

# Mitigating Basement Backups

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Avon Lake  
Regional Water

*This document was originally created by staff from the City of Westlake, and they offered to share it with other jurisdictions. Avon Lake Regional Water has modified the original document to better fit the needs of the residents of Avon Lake. Mitigating wet basements is a mutual undertaking between Avon Lake Regional Water, the City of Avon Lake, and the citizens. We hope this document helps you understand more about the causes of basement flooding and what you can do to help minimize its chances.*

## WHY IS THERE WATER IN MY BASEMENT?

There are two major sources of water in a basement as the result of a heavy rainfall.

1. Sanitary Sewer Back-up
2. Storm Water Infiltration

In order to safeguard your home against flooding you should understand the basic plumbing of your home and the preventative techniques discussed in this document. Basement flooding can result in serious property damage. Be mindful of health and safety when cleaning up a flooded basement. Floodwater may carry waterborne diseases, corrosive agents, irritants, and sharp objects. Electrical accidents are possible because of contact between appliances and water. Dress appropriately: wear overalls, gloves, protective eyewear, protective boots and a mask. Open windows and stay away from electrical equipment and outlets or shut off the electrical power.

## AVON LAKE'S SEWER SYSTEMS

Avon Lake has two separate sewer systems. The sanitary sewer system is maintained by Avon Lake Regional Water and carries wastewater from homes, commercial buildings, and industry to the wastewater treatment plant. After treatment, the water is returned to Lake Erie. The storm sewer is maintained by Avon Lake's Service Department and carries rainfall and other surface run-off from parking lots, roads, and private properties directly to retention ponds, creeks, and the Lake. This water is not treated before it enters these water bodies.

In certain sections of the City, there is a combined sewer system that collects both sanitary sewage and storm water. Under normal conditions, all water that passes through the combined sewer system travels to the wastewater treatment plant for treatment. When flows in the combined sewer are too large, flow of stormwater and untreated sewage is then diverted directly to Lake Erie. Avon Lake Regional Water has been working since 2003 to separate storm and sanitary sewers and has separated 13 of Avon Lake's 17 combined sewers as of 2011. The remaining 4 will be addressed by 2020.

## PROPER HOUSE PLUMBING

The following items should be connected to the storm sewer:

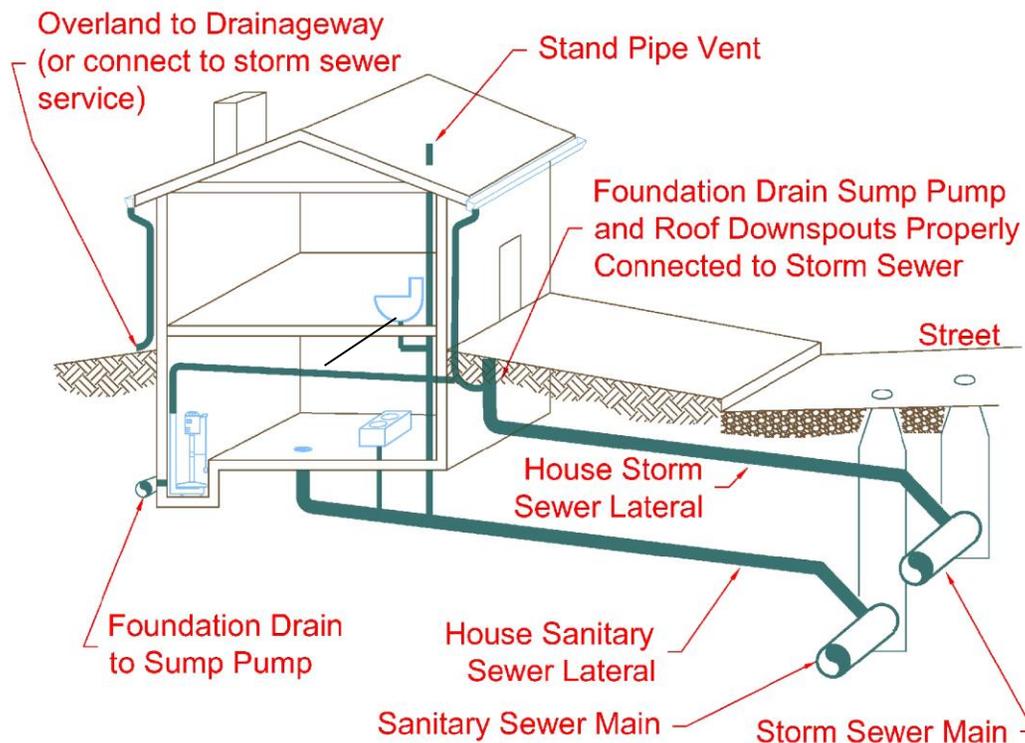
1. Foundation/footer/footing drain – Perforated pipe along the foundation designed to keep water out of the basement
2. Sump Pump – The footer drain of some homes is connected to the sump pump, which pumps water from the foundation to the higher elevation of the storm connection to provide drainage for the basement.
3. Downspout Leader – A shallow pipe that is plumbed around the exterior of the house, in which all the downspouts are connected to as well as the sump pump.
4. Storm Connection – The pipe that is plumbed from the house to the storm main that collects the downspout leader and miscellaneous yard drains.

The following items should be connected to the sanitary sewer:

1. Sinks

2. Washing Machine
3. Showers
4. Toilets
5. Floor drains in basement and/or garage
6. Grinder Pumps – Wastewater facilities in the basement that are pumped up to a shallow sanitary sewer.

The following diagram shows typical exterior house plumbing for a house with a sump pump. Houses without sump pumps on gravity connections are similar but have a deeper storm lateral which can drain the foundation by gravity. See the detail in the Appendix as well, which shows the downspout leader in detail.

