



REPLY TO  
ATTENTION OF

**DEPARTMENT OF THE ARMY**  
FORT WORTH DISTRICT, CORPS OF ENGINEERS  
P. O. BOX 17300  
FORT WORTH, TEXAS 76102-0300

March 8, 2004

#E1-738  
R2



Planning, Environmental, and Regulatory Division  
Regulatory Branch

SUBJECT: Project Number 200300101, Surface Transportation Board (STB) Docket  
Number 34284

Ms. Kiri Ghosh  
Case Control Unit  
Surface Transportation Board  
1925 K Street, NW  
Washington, D.C. 20423-0001

Dear Ms. Ghosh:

This letter is in response to the notice of intent to prepare an environmental impact statement (EIS) and request for comments regarding a proposal by Southwest Gulf Railroad (SGR) to construct and operate a seven-mile rail line from a proposed limestone quarry to an existing Union Pacific rail line near the city of Dunlay in Medina County, Texas. This project has been assigned Project Number 200300101. Please include this number in all future correspondence concerning this project. Failure to reference the project number may result in a delay.

We have reviewed this project in accordance with Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. Under Section 404, the U. S. Army Corps of Engineers (USACE) regulates the discharge of dredged and fill material into waters of the United States, including wetlands. Our responsibility under Section 10 is to regulate any work in, or affecting, navigable waters of the United States. Any such discharge or work requires Department of the Army authorization from the USACE in the form of a permit. For more information on the USACE Regulatory Program, please see our Internet homepage at [www.swf.usace.army.mil](http://www.swf.usace.army.mil) and select "Permits". The EIS should address the requirements of the USACE Regulatory Program, including the elements that are discussed in the following paragraphs.

It appears that areas subject to Section 404 regulation, such as Polecat Creek, Elm Creek, Quihi Creek, and Cherry Creek, as well as other unnamed tributaries to navigable waters and adjacent wetlands, occur within the proposed project area. The construction, expansion, modification, or improvement of linear transportation crossings such as highways, railways, trails, airport runways, and taxiways are examples of linear transportation projects that may require Department of the Army authorization where they occur in waters of the United States.

If a Department of the Army permit is required, the project may be authorized by one or more general permits including nationwide permit 14 for Linear Transportation Crossings (copy enclosed). For work to be authorized by general permit it must comply with the specifications and conditions of the permit. Projects that would not meet the specifications and conditions of a general permit may require authorization by individual permit.

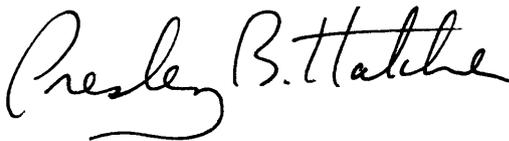
If a Department of the Army permit is required, you should provide us with a detailed description of the proposed project, a suitable map of the proposed project area showing the location of proposed discharges, the type and amount of material (temporary or permanent), if any, to be discharged, and plan and cross-section views of the proposed project. Please refer to the enclosed guidance for Department of the Army submittals and individual permit application checklist for additional details about what you should submit for this and future projects. Information about the proposed project and project alternatives relating to Department of the Army permitting should be presented in the EIS.

Important cultural resources are known to occur in the vicinity of the proposed project. Several endangered and threatened species, including the black-capped Vireo (*Vireo atricapilla*) and the golden-cheeked warbler (*Dendroica chrysoparia*) are known to occur in Medina County. Please consider the potential effects of your proposed action on cultural resources and endangered species in your planning efforts. For additional information about endangered and threatened species, please contact the U. S. Fish and Wildlife Service.

We encourage you to avoid and minimize adverse impacts to streams, wetlands, and other waters of the United States in planning this project. Please note that it is unlawful to start work without a Department of the Army permit if one is required.

Thank you for your interest in our nation's water resources. If you have any questions concerning our regulatory program, please contact Ms. Jessica Napier at the address above or telephone (817) 886-1745.

Sincerely,

  
for Wayne A. Lea  
Chief, Regulatory Branch

Enclosures

Copy furnished:

Mr. Darrell T. Brownlow  
Brownlow Consulting Group  
12425 FM 775  
Floresville, Texas 78114

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# NATIONWIDE PERMIT 14

## Linear Transportation Projects

Effective Date: March 18, 2002

Activities required for the construction, expansion, modification, or improvement of linear transportation crossings (e.g., highways, railways, trails, airport runways, and taxiways) in waters of the US, including wetlands, if the activity meets the following criteria:

a. This NWP is subject to the following acreage limits:

(1) For linear transportation projects in non-tidal waters, provided the discharge does not cause the loss of greater than 1/2-acre of waters of the US; or

(2) For linear transportation projects in tidal waters, provided the discharge does not cause the loss of greater than 1/3-acre of waters of the US.

b. The permittee must notify the District Engineer in accordance with General Condition 13 if any of the following criteria are met:

(1) The discharge causes the loss of greater than 1/10-acre of waters of the US; or

(2) There is a discharge in a special aquatic site, including wetlands;

c. The notification must include a compensatory mitigation proposal to offset permanent losses of waters of the US to ensure that those losses result only in minimal adverse effects to the aquatic environment and a statement describing how temporary losses will be minimized to the maximum extent practicable;

d. For discharges in special aquatic sites, including wetlands, and stream riffle and pool complexes, the notification must include a delineation of the affected special aquatic sites;

e. The width of the fill is limited to the minimum necessary for the crossing;

f. This permit does not authorize stream channelization, and the authorized activities must not cause more than minimal changes to the hydraulic flow characteristics of the stream, increase flooding, or cause more than minimal degradation of water quality of any stream (see General Conditions 9 and 21);

g. This permit cannot be used to authorize non-linear features commonly associated with transportation projects, such as vehicle maintenance or storage buildings, parking lots, train stations, or aircraft hangars; and

h. The crossing is a single and complete project for crossing waters of the US. Where a road segment (i.e., the shortest segment of a road with independent utility that is part of a larger project) has multiple crossings of streams (several single and complete projects) the Corps will consider whether it should use its discretionary authority to require an Individual Permit. (Sections 10 and 404)

Note: Some discharges for the construction of farm roads, forest roads, or temporary roads for moving mining equipment may be eligible for an exemption from the need for a Section 404 permit (see 33 CFR 323.4).

### NATIONWIDE PERMIT GENERAL CONDITIONS

The following General Conditions must be followed in order for any authorization by an NWP to be valid:

- 1. Navigation.** No activity may cause more than a minimal adverse effect on navigation.
- 2. Proper Maintenance.** Any structure or fill authorized shall be properly maintained, including maintenance to ensure public safety.
- 3. Soil Erosion and Sediment Controls.** Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow.
- 4. Aquatic Life Movements.** No activity may substantially disrupt the necessary life-cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. Culverts placed in streams must be installed to maintain low flow conditions.

5. **Equipment.** Heavy equipment working in wetlands must be placed on mats, or other measures must be taken to minimize soil disturbance.

6. **Regional and Case-By-Case Conditions.** The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state or tribe in its Section 401 Water Quality Certification and Coastal Zone Management Act consistency determination. **Note: Statewide Regional Conditions have been added for activities within Texas.**

7. **Wild and Scenic Rivers.** No activity may occur in a component of the National Wild and Scenic River System; or in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status; unless the appropriate Federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation, or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency in the area (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service).

8. **Tribal Rights.** No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

9. **Water Quality.** (a) In certain states and tribal lands an individual 401 Water Quality Certification must be obtained or waived (See 33 CFR 330.4(c)).

(b) For NWP's 12, 14, 17, 18, 32, 39, 40, 42, 43, and 44, where the state or tribal 401 certification (either generically or individually) does not require or approve water quality management measures, the permittee must provide water quality management measures that will ensure that the authorized work does not result in more than minimal degradation of water quality (or the Corps determines that compliance with state or local standards, where applicable, will ensure no more than minimal adverse effect on water quality). An important component of water quality management includes stormwater management that minimizes degradation of the downstream aquatic system, including water quality (refer to General Condition 21 for stormwater management requirements). Another important component of water quality management is the establishment and maintenance of vegetated buffers next to open waters, including streams (refer to General Condition 19 for vegetated buffer requirements for the NWP's).

This condition is only applicable to projects that have the potential to affect water quality. While appropriate measures must be taken, in most cases it is not necessary to conduct detailed studies to identify such measures or to require monitoring.

10. **Coastal Zone Management.** In certain states, an individual state coastal zone management consistency concurrence must be obtained or waived (see 33 CFR 330.4(d)).

11. **Endangered Species.** (a) No activity is authorized under any NWP which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will destroy or adversely modify the critical habitat of such species. Non-federal permittees shall notify the District Engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the project, or is located in the designated critical habitat and shall not begin work on the activity until notified by the District Engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that may affect Federally-listed endangered or threatened species or designated critical habitat, the notification must include the name(s) of the endangered or threatened species that may be affected by the proposed work or that utilize the designated critical habitat that may be affected by the proposed work. As a result of formal or informal consultation with the FWS or NMFS the District Engineer may add species-specific regional endangered species conditions to the NWP's.

(b) Authorization of an activity by a NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the USFWS or the NMFS, both lethal and non-lethal "takes" of protected

species are in violation of the ESA. Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the USFWS and NMFS or their world wide web pages at <http://www.fws.gov/r9endspp/endspp.html> and [http://www.nmfs.noaa.gov/prot\\_res/overview/es.html](http://www.nmfs.noaa.gov/prot_res/overview/es.html) respectively.

**12. Historic Properties.** No activity which may affect historic properties listed, or eligible for listing, in the National Register of Historic Places is authorized, until the District Engineer has complied with the provisions of 33 CFR part 325, Appendix C. The prospective permittee must notify the District Engineer if the authorized activity may affect any historic properties listed, determined to be eligible, or which the prospective permittee has reason to believe may be eligible for listing on the National Register of Historic Places, and shall not begin the activity until notified by the District Engineer that the requirements of the National Historic Preservation Act have been satisfied and that the activity is authorized. Information on the location and existence of historic resources can be obtained from the State Historic Preservation Office and the National Register of Historic Places (see 33 CFR 330.4(g)). For activities that may affect historic properties listed in, or eligible for listing in, the National Register of Historic Places, the notification must state which historic property may be affected by the proposed work or include a vicinity map indicating the location of the historic property.

**13. Notification.**

(a) Timing; where required by the terms of the NWP, the prospective permittee must notify the District Engineer with a preconstruction notification (PCN) as early as possible. The District Engineer must determine if the notification is complete within 30 days of the date of receipt and can request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the District Engineer will notify the prospective permittee that the notification is still incomplete and the PCN review process will not commence until all of the requested information has been received by the District Engineer. The prospective permittee shall not begin the activity:

- (1) Until notified in writing by the District Engineer that the activity may proceed under the NWP with any special conditions imposed by the District or Division Engineer; or
- (2) If notified in writing by the District or Division Engineer that an Individual Permit is required; or
- (3) Unless 45 days have passed from the District Engineer's receipt of the complete notification and the prospective permittee has not received written notice from the District or Division Engineer. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) Contents of Notification: The notification must be in writing and include the following information:

- (1) Name, address and telephone numbers of the prospective permittee;
- (2) Location of the proposed project;
- (3) Brief description of the proposed project; the project's purpose; direct and indirect adverse environmental effects the project would cause; any other NWP(s), Regional General Permit(s), or Individual Permit(s) used or intended to be used to authorize any part of the proposed project or any related activity. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP (Sketches usually clarify the project and when provided result in a quicker decision.);
- (4) For NWPs 7, 12, 14, 18, 21, 34, 38, 39, 40, 41, 42, and 43, the PCN must also include a delineation of affected special aquatic sites, including wetlands, vegetated shallows (e.g., submerged aquatic vegetation, seagrass beds), and riffle and pool complexes (see paragraph 13(f));
- (5) For NWP 7 (Outfall Structures and Maintenance), the PCN must include information regarding the original design capacities and configurations of those areas of the facility where maintenance dredging or excavation is proposed;
- (6) For NWP 14 (Linear Transportation Projects), the PCN must include a compensatory mitigation proposal to offset permanent losses of waters of the US and a statement describing how temporary losses of waters of the US will be minimized to the maximum extent practicable;
- (7) For NWP 21 (Surface Coal Mining Activities), the PCN must include an Office of Surface Mining (OSM) or state-approved mitigation plan, if applicable. To be authorized by this NWP, the District Engineer must determine that the activity complies with the terms and conditions of the NWP and that the adverse environmental effects are minimal both individually and cumulatively and must notify the project sponsor of this determination in writing;

