SECTION 3.4

New and Substantially Improved Buildings

Sewage Management Systems

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3.4 Sewage Management Systems

3.4.1 Introduction

Sewage management systems for buildings can be arranged into two components:

1. Treatment/Disposal Components
2. Collection Components

> **NOTE:** This chapter applies to new and substantially improved structures that must be built in compliance with the minimum requirements of the NFIP. Many of the structures that were built prior to the adoption of floodplain management regulations by communities have building utilities system that are not resistant to flood damages. For additional information on how to protect building utility systems in these structures, see Chapter 4 on Existing Buildings.

Treatment/Disposal Components can include either an off-site or an on-site system that is used to temporarily store or treat the sewage. Some examples of these components are:

- Public sewer system
- Septic system
- Elevated storage tank

Collection Components generally include the drains in the toilets, floors, urinals, bathtubs, showers, sinks, and building interior piping.

For a sewage management system that discharges into a public facility, only the on-site portion of the system is covered in this manual.

In general, the figures in this chapter attempt to illustrate some general practices that meet the requirements of the National Flood Insurance Program (NFIP). Local codes permit many variations that also meet NFIP regulations. Please refer to any state and local code officials for specific practices that may meet both NFIP and other requirements.

General Sewage Management System Hazards

Floodwaters present three main dangers to sewage management systems in residential and non-residential buildings:

1. **Back-up** of sewage into buildings due to surcharged sewers. This can be caused by floodwaters infiltrating a system, the failure of a utility-owned sewage pump station, the failure of a check or back-

flow prevention valve, or the failure of an effluent ejector pump. Surcharge of sewers causing sewer back-up can occur outside the flooded area, especially in combined sanitary and storm sewer lines.

2. **Physical damage** of the system components; i.e., pipes, septic tanks, distribution boxes, and distribution pipes. The most common sources of physical damage are erosion, scour, debris impacting risers, collapse of pipe from loss of material, and infiltration at leaky joints. As a result, the systems usually fail as a result of impact and burgeoning forces that break and dislodge the system components.

3. **Contamination** of floodwaters by sewage, which presents a health hazard to those who come in contact with the floodwaters. Contamination can be caused by sewage back-up, physical damage to pipes and tanks, seepage of sewage into floodwaters due to leaky pipe connections, and/or loss of power at sewage pump stations and treatment plants.

NOTE:

A coastal survey of the damage caused by Hurricane Fran to sewage management components showed that most of the damage was caused by erosion and scour, which exposed pipes and tanks and broke many pipe connections.

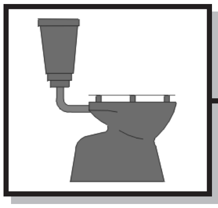
Any one of the dangers listed above can contaminate and render residential and non-residential buildings uninhabitable and present serious health risks to those who come in contact with floodwaters, thus making cleanup operations expensive and potentially hazardous.

Two approaches must be used simultaneously to eliminate or minimize the dangers that floodwaters present to sewage management systems.

1. Prevent sewer back-up into buildings.

2. Prevent physical damage to the system components.

The major sewage issues that must be addressed when building in a Special Flood Hazard Area (SFHA) are sewage backup and damage to the system caused by the flooding. This chapter will discuss the concepts involved in preventing sewage back up and system damage caused by flooding so that the building can be reoccupied as quickly as possible after the floodwaters have receded.



3.4.2 NFIP Requirements

The NFIP requires that the sewage management system in a new or substantially improved structure located in a Special Flood Hazard Area (SFHA) must be designed so that floodwaters cannot damage any component of the system. See *Table 3.4.2* for a summary of compliant mitigation methods.

Methods of Mitigation	A Zones	V Zones
1. Elevation	Highly Recommended	Minimum Requirement
2. Component Protection	Minimum Requirement	Not Allowed*

Table 3.4.2: Summary of NFIP regulations
***Allowed only for those items required to descend below the DFE for service connections.**

1. **Elevation** refers to the location of a component above the Design Flood Elevation (DFE).

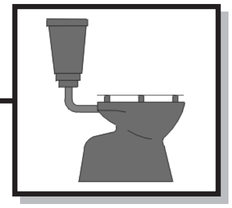
2. **Component Protection** refers to the implementation of design techniques that protect a component or group of components located below the DFE from flood damage by preventing floodwater from entering or accumulating within the system components.

NOTE:
The Design Flood Elevation (DFE) is a regulatory flood elevation adopted by a community that is the BFE, at a minimum, and may include freeboard, as adopted by the community.

3.4.3 Treatment/Disposal Components

In general, the treatment/disposal systems include either an off-site public facility or an on-site facility that is used to temporarily store or treat the sewage. In this section, a description of these facilities and the various components that comprise them will be examined.

A practical strategy for protecting components of sewage treatment and disposal systems from damage by velocity flow and wave action involves designing the components that are to be located below the DFE to ensure stability and sturdiness. In V Zones especially, erosion and scour of sandy soils by velocity flow during a storm are practically impossible to stop. Effort is therefore best applied to designing the system to withstand the forces of velocity flow and debris impact without incurring much, if any, damage. Due to the nature of treatment/disposal components that rely on gravity flow, it is very frequently impossible to elevate the system. In almost all systems, a method of component protection must be developed that can protect the system in-place.



Public and On-Site Sewage Treatment/Disposal Systems

Public sewage treatment/disposal systems convey sewage through collector lines to an off-site public treatment plant. In certain cases the public sewage collector lines also serve as storm water collector lines. This type of system is called a combined sanitary and storm sewer system. Many of the early sewer systems were built, and still operate as, combined systems. See *Figure 3.4.3A* and *Figure 3.4.3B* for examples of off-site sewer systems located in velocity and non-velocity flow areas. As stated previously in Section 3.4.1, only the privately owned on-site portion of public sewage systems is covered in this manual.

On-site sewage treatment/disposal systems either treat and dispose of sewage on-site or hold sewage for periodic removal and disposal. The most common on-site sewage treatment and disposal system in residential structures is the septic system. See *Figure 3.4.3C* and *Figure 3.4.3D* for examples of on-site sewer systems located in velocity and non-velocity flow areas. Examples of less commonly used on-site sewage treatment systems include the elevated aeration treatment tank, the elevated solids separation tank, and the cesspool.

Storage facilities typically have one of two different uses. In some cases it is desirable to have a temporary storage tank where all sewage is stored. A contractor must be hired to remove and dispose of the tank contents periodically. The second type of tank is similar, except that it is equipped with a high-pressure ejector pump that detects the level inside the tank and drains the tank into the public sewer system when the internal tank level rises.

In some cases, older septic tanks can fail or collapse under the overbearing load caused by the weight of saturated soils. These systems may function properly as septic systems prior to flooding, but the structural frame of the tank may have deteriorated so that the added weight of the moisture in the soil causes the tank to collapse.

Alternate Sewage Systems

When a backflow prevention valve or gate of a sewage system is closed as a result of surcharged sewers, the sewage collection system within a building cannot be used unless the effluent is either stored temporarily or forced around the valve or gate into the surcharged service connection pipeline through the

CAUTION:

In addition to building code and floodplain management, the installation of on-site sewage disposal systems is often regulated through health and sanitary regulations. These regulations are often administered at a different level of government than building codes and standards. In addition, these regulations often exceed the minimum requirements of the NFIP. The reader should reference Chapter 2 of this publication for further information on regulatory issues. Always verify that the sewage management system is one that is permitted by the governing regulatory agencies.

