

SANITARY SEWER BACKUP

Causes & Prevention

A. PURPOSE

The purpose of this publication is twofold:

1. It provides homeowners with basic information on the causes of sanitary sewer backups.
2. It provides homeowners with general information on solutions that can be implemented to protect their property from sanitary sewer backups.

This publication is informational only. It is not intended as a “Do-It-Yourself” guide or to be considered as implying any type of recommendation. The City recommends that any solution to a sanitary sewer backup problem be developed with the assistance of a competent professional plumbing contractor and/or a competent professional engineer.

B. SANITARY SEWER BACKUP CAUSES

The City of Decatur operates and maintains two separate sewer systems. The first system is a storm sewer system consisting of a network of large diameter pipes, manholes and inlets designed to transport stormwater (sometimes called clear water) from developed areas to an appropriate open channel or lake. The other is a sanitary sewer system which consists of a network of smaller diameter pipes (usually 8-inches in diameter) and manholes designed to transport wastewater from your service sewer line to the Sanitary District of Decatur (SDD) interceptor sewer system. SDD’s interceptor system consists of larger diameter sewer pipes that transport wastewater to a treatment plant where the wastewater is processed and discharged to a stream. Both the City’s sanitary sewers and the SDD’s interceptors are designed only for sanitary wastes. (See Figure 1.)

In some older areas of town a third system may exist called combine sewers. Combine sewers are systems that transport both storm and sanitary water to the treatment plant. In these areas the potential for backup or surcharge in the sewer system is much greater because of the unpredictability of the amount of rainwater that will enter the combined system.

If only sanitary wastes were transported by the sanitary sewer systems. Sanitary sewer backups would only occur when obstructions were present in sewer pipes. However, during certain types of wet weather conditions, sanitary sewer systems become inundated with additional non-wastewater (clear water). The sanitary sewer system was never designed to carry this additional water so the sewer systems become surcharged and this result in backups of wastewater in lower levels and basements. (See Figure 2).

The additional clear water entering the sanitary sewer systems is called infiltration/inflow (I/I). Infiltration is defined as indirect sources of stormwater or groundwater (clear water) infiltrating into a sanitary sewer system. Examples of infiltration include:

- Defective pipes and joints (cracked, broken, misaligned, etc.) in the public sanitary sewer systems.
- Defective pipes and joints in the property owners' sewer service lines.
- Defective and deteriorated manholes in the public sanitary sewer systems.

Inflow is defined as direct sources of clear water entering into the sanitary sewer systems. Examples of inflow include:

- Building footing and foundation drains connected to sanitary sewer service lines.
- Sump pumps connected to sanitary sewer service lines.
- Window well drains, stairway drains, yard drains and patio drains connected to sanitary sewer service lines.
- Storm sewers and storm inlets connected to the public sanitary sewer systems.

Inflow sources, unlike infiltration sources, are usually larger in magnitude and therefore contribute more significantly to the surcharging problem in the sanitary sewer system. For example, eight residential sump pumps rated at 2800 gallons per hour each and connected illegally to the sewer system can consume the entire flow capacity of a typical eight-inch diameter sanitary sewer (345 gallons per minute). Additionally, footing drains four inch in diameter and flowing full from four homes connected illegally to the City's sewer system can consume the entire flow capacity of an 8-inch diameter sanitary sewer.

As mentioned earlier, sanitary sewer backups should occur only during times of heavy rains or extended periods of wet weather. If sanitary sewer backups are occurring at your home during times of no rainfall, there is probably something wrong with the public sewer system in your neighborhood and the City's Public Works Department should be contacted at 424-2747.

C. IDENTIFYING PRIVATE SOURCES OF INFLOW

As described in Section B, some of the major sources of inflow into the sanitary sewer system are located on private property. These inflow sources involve a direct connection on private property between the plumbing for the sanitary service line and the plumbing for stormwater and groundwater drainage (see Figure 3). The City urges all property owners to investigate the location and the point of discharge of all plumbing on their property associated with stormwater, groundwater and sewage. During the course of this investigation, if a plumbing connection is found that would allow clear water (stormwater/groundwater) to flow into the sanitary service line this connection must be removed. Failure to disconnect would continue to allow inflow into the sanitary sewer system and could reduce the effectiveness of any solution implemented by a property owner to prevent sewage backup.

The major sources of inflow on private property are listed below with the methodology that can be used to locate the source.

1. Building footing and foundation drains connected directly to the sanitary service line. This type of connection can only be identified with certainty by exposing the sanitary service line and inspecting the exposed sewer line for cross connections with the building footing and foundation drains. Property owners should be concerned about this type of connection if their building has a basement and no sump pump.
2. Sump pump discharge connected directly to the sanitary service line. This type of connection can usually be identified by tracing the discharge piping of the sump pump to its point of discharge. If the sump pump discharges to pipes that are used to transport sewage, the connection must be removed and the discharge of the sump pump must be directed elsewhere. If the sump pump piping cannot be traced, the discharge water from the sump pump can be dyed and then traced to a sanitary or storm sewer.
3. Downspouts, window well drains, stairway drains, yard drains and patio drains connected to the sanitary service lines. These types of connections can usually be detected by smoke testing the City sanitary sewer and/or by dyeing the discharge water from the individual drains or downspouts.