- (8) For NWP 27 (Stream and Wetland Restoration Activities), the PCN must include documentation of the prior condition of the site that will be reverted by the permittee;
- (9) For NWP 29 (Single-Family Housing), the PCN must also include:
- (i) Any past use of this NWP by the Individual Permittee and/or the permittee's spouse;
  - (ii) A statement that the single-family housing activity is for a personal residence of the permittee;
  - (iii) A description of the entire parcel, including its size, and a delineation of wetlands. For the purpose of this NWP, parcels of land measuring 1/4-acre or less will not require a formal on-site delineation. However, the applicant shall provide an indication of where the wetlands are and the amount of wetlands that exists on the property. For parcels greater than 1/4-acre in size, formal wetland delineation must be prepared in accordance with the current method required by the Corps. (See paragraph 13(f));
  - (iv) A written description of all land (including, if available, legal descriptions) owned by the prospective permittee and/or the prospective permittee's spouse, within a one mile radius of the parcel, in any form of ownership (including any land owned as a partner, corporation, joint tenant, co-tenant, or as a tenant-by-the-entirety) and any land on which a purchase and sale agreement or other contract for sale or purchase has been executed;
- (10) For NWP 31 (Maintenance of Existing Flood Control Facilities), the prospective permittee must either notify the District Engineer with a PCN prior to each maintenance activity or submit a five year (or less) maintenance plan. In addition, the PCN must include all of the following:
- (i) Sufficient baseline information identifying the approved channel depths and configurations and existing facilities. Minor deviations are authorized, provided the approved flood control protection or drainage is not increased;
  - (ii) A delineation of any affected special aquatic sites, including wetlands; and,
  - (iii) Location of the dredged material disposal site;
- (11) For NWP 33 (Temporary Construction, Access, and Dewatering), the PCN must also include a restoration plan of reasonable measures to avoid and minimize adverse effects to aquatic resources;
- (12) For NWPs 39, 43 and 44, the PCN must also include a written statement to the District Engineer explaining how avoidance and minimization for losses of waters of the US were achieved on the project site;
- (13) For NWP 39 and NWP 42, the PCN must include a compensatory mitigation proposal to offset losses of waters of the US or justification explaining why compensatory mitigation should not be required. For discharges that cause the loss of greater than 300 linear feet of an intermittent stream bed, to be authorized, the District Engineer must determine that the activity complies with the other terms and conditions of the NWP, determine adverse environmental effects are minimal both individually and cumulatively, and waive the limitation on stream impacts in writing before the permittee may proceed;
- (14) For NWP 40 (Agricultural Activities), the PCN must include a compensatory mitigation proposal to offset losses of waters of the US. This NWP does not authorize the relocation of greater than 300 linear-feet of existing serviceable drainage ditches constructed in non-tidal streams unless, for drainage ditches constructed in intermittent non-tidal streams, the District Engineer waives this criterion in writing, and the District Engineer has determined that the project complies with all terms and conditions of this NWP, and that any adverse impacts of the project on the aquatic environment are minimal, both individually and cumulatively;
- (15) For NWP 43 (Stormwater Management Facilities), the PCN must include, for the construction of new stormwater management facilities, a maintenance plan (in accordance with state and local requirements, if applicable) and a compensatory mitigation proposal to offset losses of waters of the US. For discharges that cause the loss of greater than 300 linear feet of an intermittent stream bed, to be authorized, the District Engineer must determine that the activity complies with the other terms and conditions of the NWP, determine adverse environmental effects are minimal both individually and cumulatively, and waive the limitation on stream impacts in writing before the permittee may proceed;
- (16) For NWP 44 (Mining Activities), the PCN must include a description of all waters of the US adversely affected by the project, a description of measures taken to minimize adverse effects to waters of the US, a description of measures taken to comply with the criteria of the NWP, and a reclamation plan (for all aggregate mining activities in isolated waters and non-tidal wetlands adjacent to headwaters and any hard rock/mineral mining activities);
- (17) For activities that may adversely affect Federally-listed endangered or threatened species, the PCN must include the name(s) of those endangered or threatened species that may be affected by the proposed work or utilize the designated critical habitat that may be affected by the proposed work; and
- (18) For activities that may affect historic properties listed in, or eligible for listing in, the National Register of

Historic Places, the PCN must state which historic property may be affected by the proposed work or include a vicinity map indicating the location of the historic property.

(c) Form of Notification: The standard Individual Permit application form (Form ENG 4345) may be used as the notification but must clearly indicate that it is a PCN and must include all of the information required in (b) (1)-(18) of General Condition 13. A letter containing the requisite information may also be used.

(d) District Engineer's Decision: In reviewing the PCN for the proposed activity, the District Engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. The prospective permittee may submit a proposed mitigation plan with the PCN to expedite the process. The District Engineer will consider any proposed compensatory mitigation the applicant has included in the proposal in determining whether the net adverse environmental effects to the aquatic environment of the proposed work are minimal. If the District Engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse effects on the aquatic environment are minimal, after considering mitigation, the District Engineer will notify the permittee and include any conditions the District Engineer deems necessary. The District Engineer must approve any compensatory mitigation proposal before the permittee commences work. If the prospective permittee is required to submit a compensatory mitigation proposal with the PCN, the proposal may be either conceptual or detailed. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the District Engineer will expeditiously review the proposed compensatory mitigation plan. The District Engineer must review the plan within 45 days of receiving a complete PCN and determine whether the conceptual or specific proposed mitigation would ensure no more than minimal adverse effects on the aquatic environment. If the net adverse effects of the project on the aquatic environment (after consideration of the compensatory mitigation proposal) are determined by the District Engineer to be minimal, the District Engineer will provide a timely written response to the applicant. The response will state that the project can proceed under the terms and conditions of the NWP.

If the District Engineer determines that the adverse effects of the proposed work are more than minimal, then the District Engineer will notify the applicant either: (1) That the project does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an Individual Permit; (2) that the project is authorized under the NWP subject to the applicant's submission of a mitigation proposal that would reduce the adverse effects on the aquatic environment to the minimal level; or (3) that the project is authorized under the NWP with specific modifications or conditions. Where the District Engineer determines that mitigation is required to ensure no more than minimal adverse effects occur to the aquatic environment, the activity will be authorized within the 45-day PCN period. The authorization will include the necessary conceptual or specific mitigation or a requirement that the applicant submit a mitigation proposal that would reduce the adverse effects on the aquatic environment to the minimal level. When conceptual mitigation is included, or a mitigation plan is required under item (2) above, no work in waters of the US will occur until the District Engineer has approved a specific mitigation plan.

(e) Agency Coordination: The District Engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the project's adverse environmental effects to a minimal level.

For activities requiring notification to the District Engineer that result in the loss of greater than 1/2-acre of waters of the US, the District Engineer will provide immediately (e.g., via facsimile transmission, overnight mail, or other expeditious manner) a copy to the appropriate Federal or state offices (USFWS, state natural resource or water quality agency, EPA, State Historic Preservation Officer (SHPO), and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will then have 10 calendar days from the date the material is transmitted to telephone or fax the District Engineer notice that they intend to provide substantive, site-specific comments. If so contacted by an agency, the District Engineer will wait an additional 15 calendar days before making a decision on the notification. The District Engineer will fully consider agency comments received within the specified time frame, but will provide no response to the resource agency, except as provided below. The District Engineer will indicate in the administrative record associated with each notification that the resource agencies' concerns were considered. As required by section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act, the District Engineer will provide a response to NMFS within 30 days of receipt of any Essential Fish Habitat conservation recommendations. Applicants are encouraged to provide the Corps multiple copies of notifications to expedite agency notification.

(f) Wetland Delineations: Wetland delineations must be prepared in accordance with the current method required by the Corps (For NWP 29 see paragraph (b)(9)(iii) for parcels less than (1/4-acre in size). The permittee may ask the

Corps to delineate the special aquatic site. There may be some delay if the Corps does the delineation. Furthermore, the 45-day period will not start until the wetland delineation has been completed and submitted to the Corps, where appropriate.

**14. Compliance Certification.** Every permittee who has received NWP verification from the Corps will submit a signed certification regarding the completed work and any required mitigation. The certification will be forwarded by the Corps with the authorization letter and will include:

(a) A statement that the authorized work was done in accordance with the Corps authorization, including any general or specific conditions;

(b) A statement that any required mitigation was completed in accordance with the permit conditions; and

(c) The signature of the permittee certifying the completion of the work and mitigation.

**15. Use of Multiple Nationwide Permits.** The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the US authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit (e.g. if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the US for the total project cannot exceed 1/3-acre).

**16. Water Supply Intakes.** No activity, including structures and work in navigable waters of the US or discharges of dredged or fill material, may occur in the proximity of a public water supply intake except where the activity is for repair of the public water supply intake structures or adjacent bank stabilization.

**17. Shellfish Beds.** No activity, including structures and work in navigable waters of the US or discharges of dredged or fill material, may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWP 4.

**18. Suitable Material.** No activity, including structures and work in navigable waters of the US or discharges of dredged or fill material, may consist of unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.) and material used for construction or discharged must be free from toxic pollutants in toxic amounts (see section 307 of the CWA).

**19. Mitigation.** The District Engineer will consider the factors discussed below when determining the acceptability of appropriate and practicable mitigation necessary to offset adverse effects on the aquatic environment that are more than minimal.

(a) The project must be designed and constructed to avoid and minimize adverse effects to waters of the US to the maximum extent practicable at the project site (i.e., on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing or compensating) will be required to the extent necessary to ensure that the adverse effects to the aquatic environment are minimal.

(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland impacts requiring a PCN, unless the District Engineer determines in writing that some other form of mitigation would be more environmentally appropriate and provides a project-specific waiver of this requirement. Consistent with National policy, the District Engineer will establish a preference for restoration of wetlands as compensatory mitigation, with preservation used only in exceptional circumstances.

(d) Compensatory mitigation (i.e., replacement or substitution of aquatic resources for those impacted) will not be used to increase the acreage losses allowed by the acreage limits of some of the NWPs. For example, 1/4-acre of wetlands cannot be created to change a 3/4-acre loss of wetlands to a 1/2-acre loss associated with NWP 39 verification. However, 1/2-acre of created wetlands can be used to reduce the impacts of a 1/2-acre loss of wetlands to the minimum impact level in order to meet the minimal impact requirement associated with NWPs.

(e) To be practicable, the mitigation must be available and capable of being done considering costs, existing technology, and logistics in light of the overall project purposes. Examples of mitigation that may be appropriate and practicable include, but are not limited to: reducing the size of the project; establishing and maintaining wetland or upland vegetated buffers to protect open waters such as streams; and replacing losses of aquatic resource functions and values by creating, restoring, enhancing, or preserving similar functions and values, preferably in the same watershed.

(f) Compensatory mitigation plans for projects in or near streams or other open waters will normally include a requirement for the establishment, maintenance, and legal protection (e.g., easements, deed restrictions) of vegetated buffers to open waters. In many cases, vegetated buffers will be the only compensatory mitigation required. Vegetated buffers should consist of native species. The width of the vegetated buffers required will address documented water quality or aquatic habitat loss concerns. Normally, the vegetated buffer will be 25 to 50 feet wide on each side of the stream, but the District Engineers may require slightly wider vegetated buffers to address documented water quality or habitat loss concerns. Where both wetlands and open waters exist on the project site, the Corps will determine the appropriate compensatory mitigation (e.g., stream buffers or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where vegetated buffers are determined to be the most appropriate form of compensatory mitigation, the District Engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland impacts.

(g) Compensatory mitigation proposals submitted with the "notification" may be either conceptual or detailed. If conceptual plans are approved under the verification, then the Corps will condition the verification to require detailed plans be submitted and approved by the Corps prior to construction of the authorized activity in waters of the US.

(h) Permittees may propose the use of mitigation banks, in-lieu fee arrangements or separate activity-specific compensatory mitigation. In all cases that require compensatory mitigation, the mitigation provisions will specify the party responsible for accomplishing and/or complying with the mitigation plan.

**20. Spawning Areas.** Activities, including structures and work in navigable waters of the US or discharges of dredged or fill material, in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., excavate, fill, or smother downstream by substantial turbidity) of an important spawning area are not authorized.

**21. Management of Water Flows.** To the maximum extent practicable, the activity must be designed to maintain preconstruction downstream flow conditions (e.g., location, capacity, and flow rates). Furthermore, the activity must not permanently restrict or impede the passage of normal or expected high flows (unless the primary purpose of the fill is to impound waters) and the structure or discharge of dredged or fill material must withstand expected high flows. The activity must, to the maximum extent practicable, provide for retaining excess flows from the site, provide for maintaining surface flow rates from the site similar to preconstruction conditions, and provide for not increasing water flows from the project site, relocating water, or redirecting water flow beyond preconstruction conditions. Stream channelizing will be reduced to the minimal amount necessary, and the activity must, to the maximum extent practicable, reduce adverse effects such as flooding or erosion downstream and upstream of the project site, unless the activity is part of a larger system designed to manage water flows. In most cases, it will not be a requirement to conduct detailed studies and monitoring of water flow.

This condition is only applicable to projects that have the potential to affect waterflows. While appropriate measures must be taken, it is not necessary to conduct detailed studies to identify such measures or require monitoring to ensure their effectiveness. Normally, the Corps will defer to state and local authorities regarding management of water flow.

**22. Adverse Effects From Impoundments.** If the activity creates an impoundment of water, adverse effects to the aquatic system due to the acceleration of the passage of water, and/or the restricting its flow shall be minimized to the maximum extent practicable. This includes structures and work in navigable waters of the US, or discharges of dredged or fill material.

