CITY OF ST. PETERS, MISSOURI

STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICES

JANUARY 2001

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CITY OF ST. PETERS
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URBAN STORMWATER WETLANDS

CODE 800

DEFINITION

A constructed system of shallow pools that create growing conditions suitable for emergent and riparian wetland plants, explicitly designed to lessen the impacts of stormwater quality and quantity in urban areas.

PURPOSE

Stormwater wetlands are designed and installed to maximize pollutant removal and create wetland habitat
through the creation of a matrix of water, sediment, plants, and detritus that collectively provides temporary storage of urban stormwater runoff, and removes multiple pollutants from it through a series of complementary physical, chemical, and biological pathways.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to watersheds in urban or urbanizing landscapes where stormwater quality and quantity control is needed to meet the diverse management objectives of developers and local governing units. Stormwater wetlands typically should are not located within delineated natural wetland areas. Natural wetlands provide critical habitat, ecosystem services, and are protected under local, state and federal statutes. Stormwater wetlands should also not be confused with created or restored wetlands that are used to mitigate for the loss of natural wetlands under permitting provisions of wetland protection requirements.

CRITERIA

For maximum effectiveness, the following basic design criteria should be followed to achieve the major objectives of the stormwater wetland:

1. Capture and effectively treat the stormwater runoff produced by 90 percent of the storms in the urban watershed by designing a stormwater wetland to meet seven basic sizing criteria:
   - Minimum treatment volume; to capture and treat an amount equal to 0.5 watershed inch.
   - Surface area requirement; minimum wetland to watershed ratio:

     Shallow Marsh Wetland 2%
     Pond/wetlands 1%
     Extended Detention - (ED)/wetlands 1%
     Pocket wetlands 1%

   Wetland types defined in Reference 1:

   - Depth/Area allocation; guidelines in Table 2.

- Treatment/Volume allocation; guidelines in Table 2.
- Flow path length; dry weather flow path of 2:1 for length to width ratio.
- Dry weather water balance; determine that inflow and ground water inputs are greater than infiltration and evaporation water losses or all designs except pocket wetlands.
- Extended detention volume; consider extended volume, time, release, clogging protection, and water elevation.

2. Pre-treat the stormwater runoff before it reaches the wetland area so as to reduce water velocity, trap coarse sediments and associated pollutants. Examples of pre-treatment structures are pre-settling basins and forebays.

3. Create a diversity of depth zones within the wetland to meet the unique growing requirements of emergent wetland plants.

4. Establish a diverse and dense wetland plant community in the shortest possible time.

5. Create a functional pondscape within and around the wetland that augments pollutant removal, creates better wildlife habitat, and promotes a more natural appearance.

6. Reduce the future maintenance burden of the stormwater wetland through preventative management to protect its long-term function.

7. Provide habitat elements that promote greater wildlife and waterfowl use within the wetland and buffer, but avoid undesirable habitat outcomes.

8. Serve as an attractive, yet safe, community amenity for adjacent residents.

9. Reduce or avoid any undesirable secondary environmental impacts produced by the construction or operation of the stormwater wetland.

CONSIDERATIONS

Avoid conflict with natural wetlands wherever possible. Employ design techniques to enhance pollutant removal performance of stormwater wetland systems (Table 1). Establish the plant community by transplanting stock native to the region and/or by utilizing mulch/topsoil from a nearby donor wetland scheduled to be developed. Plan habitat diversity to meet the feeding, breeding/nesting, and cover requirements for a wide range of aquatic, avian, and terrestrial species. Check with state and/or federal agencies that issue permits for wetlands about the regulatory status of stormwater wetlands and needed permits prior to construction.

PLANS AND SPECIFICATIONS

Site suitability should be determined on each site by field observation by a qualified interdisciplinary design team with expertise in stormwater engineering, wetlands, landscaping, and pond construction. Construction specifications should be shown in a site-specific construction plan or drawing. Design criteria for stormwater wetland designs are shown in Table 3.

OPERATION AND MAINTENANCE

Both initial establishment and future development of a stormwater wetland require active management of the hydrology and vegetation, as it grows in biomass, diversity, and spatial coverage.

The design team must plan for the future operation and maintenance of the stormwater wetland in this stage, with a strong emphasis on the first three years. Maintenance shall be the responsibility of the developer until the establishment of an enforceable covenant for the development. At which time the responsibility for maintenance of the basin will fall to the homeowner's association or party designated by the covenant. The covenant should specifically include a projected schedule for inspections and forebay sediment cleanouts, and show evidence that dedicated funding will be available to perform this function.

Inspection Criteria: The stormwater wetland should be inspected twice a year in the first three years after construction, with an annual inspection thereafter. Inspections should be conducted with the as-built and pondscaping plans in hand, and should take specific note of species distribution/survival, sediment accumulation, water elevations, and condition of the outlet. Records should be stored so that the progressive development of the wetland system over time can be tracked.

Sediment Cleanout: Accumulated sediment in the forebay should be cleaned out every 3 to 5 years. Cleanouts are conducted after draining the forebay, with the help of a skid loader or backhoe. The preferred disposal method is on-site land application at a pre-designated spoil area.

Mowing: The maintenance access, maintenance bench and embankment should be mowed once a year to prevent woody growth. All remaining areas can be managed as a wet meadow or forest.

REFERENCES

1. Schueler, Thomas R.; Design of Stormwater Wetland Systems: guidelines for creating diverse and effective stormwater wetlands in the middle-atlantic region. October, 1992. Metropolitan Washington Council of Governments, Washington, DC; Publication Number 92710.

2. Stormwater Management Manual for the Puget Sound Basin.

TABLE 1
DESIGN TECHNIQUES TO ENHANCE
POLLUTANT REMOVAL PERFORMANCE OF STORMWATER
WETLAND SYSTEMS

1. **Increase the Volume of Runoff Treatment**

    - Capture greater percentage of annual runoff volume
    - Provide for longer residence time in wetland for most storm events

2. **Increase the Surface Area to Volume Ratio**

    - Increase the total area of the wetland, or
    - Increase the internal structural complexity of the wetland, by adding complex microtopography and establishing extensive and dense wetland plant cover.

3. **Increase the Effective Flow Path Through the Wetland**

    - Extend distance between the inlet and outlet berms
    - Maximize sinciosity of dry weather flow path with high marsh wedges.
    - Create some areas with extremely shallow flow path (i.e. hi marsh).
    - Use multiple cells within the wetland system.

4. **Provide Runoff Pre-Treatment and Energy Dissipation**

    - Use forebay or pond cell near inlet, with broad crested weirs to spread flow between cells.

5. **Utilize Redundant Pollutant Removal Pathways**

    - Provide extended detention to keep removal rates reliable during non-growing season, or
    - Utilize permanent pool to increase algal uptake and sedimentation

From Table 7, Reference 1.

TABLE 2

GUIDELINES FOR THE ALLOCATION OF DEPTH ZONES AND TREATMENT VOLUME IN STORMWATER WETLAND SYSTEMS

Storm Wetland Systems

TARGET ALLOCATIONS	Design No. 1 Shallow Marsh	Design No. 2 Pond/ Wetland	Design No. 3 ED Wetland	Design No. 4 Pocket Wetland
Percent of Surface Area				
Forebay	5	0	5	0
Micropool	5	5	5	0
Deepwater	5	40	0	5
"Lo Marsh"	40	25	40	50
"Hi Marsh"	40	25	40	40
"Semi-Wet"	5	5	10	5
Percent of Treatment Volume				
Forebay	10	0	10	0
Micropool	10	10	10	0
Deepwater	10	60	-	20
"Lo Marsh"	45	20	20	55
"Hi Marsh"	25	10	10	25
"Semi-Wet"	0	0	50	0

Deepwater - One to six feet below normal pool (includes forebays, micropools, pool and channel)
Lo Marsh - Six to 18 inches below normal pool
Hi Marsh - Zero to six inches below normal pool
Semi-Wet - Zero to 2 feet above normal pool (includes ED)

Note: The allocations are only general guidelines and will vary according to design and site constraints.

From Table 11, Reference 1.

TABLE 3

DESIGN CRITERIA FOR STORMWATER WETLAND DESIGNS

DESIGN CRITERIA	DESIGN NO.1 SHALLOW MARSH	DESIGN NO.2 POND/ WETLAND	DESIGN NO.3 ED WETLAND	DESIGN NO.4 POCKET WETLAND
Wetland/Watershed Ratio	.02	.01	.01	.01 (target)
Minimum Drainage Area	25 ac.	25 ac.	10 ac.	1-10 ac.
Length to Width (minimum)	1:1	1:1	1:1	1:1 (target)
Extended Detention	No	No	Yes	No
Allocation of Treatment Volume (pool,marsh,ED)	40/60/0	70/30/0	20/30/50	20/80/0
Allocation of Surface Area (deep,lo,high)	20/40/40	45/25/30	20/35/45	10/40/50
Cleanout Freq.	2-5 yrs	10 yrs	2-5 yrs	10 yrs
Forebay	Required	No	Required	Optional
Micropool	Required	Required	Required	Optional
Outlet Configuration	Reverse-slope pipe or hooded broad crest weir	same	same	Hooded broad crested weir
Propagation Technique	Mulch or Transplant	Mulch or Transplant	Mulch or Transplant	Volunteer
Buffer (feet)	20 to 50	25 to 50	25 to 50	0 to 25
Pondscaping Plan Requirements	Emphasize wildlife habitat marsh micro-topography, buffer	Emphasize wildlife habitat and hi marsh wedges	Emphasize stabilization of ED zone, project pondscaping zones	pondscaping plan optional

From Table 16, Reference 1.

CITY OF ST. PETERS
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DIVERSION

CODE 815

DEFINITION

A channel and supporting ridge constructed across the slope to collect and divert runoff.

PURPOSE

The purpose of this practice is to divert excess surface water from one area for use or safe disposal in other areas.

CONDITIONS WHERE PRACTICE APPLIES

This permanent site development practice applies to areas where runoff can be diverted and used or disposed of safely to prevent flood damage, erosion, or sedimentation damage.

Specific locations and conditions include:
1. Above steep slopes to limit surface runoff onto the slope;
2. Across long slopes to reduce slope length to prevent gully erosion;
3. Below steep grades where flooding , seepage problems, or sediment depositions may occur;
4. Around buildings or areas that are subject to damage from runoff.

CRITERIA

Capacity-Diversions designed to protect areas such as minor buildings and roads, shall have enough capacity to carry the peak runoff expected from a storm frequency consistent with the hazard involved but not less than a 25-year frequency, 24-hour duration storm.

Diversions designed to protect major structures, homes, school buildings and high capacity roads shall have enough capacity to carry the peak runoff from a 100-year frequency 24-hour duration storm.

Cross section - The channel may be parabolic, V-shaped, or trapezoidal, and shall accommodate the equipment to be used for maintaining the diversion. The diversion shall be designed to have stable side slopes. Channel cut slopes shall not be steeper than 3:1. The slope of a vegetated fill shall be 2:1 or flatter. The ridge height shall include an adequate settlement factor. Settlement allowance will be 10% of design fill height or 0.2 feet, whichever is greater. The ridge shall have a minimum top width of 4 feet at the design elevation. In the case of diversions with a ridge, the design height of the ridge should be 0.5 feet above the design water elevation. In the case of an excavated channel diversion, the lowest bank of the channel shall be 0.3 feet above the design water elevation. The minimum cross section shall meet the specified dimensions. The top of the constructed ridge shall not be lower than the design elevation plus the specified overfill for settlement.

Grade and velocity - Channel grades may be uniform or variable. Channel velocity shall not exceed that considered erosive for the soil and planned vegetation or lining. See table 1 for the maximum design velocities. Channel grades shall be sufficient to minimize standing water and wetness problems. If possible velocities 2 fps or higher should be used to avoid sedimentation. Compute velocity for bare earth channels using Manning's formula with "n" value of 0.035.

Location - The location of a diversion and outlet must be in compliance with state drainage law, traditional case law precedent and local ordinances and regulations. Diversion location will be dictated by outlet condition, topography, land use, length of slope, and soil type. Diversions shall not outlet on the right-of-way of a public road, highway, or other public utility without the written approval of the appropriate authorities.

Sedimentation - Diversions should not be used below high sediment producing areas unless land treatment practices or structural measures, designed to prevent damaging accumulations of sediment in the channels, are installed with or before the diversions. If movement of sediment into the channel is a significant problem, a vegetated filter strip meeting the requirements of management practice standard FILTER STRIP 835 shall be used where soil or climate does not preclude its use. Then, the design shall include extra capacity for sediment and be supported by supplemental structures, cultural or tillage practices, or special maintenance measures.

Outlets - Each diversion must have a safe and stable outlet with adequate capacity. Examples of acceptable outlets include are not limited to GRASS LINED CHANNELS 840, IMPOUNDMENT STRUCTURE - FULL FLOW 841, IMPOUNDMENT STRUCTURE - ROUTED 842, LEVEL SPREADED 870, ROCK OUTLET PROTECTION 910, and INFILTRATION TRENCH 945. The outlet must convey runoff to a point where outflow will not cause damage. Vegetative outlets shall be installed prior to and have vegetation adequately established in the outlet channel before diversion construction. Underground outlets consist of an inlet and underground conduit. Underground outlets shall meet the requirements of the management practice standard SUBSURFACE DRAIN 945. The release rate when combined with storage is to be such that the design storm will not overtop the diversion ridge. On large watersheds, runoff flows are usually too large to outlet entirely through underground outlets.

The design elevation of the water surface in the diversion shall not be lower than the design elevation of the water surface in the outlet at their junction when both are operating at design flow.

Vegetation - Disturbed areas that are not to be cultivated shall be established to vegetation as soon as practicable, generally within 15 days after construction is complete. If the soils or climatic conditions preclude the use of vegetation for erosion protection, non-vegetative linings such as gravel, rock riprap, or cellular block may be used. Seedbed preparation, seeding, fertilizing, and mulching shall comply with the management practice standard PERMANENT SEEDING 880. The vegetation shall be maintained and trees and shrubs controlled by hand, machine, or chemicals.

Sediment-laden water should first be directed through an approved sediment trapping device before entering receiving surface waters. Examples of acceptable sediment trapping facilities include but are not limited to management practice standards IMPOUNDMENT STRUCTURE - ROUTED 842 and TEMPORARY SEDIMENT TRAP 960.

CONSIDERATIONS

Diversions should be planned as a part of initial site development. They are principally runoff control measures that subdivide the site into specific drainage areas. Permanent diversions can be installed as temporary diversions until the site is stabilized then completed as a permanent measure, or they can be installed in final form during the initial construction operation. The amount of sediment anticipated and the maintenance required as a result of construction operations will determine which approach should be used. Stabilize permanent diversions with vegetation or materials such as riprap, paving stone, or concrete as soon as possible after installation. Base the location, type of stabilization, and diversion configuration on final site conditions. Evaluate function, need, velocity control, outlet stability, and site aesthetics. When properly located, land forms such as landscape islands, swales or ridges can be used effectively as permanent diversions. Base the capacity of a diversion on the runoff characteristics of the site and the potential damage after development. Consider designing an emergency overflow section or bypass area to limit damage from storms that exceed the design storm. The overflow section may be designed as a weir with riprap protection.

A typical diversion cross section consists of a channel and a supporting ridge. In the case of an excavated type diversion, the natural ground serves as the diversion ridge. Diversion cross sections must be adapted to the equipment that will be used for their construction and maintenance. The channel may be natural, parabolic or trapezoidal in shape; use of "V" channels is generally discouraged due to erosion problems experienced.

At all points where diversion ridges or channels will be crossed by construction equipment, the diversion should be protected according to requirements of the management practice standard STABILIZED CONSTRUCTION ENTRANCE 930. Bridges or culverts of adequate capacity may also be used.

Subsurface drainage should be used along permanent vegetated diversion channels when adequate grade can not be achieved to prevent ponding water, when hillside seeps or soils with poor internal drainage keep the channel wet or when base flow is intercepted by the diversion.

PLANS AND SPECIFICATIONS

Plans and specifications for installing diversions shall be in keeping with this standard and shall describe the requirements for applying the practice. At a minimum include the following items:

1. Diversion location
2. Channel grade
3. Diversion cross sections
4. Seeding and fertility rates.
5. The installation, inspection, and maintenance schedule with responsible party identified.

OPERATION AND MAINTENANCE

A maintenance program shall be established to maintain diversion capacity, storage, ridge height, vegetation and outlet. Maintenance needs are to be discussed with the landowner or operator who is responsible for maintaining the practice. Diversion ridges can be hazardous for mowing. Any hazards must be brought to the attention of the responsible person. Diversions should be inspected after every major rainfall and any needed repairs made promptly.

Table 1

Maximum Permissible Design Velocities

Soil Texture	Channel Vegetation Retardance and Cover		Permissible Velocity Feet per Second 1/ .
Sand, silt, sandy loam, silt loam, loamy sand (ML,SM,SP,SW)	B - Tall fescue, smooth canary grass	bromegrass, reed	3.5
	C - Kentucky bluegrass,	redtop, red fescue	3.0
	D - Annuals 2/ Small grain (rye, oats, wheat, ryegrass)		2.5
Silty clay loam, Sandy clay loam (ML-CL, SC)	B - Tall fescue, smooth canary grass	bromegrass, reed	4.5
	C - Kentucky bluegrass,	redtop, red fescue	4.0
	D - Annuals 2/, Small grain (rye, oats, wheat), ryegrass		3.5
Clay (CL)	B - Tall fescue, smooth canary grass	bromegrass, reed	5.5
	C - Kentucky bluegrass,	redtop, red fescue	5.0
	D - Annuals 2/ Small grain (rye, oats, wheat, ryegrass)		4.0

1/ To be used only in stabilized protected areas.

2/ Annuals - use only as temporary protection until permanent vegetation is established.

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DIVERSION DIKE

CODE 820

DEFINITION

A dike or dike and channel constructed along the perimeter of a disturbed construction area.

PURPOSE

The purpose of this practice is to prevent storm runoff from entering the work area or to prevent sediment-laden runoff from entering the construction site without first passing through a sediment trapping facility.

CONDITION WHERE PRACTICE APPLIES

Diversion dikes may be located at the upslope side of a construction site to prevent surface runoff from entering the disturbed area or at the downslope side of the work area to divert sediment-laden runoff to on-site sediment traps or basins. Diversion dikes do not usually encircle the entire area.

CRITERIA

Diversion dikes with 3 acres drainage area or less shall be designed using the management practice standard TEMPORARY DIVERSION 955 Diversion dikes with drainage areas greater than 3 acres shall be designed using the management practice standard DIVERSION 815.

CONSIDERATIONS

A diversion dike is a special application of a temporary or permanent diversion. It differs from other diversions in that the location and grade are usually fixed, and the cross section and stabilization requirements are based on the existing grade of the work boundary. Hence, the design cross section may vary significantly throughout the length. Give special care to avoid erosive velocities in steep areas. Identify areas where sedimentation will occur since they are often subject to overtopping.

Diversion dikes should be protected from damage from ongoing construction activities. At all points where diversion ridges or channels will be crossed by construction equipment, the diversion should be protected according to requirements of the management practice standard STABILIZED CONSTRUCTION ENTRANCE 930. Bridges or culverts of adequate capacity may also be used. Immediately vegetate diversion dikes after construction, but make sure channel flow area is stabilized during the initial phase of construction. Exercise caution in diverting flow to be certain that the diverted water is released through a stable outlet and that the flow will not cause flood damage. Sediment laden water should first be directed through an approved sediment trapping device before entering receiving surface waters. Examples of acceptable sediment trapping devices include but are not

limited to management practice standards IMPOUNDMENT STRUCTURE-ROUTED 842, or TEMPORARY SEDIMENT TRAP 960.

PLANS AND SPECIFICATIONS

The plans and specifications for installing diversion dikes shall be in keeping with this standard and shall describe the requirements for applying the practice. At a minimum include the following items:

1. Dike location,
2. Minimum cross sections,
3. Channel grade,
4. Seeding requirements,
5. The installation, inspection and maintenance schedules with the responsible party clearly identified.

OPERATION AND MAINTENANCE

Inspect diversion dikes once a week and after every rainfall. Immediately remove sediment from the flow area and repair the dike. Protect the dike from construction equipment crossing.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

DUST CONTROL

CODE 825

DEFINITION

Controlling dust blowing and movement on construction sites and roads.

PURPOSE

The purpose of this practice is to prevent blowing and movement of dust from exposed soil surfaces, reduce on and off-site damage, to minimize health hazards, and improve traffic safety.

CONDITIONS WHERE PRACTICE APPLIES

This practice is applicable to areas subject to dust blowing and movement where on and off-site damage is likely without treatment.

CRITERIA

The following are temporary and permanent methods for dust control.

Temporary Methods:

1. Mulches - See management practice standard MULCHING 875. Chemical or wood cellulose fiber binders may be used instead of asphalt to bind mulch material.

2. Vegetative Cover - See management practice standard TEMPORARY SEEDING 965.

3. Spray-on Adhesives - On mineral soils (not effective on muck soils). Keep traffic off these areas.

   Anionic asphalt emulsion Water Dilution: 7:1 coarse spray at 1,200 gal/acre

   Latex emulsion Water Dilution: 12.5:1 fine spray at 235 gal/acre

   Resin-in-water emulsion Water Dilution: 4:1 fine spray at 300 gal/acre.

4. Tillage - Roughen the surface and bring clods to the surface. This is an emergency measure, which should be used before soil blowing starts. Begin tillage on windward side of site. Chisel-type plows spaced about 12"-18" apart and spring-toothed harrows, are examples of equipment which may produce the desired effect.

5. Irrigation - This is commonly used and affords fast protection for haul roads and other heavy traffic roads. The site is sprinkled with water until the surface is moist. Repeat as needed.

6. Barriers - Solid board fences, snow fences, burlap fences, crate walls, bales of hay and similar material can be used to control air currents and blowing soil. Barriers placed at right angles to prevailing wind currents at intervals of about 10 times their height are effective in controlling soil blowing.

7. Calcium Chloride - Apply at a rate that will keep the surface moist. This chemical may be applied by a mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so much as to cause water pollution or plant damage. Application rates should be strictly in accordance with manufacturer's specified rates. Periodic re-treatment may be needed.

8. Stone - Stone can be used to stabilize roads or other areas during construction using crushed stone or coarse gravel. See management practice standard STABILIZED CONSTRUCTION ENTRANCE 930.

9. Street cleaning - Paved areas that have soil on them from construction sites should be cleaned daily, or as needed, utilizing a street sweeper or bucket-type endloader or scraper.

10. Permanent vegetation - See the management practice standard PERMANENT SEEDING 880 or SODDING 925. Existing trees or large shrubs may afford valuable protection if left in place.

CONSIDERATIONS

The easiest way to control dust is to avoid exposed soil surfaces. This is not possible on most construction sites, but the area exposed can usually be reduced by careful planning of controlled traffic patterns and by phasing of clearing and grading. Consider use of undisturbed vegetative buffers (min. 50 ft.) between graded areas and protected areas.

PLANS AND SPECIFICATIONS

Plans and specifications for dust control shall be in keeping with this standard and shall describe the requirements for applying the practice. At a minimum the following items should be included.

1. The area to be treated.

2. The methods that are acceptable to use.

Specifications should indicate when dust control is needed and the method of control to be used. Appropriate industry standards should be used. The installation, inspection and maintenance schedules with the responsible party clearly identified.

