

Appendix C

STRUCTURAL BMP FACT SHEETS

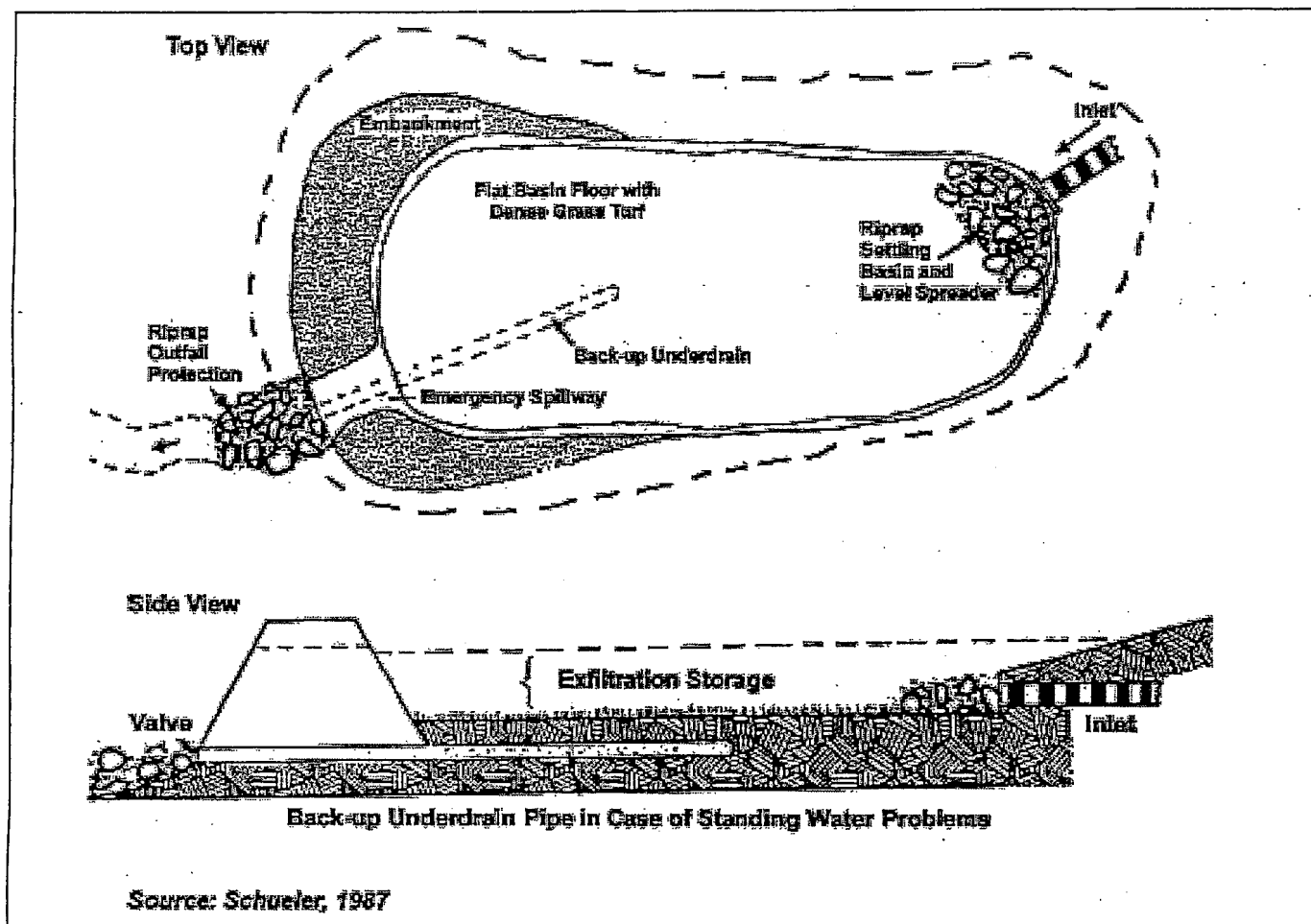
This appendices contains fact sheets that provide a summary for each of the structural BMP options mentioned in the document. These fact sheets are designed as quick-reference guides to be used in the field. - - - - -

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Structural BMP Fact Sheet

SFWMD-BMP-RS-1 - Retention Systems - Dry Retention Basins



DESCRIPTION

- Dry retention basins are depressed areas where incoming urban runoff is temporarily stored until it gradually filtrates into the surrounding soil.

SELECTION CRITERIA

- Deep permeable soils (minimum one-half inch per hour infiltration rate).
- Small drainage area.

LIMITATIONS

- May not be appropriate where ground water requires protection.
- Restrictions may apply to systems located above sole source (drinking water) aquifers.
- Long-term effectiveness in most cases will depend on proper operation and maintenance of the entire system.
- Low longevity.

DESIGN AND SIZING CONSIDERATIONS

- Require a deep layer of permeable soils at separation distances of at least 1 foot between the bottom of the structure and seasonal ground water levels.
- Runoff should gradually drain (infiltrate) down to maintain aerobic conditions that favor bacteria that aid in pollutant removal and to ensure the basin is ready to receive the next storm (check local regulations also).
- Runoff entering the basin may require pretreatment to remove coarse sediment that may clog the surface soil pore on the basin floor.

Targeted Pollutants

Suspended Sediments
Total Phosphorus
Total Nitrogen
Heavy Metals
Oxygen Demanding Substances
Trace Metals
Bacteria

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training
- ☒ High ☐ Low

- Concentrated runoff should flow through a sediment trap
- A vegetated filter strip may be used for sheetflow.
- A design safety factor of 2 is recommended.
- Side slopes of 1:4 are recommended if riding mower is to be used.
- A bottom slope of 2 percent or close to zero is recommended to maximize infiltration.
- To avoid resuspension of settled out solids, nonerosive velocities should be maintained along pond bottoms during peak runoff events.

CONSTRUCTION/INSPECTION CONSIDERATIONS

- ~~Design soil conditions must be confirmed during excavation.~~
- Driving of heavy equipment over retention basin must be avoided during and after construction.
- If retention basin is used for sediment and erosion control during construction, the last one foot at basin bottom should not be excavated to final grade until the entire drainage area has been stabilized.
- After final grading, deep tilling of the infiltration area is recommended to maximize infiltration.
- Stabilize with vegetation within one week after construction.
- Basin bottom should be seeded, instead of sodded, to maximize infiltration.