**23. Waterfowl Breeding Areas.** Activities, including structures and work in navigable waters of the US or discharges of dredged or fill material, into breeding areas for migratory waterfowl must be avoided to the maximum extent practicable.

**24. Removal of Temporary Fills.** Any temporary fills must be removed in their entirety and the affected areas returned to their preexisting elevation.

**25. Designated Critical Resource Waters.** Critical resource waters include, NOAA-designated marine sanctuaries, National Estuarine Research Reserves, National Wild and Scenic Rivers, critical habitat for Federally listed threatened

and endangered species, coral reefs, state natural heritage sites, and outstanding national resource waters or other waters officially designated by a state as having particular environmental or ecological significance and identified by the District Engineer after notice and opportunity for public comment. The District Engineer may also designate additional critical resource waters after notice and opportunity for comment.

(a) Except as noted below, discharges of dredged or fill material into waters of the US are not authorized by NWP 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, and 44 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters. Discharges of dredged or fill materials into waters of the US may be authorized by the above NWPs in National Wild and Scenic Rivers if the activity complies with General Condition 7. Further, such discharges may be authorized in designated critical habitat for Federally listed threatened or endangered species if the activity complies with General Condition 11 and the USFWS or the NMFS has concurred in a determination of compliance with this condition.

(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, and 38, notification is required in accordance with General Condition 13, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The District Engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

**26. Fills Within 100-Year Floodplains.** For purposes of this General Condition, 100-year floodplains will be identified through the existing Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps or FEMA-approved local floodplain maps.

(a) Discharges in Floodplain; Below Headwaters. Discharges of dredged or fill material into waters of the US within the mapped 100-year floodplain, below headwaters (i.e. five cfs), resulting in permanent above-grade fills, are not authorized by NWPs 39, 40, 42, 43, and 44.

(b) Discharges in Floodway; Above Headwaters. Discharges of dredged or fill material into waters of the US within the FEMA or locally mapped floodway, resulting in permanent above-grade fills, are not authorized by NWPs 39, 40, 42, and 44.

(c) The permittee must comply with any applicable FEMA-approved state or local floodplain management requirements.

**27. Construction Period.** For activities that have not been verified by the Corps and the project was commenced or under contract to commence by the expiration date of the NWP (or modification or revocation date), the work must be completed within 12-months after such date (including any modification that affects the project).

For activities that have been verified and the project was commenced or under contract to commence within the verification period, the work must be completed by the date determined by the Corps.

For projects that have been verified by the Corps, an extension of a Corps approved completion date maybe requested. This request must be submitted at least one month before the previously approved completion date.

## FURTHER INFORMATION

1. District Engineers have authority to determine if an activity complies with the terms and conditions of an NWP.
2. NWPs do not obviate the need to obtain other Federal, state, or local permits, approvals, or authorizations required by law.
3. NWPs do not grant any property rights or exclusive privileges.
4. NWPs do not authorize any injury to the property or rights of others.
5. NWPs do not authorize interference with any existing or proposed Federal project.

## DEFINITIONS

**Best Management Practices (BMPs):** BMPs are policies, practices, procedures, or structures implemented to mitigate the adverse environmental effects on surface water quality resulting from development. BMPs are categorized as structural or non-structural. A BMP policy may affect the limits on a development.

**Compensatory Mitigation:** For purposes of Section 10/404, compensatory mitigation is the restoration, creation, enhancement, or in exceptional circumstances, preservation of wetlands and/or other aquatic resources for the purpose

of compensating for unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.

**Creation:** The establishment of a wetland or other aquatic resource where one did not formerly exist.

**Enhancement:** Activities conducted in existing wetlands or other aquatic resources that increase one or more aquatic functions.

**Ephemeral Stream:** An ephemeral stream has flowing water only during and for a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.

**Farm Tract:** A unit of contiguous land under one ownership that is operated as a farm or part of a farm.

**Flood Fringe:** That portion of the 100-year floodplain outside of the floodway (often referred to as "floodway fringe").

**Floodway:** The area regulated by Federal, state, or local requirements to provide for the discharge of the base flood so the cumulative increase in water surface elevation is no more than a designated amount (not to exceed one foot as set by the National Flood Insurance Program) within the 100-year floodplain.

**Independent Utility:** A test to determine what constitutes a single and complete project in the Corps regulatory program. A project is considered to have independent utility if it would be constructed absent the construction of other projects in the project area. Portions of a multi-phase project that depend upon other phases of the project do not have independent utility. Phases of a project that would be constructed even if the other phases were not built can be considered as separate single and complete projects with independent utility.

**Intermittent Stream:** An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.

**Loss of Waters of the US:** Waters of the US that include the filled area and other waters that are permanently adversely affected by flooding, excavation, or drainage because of the regulated activity. Permanent adverse effects include permanent above-grade, at-grade, or below-grade fills that change an aquatic area to dry land, increase the bottom elevation of a waterbody, or change the use of a waterbody. The acreage of loss of waters of the US is the threshold measurement of the impact to existing waters for determining whether a project may qualify for an NWP; it is not a net threshold that is calculated after considering compensatory mitigation that may be used to offset losses of aquatic functions and values. The loss of stream bed includes the linear feet of stream bed that is filled or excavated. Impacts to ephemeral streams are not included in the linear foot measurement of loss of stream bed for the purpose of determining compliance with the linear foot limits of NWPs 39, 40, 42, and 43. Waters of the US temporarily filled, flooded, excavated, or drained, but restored to preconstruction contours and elevations after construction, are not included in the measurement of loss of waters of the US.

**Non-tidal Wetland:** A non-tidal wetland is a wetland (i.e., a water of the US) that is not subject to the ebb and flow of tidal waters. The definition of a wetland can be found at 33 CFR 328.3(b). Non-tidal wetlands contiguous to tidal waters are located landward of the high tide line (i.e., spring high tide line).

**Open Water:** An area that, during a year with normal patterns of precipitation, has standing or flowing water for sufficient duration to establish an ordinary high water mark. Aquatic vegetation within the area of standing or flowing water is either non-emergent, sparse, or absent. Vegetated shallows are considered to be open waters. The term "open water" includes rivers, streams, lakes, and ponds. For the purposes of the NWPs, this term does not include ephemeral waters.

**Perennial Stream:** A perennial stream has flowing water year-round during a typical year. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from rainfall is a supplemental source of water for stream flow.

**Permanent Above-grade Fill:** A discharge of dredged or fill material into waters of the US, including wetlands, that results in a substantial increase in ground elevation and permanently converts part or all of the waterbody to dry land. Structural fills authorized by NWPs 3, 25, 36, etc. are not included.

**Preservation:** The protection of ecologically important wetlands or other aquatic resources in perpetuity through the implementation of appropriate legal and physical mechanisms. Preservation may include protection of upland areas adjacent to wetlands as necessary to ensure protection and/or enhancement of the overall aquatic ecosystem.

**Restoration:** Re-establishment of wetland and/or other aquatic resource characteristics and function(s) at a site

where they have ceased to exist, or exist in a substantially degraded state.

**Riffle and Pool Complex:** Riffle and pool complexes are special aquatic sites under the 404(b)(1) Guidelines. Riffle and pool complexes sometimes characterize steep gradient sections of streams. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a coarse substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. A slower stream velocity, a streaming flow, a smooth surface, and a finer substrate characterize pools.

**Single and Complete Project:** The term "single and complete project" is defined at 33 CFR 330.2(i) as the total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers (see definition of independent utility). For linear projects, the "single and complete project" (i.e., a single and complete crossing) will apply to each crossing of a separate water of the US (i.e., a single waterbody) at that location. An exception is for linear projects crossing a single waterbody several times at separate and distant locations: each crossing is considered a single and complete project. However, individual channels in a braided stream or river, or individual arms of a large, irregularly shaped wetland or lake, etc., are not separate waterbodies.

**Stormwater Management:** Stormwater management is the mechanism for controlling stormwater runoff for the purposes of reducing downstream erosion, water quality degradation, and flooding and mitigating the adverse effects of changes in land use on the aquatic environment.

**Stormwater Management Facilities:** Stormwater management facilities are those facilities, including but not limited to, stormwater retention and detention ponds and BMPs, which retain water for a period of time to control runoff and/or improve the quality (i.e., by reducing the concentration of nutrients, sediments, hazardous substances and other pollutants) of stormwater runoff.

**Stream Bed:** The substrate of the stream channel between the ordinary high water marks. The substrate may be bedrock or inorganic particles that range in size from clay to boulders. Wetlands contiguous to the stream bed, but outside of the ordinary high water marks, are not considered part of the stream bed.

**Stream Channelization:** The manipulation of a stream channel to increase the rate of water flow through the stream channel. Manipulation may include deepening, widening, straightening, armoring, or other activities that change the stream cross-section or other aspects of stream channel geometry to increase the rate of water flow through the stream channel. A channelized stream remains a water of the US, despite the modifications to increase the rate of water flow.

**Tidal Wetland:** A tidal wetland is a wetland (i.e., water of the US) that is inundated by tidal waters. The definitions of a wetland and tidal waters can be found at 33 CFR 328.3(b) and 33 CFR 328.3(f), respectively. Tidal waters rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by other waters, wind, or other effects. Tidal wetlands are located channelward of the high tide line (i.e., spring high tide line) and are inundated by tidal waters two times per lunar month, during spring high tides.

**Vegetated Buffer:** A vegetated upland or wetland area next to rivers, streams, lakes, or other open waters which separates the open water from developed areas, including agricultural land. Vegetated buffers provide a variety of aquatic habitat functions and values (e.g., aquatic habitat for fish and other aquatic organisms, moderation of water temperature changes, and detritus for aquatic food webs) and help improve or maintain local water quality. A vegetated buffer can be established by maintaining an existing vegetated area or planting native trees, shrubs, and herbaceous plants on land next to open-waters. Mowed lawns are not considered vegetated buffers because they provide little or no aquatic habitat functions and values. The establishment and maintenance of vegetated buffers is a method of compensatory mitigation that can be used in conjunction with the restoration, creation, enhancement, or preservation of aquatic habitats to ensure that activities authorized by NWP result in minimal adverse effects to the aquatic environment. (See General Condition 19.)

**Vegetated Shallows:** Vegetated shallows are special aquatic sites under the 404(b)(1) Guidelines. They are areas that are permanently inundated and under normal circumstances have rooted aquatic vegetation, such as seagrasses in marine and estuarine systems and a variety of vascular rooted plants in freshwater systems.

**Waterbody:** A waterbody is any area that in a normal year has water flowing or standing above ground to the extent that evidence of an ordinary high water mark is established. Wetlands contiguous to the waterbody are considered part of the waterbody.

### **ADDITIONAL INFORMATION**

Information about the U.S. Army Corps of Engineers regulatory program, including nationwide permits, may also be accessed on our Internet page: <http://www.usace.army.mil/inet/functions/cw/cecwo/reg>

This nationwide permit is effective March 18, 2002, and expires on March 19, 2007, unless sooner modified, suspended, or revoked.

Summary Version: March 18, 2002



## **Texas Commission on Environmental Quality**

### **401 Water Quality Certification Conditions for Nationwide Permits**

#### **Attachment 1**

Below are the 401 water quality certification conditions the Texas Commission on Environmental Quality (TCEQ) added to the January 15, 2002 issuance of Nationwide Permits (NWP), as described in the Federal Register (Part II, Vol. 67, No. 10, pages 2020-2095). These conditions were included as part of TCEQ's certification finalized on April 12, 2002 and September 5, 2003.

Additional information regarding these conditions, including descriptions of the best management practices, can be obtained from the TCEQ by contacting the 401 Coordinator, MC-150, P. O. Box 13087, Austin, Texas 78711-3087 or from the appropriate U.S. Army Corps of Engineers district office.

#### **I. Erosion Control**

Disturbed areas must be stabilized to prevent the introduction of sediment to adjacent wetlands or water bodies during wet weather conditions (erosion). *At least one* of the following BMPs must be maintained and remain in place until the area has been stabilized for NWPs 3, 7, 12, 13, 14, 15, 17, 18, 19, 21, 22, 25, 27, 29, 30, 31, 32, 33, 36, 37, 38, 39, 40, 41, 42, 43, and 44. If the applicant does not choose one of the BMPs listed, an individual 401 certification is required.

- o Temporary Vegetation
- o Blankets/Matting
- o Mulch
- o Sod
- o Interceptor Swale
- o Diversion Dike
- o Erosion Control Compost
- o Mulch Filter Berms and Socks
- o Compost Filter Berms and Socks

#### **II. Sedimentation Control**

Prior to project initiation, the project area must be isolated from adjacent wetlands and water bodies by the use of BMPs to confine sediment. Dredged material shall be placed in such a manner that prevents sediment runoff into water in the state, including wetlands. Water bodies can be isolated by the use of one or more of the required BMPs identified for sedimentation control. These BMP's must be maintained and remain in place until the dredged material is stabilized. *At least one* of the following BMPs must be maintained and remain in place until the area has been stabilized for NWPs 3, 7, 12, 13, 14, 15, 17, 18, 19, 21, 22, 25, 27, 29, 30, 31, 32, 33, 36, 37, 38, 39, 40, 41, 42, 43, and 44. If the applicant does not choose one of the BMPs listed, an individual 401 certification is required.