OPERATION AND MAINTENANCE

When temporary dust control measures are used, repetitive treatment should be applied as needed to accomplish control.

CITY OF ST. PETERS
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PRACTICE

EROSION BLANKET

CODE 830

DEFINITION

This practice refers to the application of a preformed protective blanket of straw or other plant residue, or plastic fibers formed into a mat, usually with a plastic mesh on one or both sides.

PURPOSE

The purpose of this practice is to protect the soil surface from raindrop impacts and overland flow during the establishment of grass or other vegetation. It also reduces soil moisture loss due to evaporation.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:
1) Protection of newly seeded areas is critical.
2) Slopes greater than 3:1.
3) Drainage ways, where the expected velocity is to be greater than 2ft./sec.

CRITERIA

Erosion blankets will be installed per the manufacture's specifications or as called out below, which ever standard is greater. Erosion blankets will be installed after all topsoiling, fertilizing, liming and seeding is complete. The blanket will be in firm contact with the soil. It will be anchored per the manufacturer's recommendation with the proper number and spacing of wire staples. The staples will be the proper width and length to meet the manufacturer's recommendations.

On slopes and in small drains the blanket will be unrolled upstream to downstream parallel to the direction of flow. The upstream end of each blanket will be anchored in a minimum 6-inch deep anchor trench. These blankets, when laid side by side, will overlap a minimum of 3 inches. When more than one blanket length is needed, the material will be overlapped 6 inches over the downstream piece. All edges will be stapled as per manufacturer's recommendation.

CONSIDERATIONS

Erosion blankets will be located as part of the site development plan. They will protect the ground surface from raindrop impacts and flowing water. They will also retain moisture on seeded areas thus increasing the potential for germination and survival of the vegetation. Erosion blankets materials will break down over time. They should be chosen so that they last long enough for the grass or other vegetation to become established.

PLANS AND SPECIFICATIONS

Plans and specifications for installing erosion blankets shall be in keeping with this standard and shall describe the requirements for applying the practice. Include the following items:

1. Location of the erosion blanket
2. Type of blanket
3. Location and cross section of anchor trenches

OPERATION AND MAINTENANCE

Inspect all erosion blankets periodically and after rainstorms to check for damage due to water running under the blanket or if the blankets that have been displaced. Where water has flowed under the blanket, more staples may be needed per given area or more frequent anchoring trenches installed. If significant erosion has occurred under the blanket then reseeding may be needed. Any erosion blankets that have been displaced will need to be put back and re-stapled.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

URBAN FILTER STRIP

CODE 835

DEFINITION

A created area of vegetation designed to remove sediment and other pollutants from surface water runoff.

PURPOSE

The purpose of this practice is to remove sediment and other pollutants from runoff water by filtration, deposition, infiltration, absorption, and vegetative uptake.

CONDITIONS WHERE PRACTICE APPLIES

This practice may be applied in a variety of urban land uses where surface water runoff is discharged as overland sheet flow. Some typical locations of vegetated filter strips include:

1. On construction sites and land undergoing development where filter strips are needed at the lower edge of disturbed areas to reduce sediment damage from overland (sheet) flow to adjacent property.

2. Above or adjacent to wetlands, streams, ponds or lakes, or conservation practices used to store, manage, or convey water, where shallow sheet-flow conditions can be maintained to reduce sediment and sediment-associated materials.

3. Adjacent to roadways, parking lots, and other impervious surfaces to disconnect them from streams and other water resources.

CRITERIA

For maximum effectiveness, filter strips should be designed and installed to achieve the following general criteria:

1. Avoid compacting the soils underlying the strip during construction, and protect the filter strips from heavy foot and vehicular traffic to prevent compaction and loss of infiltration capacity.

2. Have uniform sheet flow throughout. This may require the use of a level spreader or a gravel-filled trench across the upper edge of the filter strip.

3. Establish vegetation on the filter strip as early as possible in the construction schedule.

4. Maintain the vegetation at the most dense stand possible, especially at ground level.

5. Design for flow depth that does not exceed the height of the filtering media (grass).

Design and installation criteria should be determined on each site by field observation by a qualified professional. This professional should give consideration to the interactions of the following design topics:

1. Soil and site conditions: The area should be cleared of all trees, stumps, brush, rocks, and similar materials that can interfere with installation of the filter strip.

The filter strip shall be shaped to grade and dimensions shown on the plan or as staked at the site. Provisions shall be made to stockpile topsoil and spread it to appropriate thickness before seeding. Excess spoil shall be utilized off site or deposited in areas where it does not interfere with required flow characteristics of the filter strip or contribute to other erosion or sedimentation problems.

2. Slope: Vegetative filter strips function best slopes on less than 5 percent. Slopes steeper than 15 percent are difficult to maintain uniform sheet flow throughout.

3. Drainage area and runoff volume: The maximum contributing area to an individual filter without the use of a level spreader shall be 5 acres. Some applications (e.g. roof downspouts) with less than 5 acre drainage may require a level spreader to prevent a concentrated flow place through the filter strip.

4. Width: Filter strip width (perpendicular to flow) shall be calculated on the basis of the 2 year frequency, 24 hour duration storm and a hydraulic radius approximately equal to the design flow depth.

5. Length: The length of flow through vigorous vegetation shall be at least 10 ft. for slopes of less than one percent, and proportionately longer to at least 25 ft. for 30 percent slopes. Length greater than the minimums are recommended to increase effectiveness. Good performance for pollutant removal of heavily polluted water can be expected if the filter is 50 to 75 feet long.

6. Vegetation: Vegetation should be planted during optimum seeding times on firm, moist seedbeds. Lime and fertilizer should be applied according to soil test recommendations and incorporated into the upper 3 to 6 inches of soil as part of seedbed preparation for seeding or sodding. Mulch should be applied immediately after seeding on all vegetative filter strips to minimize rill development during cover establishment.

CONSIDERATIONS

On construction sites and other areas with bare soil above the filter strip, consideration should be given to construction of a silt catchment basin, silt fence, or other sediment control provisions above the filter strip.

Shrub and wildlife plantings should not be planned as part of vegetative filter strips because they are relatively ineffective for water quality improvement.

Mulch should be applied immediately after seeding on all vegetative filter strips to minimize rill development during cover establishment.

The use of native vegetation should be used if possible.

PLANS AND SPECIFICATIONS

Construction specifications will be shown in a site-specific construction plan or drawing. At a minimum, the following items should be included:

1. Location of the practice.

2. Flow length of the vegetated area.

3. Required appurtenant practices such as level spreaders or settling basins.

4. Seeding and mulching requirements.

5. Installation, inspection, and maintenance schedules with the responsible party identified.

OPERATION AND MAINTENANCE

Vegetative filter strips should be mowed and the residue harvested at a minimum of two or three times a year to promote good growth and vegetative density at ground level, nutrient removal from the system, and filtering ability.

Caution should be used when applying herbicides to filter strips or adjacent areas to minimize pollution to the water resources being protected.

Vegetative filter strips should not be used as roadways because traffic can cause damage that may cause concentrated flow problems. Filter strips should be inspected regularly for damage to vegetative stand, soil erosion, sediment inundation, and so on, and should be repaired as soon as possible.

Filter strips that have accumulated so much sediment that they are higher than adjacent areas should be disked or graded as necessary to reestablish shallow sheet-flow conditions, and be reseeded.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT
PRACTICE

GRASS-LINED CHANNELS

CODE 840

DEFINITION

A natural or constructed channel that is shaped or graded to required dimensions and established in suitable vegetation for stable conveyance of runoff.

PURPOSE

The purpose of a grass-lined channel is to convey and dispose of concentrated surface runoff without damage from erosion, deposition, or flooding.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to construction sites and developing areas where:
1. Concentrated runoff will cause damage from erosion or flooding;
2. Sufficient depth of soil materials to allow establishment of vegetation that will stabilize the cross section and grade of the channel.
3. Slopes are generally less than 5%;
4. Space is available for a relatively large cross section.

Typical uses include roadside ditches, channels at property boundaries, outlets for diversions, and other channels and drainage of low areas.

CRITERIA

Capacity - Grass-lined channels shall be designed to carry the peak runoff from the 15 year – 20 minute storm event. Where flood hazard exists, increase the capacity according to the potential damage.

Velocity - The maximum permissible velocities of flow shall not exceed the values shown in Table 1.

Cross section - The channel shape may be parabolic, trapezoidal, or V-shaped, depending on the need and site conditions. The design water surface elevation of a grassed waterway receiving water from diversions or other tributary channels shall be equal to or less than the design water surface elevation in the diversion or other tributary channels. The parabolic shape is the preferred cross section. Most waterways constructed with a trapezoidal section tend to revert to a parabolic cross section. The triangular cross section concentrates flow in the "v" of the channel causing higher and more erosive velocities. When bare or vegetated triangular channels are used, the minimum side slopes should be 6:1 or flatter.

Drainage - Where there is base flow, it shall be handled by a stone lined center, subsurface drain, or other suitable means since sustained wetness usually prevents adequate vegetative cover. The cross-

sectional area of the stone lined center or subsurface drain size to be provided shall be determined by using a flow rate of 0.1 cfs/acre or by actual measurement of the maximum base flow.

Where tile is used along the waterway, it should be located as close to 1/3 of the channel (top) width from the center of the waterway as practical. The top of the tile should be at least 2.0 feet (up to 4 feet, where possible) below the bottom of the waterway, except where soil or outlet conditions make this depth unpractical. The tile shall meet the requirements shown in the management practice standard SUBSURFACE DRAIN 945.

Alignment - Minor changes may be made to improve alignment. Care must be taken to avoid exposing soil materials (such as sodium soils or high clay content glacial till subsoils) that are not conducive to the establishment and maintenance of adequate vegetative cover.

Outlets - All grass-lined channels shall have a stable outlet with adequate capacity to prevent ponding or flooding damages. Appropriate measures must be taken to dissipate the energy of the flow to prevent scouring of the outlet channel. Examples of acceptable outlets include are not limited to GRASS LINED CHANNELS 840, IMPOUNDMENT STRUCTURE - FULL FLOW 841, IMPOUNDMENT STRUCTURE - ROUTED 842, LEVEL SPREADED 870, ROCK OUTLET PROTECTION 910, and INFILTRATION TRENCH 945.

Establishment of vegetation - Grass-lined channels will be vegetated according to the management practice standard PERMANENT SEEDING 880.

Side slopes - Side slopes shall not be steeper than a ratio of 3 horizontal to 1 vertical. They should be designed to accommodate the equipment used for maintenance. Where planned to be crossed by large equipment, trapezoidal waterways shall have side slopes of 8:1 or flatter and be protected according to the management practice standard STABILIZED CONSTRUCTION ENTRANCE 930.

Sedimentation protection - Protect permanent grass channels from sediment produced in the watershed, especially during the construction period. This can be accomplished by the effective use of diversions, sediment traps, protected side inlets and vegetative filter strips along the channel.

CONSIDERATIONS

Generally, channels should be located to conform with and use the natural drainage system. Channels may also be needed along development boundaries, roadways, and backlot lines. In all situations waterway channels should be located so that they do not make sharp, unnatural changes in direction or grade of flow. It is better to design lots to conform to natural features of the land than to have unnatural drainageways result from manipulation of land forms. Avoid channels crossing watershed boundaries or ridges.

Major reconfiguration of the drainage system often entails increased maintenance and risk of failure. Establishment of a dense, erosion resistant vegetation is essential. Construct and vegetate grass-lined channels early in the construction schedule before grading and paving increase the rate of runoff.

All grass lined channels should be designed to permit easy crossing of equipment during construction and maintenance.

If local ordinances permit, storm sewers may be used to extend existing agricultural tile or base flow across a development. They may also be used as an under drain for the waterway if the conduit is open jointed.

Geotextile fabrics or special mulch protection such as fiberglass roving or straw and netting provide stability until the vegetation is fully established. It may also be necessary to divert water from the channel until vegetation is established or to line the channel with sod. Rock checks or filter fabric checks may also be needed to protect the channel before vegetation is established. Sediment traps may be needed at channel inlets and outlets.

Applicable state drainage laws, traditional case law precedent and local ordinances and regulations must be observed in locating grass-lined channels.

PLANS AND SPECIFICATIONS

Plans and specifications for installing grass-lined channels shall be in keeping with this standard and shall describe the requirements for applying the practice. At a minimum include the following items:

1. Channel location and alignment;
2. Grade, depth and width;
3. Channel cross section type;
4. Seeding specifications and dates;
5. Subsurface drainage, if needed;
6. Installation, inspection and maintenance schedules with the responsible party identified.

OPERATION AND MAINTENANCE

During the establishment period, check grass-lined channels after every rainfall. After grass is established, check the channel at regular intervals and after every heavy rainfall event. Immediately make repairs. It is particularly important to check the channel outlet and all road crossings for bank stability and evidence of piping or scour holes. Remove all significant sediment accumulations to maintain the designed carrying capacity. Keep the grass in a healthy, vigorous condition at all times, since it is the primary erosion protection for the channel.

Table 1

Permissible Velocities for Channels Lined with Vegetation

Channel Slope	Lining	Permissible Velocity (ft/sec) 1/ .
0-5%	Reed canarygrass Tall fescue Kentucky bluegrass Smooth bromegrass	5
	Grass-legume mixture	4
	Red fescue, Red Top	3
	Small grains 2/	2.5
5-10%	Reed canarygrass	5
	Tall fescue Kentucky bluegrass Smooth bromegrass	4
Greater than 10%	Reed canarygrass Tall fescue Kentucky bluegrass Smooth bromegrass	3

1/ For highly erodible soils, permissible velocities should be decreased 25%. An erodibility factor (K) greater than 0.35 would indicate a highly erodible soil. Erodibility factors (K-factors) for Illinois soils are available in every SCS office.

2/ For temporary seedings.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

IMPOUNDMENT STRUCTURE - ROUTED

CODE 842

DEFINITION

A dam or excavation which creates an impoundment to collect and store debris, sediment, or water.

PURPOSE

The purpose of this practice is to reduce sediment and/or debris in runoff waters or retard flooding, to prevent damage to downstream facilities; or to provide surface water for consumption, irrigation, wildlife habitat, recreation or fire protection.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where sediment or debris is expected to be contained in runoff waters and may impair the capacity of the watercourse or damage other structures, down stream of the site.

CRITERIA

Investigations - sufficient investigations shall be made of the impoundment site and borrow areas to determine the suitability of site and materials for construction, water holding ability and structure stability. A complete analysis of foundation and proposed fill materials shall be made when, in the opinion of the responsible engineer, it is necessary.

Pool capacities - structures for the impoundment of debris or sediment shall have a capacity equal to the volume of sediment or debris expected to be trapped at the site as calculated by the Universal Soils Loss Equation, during the planned useful life of the structure. That capacity may be proportionally reduced, if periodic removal of sediment/debris is planned.

Runoff computation - total runoff amounts and peak discharges shall be computed using the 10 year – 20 minute storm event, for drainage areas less than 10 acres. Runoff from drainage areas greater than or equal to 10 acres shall be computed using the 10 year - 24 hour storm event.

Principal spillways - The principal spillway structure shall be capable of passing the peak discharge from the 10 year – 20 minute storm event, for drainage areas less 10 acres, and the 10 year - 24 hour storm event for drainage areas greater than or equal to 10 acres. The high water elevation shall be at or below emergency spillway flow line elevation.

For structures with flood retarding as a purpose capacity of the principal spillway, the spillway shall be designed per the local governing authorities standards for storm water detention.

The elevation of the crest of the lowest stage of the principal spillway shall be set at the elevation of the sediment pool. For dry dams, the riser shall be designed to permit design discharge at the sediment pool

elevation with provisions for discharging water at lower elevations to satisfy the functional requirements of the structure.

All parts of the principal spillway, except attached gates and trash racks, shall have an expected service life equal to or greater than the design life of the structure or provisions made for replacement.

The minimum diameter of the conduit used as a principal spillway shall be 10 inches.

The storage volume shall not be less than the expected sediment accumulation during a period equal to the design life.

The retarding storage requirements shall be sufficient to contain the runoff expected to occur at a frequency consistent with the level of protection to be provided to the downstream benefited area, with proper allowance for discharge through the principal spillway. The retarding storage capacity shall be sufficient to limit the use of the emergency spillway to a permissible frequency and duration based upon consideration of the erosion resistance of the spillway material and vegetative protection to be provided.

Principal spillway structures may be conduits, weir-type straight drops, or chutes. All materials used for the construction of the principal spillway and basin must meet the most current MSD standards.

Pipe conduits should meet the following requirements:

Anti-seep collars should be installed around the pipe conduit in the normal saturation zone if any of the following conditions exist:

1. The settled dam height exceeds 15 feet.
2. The conduit is of smooth exterior pipe larger than eight inches in diameter.
3. The conduit is of corrugated exterior pipe larger than 12 inches in diameter.

Anti-seep collars and their connections to the pipe should be watertight. The collar material should be compatible with pipe materials. The maximum spacing should be approximately 14 times the minimum projection of the collar measured perpendicular to the pipe. A minimum of one anti-seep collar should be used on all conduits.

Closed conduit spillways designed for pressure flow must have adequate anti-vortex devices at their inlets.

If needed to prevent clogging of the conduit, an appropriate trash guard should be installed at the inlet or riser.

For safety reasons, all vertical drop inlets should be constructed to prevent accidental injury. This may be accomplished by using a horizontal anti-vortex baffle, trash rack or guard rail.

Emergency spillways - An emergency spillway must be provided for each basin, unless the principal spillway is large enough to pass peak discharge from the 100 year – 20 minute event.

Emergency spillways shall provide for passing the design flow at a safe velocity to a point downstream where the dam will not be endangered.

Constructed emergency spillways are open channels that usually consist of an inlet channel, a control section, and an exit channel. They shall be stable for the material in which the spillway is to be constructed. The emergency spillway shall have a bottom width of not less than 10 feet.

Upstream from the control section, the inlet channel shall be level for the distance needed to protect and maintain the crest elevation of the spillway. The inlet channel may be curved to fit existing topography. The grade of the exit channel of a constructed emergency spillway shall fall within the range established by discharge requirements and permissible velocities. Design procedures and details for vegetated earth emergency spillways may be found in the SCS Engineering Field Handbook, the SCS National Engineering Handbook, and SCS Technical Release 52, or other references specified by the local regulatory authorities.

Foundation cutoff - A cutoff of relatively impervious material shall be provided under the dam if necessary. The cutoff shall be located at or upstream from the centerline of the dam. It shall extend up the abutments as required and be deep enough to extend into a relatively impervious layer or provide for a stable dam when combined with seepage control. The cutoff trench shall have a bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations. Side slopes shall not be steeper than one horizontal to one vertical.

Seepage control - Seepage control is to be included if:

1. pervious layers are not intercepted by the cutoff,
2. seepage creates swamping downstream,
3. such control is needed to insure a stable embankment,
4. special problems require drainage for a stable dam.

Seepage may be controlled by:

1. foundation, abutment, or embankment drains,
2. reservoir blanketing,
3. a combination of these measures.

Earth embankment - The minimum top width for a dam is shown in Table 4. If the embankment top is to be used as a public road, the minimum width shall be 16 feet for one-way traffic and 26 feet for two-way traffic. Guardrails or other safety measures shall be used where necessary and shall meet the requirements of the responsible road authority.

The combined upstream and downstream side slopes of the settled embankments shall not be less than five horizontal to one vertical, and neither slope shall be steeper than two horizontal to one vertical. All slopes must be designed to be stable, even if flatter side slopes are required.

If needed to protect the slopes of the dam, special measures, such as berms, rock riprap, sand-gravel, soil cement, or special vegetation, shall be provided.

The minimum elevation of the top of the settled embankment shall be 2 foot above the water surface in the reservoir with the emergency spillway flowing at design depth. The minimum difference in elevation between the crest of the emergency spillway and the settled top of the dam shall be 2 feet for all dams having more than a 20 acre drainage area or more than 20 feet in effective height.

The design height of the dam shall be increased by the amount needed to insure that after settlement the height of the dam equals or exceeds the design height. This increase shall not be less than 5 percent, except where detailed soil testing and laboratory analysis show that a lesser amount is adequate.

Excavated impoundments

Runoff - Provisions shall be made for a pipe and emergency spillway if necessary. Runoff flow patterns shall be considered when locating the pit and placing the spoil.

Side slopes - Side slopes of excavated ponds shall be stable and shall not be steeper than three horizontal to one vertical.

Perimeter form - If the structures are to be used for recreation or are highly visible to the public, the perimeter or edge should be curvilinear.

Inlet protection - If surface water enters the pond in a natural or excavated channel, the side slope of the impoundment shall be protected against erosion.

Excavated material - The material excavated from the pond shall be placed so that its weight will not endanger the stability of the pond side slopes and so that it will not be washed back into the pond by rainfall. It shall be disposed of in one of the following ways:

1. Uniformly spread to a height that does not exceed 3 feet, with the top graded to a continuous slope away from the impoundment.
2. Uniformly placed or shaped reasonably well, with side slopes assuming a natural angle of repose. The excavated material will be placed at a distance equal to the depth of the impoundment but not less than 12 feet from the edge of the impoundment.
3. Shaped to a designed form that blends visually with the landscape
4. Used for low embankment and leveling.
5. Hauled away.

Vegetation - Disturbed areas that are not to be cultivated shall be established as soon as practicable after construction. Seedbed preparation, seeding, fertilizing and mulching shall comply with management practice standard 880 or 970 Permanent or Temporary Seeding.

CONSIDERATIONS

Site safety - Impoundments are potential attractive nuisances and safety aspects must be considered in their design and layout. If the area is used or may be used for recreation, it is recommended that warning signs be erected, that lifesaving equipment be available on site and that emergency instructions be posted in a conspicuous location.

Visual resource design - The visual design of impoundments shall be carefully considered in areas of high public visibility and those associated with recreation. The underlying criterion for all visual design is appropriateness. The shape and form of ponds, excavated material, and plantings are to relate visually to their surroundings and to their function.

The embankment may be shaped to blend with the natural topography. The edge of the impoundment may be shaped so that it is generally curvilinear rather than rectangular. Excavated material can be

shaped so that the final form is smooth, flowing, and fitting to the adjacent landscape rather than angular geometric mounds. If feasible, islands may be added for visual interest and to attract wildlife.

PLANS AND SPECIFICATIONS

Plans and specifications for installing full flow impoundment structures shall be in keeping with this standard and shall describe the requirements for installing the practice. Items that specifications should address, if applicable, and appropriate construction/material specifications, standard drawings and other standards are as follows:

Site and foundation preparation - All site and foundation areas shall be prepared and maintained in such a manner that earthfill placement or other specified treatments allow the practice to achieve its intended purpose.

Excavations and earthfill - All specified excavation shall be preformed and earthfills shall be placed in such a manner that allows the practice to achieve its intended purpose.

Spillway structures - All spillways including inlet and outlet structures shall be constructed or installed in a manner that allows the practice to achieve its intended purpose. Materials and construction techniques specified shall be appropriate for the intended life and hazard classification of the practice. Where available, manufacturer's installation recommendations may be included in specifications.

Site physical protection plan - Adequate measure shall be specified to control, on site, additional runoff and/or contaminants expected as a result of construction activities; to provide for the safety of the general public; and to provide a maintainable system of erosion protection for the constructed practice.