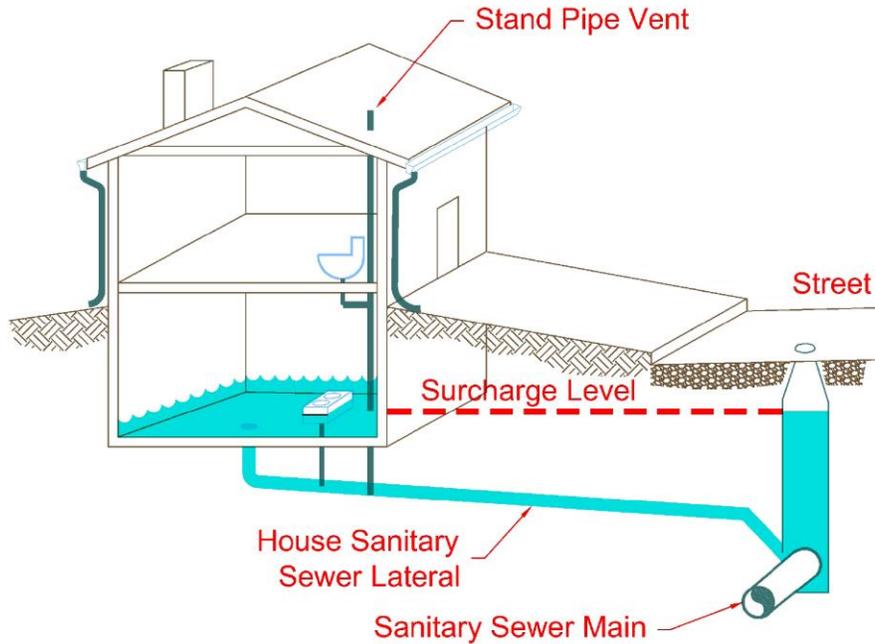


## SANITARY SEWER BACK-UP

### A. What Causes Sanitary Sewer Back-up?

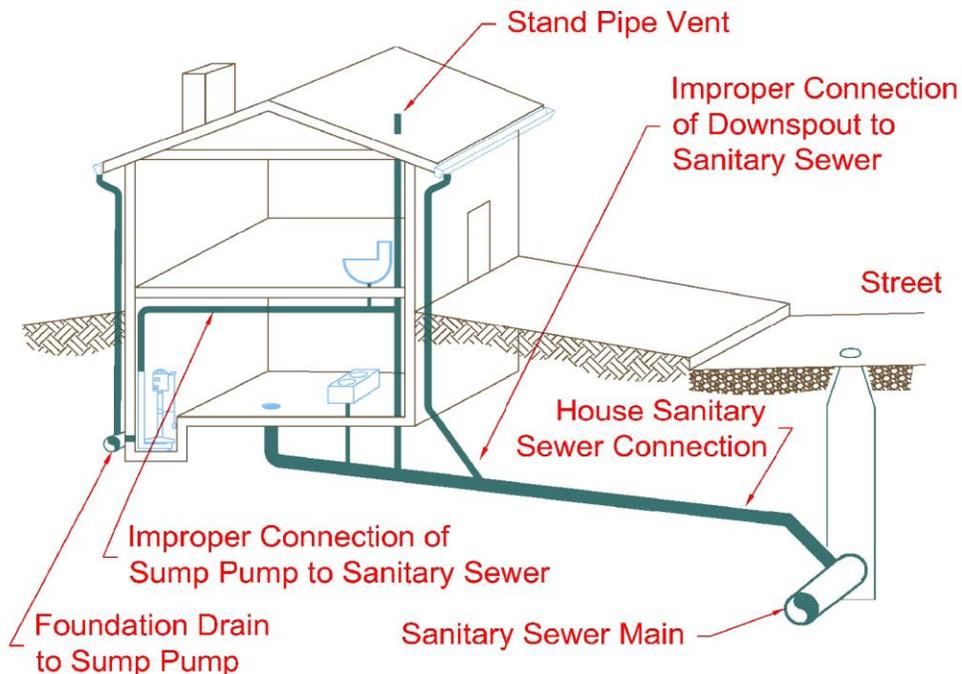
The storm sewer system has a much higher capacity than the sanitary sewer system in order to handle the large volumes of water that can be produced by major storms. Problems arise when water that should be directed to the storm sewer makes its way into the sanitary sewer. If too much storm water enters the sanitary system, the sanitary sewer may back up (surcharge) and overflow into basements. When this occurs, residences at lower elevations are most at risk of experiencing sewer backup.

When the sanitary sewer is surcharged, water backs up through the sanitary connection and flows out of the floor drain within the basement or other sanitary facilities. The depth of water in the basement will equal the height of the surcharge within the sanitary main. See diagram below (storm sewer not shown for simplicity):



**B. Sources of Storm Water in Sanitary Main**

1. **Cross Connection** – Is a connection that permits extraneous storm-related water (water from sources other than sanitary fixtures) to enter the sanitary sewer system. Extraneous storm-related water is water that should either be going to the storm sewer or allowed to soak into the ground without entering the sanitary sewer. Some examples of this are when the following are connected to the sanitary connection: downspouts, sump pumps, footer drains, window well drains, and driveway drains. The diagram below shows some examples (storm sewer not shown for simplicity):

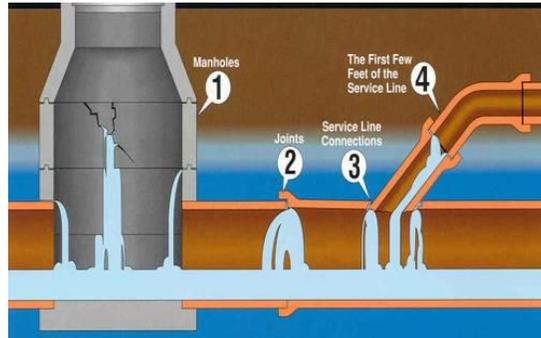


Removal of cross connections will significantly reduce the flow of extraneous storm-related water to the sanitary sewer system. As a result, the possibilities of basement flooding due to surcharged sanitary sewers are reduced and the costs for treating this excess water are eliminated.

2. **Inflow and Infiltration**- Are caused by extraneous storm-related water migrating into the sanitary connections or mains through open joints and or cracks within the pipes.



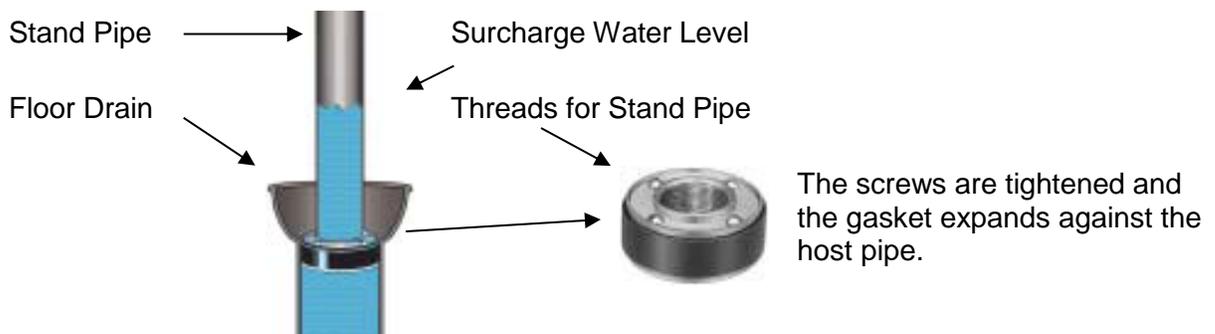
Sanitary connection with infiltration



### C. Protecting a House from Sanitary Sewer Back-up

There are three techniques used in protecting the home. The first is to allow the water to back-up through the connection and contain the water as it seeks the surcharge elevation without covering the entire basement floor. A standpipe accomplishes this task. The key to this protection is elevation, not volume. It is not necessary to have the volume of water flooded in the basement equal the contained volume. The second approach is to block the path of water at the sanitary connection with a backwater valve installed either in the front yard or on the branches of the plumbing in the basement floor. The third method is to disconnect the basement from gravity drainage to the sanitary sewer, instead opting for pumping over a high point and then into the sewer.