## 401 Water Quality Certification Conditions for Nationwide Permits

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- o Sand Bag Berm
- o Silt Fence
- o Triangular Filter Dike
- o Stone Outlet Sediment Traps
- o Erosion Control Compost
- o Compost Filter Berms and Socks
- o Rock Berm
- o Hay Bale Dike
- o Brush Berms
- o Sediment Basins
- o Mulch Filter Berms and Socks

### **III. Post-Construction TSS Control**

After construction has been completed and the site is stabilized, total suspended solids (TSS) loadings shall be controlled by *at least one* of the following BMPs for NWPs 12, 14, 17, 18, 21, 29, 31, 36, 39, 40, 41, 42, and 44. If the applicant does not choose one of the BMPs listed, an individual 401 certification is required. Runoff from bridge decks has been exempted from the requirement for post construction TSS controls.

- o Retention/Irrigation
- o Extended Detention Basin
- o Vegetative Filter Strips
- o Grassy Swales
- o Erosion Control Compost
- o Compost Filter Berms and Socks
- o Constructed Wetlands
- o Wet Basins
- o Vegetation lined drainage ditches
- o Sand Filter Systems
- o Mulch Filter Berms and Socks

### **IV. Return Water from Upland Contained Disposal Areas**

Effluent from an upland contained disposal areas shall not exceed a TSS concentration of 300 mg/L unless an individual certification has been issued with site-specific TSS limits.

**401 Water Quality Certification Conditions  
for Nationwide Permits  
Page 3**

**V. NWP 39, 40, and 42**

The Corps will copy the TCEQ on all authorizations for impacts of greater than 300 feet of intermittent streams sent to applicants.



**Attachment 2**  
**Reference to Nationwide Permits Best Management Practices Requirements**

NWP	Permit Description	Erosion Control	Sediment Control	Post Construction TSS
1	Aid to Navigation			
2	Structures in Artificial Canals			
3	Maintenance ( Repair, Replacement, rehabilitation of currently serviceable structure or fill)	X	X	
4	Fish and Wildlife Harvesting, Enhancement and Attraction Devices and Activities (Duck Blinds and Crab Traps)			
5	Scientific Measurement Devices			
6	Survey Activities			
7	Outfall Structures and Maintenance	X	X	
8	Oil and Gas Structures			
9	Structures in Fleeting And Anchorage Areas			
10	Mooring Buoys			
11	Temporary Recreation Structures			
12	Utility Line Activities	X	X	X
13	Bank Stabilization	X	X	
14	Linear Transportation Projects	X	X	X
15	U.S. Coast Guard Approved Bridges	X	X	
16	Return Water From Upland Disposal Areas			
17	Hydropower Projects	X	X	X
18	Minor Discharges (25yds)	X	X	X
19	Minor Dredging	X	X	
20	Oil Spill Cleanup			
21	Surface Coal Mining Activities	X	X	X
22	Removal of Vessels	X	X	

**Attachment 2**  
**Reference to Nationwide Permits Best Management Practices Requirements**

NWP	Approved Categorical Exclusions	Erosion Control	Sediment Control	Post Construction TSS
23	Approved Categorical Exclusions			
24	State Administered 404 Program			
25	Structural Discharges	X	X	
26	Reserved			
27	Stream and Wetland Restoration	X	X	
28	Modifications of Existing Marinas			
29	Single-Family Housing	X	X	X
30	Moist Soil Management for Wildlife	X	X	
31	Maintenance of Existing Flood Control Facilities	X	X	X
32	Completed Enforcement Actions	X	X	
33	Temporary Construction, Access and Dewatering	X	X	
34	Cranberry Production			
35	Maintenance Dredging of Existing Basins			
36	Boat Ramps	X	X	X
37	Emergency Watershed Protection and Rehabilitation	X	X	
38	Cleanup of Hazardous and Toxic Waste	X	X	
39	Residential, Commercial, and Institutional Developments	X	X	X
40	Agricultural Activities	X	X	X
41	Reshaping Existing Drainage Ditches	X	X	X
42	Recreational Facilities	X	X	X
43	Stormwater Management Facilities	X	X	
44	Mining Activities	X	X	X



# TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

## Description of BMPs

### EROSION CONTROL BMPs

#### Temporary Vegetation

**Description:** Vegetation can be used as a temporary or permanent stabilization technique for areas disturbed by construction. Vegetation effectively reduces erosion in swales, stockpiles, berms, mild to medium slopes, and along roadways. Other techniques such as matting, mulches, and grading may be required to assist in the establishment of vegetation.

#### **Materials:**

- The type of temporary vegetation used on a site is a function of the season and the availability of water for irrigation.
- Temporary vegetation should be selected appropriately for the area.
- County agricultural extension agents are a good source for suggestions for temporary vegetation.
- All seed should be high quality, U.S. Dept. of Agriculture certified seed.

#### **Installation:**

- Grading must be completed prior to seeding.
- Slopes should be minimized.
- Erosion control structures should be installed.
- Seedbeds should be well pulverized, loose, and uniform.
- Fertilizers should be applied at appropriate rates.
- Seeding rates should be applied as recommended by the county agricultural extension agent.
- The seed should be applied uniformly.
- Steep slopes should be covered with appropriate soil stabilization matting.

## Blankets and Matting

**Description:** Blankets and matting material can be used as an aid to control erosion on critical sites during the establishment period of protective vegetation. The most common uses are in channels, interceptor swales, diversion dikes, short, steep slopes, and on tidal or stream banks.

### **Materials:**

New types of blankets and matting materials are continuously being developed. The Texas Department of Transportation (TxDOT) has defined the critical performance factors for these types of products and has established minimum performance standards which must be met for any product seeking to be approved for use within any of TxDOT's construction or maintenance activities. The products that have been approved by TxDOT are also appropriate for general construction site stabilization. TxDOT maintains a web site at <http://www.dot.state.tx.us/insdot/orgchart/cmd/erosion/contents.htm> which is updated as new products are evaluated.

### **Installation:**

- Install in accordance with the manufacturer's recommendations.
- Proper anchoring of the material.
- Prepare a friable seed bed relatively free from clods and rocks and any foreign material.
- Fertilize and seed in accordance with seeding or other type of planting plan.
- Erosion stops should extend beyond the channel liner to full design cross-section of the channel.
- A uniform trench perpendicular to line of flow may be dug with a spade or a mechanical trencher.
- Erosion stops should be deep enough to penetrate solid material or below level of ruling in sandy soils.
- Erosion stop mats should be wide enough to allow turnover at bottom of trench for stapling, while maintaining the top edge flush with channel surface.

## Mulch

**Description:** Mulching is the process of applying a material to the exposed soil surface to protect it from erosive forces and to conserve soil moisture until plants can become established. When seeding critical sites, sites with adverse soil conditions or seeding on other than optimum seeding dates, mulch material should be applied immediately after seeding. Seeding during optimum seeding dates and with favorable soils and site conditions will not need to be mulched.

### **Materials:**

- Mulch may be small grain straw which should be applied uniformly.
- On slopes 15 percent or greater, a binding chemical must be applied to the surface.

- Wood-fiber or paper-fiber mulch may be applied by hydroseeding.
- Mulch nettings may be used.
- Wood chips may be used where appropriate.

**Installation:**

Mulch anchoring should be accomplished immediately after mulch placement. This may be done by one of the following methods: peg and twine, mulch netting, mulch anchoring tool, or liquid mulch binders.

**Sod**

**Description:** Sod is appropriate for disturbed areas which require immediate vegetative covers, or where sodding is preferred to other means of grass establishment. Locations particularly suited to stabilization with sod are waterways carrying intermittent flow, areas around drop inlets or in grassed swales, and residential or commercial lawns where quick use or aesthetics are factors. Sod is composed of living plants and those plants must receive adequate care in order to provide vegetative stabilization on a disturbed area.

**Materials:**

- Sod should be machine cut at a uniform soil thickness.
- Pieces of sod should be cut to the supplier's standard width and length.
- Torn or uneven pads are not acceptable.
- Sections of sod should be strong enough to support their own weight and retain their size and shape when suspended from a firm grasp.
- Sod should be harvested, delivered, and installed within a period of 36 hours.

**Installation:**

- Areas to be sodded should be brought to final grade.
- The surface should be cleared of all trash and debris.
- Fertilize according to soil tests.
- Fertilizer should be worked into the soil.
- Sod should not be cut or laid in excessively wet or dry weather.
- Sod should not be laid on soil surfaces that are frozen.
- During periods of high temperature, the soil should be lightly irrigated.

- The first row of sod should be laid in a straight line with subsequent rows placed parallel to and butting tightly against each other.
- Lateral joints should be staggered to promote more uniform growth and strength.
- Wherever erosion may be a problem, sod should be laid with staggered joints and secured.
- Sod should be installed with the length perpendicular to the slope (on the contour).
- Sod should be rolled or tamped.
- Sod should be irrigated to a sufficient depth.
- Watering should be performed as often as necessary to maintain soil moisture.
- The first mowing should not be attempted until the sod is firmly rooted.
- Not more than one third of the grass leaf should be removed at any one cutting.

### **Interceptor Swale**

Interceptor swales are used to shorten the length of exposed slope by intercepting runoff, prevent off-site runoff from entering the disturbed area, and prevent sediment-laden runoff from leaving a disturbed site. They may have a v-shape or be trapezoidal with a flat bottom and side slopes of 3:1 or flatter. The outflow from a swale should be directed to a stabilized outlet or sediment trapping device. The swales should remain in place until the disturbed area is permanently stabilized.

#### **Materials:**

- Stabilization should consist of a layer of crushed stone three inches thick, riprap or high velocity erosion control mats.
- Stone stabilization should be used when grades exceed 2% or velocities exceed 6 feet per second.
- Stabilization should extend across the bottom of the swale and up both sides of the channel to a minimum height of three inches above the design water surface elevation based on a 2-year, 24-hour storm.

#### **Installation:**

- An interceptor swale should be installed across exposed slopes during construction and should intercept no more than 5 acres of runoff.
- All earth removed and not needed in construction should be disposed of in an approved spoils site so that it will not interfere with the functioning of the swale or contribute to siltation in other areas of the site.
- All trees, brush, stumps, obstructions and other material should be removed and disposed of so as not to interfere with the proper functioning of the swale.

- Swales should have a maximum depth of 1.5 feet with side slopes of 3:1 or flatter. Swales should have positive drainage for the entire length to an outlet.
- When the slope exceeds 2 percent, or velocities exceed 6 feet per second (regardless of slope), stabilization is required. Stabilization should be crushed stone placed in a layer of at least 3 inches thick or may be high velocity erosion control matting. Check dams are also recommended to reduce velocities in the swales possibly reducing the amount of stabilization necessary.
- Minimum compaction for the swale should be 90% standard proctor density.

### **Diversion Dikes**

A temporary diversion dike is a barrier created by the placement of an earthen embankment to reroute the flow of runoff to an erosion control device or away from an open, easily erodible area. A diversion dike intercepts runoff from small upland areas and diverts it away from exposed slopes to a stabilized outlet, such as a rock berm, sandbag berm, or stone outlet structure. These controls can be used on the perimeter of the site to prevent runoff from entering the construction area. Dikes are generally used for the duration of construction to intercept and reroute runoff from disturbed areas to prevent excessive erosion until permanent drainage features are installed and/or slopes are stabilized.

#### **Materials:**

- Stone stabilization (required for velocities in excess of 6 fps) should consist of riprap placed in a layer at least 3 inches thick and should extend a minimum height of 3 inches above the design water surface up the existing slope and the upstream face of the dike.
- Geotextile fabric should be a non-woven polypropylene fabric designed specifically for use as a soil filtration media with an approximate weight of 6 oz./yd<sup>2</sup>, a Mullen burst rating of 140 psi, and having an equivalent opening size (EOS) greater than a #50 sieve.

#### **Installation:**

- Diversion dikes should be installed prior to and maintained for the duration of construction and should intercept no more than 10 acres of runoff.
- Dikes should have a minimum top width of 2 feet and a minimum height of compacted fill of 18 inches measured from the top of the existing ground at the upslope toe to top of the dike and have side slopes of 3:1 or flatter.
- The soil for the dike should be placed in lifts of 8 inches or less and be compacted to 95 % standard proctor density.
- The channel, which is formed by the dike, must have positive drainage for its entire length to an outlet.
- When the slope exceeds 2 percent, or velocities exceed 6 feet per second (regardless of slope), stabilization is required. In situations where velocities do not exceed 6 feet per second, vegetation may be used to control erosion.

## Erosion Control Compost

**Description:** Erosion control compost (ECC) can be used as an aid to control erosion on critical sites during the establishment period of protective vegetation. The most common uses are on steep slopes, swales, diversion dikes, and on tidal or stream banks.