OPERATION AND MAINTENANCE

An operation and maintenance plan should be developed and concurred in by the owners/operators of the impoundment structure. The operation plan shall establish a schedule for testing all operable facilities to ensure that they function as intended, or that necessary repairs are made. The maintenance plan shall specify responsible parties for maintaining or replacing, as necessary: all vegetative components of the structure, riprap for wave protection or outlet protection, inlet and outlet works, safety features including fences and signs, and on-site erosion/water control facilities.

Procedures and responsible parties for removing and disposing of accumulated debris and/or sediment as necessary to ensure the function of the structure shall be specified at a minimum. At a minimum, sediment and debris shall be removed once the capacity of the basin is 2/3 filled. Procedures and responsible parties for repairing damage to embankment, spillway structures and other appurtenances shall be specified. The structure shall be inspected at least yearly and after every storm event causing flows through vegetated spillways or over top of embankment.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

INFILTRATION TRENCH

CODE 845

DEFINITION

Excavated trenches in which stormwater runoff is collected for temporary storage and infiltration.

PURPOSE

The purpose of this practice is to reduce runoff volume and peak discharges from a site and to filter contaminants out of runoff before it reaches receiving waters.

CONDITIONS WHERE PRACTICE APPLIES

This permanent site development practice applies to small drainage areas, usually less than 5 acres and sites with soils in the hydrologic groups A and B. Soils in hydrologic groups C and D usually will not perform adequately unless used on very small acreages, such as a back yard.

CRITERIA

Infiltration trenches do not have a set design capacity and all must have an overflow component since none are designed to handle large runoff volumes.

Recommended design capacities range from approximately 0.5 to 2.0 inches per acre of drainage area.

The capacity of the trench will be based on the void ratio of the aggregate used in the system.

The trench shall be filled with coarse aggregate. The bottom 6 inch layer in the trench or pit shall be sand. The aggregate shall be separated from the soil material by filter fabric. The fabric shall also cover the top of the aggregate to prevent plugging.

The filter fabric shall meet the requirement in material specification, with an apparent opening size of at least 30 for non-woven and 50 for woven.

CONSIDERATIONS

To the extent possible, grease, oil, floatable organic materials, and settleable particles should be removed from runoff water before it enters the infiltration trench. Runoff filtering practices such as management practice standard FILTER STRIP 835, or sediment traps and grease traps can be used to reduce the volume of these objectionable materials.

Care must be taken to prevent groundwater contamination by not installing infiltration trenches in highly permeable sand or gravel seams that are directly connected to underlying aquifers.

Field permeability tests should be ran at the bottom of the trench to better predict its ability to function.

A separation distance of at least four feet should exist between the bottom of the infiltration facility and seasonal high groundwater or bedrock.

Caution should be taken in siting infiltration trenches in aquifer recharge areas to prevent contamination of drinking water supplies.

PLANS AND SPECIFICATIONS

Plans and specifications for installing infiltration trench shall be in keeping with this standard and shall describe the requirements for applying the practice. At a minimum include the following items:

1. System location
2. Depth and width
3. Aggregate gradation
4. Filter fabric requirements
5. The installation, inspection, and maintenance schedule with the responsible party identified.

OPERATION AND MAINTENANCE

The infiltration trench should be inspected at least annually and after each major rainfall. Coarse grain material will collect on top of the filter fabric and will have to be removed when the system infiltration rates drop below acceptable levels.

Maintenance needs are to be discussed with the landowner or operator who is responsible for maintaining the practice.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

INLET PROTECTION - BLOCK & GRAVEL

CODE 850

DEFINITION

A sediment control barrier formed around a storm drain inlet by the use of standard concrete blocks and gravel.

PURPOSE

The purpose of this practice is to help prevent sediment from entering storm drains before stabilizing the contributing watershed. This practice allows early use of the storm drain system.

CONDITIONS WHERE PRACTICE APPLIES

A block and gravel type of inlet protection may be used where storm drain inlets are to be made operational before permanent stabilization of the disturbed drainage area. This method of inlet protection applies to both drop inlets and curb inlets where heavy flows are expected and an overflow capacity is necessary to prevent excessive ponding around the structure. Shallow temporary flooding after rainfall should be expected.

This practice may be used near the edge of fill material and must not divert water away from the storm drain.

This practice can be used in combination with other temporary inlet protection devices such as management practice standards INLET PROTECTION - EXCAVATED DRAIN 855 or INLET PROTECTION -FABRIC DROP 860.

CRITERIA

The drainage area should be smaller than 1 acre unless site conditions and assurances that timely inspection and maintenance allows for frequent removal and adequate disposal of accumulated sediment.

The height of the barrier shall be at least 12 inches but no greater than 24 inches. Do not use mortar. Limit the height to prevent excess ponding and bypass flow.

Recess the first course of blocks at least 2 inches below the crest opening of the storm drain for lateral support. Support subsequent courses laterally if needed by placing a 2 x 4-inch wood stud through the block openings that are perpendicular to the block course needing support. Lay one block on its side on each side of the bottom row for dewatering the pool. Place hardware cloth or comparable wire mesh with 1/2 inch openings over all block openings to hold gravel in place. Place gravel just below the top of the blocks on slopes of 2:1 or flatter. The gravel shall meet the requirements for coarse

aggregate. Use aggregate filled, permeable bags in front of curb inlets. The bags shall be placed in a circular pattern in front of the inlet.

CONSIDERATIONS

In developing areas, installation of streets and storm sewer networks usually occur before the construction of homes, businesses or other developments. During this and subsequent phases of construction, unprotected soil is susceptible to erosion. Storm sewers that are operational before their drainage areas are stabilized often carry large amounts of sediment to lakes, detention ponds, streams, or other natural or constructed drainageways. As a result, the water quality of the receiving body of water is detrimentally affected. In cases of extreme sediment loading, the storm sewer may clog completely or lose a major portion of its capacity. To avoid these problems, it is necessary to prevent sediment from entering the system at the inlets.

Storm drain inlet protection consists of several types of inlet filters and traps. Each type differs in application dependant upon site conditions and type of inlet. Not all designs are appropriate in all cases. The user must carefully select a design suitable for the needs and site conditions. Field experience has shown that inlet protection, which causes excessive ponding in an area of high construction activity, may become so inconvenient that it is removed or bypassed, thus transmitting sediment-laden flows unchecked. In such situations, a structure with an adequate overflow mechanism must be utilized.

Stone is utilized as the chief ponding/filtering agent in many types of inlet protection. The various types of "coarse aggregates" which are shown are able to filter out sediment mainly through slowing down flows directed to the inlet by creating an increased flow path for the stormwater (through void space in the respective stone). The stone filtering medium by no means slows stormwater flow rate as does filter cloth and therefore cannot provide the same degree of filter efficiency when smaller silt and clay particles are introduced into stormwater flows. However, as mentioned earlier, excessive ponding in busy areas adjacent to stormwater inlets is in many cases unacceptable.

In most instances, inlet protection utilizing stone should not be the sole control measure. At the time that storm sewer inlet and associated appurtenances become operational, areas adjacent to the structures are most likely at final grade or will not be altered for extended periods; this is the time when management practice standard TEMPORARY SEEDING 965 and other appropriate controls should be implemented to enhance sediment-loss reductions. In addition, by varying stone sizes used in the construction of inlet protection, a greater degree of sediment removal can be obtained. As an option, filter cloth can be used with the stone in these devices to further enhance sediment removal. Notably, the potential inconvenience of excessive ponding must be examined with these choices, especially the latter. In all designs, which utilize stone with a wire-mesh support as a filtering mechanism, the stone can be completely wrapped with the wire mesh to improve stability and provide easier cleaning.

Filter fabric may be added to any of the devices, which utilize coarse aggregate stone to enhance sediment removal. The fabric shall meet the requirements as shown in material specification 592 GEOTEXTILE. Table 1 or 2 class 1 with an AOS of at least 30 for nonwoven and 50 for woven will be used. As a result of the significant increase in filter efficiency provided by the fabric, a larger range of stone sizes may be utilized with such a configuration. The larger stone will help keep larger sediment masses from clogging the cloth.

Inlet protection devices are for drainage areas of one acre or less. Runoff from areas larger than one acre should be routed through a properly designed practice such as IMPOUNDMENT STRUCTURE-ROUTED 842, TEMPORARY SEDIMENT TRAP 960.

The best way to prevent sediment from entering the storm sewer system is to stabilize disturbed areas of the site as quickly as possible, preventing erosion and stopping sediment at its source.

PLANS AND SPECIFICATIONS

Plans and specifications for installing block and gravel inlet protection shall be in keeping with this standard and shall describe the requirements for applying the practice. At a minimum include the following items:

1. Inlet location
2. Stone gradation
3. Wire screen hole size
4. Installation, inspections, and maintenance schedules with responsible party identified.

OPERATION AND MAINTENANCE

Inspect the barrier after each runoff producing rain and make repairs as needed. A maintenance schedule shall be provided prior to approval from the governing authority.

Sediment shall be removed and the trap restored to its original dimensions when the sediment has accumulated to one-half the design depth of the trap. Removed sediment shall be deposited in a suitable area in such a manner that it will not erode.

When the contributing drainage area has been adequately stabilized, remove all materials and any unstable soil, and either salvage or dispose of it properly. Bring the disturbed area to proper grade, then smooth and compact it. Appropriately stabilize all bare areas around the inlet.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

INLET PROTECTION - EXCAVATED DRAIN

CODE 855

DEFINITION

An excavated area in the approach to a storm drain, drop inlet, or curb inlet.

PURPOSE

The purpose of this practice is to help prevent sediment from entering storm drains before stabilizing the contributing watershed. This practice allows early use of the storm drain system.

CONDITIONS WHERE PRACTICE APPLIES

An excavated drain type of inlet protection may be used where storm drain drop inlets are to be made operational before permanent stabilization of the disturbed drainage area. This method of inlet protection is applicable where relatively heavy flows are expected and overflow capability and ease of maintenance are desired. Frequent maintenance is required and temporary flooding in the excavated area will occur. This practice can be used in combination with other temporary inlet protection devices such as practices, INLET PROTECTION-BLOCK AND GRAVEL 850, and INLET PROTECTION-FABRIC DROP 860.

CRITERIA

Limit the drainage area to 1 acre. The minimum depth shall be 1 foot and the maximum depth shall be 2 feet as measured from the crest of the inlet structure.

Maintain side slopes around the excavated area no steeper than 2:1.

The minimum volume of excavated area around the drop inlet shall be approximately 135 yd3/acre of drainage area.

Shape the basin to fit site conditions, with the longest dimension oriented toward the longest inflow area to provide maximum trap efficiency. Where an inlet is located so as to receive concentrated flows such as in a highway median, the basin shall have a rectangular shape in a 2:1 length to width ratio, with the length being oriented in the direction of flow.

Install provisions, such as weep holes, for draining the temporary pool to improve trapping efficiency for small storms and to avoid problems from standing water after heavy rains.

Gravel meeting the requirements for coarse aggregate may be placed next to the storm drain inlet structure to improve filtering efficiency.

When gravel is used, the weep hole should be covered with screen wire or hardware cloth to prevent the gravel from entering the storm drain.

CONSIDERATIONS

In developing areas, installation of streets and storm sewer networks usually occurs before homes, businesses or other developments are constructed. During this and subsequent phases of construction, unprotected soil is susceptible to erosion. Storm sewers that are operational before their drainage areas are stabilized often carry large amounts of sediment to lakes, detention ponds, streams, or other natural or constructed drainageways. As a result, the water quality of the receiving body of water is detrimentally affected. In cases of extreme sediment loading, the storm sewer may clog completely or lose a major portion of its capacity. To avoid these problems, it is necessary to prevent sediment from entering the system at the inlets.

Field experience has shown that inlet protection, which causes excessive ponding in an area of high construction activity, may become so inconvenient that it is removed or bypassed. Thus transmitting sediment laden flows unchecked. In such situations, a structure with an adequate overflow mechanism should be utilized.

Storm drain inlet protection consists of several types of inlet filters and traps. Each type differs in application dependant upon site conditions and type of inlet. Not all designs are appropriate in all cases. The user must carefully select a design suitable for the needs and site conditions.

Stone is utilized as the chief ponding/filtering agent in many types of inlet protection. The various types of "coarse aggregates" which are depicted are able to filter out sediment mainly through slowing down flows directed to the inlet by creating an increased flow path for the stormwater (through void space in the respective stone). The stone filtering medium by no means slows stormwater flow rate as does filter cloth and therefore cannot provide the same degree of filter efficiency when smaller silt and clay particles are introduced into stormwater flows. However, as mentioned earlier, excessive ponding in busy areas adjacent to stormwater inlets is in many cases unacceptable. That is why stone must be utilized with many installations.

Fortunately, in most instances, inlet protection utilizing stone should not be the sole control measure. At the time that storm sewer inlet and associated appurtenances become operational, areas adjacent to the structures are most likely at final grade or will not be altered for extended periods; this is the time when management practice standard TEMPORARY SEEDING 965 and other appropriate controls should be implemented to enhance sediment-loss mitigation. In addition, by varying stone sizes used in the construction of inlet protection, a greater degree of sediment removal can be obtained. As an option, filter cloth can be used with the stone in these devices to further enhance sediment removal. Notably, the potential inconvenience of excessive ponding must be examined with these choices. In all designs that utilize stone with a wire-mesh support as a filtering mechanism, the stone can be completely wrapped with the wire mesh to improve stability and provide easier cleaning.

Filter fabric may be added to any of the devices, which utilize coarse aggregate stone to enhance sediment removal. The fabric shall meet the requirements as shown in material specification 592 GEOTEXTILE. Table 1 or 2 class 1 with an AOS of at least 30 for nonwoven and 50 for woven. As a result of the significant increase in filter efficiency provided by the fabric, a larger range of stone sizes may be utilized with such a configuration. The larger stone will help keep larger sediment masses from clogging the cloth. Notably, significant ponding may occur at the inlet if filter cloth is utilized in this manner.

Inlet protection devices are for drainage areas of one acre or less. Runoff from areas larger than one acre should be routed through properly designed practices such as IMPOUNDMENT STRUCTURE-ROUTED 842 or TEMPORARY SEDIMENT TRAP 960.

A temporary berm may need to be constructed downstream of the inlet protection device to prevent bypass flows.

The best way to prevent sediment from entering the storm sewer system is to stabilize the disturbed area of the site as quickly as possible, preventing erosion and stopping sediment at its source.

PLANS AND SPECIFICATIONS

Plans and specifications for installing excavated drain inlet protection shall be in keeping with this standard and shall describe the requirements for applying the practice. At a minimum include the following items:

1. Inlet location
2. Basin length, width and depth
3. Detail around inlet structure
4. Installation, inspection, and maintenance schedules with responsible party clearly identified.

OPERATION AND MAINTENANCE

Inspect, clean, and properly maintain the excavated basin after every storm until the contributing drainage area has been permanently stabilized. To provide satisfactory basin efficiency, remove sediment when the volume of the basin has been reduced by one-half. Spread all excavated material evenly over the surrounding land area or stockpile and stabilize it appropriately.

After the contributing drainage area has been stabilized, remove the gravel and accumulated sediment; plug the weepholes and backfill to final grade. Water shall not stand in the area excavated around this inlet for more than 3 days.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

INLET PROTECTION - FABRIC DROP/STRAW BALES

CODE 860

DEFINITION

A temporary straw bale or fabric barrier placed around a drop inlet.

PURPOSE

The purpose of this practice is to help prevent sediment from entering storm drains during construction operations. This practice allows early use of the storm drainage system.

CONDITIONS WHERE PRACTICE APPLIES

This type of inlet protection may be used where storm drain inlets are to be made operational before permanent stabilization of the disturbed drainage area. This method of inlet protection is effective where the inlet drains a small, nearly level area with slopes generally less than 5% and where shallow sheet flows not exceeding 1 cfs are expected. The immediate land area around the inlet should be relatively flat (less than 1% slope) and located so that accumulated sediment can be easily removed. This method should not be used in areas receiving concentrated flows, such as in street or highway medians.

CRITERIA

The maximum drainage area shall not exceed 1 acre per inlet.

The maximum height of fabric above the crest of the drop inlet shall be 1.5 feet. This height allows a shallow temporary de-silting pool to form behind the fabric but limits the pressure against the fabric if overtopping occurs. The selected height of the top of the barrier should allow overflow to the drop inlet and not let overflow bypass the inlet to unprotected lower areas. It may be necessary to build a temporary dike on the downslope side of the structure to prevent bypass flows.

For fabric barriers, use stakes of 2 x 4-inch wood (preferred) or equivalent metal with a minimum length of 3 feet. Space the stakes a maximum of 3 feet apart, and securely drive them into the ground to a depth of approximately 18 inches.

Drive the stakes close to the drop inlet so that overflow will fall directly into the structure and not on unprotected soil.

To provide needed stability to the installation, make a frame around the stakes a maximum of 1.5 ft above the top of the drop inlet. This will serve as a stable crest for overflow during rainfall. Place the bottom 12 inches of the fabric in a trench and backfill the trench with 12 inches of compacted soil or six inches of crushed gravel.

Fasten fabric securely by staples or wire to the stakes and frames. Joints must be overlapped to the next stake.

Improved performance and sediment storage volume can be obtained by excavating the area. See management practice standard, INLET PROTECTION EXCAVATED DRAIN 855.

CONSIDERATIONS

In developing areas, installation of streets and storm sewer networks usually occur before the construction of homes, businesses or other developments. During this and subsequent phases of construction, unprotected soil is susceptible to erosion. Storm sewers that are operational before their drainage areas are stabilized often carry large amounts of sediment to lakes, detention ponds, streams, or other natural or constructed drainageways. As a result, the water quality of the receiving body of water is detrimentally affected. In cases of extreme sediment loading, the storm sewer may clog completely or lose a major portion of its capacity. To avoid these problems, it is necessary to prevent sediment from entering the system at the inlets.

Storm drain inlet protection consists of several types of inlet filters and traps. Each type differs in application dependant upon site conditions and type of inlet. Not all designs are appropriate in all cases. The user must carefully select a design suitable for the needs and site conditions.

Inlet protection devices are for drainage areas of one acre or less. Runoff from areas larger than one acre should be routed through a properly designed practice such as IMPOUNDMENT STRUCTURE-ROUTED 842 or TEMPORARY SEDIMENT TRAP 960.

In some instances, a wire mesh may be needed to reinforce the fabric and supporting posts. This should be used in areas where concentrated flows may occur or where timely maintenance may be a concern. If used, the wire mesh shall have a maximum opening of 6 inches.

A temporary berm may need to be constructed downstream of the inlet protection device to prevent bypass.

The best way to prevent sediment from entering the storm sewer system is to stabilize the disturbed area of the site as quickly as possible, preventing erosion and stopping sediment at its source.

PLANS AND SPECIFICATIONS

The plans and specifications for installing fabric drop inlet protection shall be in keeping with this standard and shall describe requirements for applying the practice. At a minimum include the following items:

1. Inlet location
2. Type and size support posts.
3. Fabric material requirements
4. Detail around inlet structure
5. Installation, inspection and maintenance schedules with responsible party identified.

OPERATION AND MAINTENANCE

Inspect the fabric barrier after each rain and make repairs as necessary.

Remove sediment from the pool area as necessary to provide adequate storage volume for the next rain. Take care not to damage or undercut the fabric during sediment removal.

When the contributing drainage area has been adequately stabilized, remove all materials and any unstable sediment and dispose of them properly. Bring the disturbed area to the grade of the drop inlet and smooth and compact it. Appropriately stabilize all bare areas around the inlet.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

LAND GRADING

CODE 865

DEFINITION

Reshaping the ground surface to planned grades as determined by engineering survey evaluation and layout.

PURPOSE

The purpose of this practice is to provide suitable topography for buildings, facilities, and other land uses, to control surface runoff, and to minimize soil erosion and sedimentation both during and after construction.

CONDITIONS WHERE PRACTICE APPLIES

This practice is applicable where grading to a planned elevation is necessary and practical for the proposed development of a site and for proper operation of sedimentation control practices.

CRITERIA

The grading plan and installation shall be based upon adequate surveys and investigations. The plan is to show the location, slope, cut, fill, and finish elevations of surfaces to be graded. It will also show the auxiliary practices for safe conveyance of runoff water, slope stabilization, soil erosion and sediment control, and stormwater management. These practices may include but are not limited to retaining walls, grass- lined swales, grade stabilization structures, lined ditches, sediment basins, detention ponds, diversions and surface and subsurface drains. The practices may be temporary or permanent, depending upon the need after construction is completed.

The development and establishment of the plan shall incorporate the following, as appropriate:

1. The cut face of the excavation, which is to be vegetated, shall be two horizontal to one vertical (2:1) or flatter. Cut slopes of materials not to be vegetated shall be at or below the safe angle of repose for the materials encountered. For maintenance reasons 4:1 or flatter slopes are preferable. Slopes steeper than 2:1 shall require special design and stabilization considerations that shall be adequately shown on the plans.

2. The permanent exposed faces of fills shall be two horizontal to one vertical (2:1) or flatter. For slope maintenance, 4:1 or flatter is recommended. Slopes exceeding 2:1 shall require special design and stabilization considerations that shall be adequately shown on the plans.

3. Provisions shall be made to safely conduct surface water to storm drains or to suitable natural watercourses and to prevent surface runoff from damaging the cut faces and fill slopes.

4. Subsurface drainage shall be provided in areas having a high water table to intercept seepage that would affect building foundations, slope stability, or create undesirable wetness.

5. Excavations shall not be made so close to property lines as to endanger the adjoining property without supporting and protecting such property from erosion, sliding, settling, or cracking.

6. No fill shall be placed where it will slide or wash upon the premises of another, or so placed adjacent to the bank of a channel as to create bank failure or decrease the natural carrying capacity of the stream.

7. At a minimum a setback of 25 feet should be provided as a buffer to sensitive areas.

8. Fills shall consist of material from cut areas, borrow pits, or other approved sources. Fill material shall be free of brush, rubbish, rocks, logs, stumps, building debris, and other objectionable material. It should be free of stones over two inches in diameter where compacted by hand or mechanical tampers or over eight inches in diameter where compacted by rollers or other equipment. Frozen material shall not be placed in the fill nor shall the fill material be placed on a frozen foundation.

9. Diversions shall be provided whenever the vertical interval of any slope exceeds 20 feet. Diversions shall be located to divide the slope face as equally as possible and shall convey the water to a stable outlet. Soils, seeps, rock outcrops, etc shall also be taken into consideration when designing diversions.
    - Diversions shall be a minimum bottom width of six feet to provide for maintenance.
    - Diversions shall be designed with cut slope of 6:1 or flatter to the toe of the upper slope and with a minimum of one foot in depth. The gradient to the outlet shall be between 2% and 3%, unless accompanied by appropriate design and computations.
    - The flow length within a diversion shall not exceed 800 feet unless accompanied by an appropriate design and computations. See management practice standards DIVERSION 815, DIVERSION DIKE 820 or TEMPORARY DIVERSION 955.

10. Surface water shall be diverted from the face of all cut and fill slopes by the use of diversions, ditches and waterways or conveyed downslope by the use of a designed structure, except where:
    - The face of the slope is or shall be stabilized and the face of all graded slopes shall be protected from surface runoff until they are stabilized.
    - The face of the slope shall not be subject to any concentrated flows of surface water such as from natural drainageways, graded waterways, downspouts, etc.
    - The face of the slope will be protected by special erosion control materials, sod, gravel, riprap, or other stabilization methods.