MAINTENANCE REQUIREMENTS

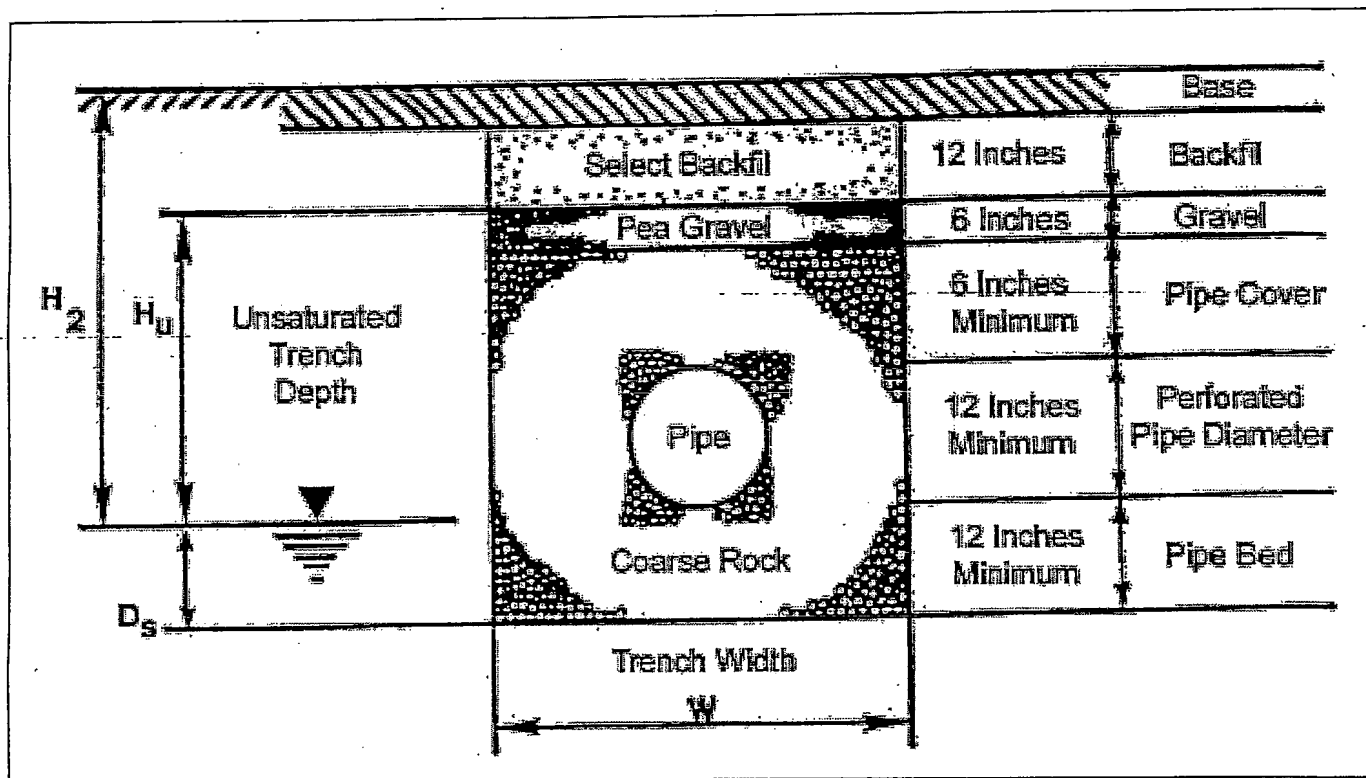
- Facility must be inspected every 6 months or after a major storm event and any debris must be removed.
- Control structure must be inspected and maintained semiannually and repaired as needed.
- Accumulated sediments must be removed at least once annually.
- Rototilling or disking the basin bottom should be done annually.
- Embankments and side slopes must be maintained.
- Use fertilizers only if absolutely necessary.

COST CONSIDERATIONS

- Facility could have ancillary use (recreation) when dry.
- Construction ranges from \$0.50 to \$1.00 per cubic foot.
- Annual maintenance ranges from 3 to 6 percent of capital costs.

Structural BMP Fact Sheet

SFWMD-BMP-RS-2 - Retention Systems - Exfiltration Trenches



DESCRIPTION

Exfiltration trenches are perforated pipes buried in trenches that have been backfilled with stone or sand/aggregate. Urban runoff diverted into the pipe gradually infiltrates from the pipe into the trench and into the subsoil, eventually reaching the ground water.

SELECTION CRITERIA

- Recommended for high density development.
- Deep permeable soils.
- Small drainage area.

LIMITATIONS

- Provides little treatment for high flows.
- Not to be considered towards flood attenuation requirements.
- Restrictions may apply to systems located above sole source (drinking water) aquifers.
- Soil must have good infiltration rates (at least 0.5 inches per hour).
- Low longevity, high maintenance.

DESIGN AND SIZING CONSIDERATIONS

- Filter cloth is required at least around the top and sides of the trench to minimize clogging.
- Minimum trench width is 3 feet.
- Pipe must be at least 12 inches in diameter.
- Ground water table must be at or below invert of pipe.
- A safety factor of two or more should be used to allow for geological uncertainties.
- Inlets connected to the trench should be designed to have sumps.

CONSTRUCTION/INSPECTION CONSIDERATIONS

- Inlets must be covered during construction to minimize sedimentation in the trench.

Targeted Pollutants

Suspended Sediments
Total Phosphorus
Total Nitrogen
Heavy Metals
Oxygen Demanding Substances
Trace Metals
Bacteria

Implementation Requirements

- Capital Costs
- O&M Costs
- Maintenance
- Training
- High ○ Low

MAINTENANCE REQUIREMENTS

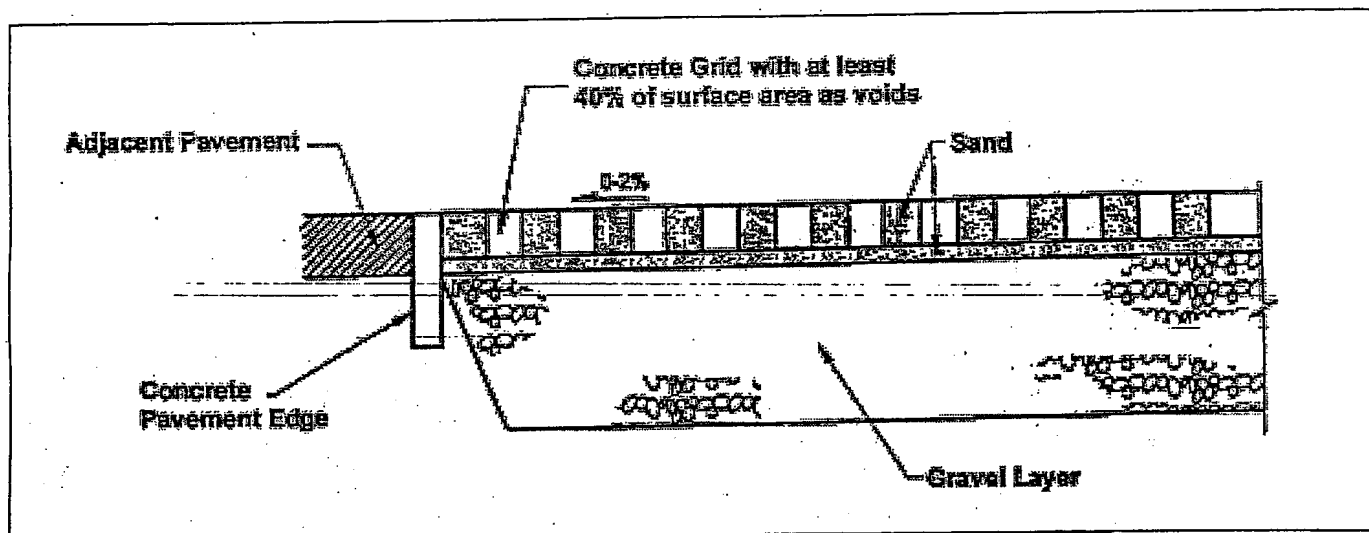
- Trash, grass clippings, and other debris should be removed from the trench perimeter and disposed of properly once a year or as needed.
- Trenches must be inspected regularly and debris removed, especially after large rain events.
- Periodic repair and sediment removal is needed to facilitate exfiltration.

COST CONSIDERATIONS

- Construction costs range from \$2.50 to \$7.91 per cubic foot of treatment volume.
- Annual maintenance is 3 to 20 percent of capital costs.

Structural BMP Fact Sheet

SFWMD-BMP-RS-3 - Retention Systems - Concrete Grid Pavers



DESCRIPTION

Surfaces such as concrete or synthetic grid pavers or blocks interspersed with areas of gravel, sand, or grass serve to reduce runoff volumes and trap vehicle-generated pollutants. They provide a reinforced pervious surface for low traffic parking.

SELECTION CRITERIA

- Recommended for high density development.
- Deep permeable soils.
- Restricted traffic, such as parking or emergency vehicle access only.
- Small drainage area.

LIMITATIONS

- Provides little treatment for high flows.
- Not to be considered towards flood attenuation requirements.
- Restrictions may apply to systems located above sole source (drinking water) aquifers.
- Soil must have good infiltration rates (at least 0.5 inches per hour).

DESIGN AND SIZING CONSIDERATIONS

- Ground water table must be at least 2 feet below grade of pavement.
- To be used only in low traffic or parking areas.

CONSTRUCTION/INSPECTION CONSIDERATIONS

- Gravel layer must be protected during construction to minimize sedimentation.

MAINTENANCE REQUIREMENTS

- Trash, grass clippings, and other debris should be removed from the surface of the area as needed.
- Pavers must be inspected regularly and debris removed, especially after large rain events.
- Nutrient and pesticide management should be performed as needed.