### **Materials:**

New types of erosion control compost are continuously being developed. The Texas Department of Transportation (TxDOT) has established minimum performance standards which must be met for any products seeking to be approved for use within any of TxDOT's construction or maintenance activities. Material used within any TxDOT construction or maintenance activities must meet material specifications in accordance with current TxDOT specifications. TxDOT maintains a website at <http://www.dot.state.tx.us/des/landscape/compost/specifications.htm> that provides information on compost specification data. This website also contains information on areas where the Texas Commission on Environmental Quality (TCEQ) restricts the use of certain compost products.

ECC used for projects not related to TxDOT should also be of quality materials by meeting performance standards and compost specification data. To ensure the quality of compost used as an ECC, products should meet all applicable state and federal regulations, including but not limited to the United States Environmental Protection Agency (USEPA) Code of Federal Regulations (CFR), Title 40, Part 503 Standards for Class A biosolids and Texas Natural Resource Conservation Commission (now named TCEQ) Health and Safety Regulations as defined in the Texas Administration Code (TAC), Chapter 332, and all other relevant requirements for compost products outlined in TAC, Chapter 332. Testing requirements required by the TCEQ are defined in TAC Chapter 332, including Sections §332.71 Sampling and Analysis Requirements for Final Products and §332.72 Final Product Grades. Compost specification data approved by TxDOT are appropriate to use for ensuring the use of quality compost materials or for guidance.

Testing standards are dependent upon the intended use for the compost and ensures product safety, and product performance regarding the product's specific use. The appropriate compost sampling and testing protocols included in the United States Composting Council (USCC) Test Methods for the Examination of Composting and Compost (TMECC) should be conducted on compost products used for ECC to ensure that the products used will not impact public health, safety, and the environment and to promote production and marketing of quality composts that meet analytical standards. TMECC is a laboratory manual that provides protocols for the composting industry and test methods for compost analysis. TMECC provides protocols to sample, monitor, and analyze materials during all stages of the composting process. Numerous parameters that might be of concern in compost can be tested by following protocols or test methods listed in TMECC. TMECC information can be found at <http://www.tmecc.org/tmecc/index.html>. The USCC Seal of Testing Assurance (STA) program contains information regarding compost STA certification. STA program information can be found at [http://tmecc.org/sta/STA\\_program\\_description.html](http://tmecc.org/sta/STA_program_description.html).

### **Installation:**

- Install in accordance with current TxDOT specification.
- Use on slopes 3:1 or flatter.
- Apply a 2 inch uniform layer unless otherwise shown on the plans or as directed.

- When rolling is specified, use a light corrugated drum roller.

### Mulch Filter Berms and Socks

**Description:** Mulch filter berms and socks are used to intercept and detain sediment laden run-off from unprotected areas. When properly used, mulch filter berms and socks can be highly effective at controlling sediment from disturbed areas. They cause runoff to pond which allows heavier solids to settle. Mulch filter berms and socks are used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. The berm or sock should remain in place until the area is permanently stabilized. Mulch filter berms should not be used when there is a concentration of water in a channel or drainage way. If concentrated flows occurs after installation, corrective action must be taken. Mulch filter socks may be installed in construction areas and temporarily moved during the day to allow construction activity provided it is replaced and properly anchored at the end of the day. Mulch filter berms and socks may be seeded to allow for quick vegetative growth and reduction in run-off velocity.

### **Materials:**

New types of mulch filter berms and socks are continuously being developed. The Texas Department of Transportation (TxDOT) has established minimum performance standards which must be met for any products seeking to be approved for use within any of TxDOT's construction or maintenance activities. Mulch filter berms and socks used within any TxDOT construction or maintenance activities must meet material specifications in accordance with current TxDOT specifications. TxDOT maintains a website at <http://www.dot.state.tx.us/des/landscape/compost/specifications.htm> that provides information on compost specification data. This website also contains information on areas where the Texas Commission on Environmental Quality (TCEQ) restricts the use of certain compost products.

Mulch filter berms and socks used for projects not related to TxDOT should also be of quality materials by meeting performance standards and compost specification data. To ensure the quality of compost used for mulch filter berms and socks, products should meet all applicable state and federal regulations, including but not limited to the United States Environmental Protection Agency (USEPA) Code of Federal Regulations (CFR), Title 40, Part 503 Standards for Class A biosolids and Texas Natural Resource Conservation Commission Health and Safety Regulations as defined in the Texas Administration Code (TAC), Chapter 332, and all other relevant requirements for compost products outlined in TAC, Chapter 332. Testing requirements required by the TCEQ are defined in TAC Chapter 332, including Sections §332.71 Sampling and Analysis Requirements for Final Products and §332.72 Final Product Grades. Compost specification data approved by TxDOT are appropriate to use for ensuring the use of quality compost materials or for guidance.

Testing standards are dependent upon the intended use for the compost and ensures product safety, and product performance regarding the product's specific use. The appropriate compost sampling and testing protocols included in the United States Composting Council (USCC) Test Methods for the Examination of Composting and Compost (TMECC) should be conducted on compost products used for mulch filter berms and socks to ensure that the products used will not impact public health, safety, and the environment and to promote production and marketing of quality composts that meet analytical standards. TMECC is a laboratory manual that provides protocols for the composting industry and test methods for compost analysis. TMECC provides protocols to sample, monitor, and analyze materials during all stages of the composting process. Numerous parameters that might be of concern in compost can be tested by following protocols or test methods listed in TMECC. TMECC information can be found at

<http://www.tmecc.org/tmecc/index.html>. The USCC Seal of Testing Assurance (STA) program contains information regarding compost STA certification. STA program information can be found at [http://tmecc.org/sta/STA\\_program\\_description.html](http://tmecc.org/sta/STA_program_description.html).

#### **Installation:**

- Install in accordance with current TxDOT specification.
- Mulch filter berms should be constructed at 1-1/2 feet high and 3 foot wide at locations shown on plans.
- Routinely inspect and maintain filter berm in a functional condition at all times. Correct deficiencies immediately. Install additional filter berm material as directed. Remove sediment after it has reached 1/3 of the height of the berm. Disperse filter berm or leave in place as directed.
- Mulch filter socks should be in 8 inch, 12 inch or 18 inch or as directed. Sock materials should be designed to allow for proper percolation through.

#### **Compost Filter Berms and Socks**

**Description:** Compost filter berms and socks are used to intercept and detain sediment laden run-off from unprotected areas. When properly used, compost filter berms and socks can be highly effective at controlling sediment from disturbed areas. They cause runoff to pond which allows heavier solids to settle. Compost filter berms and socks are used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. The berm or sock should remain in place until the area is permanently stabilized. Compost filter berms should not be used when there is a concentration of water in a channel or drainage way. If concentrated flows occur after installation, corrective action must be taken. Compost filter socks may be installed in construction areas and temporarily moved during the day to allow construction activity provided it is replaced and properly anchored at the end of the day. Compost filter berms and socks may be seeded to allow for quick vegetative growth and reduction in run-off velocity.

#### **Materials:**

New types of compost filter berms and socks are continuously being developed. The Texas Department of Transportation (TxDOT) has established minimum performance standards which must be met for any products seeking to be approved for use within any of TxDOT's construction or maintenance activities. Compost filter berms and socks used within any TxDOT construction or maintenance activities must meet material specifications in accordance with TxDOT specification 1059. TxDOT maintains a website at <http://www.dot.state.tx.us/des/landscape/compost/specifications.htm> that provides information on compost specification data. This website also contains information on areas where the Texas Commission on Environmental Quality (TCEQ) restricts the use of certain compost products.

Compost filter berms and socks used for projects not related to TxDOT should also be of quality materials by meeting performance standards and compost specification data. To ensure the quality of compost used as compost filter berms and socks, products should meet all applicable state and federal regulations, including but not limited to the United States Environmental Protection Agency (USEPA) Code of Federal Regulations (CFR), Title 40, Part 503 Standards for Class A biosolids and Texas Natural Resource Conservation Commission (now named TCEQ) Health and Safety Regulations as defined in the Texas Administration Code (TAC), Chapter 332, and all other relevant requirements for compost products

outlined in TAC, Chapter 332. Testing requirements required by the TCEQ are defined in TAC Chapter 332, including Sections §332.71 Sampling and Analysis Requirements for Final Products and §332.72 Final Product Grades. Compost specification data approved by TxDOT are appropriate to use for ensuring the use of quality compost materials or for guidance.

Testing standards are dependent upon the intended use for the compost and ensures product safety, and product performance regarding the product's specific use. The appropriate compost sampling and testing protocols included in the United States Composting Council (USCC) Test Methods for the Examination of Composting and Compost (TMECC) should be conducted on compost products used for compost filter berms and socks to ensure that the products used will not impact public health, safety, and the environment and to promote production and marketing of quality composts that meet analytical standards. TMECC is a laboratory manual that provides protocols for the composting industry and test methods for compost analysis. TMECC provides protocols to sample, monitor, and analyze materials during all stages of the composting process. Numerous parameters that might be of concern in compost can be tested by following protocols or test methods listed in TMECC. TMECC information can be found at <http://www.tmecc.org/tmecc/index.html>. The USCC Seal of Testing Assurance (STA) program contains information regarding compost STA certification. STA program information can be found at [http://tmecc.org/sta/STA\\_program\\_description.html](http://tmecc.org/sta/STA_program_description.html).

**Installation:**

- Install in accordance with TxDOT Special Specification 1059.
- Compost filter berms shall be constructed at 1-1/2 feet high and 3 foot wide at locations shown on plans.
- Routinely inspect and maintain filter berm in a functional condition at all times. Correct deficiencies immediately. Install additional filter berm material as directed. Remove sediment after it has reached 1/3 of the height of the berm. Disperse filter berm or leave in place as directed.
- Compost filter socks shall be in 8 inch, 12 inch or 18 inch or as directed. Sock materials shall be designed allowing for proper percolation through.

## SEDIMENT CONTROL BMPS

### Sand Bag Berm

**Description:** The purpose of a sandbag berm is to detain sediment carried in runoff from disturbed areas. This objective is accomplished by intercepting runoff and causing it to pool behind the sand bag berm. Sediment carried in the runoff is deposited on the upstream side of the sand bag berm due to the reduced flow velocity. Excess runoff volumes are allowed to flow over the top of the sand bag berm. Sand bag berms are used only during construction activities in streambeds when the contributing drainage area is between 5 and 10 acres and the slope is less than 15%, i.e., utility construction in channels, temporary channel crossing for construction equipment, etc. Plastic facing should be installed on the upstream side and the berm should be anchored to the streambed by drilling into the rock and driving in "T" posts or rebar (#5 or #6) spaced appropriately.

### **Materials:**

- The sand bag material should be polypropylene, polyethylene, polyamide or cotton burlap woven fabric, minimum unit weight 4 oz/yd<sup>2</sup>, mullen burst strength exceeding 300 psi and ultraviolet stability exceeding 70 percent.
- The bag length should be 24 to 30 inches, width should be 16 to 18 inches and thickness should be 6 to 8 inches.
- Sandbags should be filled with coarse grade sand and free from deleterious material. All sand should pass through a No. 10 sieve. The filled bag should have an approximate weight of 40 pounds.
- Outlet pipe should be schedule 40 or stronger polyvinyl chloride (PVC) having a nominal internal diameter of 4 inches.

### **Installation:**

- The berm should be a minimum height of 18 inches, measured from the top of the existing ground at the upslope toe to the top of the berm.
- The berm should be sized as shown in the plans but should have a minimum width of 48 inches measured at the bottom of the berm and 16 inches measured at the top of the berm.
- Runoff water should flow over the tops of the sandbags or through 4-inch diameter PVC pipes embedded below the top layer of bags.
- When a sandbag is filled with material, the open end of the sandbag should be stapled or tied with nylon or poly cord.
- Sandbags should be stacked in at least three rows abutting each other, and in staggered arrangement.
- The base of the berm should have at least 3 sandbags. These can be reduced to 2 and 1 bag in the second and third rows respectively.
- For each additional 6 inches of height, an additional sandbag must be added to each row width.

- A bypass pump-around system, or similar alternative, should be used on conjunction with the berm for effective dewatering of the work area.

### Silt Fence

**Description:** A silt fence is a barrier consisting of geotextile fabric supported by metal posts to prevent soil and sediment loss from a site. When properly used, silt fences can be highly effective at controlling sediment from disturbed areas. They cause runoff to pond which allows heavier solids to settle. If not properly installed, silt fences are not likely to be effective. The purpose of a silt fence is to intercept and detain water-borne sediment from unprotected areas of a limited extent. Silt fence is used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. This fence should remain in place until the disturbed area is permanently stabilized. Silt fence should not be used where there is a concentration of water in a channel or drainage way. If concentrated flow occurs after installation, corrective action must be taken such as placing a rock berm in the areas of concentrated flow. Silt fencing within the site may be temporarily moved during the day to allow construction activity provided it is replaced and properly anchored to the ground at the end of the day. Silt fences on the perimeter of the site or around drainage ways should not be moved at any time.

