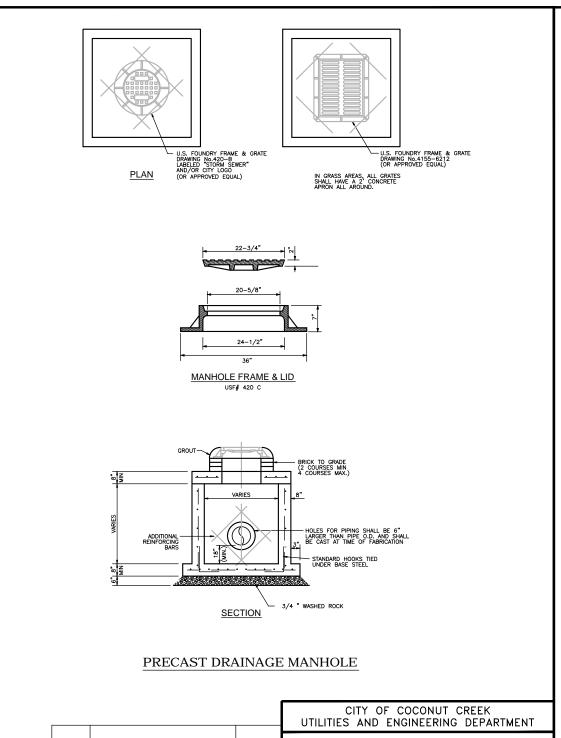
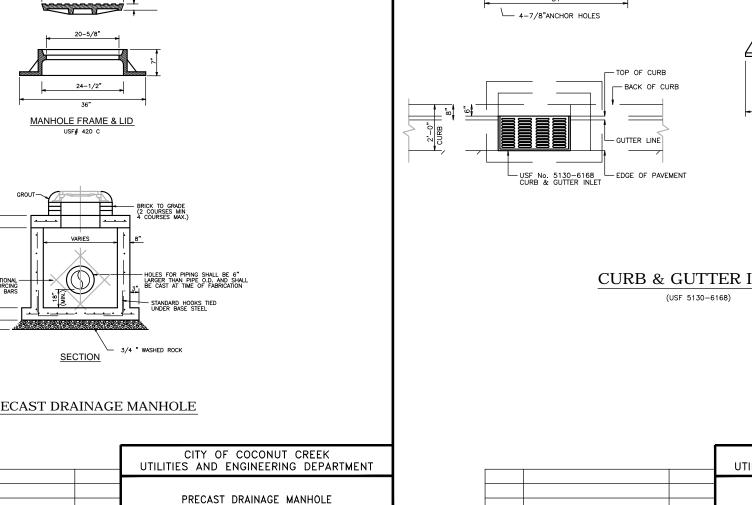
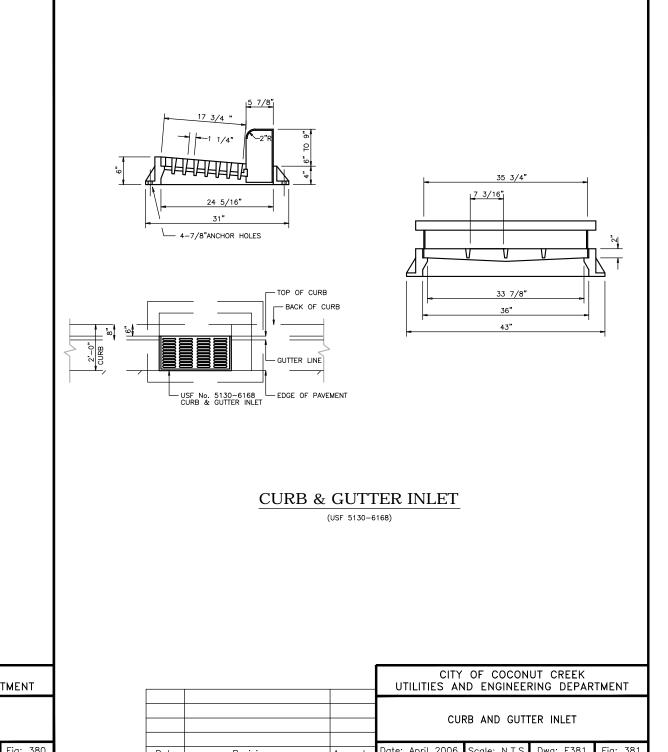
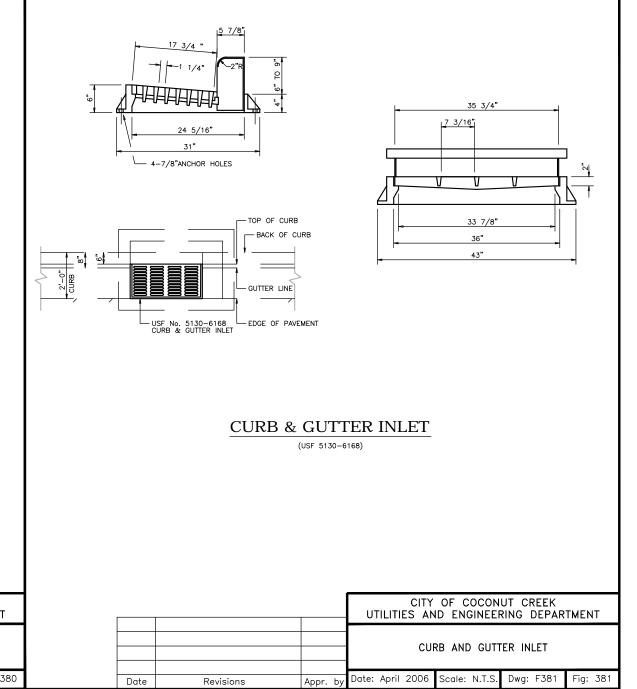