COST CONSIDERATIONS

- Construction costs range from \$0.50 to \$2.00 per square foot.
- Annual maintenance is 5 percent of initial construction costs.

Targeted Pollutants

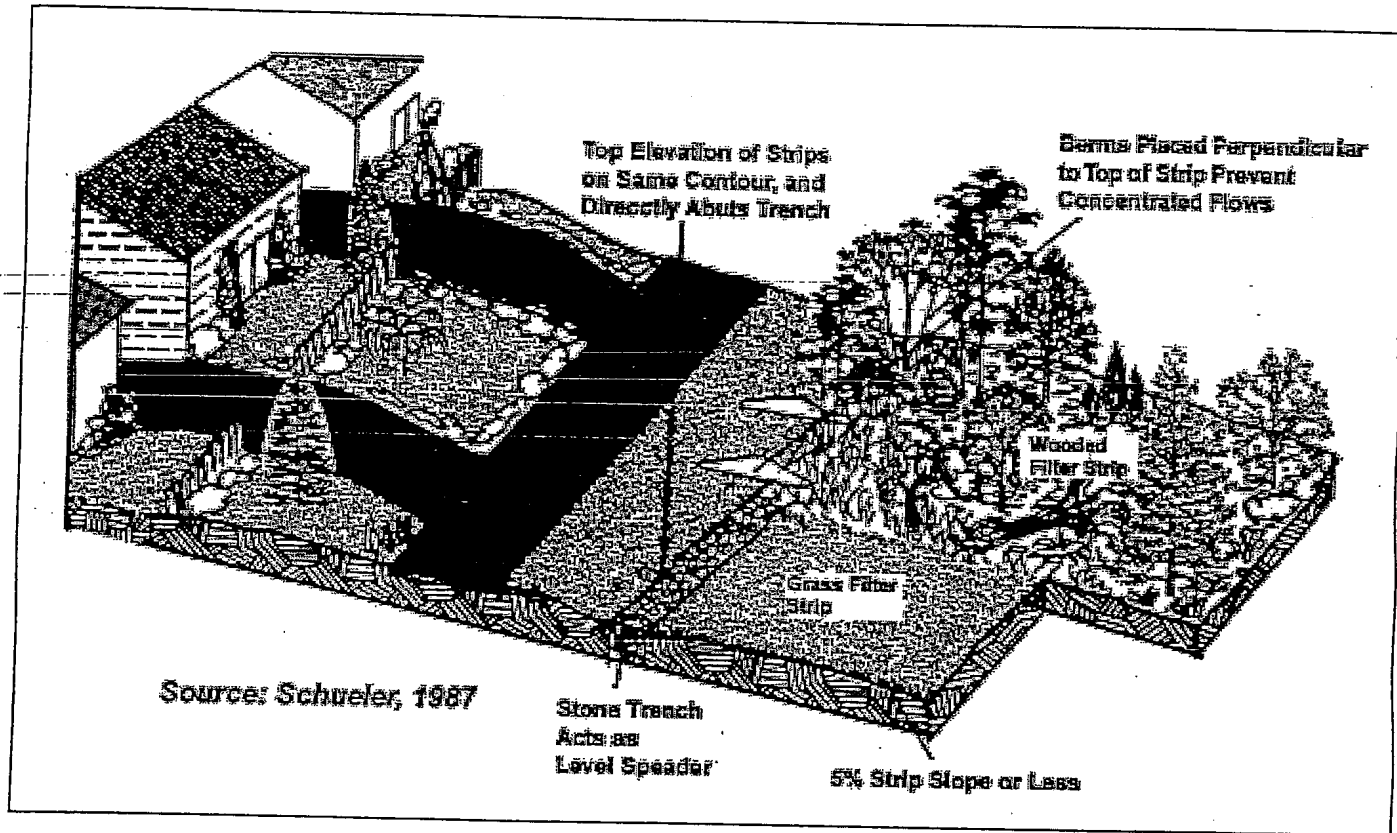
Implementation Requirements

- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

☒ High ☐ Low

Structural BMP Fact Sheet

SFWMD-BMP-RS-4 - Retention Systems - Vegetated Filter Strips



DESCRIPTION

Vegetated filter strips are strips of land with vegetated cover that are designed to reduce sediment and remove pollutants.

SELECTION CRITERIA

- Recommended for agriculture and low density development.
- Pretreatment for other structural practices, such as dry detention ponds and exfiltration trenches.
- Small drainage area.

LIMITATIONS

- Provide little treatment for concentrated flows.
- Restrictions may apply to systems located above sole source (drinking water) aquifers.
- Soil must have good infiltration rates (at least 0.5 inches per hour).

DESIGN AND SIZING CONSIDERATIONS

- Filter strip should be at least 20 feet long. Better performance can be achieved if the strip is 50 to 100 feet long.
- The grade slope should not exceed 5 percent.
- A level spreader at least as wide as the contributing overland flow area that is graded uniformly to avoid flow concentration is highly recommended.
- Seasonal ground water table must be at least 2 to 4 feet lower than the bottom of the filter strip.

CONSTRUCTION/INSPECTION CONSIDERATIONS

- Forested strips next to water bodies should be left undisturbed except for the removal of trees that present unusual hazards and small debris that may be refloated by high water.
- Top edge of the filter strip should be regraded and reseeded if strip has been used as a sediment and erosion control measure during the construction phase.

Targeted Pollutants

Suspended Sediments
Total Phosphorus
Total Nitrogen
Heavy Metals
Oxygen Demanding Substances
Trace Metals

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training
- ☒ High ☐ Low

MAINTENANCE REQUIREMENTS

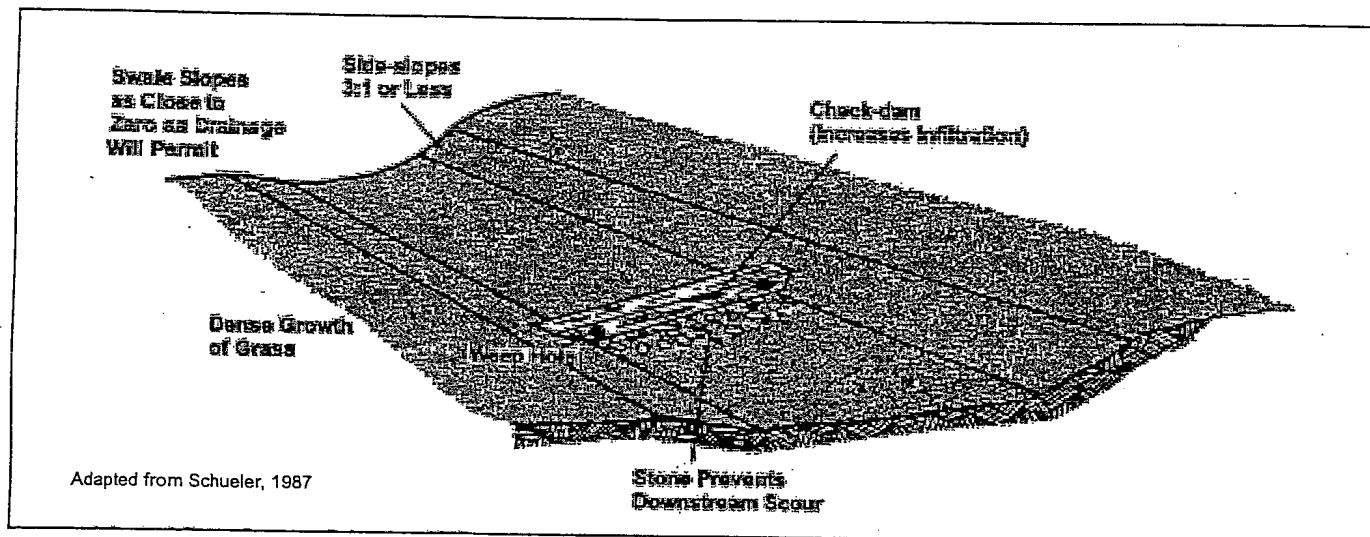
- Mowing must be performed as needed, but should be limited to spring or fall to avoid impacts on ground nesting birds.
- Aeration of filter strips is required.
- Maintaining a healthy vegetation aids in removal efficiency and prevents erosion.
- Sediment buildup must be removed annually to prevent a damming effect.
- Nutrient and pesticide management should be performed as needed.
- Periodic harvesting of some trees not directly adjacent to water bodies removes sequestered nutrients and maintains an efficient filter through vigorous vegetation.
- To minimize soil compaction, vehicular traffic and excessive pedestrian traffic should be avoided.
- Periodic repair and sediment removal is needed to prevent channelization.