### **Materials:**

- Silt fence material should be polypropylene, polyethylene or polyamide woven or nonwoven fabric. The fabric width should be 36 inches, with a minimum unit weight of 4.5 oz/yd, mullen burst strength exceeding 190 lb/in<sup>2</sup>, ultraviolet stability exceeding 70%, and minimum apparent opening size of U.S. Sieve No. 30.
- Fence posts should be made of hot rolled steel, at least 4 feet long with Tee or Y-bar cross section, surface painted or galvanized, minimum nominal weight 1.25 lb/ft<sup>2</sup>, and Brindell hardness exceeding 140.
- Woven wire backing to support the fabric should be galvanized 2" x 4" welded wire, 12 gauge minimum.

### **Installation:**

- Steel posts, which support the silt fence, should be installed on a slight angle toward the anticipated runoff source. Post must be embedded a minimum of 1 foot deep and spaced not more than 8 feet on center. Where water concentrates, the maximum spacing should be 6 feet.
- Lay out fencing down-slope of disturbed area, following the contour as closely as possible. The fence should be sited so that the maximum drainage area is ¼ acre/100 feet of fence.
- The toe of the silt fence should be trenched in with a spade or mechanical trencher, so that the down-slope face of the trench is flat and perpendicular to the line of flow. Where fence cannot be trenched in (e.g., pavement or rock outcrop), weight fabric flap with 3 inches of pea gravel on uphill side to prevent flow from seeping under fence.
- The trench must be a minimum of 6 inches deep and 6 inches wide to allow for the silt fence fabric to be laid in the ground and backfilled with compacted material.
- Silt fence should be securely fastened to each steel support post or to woven wire, which is in turn attached to the steel fence post. There should be a 3-foot overlap, securely fastened where ends of fabric meet.

## Triangular Filter Dike

**Description:** The purpose of a triangular sediment filter dike is to intercept and detain water-borne sediment from unprotected areas of limited extent. The triangular sediment filter dike is used where there is no concentration of water in a channel or other drainage way above the barrier and the contributing drainage area is less than one acre. If the uphill slope above the dike exceeds 10%, the length of the slope above the dike should be less than 50 feet. If concentrated flow occurs after installation, corrective action should be taken such as placing rock berm in the areas of concentrated flow. This measure is effective on paved areas where installation of silt fence is not possible or where vehicle access must be maintained. The advantage of these controls is the ease with which they can be moved to allow vehicle traffic and then reinstalled to maintain sediment

### **Materials:**

- Silt fence material should be polypropylene, polyethylene or polyamide woven or nonwoven fabric. The fabric width should be 36 inches, with a minimum unit weight of 4.5 oz/yd, mullen burst strength exceeding 190 lb/in<sup>2</sup>, ultraviolet stability exceeding 70%, and minimum apparent opening size of U.S. Sieve No. 30.
- The dike structure should be 6 gauge 6" x 6" wire mesh folded into triangular form being eighteen (18) inches on each side.

### **Installation:**

- The frame of the triangular sediment filter dike should be constructed of 6" x 6", 6 gauge welded wire mesh, 18 inches per side, and wrapped with geotextile fabric the same composition as that used for silt fences.
- Filter material should lap over ends six (6) inches to cover dike to dike junction; each junction should be secured by shoat rings.
- Position dike parallel to the contours, with the end of each section closely abutting the adjacent sections.
- There are several options for fastening the filter dike to the ground. The fabric skirt may be toed-in with 6 inches of compacted material, or 12 inches of the fabric skirt should extend uphill and be secured with a minimum of 3 inches of open graded rock, or with staples or nails. If these two options are not feasible the dike structure may be trenched in 4 inches.
- Triangular sediment filter dikes should be installed across exposed slopes during construction with ends of the dike tied into existing grades to prevent failure and should intercept no more than one acre of runoff.
- When moved to allow vehicular access, the dikes should be reinstalled as soon as possible, but always at the end of the workday.

## Rock Berm

**Description:** The purpose of a rock berm is to serve as a check dam in areas of concentrated flow, to intercept sediment-laden runoff, detain the sediment and release the water in sheet flow. The rock berm should be used when the contributing drainage area is less than 5 acres. Rock berms are used in areas where the volume of runoff is too great for a silt fence to contain. They are less effective for sediment removal than

silt fences, particularly for fine particles, but are able to withstand higher flows than a silt fence. As such, rock berms are often used in areas of channel flows (ditches, gullies, etc.). Rock berms are most effective at reducing bed load in channels and should not be substituted for other erosion and sediment control measures further up the watershed.

**Materials:**

- The berm structure should be secured with a woven wire sheathing having maximum opening of 1 inch and a minimum wire diameter of 20 gauge galvanized and should be secured with shoat rings.
- Clean, open graded 3- to 5-inch diameter rock should be used, except in areas where high velocities or large volumes of flow are expected, where 5- to 8-inch diameter rocks may be used.

**Installation:**

- Lay out the woven wire sheathing perpendicular to the flow line. The sheathing should be 20 gauge woven wire mesh with 1 inch openings.
- Berm should have a top width of 2 feet minimum with side slopes being 2:1 (H:V) or flatter.
- Place the rock along the sheathing to a height not less than 18".
- Wrap the wire sheathing around the rock and secure with tie wire so that the ends of the sheathing overlap at least 2 inches, and the berm retains its shape when walked upon.
- Berm should be built along the contour at zero percent grade or as near as possible.
- The ends of the berm should be tied into existing upslope grade and the berm should be buried in a trench approximately 3 to 4 inches deep to prevent failure of the control.

**Hay Bale Dike**

**Description:** The purpose of a hay or straw bale dike is to intercept and detain small amounts of sediment-laden runoff from relatively small unprotected areas. Straw bales are to be used when it is not feasible to install other, more effective measures or when the construction phase is expected to last less than 3 months. Straw bales should not be used on areas where rock or other hard surfaces prevent the full and uniform anchoring of the barrier.

**Materials:**

**Straw:** The best quality straw mulch comes from wheat, oats or barley and should be free of weed and grass seed which may not be desired vegetation for the area to be protected. Straw mulch is light and therefore must be properly anchored to the ground.

**Hay:** This is very similar to straw with the exception that it is made of grasses and weeds and not grain stems. This form of mulch is very inexpensive and is widely available but does introduce weed and grass seed to the area. Like straw, hay is light and must be anchored.

- Straw bales should weigh a minimum of 50 pounds and should be at least 30 inches long.
- Bales should be composed entirely of vegetable matter and be free of seeds.
- Binding should be either wire or nylon string, jute or cotton binding is unacceptable. Bales should be used for not more than two months before being replaced.

**Installation:**

- Bales should be embedded a minimum of 4 inches and securely anchored using 2" x 2" wood stakes or 3/8" diameter rebar driven through the bales into the ground a minimum of 6 inches.
- Bales are to be placed directly adjacent to one another leaving no gap between them.
- All bales should be placed on the contour.
- The first stake in each bale should be angled toward the previously laid bale to force the bales together.

**Brush Berms**

Organic litter and spoil material from site clearing operations is usually burned or hauled away to be dumped elsewhere. Much of this material can be used effectively on the construction site itself. The key to constructing an efficient brush berm is in the method used to obtain and place the brush. It will not be acceptable to simply take a bulldozer and push whole trees into a pile. This method does not assure continuous ground contact with the berm and will allow uncontrolled flows under the berm.

Brush berms may be used where there is little or no concentration of water in a channel or other drainage way above the berm. The size of the drainage area should be no greater than one-fourth of an acre per 100 feet of barrier length; the maximum slope length behind the barrier should not exceed 100 feet; and the maximum slope gradient behind the barrier should be less than 50 percent (2:1).

**Materials:**

- The brush should consist of woody brush and branches, preferably less than 2 inches in diameter.
- The filter fabric should conform to the specifications for filter fence fabric.
- The rope should be 1/4 inch polypropylene or nylon rope.
- The anchors should be 3/8-inch diameter rebar stakes that are 18-inches long.

**Installation:**

- Lay out the brush berm following the contour as closely as possible.
- The juniper limbs should be cut and hand placed with the vegetated part of the limb in close contact with the ground. Each subsequent branch should overlap the previous branch providing a shingle effect.

- The brush berm should be constructed in lifts with each layer extending the entire length of the berm before the next layer is started.
- A trench should be excavated 6-inches wide and 4-inches deep along the length of the barrier and immediately uphill from the barrier.
- The filter fabric should be cut into lengths sufficient to lay across the barrier from its up-slope base to just beyond its peak. The lengths of filter fabric should be draped across the width of the barrier with the uphill edge placed in the trench and the edges of adjacent pieces overlapping each other. Where joints are necessary, the fabric should be spliced together with a minimum 6-inch overlap and securely sealed.
- The trench should be backfilled and the soil compacted over the filter fabric.
- Set stakes into the ground along the downhill edge of the brush barrier, and anchor the fabric by tying rope from the fabric to the stakes. Drive the rope anchors into the ground at approximately a 45-degree angle to the ground on 6-foot centers.
- Fasten the rope to the anchors and tighten berm securely to the ground with a minimum tension of 50 pounds.
- The height of the brush berm should be a minimum of 24 inches after the securing ropes have been tightened.

### Stone Outlet Sediment Trap

A stone outlet sediment trap is an impoundment created by the placement of an earthen and stone embankment to prevent soil and sediment loss from a site. The purpose of a sediment trap is to intercept sediment-laden runoff and trap the sediment in order to protect drainage ways, properties and rights of way below the sediment trap from sedimentation. A sediment trap is usually installed at points of discharge from disturbed areas. The drainage area for a sediment trap is recommended to be less than 5 acres.

Larger areas should be treated using a sediment basin. A sediment trap differs from a sediment basin mainly in the type of discharge structure. The trap should be located to obtain the maximum storage benefit from the terrain, for ease of clean out and disposal of the trapped sediment and to minimize interference with construction activities. The volume of the trap should be at least 3600 cubic feet per acre of drainage area.

#### **Materials:**

- All aggregate should be at least 3 inches in diameter and should not exceed a volume of 0.5 cubic foot.
- The geotextile fabric specification should be woven polypropylene, polyethylene or polyamide geotextile, minimum unit weight of 4.5 oz/yd<sup>2</sup>, mullen burst strength at least 250 lb/in<sup>2</sup>, ultraviolet stability exceeding 70%, and equivalent opening size exceeding 40.

#### **Installation:**

- Earth Embankment: Place fill material in layers not more than 8 inches in loose depth. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content of the

material. Compact each layer to 95 percent standard proctor density. Do not place material on surfaces that are muddy or frozen. Side slopes for the embankment are to be 3:1. The minimum width of the embankment should be 3 feet.

- A gap is to be left in the embankment in the location where the natural confluence of runoff crosses the embankment line. The gap is to have a width in feet equal to 6 times the drainage area in acres.
- Geotextile Covered Rock Core: A core of filter stone having a minimum height of 1.5 feet and a minimum width at the base of 3 feet should be placed across the opening of the earth embankment and should be covered by geotextile fabric which should extend a minimum distance of 2 feet in either direction from the base of the filter stone core.
- Filter Stone Embankment: Filter stone should be placed over the geotextile and is to have a side slope which matches that of the earth embankment of 3:1 and should cover the geotextile/rock core a minimum of 6 inches when installation is complete. The crest of the outlet should be at least 1 foot below the top of the embankment.

### **Sediment Basins:**

The purpose of a sediment basin is to intercept sediment-laden runoff and trap the sediment in order to protect drainage ways, properties and rights of way below the sediment basin from sedimentation. A sediment basin is usually installed at points of discharge from disturbed areas. The drainage area for a sediment basin is recommended to be less than 100 acres.

Sediment basins are effective for capturing and slowly releasing the runoff from larger disturbed areas thereby allowing sedimentation to take place. A sediment basin can be created where a permanent pond BMP is being constructed. Guidelines for construction of the permanent BMP should be followed, but revegetation, placement of underdrain piping, and installation of sand or other filter media should not be carried out until the site construction phase is complete.

### **Materials:**

- Riser should be corrugated metal or reinforced concrete pipe or box and should have watertight fittings or end to end connections of sections.
- An outlet pipe of corrugated metal or reinforced concrete should be attached to the riser and should have positive flow to a stabilized outlet on the downstream side of the embankment.
- An anti-vortex device and rubbish screen should be attached to the top of the riser and should be made of polyvinyl chloride or corrugated metal.

### **Basin Design and Construction:**

- For common drainage locations that serve an area with ten or more acres disturbed at one time, a sediment basin should provide storage for a volume of runoff from a two-year, 24-hour storm from each disturbed acre drained.
- The basin length to width ratio should be at least 2:1 to improve trapping efficiency. The shape may be attained by excavation or the use of baffles. The lengths should be measured at the elevation of the riser de-

watering hole.