11. Cut slopes occurring in ripable rock shall be serrated. These serrations shall be made with conventional equipment as the excavation is made. Each step or serration shall be constructed on the contour and will have steps cut at nominal two-foot intervals with nominal three-foot horizontal shelves. These steps will vary depending on the slope ratio or the cut slope. These steps will weather and act to hold moisture, lime, fertilizer and seed thus producing a much quicker and longer lived vegetative cover and better slope stabilization. Overland flow shall be diverted from the top of all serrated cut slopes and carried to a suitable outlet.

12. Stockpiles, borrow areas, and spoil areas shall be shown on the plans and shall be subject to the provision of this standard.

13. All disturbed areas shall be stabilized in accordance with the management practice standards MULCHING 875, PERMANENT SEEDING 880 or TEMPORARY SEEDING 915, as appropriate.

14. Use slope breaks, such as diversions or benches, as appropriate, to reduce the length of cut-and-fill slope to limit sheet and rill erosion and prevent gullying. A spacing guide is shown below.

	Horizontal Distance (ft)
Steep Slopes	
2:1	20
3:1	35
4:1	45
Long Slopes	
15-25%	50
10-15	80
6-10%	125
3-6%	200
<3%	300

CONSIDERATIONS

Fitting a proposed development to the natural configurations of an existing landscape reduces the need for some erosion and sediment control measures. It may also result in a more desirable and less costly development.

Before grading begins, decisions must be made on the steepness of cut-and-fill slopes, how they will be protected from runoff, how they will be stabilized, and how they will be maintained. The grading plan establishes drainage areas, directs drainage patterns, and affects runoff velocities.

The grading plan forms the basis of the erosion and sediment control plan. Key considerations that affect erosion and sedimentation include deciding which slopes are to be graded, when the work will start and stop, the percent and length of finished slopes, where and how excess material will be disposed of, and where fill is needed.

Leaving undisturbed temporary and permanent buffer zones in the grading operation may provide an effective and low-cost erosion control measure that will help reduce runoff velocity and volume and off-site sedimentation. In developing the grading plan, always consider how to take advantage of undisturbed water disposal outlets before storm drains or other constructed outlets are installed.

PLANS AND SPECIFICATIONS

Plans and specifications for land grading shall be in keeping with this standard and shall describe the requirements for applying the practice. At a minimum include the following items:

1. The finished land slope grade and direction of land slope.
2. Location of other related structures, e.g. drains, curbs, etc.
3. Topsoil stockpile location.
4. Borrow areas if needed.

5. Installation, inspection and maintenance schedules with responsible party identified.

OPERATION AND MAINTENANCE

Periodically check all graded areas and the supporting erosion and sediment control practices, especially after heavy rainfalls. Promptly remove all sediment from diversions, sediment trapping practices and other water-disposal practices. If washouts or breaks occur, repair them immediately. Prompt maintenance of small, eroded areas before they become significant gullies is an essential part of an effective erosion and sediment control plan.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT
PRACTICE

LEVEL SPREADER

CODE 870

DEFINITION

A nonerosive outlet for concentrated runoff constructed to disperse flow uniformly across a slope.

PURPOSES

The purpose of this practice is to convert concentrated flow to sheet flow and release it uniformly over a stabilized area.

CONDITIONS WHERE PRACTICE APPLIES

1. Where sediment-free storm runoff can be released in sheet flow down a stabilized slope without causing erosion.

2. Where a level lip can be constructed in cut.

3. Where the area above the spreader lip is uniform with a slope of 10% or less and is stable for anticipated flow conditions, preferably well-vegetated.

4. Where the runoff water will not re-concentrate after release.

5. Where there will be no traffic over the spreader.

CRITERIA

Capacity - Determine the capacity of the spreader by estimating peak flow from the 15 year – 20 minute storm event. Restrict the drainage area so that maximum flows into the spreader will not exceed 30 cfs.

Spreader dimensions - When water enters the spreader from one end, as from a diversion, select the appropriate length and depth of the spreader from the table below.

Design flow (cfs)	Min. Dimension Depth (ft)	Length (ft)
0-10	0.5	10
10-20	0.6	20
20-30	0.7	30

Construct a 20 foot transition section in the diversion channel so the width of the channel will smoothly meet the width of the spreader to ensure uniform outflow.

Grade - The grade of the last 20 feet of the diversion channel should provide a smooth transition from channel grade to the level spreader and where possible, shall be less than or equal to 1%. The grade of the spreader should be 0%.

Spreader lip - Construct the level lip on undisturbed soil to uniform height and zero grade over the length of the spreader. Protect it with an erosion-resistant material, such as fiberglass matting, to prevent erosion and allow vegetation to become established. For design flows in excess of 4 cfs or for permanent installation, a rigid lip of non-erodible material, such as pressure-treated timbers or concrete curbing, should be used.

Outlet area - The outlet disposal area must be generally smooth and well-vegetated with a maximum slope of 10%.

Spreader lip matting - For vegetated lip the erosion control matting shall be a minimum of 4 feet wide extending 6 inches over the level lip. The upstream edge will be buried at least 6 inches deep in a vertical trench. The downstream edge shall be securely held in place with closely spaced heavy duty staples at least 12 inches long.

A rigid level lip should be entrenched at least 2 inches below existing ground and securely anchored to prevent displacement. An apron of coarse aggregate should be placed to the top of the level lip and extend downslope at least 3 feet. Place filter fabric under the stone and use galvanized wire mesh over the stone to hold the stone securely in place.

Seeding - Immediately after its construction, appropriately seed and mulch the entire disturbed area of the spreader. Mulching shall meet the requirements as shown in the management practice standard MULCHING 875 and seeding shall meet the requirements as shown in the management practice standard PERMANENT SEEDING 880.

CONSIDERATIONS

The level spreader is a relatively low-cost structure to release small volumes of concentrated flow where site conditions are suitable. Particular care must be taken to construct the outlet lip completely level in a stable, undisturbed soil. Any depressions in the lip will concentrate the flow, resulting in erosion. Evaluate the outlet system to be sure that flow does not concentrate below the outlet. The level spreader is most often used as an outlet for temporary or permanent diversions and diversion dikes. Runoff water containing high sediment loads must be treated in a sediment trapping device such as management practice standard TEMPORARY SEDIMENT TRAP 960 or IMPOUNDMENT STRUCTURE-ROUTED 842 before release in a level spreader.

PLANS AND SPECIFICATIONS

Plans and specifications for installing a level spreader shall be in keeping with this standard and shall describe the requirements for applying the practice. At a minimum include the following items:

1. The spreader location
2. The length and width
3. Lip detail: matting or rigid
4. Stone gradation
5. Rigid lip material specifications if used,
6. Erosion mat specifications if used

7. Seeding and mulching requirements
8. Installation, inspection, and maintenance schedules with responsible party clearly identified.

OPERATION AND MAINTENANCE

Inspect level spreaders after every rainfall until vegetation is established, and promptly make needed repairs. After the area has been stabilized, make periodic inspections and maintain vegetation in a healthy, vigorous condition.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT
PRACTICE

TEMPORARY MULCHING

CODE 875

DEFINITION

The application of plant residues and other suitable materials to the soil surface.

PURPOSE

The purpose of this practice is as follows:

1. To prevent erosion and prevent surface compaction or crusting by protecting the soil surface from raindrop impact and reducing the velocity of overland flow.
2. To foster the growth of vegetation by conserving available moisture and providing insulation against extreme heat and cold.
3. To improve the aesthetics of the site.
4. To control weeds.
5. Provide temporary protection of site when site conditions will not allow seeding to occur.

CONDITIONS WHERE PRACTICE APPLIES

Temporary Mulches:

1. Areas that have been seeded to provide a temporary or permanent seeding.
2. Areas that cannot be seeded because of the season of the year and need for soil surface protection.
3. For mud and dust control.
4. Provide protection during periods when construction or seeding cannot be done.

Permanent Mulches:

1. Used together with planting trees, shrubs, and other ground covers, which do not provide adequate soil stabilization.
2. Used in lieu of vegetative planting for ornamental reasons or because the site is not suitable for vegetation.

CRITERIA

A. The choice of materials will be based on the type of soil to be protected, season and economics.

B. Prior to Application

   1. Shape and grade, as required, the waterway, channel, slope, or other area to be protected.
   2. Remove all rocks, clods, or debris larger than 2 inches in diameter that will prevent contact between the mulch and the soil surface.

3. When open-weave nets are used, lime, fertilizer, and seed may be applied either before or after laying the net. When excelsior matting is used. These materials must be applied before the mat is laid.

C. Time of Application

1. Immediately after seeding or planting by conventional method or hydroseeding. Can be applied with seeding as hydromulching.
2. Immediately after seedbed preparation when dormant seedings are to be made by seeding over the mulch.
3. When temporary erosion control is to be attained, mulch may be applied any time soil and site conditions are suitable for spreading and anchoring.

D. Application: Mulch materials shall be spread uniformly, by hand or machine. When spreading straw mulch by hand, divide the area to be mulched into approximately 1,000 sq. ft. sections and place approximately 90 lbs. of straw in each section to facilitate uniform distribution.

E. Mulch Anchoring: Straw mulch shall be anchored immediately after spreading to prevent windblow. One of the following methods of anchoring straw shall be used:

1. Mulch anchoring tool: This is a tractor-drawn implement (mulch crimper, serrated straight disk, or dull farm disk) designed to punch mulch approximately 2 inches into the soil surface. This method provides maximum erosion control with straw. It is limited to use on slopes no steeper than 3:1, where equipment can operate safely. Machinery shall be operated on the contour.

2. Liquid mulch binders: Application of liquid mulch binders and tackifiers should be heaviest at edges of areas and at crests of ridges and banks, to prevent windblow. The remainder of the area should have binder applied uniformly. Binders may be applied after mulch is spread; however, it is recommended to be sprayed into the mulch as it is being blown onto the soil. Applying straw and binder together is the most effective method.

   The following types of binders may be used:

   a. Synthetic binders--Chemical binders may be used as recommended by the manufacturer to anchor mulch. These are expensive, and therefore, usually used in small areas or in residential areas where asphalt may be a problem.

   b. Wood Fiber--Wood fiber hydroseeder slurries may be used to tack straw mulch. This combination treatment is well suited to steep slopes and critical areas, and severe climate conditions.

3. Mulch netting--Lightweight, degradable, plastic, polyester, or paper nets may be stapled over the mulch according to manufacturer's recommendations.

4. Peg and twine--Because it is labor-intensive, this method is feasible only in small areas where other methods cannot be used. Drive 8 to 10-inch wooden pegs to within 3 inches of the soil surface, every 4 feet in all directions. Stakes may be driven before or after straw is spread. Secure mulch by stretching twine between pegs in a criss-cross-within-a-square pattern. Turn twine 2 or more times around each peg.

F. Chemical Mulches - Chemical mulches may be used alone only in the following situations:

1. Where no other mulching material is available.
2. In conjunction with temporary seeding during the times when mulch is not required for that practice.

Note: Chemical mulches may be used to bind other mulches or with wood fiber in a hydroseeded slurry at any time. Manufacturer's recommendations for application of chemical mulches shall be followed.

Nets and Mats - Nets may be used alone on level areas, on slopes no steeper than 3:1, and in waterways.

When mulching is done in late fall or during June, July, and August, or where soil is highly erodible, nets should only be used in conjunction with an organic mulch such as straw.

When nets and organic mulch are used together, the net should be installed over the mulch except when the mulch is wood fiber. Wood fiber may be sprayed on top of the installed net.

Excelsior blankets are considered protective mulches and may be used alone on erodible soils and during all times of year.

Other products designed to control erosion shall conform to manufacturer's specification and should be applied in accordance with manufacturer's instructions provided those instructions are at least as stringent as this specification.

Laying the Net:

1. Start laying net from top of channel or top of slope and unroll downgrade. Always lay netting in the direction of water flow.
2. Allow to lay loosely on soil--do not stretch.
3. To secure net: Upslope ends of net should be buried in a slot or trench no less than 6 inches deep. Tamp earth firmly over net. Staple the net every 12 inches across the top end. Edges of net shall be stapled every 3 feet. Where 2 strips of net are laid side by side, the adjacent edges shall be overlapped 3 inches and stapled together.

Staples will be made of plain iron wire, No. 8 gauge or heavier, and will be 6 inches or more in length. Staples shall be placed down the center of net strips at 3-foot intervals. DO NOT STRETCH net when applying staples.

Joining strips: Insert new roll of net in trench, as with upslope ends of net. Overlap the end of the previous roll 18 inches, turn under 6 inches, and staple across end of roll just below anchor slot and at the end of the turned-under net every 12 inches.

At bottom of slopes: Extend net out onto a level area before anchoring. Turn ends under a minimum of 6 inches, and staple across end every 12 inches.

Check slots: On highly erodible soils and on slopes steeper than 4:1, erosion check slots should be made every 15 feet. Insert a fold of net into a 6-inch trench and tamp firmly. Staple at 12-inch intervals across the downstream portion of the net.

Rolling: After installation, stapling, and seeding, the net should be rolled to ensure firm contact between net and soil.

CONSIDERATIONS

1. A surface mulch is one of the most effective means of controlling runoff and erosion on disturbed lands.
2. The choice of materials for mulching shall be based on the type of soil to be protected, site conditions, season, and economics.
3. Organic mulch materials such as straw, wood chips, bark, and wood fiber have been found to be the most effective.
4. Chemical soil stabilizers or soil binders are not effective mulches when used alone. These materials are useful to bind organic mulches together.
5. A variety of mulch nets, mats, or blankets are available to use as mulching or to hold the mulch in place. Netting and mats are especially helpful on critical areas such as waterways.

Organic Mulches:

Straw - The mulch most commonly used in conjunction with seeding. The recommended straw should come from oats, wheat, rye or barley, and may be spread by hand or machine. Straw can be windblown and should be anchored to stay in place.

Wood Chips - Suitable for areas that will not be closely mowed, and around ornamental plantings. Chips decompose slowly and do not require tacking. They should be treated with 12 pounds nitrogen per ton to prevent nutrient deficiency in plants. Wood Chips obtained from trees cleared on the site can be used as very inexpensive mulch.

Bark Chips, Shredded Bark - By-products of timber processing. They are often used in landscaped plantings. Bark is also a suitable mulch for areas planted to grasses and not closely mowed ; and may be applied by hand or mechanically. Bark is not usually toxic to grasses or legumes, and additional nitrogen fertilizer is not required.

There are other organic materials that make excellent mulches but are only available locally or seasonally. Creative use of these materials can reduce costs.

Chemical Mulches and Soil Binders:

Wide ranges of synthetic, spray-on materials are marketed to stabilize and protect the soil surface. These are emulsions or dispersions of vinyl compounds, asphalt, rubber, or other substances, which are mixed with water and applied to the soil. They may be used alone or may be used to tack wood fiber hydromulches or straw.

When used alone, chemical mulches do not have the capability to insulate the soil or retain soil moisture that organic mulches have. This soil protection is also damaged by traffic. Application of these mulches is usually more expensive than organic mulching, and the mulches decompose in 60-90 days.

Nets and Mats:

When used alone, netting does not retain soil moisture or modify soil temperature. It stabilizes the soil surface while grasses are being established, and is useful in grassed waterways and on slopes. Light netting may also be used to hold other mulches in place.

The most critical aspect of installing nets and mats is obtaining firm, continuous contact between the material
and the soil. Without such contact, the material is useless and erosion occurs. It is important to use an adequate number of staples and to roll the material after laying it to ensure that the soil is protected.

Aggregate Cover - Gravel and crushed stone provide a long term protection against erosion, particularly on short slopes. Before the gravel or crushed stone is applied it should be washed. If vegetation is not desired, black polyethylene sheeting should be placed on the ground first to prevent seed germination and growth through the aggregate cover.

PLANS AND SPECFICATIONS

Plans and specifications for applying mulch shall be in keeping with this standard and shall describe the requirements for applying the practice. Include the following items:

1. Materials to be used.
2. How mulch will be anchored.
3. Location of different materials if more than one material is used on the site.

OPERATION AND MAINTENANCE

All mulches should be inspected periodically, in particular after rainstorms, to check for rill erosion. Where erosion is observed, additional mulch should be applied. Nets should be inspected after rainstorms for dislocation or failure. If washouts or breakage occur, re-install netting as necessary after repairing damage to the slope. Inspections should occur until grasses are firmly established. Where mulch is used in conjunction with ornamental plantings, inspect periodically throughout the year to determine if mulch is maintaining coverage of the soil surface; repair as needed.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

PERMANENT SEEDING
(acres or sq.ft.)
CODE 880

DEFINITION

Establishing permanent vegetative cover to stabilize disturbed areas.

PURPOSE

The purpose of this practice is to reduce erosion and decrease sediment from disturbed areas, and to permanently stabilize such areas in a manner that adopts to site conditions and allows selection of the most appropriate plant materials.

CONDITIONS WHERE PRACTICE APPLIES

1. Disturbed areas where long-lived vegetative cover is needed to stabilize the soil.
2. On other areas where cover is desired.

CRITERIA

Selection of Plant Materials - Selection of plant materials will be based on climate, topography, soils, land use, available light, aesthetics and maintenance. See tables 1, 2 and 5 for selection of grasses and legumes and ground covers. For trees and shrubs see management practice standard 985, TREE AND SHRUB PLANTING.

Seedbed Preparation - Seedbed preparation is essential for the seed to germinate and grow. For broadcast seeding and drilling, loosen the top 3 to 6 inches of soil. If recent tillage or grading operations have resulted in a loose surface, additional tillage may not be required. If rainfall caused the soil surface to become sealed or crusted, till the surface prior to seeding. Avoid preparing the seedbed in excessively wet conditions.

Soil Testing - One soil test will be performed for every 50 acres, or portion thereof, of project area. All tests are to be performed after the completion of grading operations to determine the amount of soil amendments required. All soil testing is to be performed by a testing facility approved by the governing agency. A list of approved testing facilities is shown in Table 6. All soil testing results and recommendations are to be submitted to the governing agency.

Liming - Acid soils with low pH can prevent seeding success. Sites where the pH of the soil is less than 6.0 shall apply lime at a rate of 1-1/2 tons per acre, or as specified by the soils testing agent. The lime application shall be finely ground agricultural limestone.

Fertilizer - Apply 400 lbs./acre of 6-24-24 fertilizer (8 lbs./1000 S.F.) into the top 3 to 6 inches of soil, or as specified by the soils testing agent.

Seeding Rates - Apply seed evenly with a broadcast seeder, drill, or hydroseeder. Grasses and legumes should be planted more than ½" deep. Seeding shall occur at the rates specified in Table 3 and 4, and times specified in Table 5.

Mulching - Mulching shall be required on all seedbeds prior to the placement of seed. Mulch shall be placed in accordance with section 875 of this document.
Irrigation - Where an adequate water supply is available, irrigate to keep the seedbed moist (not wet) for 7 to 10 days after seeding. This may require watering daily the first week, especially during hot weather, and less frequently thereafter. Water application rates must be carefully controlled to prevent runoff and erosion. Inadequate or excessive amounts of water can be more harmful than no supplemental water. Irrigation is seldom needed for low-maintenance seedings made at the appropriate time of the year.

OPERATION AND MAINTENANCE

Permanent seeding shall be inspected, at the request of the developer, or his representatives, no sooner than four (4) weeks after planting, to see if stands are of adequate thickness (more than 30% of the ground surface covered). Stands should be uniform and dense for best results. Fertilize, re-seed and mulch bare and sparse areas immediately to prevent erosion.

Inspect all planted areas for failures and make necessary repairs, replacements, re-seedings, and re-mulching within the planting season, if possible. If a stand has less than 40% cover, re-evaluate the choice of plant materials, quantities of lime and fertilizer, seeding or planting methods, time of seeding or planting and available light and moisture. Re-establish the stand following the original specifications, but with modifications based on the evaluation. If vegetation continues to fail to grow, a soil test will be requested to determine the problem.

Do not mow high-maintenance turf seedings until the stand is at least 6 inches tall. Do not mow closer than 3 inches during the year of establishment.

Low-maintenance stands should be mowed only as needed to control weeds. Mowing should be done before weeds go to seed. Keep mowing height above the height of the seeded plants. Vine and shrub type ground covers may need hand weeding until the area is well covered.

Herbicides may also be used for weed control. Apply all herbicides according to rates specified on the label.

Should the plant material to be planted be out of season consult temporary seeding practices in the document for temporary vegetation.

1. Conventional Method - If soil conditions are suitable during the dormant seeding period, apply lime and fertilizer, prepare the seedbed and seed as specified in this specification. Increase the seeding rate at least 50%. Mulch following seeding.

2. Overseeding Method - Liming, fertilizing, seedbed preparation and mulching may be done after August 31. The seed shall be broadcast uniformly over the mulch between November 15 and March 1. When this is done, increase the seeding rates 50%.

ALTERNATE PLANTING METHODS

Sprigging - Some plants cannot be grown from seed and must be planted vegetatively. Sprigs are fragments of horizontal stems or roots, which include at least one node (joint). Sprigs may be planted by either of the following methods:

A. Broadcast sprigs and press into the top 1/2 to 2 inches of soil with a cultipacker or a disk set straight so that the sprigs are not brought back toward the surface.

B. Make furrows 4-6 inches deep and 2 feet apart. On sloping areas, make furrows Perpendicular to the slope (on the contour). Place sprigs in the furrows with one end at or above ground level. Close the furrow when plants have been placed.

C. Plant sprigs in furrows with a tractor-drawn transplanter. Sprigging should be done during specified seeding periods.

Ground covers - Most shrub and vine type ground covers are available as bare root stock, balled and burlapped, or in containers or pots. On flat areas where erosion is not a problem, prepare the site by tilling to a depth of 10-12 inches. On sloping sites, till 2 - 3 inches deep to incorporate needed soil amendments.

Individual plants - Prepare a hole slightly larger than the container or ball and deep enough that the roots can extend to the bottom. Most ground covers should be planted 1/2" to 1" deeper than they have grown in the pot or container.

ESCROW AGREEMENT

An escrow agreement, to cover the costs to grade, fertilize, place permanent seeding, and irrigate, the completed project shall be established prior to issuance of the construction permit for any residential common ground areas and any non-residential development. The escrow cost estimate must be submitted with the plans and specifications for the project, for approval, prior to the execution of the escrow agreement. The escrowed funds for permanent seeding will be released upon successful completion of an inspection of said revegetation. The inspection may be requested by the developer, or his representative(s) no earlier than one (1) month after the placement of permanent vegetation for the project. Partial escrow releases for permanent seeding may be performed as deemed appropriate by the inspecting agency.

PLANS AND SPECIFICATIONS

The plans and specifications for seeding or planting and mulching shall include the following items:

1. Escrow cost estimate for all proposed permanent seeding.
2. Seeding mixtures and rates or plant species and density.
3. Site preparation.
4. Fertilization mixtures and rates as defined by soil tests.
5. Seeding or planting methods.
6. Seeding or planting periods.
6. Mulching materials and application rates.
7. Schedule for installation, inspection and maintenance.

