CHAPTER 8

INFILTRATION PRACTICES

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DEFINITION

Infiltration practices are designed to infiltrate surface runoff into the ground. These devices include both infiltration trenches and infiltration ponds. An infiltration trench is a subsurface trench filled with stone to which runoff is either piped directly or flows overland. An infiltration basin is an open area to which the runoff is discharged and allowed to pond while infiltrating through the sides and bottom of the basin.

EFFECTIVENESS

Infiltration practices have a lot to recommend them, as they can more closely achieve the goal of no change from the predevelopment to post-development runoff hydrology than other methods. By infiltrating the runoff, the pollutants will be removed in the soil and the stream hydrology maintained. However, infiltration practices have a major drawback, their high maintenance requirements. Studies by the Maryland Department of the Environment in 1986 and 1990 revealed that of those surveyed 48% of the basins and 80% of the trenches were functioning as designed in 1986 and only 38% of the basins and 53% of the trenches were functioning as designed in 1990 (1986 & 1990). The 1990 survey was a followup of the 1986 survey. These surveys are of importance as Maryland has been a leader in stormwater management in general and stormwater infiltration in particular. The Maine Department of Environmental Protection (1989) recommends the selection of infiltration practices only after exhausting other alternatives.

The United States Environmental Protection Agency (1993) lists the following percent removals for infiltration devices:

Infiltration trenches

Pollutant	TSS	TP	TN	COD	Pb	Zn	Factors
Average	75	60	55	65	65	65	Soil perc rates
Reported range	45 - 100	40 - 100	(-10)-100	45 - 100	45 - 100	45 - 100	Storage volume
Probable range SCS Group A Group B	60 -100 50 - 90	60 - 100 50 - 90	60 - 100 50 - 90	60 - 100 50 - 90	60 - 100 50 - 90	60 - 100 50 - 90	Trench surface area
No. Values	9	9	9	4	4	4	

Infiltration basins

Pollutant	TSS	TP	TN	COD	Pb	Zn	Factors
Average	75	65	60	65	65	65	Soil perc rates
Reported range	45 - 100	45 - 100	45 - 100	45 - 100	45 - 100	45 - 100	Storage volume
Probable range SCS soil Group A Group B	60 - 100 50 - 80	60 - 100 50 - 80	60 - 100 50 - 80	60 - 100 50 - 80	60 - 100 50 - 80	60 - 100 50 - 80	Basin surface area
No. Values	7	7	7	4	4	4	

PLANNING CONSIDERATIONS

Infiltration devices should only be selected after all other methods of providing stormwater treatment have been evaluated and eliminated. Infiltration devices should be used on small watersheds (up to 25 acres) that do not have a permanent source of base flow and are not subject to erosion.

The infiltration device should be constructed in soils with a percolation rate not less than 0.5 inches per hour. Depth to seasonal high ground water and bedrock should be at least 4 feet from the bottom of the device.

Infiltration devices should be preceded by a pretreatment device such as vegetated filter strip, treatment swale, or water quality inlet. Infiltration devices should not be used in well head protection areas. Infiltration devices should only be designed for residential and retail type commercial developments. They should not be utilized at industrial sites or petroleum storage or dispensing sites.

Infiltration devices should be capable of infiltrating the design storm within 72 hours. Consideration of frozen ground conditions in both the contributing watershed and infiltration basin must be made during the design. The infiltration device should not have runoff directed to it until the contributing watershed is stabilized. As the failure rate is high, provisions must be made to handle the stormwater runoff as though the infiltration device is non-existent.

The United States Environmental Protection Agency (1993) lists the following advantages and disadvantages:

Infiltration Trenches

ADVANTAGES

-Provides groundwater recharge
-Can serve small drainage areas
-Can fit in medians, perimeters, and other unused areas of the development site
-Helps replicate predevelopment hydrology, increases dry weather baseflow, and reduces bankfull flooding frequency

DISADVANTAGES

-Possible risk of contaminating ground water
-Only feasible where soil is permeable and there is sufficient depth to rock and water table
-High failure rate
-If not adequately maintained, can be an eyesore, breed mosquitoes, and create undesirable odors
-Regular maintenance activities cannot prevent rapid clogging of infiltration basins

Infiltration Basins

ADVANTAGES

-Provides ground water recharge
-Can serve large developments
-High removal capability for particulate pollutants and moderate removal for soluble pollutants
-When basin works, it can replicate predevelopment hydrology more closely than other options
-Basins provide more habitat value than other infiltration systems

DISADVANTAGES

-Possible risk of contaminating ground water
-Only feasible where soil is permeable and there is sufficient depth to rock and water table
-Since not as visible as other BMP's less likely to be maintained by residents
-Requires significant maintenance
-High failure rate

DESIGN CRITERIA

I. INFILTRATION TRENCHES

An infiltration trench should range from 2 to 10 feet in stone reservoir depth.