- Place fill material in layers not more than 8 inches in loose depth. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content of the material. Compact each layer to 95 percent standard proctor density. Do not place material on surfaces that are muddy or frozen. Side slopes for the embankment should be 3:1 (H:V).
- An emergency spillway should be installed adjacent to the embankment on undisturbed soil and should be sized to carry the full amount of flow generated by a 10-year, 3-hour storm with 1 foot of freeboard less the amount which can be carried by the principal outlet control device.
- The emergency spillway should be lined with riprap as should the swale leading from the spillway to the normal watercourse at the base of the embankment.
- The principal outlet control device should consist of a rigid vertically oriented pipe or box of corrugated metal or reinforced concrete. Attached to this structure should be a horizontal pipe, which should extend through the embankment to the toe of fill to provide a de-watering outlet for the basin.
- An anti-vortex device should be attached to the inlet portion of the principal outlet control device to serve as a rubbish screen.
- A concrete base should be used to anchor the principal outlet control device and should be sized to provide a safety factor of 1.5 (downward forces = 1.5 buoyant forces).
- The basin should include a permanent stake to indicate the sediment level in the pool and marked to indicate when the sediment occupies 50% of the basin volume (not the top of the stake).
- The top of the riser pipe should remain open and be guarded with a trash rack and anti-vortex device. The top of the riser should be 12 inches below the elevation of the emergency spillway. The riser should be sized to convey the runoff from the 2-year, 3-hour storm when the water surface is at the emergency spillway elevation. For basins with no spillway the riser must be sized to convey the runoff from the 10-yr, 3-hour storm.
- Anti-seep collars should be included when soil conditions or length of service make piping through the backfill a possibility.
- The 48-hour drawdown time will be achieved by using a riser pipe perforated at the point measured from the bottom of the riser pipe equal to ½ the volume of the basin. This is the maximum sediment storage elevation. The size of the perforation may be calculated as follows:

$$A_o = \frac{A_s \times \sqrt{2h}}{C_d \times 980,000}$$

Where:

$A_o$  = Area of the de-watering hole, ft<sup>2</sup>

$A_s$  = Surface area of the basin, ft<sup>2</sup>

$C_d$  = Coefficient of contraction, approximately 0.6

$h$  = head of water above the hole, ft

Perforating the riser with multiple holes with a combined surface area equal to  $A_o$  is acceptable.

### Erosion Control Compost

**Description:** Erosion control compost (ECC) can be used as an aid to control erosion on critical sites during the establishment period of protective vegetation. The most common uses are on steep slopes, swales, diversion dikes, and on tidal or stream banks.

#### **Materials:**

New types of erosion control compost are continuously being developed. The Texas Department of Transportation (TxDOT) has established minimum performance standards which must be met for any products seeking to be approved for use within any of TxDOT's construction or maintenance activities. Material used within any TxDOT construction or maintenance activities must meet material specifications in accordance with current TxDOT specifications. TxDOT maintains a website at <http://www.dot.state.tx.us/des/landscape/compost/specifications.htm> that provides information on compost specification data. This website also contains information on areas where the Texas Commission on Environmental Quality (TCEQ) restricts the use of certain compost products.

ECC used for projects not related to TxDOT should also be of quality materials by meeting performance standards and compost specification data. To ensure the quality of compost used as an ECC, products should meet all applicable state and federal regulations, including but not limited to the United States Environmental Protection Agency (USEPA) Code of Federal Regulations (CFR), Title 40, Part 503 Standards for Class A biosolids and Texas Natural Resource Conservation Commission (now named TCEQ) Health and Safety Regulations as defined in the Texas Administration Code (TAC), Chapter 332, and all other relevant requirements for compost products outlined in TAC, Chapter 332. Testing requirements required by the TCEQ are defined in TAC Chapter 332, including Sections §332.71 Sampling and Analysis Requirements for Final Products and §332.72 Final Product Grades. Compost specification data approved by TxDOT are appropriate to use for ensuring the use of quality compost materials or for guidance.

Testing standards are dependent upon the intended use for the compost and ensures product safety, and product performance regarding the product's specific use. The appropriate compost sampling and testing protocols included in the United States Composting Council (USCC) Test Methods for the Examination of Composting and Compost (TMECC) should be conducted on compost products used for ECC to ensure that the products used will not impact public health, safety, and the environment and to promote production and marketing of quality composts that meet analytical standards. TMECC is a laboratory manual that provides protocols for the composting industry and test methods for compost analysis. TMECC provides protocols to sample, monitor, and analyze materials during all stages of the composting process. Numerous parameters that might be of concern in compost can be tested by following protocols or test methods listed in TMECC. TMECC information can be found at <http://www.tmecc.org/tmecc/index.html>. The USCC Seal of Testing Assurance (STA) program contains information regarding compost STA certification. STA program information can be found at [http://tmecc.org/sta/STA\\_program\\_description.html](http://tmecc.org/sta/STA_program_description.html).

**Installation:**

- Install in accordance with current TxDOT specification.
- Use on slopes 3:1 or flatter.
- Apply a 2 inch uniform layer unless otherwise shown on the plans or as directed.
- When rolling is specified, use a light corrugated drum roller.

**Mulch Filter Berms and Socks**

**Description:** Mulch filter berms and socks are used to intercept and detain sediment laden run-off from unprotected areas. When properly used, mulch filter berms and socks can be highly effective at controlling sediment from disturbed areas. They cause runoff to pond which allows heavier solids to settle. Mulch filter berms and socks are used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. The berm or sock should remain in place until the area is permanently stabilized. Mulch filter berms should not be used when there is a concentration of water in a channel or drainage way. If concentrated flows occurs after installation, corrective action must be taken. Mulch filter socks may be installed in construction areas and temporarily moved during the day to allow construction activity provided it is replaced and properly anchored at the end of the day. Mulch filter berms and socks may be seeded to allow for quick vegetative growth and reduction in run-off velocity.

**Materials:**

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Testing standards are dependent upon the intended use for the compost and ensures product safety, and product performance regarding the product's specific use. The appropriate compost sampling and testing protocols included in the United States Composting Council (USCC) Test Methods for the Examination

of Composting and Compost (TMECC) should be conducted on compost products used for mulch filter berms and socks to ensure that the products used will not impact public health, safety, and the environment and to promote production and marketing of quality composts that meet analytical standards. TMECC is a laboratory manual that provides protocols for the composting industry and test methods for compost analysis. TMECC provides protocols to sample, monitor, and analyze materials during all stages of the composting process. Numerous parameters that might be of concern in compost can be tested by following protocols or test methods listed in TMECC. TMECC information can be found at <http://www.tmecc.org/tmecc/index.html>. The USCC Seal of Testing Assurance (STA) program contains information regarding compost STA certification. STA program information can be found at [http://tmecc.org/sta/STA\\_program\\_description.html](http://tmecc.org/sta/STA_program_description.html).

#### **Installation:**

- Install in accordance with current TxDOT specification.
- Mulch filter berms should be constructed at 1-1/2 feet high and 3 foot wide at locations shown on plans.
- Routinely inspect and maintain filter berm in a functional condition at all times. Correct deficiencies immediately. Install additional filter berm material as directed. Remove sediment after it has reached 1/3 of the height of the berm. Disperse filter berm or leave in place as directed.
- Mulch filter socks should be in 8 inch, 12 inch or 18 inch or as directed. Sock materials should be designed to allow for proper percolation through.

#### **Compost Filter Berms and Socks**

**Description:** Compost filter berms and socks are used to intercept and detain sediment laden run-off from unprotected areas. When properly used, compost filter berms and socks can be highly effective at controlling sediment from disturbed areas. They cause runoff to pond which allows heavier solids to settle. Compost filter berms and socks are used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. The berm or sock should remain in place until the area is permanently stabilized. Compost filter berms should not be used when there is a concentration of water in a channel or drainage way. If concentrated flows occur after installation, corrective action must be taken. Compost filter socks may be installed in construction areas and temporally moved during the day to allow construction activity provided it is replaced and properly anchored at the end of the day. Compost filter berms and socks may be seeded to allow for quick vegetative growth and reduction in run-off velocity.

#### **Materials:**

New types of compost filter berms and socks are continuously being developed. The Texas Department of Transportation (TxDOT) has established minimum performance standards which must be met for any products seeking to be approved for use within any of TxDOT's construction or maintenance activities. Compost filter berms and socks used within any TxDOT construction or maintenance activities must meet material specifications in accordance with TxDOT specification 1059. TxDOT maintains a website at <http://www.dot.state.tx.us/des/landscape/compost/specifications.htm> that provides information on compost specification data. This website also contains information on areas where the Texas Commission on Environmental Quality (TCEQ) restricts the use of certain compost products.

Compost filter berms and socks used for projects not related to TxDOT should also be of quality materials by meeting performance standards and compost specification data. To ensure the quality of compost used as compost filter berms and socks, products should meet all applicable state and federal regulations, including but not limited to the United States Environmental Protection Agency (USEPA) Code of Federal Regulations (CFR), Title 40, Part 503 Standards for Class A biosolids and Texas Natural Resource Conservation Commission (now named TCEQ) Health and Safety Regulations as defined in the Texas Administration Code (TAC), Chapter 332, and all other relevant requirements for compost products outlined in TAC, Chapter 332. Testing requirements required by the TCEQ are defined in TAC Chapter 332, including Sections §332.71 Sampling and Analysis Requirements for Final Products and §332.72 Final Product Grades. Compost specification data approved by TxDOT are appropriate to use for ensuring the use of quality compost materials or for guidance.

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**Installation:**

- Install in accordance with TxDOT Special Specification 1059.
- Compost filter berms shall be constructed at 1-1/2 feet high and 3 foot wide at locations shown on plans.
- Routinely inspect and maintain filter berm in a functional condition at all times. Correct deficiencies immediately. Install additional filter berm material as directed. Remove sediment after it has reached 1/3 of the height of the berm. Disperse filter berm or leave in place as directed.
- Compost filter socks shall be in 8 inch, 12 inch or 18 inch or as directed. Sock materials shall be designed allowing for proper percolation through.

## POST-CONSTRUCTION TSS CONTROLS

### Retention/Irrigation Systems

**Description:** Retention/irrigation systems refer to the capture of runoff in a holding pond, then use of the captured water for irrigation of appropriate landscape areas. Retention/irrigation systems are characterized by the capture and disposal of runoff without direct release of captured flow to receiving streams. Retention systems exhibit excellent pollutant removal but can require regular, proper maintenance. Collection of roof runoff for subsequent use (rainwater harvesting) also qualifies as a retention/irrigation practice, but should be operated and sized to provide adequate volume. This technology, which emphasizes beneficial use of stormwater runoff, is particularly appropriate for arid regions because of increasing demands on water supplies for agricultural irrigation and urban water supply.

**Design Considerations:** Retention/irrigation practices achieve 100% removal efficiency of total suspended solids contained within the volume of water captured. Design elements of retention/irrigation systems include runoff storage facility configuration and sizing, pump and wet well system components, basin lining, basin detention time, and physical and operational components of the irrigation system. Retention/irrigation systems are appropriate for large drainage areas with low to moderate slopes. The retention capacity should be sufficient considering the average rainfall event for the area.

**Maintenance Requirements:** Maintenance requirements for retention/irrigation systems include routine inspections, sediment removal, mowing, debris and litter removal, erosion control, and nuisance control.

### Extended Detention Basin

**Description:** Extended detention facilities are basins that temporarily store a portion of stormwater runoff following a storm event. Extended detention basins are normally used to remove particulate pollutants and to reduce maximum runoff rates associated with development to their pre-development levels. The water quality benefits are the removal of sediment and buoyant materials. Furthermore, nutrients, heavy metals, toxic materials, and oxygen-demanding materials associated with the particles also are removed. The control of the maximum runoff rates serves to protect drainage channels below the device from erosion and to reduce downstream flooding. Although detention facilities designed for flood control have different design requirements than those used for water quality enhancement, it is possible to achieve these two objectives in a single facility.

**Design Considerations:** Extended detention basins can remove approximately 75% of the total suspended solids contained within the volume of runoff captured in the basin. Design elements of extended detention basins include basin sizing, basin configuration, basin side slopes, basin lining, inlet/outlet structures, and erosion controls. Extended detention basins are appropriate for large drainage areas with low to moderate slopes. The retention capacity should be sufficient considering the average rainfall event for the area.

**Maintenance Requirements:** Maintenance requirements for extended detention basins include routine inspections, mowing, debris and litter removal, erosion control, structural repairs, nuisance control, and sediment removal.

### Vegetative Filter Strips

**Description:** Filter strips, also known as vegetated buffer strips, are vegetated sections of land similar to grassy swales, except they are essentially flat with low slopes, and are designed only to accept runoff as

overland sheet flow. They may appear in any vegetated form from grassland to forest, and are designed to intercept upstream flow, lower flow velocity, and spread water out as sheet flow. The dense vegetative cover facilitates conventional pollutant removal through detention, filtration by vegetation, and infiltration.

Filter strips cannot treat high velocity flows, and do not provide enough storage or infiltration to effectively reduce peak discharges to predevelopment levels for design storms. This lack of quantity control favors use in rural or low-density development; however, they can provide water quality benefits even where the impervious cover is as high as 50%. The primary highway application for vegetative filter strips is along rural roadways where runoff that would otherwise discharge directly to a receiving water, passes through the filter strip before entering a conveyance system. Properly designed roadway medians and shoulders make effective buffer strips. These devices also can be used on other types of development where land is available and hydraulic conditions are appropriate. Flat slopes and low to fair permeability of natural subsoil are required for effective performance of filter strips. Although an inexpensive control measure, they are most useful in contributing watershed areas where peak runoff velocities are low, as they are unable to treat the high flow velocities typically associated with high impervious cover. The most important criteria for selection and use of this BMP are soils, space, and slope.