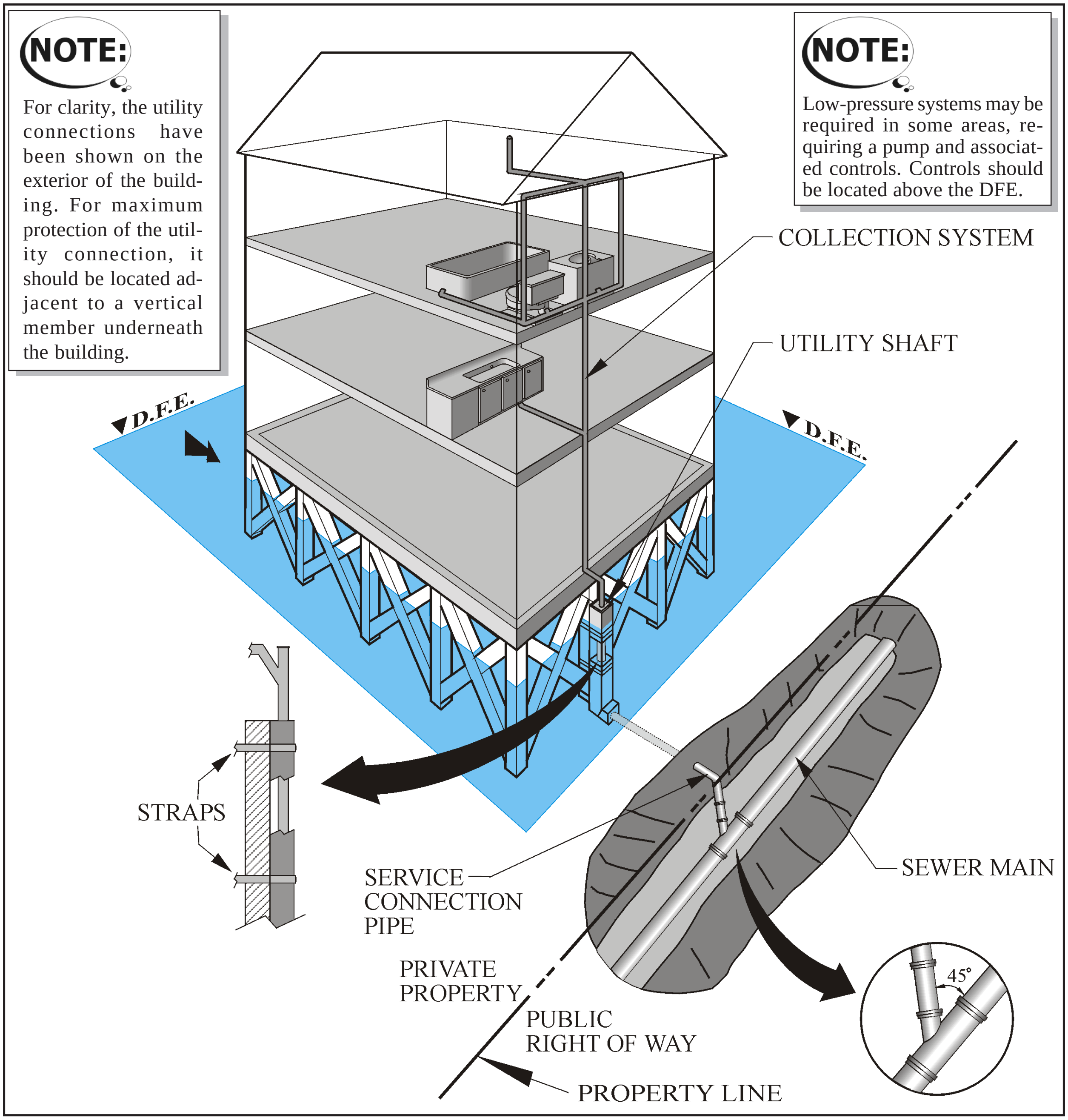


Figure 3.4.3A: The components of a public sewage management system in a velocity flow area

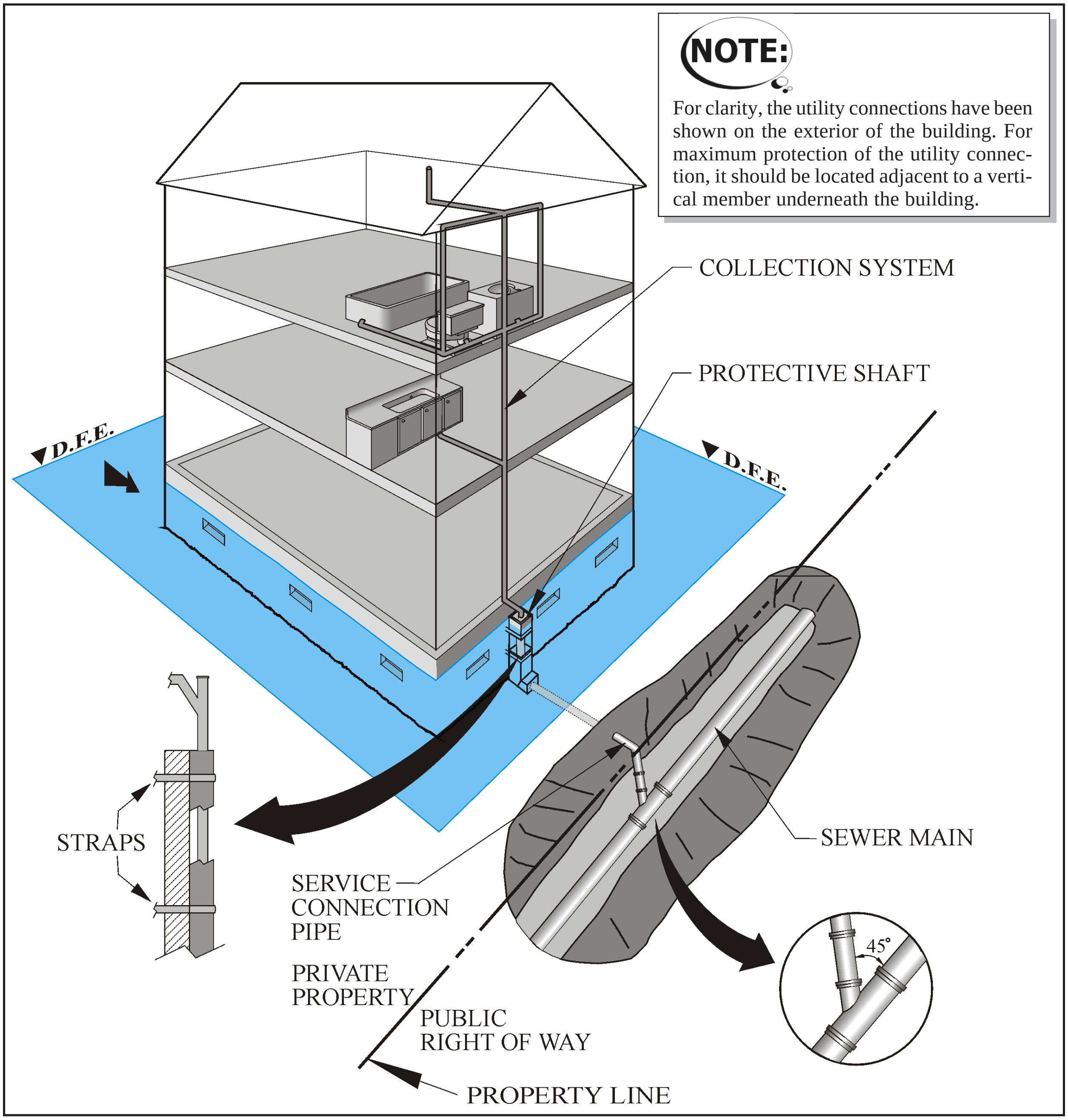


Figure 3.4.3B: The components of a public sewage management system in a non-velocity flow area