D. TYPES OF BACKUP PREVENTIONS

Presented below are possible solutions that could be implemented by homeowners to protect their property from backups. This section assumes that sanitary sewage is backing up through plumbing fixtures located in a basement or lower level and the property owner has identified and eliminated all sources of inflow from private sources into the sanitary sewer. This section also assumes that the sewer service pipe and joints under the floor slab are strong and tight. If the service sewer pipe is weak and/or contains leaky joints, implementation of the solutions below could cause water to accumulate under the floor slab and its pressure could cause the floor slab to fail.

The City recommends that homeowners in addition to considering one of the solutions listed below also consider the purchase of insurance to cover damages caused by sump pump failures and sewage backups.

1. Plugs. Since the lower level floor drains are usually the lowest connection in your house, it is the first place of entry for sewage backups. The drain can be closed with a rubber or wooden plug during heavy rains. Plugs can be purchased at most hardware stores. The plug can be installed permanently or it can be installed by the homeowner before or during rainstorms. This is the simplest and least expensive way to stop sewage backup and will work until the sanitary sewer water level becomes high enough to fill and overflow other plumbing fixtures located in the basement or lower level. (See Figure 4) **WARNING!** If there is any uncertainty about the condition of sewer pipes below the basement floor, this method could result in serious damage to the floor.

Advantages:

- a. Many types can be installed by the home owner without special tools.
- b. Plugs can be flush with the top of the basement floor to avoid tripping.
- c. Low cost, no changes are required in the house sewer system.
- d. No permit is required since the house sewer system is not altered.

Disadvantages:

- a. Water backup from exceptional rain storms may cause a build-up of water pressure within the house sewer system great enough to rupture pipe joints and basement floors.
 - b. If basement floor and sewer pipe joints are sound, water will overflow from the next lowest open fixtures.
 - c. Plugs must be removed to restore drainage if water seeping through the walls or floor accumulates in the basement.
2. Standpipes. A standpipe inserted into the floor drain serves the same purpose as a plug, except the standpipe is open at the surface. When water rises to the top, it will overflow onto the floor. An open standpipe doesn't relieve pressure in the sewer lines or reduce pressure which may build up under the floor slab due to leaky joints. (See Figure 5) **WARNING!** If there is any uncertainty about the condition of sewer pipes below the basement floor, this method could result in serious damage to the floor.

Advantages:

- a. Many types can be installed by the home owner without special tools.
- b. Pressure due to trapped water in sewer pipes or under floors may not rise to dangerous levels since overflow keeps pressure buildup from becoming too high.
- c. No permit is required since the house sewer system is not altered.

Disadvantages:

- a. May cause rupturing of sewer pipe joints under the basement and subsequent cracking concrete if standpipe is too high, or if standpipe is capped.
 - b. Basement floor drains cannot be used until standpipes have been removed.
 - c. Pipes projecting above the floor are hazardous in heavy traffic areas.
3. Valves. Since sanitary sewer backup comes through the sewer service line running from the public sewer, another possible means of preventing sewer backup is to install some type of valve which can be closed when the sewer surcharges.

A variety of valves are available. Some valves close automatically when the water flows through the service line reverses (check valves) while others require manual means to close (gate valves). The valves may be installed on the service sewer line either inside or outside the basement or lower level. However, due to potential damage to basement floors as discussed in 1 and 2 above, it is far safer to install a valve outside the basement with access by means of a manhole.

Because of debris flowing through the sanitary sewer service line, valves (check or gate) sometimes jam and fail to close completely. Additionally, unless the valve operates automatically like the check valve, the valve is ineffective unless somebody is on hand to close it. All valves require periodic maintenance; therefore access to the valve is essential. During the time the valve is tightly closed, sanitary sewage backup into the house is cut off. However, normal sanitary sewage flow from the hose to the sanitary sewer is also cut off. This means that household plumbing fixtures cannot be used unless a pump bypass is provided (See Figure 6).

Advantages:

- a. No dangerous pressure builds in the sewer drain system under the basement floor.
- b. Nothing to remove to restore drainage of the basement floor.
- c. No pipes projecting from floor drains where they could be hazardous.

Disadvantages:

- a. Property owner must be home to close the hand-operated valve at the proper time and will not be able to use fixture while the valve is closed.
 - b. The valve should be checked frequently and maintained to make sure it works properly and is not held open by debris.
 - c. Gate valve must be reopened to resume full use of plumbing facilities.
 - d. Valve could not be closed tightly which would still allow sewage to back up
4. Overhead Sewers. The basement floor drain and any plumbing fixtures in the lower levels of your house that have experienced backups will be disconnected from the sewer system. Plumbing from those fixtures will be re-routed to a sealed tank. Inside the tank, an ejector pump lifts the waste water up several feet high in new plumbing before dumping into your sewer line. Often the new plumbing is connected “overhead” to pipes that lead out of your house and dump into the sewer line. Since the fixtures in the lower level are no longer directly connected to the sewer line, they cannot experience a backup. Plumbing fixtures on upper floors of your home that have never experienced backups need not be routed through the ejector pump system. (See Figure 7).