TABLE 1
PERMANENT SEEDING PLANT CHARACTERISTICS

SPECIES		REGION OF THE STATE	MAINTENANCE		SEEDING COMPETITIVE ABILITY	FERTILITY NEEDS		SEEDING EMERGENCE & VIGOR
			LOW	HIGH		LOW	HIGH	
COOL SEASON GRASSES	TURF FESCUE	ALL		●	H		●	M-H
	TALL FESCUE	ALL	● 1	●	H	●		M-H
	KETUCKY BLUEGRASS	ALL	● 1	●	H	●	● 1	M-H
	PERENNIAL RYEGRASS	ALL	● 1	●	H	●	● 1	M-H
	REDTOP	ALL	●		M	●		M
	REED CANARY	NORTH 2/3	●		L		● 2	L
WARM SEASON GRASSES	COMMON BERMUDAS	SOUTH	●		L	●		M
	HYBRID BERMUDA	SOUTH		●			●	
	BUFFALOGRASS 3	ALL	●			●		
	ZOYSIA 4	SOUTH		●			●	
LEGUMES	BIRDSFOOT TREFOIL	NORTH	●		L			L
	CROWNVETCH	ALL		●		●	● 1	M-H
	COMMON LESPEDEZA 7	ALL		●	M	●		H
	RED CLOVER	ALL	●		H		●	M-H
	WHITE CLOVER	ALL	●		L-M		●	M-H
	SERICEA LESPEDEZA 6	ALL	●		M	●		H
COMPANION CROPS/CEREAL GRAINS	WHEAT/RYE	ALL	●		L-M		●	H
	OATS	ALL	●		M		●	M

L=LOW, M=MEDIUM, H=HIGH

1. Will be high maintenance in lawn type settings.
2. Responds well to fertilizeer, but does not necessarily have to be applied.
3. Usually sprigged, but can be seeded.
4. Usually sprigged, plugged, or sodded.
5. Legumes alone will not provide adequate erosion protection; use with a grass in a mixture.
6. Can be invasive in low fertillity fields.
7. Will reseed each year if not mowed until after seed shatter in September.

TABLE 2
PERMANENT SEEDING
SPECIES SOIL DRAINAGE REQUIREMENTS & TOLERANCES FOR ENVIRONMENTAL CONDITIONS

	SOIL DRAINAGE				ENVIRONMENTAL TOLERANCES			
SPECIES	**WELL**	**MOD. WELL**	**SOMEWHAT POOR**	**POOR**	**SHADE**	**DROUGHT**	**FLOODING**	**TRAFFIC**
TURF FESCUE	●	●	●		G	G	M	G
TALL FESCUE	●	●	●		G	G	M	G
KENTUCKY BLUEGRASS	●	●	●		M	M	M	G
PERENNIAL RYE	●	●	●		P	M	P	G
REDTOP	●	●	●	●	P	G	G	P
REED CANARY	●	●	●	●	M	G	E	G
COMMON BERMUDA	●	●			P	E	G	E
HYBRID BERMUDA	●	●			P	E	G	E
BUFFALO	●	●			P	E	G	P
ZOYSIA	●	●			P	G	P	G
BIRDSFOOT TREFOIL	●	●	●	●	M	M	P	G
CROWNVETCH	●	●	●		M	M	P	G
COMMON LESPEDEZA	●	●	●		M	E	P	G
RED CLOVER	●	●	●		M	G	P	G
WHITE CLOVER	●	●	●		G	P	P	G
SENCIA LESPEDEZA	●	●	●		M	G	P	G
WHEAT/RYE	●	●	●		M	G	P	M
OATS	●	●	●		M	M	P	M

KEY: P=POOR, M=MODERATE, G=GOOD, E=EXCELLENT

* Drainage descriptions from "Poorly Drained" to "Well Drained" can be found in county *Soil Surveys* at most local NRCS/Soil and Water Conservation District Offices.

TABLE 3
PERMANENT SEEDING RATES

SPECIES		ALONE (PLS)*		IN MIXTURE (PLS)*	
		LBS./1000 SF	LBS./AC.	LBS./1000 SF	LBS./AC.
COOL SEASON GRASSES	TURF FESCUE	10	80	5	40
	TALL FESCUE	10	80	5	40
	KENTUCKY BLUEGRASS	3	60	1.5	30
	PERENNIAL RYEGRASS	10	80	5	40
	REDTOP	1/4	8	1/8	4
	REED CANARY	4	30	2	15
WARM SEASON GRASSES	COMMON BERMUDA	2	90	-	-
	HYBRID BERMUDA	3	140	-	-
LEGUMES	BIRDSFOOT TREFOIL	-	-	1/8	5
	CROWN VETCH	-	-	-	4
	COMMON LESPEDEZA	-	-	1/4	15
	RED CLOVER	-	-	1/8	5
	WHITE CLOVER	-	-	-	2
	SERICEA LESPEDEZA	-	-	1/4	8

* PLS or Pure Live Seed=The Amount of seed guaranteed to grow. To calculate the amount of bulk seed needed: Read seed tag and multiply % purity X % germination = % PLS; then divide lbs. of PLS recommended by % PLS. Example: 30lbs of Reed Canary is needed to seed a 1 ac. waterway; 90% pure X 90% germination = 81% PLS; 30 lbs PLS / 81% = 37 lbs. bulks seed needed.

Note: Use lbs/1000 sf rate to establish dense vegetation for lawns and where it is critical to establish vegetation for erosion control.

TABLE 4
PERMANENET SEEDING MIXTURES FOR CRITICAL AREA SEEDINGS

	SEEDING RATE (PLS)*	
GRASS-LEGUMES MIXTURE	**LBS./1000 SF**	**LBS./AC.**
REED CANARYGRASS \ WHITE CLOVER	5 \ 0.1	40 \ 1
REED CANARYGRASS \ RED CLOVER	5 \ 1/4	40 \ 2
TALL FESCUE** \ BIRDSFOOT TREFOIL	10 \ 1/4	80 \ 2
TALL FESCUE** \ WHITE CLOVER	10 \ 0.1	80 \ 1
TALL FESCUE** \ LESPEDEZA	10 \ 1/2	80 \ 4
TALL FESCUE** \ LESPEDEZA / WHITE CLOVER	10 \ 1/2 \ 0.1	80 \ 4 \ 1
TALL FESCUE** \ RED CLOVER	10 \ 1/4	80 \ 2
TALL FESCUE** \ WHITE CLOVER / RED CLOVER	10 \ 1/4 \ 0.1	80 \ 2 \1
KENTUCKY BLUEGRASS \ WHITE CLOVER	3 \ 0.1	25 \ 1
KENTUCKY BLUEGRASS \ RED CLOVER	3 \ 1/4	25 \ 2
KENTUCKY BLUEGRASS \ BIRDSFOOT TREFOIL	3 \ 1/4	25 \ 2
KENTUCKY BLUEBRASS \ LESPEDEZA	3 \ 1/2	25 \ 4
WHEAT / RYE (AS NURSERY CROP)	1.5	60
OATS (AS NURSERY CROP)	0.75	30

* PLS or Pure Live Seed = the amount of seed guaranteed to grow. To calculate the amount of bulk seed needed: Read seed tag and multiply % purity X % germination = % PLS; then divide lbs of PLS recommended by % PLS. Example: 30lbs of Reed Canary is needed to seed a 1 ac. waterway; 90% pure X 90% germination = 81% PLS; 30 lbs PLS / 81% = 37 lbs bulk seed needed.

** Turf fescue and perennial ryegrass may be substituted for fescue at the same rate.

TABLE 5
PERMANENT SEEDING
OPTIMUM AND ACCEPTABLE* PLANTING DATES

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TURF FESCUE		*	*	OPT	*	*			*	OPT	*	*			
TALL FESCUE		*	*	OPT	*	*			*	OPT	*	*			
KENTUCKY BLUEGRASS		*	*	OPT	*	*			*	OPT	*	*			
PERENNIAL RYEGRASS		*	*	OPT	*	*			*	OPT	*	*			
REDTOP		*	*	OPT	*	*			*	OPT	*	*			
REED CANARY		*	*	OPT	*	*			*	OPT	*	*			
BERMUDA COMMON					OPT	OPT	*	*							
BERMUDA HYBRID					OPT	OPT	*	*							
BUFFALO GRASS 1			*	*	OPT	OPT	*	*							
ZOYSIA 2					OPT	OPT	*	*							
BIRDSFOOT TREFOIL	*	*	*	OPT	OPT	*									
CROWNVETCH	*	*	*	OPT	OPT	*									
COMMON LESPEDEZA				OPT	OPT										
RED CLOVER	*	*	*	OPT	OPT	*			*	OPT	OPT				
WHITE CLOVER	*	*	*	OPT	OPT	*				OPT	OPT				
SERICEA LESPEDEZA		*	*	OPT	OPT	*			*	OPT	OPT				
WHEAT / RYE	*	OPT	OPT	OPT	OPT				*	OPT	OPT	OPT	OPT	*	
OATS		*	OPT	OPT	OPT										

TABLE KEY	
	OPTIMUM SEEDING DATE
*	* WITH MULCH COVER - ACCEPTABLE / DORMANT SEEDING DATE

1 Can also be sprigged.
2. Usually sprigged. Space plugs every 6, 8, or 12 inches; with 4,000, 2,500, or 1,000 sprigs / 1000 sf respectively.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

PORTABLE SEDIMENT TANK

CODE 895

DEFINITION

A compartmented container through which sediment-laden water is pumped to trap and retain the sediment.

PURPOSE

The purpose of this practice is to trap and retain sediment prior to pumping the water to drainageways, adjoining properties, and rights-of-way below the sediment tank site.

CONDITIONS WHERE PRACTICE APPLIES

A sediment tank is to be used on sites where excavations are deep and space is limited, such as urban construction, where direct discharge of sediment-laden water to stream and storm drainage systems is to be avoided. Also it is used where an excavation extends below the seasonal high water table causing a sump pump to be used.

CRITERIA

The portable sediment tank will be constructed with three equal baffled compartments. The inlet and outlet pipe will be a minimum diameter of 3 inches. The minimum storage volume of the tank shall be in cubic feet, calculated by multiplying 32 times the pump discharge in gallons per minute (GPM).

CONSIDERATIONS

The sediment tank should be located for ease of clean out and disposal of the trapped sediment, and to minimize the interference with construction activities and pedestrian traffic. Portable sediment tanks should only be used when other sediment trapping practices cannot be installed due to lack of space or other reasons. This is due to their lack of efficiency and high labor requirements to remove the sediment.

PLANS AND SPECIFICATIONS

Portable sediment tanks do not require any plans. Specifications for installing portable sediment tanks shall be in keeping with this standard and shall describe the requirements for applying the practice. The specifications will show the required storage volume of the tank

OPERATION AND MAINTENANCE

The tank shall be cleaned out when one-third of the storage volume is filled with sediment. All sediment collected in the tank shall be disposed of in an approved sediment trapping device such as

management practice standard TEMPORARY SEDIMENT TRAP 960 or IMPOUNDMENT STRUCTURE-ROUTED 842 or on the construction site or as approved by the engineer/inspector.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT
PRACTICE

RIGHT-OF-WAY DIVERSION

CODE 900

DEFINITION

A ridge or ridge and channel constructed diagonally across a sloping road or utility right-of-way that is subject to erosion.

PURPOSE

The purpose of this practice is to limit the accumulation of erosive volumes of water by diverting surface runoff at predesigned intervals.

CONDITIONS WHERE PRACTICE APPLIES

Where runoff protection is needed to prevent erosion on sloping access right-of-ways or other long, narrow sloping areas generally less than 100 feet in width.

CRITERIA

The diversion ridge shall be constructed of compacted soil or coarse aggregate or a combination of both.

Height - The height shall be a minimum of 18 inches measured from the channel bottom to the ridge top for gravel diversions and 18 inches from ground surface to the ridge top for earth diversions.

Side slope - 2:1 or flatter, 3:1 or flatter where vehicles cross.

Base width of ridge - 6 feet minimum.

Length - The diversion should be constructed completely across the disturbed portion of the right-of-way.

The required spacing of diversions is shown below:

Ave. Land Slope (%)	**Max. Spacing (ft)**
<5	125
5 to 10	100
10 to 20	75
20 to 35	50
>35	25

Grade and angle - The grade should be positive not to exceed 2%. A crossing angle of approximately 60 degrees is preferred.

Outlet - Diversions shall have stable outlets that are not subject to erosion. Site spacing may need to be adjusted for field conditions to utilize the most suitable outlet. Examples of stable outlets include management practice standards LEVEL SPREADER 870, or TEMPORARY SEDIMENT TRAP 960.

Concentrated flows should spread over the widest possible area after release. Flows with high sediment concentrations should pass through appropriate sediment trapping practices such as IMPOUNDMENT STRUCTURE-ROUTED 842 or TEMPORARY SEDIMENT TRAP 960.

CONSIDERATIONS

Construction of access roads, power lines, pipelines, and other similar installations often requires clearing long narrow rights-of-way over sloping terrain. Disturbance and compaction promotes gully formation in these cleared strips by increasing the volume and velocity of runoff. Gully formation may be especially severe in tire tracks and ruts. To prevent gullying, runoff can often be diverted across the width of the right-of-way to undisturbed areas by using small pre-designed diversions. Give special consideration to each individual outlet area, as well as to the cumulative effect of added diversions.

Generally earthen diversions are applicable where there will be little or no construction traffic within the right-of-way. Gravel structures are more applicable to road and other rights-of-ways where vehicular traffic is anticipated.

When earthen ridges are used, at all points where the ridge or channel will be crossed by heavy equipment the diversion should be protected according to requirements of the management practice standard STABILIZED CONSTRUCTION ENTRANCE 930.

PLANS AND SPECIFICATIONS

Plans and specifications for installing right-of-way diversions shall describe the requirements for applying the practice. At a minimum include:

1. Approximate location.
2. Minimum cross section and maximum grade.
3. Coarse aggregate gradation, if used.
4. Installation, inspection and maintenance schedules with the responsible party clearly identified.

OPERATION AND MAINTENANCE

Periodically inspect the right-of-way diversions for wear and after heavy rainfall for erosion damage. Immediately remove sediment from the flow area and repair the dike. Check outlet areas and make timely repairs as needed. When permanent road drainage is established and the area above the temporary right-of-way diversions is permanently stabilized, remove the ridge and fill the channel to blend with the natural ground, and appropriately stabilize the disturbed area.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT
PRACTICE

ROCK OUTLET PROTECTION

CODE 910

DEFINITION

A section of rock protection placed at the outlet end of culverts, conduits, or channels.

PURPOSE

The purpose of this practice is to prevent scour erosion at stormwater outlets, to protect the outlet structure, and to minimize the potential for downstream erosion by reducing the velocity and energy of concentrated stormwater flows. The practice also reduces the effects of turbidity and sedimentation downstream.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the receiving channel or area. This applies to:

1. Culvert outlets of all types.
2. Pipe conduits from all sediment basins, dry and wet basin detention storm water ponds.
3. New channels constructed as outlets for culverts and conduits.
4. Where outflows from conduits or channels do not exceed 10 fps.

The design of structurally lined aprons at the outlets of pipes and paved channels sections applies to the immediate area or reach below the pipe or channel and does not apply to continuous rock linings of channels or streams.

The design of rock outlet protection depends entirely on the location. Pipe outlets at the top of cuts or on slopes steeper than 10 percent cannot be protected by rock aprons or riprap sections due to re-concentration of flows and high velocities encountered after the flow leaves the apron.

CRITERIA

Tailwater depth - Depth of tailwater immediately below the pipe outlet must be determined for the design capacity of the pipe. Manning's Equation may be used to determine tailwater depth. If the tailwater depth is less than half the diameter of the outlet pipe and the receiving stream is wide enough to accept divergence of the flow, it shall be classified as a Minimum Tailwater Condition. If the tailwater depth is greater than half the pipe diameter and the receiving stream will continue to confine the flow, it shall be classified as a Maximum Tailwater Condition. Pipes which outlet onto a flat area with no defined channel will be assumed to have a Minimum Tailwater Condition.

Apron length - Apron length (La) shall be determined according to the appropriate tailwater condition and velocity out of the conduits.

Apron width - When the pipe discharges directly
into a well-defined channel, the apron shall extend across the channel bottom and up the channel banks to an elevation one foot above the maximum tailwater depth or to the top of the bank, whichever is less.

If the pipe discharges onto a flat area with no defined channels, the following criteria will be followed. Apron width will be 3 times the pipe diameter at the upstream location. The downstream width will be the pipe diameter plus the apron length for pipes with minimum tailwater conditions and the pipe diameter plus 0.4 times the apron length for pipes flowing under maximum tailwater conditions.

Bottom grade - The outlet protection apron shall be constructed with no slope (0.0% grade) along its length. There shall be no overfill at the end of the apron. The elevation of the downstream end of the apron shall be equal to the elevation of the receiving channel or adjacent ground.

Alignment - Outlet protection apron shall be located so that there are no bends in the horizontal alignment.

Materials - Outlet protection may be done using rock riprap, concrete block or gabions.

Thickness - The maximum thickness of the riprap layer shall be 1.5 times the maximum stone diameter for d50 of 15 inches or less; and 1.2 times the maximum stone size for d50 greater than 15 inches

Stone quality - Stone for riprap shall consist of field stone or rough unhewn quarry stone. The stone shall be hard and angular and a quality that will not disintegrate on exposure to water or weathering. The specific gravity of the individual stones shall be at least 2.5.

Recycled concrete equivalent may be used provided it has a density of at least 150 pounds per cubic foot, and does not have any exposed steel or reinforcing bars.

Filter Fabric - In all cases, filter fabric shall be placed between the riprap and the underlying soil to protect soil movement into and through the riprap.

Gabions - shall be made of hexagonal triple twist mesh with heavily galvanized steel wire. Gabions shall be fabricated in such a manner that the sides, ends, and lid can be assembled at the construction site into mats of the specified sizes. The mats shall be a minimum of 9 inches thick.

The area on which the gabion is to be installed shall be graded as shown on the drawings. Foundation conditions shall be the same as for placing rock riprap. Where required, a cut off may be needed to prevent undermining of the main gabion structure.

CONSIDERATIONS

The outlets of channels, conduits and other structures are points of high erosion potential, because they frequently carry flows at velocities that exceed the allowable limit for the area downstream. To prevent scour and undermining, an outlet stabilization structure is needed to absorb the impact of the flow and reduce the velocity to non-erosive levels. A riprap-lined apron is the most commonly used practice for this purpose because of its relatively low cost and ease of installation. The riprap apron should be extended downstream until stable conditions are reached even though this may exceed the length calculated for design velocity control.

Riprap-stilling basins or plunge pools reduce flow velocity rapidly. They should be considered in lieu of aprons where overfills exit at the ends of pipes or where high flows would require excessive apron length. Consider other energy dissipaters such as concrete impact basins or paved outlet structures when conduits are flowing more than 10 fps. These will require a special design and table 2 cannot be used.

PLANS AND SPECIFICATIONS

Plans and specification for installing rock outlet protection shall be in keeping with this standard and will describe the requirements for applying the practice. At a minimum include the following:

1. Location where the practice will be installed.
2. Dimensions of the practice.
3. Plan view, profile and cross section of each channel reach between the storm drain outlet under consideration and the existing publicly maintained system or the natural stream channel receiving the discharge flow.
4. Rock size.
5. Rock thickness.
6. Fabric specifications.
7. The installation, inspection and maintenance schedules with the responsible person clearly identified.

OPERATION AND MAINTENANCE

Inspect riprap outlet structures after heavy rains to see if any erosion around or below the riprap has taken place or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

SILT FENCE

CODE 920

DEFINITION

A temporary barrier of entrenched geotextile fabric (filter fabric) stretched across and attached to supporting posts used to intercept sediment-laden runoff from small drainage areas of disturbed soil.

PURPOSE

The purpose of this practice is to cause deposition of transported sediment load from sheet flows leaving disturbed areas.

CONDITIONS WHERE PRACTICE APPLIES

A silt fence may be used subject to the following conditions:

1. The maximum allowable slope lengths contributing runoff to a silt fence are listed in the table below:

% Slope	Maximum Spacing (ft)
25	50
20	75
15	125
10	175
<10	200

2. The maximum drainage area for overland flow to a silt fence shall not exceed 1/2 acre per 100 feet of fence; and

3. Erosion would occur in the form of sheet erosion; and

4. There is no concentration of water flowing to the barrier; and

5. Where effectiveness is required for more than one construction season or 6 months, whichever is less.

6. As protection for a storm drain inlet refer to management practice standard INLET PROTECTION - FABRIC DROP 860.

CRITERIA

Design computations are not required. All silt fences shall be placed as close to the contour as possible, with the ends extending upslope. The area below the fence must be undisturbed or stabilized.

1. Silt fence fabric shall have a minimum apparent opening size (AOS) of 30 for nonwoven and 50 for woven.

2. Fence posts shall be a minimum of 48 inches long. Wood posts will be of sound quality wood with a minimum cross sectional area of 1.56 square inches (1.25 inches x 1.25 inches). Steel posts will be standard T and U sections weighing not less than 1.0 pound per linear foot. The maximum spacing will be 5 feet. When wire backing is used, the maximum spacing may be increased to 10 feet. The posts shall be driven a minimum of 18 inches into the ground. Spacing may need to be adjusted so that posts are located in low areas where water may pond.

3. Wire fence shall be a minimum 10 gauge top and bottom wires with a maximum 6 inch mesh opening, or as approved by the engineer inspector.

4. The filter fabric should be furnished in a continuous roll cut to the length of the silt fence needed to avoid splices. When splices are necessary, the fabric should be spliced at a support post with a minimum 6 inch overlap, folded over and securely fastened.

5. The height of a silt fence shall be a minimum of 24 inches above the original ground surface and shall not exceed a height of 30 inches above the ground surface. Wire supports shall be used on silt fences exceeding 24 inches in height.

6. The silt fence shall be entrenched to a minimum depth of 6 inches, with an additional 4 inches extending along the bottom of the trench in the upslope direction. The trench shall be backfilled and the soil compacted over the fabric.

7. The filter fabric and wire support, if used, must be securely fastened to the upslope side of the posts using heavy duty wire staples at least one inch long, tie wires or hog rings. The fabric shall not be stapled or wired to the wire support. The fabric shall not be stapled to existing trees.

8. Silt fences shall be used prior to the establishment of erosion controls and installed prior to the clearing of existing vegetation.

CONSIDERATIONS

Silt fences should be considered for trapping sediment where sheet and rill erosion may be expected to occur in small drainage areas. Silt fences should not be placed in areas of concentrated flows.

Research has shown that silt fences can trap a much higher percentage of suspended sediments than straw bale barriers, and in most cases are the preferred option. As with straw bale barriers, improper placement as well as improper installation and maintenance of silt fences have, in many instances, significantly decreased the effectiveness of this practice.

While both woven and non-woven fabrics are commercially available, the woven fabric generally displays higher strength than the non-woven fabrics. When tested under acid and alkaline water conditions, most of the woven fabrics increase in strength. There are a variety of reactions among non-woven fabrics.

The same is true of testing under extensive ultra violet radiation. Permeability rates demonstrate very high filtering efficiencies for sandy sediments, there is considerable variation among both woven and non-woven fabrics when filtering the finer silt and clay particles.

PLANS AND SPECIFICATIONS

Plans and specifications for installing silt fences shall be in keeping with this standard and shall describe the requirements for applying the practice and contain the following minimum requirements:

1. Show the location of all the silt fencing to be installed.
2. The type, size, and spacing of fence posts.
3. The size of woven wire support fences if used.
4. The type of filter fabric used.
5. The method of anchoring the filter cloth.
6. The method of fastening the filter cloth to the fencing support.
7. The installation, inspection and maintenance schedules with the responsible party clearly identified.

OPERATION AND MAINTENANCE

Silt fences shall be removed when they have served their usefulness, but not before the upslope areas have been permanently stabilized.

Silt fences shall be inspected immediately after each rainfall and at least daily during prolonged rainfall.