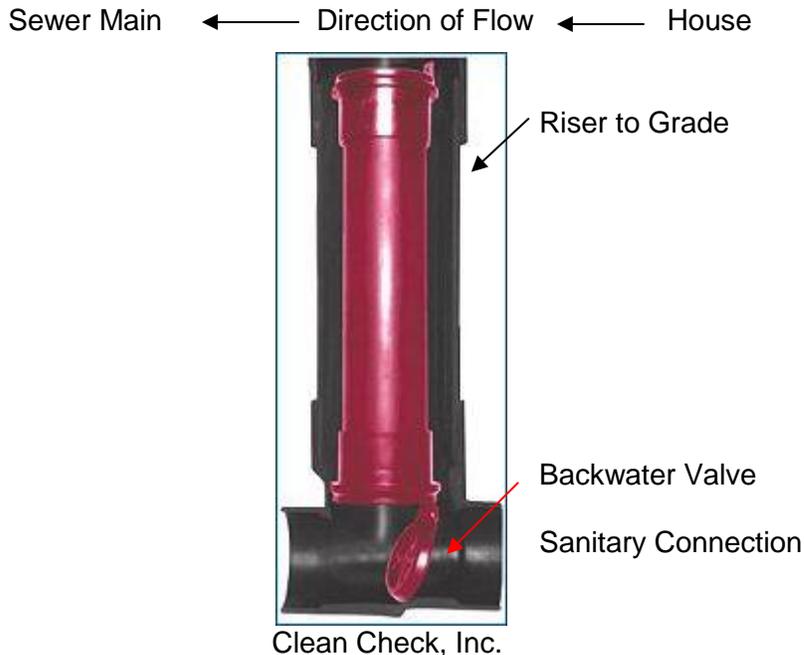
1. **Standpipe** – Standpipes are lengths of pipe open at the top and screwed into an expandable rubber gasketed escutcheon within the floor drain. The height of the standpipe should be higher than the deepest flooding elevation experienced within the basement. The standpipe will hold the sanitary surcharge until it recedes. Standpipes are generally inexpensive, easy to install and help relieve pressure caused by backups. Also, the protruding pipes may be a trip hazard and basement floor drains cannot be used until standpipes are removed. Special fittings may need to be used to connect a condensate drain to a standpipe. (See the Flood Guard® brand example below.)



2. **Backwater Valve** – A backwater valve is a device that prevents sewage from backing up into your basement. A valve will automatically prevent water from the sanitary sewer from coming back into your home's plumbing system. A properly installed backwater valve must be placed so that sewage backup will be stopped and not come out through plumbing fixtures or the floor drain in your

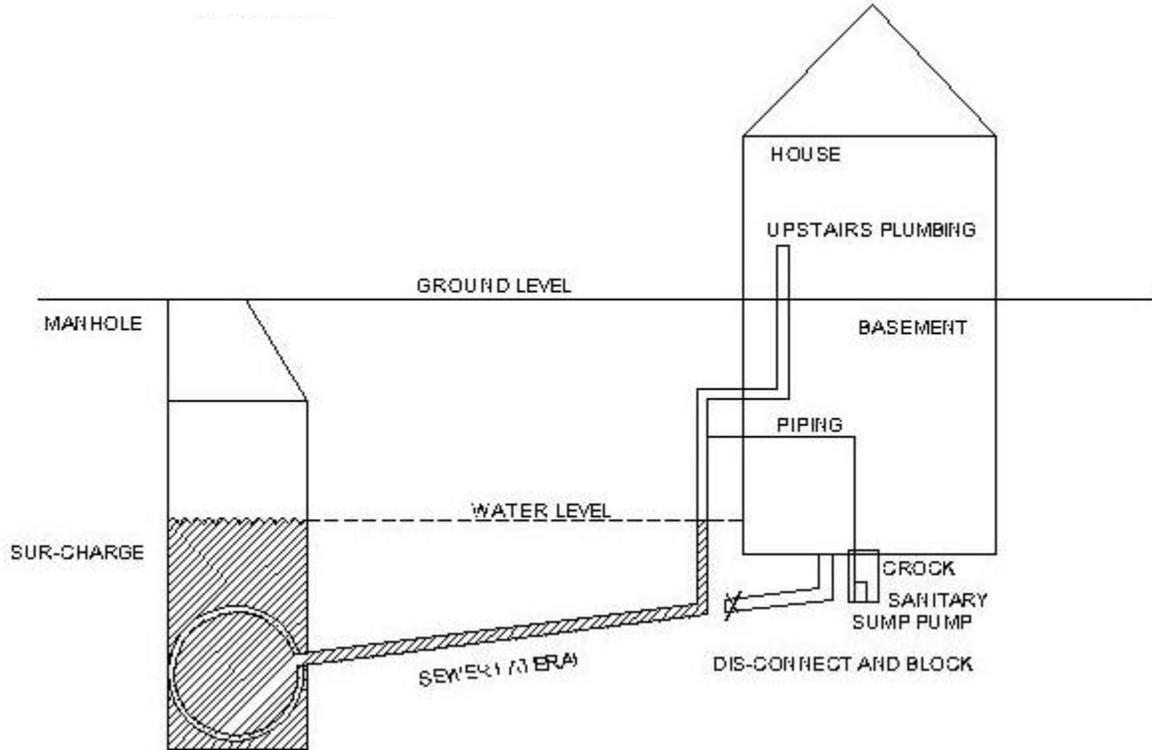
basement. A licensed plumber can look at your system and recommend the appropriate installation. As examples, two such valves are the Clean Check Expandable Back Water Valve<sup>®</sup> and the Canplas Extendable Adapt-A-Valve Backwater Valve<sup>®</sup>. If you are going to install a backwater valve, a licensed plumbing contractor must install it properly and an Avon Lake plumbing permit is required. **These valves also require periodic inspection and maintenance to remove debris and reduce the risk of failure. Valves installed in sewer lines sometimes become clogged with debris and fail to close completely. When this happens, the valve will slow down the flow of sewage but will not stop it completely.** Ask a licensed plumbing contractor how to properly inspect and maintain the backwater valve that is installed for your home.