The trench system storage volume should be equivalent to the volume of runoff generated by a 2 year-24 hour storm, less expected infiltration.

The maximum storage time(time to drain) should be 72 hours.

The depth to seasonal high water table and bedrock should be at least 4 feet below the bottom of the trench.

The backfill material should consist of a clean aggregate material with a maximum diameter of 3" and a minimum diameter of 1-1/2". Void spaces in these aggregates is assumed to be in the range of 30 to 40%. The aggregate material should be completely surrounded with a geotextile fabric.

An observation well should be installed in every infiltration trench.

All trenches should be excavated using light equipment, taking care not to compact the underlying soils.

A trench can also be used under a grassed swale to improve the performance of the swale. A trench with a grassed surface should consist of at least one foot of soil above the stone.

II. INFILTRATION BASINS

The floor of the basin should be graded as flat as possible to permit uniform ponding and exfiltration. Low spots and depressions should be leveled out. Side-slopes leading to the floor should have a maximum slope of 3:1(h:v) to allow for easier mowing and better bank stabilization.

All basins should have sediment forebays or riprap aprons that dissipate the velocity of incoming runoff, spread out the flow and trap sediments before they reach the basin floor.

The storm drain inlet pipe (or channel) leading to the basin should discharge at the same invert elevation as the basin floor. Similarly, the low flow orifice in an infiltration/detention basin should be set at the same elevation as the basin floor, to prevent baseflow from ponding and thus impeding the function of the basin.

The floor of the basin should be stabilized by a dense turf of water tolerant reed canary grass or tall fescue, immediately after basin construction. The grass turf promotes better infiltration, pollutant filtering, and prevents erosion of the basin floor.

The basin should be excavated with light equipment with tracks or over-sized tires to minimize compaction of the underlying soils. After the basin is excavated to the final design elevation, the floor should be deeply tilled with a rotary tiller or disc harrow to restore infiltration rates, followed by a pass with a leveling drag. Vegetation should be established immediately. The riser, embankment, and emergency spillway should be sized and constructed to the normal specifications for conventional ponds.

A minimum buffer of 25 feet from the edge of the basin to the nearest adjacent lot should be reserved. A landscaping plan should be prepared for the basin buffer that emphasizes low maintenance, water tolerant, native plant species that provide food and cover for wildlife, and when necessary, can act as a screen.

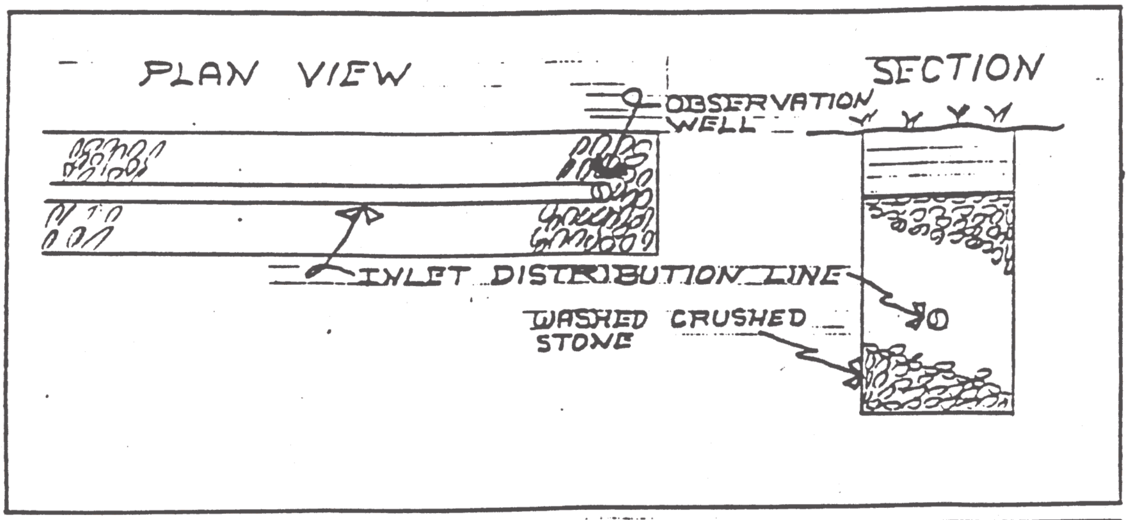
Basin should be equipped with an emergency spillway.

Adequate access to the basin floor should be provided from a public or private right-of-way that can withstand light equipment. Such access should be at least 12 feet wide, and should not cross the emergency spillway.

The basin storage volume should be equivalent to the volume of runoff generated by a 2 year-24 hour storm, less expected infiltration.