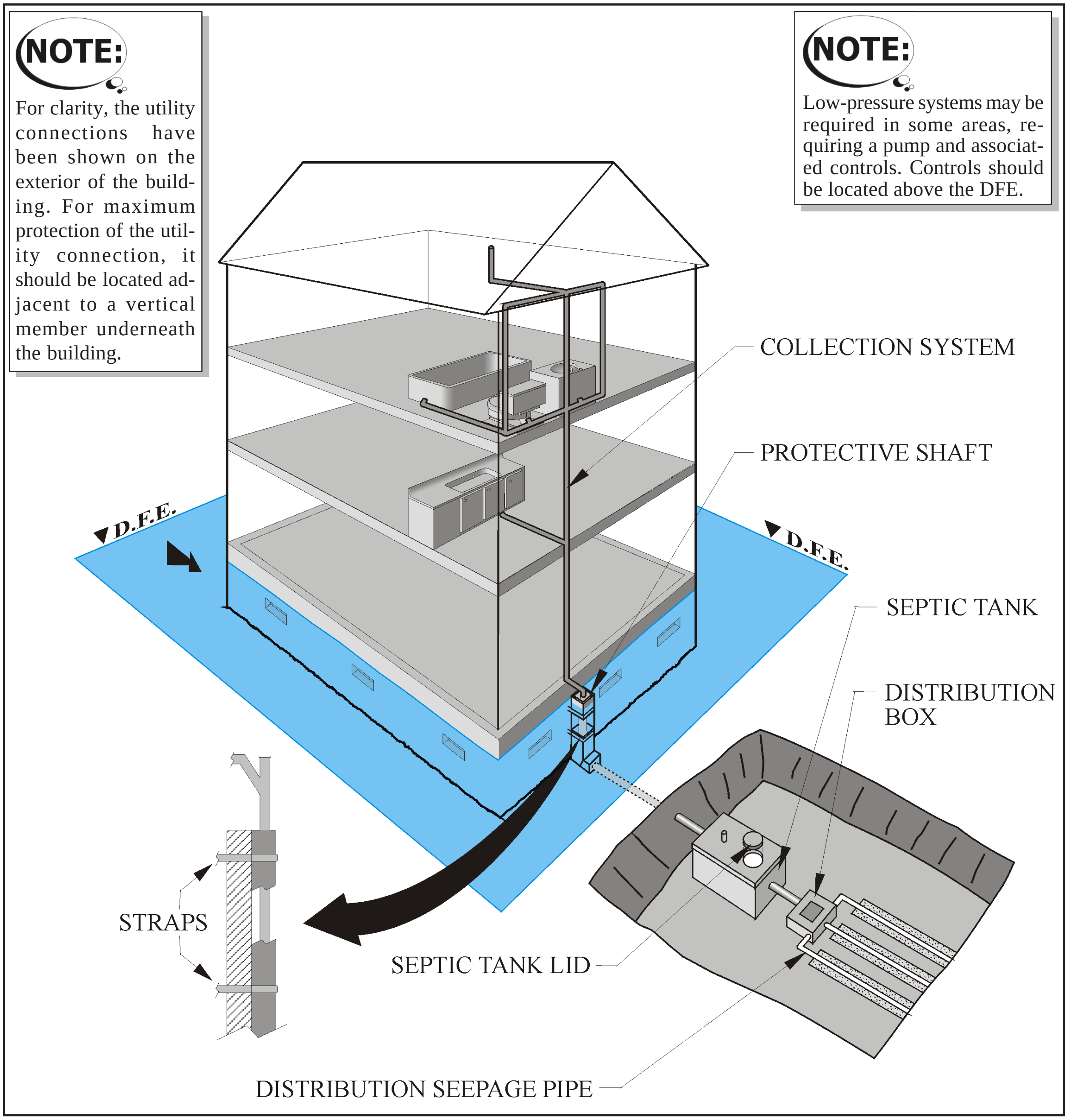


Figure 3.4.3C: The components of a typical on-site sewage management system in a velocity flow area

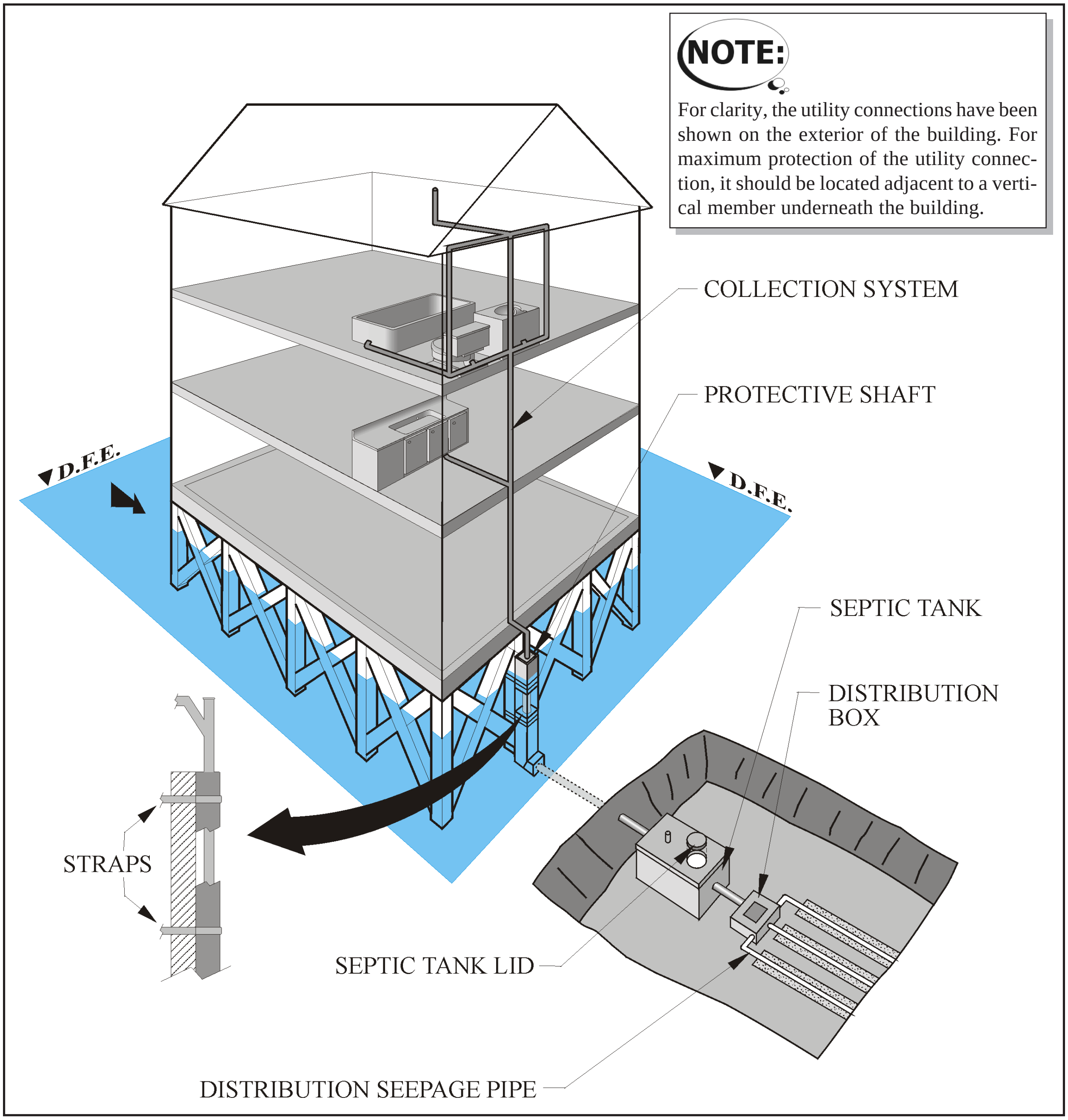


Figure 3.4.3D: The components of a typical on-site sewage management system in a non-velocity flow area

> **CAUTION:**
> Before a storage tank is designed to temporarily store sewage or a sewage effluent ejector pump is incorporated into a design, local code officials should be consulted to ensure that the local code allows their use.

use of sewage ejection systems. The primary elements of a sewage ejection system are the temporary storage tank, sewage effluent ejector pump, and/or overhead connections.

A. On-site Sewage Storage Tank

A ready-made plastic or fiberglass tank, a precast concrete tank, or a cast-in-place concrete tank can be used to temporarily store sewage during a flood or surcharged sewer incident. When the floodwaters have receded, the sewage can be pumped out of the tank into the public sewer or on-site treatment system. The tank must be watertight, if installed below the DFE, and installed to resist buoyancy forces as described in Section 3.2.3. Local officials should be consulted to ensure that temporary storage tanks are permitted.

B. On-site Sewage Effluent Ejector Pump

An ejector pump can be used to force sewage through or around an otherwise closed check valve or gate into a surcharged sewer. If a check valve/gate valve combination is installed in the service connection pipe, the gate valve must be open in order for an ejector pump to be used. Before a sewage effluent ejector pump is incorporated into a design that also includes a check valve/gate valve combination in the service connection pipe, the local officials should be consulted to ensure that such a combination is permitted.

Sewage flows from the collection drains into a sump pit or basin. When the level of the effluent is high enough to trigger an automatic switch, the ejector pump sitting at the bottom of the pit is activated. The pump automatically shuts off when the effluent falls below a certain level. The ejector pump could either be used only during a flood or it could be used for normal operation of the sewage collection system. A back-up electrical power source should be provided to ensure operation during an electric power outage that often occurs in association with flooding.

C. "Overhead" Connections in Non-Residential, Dry Floodproofed Buildings in A Zones

In a new or substantially improved non-residential dry floodproofed building located in an A Zone, it is allowable to have a sewage collection drain below the DFE. With one or more sewage collection drains below the DFE, however, it is necessary to design a system that prevents sewage from backing up into the building when the sewers are surcharged.