It is important to note that a backwater valve is designed to be closed during sewer surcharge conditions to keep water from the sanitary sewer system from flowing into your home. When the backwater valve closes due to a backup, water from the inside of your home cannot drain out. **Therefore, when there is a risk of sewer surcharge, such as during a heavy rain storm, you should avoid using the toilet, sink, shower, washer, dishwasher or any other appliance that releases water to the sanitary sewer system.** The water will not be able to get past your backflow prevention device(s) and will have nowhere to go except back into your home. This is referred to as “self-flooding” as the basement will be flooded with wastewater that originated within your home.



3. **Disconnect Basement from Gravity Drainage** – Wastewater drainage from most basements is by gravity to the sanitary sewer. From an economic and maintenance standpoint, this is a preferred alternative. However, if the level of the sanitary sewer is not much below the basement elevation and the other two methods above (standpipe or backwater valve) are not used, the water can easily enter the basement through floor drains and plumbing fixtures when there is a surcharge in the sanitary sewer. However, this can be prevented by creating a high point between the basement and the sanitary sewer. The figure below shows how disconnecting gravity drainage from a basement places the equivalent of a standpipe in the discharge from the house. A check valve is placed in the discharge line of the sanitary sump pump, which significantly reduces the chances for water to back up over the high point and make its way into the basement through the sump crock. This method is most likely to assure that water from the sanitary sewer does not back up into the basement and is the preferred method for use in areas prone to sewer surcharges. However, there are certain considerations that must be made. First, like with a groundwater sump pump, a backup pump should be installed to minimize the chances for pump failure causing a flooded basement. Second, by

installing a sump pump, the owner is relying on power to push the wastewater out of the basement. If there is no power, the pump will not work. Third, the pump will require regular inspection to assure it is working. It is important to note that the sewage pump would only be removing sewage from the basement. All wastewater from above grade (e.g., the first and second floors) would flow by gravity into the sanitary sewer. During surcharge events, all wastewater would still flow away from the house if this method is employed.



If stormwater from your property still enters the sanitary sewer system, you are increasing the risk that your property and the properties around you may flood. If you redirect drainage from your property to the storm sewer system, you will reduce the risk of flooding for yourself and for your neighbors.

## STORM WATER INFILTRATION

Basement flooding as a result of storm water occurs from four situations.

1. Excessive Water at Foundation/Slab
2. Compromised Waterproofing/Backfill
3. Compromised Storm Connection
4. Stormwater Migration Through the Sanitary Trench to the Sump Pump

### 1. Excessive Water at Foundation/Slab

When this situation exists the footer drain becomes overwhelmed and water eventually migrates into the basement because water is not being drawn away from the house. The following are the main reasons for this event

A. **Compromised Footer Drain** – If the footer drain is blocked or the perforations or open joints become full of silt, water is not drawn away from the house. The solution to this would be to clean the pipe or replace it.

**B. Sump Pump Failure** – If the footer drain is connected to the sump pump, which is not operating due to mechanical failure or power outage, the house could flood since the footer drain becomes overwhelmed. Also, the sump pump may not be large enough to pump the required capacity based on the size of the home.

In most applications Avon Lake and ALMU recommend a back-up sump pump to protect against power failure, primary pump failure, or to prevent the primary pump from being overwhelmed by a heavy storm. Two types of back-up sump pumps may be used in Avon Lake: (1) Standard Electric Pumps, which have a high capacity, and (2) Battery Back-up Pumps, which operate on a rechargeable battery. Note: water-powered sump pumps are not permitted by ALMU due to possible back-siphonage and water system contamination.

The back-up pump, regardless of type, should be plumbed to discharge to the yard. By doing so, the secondary pump will work more efficiently in case the lateral is full or blocked. This also allows homeowners to see that the secondary pump is running which shows that the primary pump may have failed or there is a problem with the storm lateral or discharge line. Make sure to pipe discharge away from the house foundation. See photo below:



Two discharge lines in crock



Discharge line plumbed to yard

Some homes may be too large for a single pump and require a second electric sump pump. If this is recommended at your house then this pump shall be installed at a higher float elevation and discharged to grade as well.

**C. Gravity Tie** – This exists at a house which has no sump pump and the footer drain is connected to the storm connection by gravity. During a large rain event the storm main or creek could surcharge and cause water to back up through the storm connection and overwhelm the footer drain, which could cause water to flood into the basement. The solution to this plumbing scenario is to install an exterior sump pump and break the gravity connection. This will prevent the water from backing up to the foundation drain and/or floor drain.

**D. Compromised Downspout Leader** – If the downspout leader is blocked, crushed, and/or broken water will leave the pipe and travel through the house backfill and could overwhelm the footer drain and/or sump pump. This problem can occur even if the downspouts are connected, because water could back-up through the storm connection if the storm main is surcharged, which may cause the downspout leader to be pressurized. Then water will leave the compromised downspout and be introduced along the foundation.

The solution to this is to televise the suspected pipe and locate the compromised section for repair.