COST CONSIDERATIONS

- Costs are lower if existing vegetation is used.
- Construction cost ranges from \$0 to \$1.3 per square foot.
- Annual maintenance cost ranges from \$100 to \$1,400 per acre.

Structural BMP Fact Sheet

SFWMD-BMP-RS-5 - Retention Systems - Grassed Swales



DESCRIPTION

Grassed swales are filtration and conveyance mechanisms that are generally used to provide pretreatment before runoff is discharged to treatment systems.

SELECTION CRITERIA

- Low density areas.
- Small drainage area.

LIMITATIONS

- Restrictions may apply to systems located above sole source (drinking water) aquifers.
- Long-term effectiveness in most cases will depend on proper maintenance of the entire system.
- If flows pass through rapidly and limited soil infiltration occurs, minimal pollutant removal can be expected.
- Soil must have good infiltration rates (at least 0.5 inch per hour).

DESIGN AND SIZING CONSIDERATIONS

- Swales are typically shallow, vegetated, man-made trenches with a width-to-depth ratio equal to or greater than 6 to 1, or side slopes equal to or greater than 3-feet horizontal to 1-foot vertical.
- Check dams across the flow path will increase containment of first-flush contaminants.
- If longitudinal slopes exceed 4 percent, check dams are needed.
- Flow velocities must not exceed 1.5 to 3 feet per second.
- Seasonal ground water table must be at least 2 to 4 feet lower than the bottom of the swale.

CONSTRUCTION/INSPECTION CONSIDERATIONS

- Soil should not be compacted during construction. If it is, it should be tilled.
- Swale must be stabilized with vegetation within one week after it has been graded.

MAINTENANCE REQUIREMENTS

- The established width should be maintained to ensure the continued effectiveness and capacity of the system.
- Grassed swales should be mowed to stimulate vegetative growth, control weeds, and maintain the capacity of the system (see Appendix B for guidelines).
- Inspections, vegetation maintenance, mowing, and debris removal are required at least annually.
- Inspect check dams for erosion at least annually.
- Sediment removal, reseeding, or resodding should be done at least every 5 years.

Targeted Pollutants

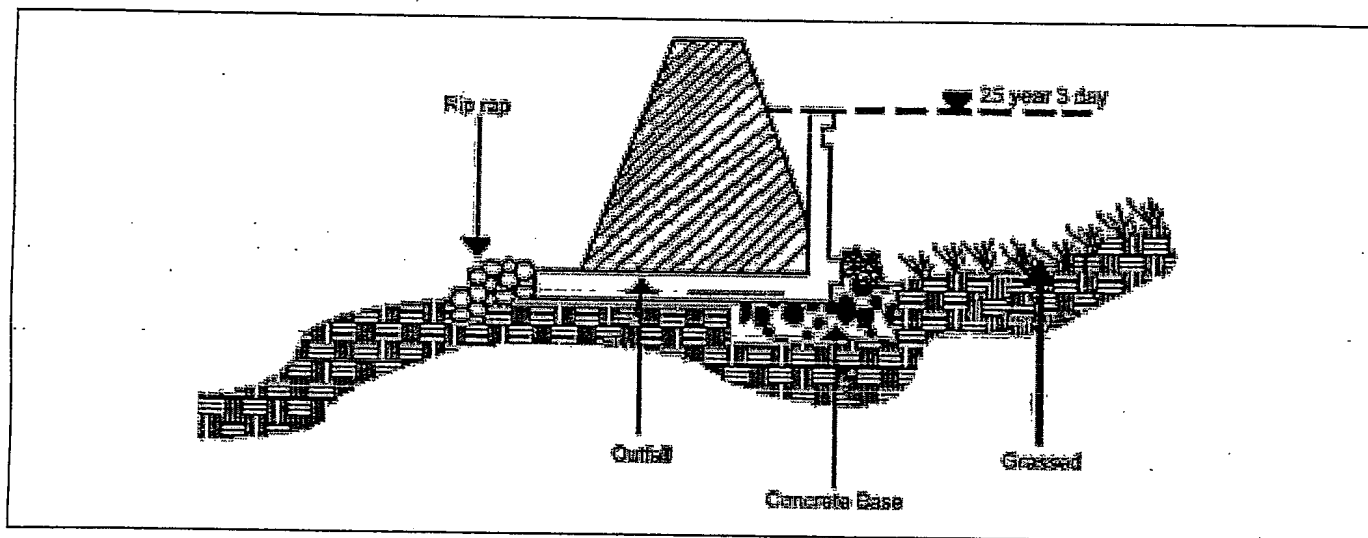
Suspended Sediments
Total Phosphorus
Total Nitrogen
Heavy Metals
Oxygen Demanding
Substances

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training
- ☒ High ☐ Low

Structural BMP Fact Sheet

SFWMD-BMP-DS-1 - Detention Systems - Dry Detention Ponds



DESCRIPTION

Dry detention ponds are depressed green areas where urban runoff is temporarily stored, then gradually released through a control structure or by filtration into the ground

SELECTION CRITERIA

- Moderately permeable soils.
- Moderate to large amount of open area available.
- Moderate to large drainage area.

LIMITATIONS

- May not be appropriate where ground water requires protection.
- Restrictions may apply to systems located above sole source (drinking water) aquifers.
- Long-term effectiveness in most cases will depend on proper operation and maintenance of the entire system.
- Moderate longevity.

DESIGN AND SIZING CONSIDERATIONS

- Requires a moderate layer of permeable soil at separation distances of at least 1 foot between the bottom of the structure and seasonal ground water levels.
- Runoff should gradually drain down and/or infiltrate to maintain aerobic conditions favoring bacteria that aid in pollutant removal and to ensure the basin storage capacity is available for subsequent storm events (check local regulations also).
- Concentrated runoff should flow through a sediment trap.
- A vegetated filter strip may be used for sheetflow.
- Side slopes of 1:4 are recommended if riding mower is to be used.
- A bottom slope of 1 percent is recommended to maximize infiltration and avoid ponding.
- To avoid resuspension of settled out solids, nonerosive velocities should be maintained along the pond bottom during peak runoff events.

CONSTRUCTION/INSPECTION CONSIDERATIONS

- Design soil conditions must be confirmed during excavation.
- Driving of heavy equipment over a detention basin must be avoided during and after construction.
- If a detention basin is used for sediment and erosion control during construction, the last foot at the basin bottom should not be excavated to final grade until entire drainage area has been stabilized.
- After final grading, deep till of infiltration area is recommended to maximize infiltration.
- Stabilize with vegetation within three days after construction.
- Basin bottom should be seeded, instead of sodded, to maximize infiltration.