Fencing or dense vegetation should be provided to restrict access

Figure 8.1: Schematic of an Infiltration Trench



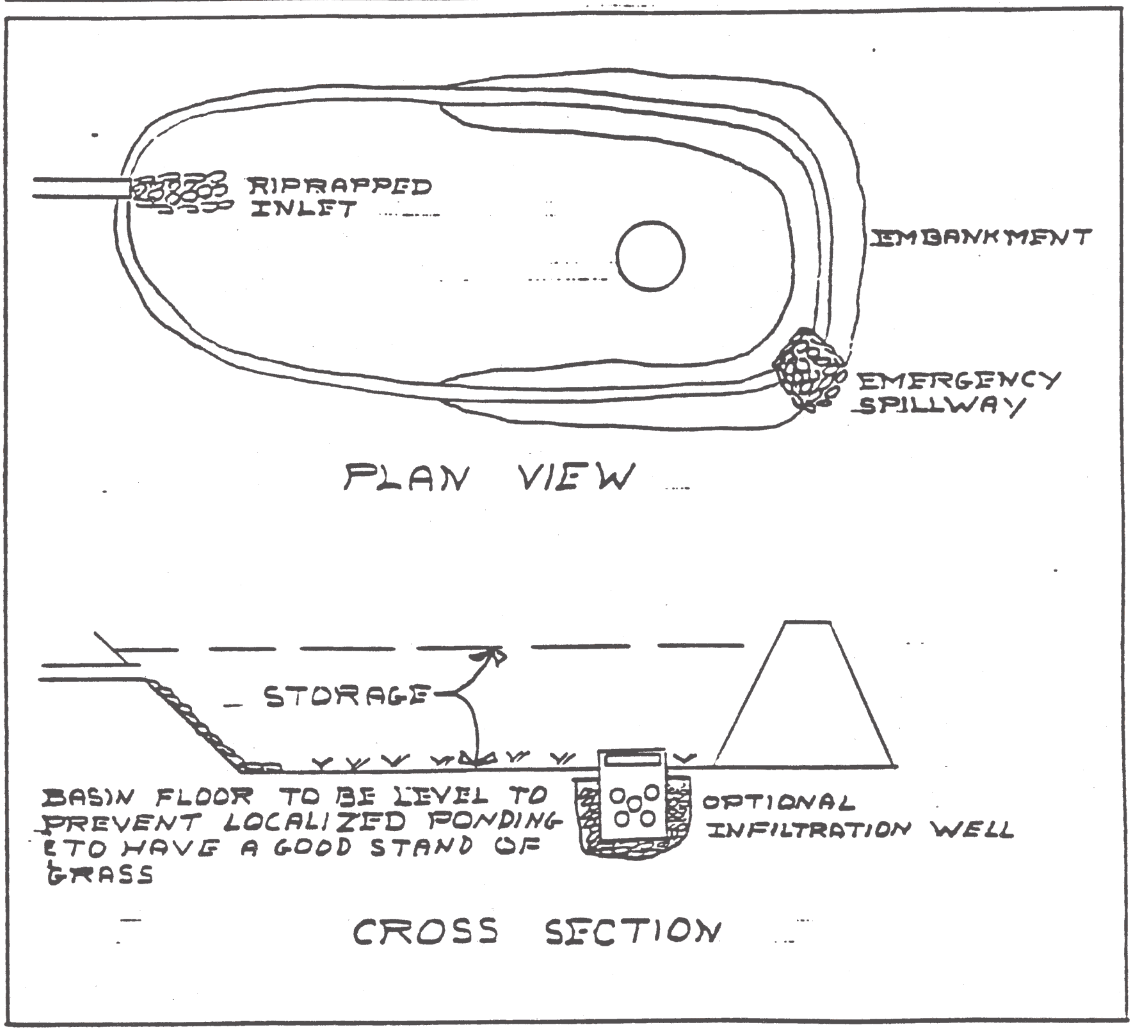


Figure 8.2: Schematic of an Infiltration Basin

MAINTENANCE REQUIREMENTS

Maintenance of infiltration practices is as or more important than maintenance on any other practice. Without adequate maintenance these systems not only fail to meet their design objective but may and have resulted in flooding and associated property damage.

Maintenance responsibilities should be clearly vested, and funds reserved for both routine and non-routine maintenance tasks.

The change in standing water depth above the basin floor or trench bottom over time should be checked after each major storm in the first few months after construction to monitor exfiltration rates. Similar tests should be conducted annually to gage the degree of surface clogging that may occur over the years, and to help in scheduling restorative maintenance. These annual inspections should include removal of accumulated sediments; inspection and maintenance of pretreatment devices; maintenance of a dense grass buffer strip for surface trenches; and partial or total reconstruction in the event of clogging.

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