Should the fabric decompose or become ineffective prior to the end of the expected usable life and the fence still is necessary, the fabric or the entire system shall be replaced promptly.

Sediment deposits should be removed after each rainfall. They must be removed when the level of deposition reaches approximately one-half the height of the barrier.

Any sediment deposits remaining in place after the silt fence is no longer required shall be dressed to conform to the existing grade, a seedbed prepared and the site vegetated.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

STABILIZED CONSTRUCTION ENTRANCE

CODE 930

DEFINITION

A stabilized pad of aggregate underlain with filter fabric located at any point where traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk, or parking area.

PURPOSE

The purpose of this standard is to reduce or eliminate the tracking of sediment onto public right-of-ways or streets.

CONDITIONS WHERE PRACTICE APPLIES

A stabilized construction entrance shall be used at all points of construction ingress and egress.

CRITERIA

Stabilized construction entrance shall meet the following requirements:

1. Aggregate size – Minimum 1" clean.

2. Thickness - 6 inches or more.

3. Width - 14 feet minimum but not less than the full width of points where ingress or egress occur.

4. Length - As required, but not less than 70 feet, except on a single residence lot where a 30 feet minimum would apply.

5. Filter fabric shall be used under the aggregate to minimize the migration of stone into the underlying soil by heavy vehicle loads.

6. All surface water flowing or diverted toward construction entrances shall be piped across the entrance. If piping is impractical, a mountable berm with 5:1 slopes will be permitted.

7. Washing - If conditions on the site are such that a majority of the mud is not removed by the vehicles traveling over the gravel, then the tires of the vehicles must be washed before entering a public road. Wash water must be carried away from the entrance to a sediment trapping facility such as management practice standards IMPOUNDMENT STRUCTURE-ROUTED 842 or TEMPORARY SEDIMENT TRAP 960. All sediment shall be prevented from entering storm drains, ditches, watercourses, or surface waters including wetlands. A wash rack may be used to make washing more convenient and effective.

8. Location - the washing station should be located to provide for maximum utility by all construction vehicles.

9. Timing - the graveled access shall be installed as soon as practical after the start of site disturbance.

10. Removal - the entrance shall remain in place and be maintained until the disturbed area is stabilized by permanent best management practices.

CONSIDERATIONS

Improperly planned and maintained construction entrances can become a continual erosion problem.

The tracking of mud from active building sites onto paved roads by construction vehicles can be greatly reduced, and in some cases eliminated, by the use of a stabilized construction entrance. These entrances provide an area where mud can be removed from construction vehicle tires before they enter a public road.

If the action of the vehicle's tires traveling over the stone is not sufficient to remove the majority of the mud, then the tires must be washed before the vehicle enters a public road. When washing is required it shall be done on an area stabilized with aggregate, or using a wash rack underlain with gravel. Provisions shall be made to intercept the wash water and trap the sediment before it is carried off-site.

Construction entrances should be used in conjunction with the stabilization of construction roads, and other exposed areas, to reduce the amount of mud picked up by construction vehicles.

PLANS AND SPECIFICATIONS

Plans and specifications for installing stabilized construction entrances shall be in keeping with this standard and shall describe the requirements for applying the practice. At a minimum include the following items:
1. Location
2. Length
3. Width
4. Thickness
5. Type of materials
6. The installation, inspection and maintenance schedules with the responsible party identified.

OPERATION AND MAINTENANCE

The entrance shall be maintained in a condition, which will prevent tracking of sediment onto public right-of-ways or streets. This may require periodic top dressing with additional aggregate. All sediment spilled, dropped, or washed onto public right-of-ways must be removed immediately. Periodic inspection and needed maintenance shall be provided after each rain.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

STRAW BALE BARRIER

CODE 935

DEFINITION

A temporary barrier consisting of a row of entrenched and anchored straw bales or similar material used to intercept sediment-laden runoff from small drainage areas of disturbed soil.

PURPOSE

The purpose of this practice is to cause deposition of transported sediment load from sheet flow leaving disturbed areas.

CONDITIONS WHERE PRACTICE APPLIES

A straw bale barrier may be used subject to the following conditions:

1. The maximum allowable slope lengths contributing runoff to a straw bale barrier are listed in the table below:

% Slope	Maximum Spacing (ft)
25	25
20	50
15	75
10	100
<10	125

2. The maximum drainage area for overland flow to a straw bale barrier shall not exceed 1/4 acre per 100 feet of barrier; and

3. Erosion would occur in the form of sheet and rill erosion; and

4. There is no concentration of water flowing to the barrier; and

5. Where effectiveness is required for less than 3 months.

CRITERIA

Straw bale barriers do not require any formal design but the following requirements must be met:

1. Bales shall be placed in a single row, lengthwise on the contour, with the ends of adjacent bales tightly abutting one another. The end bales should extend upslope so that the trapped sediment laden water cannot flow around the ends of the barrier.

2. All bales shall be either wire-bound or string tied. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings. Hay or other baled material may be used in lieu of straw.

3. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. After bales are staked and chinked, the excavated soil shall be backfilled and compacted against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 inches against the uphill side of the barrier.

4. Each bale shall be securely anchored by at least two stakes (minimum cross sectional area of 3.0 square inches, or standard "T" or "U" steel posts (minimum weight of 1.0 pound per linear foot) or rebars driven through the bale. The first stake in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or steel pickets shall be driven a minimum 18-inch deep into the ground to securely anchor the bales.

5. The holes between bales shall be chinked (filled by wedging) with straw to prevent water from escaping between the bales. Loose straw scattered over the area immediately uphill from a straw bale barrier tends to increase efficiency.

6. Straw bale barriers shall be installed prior to the clearing of existing vegetation or any site grading.

CONSIDERATIONS

Straw bale barriers should be considered for trapping sediment where sheet and rill erosion is occurring in small drainage areas. Straw bale barriers should not be placed in areas of concentrated flow. The management practice standard SILT FENCE 920 does the same job and is usually faster and cheaper to install.

Based on field observations in Illinois and other states, straw barriers have not been as effective as a sediment control measure as they could be. There are four major reasons for this. First, improper use of straw bales has been a major problem. Straw bale barriers have been used in streams and drainageways where high water velocities and/or volumes have destroyed them or significantly impaired their effectiveness. Second, improper placement and installation of the barriers, such as staking the bales directly to the ground with no soil seal or entrenchment has allowed undercutting and flow around the end. This has resulted in additions of, rather than removal of, sediment from runoff waters. Third, inadequate inspection and maintenance lowers the effectiveness of these barriers. Fourth, because straw bales decompose in the presence of moisture, they have a very limited life span.

PLANS AND SPECIFICATIONS

Plans and specifications for installing straw bale barriers shall be in keeping with this standard and shall describe the requirements for applying the practice. At a minimum include the following items:

1. The depth of trench required to bed the bales.
2. The method(s) required to anchor the bales.

3. The installation, inspection and maintenance schedules with the responsible party clearly identified.
4. The replacement schedule for bales.

OPERATION AND MAINTENANCE

1. Straw bale barriers shall be inspected immediately after each runoff event and at least daily during prolonged rainfall.

2. Close attention shall be paid to the repair of damaged bales, end runs and undercutting beneath bales.

3. Necessary repairs to the barrier or replacement of bales shall be accomplished promptly.

4. Sediment deposits should be removed after each rainfall. They must be removed when the level of deposition reaches approximately one-half the height of the barrier.

5. Any sediment deposits remaining in place after the straw bale barrier is no longer required shall be dressed to conform to the existing grade, prepared and seeded.

6. Straw bale barriers shall be removed when they have served their usefulness, but not before the upslope areas have been permanently stabilized.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

STRUCTURAL STREAMBANK STABILIZATION

CODE 940

DEFINITION

Stabilization of eroding streambanks by use of designed structural measures.

PURPOSE

The purpose of this practice is to protect streambanks from the erosive forces of flowing water.

CONDITIONS WHERE PRACTICE APPLIES

Sections of streambanks that are subject to erosion due to excessive runoff from construction activities. Generally applicable where flow velocities exceed 5 ft/sec or where vegetative streambank protection is inappropriate.

CRITERIA

Since each reach of channel requiring protection is unique, measures for structural streambank protection should be installed according to a plan based on specific site conditions.

Develop designs according to the following principles:

1. Make protective measures compatible with other channel modifications planned or being carried out in other channel reaches.

2. Use the minimum design velocity of the peak discharge of the 15 year – 20 minute storm. Structural measures must be effective for this design flow and must be capable of withstanding greater flows without serious damage.

3. Ensure that the channel bottom is stable or stabilized by structural means before installing any permanent bank protection.

4. Ensure that streambank protection extends between stabilized or controlled points along the stream.

5. Do not change channel alignment without a complete evaluation of the anticipated effect on the rest of the stream channel, especially downstream.

6. Give special attention to maintaining and improving habitat for fish and wildlife.

7. Ensure that all requirements of state law and all permit requirements of local, state, and federal agencies are met.

8. The following stabilization methods may be applied:

   Riprap - Riprap is the most commonly used structural material for stabilizing streambanks. When possible, slope banks to 2:1 or flatter, and place a gravel filter or filter fabric on the smoothed slopes before installing riprap. Place the toe of the riprap at least 1 foot below the stream channel bottom or below the anticipated depth of channel degradation. Where necessary, riprap the entire length between well-stabilized points of the stream channel. Riprap shall be installed according to St. Louis County Specifications.

   Gabions - These rectangular, rock-filled wire baskets are pervious, semi-flexible building blocks that can be used to armor the bed and/or banks of channels or act as deflectors to divert flow away from eroding channel sections. Gabions shall be installed according to St. Louis County Specifications.

   Reinforced concrete - may be used to armor eroding sections of the streambank by constructing retaining walls or bulk heads. Provide positive drainage behind these structures. Reinforced concrete may also be used as a channel lining for stream stabilization.

   Grid pavers - modular concrete units with interspersed void areas that can be used to armor the streambank while maintaining porosity and allowing the establishment of vegetation. These structures may be obtained in precast blocks or mats that come in a variety of shapes, or they may be formed and poured in place. Keep design and installation in accordance with manufacturer's instructions.

   Revetment - Structural support or armoring to protect an embankment from erosion. Riprap or gabions are commonly used. Gabions may be either stacked or placed as a mattress. Install revetment to a depth below the anticipated channel degradation and into the channel bed as necessary to provide stability. Stabilize all areas disturbed by construction as soon as the structural measures are complete.

CONSIDERATIONS

Stream channel erosion problems vary widely in type and scale, and there is no one measure that works in all cases. Stabilization structures should be planned and designed by an engineer with experience in this field. Many of the practices discussed here involve the use of manufactured products and should be installed in accordance with the manufacturer's specifications. Where long reaches of stream channels require stabilization, make detailed stream studies.

Before selecting a structural stabilization technique, the designer should carefully evaluate the possibility of using vegetative stabilization in conjunction with structural measures to achieve the desired protection.
Vegetative techniques are generally less costly and more compatible with natural stream characteristics.

PLANS AND SPECIFICATIONS

A detail of the streambank stabilization shall be shown on the plan, and contain the following minimum requirements.

1. Location and extent of streambank to be stabilized.
2. A detail of the protective layer.
3. Thickness and gradation of riprap, if used.

4. Specifications for the materials used including the filter or filter fabric.

OPERATION AND MAINTENANCE

Check stabilized streambank sections after every high water event, and make any needed repairs immediately to prevent further damage.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT
PRACTICE

SUBSURFACE DRAIN
(ft)
CODE 945

DEFINITION

A conduit, such as corrugated plastic tubing, tile, or pipe, installed beneath the ground surface to collect and/or convey drainage water.

PURPOSE

The purpose of this standard is to:

1. Improve the soil environment for vegetative growth, reduce erosion, and improve water quality by:

    a. Regulating the water table and ground water flows,
    b. Intercepting and preventing water movement into a wet area,
    c. Relieving artesian pressures,
    d. Removing surface runoff,
    e. Leaching of saline and sodic soils,
    f. Serving as an outlet for other subsurface drains, and
    g. Regulating sub-irrigated areas or waste disposal areas.

2. Collect ground water for beneficial uses.

3. Remove water from heavy use areas, such as around buildings, roads, and play areas; and accomplish other physical improvements related to water removal.

4. Regulate water to control health hazards caused by pests such as liver fluke, flies, or mosquitoes.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to areas having a high water table where the benefits of lowering the water table or controlling ground water or surface runoff justify installing such a system.

This standard applies to areas suitable for the intended use after installation of required drainage and other conservation practices. The soil shall have enough depth and permeability to permit installation of an effective and economically feasible system. The ability to drain and treat saline and sodic soils shall be considered where this is a problem.

In areas where an outlet is available, either by gravity flow or by pumping, the outlet shall be adequate for the quantity and quality of effluent to be discharged.

CRITERIA

The design and installation shall be based on adequate surveys and investigations.

Capacity: The required capacity shall be determined by one or more of the following:

1. Application of a locally tried and proven drainage coefficient to the acreage drained, including added capacity required to dispose of surface water entering through inlets.
2. Yield of ground water based on the expected deep percolation of irrigation water from the overlying fields, including the leaching requirement.
3. Comparison of the site with other similar sites where subsurface drain yields have been measured.
4. Measurement of the rate of subsurface flow at the site during a period of adverse weather and ground water conditions.
5. Application of Darcy's law to lateral or artesian subsurface flow.
6. Estimates of lateral or artesian subsurface flow.

The minimum required drainage coefficient shall be determined from the Illinois Drainage Guide, for the kinds of crop grown and degree of existing drainage.

Size: The size of subsurface drains shall be computed by applying Manning's formula. The size shall be based on the required capacity and computed by using one of the following assumptions:

1. The hydraulic gradeline is parallel to the bottom grade of the subsurface drain with the conduit flowing full at design flow.
2. The conduit flowing partly full where a steep grade or other conditions require excess capacity.
3. Conduit flowing under pressure with hydraulic gradeline set by site conditions on a grade that differs from that of the subsurface drain. This procedure shall be used only if surface water inlets or nearness of the conduit to outlets with fixed water evaluations permit satisfactory estimates of hydraulic pressure and flows under design conditions.

All subsurface drains shall have nominal diameter that equals or exceeds 3 inches.

Depth, spacing, and location: The depth, spacing, and location of the subsurface drain shall be based on site conditions, including soils, topography, ground water conditions, crops, land use, outlets, and saline or sodic conditions.

The minimum depth of cover over subsurface drains in mineral soils shall be 2 ft. This minimum depth shall apply to normal field levels and may exclude sections of line near the outlet or sections laid through minor depressions where the conduit is not subject to damage by frost action or equipment travel.

The minimum depth of cover in organic soils shall be 2.5 ft. for normal field levels, as defined above, after initial subsidence. Structural measures shall be installed if it is feasible to control the water table level in organic soils within the optimum range of depths.

The maximum depth of cover for standard duty corrugated plastic tubing shall be 10 ft for trench widths of 2 ft or less. Heavy duty tubing shall be specified for depths greater than 10 ft, trench widths more than 2 ft, or in rocky soils. For computation of maximum allowable loads on subsurface drains, use the trench and bedding conditions specified and the crushing strength of the kind and class of drain. The design load on the conduit shall be based on a combination of equipment loads and trench loads.

Equipment loads are based on the maximum expected wheel loads for equipment to be used, the minimum height of cover over the conduit, and the trench width. Equipment loads on the conduit may be negated when the depth of cover exceeds 6 ft. Trench loads are based on the type of backfill over the conduit, the width of the trench, and the unit weight of the backfill material. A safety factor of not less than 1.5 shall be use in computing the maximum allowable depth of cover for a particular type of conduit.

Minimum velocity and grade: In areas where sedimentation is not a hazard, the minimum grades shall be based on site conditions and a velocity not less than 0.5 ft/sec. If a sedimentation hazard exists, a velocity of not less than 1.4 ft/sec shall be used to establish the minimum grades. Otherwise, provisions shall be made for preventing sedimentation by use of filters or by collecting and periodically removing sediment from installed traps, or by periodically cleaning the lines with high-pressure jetting systems or cleaning solutions.

Maximum velocity without protection: Excessive flow velocity in the drain may induce piping of soil material into the drain line.

Maximum velocities by soil texture.

TABLE 1

Soil Texture	Velocity
	ft/sec
Sand & sandy loam	3.5
Silt & silt loam	5.0
Silty clay loam	6.0
Clay & clay loam	7.0
Coarse sand or gravel	9.0

Maximum grade and protection: On sites where topographic conditions require that drain lines be placed on steep grades and design velocities will be greater than indicated under "Maximum velocity without protection," special measures shall be used to protect the conduit or surrounding soil. These measures shall be specified for each job according to the particular conditions of the site.

The protective measures shall include one or more of the following:

1. Enclose continuous perforated pipe or tubing with fabric-type filter material or properly graded sand and gravel.
2. Use non-perforated continuous tubing, a watertight pipe, or seal joints.
3. Place the conduit in a sand and gravel envelope or blinding with the least erodible soil available.
4. Select rigid butt end pipe or tile with straight smooth sections and square ends to obtain tight fitting joints.
5. Wrap open joints of the pipe or tile with tar-impregnated paper, burlap, or special fabric-type filter material.
6. Install open air risers for air release or entry.

Iron ochre considerations: If drains are to be installed in sites where iron ochre problems are likely to occur, provisions should be made to provide access for cleaning the lines. Each drain line should outlet directly into an open ditch and/or should have entry ports as needed to provide access for cleaning equipment. Drain cleaning provisions should be installed in such a way that the drains can be cleaned in an upstream or rising grade direction. If possible, drains in ochre-prone areas should be installed during the dry season when the water table is low and the iron is in its insoluble form.

Where possible, in areas where the potential for ochre problems is high, protection against ochre development can be provided by designing an outlet facility to ensure permanent submergence of the drain line.

Protection against root clogging: Problems may occur where it is necessary to place drains in close proximity to perennial vegetation. Roots of water-loving trees, such as willow, cottonwood, elm, and soft maple, or some shrubs and grasses growing near subsurface drains may enter and obstruct the flow.

The first consideration is to use non-perforated tubing or closed joints through the root zone area. Where this is not possible, water-loving trees should be removed from a distance of at least 100 ft on each side of the drain. A distance of 50 ft should be maintained from other species of trees except for fruit trees. Orchards can often drained by drains located close to the fruit trees.

Where crops and grasses may cause trouble to drain lines, facilities may be installed to provide a means for submerging the line to terminate the root growth as desired or to maintain a water table above the drainlines to prevent growth into the system.

Materials: Subsurface drains include conduits of plastic, clay, concrete, bituminized fiber, metal, or other materials of acceptable quality. The conduit shall meet strength and durability requirements of the site.

Foundation. If soft or yielding foundations are encountered, the lines shall be stabilized and protected from settlement by adding gravel or other suitable materials to the trench, by placing the conduit on a treated plank that will not readily decompose or on other rigid supports, or by using long sections of non-perforated watertight pipe having adequate strength to insure satisfactory subsurface drain performance. The use of a flat treated plank is not recommended for corrugated plastic tubing.

Filters and Filter Material: Filters will be used around conduits, as needed, to prevent movement of the surrounding soil material into the conduit. The need for a filter will be determined by the characteristic of the surrounding soil material, site conditions, and velocity of flow in the conduit. A suitable filter should be specified if:

1. Local experience indicates a need.
2. Soil materials surrounding the conduit are dispersed clays, low plasticity silts, or fine sands (ML or SM with P.I less than 7).
3. Where deep soil cracking is expected.
4. Where the method of installation may result in voids between the conduit and backfill material.

If a sand-gravel filter is specified, the filter gradation will be based on the gradation of the base material surrounding the conduit within the following limits:

D 15 size smaller than 7 times d 85 size but not smaller than 0.6 mm.

D 15 size larger than 4 times d 15 size, less than 5% passing No. 200 sieve, maximum size smaller than 1.5 inches, where D represents the filter material and d represents the surrounding base material.

The number following each letter is the percent of the sample, by weight, which is finer than that size. For example, D 15 size means that 15 percent of the filter material is finer than that size. Specified filter material must completely encase the conduit so that all openings are covered with at least 3 inches of filter material except that the top of the conduit and side filter material may be covered by a sheet of plastic or similar impervious material to reduce the quantity of filter material required. Artificial fabric or mat-type filter materials may be used, provided that the effective opening size, strength, durability, and permeability are adequate to prevent soil movement into the drain throughout the expected life of the system.

Envelopes and envelope material. Envelopes shall be used around subsurface drains if they are needed for proper bedding of the conduit or to improve the characteristics of flow of ground water into the conduit.

Materials used for envelopes do not need to meet the gradation requirements of filters, but they must not contain materials that will cause an accumulation of sediment in the conduit or that will render the envelope unsuitable for bedding of the conduit.

Envelope materials shall consist of sand-gravel, organic, or similar material. Sand-gravel envelope materials shall all pass a 1.5 inch sieve; not more than 30 percent shall pass a No. 60 sieve; and not more than 5 percent shall pass the No. 200 sieve. ASTM-C-33 fine aggregate for concrete has been satisfactorily used and is readily available.

Where organic or other compressible materials are used, they shall be used only around a rigid wall conduit and above the centerline or flexible tubing. All organic or other compressible material shall be of a type that will not readily decompose.

Placement and bedding: The conduit should not be placed on exposed rock or stones more than 1.5 inches in diameter. Where such conditions are present the trench must be over-excavated a minimum of 6 inches and refilled to grade with a suitable bedding material.

The conduit must be placed on a firm foundation to insure proper alignment. If installation will be below a water table or where unstable soils are present, special equipment, installation procedures, or bedding materials may be needed. These special requirements may also be necessary to prevent soil movement into the drain or plugging of the envelope if installation will be made in such materials as quicksand or a silt slurry. For trench installations of corrugated plastic tubing 8 inches or less in diameter, one of the following bedding methods will be specified:

1. A shaped groove or 90 degree V-notch in the bottom of the trench for tubing support and alignment.
2. As sand-gravel envelope, at least 3 inches thick, to provide support.
3. Compacted soil bedding material beside and to 3 inches above the tubing.

For trench installations of corrugated plastic tubing larger than 8 inches, the same bedding requirements will be met except that a semi-circular or trapezoidal groove shaped to fit the conduit will be used rather than a V-shaped groove.

For rigid conduits installed in a trench, the same requirements will be met except that a groove or notch is not required.

All trench installations should be made when the soil profile is in its driest possible condition in order to minimize problems of trench stability, conduit alignment, and soil movement into the drain.

For trench installations where a sand-gravel or a compacted bedding is not specified, the conduit should be blinded with selected material containing no hard objects larger than 1.5 inches in diameter. Blinder should be carried to a minimum of 3 inches above the conduit.

Auxiliary structures and protection: Structures installed in drain lines must not unduly impede the flow of water in the system. Their capacity must be no less than that of the line or lines feeding into or through them. The use of internal couplers for corrugated plastic tubing will be allowed.

If the drain system is to carry surface water flow, the capacity of the surface water inlet shall not be greater than the maximum design flow in the drain line or lines. Covers, orifice plates, and/or trash racks should be used to ensure that no foreign materials are allowed in the drain lines.

The capacity of a relief well system will be based on the flow from the aquifer, the well spacing, and other site conditions and will be adequate to lower the artesian waterhead to the desired level.

The size of relief wells is generally based on the available material rather than on hydraulic consideration. Such wells will not be less than 4 inches in diameter.

