 28 - Roll Sample Bottle

For total chlorine wait 3 to 6 minutes after addition of the reagent until reading the sample in the colorimeter. For free chlorine the sample can be read within one minute of adding the reagent.

Notes:

Figure 29 - Reagent Reaction

If chlorine levels are high the reagent will turn a brown colour.

Notes:

Figure 30 - Brown Reagent Colour

If the sample temporarily turns yellow after reagent addition and then turns clear, the chlorine levels may be very high and the sample my require dilution.

Notes:

Figure 31 - High Chlorine Sample

Cap the second sample bottle. Gently wipe both sample bottles with a lint free cloth to remove any fingerprints and water drops on the outside of the bottle.

Notes:

Figure 32 - Clean Sample Bottle

The sample bottle without reagent is the blank sample.

Notes:

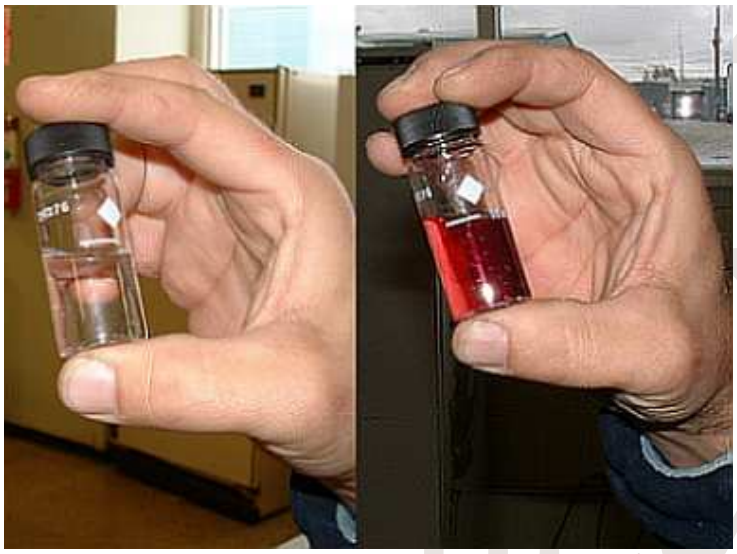

Figure 33 - Samples

Insert the blank sample into the cell holder with the white diamond facing keypad. Replace the cover to avoid letting light into the sample.

Notes:

Figure 34 - Blank Sample

Press and hold the "zero". Once the reading on the blank is complete, "0.00" will appear on the screen.

Notes:

Figure 35 - Colorimeter 0.00

Remove the blank sample and insert the test sample with the white diamond facing the keypad. Replace the cover.

Notes:

Figure 36 - Diamond Alignment

Press "read". The value on the screen is the amount of total chlorine in mg/L. If the screen flashes a "2.22", this means that the chlorine in the sample is over range (greater than 2.22 mg/L). A fresh sample will have to be taken and diluted accordingly.

Notes:

Figure 37 - Chlorine Reading

Total Chlorine limits for potable water are 0.5 to 3 mg/L. These are the upper and lower maximums, but it is preferred to have readings in the range of 0.7 mg/L to 1.7 mg/L for total chlorine.

Notes:

Figure 38 – Chlorine Meter

For Free Chlorine the lower limit is 0.1mg/L. US EPA lists the maximum residual disinfectant level for free chlorine at 4 mg/L. There is no current provincial or federal high-end limits for free chlorine. Saskatoon district health has stated in the past that due to the offensive odour and taste of free chlorine, it would be unlikely that anyone would actually drink water with very high levels present. Also, your body would reject the water.

Notes:

Figure 39 - Colorimeter

For a diluted sample the actual chlorine level will be the chlorine meter reading multiplied by 22.6. If the chlorine level is still too high dilute again.

Notes:

Figure 40 - Reading

Empty and rinse both sample bottles and return to the box.

Notes:

Figure 41 - Colorimeter Case

Should these tests fail, resume flushing and retest. If the tests still do not pass continue flushing and notify the Supervisor IV, hydrants and water quality.

Notes:

Figure 42 - Flushing

Record result on the sample form and fill out all necessary data.

Notes:

Figure 43 - Water Sample Form

Once the allowable levels of turbidity and chlorine are obtained, take the required number of bacteria test samples.

Notes:

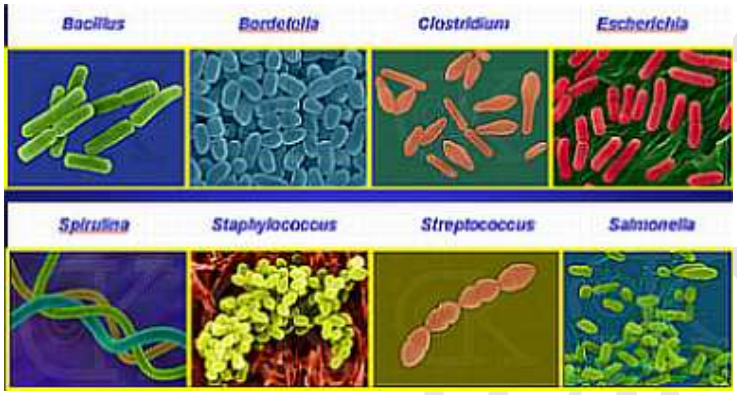

Figure 44 - Bacteria

Bacteria Test Samples

Samples are to be taken for bacterial testing. Use sealed 120 mL plastic bottles with sodium thiosulfate (an agent used to neutralize the chlorine in the water). The bacteria sample bottles cannot be reused as the sodium thiosulfate powder gets washed out.