As an alternative to using valves and gates, a reliable design technique for preventing sewage back-up into a structure that has one or more sewage collection drains below the DFE is overhead connection of the service connection pipe to the public sewer or on-site treatment system. This is, however, an expensive technique that is used most often in non-residential dry floodproofed structures where it is impractical to elevate all of the sewage collection drains to or above the DFE. This should only be used for that part of the system below the DFE. The requirements for this design technique are:

- Sump
- Backflow prevention valve/gate
- Ejector pump
- Pipe that rises from the sump to a point above the DFE before it connects to the sewer or temporary holding tank
- Back-up electric power source

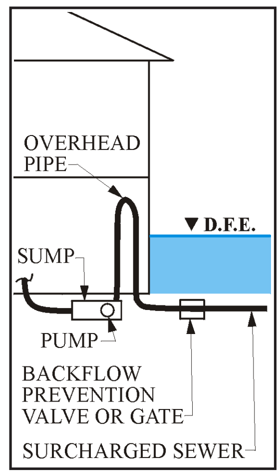


Figure 3.4.3E: Components of a typical "overhead" sewer

Sewage flows from the collection drains in the structure down to the ejector pump. Then it is pumped up through the overhead pipe to the sewer or on-site treatment system.

The sewer connection itself does not have to be above the DFE, but the pipe must rise above the DFE before it connects to the public sewer or on-site treatment system to ensure that sewage does not flow back into the structure. To ensure safety, a backflow prevention valve or gate should be installed in the service connection pipeline between the overhead portion of the pipeline and the point of connection to the sewer or on-site treatment systems. In order for the system to operate during a general power outage, a back-up source of power must be used. However, the back-up power is not necessary for flood protection. If the system is not provided with an alternative power source, the sewage for the building cannot be drained in the event of a power failure, therefore, the system should not be used. When power returns, the system should return to normal operation.

Off site septic systems

In some circumstances, a septic system is not feasible on site and no utility provides sewer service. In extreme cases it may be beneficial for the property owner to locate a piece of property that is nearby and out of the floodplain. The property owner can construct a septic system at that location and pump the waste from the original property to the new one for treatment. As with most on-site sewer systems, always check with local officials regarding the use of any sewer system.

In addition to the systems described above, there are many other options for safe effective sewage treatment. If the building is a substantially improved structure, the system that is in place can be of an unknown age and design. Local officials can be of great assistance when analyzing the old system or selecting a new system. They can offer guidance and advice as they are usually aware of the designs that have worked and the ones that have failed.

Wall Penetrations and Accesses to Septic Tanks and Manholes

This section discusses waterproofing techniques that prevent both the infiltration of floodwaters into a sewage collection and on-site treatment system, and the release of sewage into floodwaters from components of an on-site treatment system. Even where a building does not sustain any significant damage from floodwaters, the presence of contaminated floodwaters can create hazardous conditions for those cleaning flooded buildings, possibly causing delays in rehabilitation and re-occupation of the structure.

To prevent contamination of floodwaters by sewage from pipes and manholes, and the tanks they connect to, these components must be designed to retain their contents even when exposed by erosion and scour, and/or submerged under floodwaters, or surrounded by saturated soil.

Use of the following techniques can make wall penetrations, manholes, and septic tank access covers watertight, thus preventing contamination of floodwaters:

Wall Penetrations—A pipe penetration through an external wall can be sealed using an expansive sealant, a molded sleeve, an elastomeric seal, or a neoprene seal. *Figure 3.4.3F* shows a typical expansive rubber seal.

Septic Tank or Manhole Access Cover—As shown in *Figure 3.4.3G*, a neoprene gasket should be applied between the access cover and its seat. In addition, the septic tank access cover should be bolted down. This combination should ensure a watertight seal.

Inspection Pipe—The inspection pipe should have a watertight cover such as a screw-on lid, or the pipe should extend above the DFE. In areas that experience floods with velocity flow, such as V Zones and certain A Zones, protec-

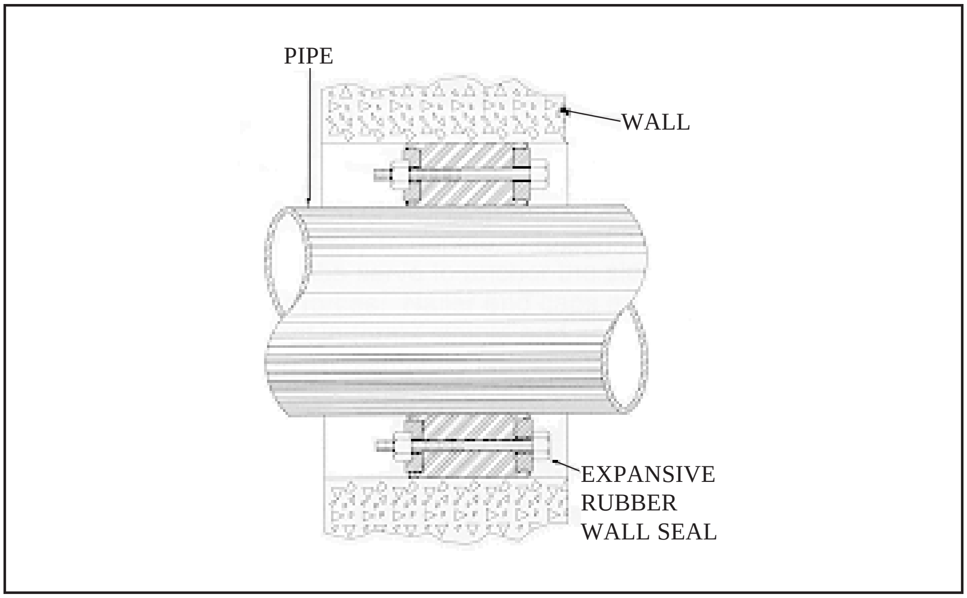


Figure 3.4.3F: Examples of an expansive rubber wall or floor penetration seal
Source: PROJEX GROUP Pty. Ltd., Unit 3/39 Rhodes Street, Hillsdale NSW, Australia 2036

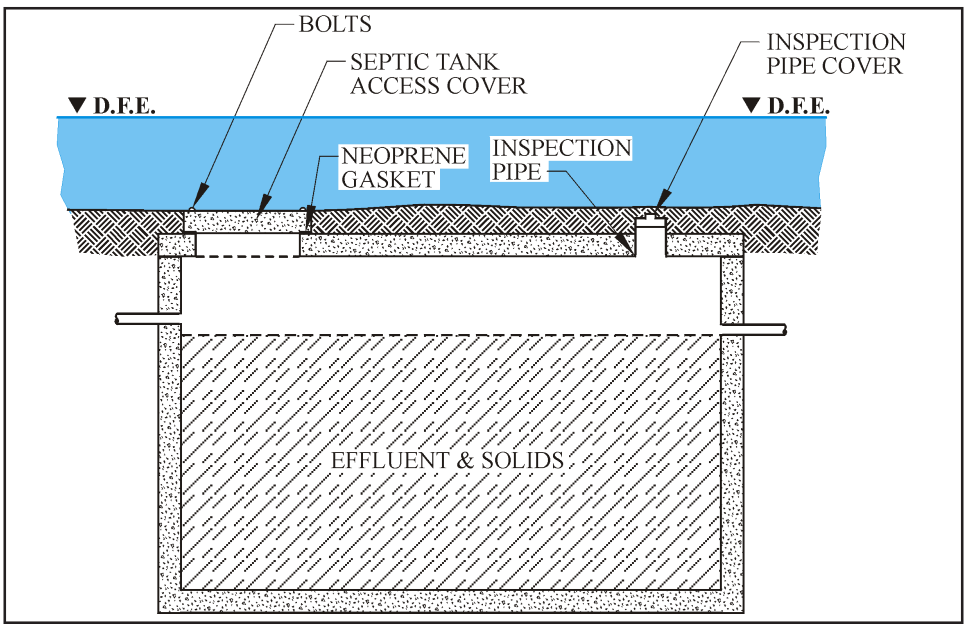


Figure 3.4.3G: Sealed septic tank with lid and access cover

tion from the forces of velocity flow and debris impact should be provided by enclosing the inspection pipe within a protective cover or manhole.

CAUTION:

Some States and communities do not allow septic leach fields in V Zones and certain A Zones.

B. Protecting Distribution Pipes in Leach Fields

On-site sewage disposal is done through leach fields that use the soil as a filter. Solids are removed at the septic tank before partially treated sewage is delivered to the leach field through distribution pipes that lead to seepage trenches, pits, or beds. This is often the final stage of on-site sewage management. These components of the system are typically less likely to be damaged by floodwaters, but they are the most expensive to install. Therefore special care should be exercised when designing the distribution pipes to ensure that they are not exposed to potential damage.

On-site disposal systems are most at risk of flood damage in V Zones and velocity flow A Zones where erosion and scour can expose the components to velocity flow and debris impact. The best protection technique for on-site disposal systems is to locate them outside of floodprone areas. If this cannot be achieved, then on-site disposal systems should be located outside of V Zones and A Zone areas subjected to velocity flow. As a last resort, on-site disposal systems can be protected by burying the distribution pipes and seepage beds, pits, or trenches below the expected level of erosion and scour. If applicable health codes or ordinances do not permit the burial of the disposal system components to a depth protected from erosion and scour or allow them in the floodplain at all; then an acceptable alternative disposal site or method must be chosen.