Targeted Pollutants

Suspended Sediments
Total Phosphorus
Total Nitrogen
Heavy Metals
Oxygen Demanding
Substances
Trace Metals

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training

● High ○ Low

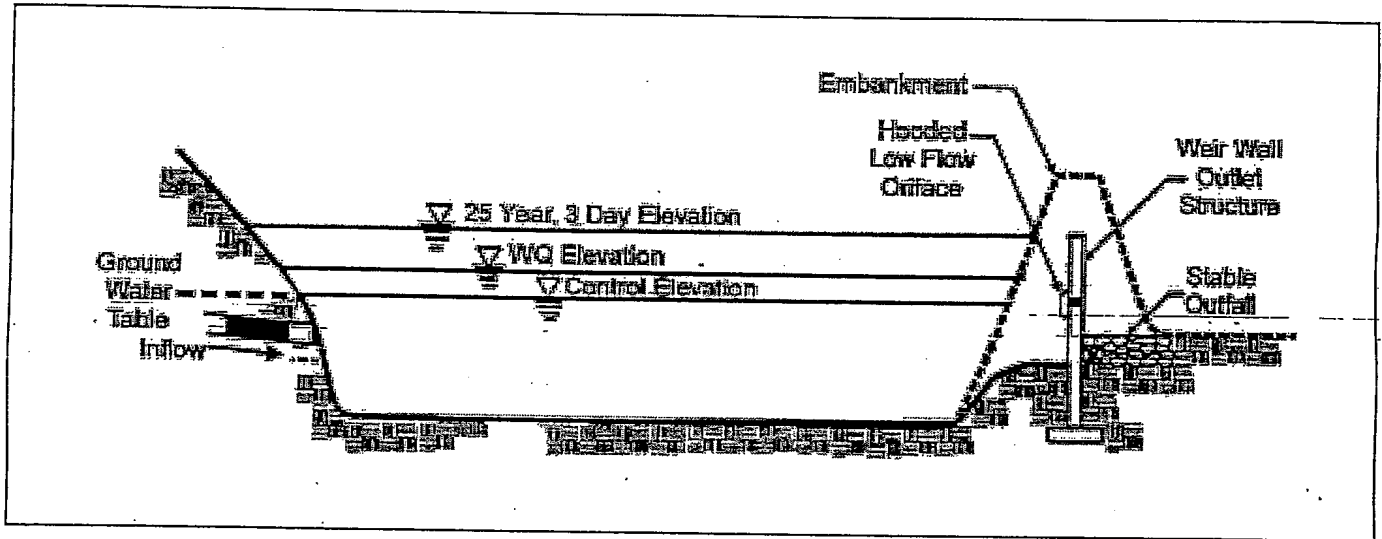
- Nutrient and pesticide management should be performed as needed.
- Residents that have swales must be educated on their maintenance requirements.

COST CONSIDERATIONS

- Construction cost ranges from \$0.60 to \$1.60 per square foot.
 - Annual maintenance cost ranges from 5 to 7 percent of capital costs.
-

Structural BMP Fact Sheet

SFWMD-BMP-DS-2 - Detention Systems - Wet Detention Ponds



DESCRIPTION

Wet detention basins are pond areas maintained at a control elevation where urban runoff is temporarily stored, then gradually released through a control structure.

SELECTION CRITERIA

- Low to moderately permeable soils acceptable.
- Moderate to large amount of open area available.
- Moderate to large drainage area.

LIMITATIONS

- May not be appropriate where ground water requires protection.
- Restrictions may apply to systems located above sole source (drinking water) aquifers.
- Long-term effectiveness in most cases will depend on proper operation and maintenance of the entire system.
- Moderate longevity.

DESIGN AND SIZING CONSIDERATIONS

- Concentrated runoff should flow through a sediment trap or dry detention/retention area upstream of a wet detention pond.
- A vegetated filter strip may be used for sheetflow.
- Side slopes of 1:4 or less are recommended if riding mower is to be used.
- To avoid resuspension of settled out solids, nonerosive velocities should be maintained along the pond bottom during peak runoff events.

CONSTRUCTION/INSPECTION CONSIDERATIONS

- Design soil conditions must be confirmed during excavation.
- Stabilize slopes with vegetation within three days after construction.

MAINTENANCE REQUIREMENTS

- Facility must be inspected every six months or after a major storm event and any debris must be removed.
- Control structure must be inspected and maintained semiannually, and repaired as needed.
- Accumulated sediments must be removed every five years.
- Embankments and side slopes must be maintained and repaired as needed.
- Use fertilizers only if absolutely necessary.

COST CONSIDERATIONS

- Construction cost ranges from \$0.50 to \$1.00 per cubic foot.
- Annual maintenance cost ranges from 3 to 5 percent of capital costs.

Targeted Pollutants

Suspended Sediments
Total Phosphorus
Total Nitrogen
Heavy Metals
Oxygen Demanding Substances
Trace Metals

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training
- ☒ High ☐ Low

MAINTENANCE REQUIREMENTS

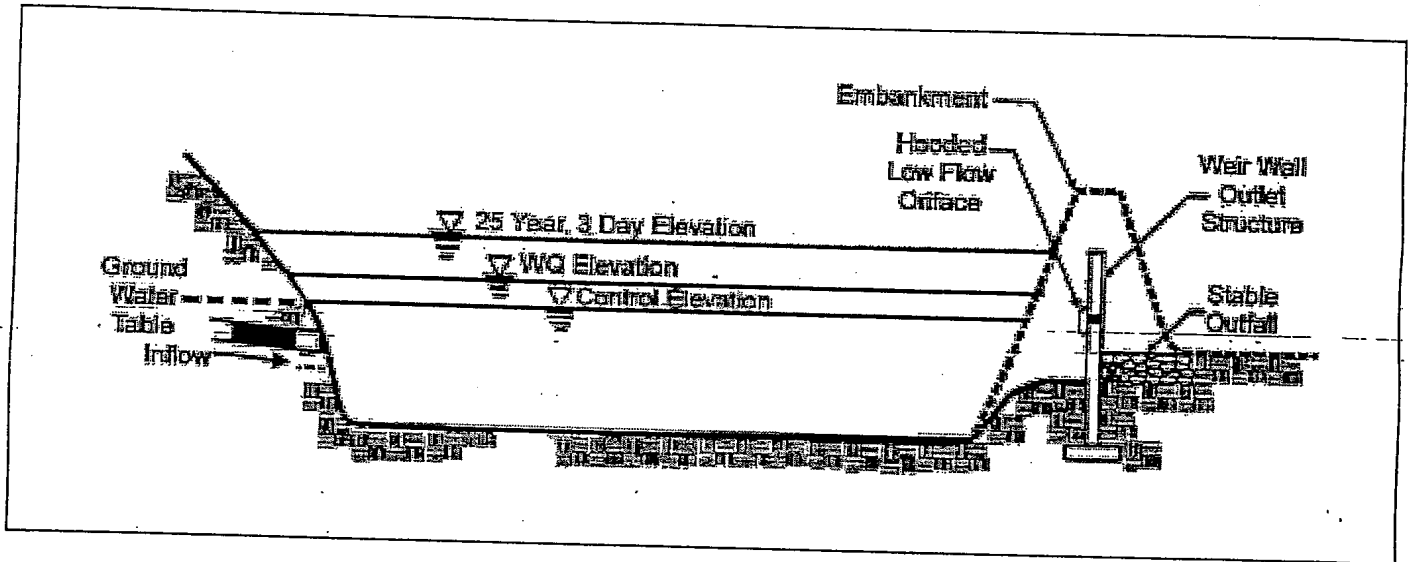
- Facility must be inspected every 6 months or after a major storm event and any debris must be removed.
- Control structure must be inspected and maintained semiannually, and repaired as needed.
- Accumulated sediments must be removed at least once annually.
- Rototilling or disking the basin bottom should be done annually.
- Embankments and side slopes must be maintained.
- Use fertilizers only if absolutely necessary.

COST CONSIDERATIONS

- Construction cost ranges from \$0.50 to \$1.00 per cubic foot.
- Annual maintenance cost ranges from 1 to 5 percent of capital costs.

Structural BMP Fact Sheet

SFWMD-BMP-DS-2 - Detention Systems - Wet Detention Ponds



DESCRIPTION

Wet detention basins are pond areas maintained at a control elevation where urban runoff is temporarily stored, then gradually released through a control structure.

SELECTION CRITERIA

- Low to moderately permeable soils acceptable.
- Moderate to large amount of open area available.
- Moderate to large drainage area.

LIMITATIONS

- May not be appropriate where ground water requires protection.
- Restrictions may apply to systems located above sole source (drinking water) aquifers.
- Long-term effectiveness in most cases will depend on proper operation and maintenance of the entire system.
- Moderate longevity.