Junction boxes, manholes, catch basins, and sand traps must be accessible for maintenance. A clear opening of not less than 2 feet will be provided in either circular or rectangular structures. The drain system must be protected against velocities exceeding those proved under "Maximum velocity without protection" and against turbulence created near outlets, surface inlets, or similar structures. Continuous or closed joint pipe must be used in drain lines adjoining the structure where excessive velocities will occur.

Junction boxes shall be installed where three or more lines join or if two lines join at different elevations. In some locations it may be desirable to bury junction boxes. A solid cover should be used, and the junction box should have a minimum of 1 1/2 foot of soil cover.

If not connected to a structure, the open end of each subsurface drain line will be capped with a tight-fitting cap of the same material as the conduit or other durable materials.

The outlet must be protected against erosion and undermining of the conduit, entry of tree roots, damaging periods of submergence, and entry of rodents or other animals into the subsurface drain. A continuous section of rigid pipe without open joints or perforations will be used at the outlet end of the line and must discharge above the normal elevation of low flow in the outlet ditch. Corrugated plastic tubing is not suitable for the outlet section. Minimize the visual impact of projecting outlets.

Continuously submerged outlets will be permitted for water table control systems.

The outlet pipe and its installation will conform to the following requirements:

1. If burning vegetation on the outlet ditch bank is likely to create a fire hazard, the material from which the outlet pipe is fabricated must be fire resistant. If the likelihood is great, the outlet pipe must be fireproof.

2. Two-thirds of the pipe will be buried in the ditch bank, and the cantilever section must extend to the toe of the ditch side slope or the side protected from erosion. The minimum length of the pipe will normally be 8 feet. Under certain conditions shorter sections are appropriate, e.g., steep-sided main and laterals (1:1 or less) with a narrow bottom width of 3 feet, commonly referred to as "minimum ditches," for outletting individual subsurface drain laterals. For conduits 10 inches in diameter and greater, longer outlet sections should be considered. Use the recommendations below as a guide:

    1. 10 inches and 12 inches in diameter, use 12 feet.
    2. 15 inches and 18 inches in diameter, use 16 feet.
    3. Use 20-feet outlet pipe for all diameters larger than 18 inches.

3. If ice or floating debris may damage the outlet pipe, the outlet shall be recessed to the extent that the cantilevered part of the pipe will be protected from the current in the ditch.

4. Headwalls used for subsurface drain outlets must be adequate in strength and design to avoid washouts and other failures.

Watertight conduits strong enough to withstand the expected loads will be used if subsurface drains cross under irrigation canals, ditches, or other structures. Conduits under roadways must be designed to withstand the expected loads. Shallow subsurface drains through depressed or low areas and near outlets must be protected from damage caused by farm machinery and other equipment and from freezing and thawing.

CONSIDERATIONS

Consideration shall be given to possible damages above or below the point of discharge that might involve legal actions under state or local laws. Consideration shall be given to maintaining or enhancing environmental values.

Septic tanks and other waste disposal systems shall not be connected to subsurface drain systems.

Where wetlands will be affected, the cooperator will be advised and USDA-SCS wetland policy shall apply.

PLANS AND SPECIFICATIONS

Plans and specification for installing subsurface drains shall be in keeping with this standard and include the following:

1. Drain location and alignment.
2. Drain depth and grade.
3. Filter and envelope requirements (if used).
4. Material requirements.
5. Backfilling requirements.

OPERATION AND MAINTENANCE

A properly designed and installed subsurface drain requires little maintenance. However, check drains periodically and especially after heavy rains to see that they are operating properly. Keep the outlet free of sediment and other debris, and keep the animal guard in place and functional. Investigate any wet

areas along the line for possible cave-in due to vehicle traffic, blockage by roots, or other problems. Make all needed repairs promptly.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

SUMP PIT

CODE 950

DEFINITION

A temporary pit which is constructed to trap and filter water for pumping into a suitable discharge area.

PURPOSE

The purpose of this practice is to remove excessive water from excavations in a manner that improves the quality of the water being pumped.

CONDITIONS WHERE PRACTICE APPLIES

Sump pits are constructed when water collects during the excavation phase of construction. This practice is particularly useful in urban areas during excavation for building foundations.

CRITERIA

A perforated vertical standpipe is placed in the center of the pit to collect filtered water. The standpipe will be a perforated 12 to 24 inch diameter corrugated metal or PVC pipe. Water is then pumped from the center of the pipe to a suitable discharge area. The pit shall be filled with coarse aggregate.

CONSIDERATIONS

Discharge of water pumped from the standpipe should be to a suitable practice such as management practice standard IMPOUNDMENT STRUCTURE-ROUTED 842, TEMPORARY SEDIMENT TRAP 960, PORTABLE SEDIMENT TANK 895, or a stabilized area. If water from the sump pit will be pumped directly to a storm drainage system, filter fabric will be wrapped around the standpipe to ensure clean water discharge. It is recommended that 1/4 to 1/2 inch hardware cloth wire be wrapped around and secured to the standpipe prior to attaching the filter fabric. This will increase the rate of water seepage into the standpipe.

PLANS AND SPECIFICATIONS

Plans and specifications for installing and utilizing sump pits shall be in keeping with standard and shall describe the requirements for applying the practice. The number of sump pits and their locations will be determined by the contractor or responsible reviewing authority.

OPERATION AND MAINTENANCE

The sump pit may have to be replaced if the pit and filter fabric plugs with sediment.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

TEMPORARY DIVERSION

CODE 955

DEFINITION

A temporary ridge or excavated channel or combination ridge and channel constructed across sloping land on a predetermined grade.

PURPOSE

The purpose of this practice is to protect work areas from upslope runoff and to divert sediment-laden water to appropriate sediment trapping facility or stabilized outlet.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to construction areas where runoff can be diverted and disposed of properly to control erosion, sedimentation, or flood damage. Specific locations and conditions include:

1. Above disturbed existing slopes, and above cut or fill slopes to prevent runoff over the slope.

2. Across unprotected slopes, as slope breaks, to reduce slope length

3. Below slopes to divert excess runoff to stabilized outlets.

4. Where needed to divert sediment-laden water to sediment traps such as management practice standards IMPOUNDMENT STRUCTURE-ROUTED 842;

5. At or near the perimeter of the construction area to keep sediment from leaving the site;

6. Above disturbed areas before stabilization to prevent erosion and maintain acceptable working conditions.

7. Temporary diversions may also serve as sediment traps when the site has been over-excavated on a flat grade. They may also be used in conjunction with a silt fence, management practice standard SILT FENCE 920.

8. Where active construction activities make the use of a permanent management practice standard DIVERSION 815 unfeasible.

CRITERIA

Temporary diversions must be planned to be stable throughout their useful life and to meet the criteria given below. Those not meeting the criteria stated below will be designed as permanent diversions. See management practice standard DIVERSION 815.

1. Drainage area will not exceed three acres.

2. The minimum cross section will be as follows:

Top Width	Height	Side Slopes
0 ft	1.5 ft	4:1
4 ft	1.5 ft	2:1

3. The grade may be variable depending upon the topography and must have a positive grade to the outlet. The maximum channel grade will be limited to 1.0 percent.

4. The maximum spacing of diversions on side slopes or graded rights-of-way will be no greater than the following:

Land Slope (%)	Max. Spacing (ft)
<1	300
2-3	200
3-5	150
>5	100

5. Diverted runoff will outlet onto a stabilized area, into a properly designed waterway, grade stabilization structure or sediment trapping facility.

6. Diversions that are to serve longer than 30 working days shall be seeded and mulched meeting the requirements in management practice standards 965 TEMPORARY SEEDING and MULCHING 875 as soon as they are constructed to preserve dike height and reduce maintenance.

7. The channel cross section may be parabolic, v-shaped or trapezoidal.

8. Sediment traps shall be constructed in the flow line of the channel every 100'.

CONSIDERATIONS

It is important that diversions are properly designed, constructed and maintained since they concentrate water flow and increase erosion potential. Particular care must be taken in planning diversion grades. Too large a grade can result in erosion in the diversion channel or at the outlet. A change of slope from steeper grade to flatter may cause deposition to occur. The deposition reduces carrying capacity and may cause overtopping and failure.

Frequent inspection and timely maintenance are essential to the proper functioning of diversions. Sufficient area must be available to construct and properly maintain diversions.

It is usually less costly to excavate a channel and form a ridge or dike on the downhill side with the spoil than to build diversions by other methods. Where space is limited, it may be necessary to build the ridge by hauling in diking material or using straw bales or other material approved by the governing agency to divert the flow. Use gravel to armor the diversion dike where vehicles must cross frequently.

Temporary diversions may serve as in-place sediment traps if over-excavated 1 to 2 feet and placed on a nearly flat grade. The dike serves to divert water as the stage increases. A combination silt fence and

channel in which fill from the channel is used to stabilize the fence can trap sediment and divert runoff simultaneously.

Wherever feasible, build and stabilize diversions and outlets before initiating other land-disturbing activities. Construction of diversions will be in compliance with Illinois drainage laws.

PLANS AND SPECIFICATIONS

Plans and specifications for installing temporary diversions shall be in keeping with this standard and shall describe the requirements for applying the practice. At a minimum include the following items:

1. Diversion location
2. Channel grade
3. Diversion cross sections
4. Seeding and fertility rates
5. The installation, inspection, and maintenance schedule with responsible party identified.

OPERATION AND MAINTENANCE

Inspect temporary diversions once a week and after every rainfall. Immediately remove sediment from the flow area and repair the diversion ridge. Carefully check outlets and make timely repairs as needed. When the area protected is permanently stabilized, remove the ridge and the channel to blend with the natural ground level and appropriately stabilize it.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

TEMPORARY SEDIMENT TRAP

CODE 960

DEFINITION

A small, temporary ponding basin formed by construction of an embankment or excavated basin.

PURPOSE

The purpose of this practice is to detain sediment-laden runoff from small disturbed areas for a sufficient period of time to allow the majority of sediment and other water-based debris to settle out.

CONDITIONS WHERE PRACTICE APPLIES

1. At the outlets of diversions, channels, slope drains, or other runoff conveyances that discharge sediment-laden water.

2. Below areas that are 5 acres or less.

3. Where access can be maintained for sediment removal and proper disposal.

4. In the approach to a storm water inlet located below a disturbed area as part of an inlet protection system.

5. Structure life should be limited to 18 months.

6. Where failure of the structure will not result in loss of life, damage to homes, commercial or industrial buildings, main highways or railroads; or in the use or service of public utilities.

CRITERIA

Storage capacity - Keep the minimum volume of the sediment trap at 67 yd^3 /acre (1800 ft^3/ac based on area draining into the basin. Measure volume below the crest elevation of the outlet.

Embankment - Ensure that embankments for temporary sediment traps do not exceed 5 feet in height measured at the center line from the original ground surface to the top of the embankment. Additional freeboard may be added to the embankment height to allow flow through a designed bypass location. Construct embankments with a minimum top width of 5 feet and side slopes of 2:1 or flatter. All embankments shall be compacted to ensure stability.

The design height of the embankment shall be increased by the amount needed to insure that after settlement the height of the dam equals or exceeds the design height. The height of the embankment shall be increased by 5% where the fill material is placed in lifts of 8" or less and compacted by heavy equipment traversing the fill. The height shall be increased by 10% when fill material is pushed up and compacted by a bulldozer.

The original ground under the embankment shall be scarified to a depth of 6" or more prior to placement of the fill material. Fill material shall not be placed over frozen ground. The earthen embankment shall be seeded with temporary or permanent vegetation in accordance with methods outlined in the management practice standards 880 PERMANENT SEEDING or 965 TEMPORARY SEEDING.

Excavation - Where sediment pools are formed or enlarged by excavation, keep side slopes at 2:1 or flatter for safety.

Outlet section - Construct the sediment trap outlet using a stone section of embankment located at the low point in the basin. The stone section serves two purposes: 1) the top section serves as a nonerosive spillway outlet for flood flow, and 2) the bottom section provides a means of dewatering the basin between runoff events.

Stone size - A combination of coarse aggregate and riprap shall be used to provide for filtering/detention as well as outlet stability. Construct the outlet using well-graded stones with a d50 size of 9 inches and a maximum stone size of 14 inches. A 1 foot thick layer of 1/2 inch rock should be placed on the inside face to reduce drainage flow rate.

Side slopes stone layer thickness - Keep the side slopes of the spillway at least 21 inches thick.

Depth - Keep the crest of the spillway outlet a minimum of 1.5 feet below the settled top of the embankment.

Protection from piping - Place filter cloth, between the soil and the riprap to prevent piping. An alternative would be to excavate a keyway trench across the riprap foundation and up the sides to the height of the dam.

Weir length and depth - Keep the spillway weir at least 4 feet long and sized to pass the peak discharge of the 15 year – 20 minute storm event without failure, overtopping of the basin or significant erosion. A maximum flow depth of 1 foot, a minimum freeboard of 0.5 feet, and maximum side slopes of 2:1 are required.

Direct spillway bypass to natural, stable areas. Locate bypass outlets so that flow will not damage the embankment.

Discharges from both the principal and emergency spillways of a sediment trap must be conveyed to a natural waterway in a channel of adequate capacity and stability. Where this channel intersects with the natural waterway, the discharge shall be less than 1 1/2 feet per second or otherwise below the velocity which will initiate erosion or scour within the receiving waterway. Outlets to stormwater facilities must have adequate capacity to receive the discharge from the sediment trap.

Where an emergency spillway is utilized, the spillway crest elevation should be at least 2 feet below the settled top of the embankment with the emergency spillway crest being 0.5 feet below the top of the embankment.

CONSIDERATIONS

Select locations for sediment traps during site evaluation. Note natural drainage divides and select trap sites so that runoff from potential sediment-producing areas can easily be diverted into the traps.

Make traps readily accessible for periodic sediment removal and other necessary maintenance. Plan locations for sediment disposal as part of trap site selection. Clearly designate all disposal areas on the plans.
In preparing plans for sediment traps, it is important to consider provisions to protect the embankment from failure from storm runoff that exceeds the design capacity. Consider nonerosive emergency spillway bypass areas, particularly if there could be severe consequences from failure. If a bypass is not possible and failure would have severe consequences, consider alternative sites.

Sediment trapping is achieved primarily by settling within a pool formed by an embankment. The sediment pool may also be formed by excavation, or by a combination of excavation and embankment. Sediment-trapping efficiency is a function of surface area and inflow rate. Installations that provide pools with large length to width ratios reduce short circuiting and allow more of the pool surface area for settling. This optimizes efficiency.

The minimum length of flow through the trap should be 10 feet and the minimum length to width ratio should be 2:1. If site conditions permit a greater travel distance through the basin and greater length to width ratio the water quality benefit provided by the sediment trap will be enhanced. The average trap storage depth should be a minimum of 2 feet to prevent resuspension of sediments.

Another method of improving the trapping efficiency is to place geotextile fabric between the fine and coarse aggregate. If this is done, timely maintenance is needed to assure that the outlet does not clog with sediment.

Because well-planned sediment traps are key measures to preventing off-site sedimentation, they should be installed in the first stages of project development.

PLANS AND SPECIFICATIONS

The plans and specifications for temporary sediment traps will show the following requirements.

1. Location of the sediment traps.
2. Size of basin including width, length and depth.
3. Minimum cross section of embankment.
4. Minimum profile through spillway.
5. Location of emergency spillway, if used.
6. Graduation and quality of rock.
7. The installation, inspection and maintenance schedules with the responsible party identified.

OPERATION AND MAINTENANCE

Inspect temporary sediment traps after each period of significant rainfall. Remove sediment and restore the trap to its original dimensions when the sediment has accumulated to one-half the design depth of the trap. Place the sediment that is removed in the designated disposal area and replace the contaminated part of the gravel facing.

Check the structure for damage from erosion or piping. Periodically check the depth of the spillway to ensure it is a minimum of 1.5 feet below the low point of the embankment to slightly above design grade. Any riprap displaced from the spillway must be replaced immediately.

After all sediment-producing areas have been permanently stabilized, remove the structure and all unstable sediment. Smooth the area to blend with the adjoining areas and stabilize properly.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT
PRACTICE

TEMPORARY SEEDING

CODE 965

DEFINITION

Planting rapid-growing annual grasses or small grains, to provide initial, temporary cover for erosion control on disturbed areas.

PURPOSE

The purpose of this practice is to temporarily stabilize denuded areas that will not be brought to final grade or on which construction will be stopped for a period of more than 14 working days.

Temporary seeding helps reduce runoff and erosion until permanent vegetation or other erosion control measures can be established. In addition, it provides residue for soil protection during seedbed preparation and reduces problems of mud and dust production from bare soil surfaces during construction.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all cleared, unvegetated, or sparsely vegetated soil surfaces where vegetative cover is needed for less than 1 year. Temporary seeding and mulching shall be placed on 70% of the total disturbed site area within 14 calendar days from the completion of grading operations. Temporary seeding may be suspended from individual lots, located in the project area, which have an active building permit. Applications of this practice include diversions, dams, temporary sediment basins, temporary road banks, topsoil stockpiles and any other exposed areas of a construction site.

CRITERIA

Plant selection - Select plants appropriate to the season and site conditions from Table 1.

Site preparation - Prior to seeding, install necessary erosion control and sediment control practices if possible. Remove large rocks or other debris that may interfere with seedbed preparation or seeding operations.

Seedbed Preparation - Seedbed preparation is essential for the seed to germinate and grow. For broadcast seeding and drilling, loosen the top 3 to 6 inches of soil. If recent tillage or grading operations have resulted in a loose surface, additional tillage may not be required. If rainfall caused the sail surface to become sealed or crusted, till the surface prior to seeding.

Liming - Acid soils with low pH can prevent seeding success. Sites where the pH of the soil is less than 6.0 shall apply lime at a rate of 1-1/2 tons per acre, or as specified by the soils testing agent. The lime application shall be finely ground agricultural limestone.

Fertilizer - Subsoil will most likely be deficient in nutrients required for growth. Apply 800 lbs./acre of 12-12-12 fertilizer (16 lbs./1000 S.F.) into the top 3 to 6 inches of soil, or as specified by the soils testing agent.

Seeding Rates - Apply seed evenly with a broadcast seeder, drill, or hydroseeder. Grasses and legumes should be planted more than ½" deep. Seeding shall occur at the rates specified in Table 1, and times specified in Table 1.

Mulching - Mulching shall be required on all seedbeds prior to the placement of seed. Mulch shall be placed in accordance with section 875 of this document.

Irrigation - Where an adequate water supply is available, irrigate to keep the seedbed moist (not wet) for 7 to 10 days after seeding. This may require watering daily the first week, especially during hot weather, and less frequently thereafter. Water application rates must be carefully controlled to prevent runoff and erosion. Inadequate or excessive amounts of water can be more harmful than no supplemental water. Irrigation is seldom needed for low-maintenance seedings made at the appropriate time of the year.

CONSIDERATIONS

Temporary seedings should be used to protect earthen structures such as dikes, diversions, dams and other structures used for sediment control during construction. Temporary seedings can also reduce the amount of maintenance these structures may need. For example, the frequency of sediment basin clean-outs will be reduced if watershed areas, outside the active construction zone, are stabilized.

Proper seedbed preparation, selection of appropriate species, and use of quality seed are important. Failure to follow established guidelines and recommendations carefully may result in an inadequate or short-lived stand of vegetation that will not control erosion.

Temporary seeding is intended to provide protection for no more than one (1) year. At the end of one year, the site will be inspected, at which time additional seeding may be required.

ESCROW AGREEMENT

An escrow agreement, to cover the cost to grade, fertilize, place temporary seeding, and irrigate, 70% of the total project area shall be established prior to issuance of a grading permit. The area to be temporary seeded may be decreased further by deleting all recorded lots, within the project area, which have an active building permit issued at the time the temporary seed is to be placed. The escrow cost estimate must be submitted with the plans and specifications for the project, for approval, prior to the execution of the escrow agreement.

The escrowed funds for temporary seeding will be released upon successful completion of an inspection of said revegetation. Partial escrow releases for temporary seeding may be performed as deemed appropriate by the inspecting agency.

PLANS AND SPECIFICATIONS

The plans and specifications for seeding or planting and mulching shall include the following items:

1. Escrow cost estimate for all proposed temporary seeding
2. Seeding schedule

3. Fertilization mixture and rate
4. Seed mixture(s) and rate(s)
5. Mulching material(s) and application rate(s)
6. Inspection and maintenance schedule

OPERATION AND MAINTENANCE

Temporary seedings shall be inspected 4 weeks after planting to determine if stands are of adequate thickness (more than 30% of the ground surface covered). Stands should be uniform and dense for best results. All areas identified during the inspection, which are bare and sparse, shall be fertilized, re-seeded, and mulched areas immediately to prevent erosion.

Mowing is not recommended for cereals seeded alone. Cereals seeded with a grass can be mowed when height is greater than 12 inches. However, to prevent damage to grasses, do not mow shorter than 4 inches.

Millets and Sundangrasss should be mowed before height is greater than 6 inches to allow re-growth and continued erosion protection.

Lespediza and tall fescue may be mowed after height exceeds 8 inches. Do not mow shorter than 4 inches.

Replant temporary or permanent vegetation within 12 months as annual plants die off and no longer provide erosion control (see Permanent Seeding).

A maintenance schedule for mowing and care of the site shall be provided prior to approval of the improvement plans.

TABLE 1
TEMPORARY SEEDING PLANT MATERIAL AND SEEDING RATES

SPECIES	SEEDING RATES		PLANT CHARACTERISTICS
	LBS / 1000 SF	LBS / AC	
OATS	2	80	NOT COLD TOLERANT, HEIGHT UP TO 2 FEET
CEREALS: RYE / WHEAT	2 / 2.5	90 / 120	COLD TOLERANT, HIEGHT UP TO 3 FEET, LOW Ph TOLERANCE
MILLETS, SUDANGRASS	1 / 1.25	45 / 60	WARM SEASON ANNUAL, AGGRESSIVE GROWTH, HEIGHT UP TO 5 FEET
ANNUAL RYEGRASS	2	75	MAY BE ADDED TO MIX, NOT HEAT TOLERANT, HEIGHT UP TO 16 INCHES
TALL FESCUE	1.5	60	LOW pH TOLERANT, HEIGHT UP TO 2 FEET
ANNUAL LESPEDEZA PLUS TALL FESCUE	0.5 + 1	15 + 45	WARM SEASON ANNUAL LEGUME, MAKES OWN NITROGEN, TOLERATES LOW pH

TABLE 2
TEMPORARY SEEDING
OPTIMUM AND ACCEPTABLE* PLANTING DATES

SPECIES	SEEDING DATES OPTIMUM & ACCEPTABLE											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
OATS		*	■	■	*							
CEREALS: RYE / WHEAT	*	*	*	*	*			*	*	■	*	
MILLETS, SUDANGRASS					*	■	*	*				
ANNUAL RYEGRASS	*	*	■	■	*		*	■	■			
TALL FESCUE	*	*	■	■				■	■			*
ANNUAL LESPEDEZA PLUS TALL FESCUE	*	*	■	■	*							

TABLE KEY		
	OPTIMUM SEEDING DATE	■
	* WITH MULCH COVER - ACCEPTABLE / DORMANT SEEDING DATE	*

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

TEMPORARY SLOPE DRAIN

CODE 970

DEFINITION

A flexible tubing or rigid conduit extending temporarily from the top to the bottom of a cut or fill slope.