In addition to the problems caused by erosion and scour, leach fields can be rendered inoperable if the surrounding soil becomes saturated. Leach fields rely on surrounding soil that can accept additional moisture to operate properly. If the surrounding soil cannot accept additional moisture, the leach field will not drain and the septic system will begin to back up. Resolving this type of situation can be very difficult because it is a function of several different factors including soil types, stratification, leach field depth, and water table depth. Therefore, recommendations to remedy this situation are not included in this manual, rather, a qualified sewer designer, who is familiar with local soil conditions, should be consulted.

Elevated Treatment Tanks

An effective strategy for protecting on-site sewage treatment and disposal systems from the effects of velocity flow and wave action is elevation of these systems above the DFE. However, the size and weight of the components involved and the need to design most systems for gravity flow from the collection system down to the treatment system make this strategy very expensive, and impractical except in extreme conditions. This strategy has, in fact, only been considered and applied in some V Zone areas where State and/or local regulations do not permit septic tanks to be located below ground.

An elevated treatment tank, as shown in *Figure 3.43H*, is a fiberglass or plastic tank located within the structure above the DFE. From the collection system, sewage is introduced into the tank by gravity flow and/or by ejector pump. The two most common types of elevated tanks are the Aeration Treatment Tank and the Solids Separation Tank**.**

> **CAUTION:**
> The use of aboveground sewage treatment tanks may not be permitted under State and/or local building codes and health regulations. Consult local officials to determine if this technique is permitted.

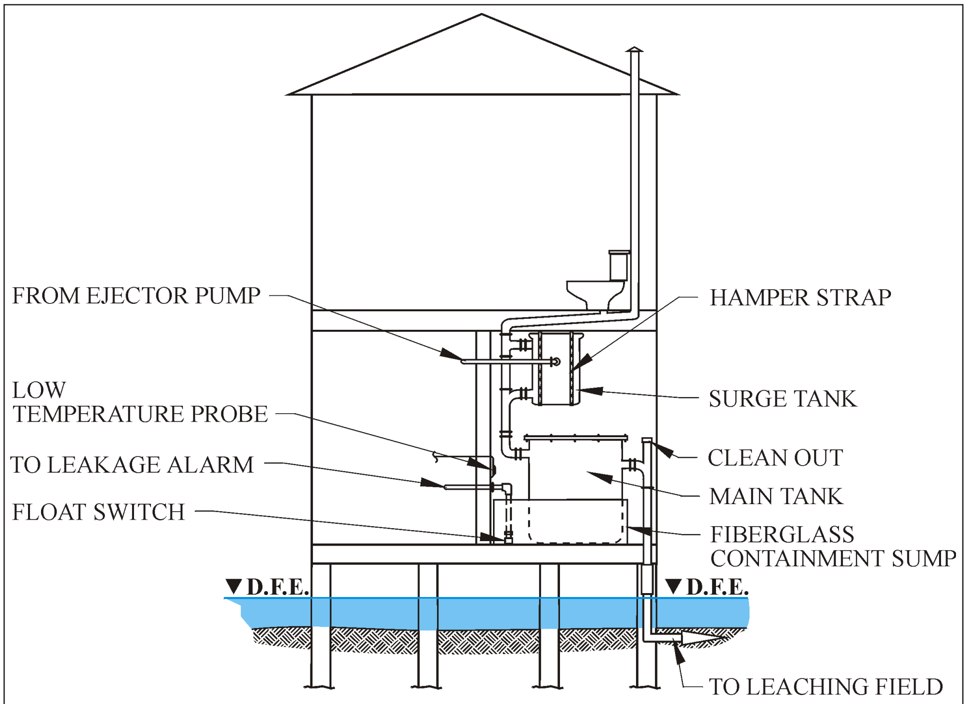


Figure 3.4.3H: An on-site sewage management system using an elevated treatment tank within a V Zone

Air is pumped into the aeration treatment tank to accelerate the digestion of the solids in the sewage by bacteria that thrive in the presence of oxygen, and the oxidization of some of the elements in the sewage into more manageable compounds.

The solids separation tank functions just like a typical septic tank. The solids are allowed to settle to the bottom of the tank where they are anaerobically digested over time.

In both cases, the sewage in the tank is either conveyed to underground leach fields or pumped out periodically and transported to a public treatment and disposal facility.

NOTE:

FEMA Publication 257 – *Mitigation of Flood and Erosion Damage to Residential Buildings in Coastal Areas* contains information on the State of Massachusetts' sewage management program enforced in V Zones.

Since the tank is located within the building, the operation of the system must be closely monitored to ensure maximum safety. These design techniques are currently being used in some structures in some coastal communities in Massachusetts where building codes prohibit the location of underground structures such as septic tanks and leach fields in dune areas.

Elevated treatment tanks eliminate the risks presented by velocity flow to sewage treatment systems because none of the components is likely to come in contact with any floodwaters below the DFE. The use of elevated treatment tanks can, however, be an expensive solution.

3.4.4 Collection Components

Sewage can back-up into a building in one or a combination of the following situations:

- Where floodwaters infiltrate the sewer system by entering through non-watertight manholes and pipe connections, and breaks in the lines, thus surcharging the sewer.
- Where a building is connected to a publicly owned combined sewer. If the combined sewer located uphill becomes overloaded and surcharged, as in a heavy storm, sewage could back-up into the structure up to the level of the effluent in the sewer.
- Where an off-site sewage pump station, fails due to loss of power. In some cases, a building may not be inundated by floodwaters, but a failed pump station will cause sewage to backup into the building.

These situations are typically caused by failures or ruptures of the collection components.

Elevation

Sewage back-up into a building located in a flood-prone area can be minimized by elevating all of the collection system components within the structure above the DFE. Elevation can be achieved by locating the components on or above the lowest floor that is above the DFE. However, this method is only effective where the back-up is not caused by the surcharge of sewers located uphill at an elevation higher than the lowest drain into the sewage collection system within the elevated building. Where surcharge of the sewer is due to an uphill overload or a failed pumping station, alternate methods, such as a backflow prevention valve or gate, must be investigated to protect collection system components.

Component Protection

Valves

Sewage back-up that cannot be prevented by elevation of the collection system components above the DFE is common in communities with combined sewer/stormwater collection systems.

In a situation where the existing building is connected to a gravity-flow combined sewer main downhill from other storm water collection points, sewage back-up is best prevented by installing a valve or gate in the service connection pipe, as shown in *Figure 3.4.4A*. The two types of valves that are often used for this purpose are the Check Valve/Non-Return Valve and the Gate Valve.

A **check valve** allows flow in only one direction. Flow from the opposite direction automatically shuts the valve. Installing a check valve in the sewer service feed pipe ensures that sewage can flow out of the collection system into the public sewer or the on-site treatment system during non-flood conditions but cannot flow back into the building during conditions of flooding.

A **gate valve** must be operated either manually or electrically. When open, a gate valve allows flow in either direction; when closed, a gate valve prevents flow in either direction.