Dyed water from a compromised downspout leader flowing back into sump pump crock

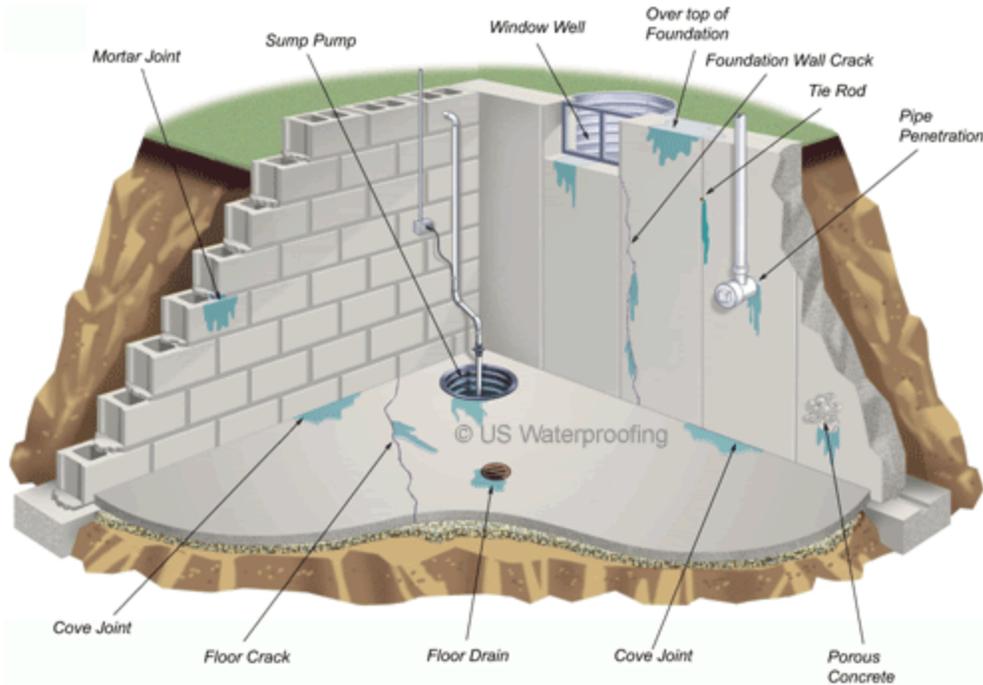
E. **Poor Grade around Foundation and House Exposure** – New home construction may have the foundation backfilled with stone to within 12” of grade. During summer months the soil on the surface shrinks and creates a void along the foundation, which exposes the porous stone backfill. During a large rain event water bypasses the gutter and falls along the foundation. Also, large homes have a large exposure to the rain that will direct a large volume of water to the foundation from the face of the house. If the porous backfill is exposed the footer drain could be overwhelmed from all this additional water. This may occur to older homes as well, depending on the type of backfill. Some downspouts are splash blocked, which could cause additional water to drain into the backfill of the house if water is not directed far enough from the foundation. Poor grade around the house could promote surface runoff to drain towards the foundation as well.

The solution to this problem is to have positive drainage away from the house. To protect the porous backfill, use non-shrinking soils in the landscaping beds along the house. Flashing could be placed at the base of the house to seal the voids created by the shrinking soils. See detail in appendix.



## 2. Compromised Waterproofing

Along the exterior of the basement wall a protective coating is placed on the wall to prevent water from migrating through the wall and into the basement. As a house ages this coating may be compromised and require replacement. Water seepage into the basement may be the result of this. See diagram of various paths of seepage.

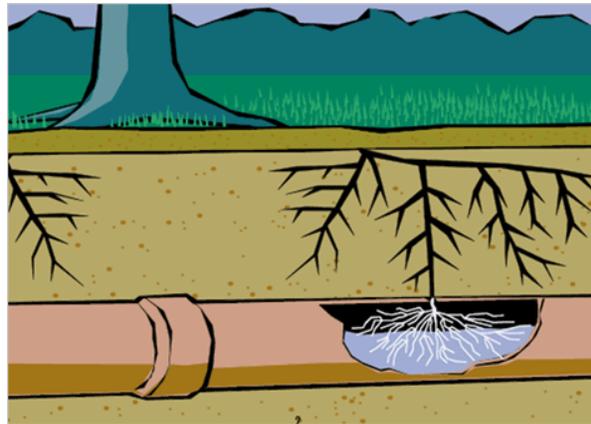


Detail provided by U.S. Waterproofing

### 3. Compromised Storm Connection

If the storm connection is blocked and/or crushed, storm water can't be drained away from the property, the foundation drain will eventually become overwhelmed, and the basement will flood.

Large trees on a property can contribute to this problem by having their roots migrate into the pipe which creates a blockage. Once roots find this source of moisture, they continue to grow; and the blockage becomes more secure.



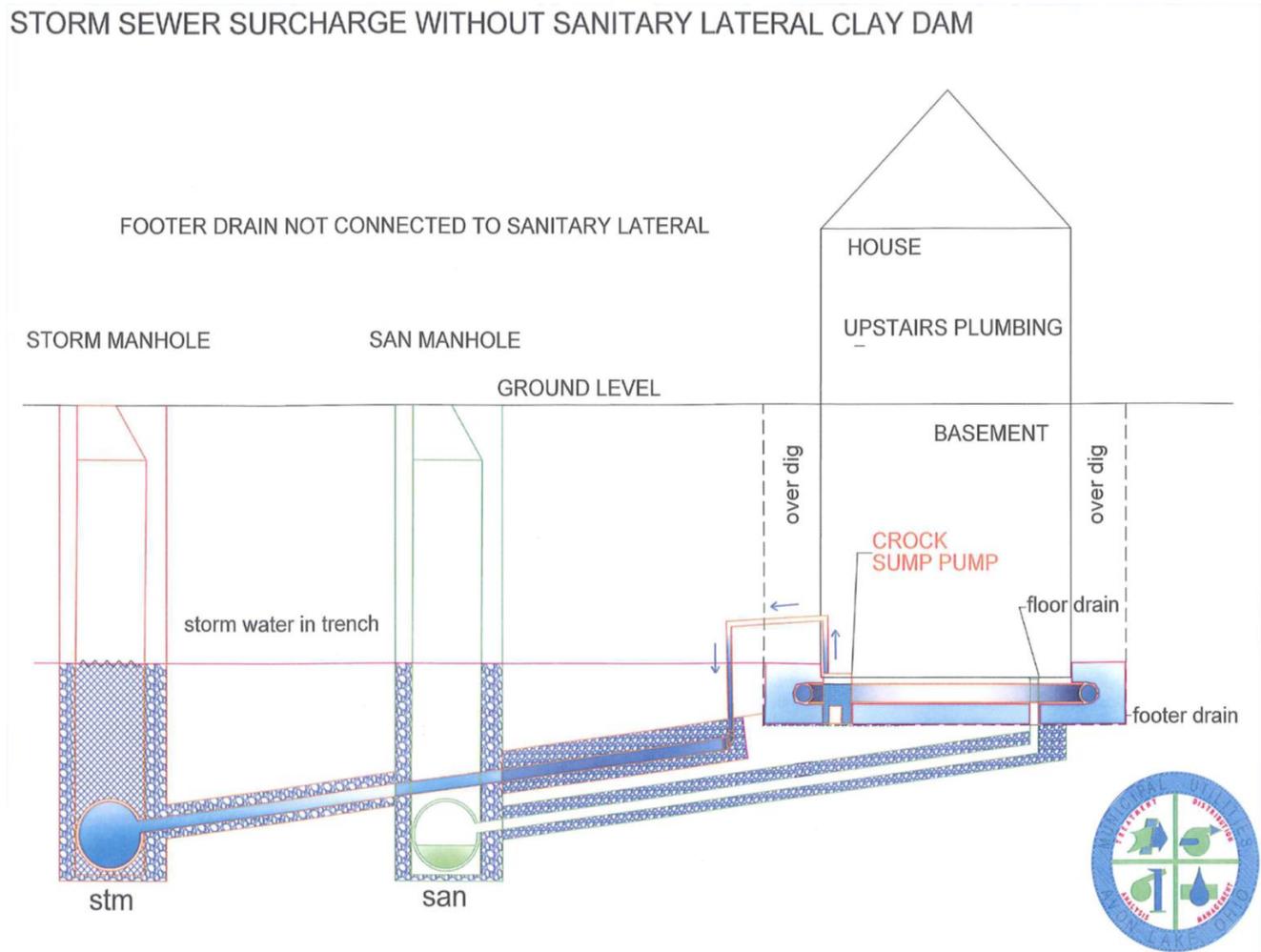
The solution to this problem is to have the connection cleaned and/or televised with a sewer camera. If cleaning does not remove the blockage, a point repair must be performed. Older homes with clay pipe have this problem due to poor joints between the pipes. The following could prevent a blockage:

A. **Sewer Cleaning** – In many cases, periodic cleaning is all that is needed to control root growth and reduce the likelihood of blockage.

B. **Copper Sulfate Treatment** – Many homeowners have had good results by flushing a small quantity of copper sulfate crystals down the sewer at regular intervals. The copper sulfate reduces the rate of growth without harming the trees. Although this treatment may not eliminate root growth, it often increases the interval between cleanings.

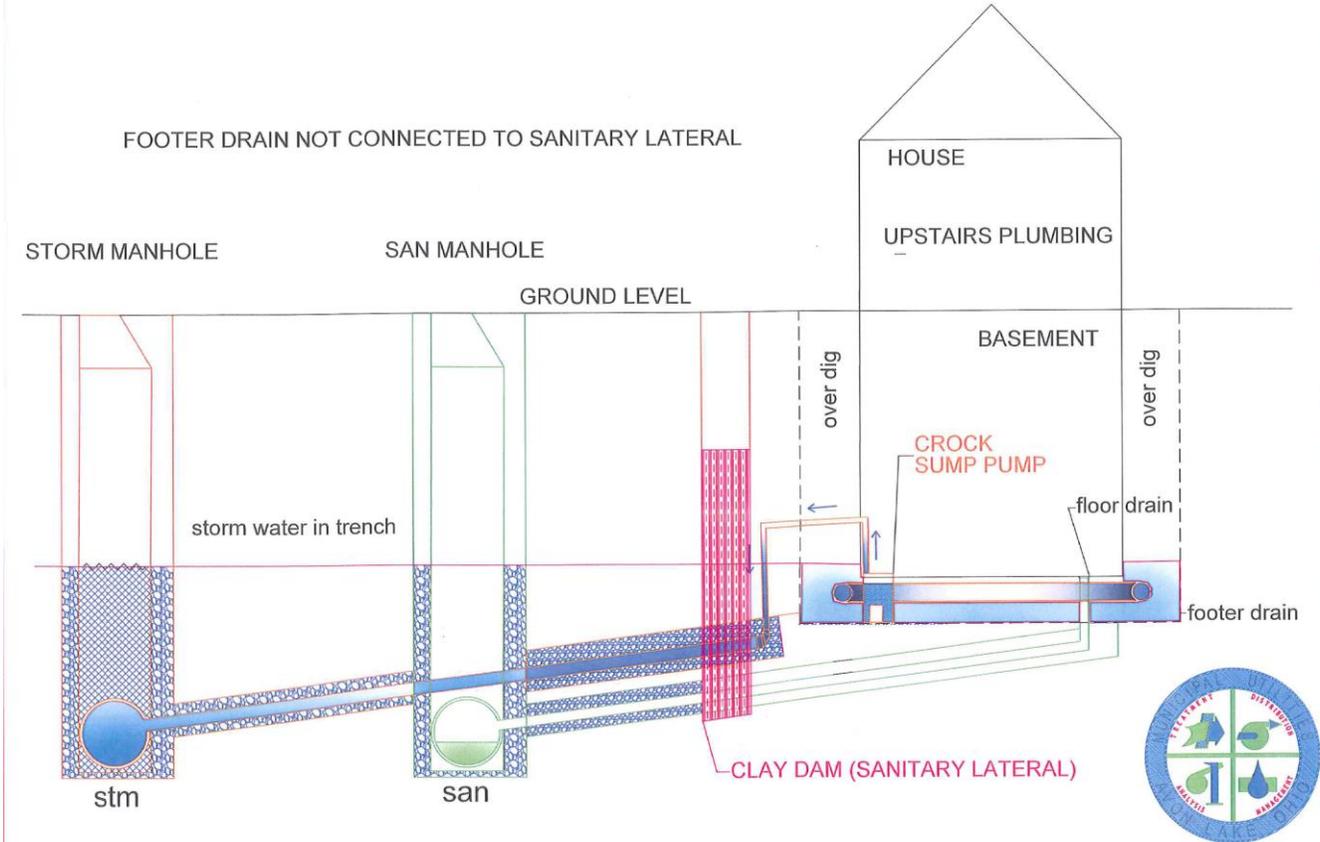
#### 4. Stormwater Migration Through the Sanitary Trench to the Sump Pump

Sewers are bedded in granular material such as crushed stone to improve performance and longevity of the sewers. One consequence of this is that the bedding material acts as a French drain and allows groundwater to travel along the bedding. As the groundwater travels along the bedding, depending upon the pressure, the water can travel back up the bedding of the sanitary lateral and migrate into the footer drains. From the footer drains, the groundwater is routed to the sump pump and can overwhelm the pump. The detail below illustrates this.



The problems associated with storm/groundwater traveling through the sanitary trench have been known for quite some time. As a method to address this, regulations began requiring a clay dam be installed in the sanitary lateral for new construction starting about 20 years ago (see detail below). Homes older than about 20 years may not have a clay dam on the sanitary lateral and could be experiencing excessive stormwater around the foundation for this reason. Homeowners can contact either ALMU (440-933-6226) or the Avon Lake Engineering Department (440-930-4101) to determine whether the sanitary trench includes a clay dam.