Advantages:

- a. The system does not rely on proper closing of a backflow valve to prevent backup from the street sewer.
- b. Loss of power during a storm does not affect use of upper level plumbing fixtures.

Disadvantages:

- a. Sewage ejector may fail to operate during a heavy rain and may be a problem.
- b. Use of lower level plumbing fixtures should be curtailed during heavy storms.
- c. Check valve failure could allow backups to still occur.
- d. Sewage ejector pump will be inoperable during power failure.

E. REFERENCES

City of Champaign, IL, "Sanitary Sewer Backup Causes and Prevention"

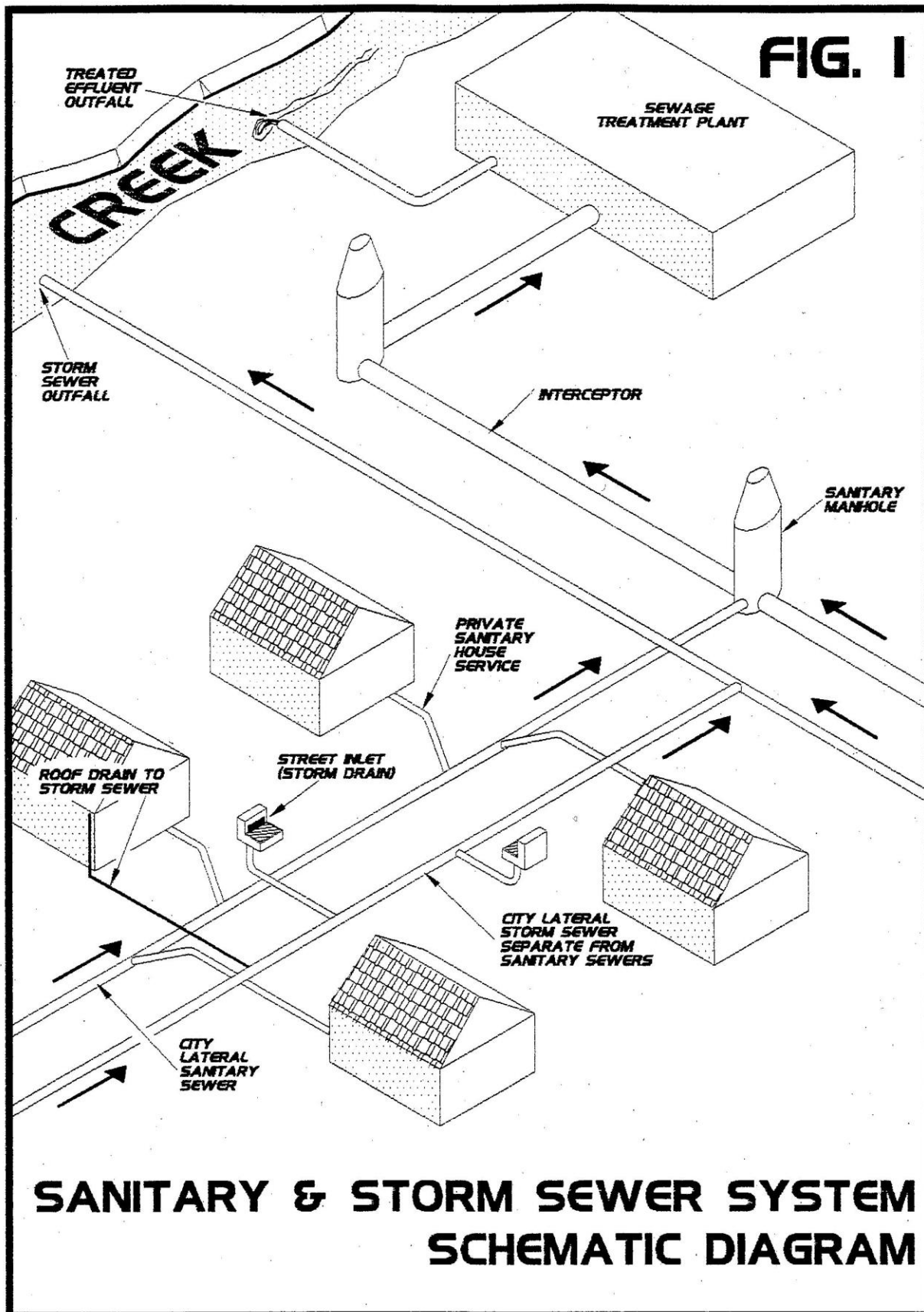
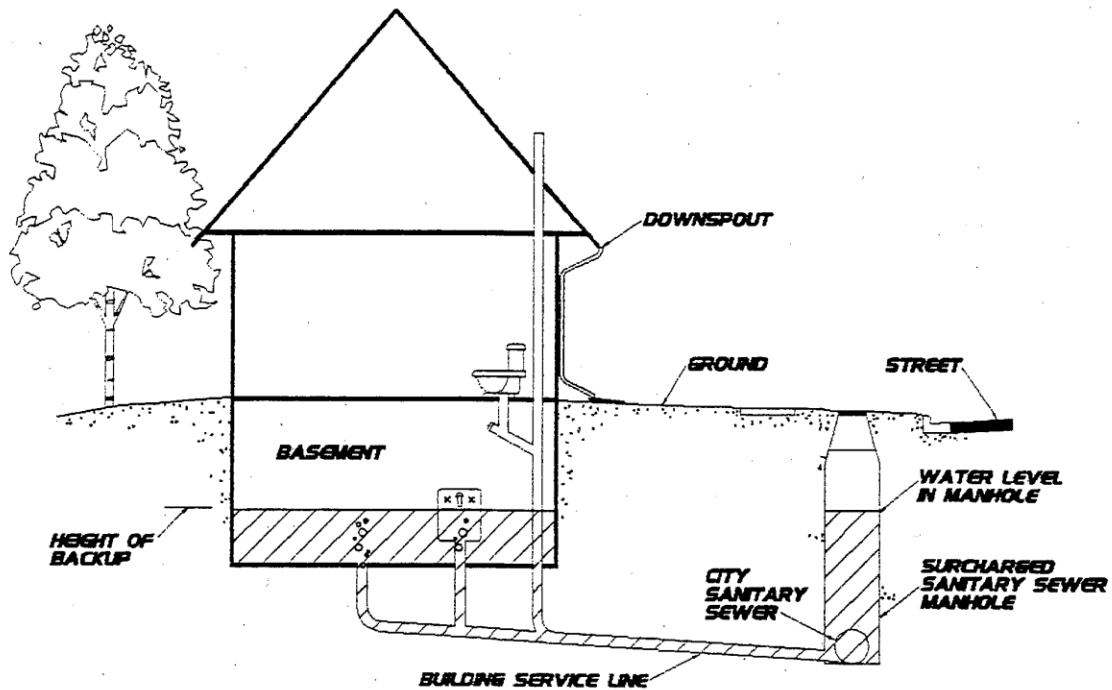
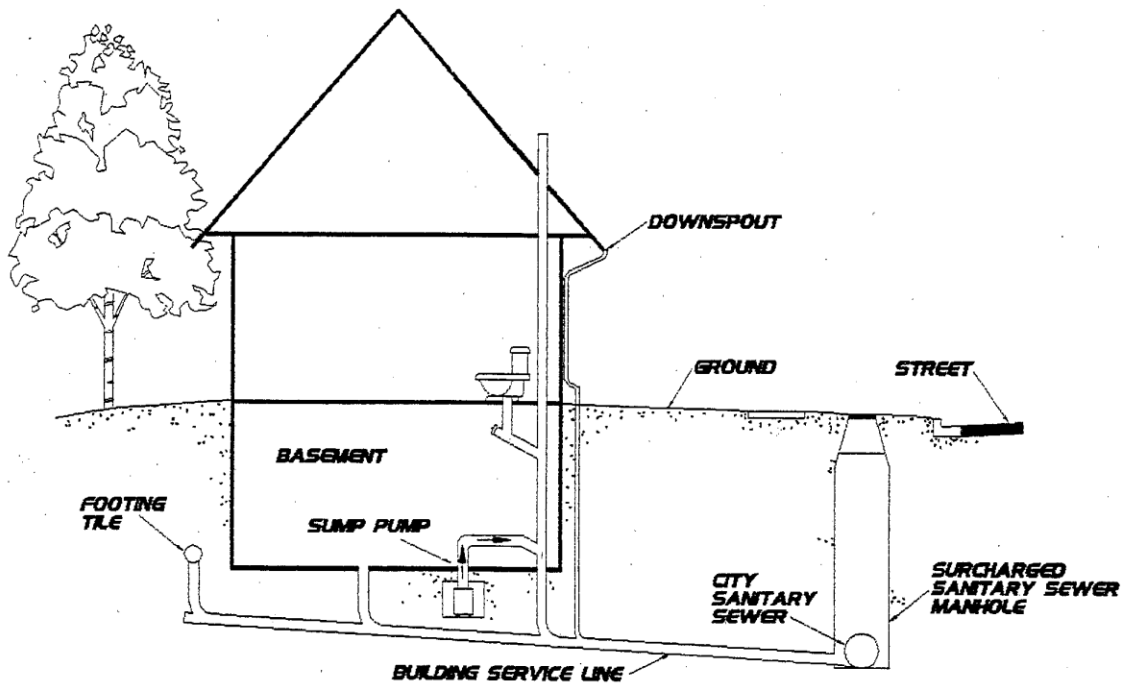