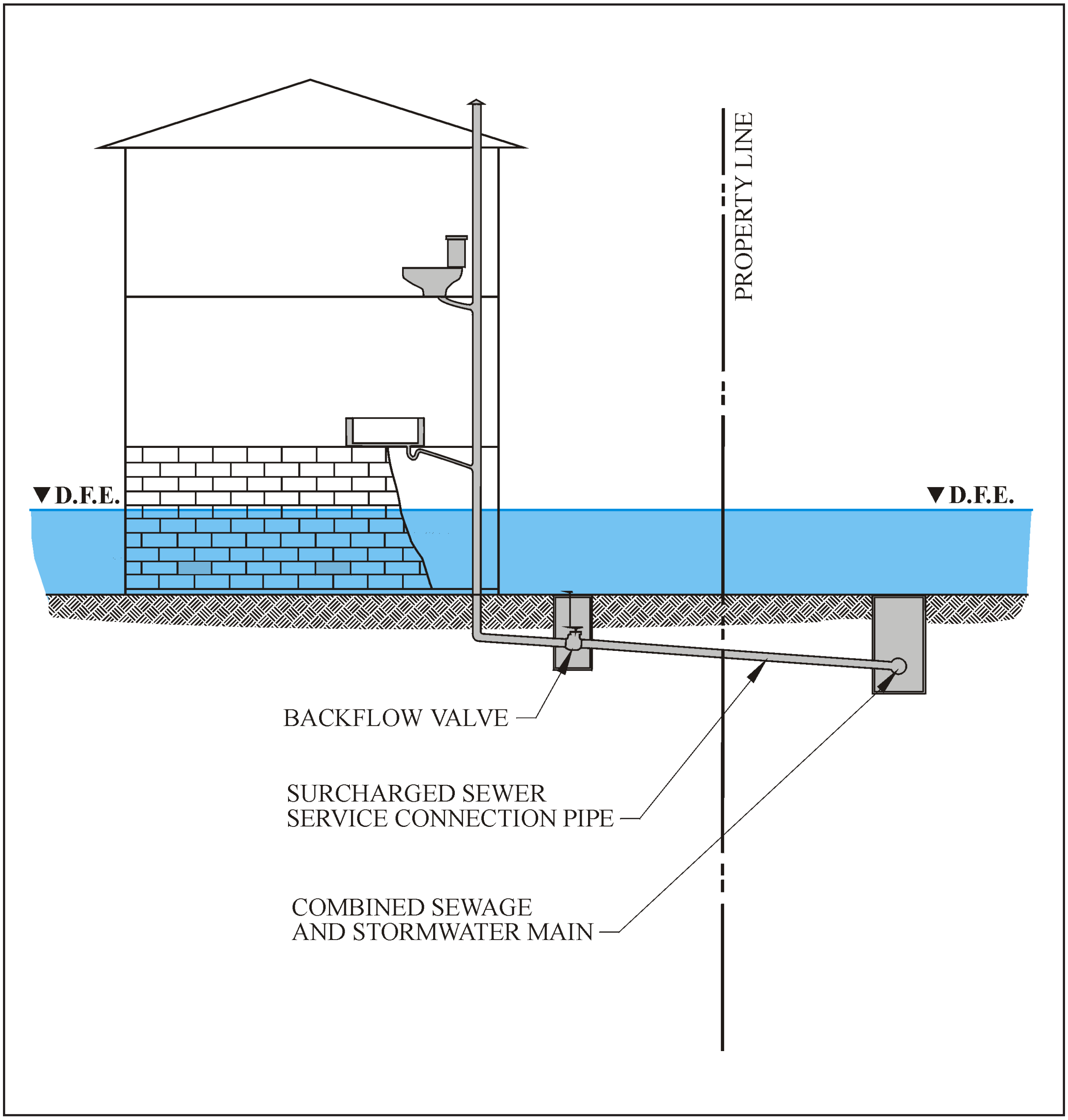


Figure 3.4.4A: Backflow conditions with non-return backflow valve installed

For the best protection against sewage backup, a combination of a check valve and a gate valve should be installed, as shown in *Figure 3.4.4B.* The operation of a check valve can be impaired by the accumulation of debris at the valve opening; while a gate valve is less likely to be affected by debris. With a combination of the two types of valves in use, backed-up sewage would shut the check valve automatically. Then, closing the gate valve either manually or electrically can seal the pipe.

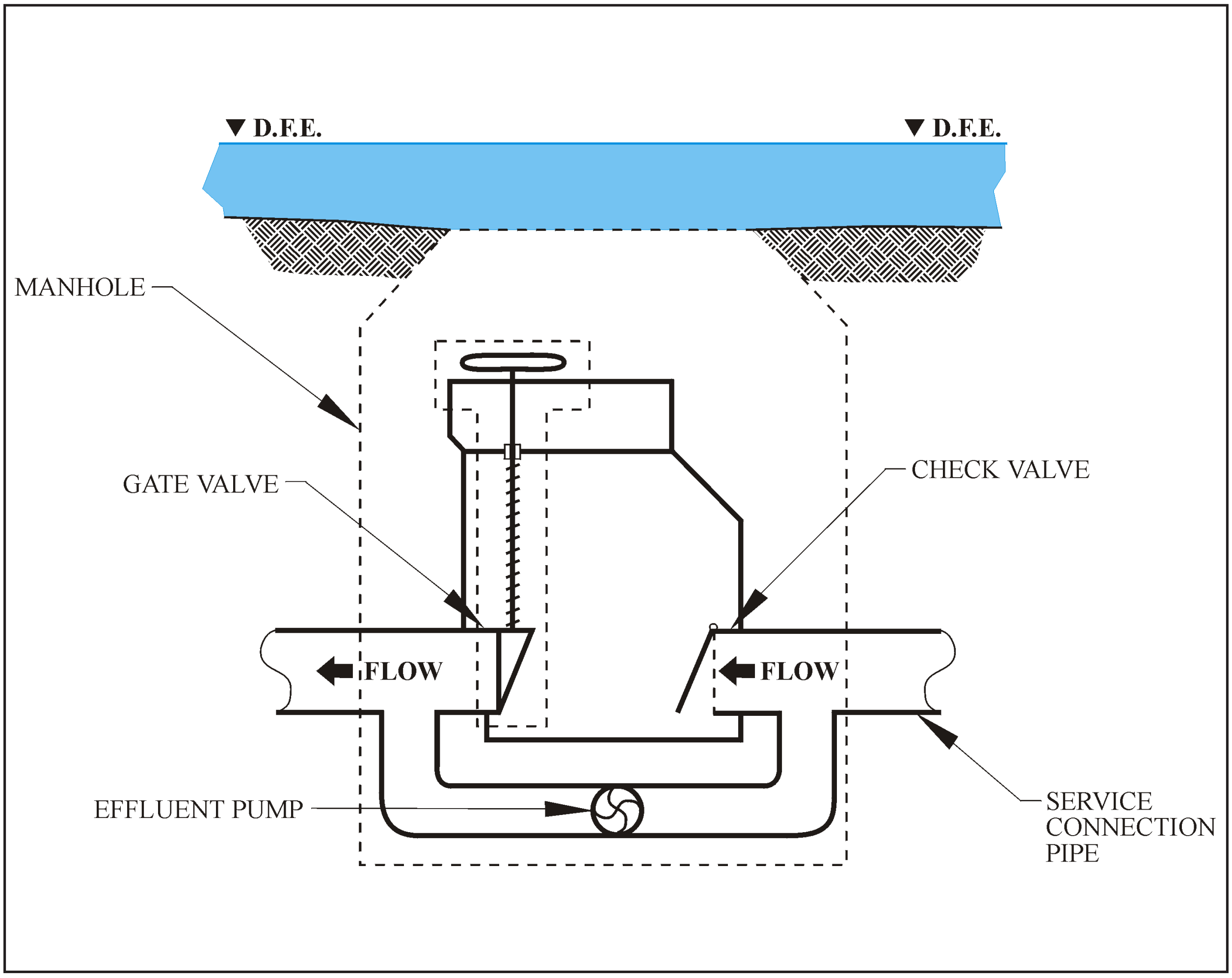


Figure 3.4.4B: Backflow valve—a check valve and gate valve with an effluent pump bypass

The local sewer utility typically controls the location of these valves. The building owner is typically responsible for all sewage components from the cleanout at the property line towards the building. The utility normally owns the system portion that extends from the cleanout at the property line all the way back to the sewer treatment plant. The location of the valve will be dictated by whomever is responsible for the installation and maintenance of the valve.

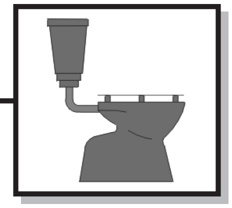
In a building elevated on pilings, the valves should be installed in the vertical service feed pipe between the bottom of the lowest floor and the ground. In a building elevated on a crawl space, the valves can be installed in the service connection pipe either between the bottom of the lowest floor and the ground, or just outside the structure envelop. In a structure on a slab-on-grade, the valves should be installed in the service connection pipe just outside the structure envelope and enclosed in a manhole.

In a floodproofed non-residential structure with a basement in a Zone A, the valves could be installed inside the basement just before the pipe penetrates either the outer wall or the floor. However, typically, these valves are located outside of a building.

Sewer Service Connection Pipe

The sewer service connection pipe is the part of the sewage collection system into which all of the sewage collection pipes within a building deliver effluent. The sewer service connection pipe delivers the effluent to either the public sewer or to the on-site treatment system. In an elevated building, this pipe is often the most vulnerable part of the sewage collection system because it is exposed from the bottom of the lowest floor to the ground. In a V Zone or a high-velocity A Zone, this length of pipe is at risk of being damaged, dislodged, or broken by velocity flow, wave action, and debris impact. The service connection pipe can be protected using on of the following three methods:

1. The sewage collection pipe can be protected from flood damage by attaching it onto the landward or downstream side of a vertical supporting structure (wall, pillar, pile, or column) using straps, as shown in *Figure 3.4.4C.* The vertical supporting structure provides support and protection from the direct impact of debris, wave action, and velocity flow. In coastal zones where salt water and salty air can accelerate corrosion, the straps attaching the pipe onto the vertical supporting structure should be of non-corrosive material.