### STORM SEWER SURCHARGE WITH SANITARY LATERAL CLAY DAM



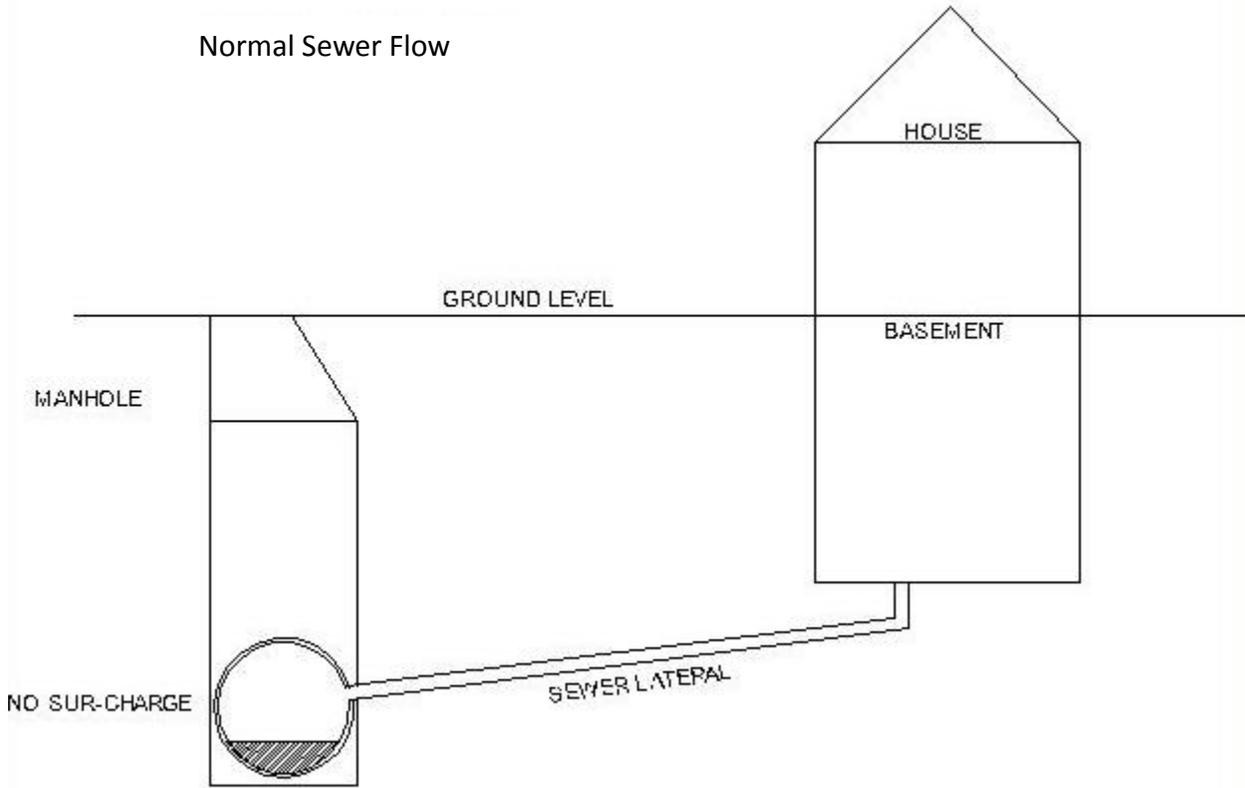
### CONCLUSION

This brochure was intended to provide a basic understanding of how basement flooding can occur and the possible solutions to prevent it. Because every home is different, it would not be practical to discuss all the various types of scenarios in depth. If you are a customer of Avon Lake Regional Water and are considering implementing any of these options to reduce chances of basement backups, please feel free to contact us at 440-933-6226 to discuss alternatives and what option(s) may best work for you.

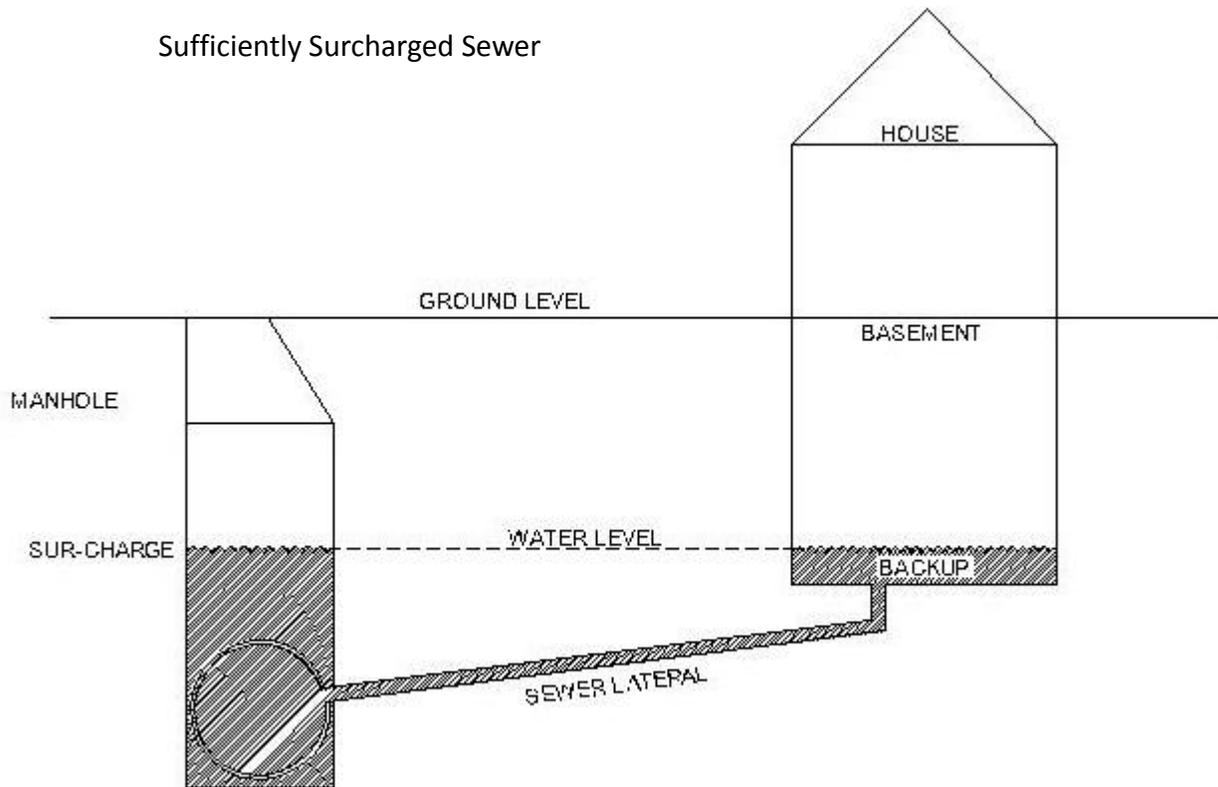
### APPENDIX

- Normal & Surcharged Sewer, with Standpipe and Disconnect Options
- Interior Sump Pump Detail with Gravity Tie Disconnect
- Exterior Sump Pump Detail with Gravity Tie Disconnect
- Exterior House Plumbing
- Clean Check Backwater Valve
- Canplas Backwater Valve
- Backwater Installation Valve Detail
- Foundation Detail with Flashing