DESIGN AND SIZING CONSIDERATIONS

- Concentrated runoff should flow through a sediment trap or dry detention/retention area upstream of a wet detention pond.
- A vegetated filter strip may be used for sheetflow.
- Side slopes of 1:4 or less are recommended if riding mower is to be used.
- To avoid resuspension of settled out solids, nonerosive velocities should be maintained along the pond bottom during peak runoff events.

CONSTRUCTION/INSPECTION CONSIDERATIONS

- Design soil conditions must be confirmed during excavation.
- Stabilize slopes with vegetation within three days after construction.

MAINTENANCE REQUIREMENTS

- Facility must be inspected every six months or after a major storm event and any debris must be removed.
- Control structure must be inspected and maintained semiannually, and repaired as needed.
- Accumulated sediments must be removed every five years.
- Embankments and side slopes must be maintained and repaired as needed.
- Use fertilizers only if absolutely necessary.

COST CONSIDERATIONS

- Construction cost ranges from \$0.50 to \$1.00 per cubic foot.
- Annual maintenance cost ranges from 3 to 5 percent of capital costs.

Targeted Pollutants

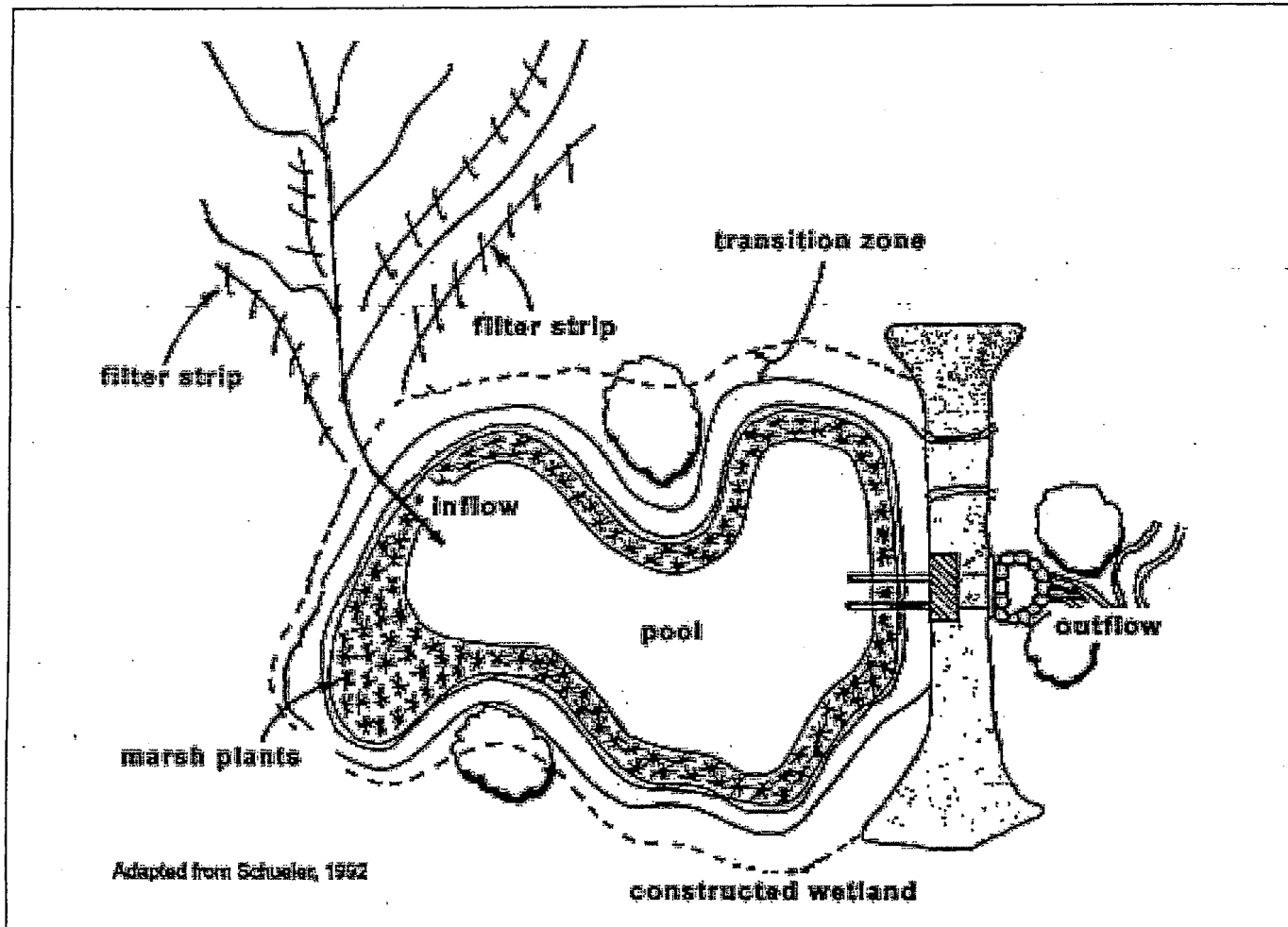
Suspended Sediments
Total Phosphorus
Total Nitrogen
Heavy Metals
Oxygen Demanding Substances
Trace Metals

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training
- ☒ High ☐ Low

Structural BMP Fact Sheet

SFWMD-BMP-DS-3 - Detention Systems - Constructed Wetlands



DESCRIPTION

Constructed wetlands and multiple pond systems treat runoff through adsorption, plant uptake, filtration, volatilization, precipitation, and microbial decomposition. They are designed to simulate the water quality improvement functions of natural wetlands to treat and contain surface water runoff pollutants and decrease loadings.

SELECTION CRITERIA

- Moderate to large drainage area.
- Shallow surface water table.
- Optimal water depth is approximately 6 inches.
- Poorly drained organic soils.

LIMITATIONS

- Potential augmentation of water flows.
- Seasonal variability of plant growth.
- Potential breeding grounds for insects and undesirable odors.
- Maintenance is required for efficiency.
- Potential increase of thermal discharge, oxygen demand, and net nutrient loading.

DESIGN AND SIZING CONSIDERATIONS

- An area consisting of at least 2 to 3 percent of the total contributing watershed's area will be needed.
- Multiple pond systems potentially provide much higher levels of treatment.

Targeted Pollutants

Suspended Sediments
Total Phosphorus
Total Nitrogen
Heavy Metals
Chemical Oxygen
Demanding Substances
Trace Metals

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

● High ○ Low

- Vegetated buffers and deep water areas (approximately 25 percent) provide additional treatment, wildlife habitat, and aesthetic enhancements.
- Maximized flow paths via buffers, stands, and peninsulas increase treatment area.
- Bottom bleed down device facilitates dewatering for maintenance.

CONSTRUCTION/INSPECTION CONSIDERATIONS

- Retain or augment organic soils to improve performance.
- Include a plant specialist for design, construction, and maintenance plans.
- Schedule slope stability, construction, and landscaping to coincide with seasonal plant growth.
- Inspect plant communities, sediment accumulations, and discharge structures annually.