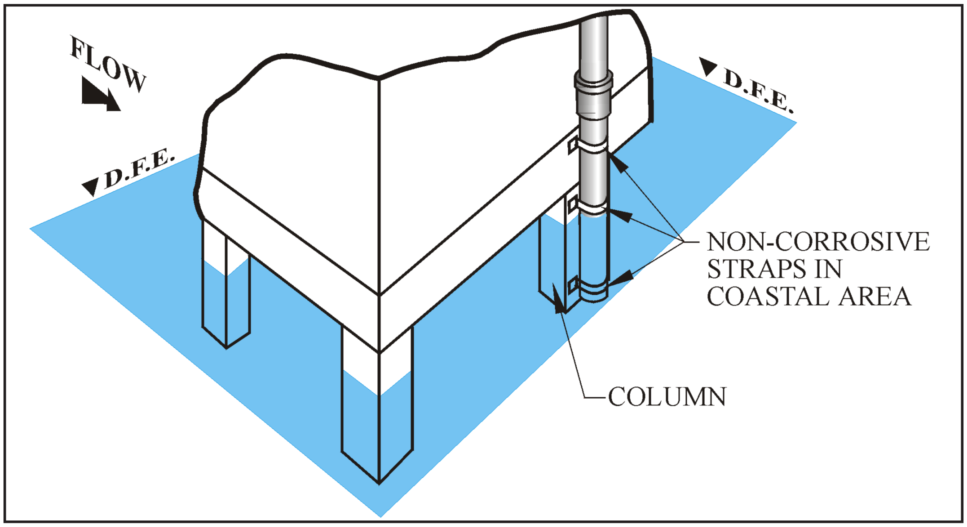


Figure 3.4.4C: A service connection pipe strapped to a pile

2. Another flood-resistant design technique involves enclosing the service connection pipe inside a concrete or masonry utility shaft extending from ground level to a point above the DFE, or to the bottom of the lowest floor, as shown in *Figure 3.4.4D*. This protects the pipe

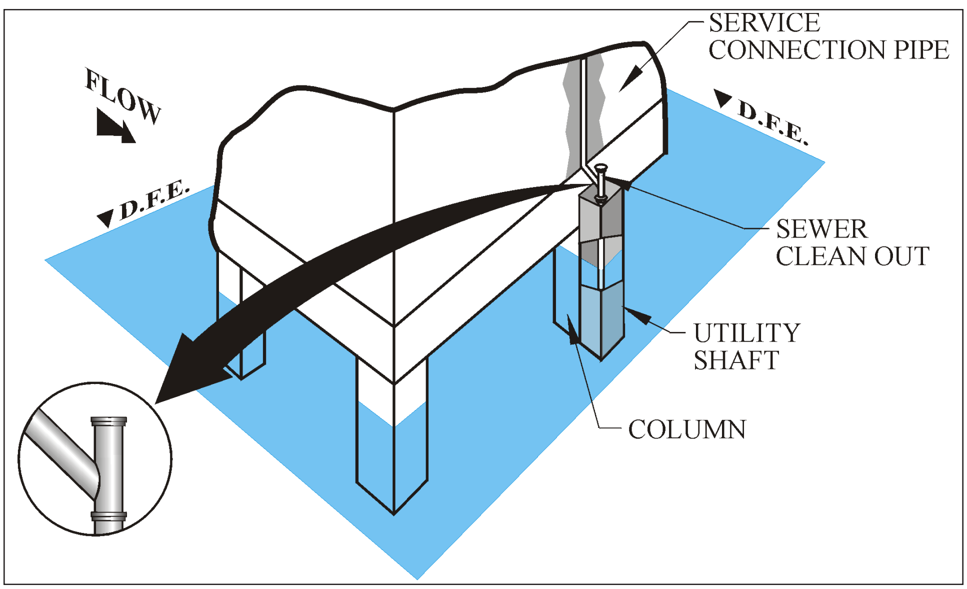


Figure 3.4.4D: A service connection pipe enclosed in a utility shaft

NOTE:

For clarity, the utility connections have been shown on the exterior of the building. For maximum protection of the utility connection, it should be located adjacent to a vertical member underneath the building.

from debris impact, velocity flow, and wave action. Such a utility shaft could also contain other utility service connection lines, and it should have holes at the bottom to allow water to drain out.

3. The service connection pipe can also be enclosed within a shaft built around the pipe using metal stud framing with cement board and stucco, as shown in *Figure 3.4.4E.* The pipe and shaft must be attached to the landward or downstream side of a column or non-breakaway wall.

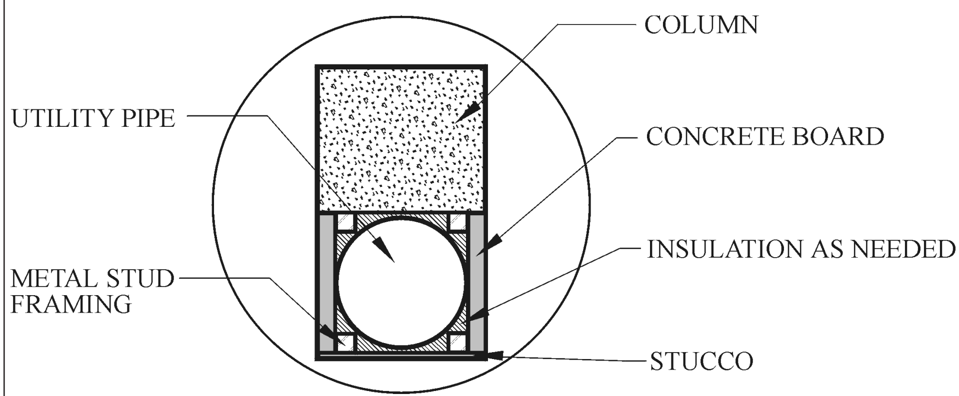


Figure 3.4.4E: Top view of utility shaft made of metal framing with cement board and stucco

3.4.5 Conclusion

When the sewage management system of a building is properly protected from flood damage, the structure can be brought back into operating order more quickly. *Figures 3.4.5A* and *3.4.5B* are flow charts designed to assist with the design of flood-resistant sewage management systems in new and substantially improved buildings. *Tables 3.4.5A* and *3.4.5B* are checklists intended to aid in the assessment of the sewage management system of an existing or proposed building. In addition, a sketch sheet is included that can be used to make additional notes about the system. With a proper assessment of a building and some careful planning before a flooding event occurs, the damage to the on-site components of the sewage management system can be minimized.