FIG. 2



SANITARY SEWER BACKUP INTO BASEMENT

FIG. 3

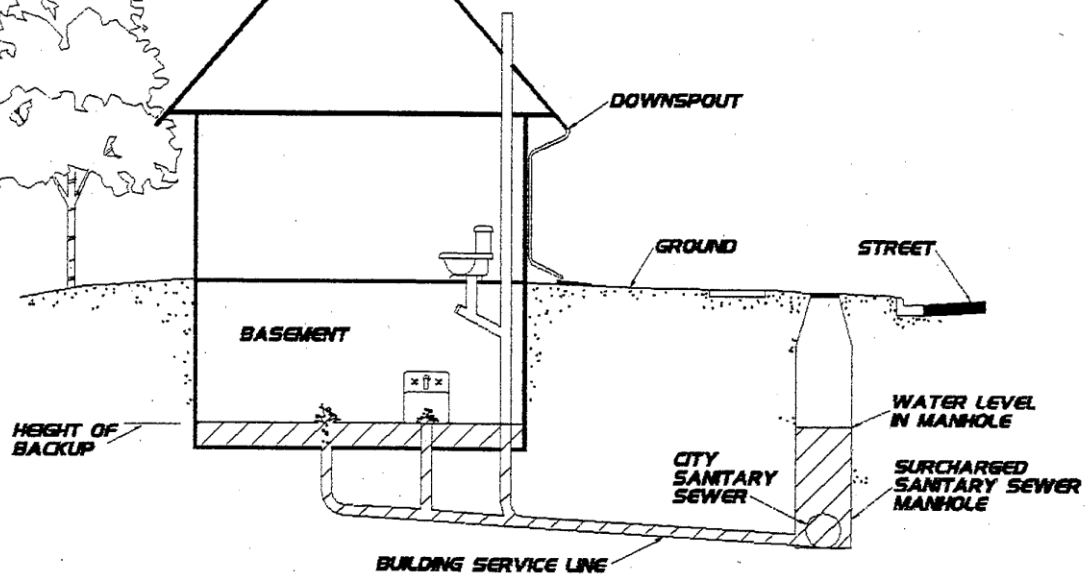


PRIVATE SOURCES OF INFLOW

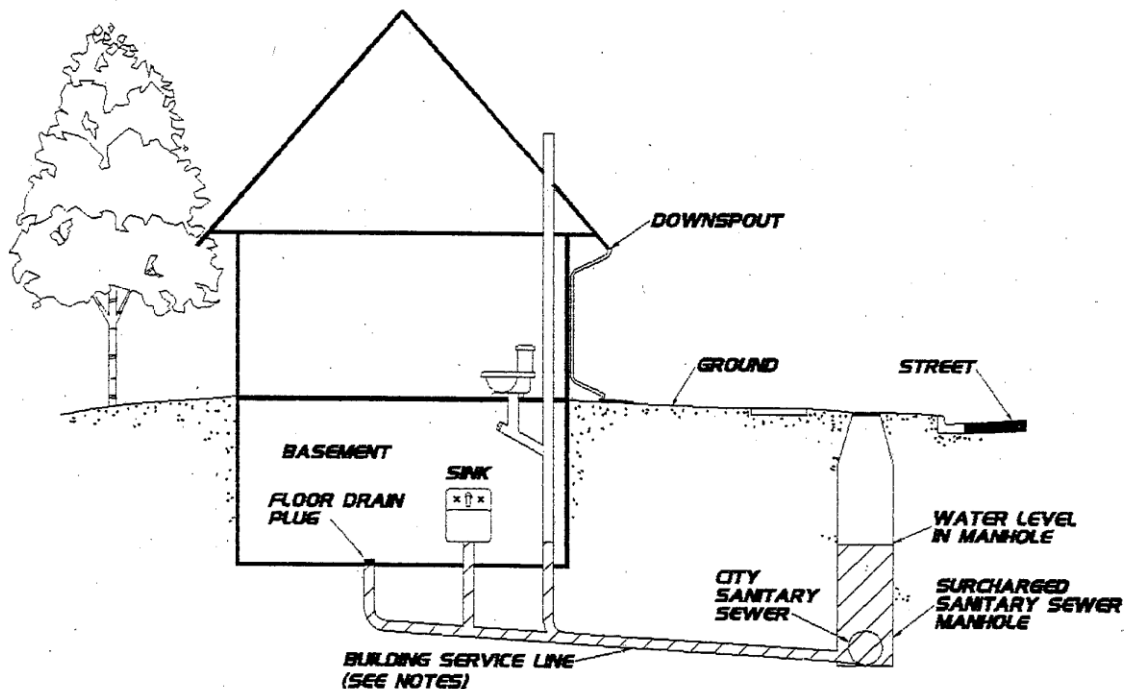
NOTES:

1. The footing tile, sump pump and downspout all transport either stormwater or groundwater (clearwater). Plumbing connections that allow clearwater to flow into the building service line must be disconnected.