PURPOSE

The purpose of this practice is to convey concentrated runoff down the face of a cut or fill slope without causing erosion on or below the slope.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to construction areas where stormwater runoff above a cut or fill slope will cause erosion if allowed to flow over the slope. Temporary slope drains are generally used in conjunction with temporary diversions or diversion dikes to convey runoff down a slope until permanent water disposal measures can be installed. The maximum allowable drainage area will be 5 acres per slope drain.

CRITERIA

Capacity - peak runoff from the 15 year frequency, 20 minute duration storm.

Dike design - An earthen dike shall be used to direct stormwater runoff in to the temporary slope drain and shall be constructed as set forth in management practice standards TEMPORARY DIVERSION 955 or DIVERSION DIKE 820.

Pipe size - unless they are individually designed, size drains according to the following table:

Inlet - the height of the earth dike at the entrance to the pipe slope drain shall be equal to or greater than the diameter of the pipe, D + 18 inches and at least 6 inches higher than the adjoining ridge on either side. The lowest point of the ridge should be a minimum of 1 foot above the top of the drain so that design flow can freely enter the pipe. The minimum top width of the dike at the inlet shall be 4 feet. The inlet may be a standard MSD flared end section with a minimum 6 inch toe plate. A standard T-section fitting may also be used. All connections shall be watertight. Appropriate inlet protection shall be used if a sediment trapping facility is impractical downstream. If ponding will cause a problem at the inlet and make such protection impractical, appropriate sediment removing measures shall be taken at the outlet of the pipe.

Outlet - the pipe slope drain shall outlet into a sediment trapping device when the drainage area is disturbed. A riprap apron shall be installed below the pipe outlet where clean water is being discharged into a stabilized area.

Conduit - the conduit will have a slope of 3 percent or steeper and will be installed with watertight connecting bands. The conduit material may be smooth iron, corrugated metal or heavy duty non-perforated corrugated plastic pipe or specially designed flexible tubing.

Install reinforced, hold-down grommets or stakes to anchor the conduit at intervals not to exceed 10 ft with the outlet end securely fastened in place. The conduit must extend beyond the toe of the slope. Terminate the drain in a 4 foot level section where practical.

CONSIDERATIONS

There is often a significant lag between the time a cut or fill is graded and the time it is permanently stabilized. During this period, the slope is very vulnerable to erosion, and temporary slope drains together with temporary diversions can provide valuable protection.

It is very important that these temporary structures be sized, installed, and maintained properly, because their failure will usually result in severe erosion of the slope. The entrance section to the drain should be well entrenched and stable so that surface water can enter freely. The drain should extend downslope beyond the toe of the slope to a stable area or appropriately stabilized outlet.

Other points of concern are failure from overtopping from inadequate pipe inlet capacity or blockage and lack of maintenance of diversion channel capacity and ridge height.

PLANS AND SPECIFICATIONS

Plans and specifications for installing temporary slope drains shall be in keeping with this standard and shall describe the requirements for applying the practice. At a minimum plans will include the following items:

1. Drain location.
2. Inlet type.
3. Conduit size and material.
4. Conduit hold down device.
5. Ridge height over conduit.
6. Installation, inspection and maintenance schedules with responsible person clearly identified.

OPERATION AND MAINTENANCE

Inspect the slope drain and supporting diversion once a week and after every rainfall and promptly make necessary repairs. The contractor should avoid the placement of any material on and prevent construction traffic across the slope drain. When the protected area has been permanently stabilized, temporary measures may be removed, materials disposed of properly, and all disturbed areas stabilized appropriately.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

TEMPORARY STREAM CROSSING

CODE 975

DEFINITION

A bridge, ford, or temporary structure installed across a stream or watercourse for short-term use by construction vehicles or heavy equipment.

PURPOSE

The purpose of this practice is to provide a means for construction vehicles to cross streams or watercourses without moving sediment into streams, damaging the streambed or channel, or causing flooding.

CONDITIONS WHERE PRACTICE APPLIES

Where heavy equipment must be moved from one side of a stream channel to another, or where light-duty construction vehicles must cross the stream channel frequently for a short period of time. Generally, a temporary stream crossing is applicable to flowing streams with drainage areas less than 1 square mile. More exacting engineering methods should be used on larger drainage areas.

CRITERIA

In addition to erosion and sedimentation control, structural stability, utility, and safety must also be taken into consideration when designing temporary stream crossings. Bridge designs, in particular, should be
undertaken by a qualified engineer.

1. The anticipated life of a temporary stream crossing structure is usually considered to be 1 year or less. Remove the structure immediately after it is no longer needed.

2. As a minimum, design the structure to pass bank full flow or peak flow, whichever is less, from a 15year frequency, 20 minute duration storm without over topping. Ensure that no erosion will result from the 15year – 20 minute peak storm.

3. Ensure that design flow velocity at the outlet of the crossing structure is nonerosive for the receiving stream channel.

4. Consider overflow for storms larger than the design storm and provide a protected overflow area.

5. A water diverting structure such as a swale shall be constructed (across the roadway on both roadway approaches) 50 feet maximum on either side of the waterway crossing. This will prevent roadway surface runoff from directly entering the waterway. The 50 feet is measured from the top of the waterway bank. If the roadway approach is constructed with a reverse grade away from the waterway, a separate diverting structure is not required.

6. The aggregate for the roadway shall be a minimum of 6 inches thick stone or recycled concrete.

7. The aggregate will be placed on geotextile fabric.

CONSIDERATIONS

Careful planning can minimize the need for stream crossings. Try to avoid crossing streams, whenever possible, complete the development separately on each side and leave a natural buffer zone along the stream. Temporary stream crossings are a direct source of water pollution; they may create flooding and safety hazards; they can be expensive to construct; and they cause costly construction delays if washed out.

Select locations for stream crossings where erosion potential is low. Evaluate stream channel conditions, overflow areas, and surface runoff control at the site before choosing the type of crossing. When practical, locate and design temporary stream crossings to serve as permanent crossings to keep stream disturbance to a minimum.

Plan stream crossings in advance of need, and when possible, construct them during dry periods to minimize stream disturbance and reduce cost. Ensure that all necessary materials and equipment are on-site before any work is begun. Complete construction in an expedient manner and stabilize the area immediately.

When construction requires dewatering of the site, construct a bypass channel before undertaking other work. If stream velocity exceeds that allowed for the in-place soil material, stabilize the bypass channel with riprap or other suitable material. After the bypass is completed and stable, the stream may be diverted.

Unlike permanent stream crossings, temporary stream crossings may be allowed to overtop during peak storm periods. However, the structure and approaches should remain stable. Keep any fill needed in floodplains to a minimum to prevent upstream flooding and reduce erosion potential. Use riprap to protect locations subject to erosion from overflow.

Where appropriate, install in-stream sediment traps immediately below stream crossings to reduce downstream sedimentation. When used, excavate the basin a minimum of 2 feet below the stream bottom and approximately two times the cross-sectional flow area of the existing channel. Ensure that the flow velocity through the basin does not exceed the allowable flow velocity for the in-place soil material; otherwise it should not be excavated. In locations where trees or other vegetation must be removed, the sediment trap may be more damaging to the stream than if it was not installed.

Stream crossings are of three general types: bridges, culverts and fords. Consider which method best suits the specific site conditions.

Bridges - Where available materials and designs are adequate to bear the expected loading, bridges are preferred for temporary stream crossing.

Bridges usually cause the least disturbance to the stream bed, banks, and surrounding area. They provide the least obstruction to flow and fish migration. They generally require little or no maintenance, can be designed to fit most site conditions, and can be easily removed and materials salvaged. However, bridges are generally the most expensive to design and construct. Further, they may offer the greatest

safety hazard if not adequately designed, installed, and maintained, and if washed out, they cause a longer construction delay and are more costly to repair.

In steep watersheds it is recommended to tie a cable or chain to one corner of the bridge frame with the other end secured to a large tree or other substantial object. This will prevent flood flows from carrying the bridge downstream where it may cause damage to property.

Culvert crossings - Culverts are the most common stream crossings. In many cases, they are the least costly to install, can safely support heavy loads, and are adaptable to most site conditions. Construction materials are readily available and can be salvaged. However, the installation and removal of culverts causes considerable disturbance to the stream and surrounding area. Culverts also offer the greatest obstruction to flood flows and are subject, therefore, to blockage and washout.

Fords - Fords made of stabilizing material such as rock are often used in steep areas subject to flash flooding, where normal flow is shallow (less than 3 inches deep) or intermittent. Fords should only be used where crossings are infrequent. Fords are especially adapted for crossing wide, shallow watercourses.

When properly installed, fords offer little or no obstruction to flow, can safely handle heavy loading, are relatively easy to install and maintain, and, in most cases, may be left in place at the end of the construction.

Problems associated with fords include the following: 1) approach sections are subject to erosion. Generally do not use fords where bank height exceeds 5 feet, 2) excavation for the installation of the riprap-gravel bottom and filter material causes major stream disturbance. In some cases, fords may be adequately constructed by shallow filling without excavation, 3) the stabilizing material is subject to washing out during storm flows and may require replacement, 4) mud and other contaminants are brought directly into the stream on vehicles unless crossings are limited to no flow conditions.

PLANS AND SPECIFICATIONS

The plans and specifications will show the location of the crossing. They also will contain the required material specifications

OPERATION AND MAINTENANCE

Inspect temporary stream crossings after runoff-producing rains to check for blockage in channel, erosion of abutments, channel scour, riprap displacement, or piping. Make all repairs immediately to prevent further damage to the installation.

Remove temporary stream crossings immediately when they are no longer needed. Restore the stream channel to its original cross-section, and smooth and appropriately stabilize all disturbed areas.

Leave in-stream sediment traps in place to continue capturing sediment.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

TOPSOILING

CODE 981

DEFINITION

Methods of preserving and using topsoil to enhance final site stabilization with vegetation.

PURPOSE

The purpose of this practice is to provide a suitable growth medium for final site stabilization with vegetation.

CONDITIONS WHERE PRACTICE APPLIES

1. Where the preservation or importation of topsoil is determined to be the most effective method of providing a suitable growth medium.

2. Where the subsoil or existing soil present any or all of the following problems:

    a. The texture, bulk density, pH, or nutrient balance of the available soil cannot be modified by a reasonable means to provide an adequate growth medium for the desired vegetation.

    b. The soil is too shallow to provide adequate rooting depth or will not supply necessary moisture and nutrients for growth of desired vegetation.

    c. The soil contains substances toxic or potentially toxic to the desired vegetation.

3. Where high-quality turf or ornamental plants are desired.

CRITERIA

Determine if sufficient quantities of suitable topsoil (described in material specification 804 Material for Topsoiling) is available at the site or nearby. Topsoil will be spread at a lightly compacted depth of 2 to 4 inches. Depths of 4 inches or greater are recommended where fine-textured (clayey) subsoils or other root limiting factors are present.

If topsoil is to be stockpiled at the site, select a location so that it will not erode, block drainage, or interfere with work on the site.

During construction of the project, soil stockpiles shall be stabilized or protected with sediment trapping measures such as management practice standards SILT FENCE 920 or TEMPORARY SEEDING 965. Perimeter controls shall be placed around the stockpile immediately; seeding of stockpiles shall be completed within 7 days of formation of the stockpile if it is to remain dormant for longer than 30 days.

Bonding - If topsoil and existing soil surface are not properly bonded, water will not infiltrate evenly, and it will be difficult to establish vegetation.

Care must be taken not to apply topsoil to existing soil surface if the two have contrasting textures. Clayey topsoil over sandy subsoil is a particularly poor combination, as water creeps along the junction between the two soil layers and may cause the topsoil to slough.

Do not apply topsoil to slopes greater than 2:1 to avoid slippage. Topsoiling of steep slopes should be discouraged unless good bonding of the soils can be achieved.

Depending on subsoil conditions, additional measures may be required for ornamental shrub and tree plantings. See management practice standard TREE AND SHRUB PLANTING 985.

CONSIDERATIONS

Topsoil is the surface layer of the soil profile, generally characterized as darker than the subsoil due to the enrichment with organic matter. It is the major zone of root development and biological activity. Microorganisms that enhance plant growth thrive in this layer. Topsoil can usually be differentiated from subsoil by texture as well as color. Clay content usually increases in the subsoil. Where subsoils are high in clay, the topsoil layer may be significantly coarser in texture. The depth of natural topsoil may be quite variable. On severely eroded sites it may be gone entirely.

Advantages of topsoil include its higher organic matter content, friable consistence (soil aggregates can be easily crushed with only moderate pressure), its available water holding capacity, and its nutrient content. Most often it is superior to subsoil in these characteristics. The texture and friability of topsoil are usually much more conducive to seedling germination, emergence, and root growth.

In addition to being a better growth medium, topsoil is often less erodible than subsoils, and the coarser texture of topsoil increases infiltration capacity and reduces runoff.

Although topsoil may provide an improved growth medium, there may be disadvantages, too. Stripping, stockpiling, hauling, and spreading topsoil, or importing topsoil, may not be cost-effective. Handling may be difficult if large amounts of branches or rocks are present, or if the terrain is too rough. Most topsoil contains weed seeds, which compete with desirable species.

In site planning, compare the options of topsoiling with preparing a seedbed in the available subsoil. The clay content of many subsoils retains moisture. When properly limed and fertilized, subsoils may provide a satisfactory growth medium, which is generally free of weed seeds.

Topsoiling is normally recommended where ornamental plants or high-maintenance turf will be grown. It may also be required to establish vegetation on shallow soils, soils containing potentially toxic materials, stony soils, and soils of critically low pH (highly acid).

PLANS AND SPECIFICATIONS

The plans and specifications for installing topsoiling shall be in keeping with this standard and shall describe the requirements for applying the practice. At a minimum include the following items:

1. Topsoil source.
2. Stockpile location and method of stabilization prior to its use.

3. Topsoil/subsoil bonding procedures.
4. Site preparation plans and method of application, distribution and compaction.
5. Installation, inspection, and maintenance schedules with the responsible party clearly identified.

OPERATION AND MAINTENANCE

After topsoil application, follow procedures for seedbed preparation. Take care to avoid excessive mixing of topsoil into the subsoil. Permanently stabilize the site following appropriate management practice standards as quickly as practicable. Periodically inspect the site until permanent stabilization is achieved. Make necessary repairs to eroded areas or areas of light vegetative cover.

CITY OF ST. PETERS

STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

TREE PROTECTION

CODE 990

DEFINITION

Methods to preserve and protect desirable trees from damage during project development.

PURPOSE

The purpose of this practice is to preserve and protect desirable trees that have present or future value for erosion protection for landscape and aesthetic value, or for other environmental benefits.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies on development sites containing trees or stands of trees.

CRITERIA

The following general criteria should be considered when developing sites in wooded areas:

1. Leave critical areas (such as floodplains, steep slopes, and wetlands) with desirable trees in their natural condition or only partially cleared.

2. Locate roadways, storage areas, and parking pads away from valuable tree stands. Follow natural contours, where feasible, to minimize cutting and filling in the vicinity of the trees.

3. Select trees to be preserved before siting roads, buildings or other structures.

4. Minimize trenching in areas with trees. Place several utilities in the same trench.

5. Designate groups of trees to be saved on the erosion and sedimentation control plan.

6. Do not excavate, traverse, or fill closer than the drip line or perimeter of the canopy of trees to be saved.

CONSIDERATIONS

Preserving and protecting trees and other natural plant groups often results in a more stable and aesthetically pleasing development. During site evaluation, note where valuable trees and other natural landscape features should be preserved, then consider these trees and plants when determining the location of roads, buildings, or other structures.

Trees that are near construction zones should be either protected or removed, because damage during construction activities may cause the death of the tree at a later time.

Trees should be considered for preservation for the following benefits:

1. Trees stabilize the soil and prevent erosion.

2. Trees reduce stormwater runoff by intercepting rainfall, promoting infiltration, and lowering the water table through transpiration.

3. Trees moderate temperature changes, provide shade and reduce the force of wind.

4. Trees provide buffers and screens against noise and visual disturbance, providing a degree of privacy.

5. Trees filter pollutants from the air, remove carbon dioxide from the air, and produce oxygen.

6. Trees provide a habitat for animals and birds.

7. Trees increase property values and improve site aesthetics.

Construction activities can significantly injure or kill trees unless protective measures are taken. Although direct contact by equipment is an obvious means of damaging trees, most serious damage is caused by root zone stress from compacting, filling, or excavating too close to the tree. Clearly mark boundaries to maintain sufficient undisturbed areas around the tree.

PLANS AND SPECIFICATIONS

The plans will show the trees to be protected and the location and type of barrier to be installed.

OPERATION AND MAINTENANCE

In spite of precautions, some damage to protected trees may occur. In such cases, repair any damage to the crown, trunk, or root system immediately.

1. Repair roots by cutting off the damaged areas. Spread peat moss or moist topsoil over exposed roots.

2. Repair damage to bark by trimming around the damaged area. Taper the cut to provide drainage.

3. Cut off all damaged tree limbs above the tree collar at the trunk or main branch. Use three separate cuts to avoid peeling bark from healthy areas of the tree.

CITY OF ST. PETERS
STANDARDS FOR EROSION AND SEDIMENT MANAGEMENT PRACTICE

VEGETATIVE STREAMBANK STABILIZATION

CODE 995

DEFINITION

The stabilization and protection of eroding streambanks with selected vegetation.

PURPOSE

The purpose of this standard is to protect streambanks from the erosive forces of flowing water and provide a natural, pleasing appearance.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to natural or excavated channels where the streambanks are susceptible to erosion from the action of water, ice or debris and the problem can be solved using vegetative measures.

Vegetative stabilization is generally applicable where bank full flow velocity does not exceed 5 ft/sec. and soils are erosion resistant. Above 5 ft/sec., structural measures are generally required.

CRITERIA

The U.S. Army Corps of Engineers, Missouri Department of Transportation, Missouri Environmental Protection Agency, and any appropriate local unit of government shall be consulted for determining permits that may be required.

Vegetative protective measures to be applied shall be compatible with improvements planned or being carried out by others.

Protective measures shall be started at a stabilized or controlled point on the stream and extended to a stabilized or controlled point downstream. The grade of the channel must be controlled, either by natural or artificial means, before any vegetative protective measures can be considered feasible unless the live dormant posts or stakes can be installed below the anticipated depth of bottom scour.

Cuttings, stakes and posts to be used as live dormant woody materials shall be obtained from moisture-loving species that will either root naturally or respond to treatment with rooting hormones as listed in Table 3. All woody plant materials will be dormant at the time of installation. Establishment dates and procedures shall conform to those listed in construction specification.

Establishment dates and procedures for vegetative streambank stabilization using selected grasses or grass mixtures shall conform to those listed in Table 1 and Table 2.

Bank reshaping and disturbance will be kept to a minimum except where necessary to adequately install the practice and meet any appropriate requirements. If deemed needed, banks will be shaped to result in a bank slope of 1:1 or flatter.

A temporary seeding shall be used on all sites using a mixture and seeding rates as listed in Table 1 to provide temporary protection while the permanent cover is becoming established. Planting dates shall be as shown in Table 2.

The use of an EROSION BLANKET meeting requirements in management practice standard 830 will provide additional protection during the establishment period.

Where necessary, structural measures shall be planned along with the vegetative measures to stabilize the streambanks using management practice standard STRUCTURAL STREAMBANK STABILIZATION 940 and any applicable construction and material specifications and standard drawings.

CONSIDERATIONS

Special attention should be given to improving wildlife habitat as a secondary benefit by using woody plants and grasses that provide food and/or cover for native wildlife species.

The retention of a 30 feet riparian zone along stream channels that is established to trees, shrubs, and/or grasses may provide wildlife, landscaping and water quality benefits.

Streambanks to be protected using grasses may need to be shaped on a 2:1 or 3:1 slope to provide for adequate seedbed preparation. The use of sod, instead of seeding, should be evaluated where economically justified and technically feasible.

The type of vegetative cover to be used should be based on the soil type, stream velocities, adjacent land use and anticipated level of maintenance to be performed.

Steep channel reaches, high erosive banks and sharp bends may require structural stabilization measures, such as riprap, while the remainder of the streambank may require vegetative measures, only.

PLANS AND SPECIFICATIONS

Plans and specifications are to be developed for specific planting sites in keeping with this standard and shall describe the requirements for applying the practice.

OPERATION AND MAINTENANCE

A maintenance program shall be established to provide sufficient moisture, fertility, replacement of dead or damaged plants and protection from damage by insects, diseases, machinery and human activities.

Streambanks stabilized using grasses will be evaluated as to whether an occasional or periodic mowing and fertilization are to be performed to maintain a healthy protective ground cover.

TABLE 1

SEEDING RATES

Seeding Mixture	Rate Lbs. PLS/Ac.	Rate Lbs. PLS/1000 Sq. Ft.	Suitable pH	Droughty	Site Suitability Well Drained	Wet
Permanent Seeding						
1. Smooth Bromegrass	24	.55		X	X	
Alfalfa	8	.20	6.0-7.5			
2. Tall Fescue or	12	.30			X	X
Redtop	2.5	.06				
3. Reed Canarygrass	12	.30		X	X	X
4. Redtop	2.5	.06		X	X	X
Ladino Clover	2.5	.06				
5. Creeping Red Fescue	15	.34		X	X	X
6. Switchgrass 1/	8	.20	5.5-7.0	X	X	X
Temporary Seedings 2/						
1. Cereal Rye or Wheat	90	2.5		X	X	X
2. Oats	90	2.5				
3. Perennial Ryegrass	24	.55	5.5-7.5	X	X	X
Companion Crops 2/						
1. Spring Oats	32			X	X	X
2. Cereal Rye or Wheat	90					

1/ Do not seed in the fall.
2/ Temporary seeding and companion crops can be planted anytime during the growing season.

TABLE 2

SEEDING DATES

SPRING
February through May

FALL
August through October

TABLE 3

WOODY PLANT MATERIALS

Plant Zone	Common Name	Genus Species	Growth Form
1	*Black Willow	Salix nigra	Tree
1	*Bankers Willow	Salix cottettii	Shrub
1	*Purple-osier willow	Salix purpurea	Shrub
1	*Sandbar Willow	Salix interior	Tree
1	*Carolina Willow	Salix caroliniana	Tree
1	*Peach-leaved Willow	Salix amycdaloides	Tree
1	*Buttonbush	Cephalanthis occidetalis	Shrub
1,2,3	*Red-osier Dogwood	Cornus stolonifera	Shrub
2,3	*Silky Dogwood	Cornus amomum	Shrub
2,3	Flowering Dogwood	Cornus florida	Tree
2,3	Green Ash	Fraxinus pennsylvanica	Tree
2,3	*Sycamore	Platanus occidentalis	Tree
1,2,3	Baldcypress	Taxodium distichum	Tree
1,2	River Birch	Betula nigra	Tree
1,2,3	*Eastern Cottonwood	Populus deltoides	Tree
1,2,3	*Swamp Cottonwood	Populus heterophylla	Tree

Species selection shall consider the position of the plant in the bank profile (see figure 2 of standard drawing).

Zone 1 = Below normal waterline to upper limit of saturation area kept moist by capillary water movement. This zone includes the greatest potential for periodic inundation and the least moisture stress.

Zone 2 = Area from upper limit of Zone 1 to 2-3 feet from the top of the bank. This area maybe subject to rapid drying and greater moisture stress.

Zone 3 = Area 2-3 feet below the top of the bank to a minimum of 30 feet into the floodplain (riparian area).

APPENDIX "A"