PRECAST CATCH BASIN











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CHAPTER 6: BEST MANAGEMENT PRACTICES FOR STORMWATER MANAGEMENT In a trench system where perforated pipe is used, a non-perforated section some 6 to 8 feet (1.8 to 2.4 m) in length is used to connect the trench to the catch basin or inlet. This procedure serves to prevent piping near structures and subsidence around the inlet. A concrete slab is generally placed around the catch basin or inlet. In the design of a trench system, any one of the above types, or a combination, may be used. A positive overflow pipe or bypass is also recommended to allow for large storm

Construction Specifications

Trench construction techniques vary with local site conditions. Strict adherence to the Occupational Safety and Health Administration's (OSHA) Trench Safety Code, and/or other local regulations relative to acceptable construction practice, should be observed. Depending on the length and width of the trench, a backhoe, wheel, or ladder-type trencher may be used for excavation. Excavated material should be stored at least 10 feet (3 m) from the trench to avoid backsliding and cave-ins. **General Construction Recommendations**

Proper construction and routine maintenance are extremely important for success trench applications. A substantial number of trenches have failed shortly after being built, primarily due to poor construction practices or inadequate field testing, or because sediment was not filtered or trapped before entering the trench. The following construction and erosion control procedures should minimize the risk of premature

- Before the entire development site is graded, the area planned for the trench should be roped off to prevent heavy equipment from compacting the underlying soils.
- 2. Diversion berms should be placed around the perimeter of the trench during all phases of construction. Sediment and erosion control plans for the sile should be oriented to keep sediment and runoff completely away from the trench area. Otherwise, the actual construction of the trench should not begin until after the site is completely stabilized.
- The trench should be excavated using a backhoe or trencher equipped with tracks or oversized tires. Normal rubber tires should be avoided, since they compact the subsoil and may reduce infiltration capability. For he same reason, the use of bulldozers or front-end loaders should be
- Sediment control is critical, and thus it is important that sediment and erosion controls be inspected following each storm to make sure they still work. If a vegetated buffer strip is planned for the pretreatment of runoff entering the facility, grass should be established immediately, preferably by sodding. When hydroseeding is used, reinforced silt fences must be placed between the buffer and trench to prevent sediment entry before the

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Unless the facility is designed to accommodate the total amount of anticipated runoff from a large design storm, some provisions should be made for overflow. To provide the maximum benefit in reducing downstream flood peaks, these structures should be designed to overflow before the total storage capacity is reached. There are many ways to accomplish this. Pipes can be used, for instance, to connect a sequence of infiltration facilities, so that when the first one fills, it passes water through to the next one, and so

Generally, several smaller facilities are more effective than one large facility, though the latter may be necessary when there are space limitations. The capacity and cost of overflow discharge systems can be reduced by allowing temporary storage space above the infiltration trenches.

Because of the small drainage areas controlled by the exfiltration trench, an emergency spillway usually is not necessary. In all cases, however, the overland flow path of any surface runoff exceeding the capacity of the trench should be evaluated to preclude the

Seepage Analysis and Control An analysis shall be made to determine any possible adverse effects of seepage zones when there are nearby building foundations, roads, parking lots, or sloping sites.

Developments on sloping sites often require the use of extensive cut-and-fill operations. The use of infiltration trenches on fill sites with steep slopes is not recommended. Fill areas can be very susceptible to slope failure due to slippage along the interface of the undisturbed soil and the fill material. This condition could be further aggravated if the fill material is allowed to become saturated using retention practices. The methods for seepage analysis and the estimation of infiltration rates using Darcy's law and flow nets can be used to conduct the seepage analysis.

When exfiltration trenches are used in residential areas, special care must be taken to prevent seepage from causing unstable soil conditions near foundations. Trenches 3 or more feet (> 0.9 m) deep shall be located at least 10 feet (3 m) downgradient from foundation walls. Trenches should also be no closer than 100 feet (30 m) from wells or

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Trench construction criteria for three different soil and geologic conditions are as follows:

Exfiltration facilities cut into permeable rock are often used in the Miami vicinity. These

trenches are the least expensive infiltration system to construct; however, the following

The inlet to the system can be placed directly over the slab cover, with discharge directly

into the trench. A more acceptable method is to set the inlet and catch basin adjacent to the trench and pipe the inflow to the trench. This technique lessens the introduction of

debris into the system. Manhole access must be provided to facilitate cleaning and

aggregate between the pipe and trench wall prevents sidewall collapse and distributes

usually 4 to 5 feet (1.2 to 1.5 m) wide and deep enough to reach a permeable soil layer.