FIG. 4



WITHOUT FLOOR DRAIN PLUG

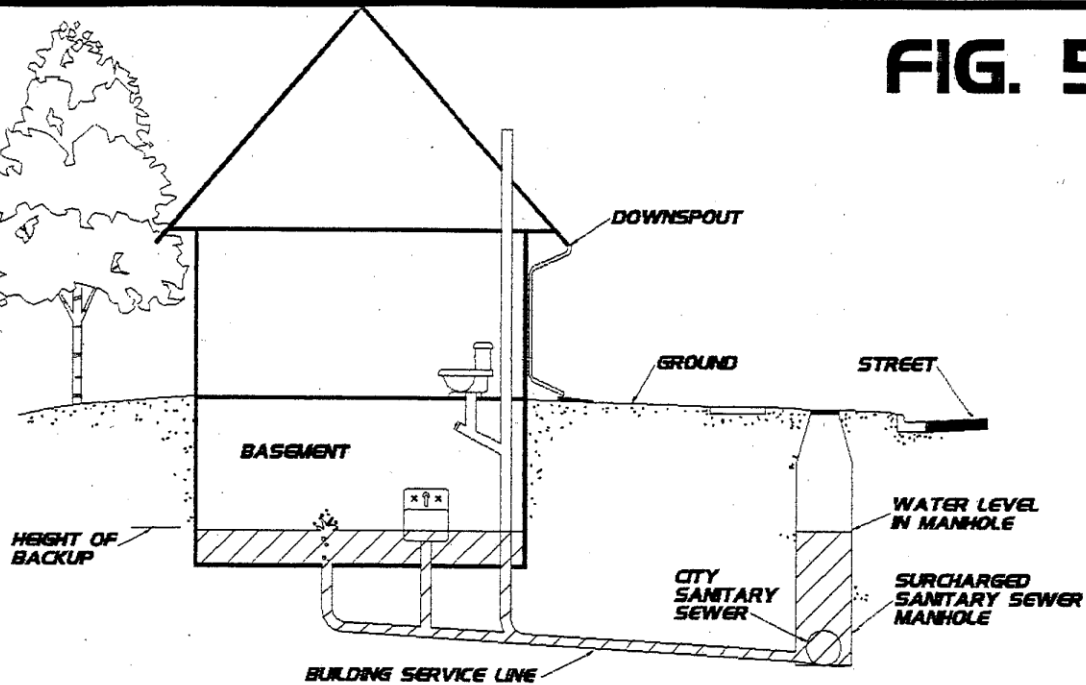


WITH FLOOR DRAIN PLUG

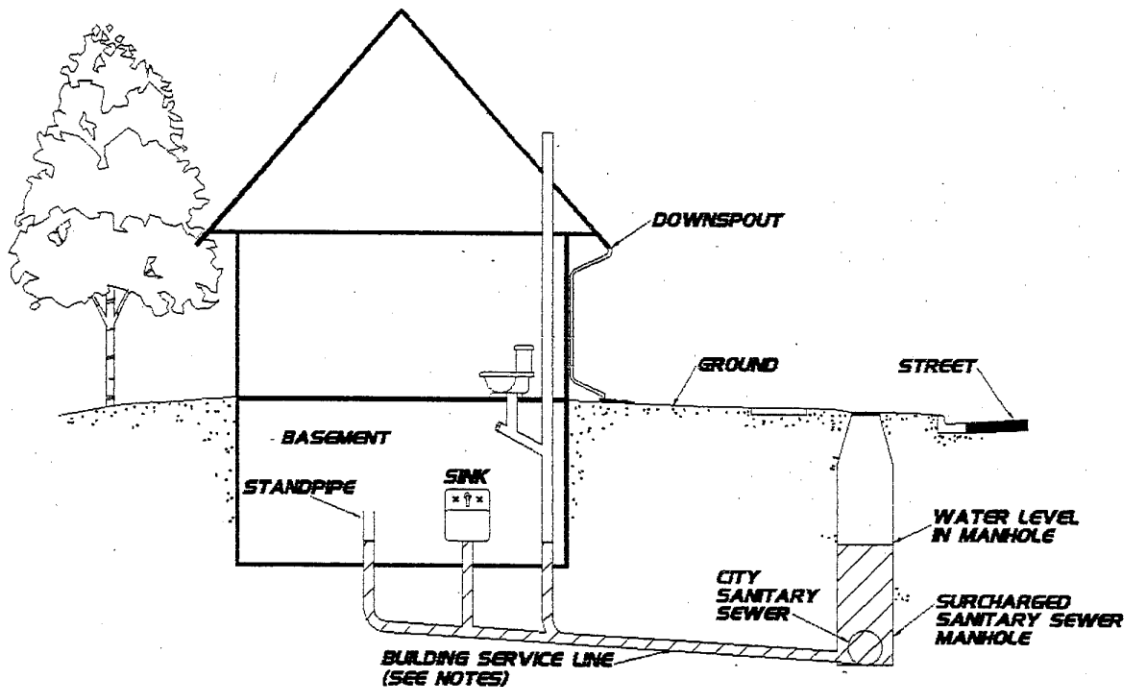
NOTES:

1. This method could result in serious damage to the floor.
2. This method will prevent backup until the water level in the pipes reaches the level of the sink.