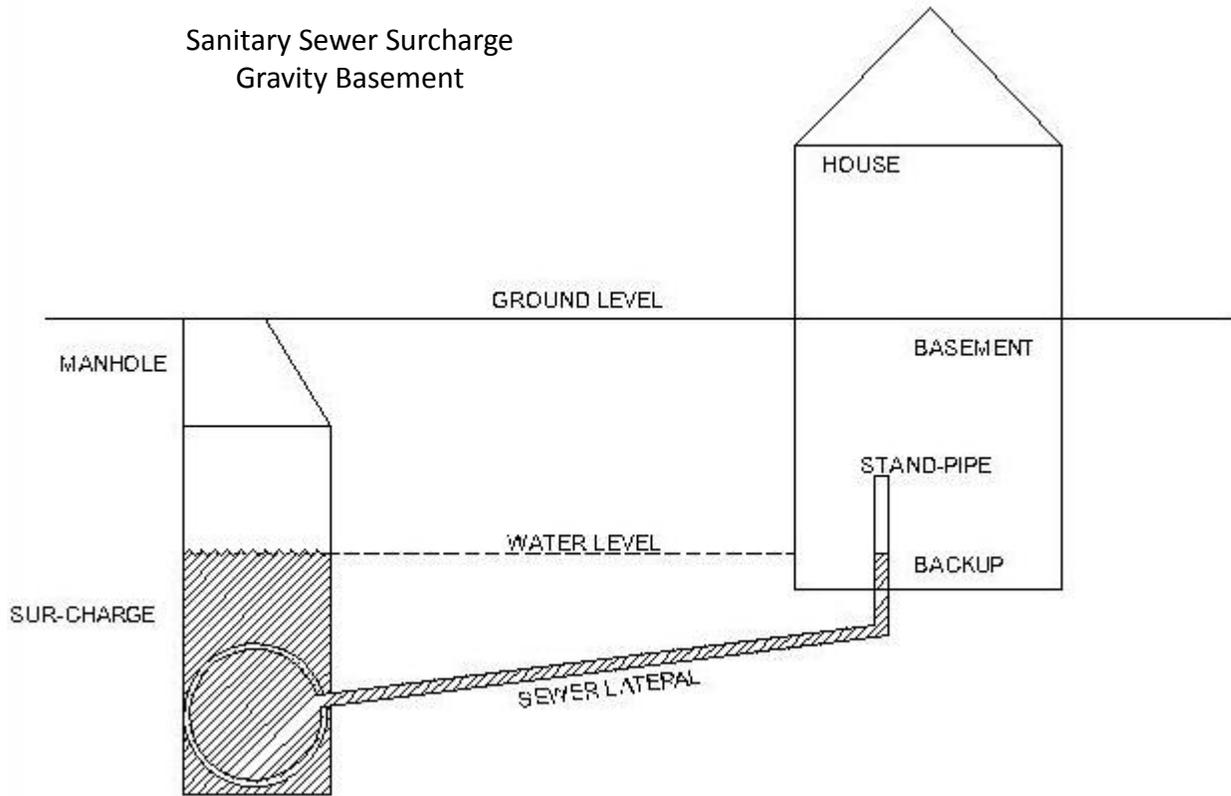
Normal Sewer Flow



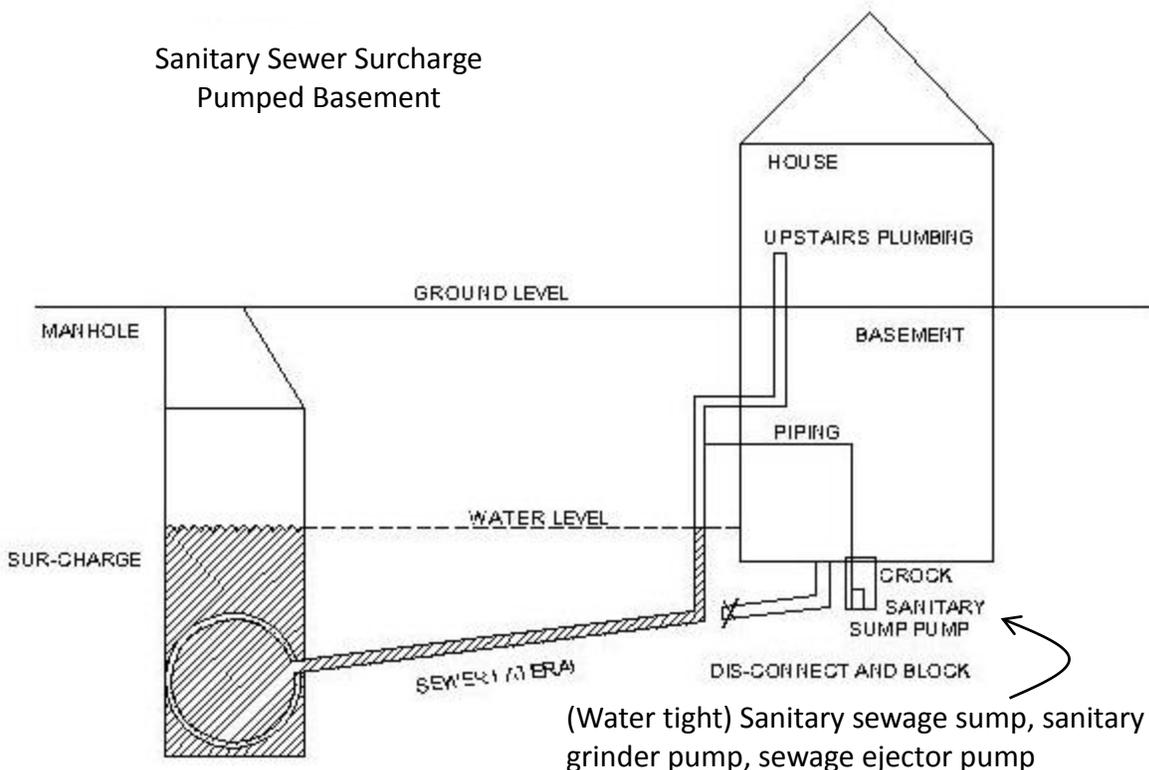
Sufficiently Surcharged Sewer



Sanitary Sewer Surchage  
Gravity Basement



Sanitary Sewer Surchage  
Pumped Basement



(Water tight) Sanitary sewage sump, sanitary grinder pump, sewage ejector pump