MAINTENANCE REQUIREMENTS

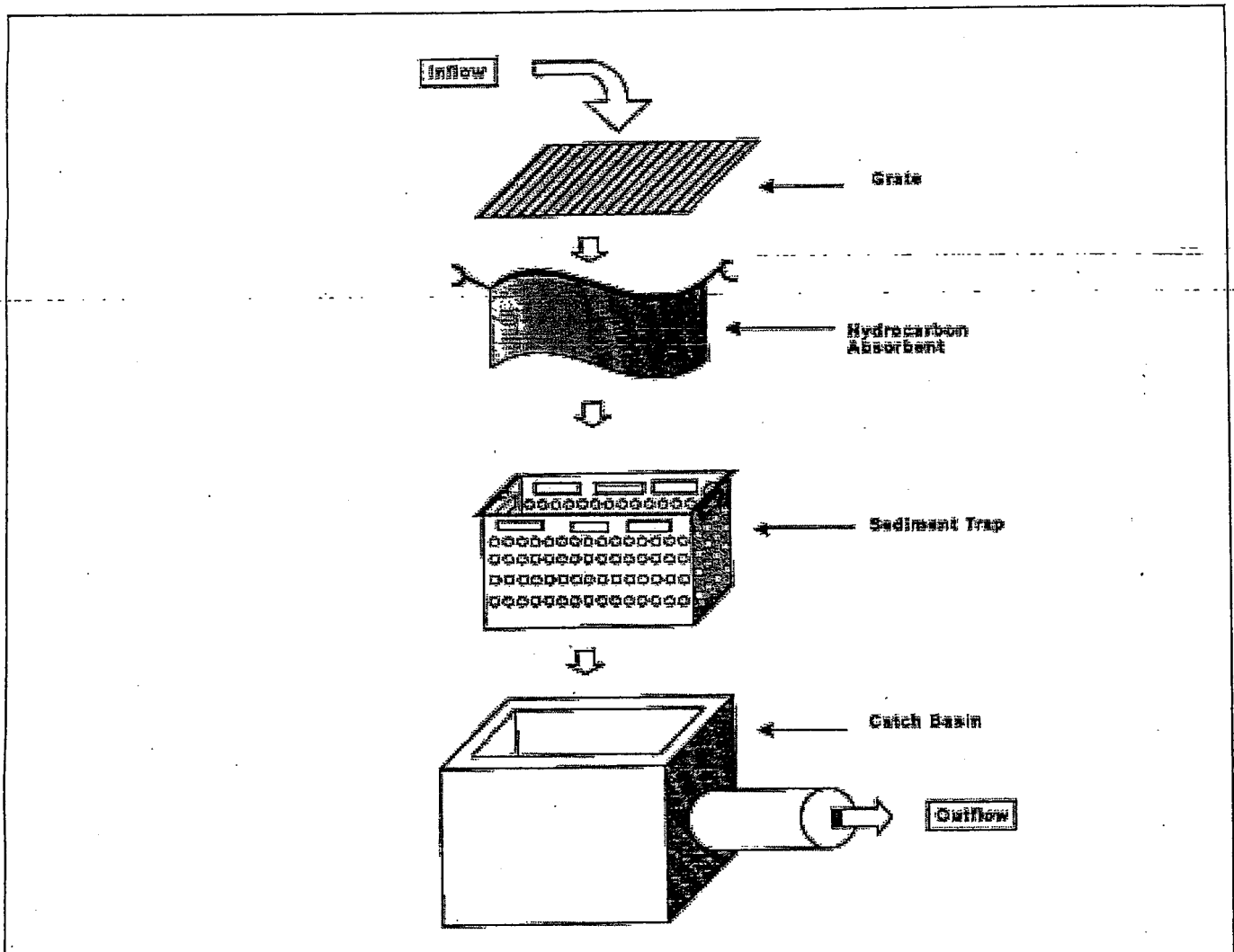
- Slope control and removal of sediment in forebays.
- Removal of trash, debris, and nuisance species.
- Supplemental plantings.

COST CONSIDERATIONS

- Construction cost ranges from \$0.05 to \$1.00 per cubic foot.
- Maintenance cost ranges from 1 to 5 percent of capital costs.

Structural BMP Fact Sheet

SFWMD-BMP-OS-1 - Other Systems - Water Quality Inlets



DESCRIPTION

Water quality inlets rely on settling to remove pollutants before discharging water to the storm sewer or other collection system. They are also designed to trap floating trash and debris. When inlets are coupled with oil/grit separators and/or hydrocarbon absorbents, hydrocarbon loadings from high traffic parking areas may be reduced.

SELECTION CRITERIA

- Applicable to many sites, including high density areas with poorly drained soils and extensive impermeable areas.
- Small drainage area.
- Flexibility to retrofit existing drainage areas with minimal or no additional land requirement.

LIMITATIONS

- Pollutant removal effectiveness is limited, and the devices should be used only when coupled with extensive clean-out methods.
- Not effective for water quality control during intensive storms.

DESIGN AND SIZING CONSIDERATIONS

- Retrofitting devices can be install in any shape or size of grate or curb inlet. Accurate measurement of inlets must be taken to ensure proper fit.

Targeted Pollutants

Suspended Sediments

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training
- ☒ High ☐ Low

- Should not obstruct flow or cause excessive hydraulic head losses.
- Need removable grates or manholes to install and clean devices.

CONSTRUCTION/INSPECTION CONSIDERATIONS

- Frequent periodic inspections and sediment removal are required (2 to 3 times per year).

MAINTENANCE REQUIREMENTS

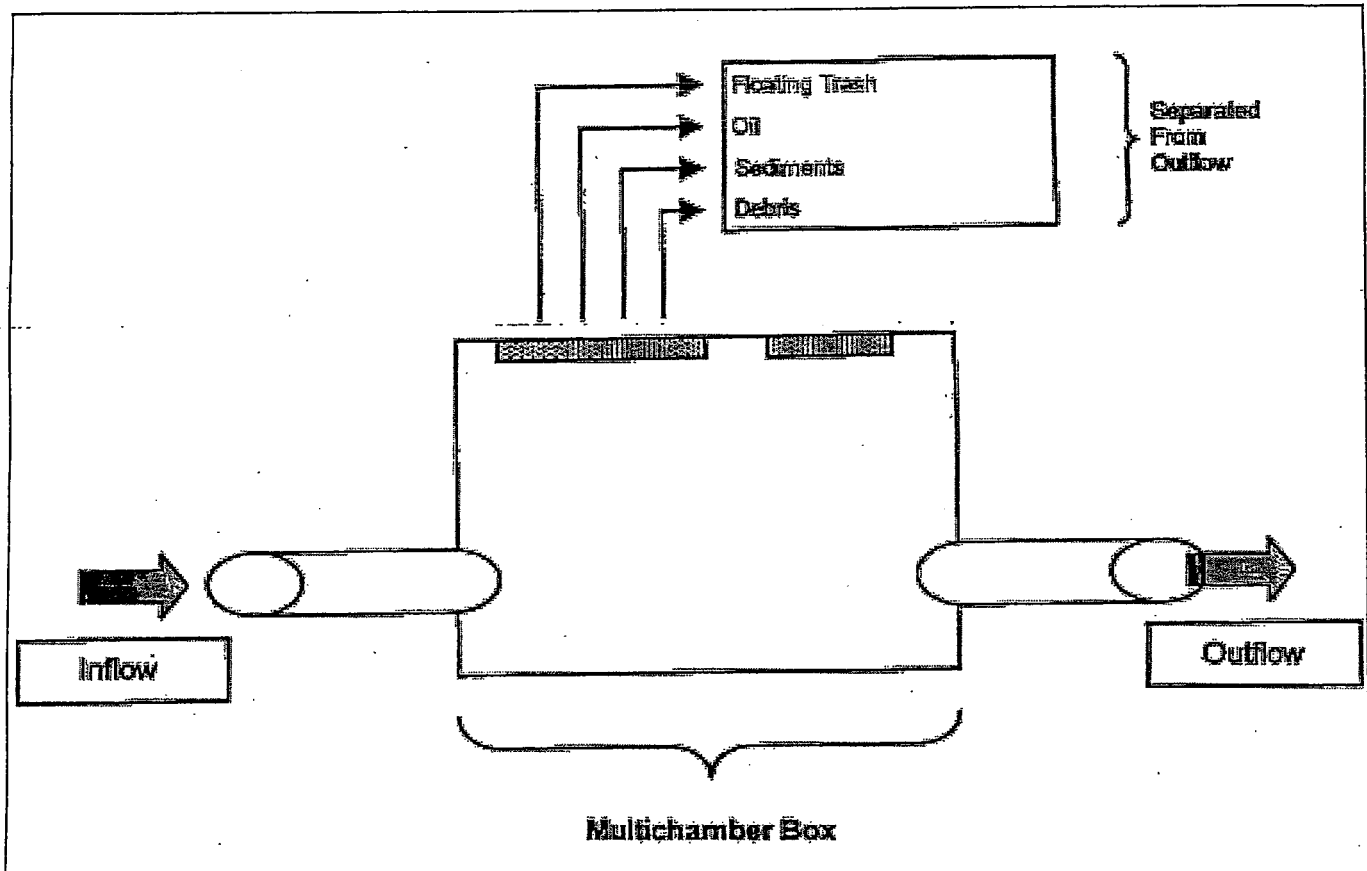
- Proper disposal of trapped coarse-grained sediments and hydrocarbons is required.
- Clean-out and disposal costs may be significant.
- Maintenance requirements are high if clean out of sediment and debris is performed routinely.
- Requires replacement of hydrocarbon absorbent at least once per year.