FIG. 5



WITHOUT FLOOR DRAIN STANDPIPE

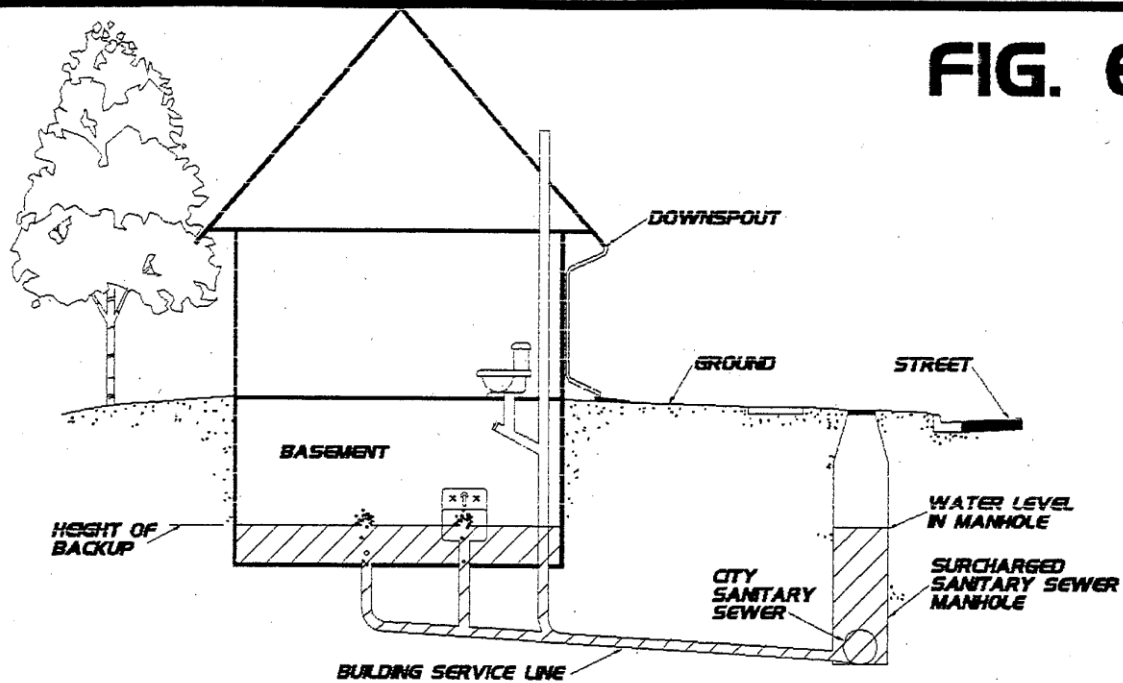


WITH FLOOR DRAIN STANDPIPE

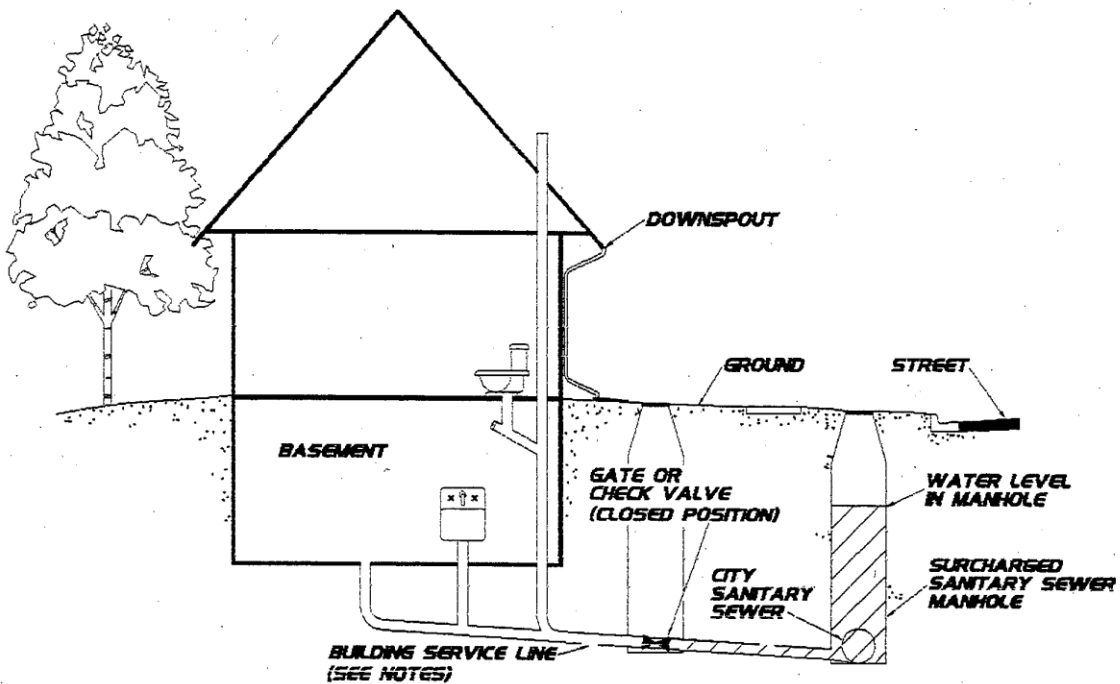
NOTES:

1. This method could result in serious damage to the floor.
2. This method will prevent backup until the water level in the pipes reaches the level of the sink or top of the standpipe.