Notes:

Figure 45 - Sample Bottle

Peel the plastic seal off from around the lid of the bottle. Do not open the bottle until immediately before use. Do not use sample bottles that are not sealed. Do not set the sample bottle lid down while taking the sample.

Notes:

Figure 46 - Plastic Seal

Turn the water stream down to allow filling the sample bottle without having any splashing occur. Let run for 30 sec. then place the bottle under the full stream of water. No water from the stream should be running down the sides of the bottle.

Notes:

Figure 47 - Filling Sample Bottle

Fill the bottle to above the 100mL line but slightly below the 120 mL marking. If sample bottle is overfilled discard. Do not touch the rim or inside of the bottle or the inside of the lid. This will contaminate the sample and it has to be discarded. Replace the lid on the bottle immediately after filling.

Notes:

Figure 48 - Bacterial Sample Bottle

Dry off the outside of the bottle and attach the sample id sticker. Record the sample ID # on the sampling form.

Notes:

Figure 49 - Bacterial Sample Label

Extreme care must be taken to ensure the sample is not contaminated by hand or air borne particles. If in doubt discard the sample and bottle.

Notes:

Figure 50 - Sneeze

For each water-sample taken for bacteriological testing, a Standard Distribution System Flushing and Sampling Form must be filled out and accompany the sample to the Water Treatment Plant. See the back of the form for instructions on how to fill it out.

Notes:

Figure 51 - Sample Form

Place samples into a cooler immediately after drawing, keeping the sample out of the light. They must be delivered with a completed sample form to the water treatment plant lab within 6 hours of collection.

Notes:

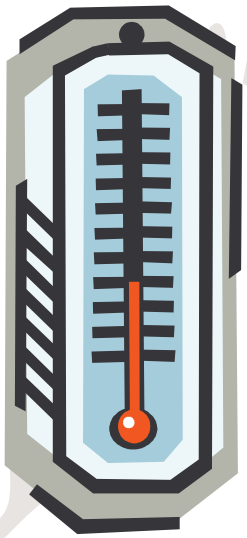

Figure 52 - Thermometer

Post Water Sampling

If the repair requires bacteriological testing it will be left isolated from the rest of the water system until bacteriological results have been received.

Notes:

Figure 53 - Valve Casing

Close hydrant and check for proper drainage. Port on hydrant should create a vacuum when hand is placed over.

Notes:

Figure 54 - Hydrant

Remove valves and hose from hydrant. Replace hydrant cap leave cap loose to let air draw into hydrant to allow for proper draining.

Notes:

Figure 55 - Hydrant Valve and Hose

Drain hydrant hose and replace manhole lid if applicable.

Notes:

Figure 56 - Hydrant Hose in Manhole

Store valves, hydrant hose, turbidity meter and chlorine meter in their respective locations.

Notes:

Figure 57 - Turbidimeter in Case

During regular work hours for the water treatment plant lab, the bacteria sample bottles and the form should be placed in the fridge designated "Public Works". Enter the plant from the doors on Avenue H. You must be "buzzed in", press the red button to the right and wait for a response from the control room.

Notes:

Figure 58 - Water Testing

Once through the double doors, turn left. The small fridge is next to the control room.

Notes:

Figure 59 - Refrigerator

Put the sample bottles in the fridge. Then take the sample form to the person working in the Control Room at the time, indicate to them that it is for a Public Works sample that was just placed in the fridge.

Notes:

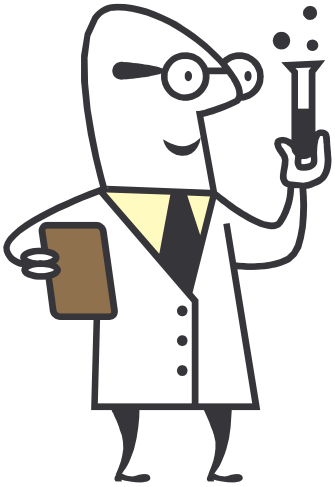

Figure 60 - Beaker

The control room personnel must be notified that a sample has just been left so that they can contact lab personnel to set up the tests in the appropriate time.

Notes:

Figure 61 - Lab Technician

The water distribution Supervisor IV or VI will receive the results from the bacteriological testing via. FAX.

Figure 62 - FAX

The water distribution Supervisor IV or VI will arrange for the opening of the remaining closed valves when the bacteriological tests pass.

Notes:

Figure 63 - Valve Key

If the bacteriological test fails the Supervisor IV or VI will arrange for re-flushing and re-sampling of the affected area, and repeat the process until all tests pass.

Notes:

Figure 64 - Water Sample Bottle

Resources Required

People

1 – Supervisor IV (Maintenance)

1 – Labourer

1- Supervisor IV (Water Distribution)

1 – Supervisor VI (Water Distribution)

1- Environmental Compliance Laboratory

Equipment

Figure 65 - Chlorine Tester

Notes:

Figure 66 - Turbidity Meter

Notes:

Figure 67 - Hydrant Hose
Notes:

Figure 68 - Throttle Valve
Notes:

Figure 69 - Hydrant Key
Notes:

Figure 70 - Valve Key
Notes:

Material

Figure 71 - Water Sample Bottle

Notes:

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