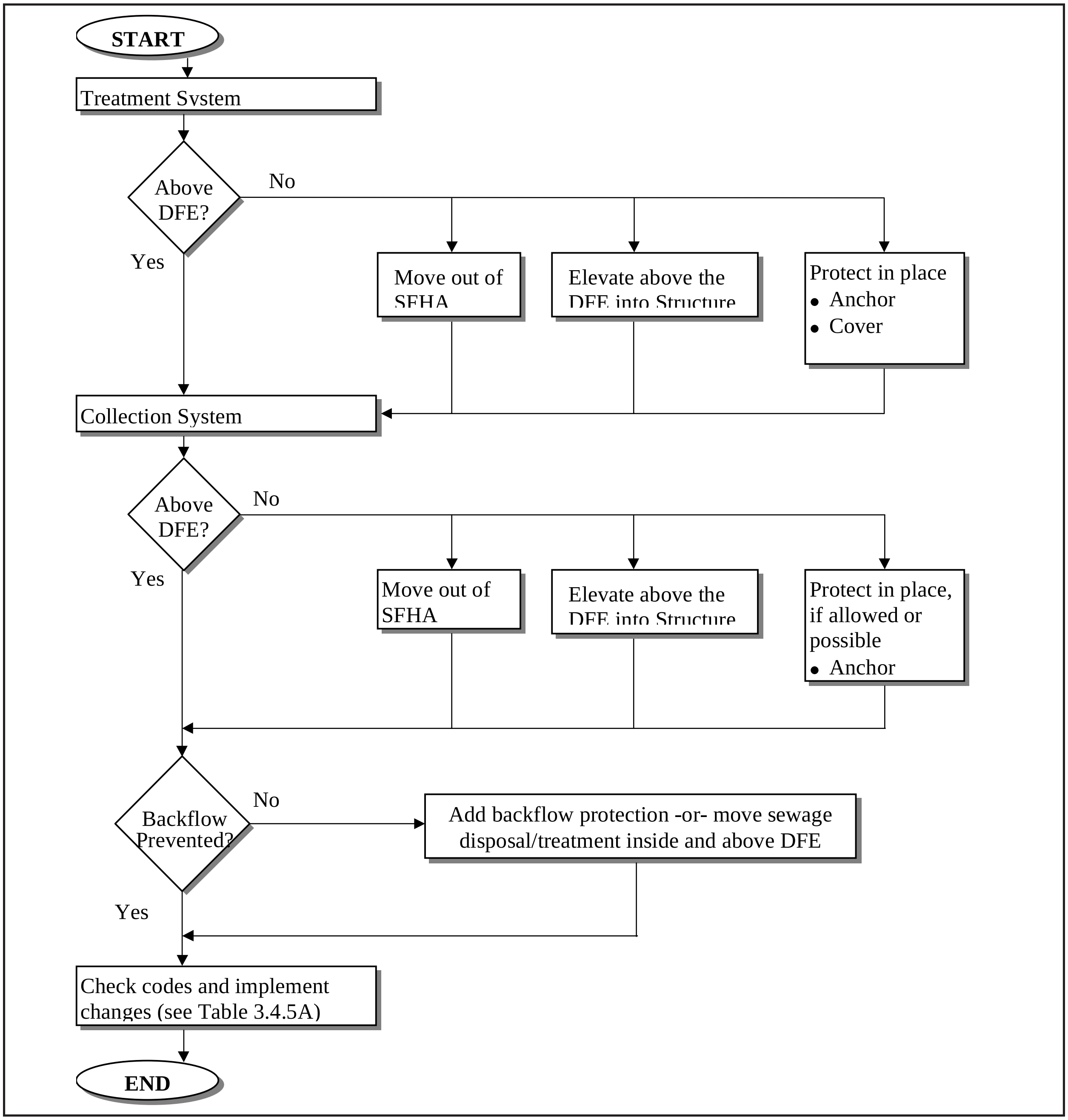
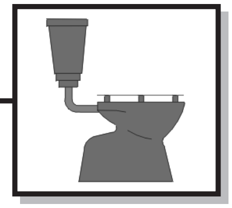


Figure 3.4.5A: Flow chart of on-site flood resistant sewage management system design



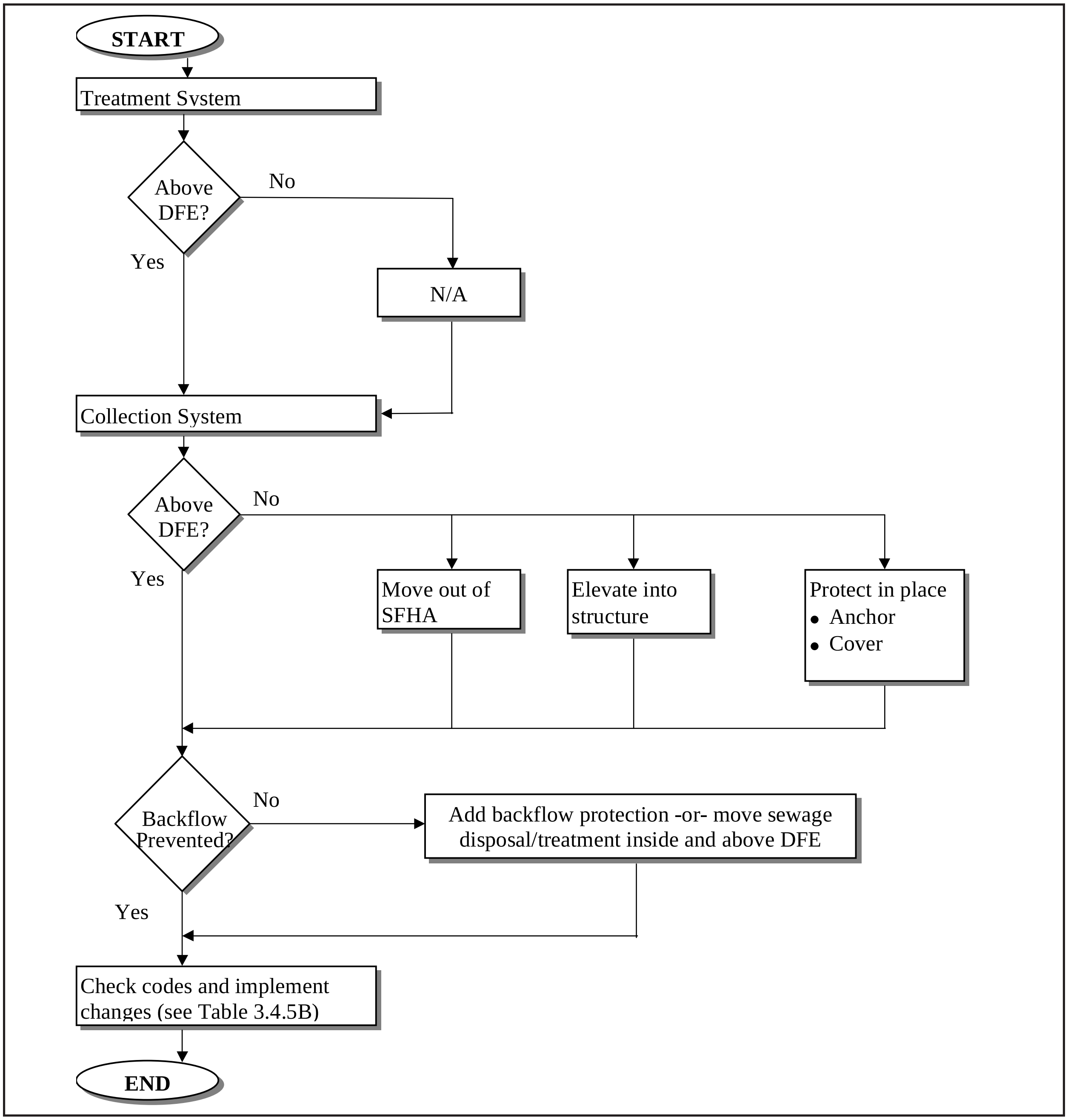


Figure 3.4.5B: Flow chart of off-site flood resistant sewage management system design

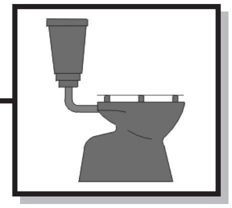
FLOOD RESISTANT ON-SITE SEWAGE MANAGEMENT SYSTEM CHECKLIST

Property ID:	Property Contact:
Property Name:	Interviewed:
Property Address:	Phone:
Surveyed By:	Date Surveyed:
DFE:	

Is the leach field located in the SFHA? ☐ Yes ☐ No Is it protected from erosion and scour? ☐ Yes ☐ No; Description:
Is the distribution box located in the SFHA? ☐ Yes ☐ No Is it protected from erosion and scour? ☐ Yes ☐ No; Description:
Is the septic tank located in the SFHA? ☐ Yes ☐ No Is it protected from erosion and scour? ☐ Yes ☐ No; Description: Is it protected from impact? ☐ Yes ☐ No; Description:
Is the building's sewer connection pipe protected from impact? ☐ Yes ☐ No Description:
Is the system equipped with a storage tank, ejector pump or backflow prevention valve? Description: Who is responsible for it?
Is the system composed of another on-site treatment system? ☐ Yes ☐ No Description:
Are all of the drains within the structure located above the DFE? ☐ Yes ☐ No Description:
• What equipment is located beneath the DFE?

☐ Septic Tank	☐ Distribution Box	☐ Connection Pipe	☐ Ejector Pump	☐ Storage Tank	☐ Backflow Valve
☐ Drain:	☐ Other:				

Table 3.4.5A: Checklist for on-site flood resistant sewage management system design



FLOOD RESISTANT OFF-SITE SEWAGE MANAGEMENT SYSTEM CHECKLIST

Property ID:	Property Contact:
Property Name:	Interviewed:
Property Address:	Phone:
Surveyed By:	Date Surveyed:
DFE:	

Is the building's sewer connection pipe protected from impact? ☐ Yes ☐ No Is it protected from erosion and scour? ☐Yes ☐ No Description:
Is the system equipped with a storage tank, ejector pump or backflow prevention valve? Description: Who is responsible for it?
Are all of the drains within the structure located above the DFE? ☐ Yes ☐ No Description:
• What equipment is located beneath the DFE?

☐ Connection Pipe	☐ Storage Tank	☐ Ejector Pump	☐ Backflow Valve	☐ Drain:	☐ Drain:
☐ Other:	☐ Other:				

Table 3.4.5B: Checklist for off-site flood resistant sewage management system design

Sketch sheet
(for details, notes, or data regarding system installations)