FIG. 6



WITHOUT GATE OR CHECK VALVE

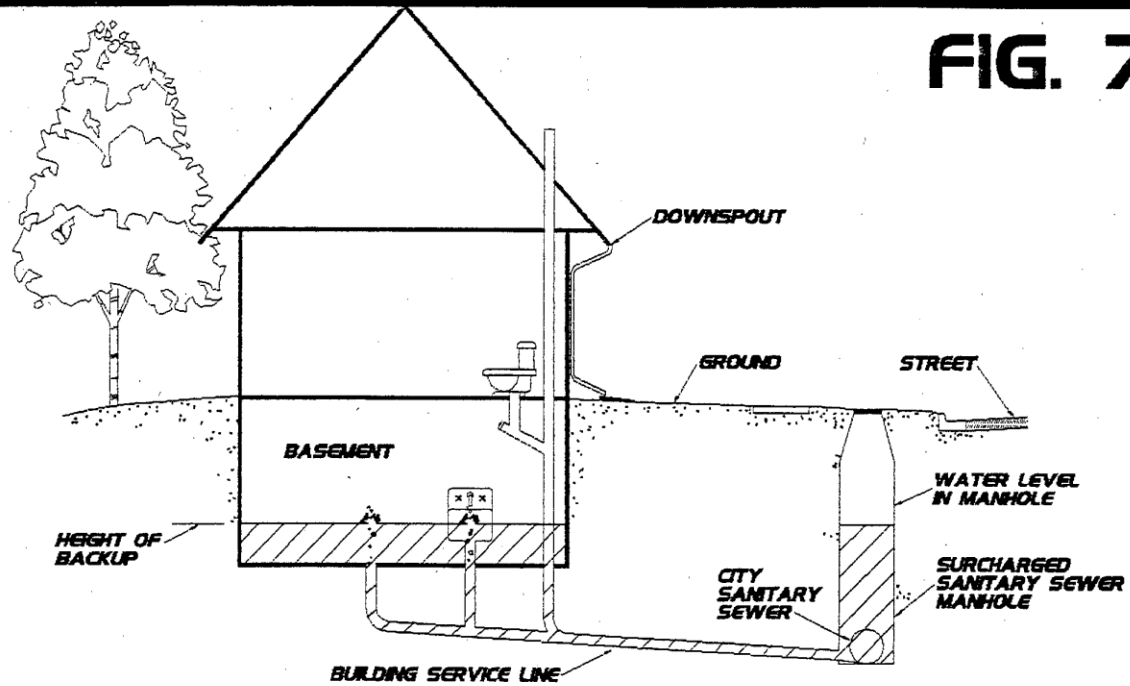


WITH GATE OR CHECK VALVE

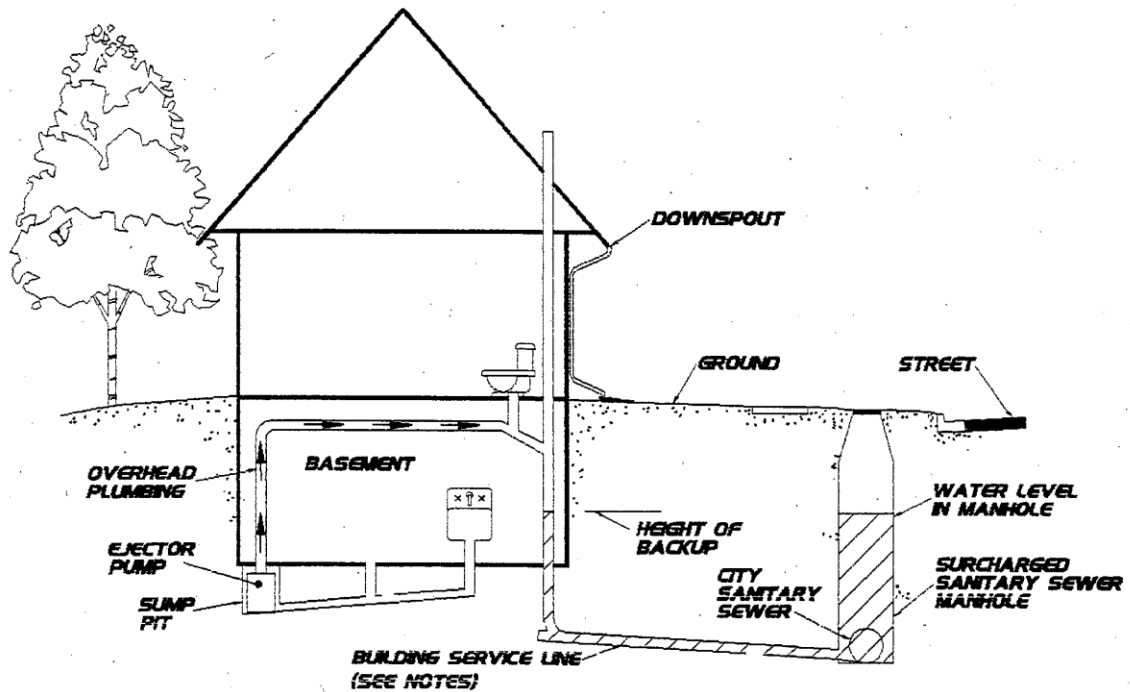
NOTES:

1. This method will eliminate basement backup when the gate or check valve is closed.

FIG. 7



WITHOUT OVERHEAD SEWER



WITH OVERHEAD SEWER

NOTES:

1. This is the preferred method and will help against future backups but is not a guarantee.
2. Ejector pumps can be installed either inside or outside of the building and can be used to pump either a portion or all of the sewage from the building.