COST CONSIDERATIONS

- Construction cost ranges from \$1,100 to \$3,000 per new precast unit and from \$600 to \$900 per retrofitted unit.
- Annual maintenance cost ranges from \$7.50 to \$90 per unit.
- Hydrocarbon absorbent costs approximately \$100.

Structural BMP Fact Sheet

SFWMD-BMP-OS-2 - Other Systems - Separation Devices



DESCRIPTION

Separation devices include sumps, baffle boxes, oil/grit separators, and sediment basins to capture trash, sediments, and floating debris.

SELECTION CRITERIA

- Applicable to many sites, including high density areas with poorly drained soils and extensive impermeable areas.
- Small drainage area.
- Flexibility to retrofit existing drainage areas with minimal or no additional land requirement.

LIMITATIONS

- Efficient only within specific ranges of volume and discharge rates.

DESIGN AND SIZING CONSIDERATIONS

- A forebay can pretreat discharges by separating heavy grit and floating debris before it enters the separator.
- A manhole cover over each chamber is recommended for easy access and inspection.

CONSTRUCTION/INSPECTION CONSIDERATIONS

- Frequent periodic inspections and sediment removal are required (1 to 3 times per year).

MAINTENANCE REQUIREMENTS

- Period inspections and sediment removal are required
- Proper disposal of trapped coarse-grained sediments is required.
- Clean-out and disposal costs may be significant.

Targeted Pollutants

Suspended Sediments

Implementation Requirements

- Capital Costs
- O&M Costs
- Maintenance
- Training
- High ○ Low

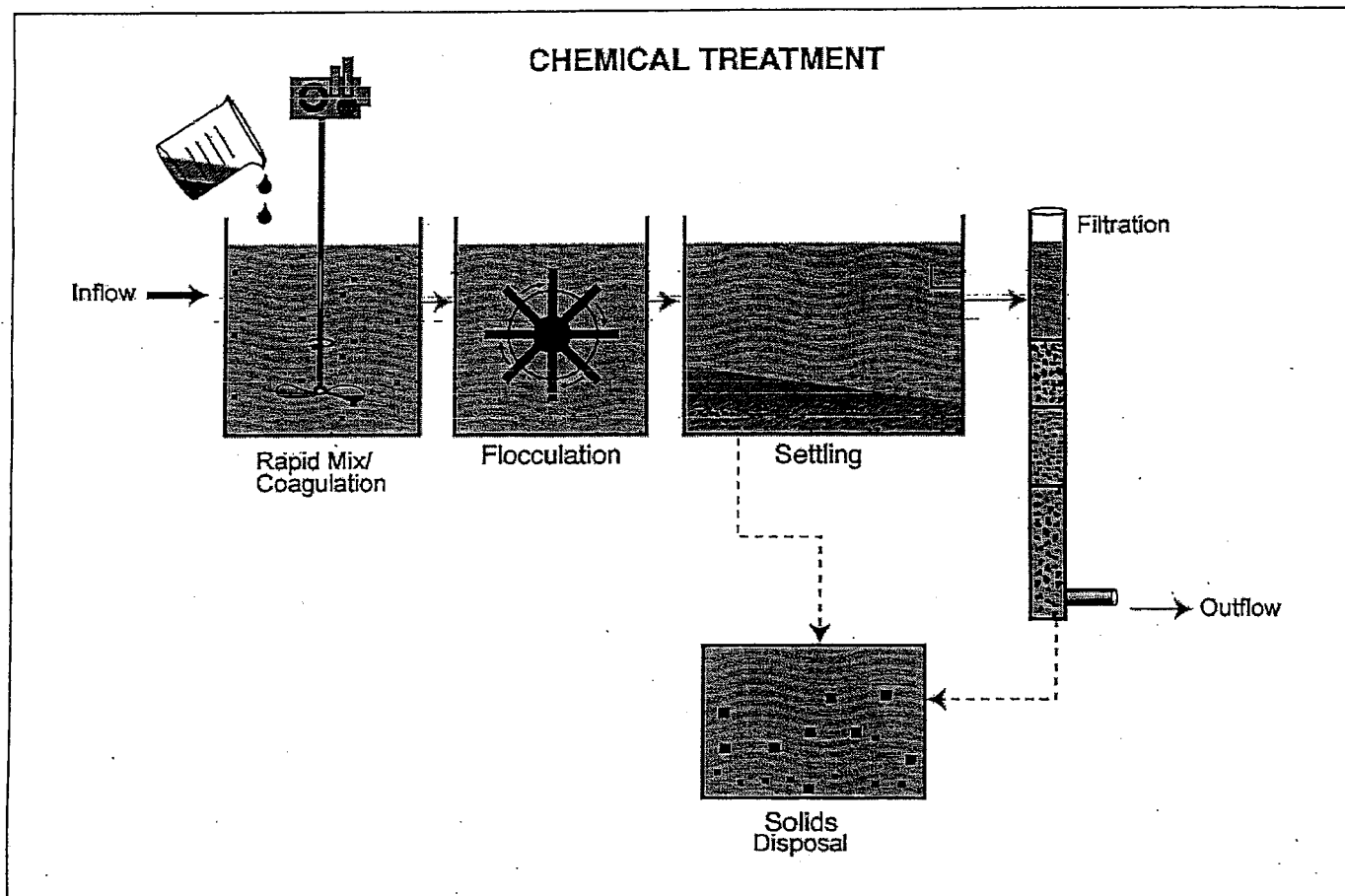
- Maintenance requirements are high if clean out of sediment and debris is performed routinely.

COST CONSIDERATIONS

- These devices may have a high initial investment cost.
 - Construction cost ranges from \$2,300 to \$40,000 per unit.
 - Annual maintenance cost is less than \$1,000 per unit.
-

Structural BMP Fact Sheet

SFWMD-BMP-OS-3 - Other Systems - Chemical Treatment



DESCRIPTION

Chemical processes include coagulation coupled with solids separation to remove pollutants. Iron, aluminum metal salts, and alum are used to coagulate compounds, then polymers are added to enhance flocculation and induce settling. Chemical processes offer the advantage of low land requirements, flexibility, reliability, decreased detention time requirements, and the ability to enhance water quality to levels substantially lower than could be achieved using other methods alone.

SELECTION CRITERIA

- Applicable to many sites, including high density areas with poorly drained soils and extensive impermeable areas.
- Moderate to large drainage area.

LIMITATIONS

- High capital, operations, and maintenance costs.
- Solid waste management requirements.

DESIGN AND SIZING CONSIDERATIONS

- Needs relatively steady flow, flow equalization basin, or storage.
- The accumulated floc is normally sent to a landfill, but some systems allow for automatic floc disposal into the sanitary sewer or adjacent drying beds.

CONSTRUCTION/INSPECTION CONSIDERATIONS

- Availability of suitable site including discharge buffer zone.

Targeted Pollutants

Suspended Sediments
Total Phosphorus

Implementation Requirements

- Capital Costs
- O&M Costs
- Maintenance
- Training

● High ○ Low

MAINTENANCE REQUIREMENTS

- Maintenance is high if chemicals are continually input and spent precipitate is removed.
- Accumulated alum floc must be pumped out of the sump area on a periodic basis.

COST CONSIDERATIONS

- Average construction cost is \$790 per acre treated.
 - Annual operation and maintenance cost is \$100 per acre of drainage area served.
 - Cost of land required at installation location.
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