Coarse aggregate or other free-draining material is generally placed in the bottom of the trench and brought up to a specified pipe flowline grade, generally a minimum of 2 feet

(60 cm). Perforated or slotted pipe is then placed in the trench, which is backfilled with coarse aggregate to the design storage elevation. A typical Dade County installation includes a 6 inch (15 cm) thickness of finer-textured filter material or pea rock placed

over the aggregate backfill. The trench is normally covered with a geotextile to prevent

These trench cross-sections are typical of most installations in extreme southern Florida

he configuration is applicable in other areas where the soil or substrate is stable and

provides sufficient infiltration capacity. Even where infiltration rates are marginal, the

system could supplement the drainage requirements of a positive outfall system by

Although trenches in cohesionless soil require a different type of construction, the

design, final shape, and size are the same as for a trench in stable soil. However, side slopes of 1.5:1 or 2:1 may be required, if the walls are not shored during construction.

Filter cloth must be used along the periphery of the trench to prevent the migration of soil fines into the coarse aggregate backfill.

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cted water to the trench walls. Whether the pipe is included or not, the trench is

1. The rock must be able to support a specified wheel load on a covering

2. The rock must be amenable to excavation without blasting.

Types of Infiltration Trenches

concrete slab or other suitable cover.

downstream requirements of the positive system.

3. Trenches in Cohesionless Soil or Sand

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Synthetic Filter Fabrics

When fine native materials are encountered in the excavation, a filter cloth envelope or wrap should be placed around the coarse aggregate backfill. This practice prevents the migration of fine sediments from the surrounding soil that could clog the trench following reverse flow conditions resulting from high ground water. A number of plastic woven or nonwoven filter fabrics can be used for this purpose. However, care should be taken to prevent tearing or puncturing the fabric. Likewise, adjacent sheets should be overlapped 12 to 18 inches (30 to 45 cm) and secured to prevent openings from developing.

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Figure 6.4a. Cross-Section of Typical Infiltration/Exfiltration System for

Parking or Roads

Source: Dyer, Riddle, Mills and Precourt, Inc., Engineers/Surveyors

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sediment buildup, which reduce their hydraulic efficiency and storage capacity to

To ensure good performance, synthetic fabrics (either woven or nonwoven) must be carefully selected, based on the properties required. As with aggregate filters, fabric filters must provide two very important functions, as follows:

 They must be able to prevent clogging of the drain by the migration of erodible soil or other material from the substrate into the trench, which could also result in erosion, piping, or other problems. 2. They must not inhibit the free flow of water.

Care should be taken in selecting the proper kind of filter fabric, as available brands differ significantly in their permeability and strength. If desired, a 6 inch (15 cm) deep filter of clean, washed sand may be substituted for filter fabric on the bottom of the

Likewise, the use of filter fabric directly surrounding slotted, corrugated polyethylene pipe has recently become a popular derivation of the typical exfiltration trench design. In these facilities, the sedimentation and filtration of particulates larger than the silt/clay size range take place within the perforated pipe. Consequently, the pipe is more prone to clogging, and large reductions in capacity occur more often than usual. While this may seem unacceptable, manufacturers point out that the pipe may be cleaned relatively easily using high-pressure hoses, vacuum systems, etc. On the other hand, conventional designs usually require complete replacement when clogging eventually

Observation Well The installation of an observation well is recommended in every infiltration trench. It

serves the following two primary functions:

1. It indicates how quickly the trench dewaters following a storm. 2. It provides a method of observing how quickly the trench fills up with

A simple observation well may consist of perforated polyvinyl chloride (PVC) pipe 4 to 6 inches (10 to 15 cm) in diameter. It is usually located in the center of the facility and is constructed flush with the ground elevation of the trench, as shown in Figure 6.4d. The top of the well should be capped and locked to discourage vandalism and tam

Figure 6.4d. Detailed Schematic of a Typical Observation Well

acing a graduated dipstick down the well immediately after a storm and again 24 and For the first year after the completion of construction, the well should be monitored quarterly and after every large storm. It is recommended that a logbook be maintained, indicating the rate at which the facility dewaters after large storms and the depth of the well at each observation. Once the performance characteristics of the structure have been verified, the monitoring schedule can be reduced to a semiannual basis, unless the

The observation well is needed to monitor the performance of the trench and is also

useful in marking the trench location. The drain time for a trench can be measured

A monitoring well in the top foot (30 cm) of stone aggregate is required when the trench has a stone surface. Sediment buildup in the top foot (30 cm) of stone aggregate or the surface inlet should be monitored on the same schedule as the observation well. The sediment deposited shall not be allowed to build up to the point where it significantly

performance data indicate that a more frequent schedule is required.

reduces the rate of infiltration into the trench.

STORM WATER **DETAILS**

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