**Design Considerations:** Vegetative filter strips can remove approximately 85% of the total suspended solids contained within the volume of runoff captured. Design elements of vegetative filter strips include uniform, shallow overland flow across the entire filter strip area, hydraulic loading rate, inlet structures, slope, and vegetative cover. The area should be free of gullies or rills which can concentrate flow. Vegetative filter strips are appropriate for small drainage areas with moderate slopes.

**Maintenance Requirements:** Maintenance requirements for vegetative filter strips include pest management, seasonal mowing and lawn care, routine inspections, debris and litter removal, sediment removal, and grass reseeding and mulching.

### Constructed Wetlands

**Description:** Constructed wetlands provide physical, chemical, and biological water quality treatment of stormwater runoff. Physical treatment occurs as a result of decreasing flow velocities in the wetland, and is present in the form of evaporation, sedimentation, adsorption, and/or filtration. Chemical processes include chelation, precipitation, and chemical adsorption. Biological processes include decomposition, plant uptake and removal of nutrients, plus biological transformation and degradation. Hydrology is one of the most influential factors in pollutant removal due to its effects on sedimentation, aeration, biological transformation, and adsorption onto bottom sediments.

The wetland should be designed such that a minimum amount of maintenance is required. The natural surroundings, including such things as the potential energy of a stream or flooding river, should be utilized as much as possible. The wetland should approximate a natural situation and unnatural attributes, such as rectangular shape or rigid channel, should be avoided.

Site considerations should include the water table depth, soil/substrate, and space requirements. Because the wetland must have a source of flow, it is desirable that the water table is at or near the surface. If runoff is the only source of inflow for the wetland, the water level often fluctuates and establishment of vegetation may be difficult. The soil or substrate of an artificial wetland should be loose loam to clay. A perennial baseflow must be present to sustain the artificial wetland. The presence of organic material is often helpful in increasing pollutant removal and retention. A greater amount of space is required for a wetland system than is required for a detention facility treating the same amount of area.

**Design Considerations:** Constructed wetlands can remove over 90% of the total suspended solids contained within the volume of runoff captured in the wetland. Design elements of constructed wetlands include wetland sizing, wetland configuration, sediment forebay, vegetation, outflow structure, depth of inundation during storm events, depth of micropools, and aeration. Constructed wetlands are appropriate for large drainage areas with low to moderate slopes.

**Maintenance Requirements:** Maintenance requirements for constructed wetlands include mowing, routine inspections, debris and litter removal, erosion control, nuisance control, structural repairs, sediment removal, harvesting, and maintenance of water levels.

### Wet Basins

**Description:** Wet basins are runoff control facilities that maintain a permanent wet pool and a standing crop of emergent littoral vegetation. These facilities may vary in appearance from natural ponds to enlarged, bermed (manmade) sections of drainage systems and may function as online or offline facilities, although offline configuration is preferable. Offline designs can prevent scour and other damage to the wet pond and minimize costly outflow structure elements needed to accommodate extreme runoff events.

During storm events, runoff inflows displace part or all of the existing basin volume and are retained and treated in the facility until the next storm event. The pollutant removal mechanisms are settling of solids, wetland plant uptake, and microbial degradation. When the wet basin is adequately sized, pollutant removal performance can be excellent, especially for the dissolved fraction. Wet basins also help provide erosion protection for the receiving channel by limiting peak flows during larger storm events. Wet basins are often perceived as a positive aesthetic element in a community and offer significant opportunity for creative pond configuration and landscape design. Participation of an experienced wetland designer is suggested. A significant potential drawback for wet ponds in arid climates is that the contributing watershed for these facilities is often incapable of providing an adequate water supply to maintain the permanent pool, especially during the summer months. Makeup water (i.e., well water or municipal drinking water) is sometimes used to supplement the rainfall/runoff process, especially for wet basin facilities treating watersheds that generate insufficient runoff.

**Design Considerations:** Wet basins can remove over 90% of the total suspended solids contained within the volume of runoff captured in the basin. Design elements of wet basins include basin sizing, basin configuration, basin side slopes, sediment forebay, inflow and outflow structures, vegetation, depth of permanent pool, aeration, and erosion control. Wet basins are appropriate for large drainage areas with low to moderate slopes.

**Maintenance Requirements:** Maintenance requirements for wet basins include mowing, routine inspections, debris and litter removal, erosion control, nuisance control, structural repairs, sediment removal, and harvesting.

### Grassy Swales

Grassy swales are vegetated channels that convey stormwater and remove pollutants by filtration through grass and infiltration through soil. They require shallow slopes and soils that drain well. Pollutant removal capability is related to channel dimensions, longitudinal slope, and type of vegetation. Optimum design of these components will increase contact time of runoff through the swale and improve pollutant removal rates.

Grassy swales are primarily stormwater conveyance systems. They can provide sufficient control under light to moderate runoff conditions, but their ability to control large storms is limited. Therefore, they are most applicable in low to moderate sloped areas or along highway medians as an alternative to ditches and curb and gutter drainage. Their performance diminishes sharply in highly urbanized settings, and they are generally not effective enough to receive construction stage runoff where high sediment loads can overwhelm the system. Grassy swales can be used as a pretreatment measure for other downstream BMPs, such as extended detention basins. Enhanced grassy swales utilize check dams and wide depressions to increase runoff storage and promote greater settling of pollutants.

Grassy swales can be more aesthetically pleasing than concrete or rock-lined drainage systems and are generally less expensive to construct and maintain. Swales can slightly reduce impervious area and reduce the pollutant accumulation and delivery associated with curbs and gutters. The disadvantages of this technique include the possibility of erosion and channelization over time, and the need for more right-of-way as compared to a storm drain system. When properly constructed, inspected, and maintained, the life expectancy of a swale is estimated to be 20 years.

#### **Design Considerations:**

- Comparable performance to wet basins
- Limited to treating a few acres
- Availability of water during dry periods to maintain vegetation
- Sufficient available land area

The suitability of a swale at a site will depend on land use, size of the area serviced, soil type, slope, imperviousness of the contributing watershed, and dimensions and slope of the swale system. In general, swales can be used to serve areas of less than 10 acres, with slopes no greater than 5 %. The seasonal high water table should be at least 4 feet below the surface. Use of natural topographic lows is encouraged, and natural drainage courses should be regarded as significant local resources to be kept in use.

#### **Maintenance Requirements:**

Research in the Austin area indicates that vegetated controls are effective at removing pollutants even when dormant. Therefore, irrigation is not required to maintain growth during dry periods, but may be necessary only to prevent the vegetation from dying.

#### **Vegetative Filter Strips**

Filter strips, also known as vegetated buffer strips, are vegetated sections of land similar to grassy swales except they are essentially flat with low slopes, and are designed only to accept runoff as overland sheet flow. A schematic of a vegetated buffer strip is shown in Figure 3.3. They may appear in any vegetated form from grassland to forest, and are designed to intercept upstream flow, lower flow velocity, and spread water out as sheet flow. The dense vegetative cover facilitates conventional pollutant removal through detention, filtration by vegetation, and infiltration.

Filter strips cannot treat high velocity flows, and do not provide enough storage or infiltration to effectively reduce peak discharges to predevelopment levels for design storms. This lack of quantity control favors use

in rural or low-density development; however, they can provide water quality benefits even where the impervious cover is as high as 50%. The primary highway application for vegetative filter strips is along rural roadways where runoff that would otherwise discharge directly to a receiving water passes through the filter strip before entering a conveyance system. Properly designed roadway medians and shoulders make effective buffer strips. These devices also can be used on other types of development where land is available and hydraulic conditions are appropriate.

Flat slopes and low to fair permeability of natural subsoil are required for effective performance of filter strips. Although an inexpensive control measure, they are most useful in contributing watershed areas where peak runoff velocities are low as they are unable to treat the high flow velocities typically associated with high impervious cover.

Successful performance of filter strips relies heavily on maintaining shallow unconcentrated flow. To avoid flow channelization and maintain performance, a filter strip should:

- Be equipped with a level spreading device for even distribution of runoff
- Contain dense vegetation with a mix of erosion resistant, soil binding species
- Be graded to a uniform, even and relatively low slope
- Laterally traverse the contributing runoff area

Filter strips can be used upgradient from watercourses, wetlands, or other water bodies along toes and tops of slopes and at outlets of other stormwater management structures. They should be incorporated into street drainage and master drainage planning. The most important criteria for selection and use of this BMP are soils, space, and slope.

#### **Design Considerations:**

- Soils and moisture are adequate to grow relatively dense vegetative stands
- Sufficient space is available
- Slope is less than 12%
- Comparable performance to more expensive structural controls

#### **Sand Filter Systems**

The objective of sand filters is to remove sediment and the pollutants from the first flush of pavement and impervious area runoff. The filtration of nutrients, organics, and coliform bacteria is enhanced by a mat of bacterial slime that develops during normal operations. One of the main advantages of sand filters is their adaptability; they can be used on areas with thin soils, high evaporation rates, low-soil infiltration rates, in limited-space areas, and where groundwater is to be protected.

Since their original inception in Austin, Texas, hundreds of intermittent sand filters have been implemented to treat stormwater runoff. There have been numerous alterations or variations in the original design as engineers in other jurisdictions have improved and adapted the technology to meet their specific

requirements. Major types include the Austin Sand Filter, the District of Columbia Underground Sand Filter, the Alexandria Dry Vault Sand Filter, the Delaware Sand Filter, and peat-sand filters which are adapted to provide a sorption layer and vegetative cover to various sand filter designs .

**Design Considerations:**

- Appropriate for space-limited areas
- Applicable in arid climates where wet basins and constructed wetlands are not appropriate
- High TSS removal efficiency

**Cost Considerations:**

Filtration Systems may require less land than some other BMPs, reducing the land acquisition cost; however the structure itself is one of the more expensive BMPs. In addition, maintenance cost can be substantial.

**Erosion Control Compost**

**Description:** Erosion control compost (ECC) can be used as an aid to control erosion on critical sites during the establishment period of protective vegetation. The most common uses are on steep slopes, swales, diversion dikes, and on tidal or stream banks.

**Materials:**

New types of erosion control compost are continuously being developed. The Texas Department of Transportation (TxDOT) has established minimum performance standards which must be met for any products seeking to be approved for use within any of TxDOT's construction or maintenance activities. Material used within any TxDOT construction or maintenance activities must meet material specifications in accordance with current TxDOT specifications. TxDOT maintains a website at <http://www.dot.state.tx.us/des/landscape/compost/specifications.htm> that provides information on compost specification data. This website also contains information on areas where the Texas Commission on Environmental Quality (TCEQ) restricts the use of certain compost products.

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#### **Installation:**

- Install in accordance with current TxDOT specification.
- Use on slopes 3:1 or flatter.
- Apply a 2 inch uniform layer unless otherwise shown on the plans or as directed.
- When rolling is specified, use a light corrugated drum roller.

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used for mulch filter berms and socks, products should meet all applicable state and federal regulations, including but not limited to the United States Environmental Protection Agency (USEPA) Code of Federal Regulations (CFR), Title 40, Part 503 Standards for Class A biosolids and Texas Natural Resource Conservation Commission (now named TCEQ) Health and Safety Regulations as defined in the Texas Administration Code (TAC), Chapter 332, and all other relevant requirements for compost products outlined in TAC, Chapter 332. Testing requirements required by the TCEQ are defined in TAC Chapter 332, including Sections §332.71 Sampling and Analysis Requirements for Final Products and §332.72 Final Product Grades. Compost specification data approved by TxDOT are appropriate to use for ensuring the use of quality compost materials or for guidance.

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#### **Installation:**

- Install in accordance with current TxDOT specification.
- Mulch filter berms should be constructed at 1-1/2 feet high and 3 foot wide at locations shown on plans.
- Routinely inspect and maintain filter berm in a functional condition at all times. Correct deficiencies immediately. Install additional filter berm material as directed. Remove sediment after it has reached 1/3 of the height of the berm. Disperse filter berm or leave in place as directed.
- Mulch filter socks should be in 8 inch, 12 inch or 18 inch or as directed. Sock materials should be designed to allow for proper percolation through.

#### **Compost Filter Berms and Socks**

**Description:** Compost filter berms and socks are used to intercept and detain sediment laden run-off from unprotected areas. When properly used, compost filter berms and socks can be highly effective at controlling sediment from disturbed areas. They cause runoff to pond which allows heavier solids to settle. Compost filter berms and socks are used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. The berm or sock should remain in place until the area is permanently stabilized. Compost filter berms should not be used when there is a concentration of water in a channel or drainage way. If concentrated flows occur after installation, corrective action must be taken. Compost filter socks may be installed in construction areas and temporarily moved during the day to allow construction activity provided it is replaced and properly

anchored at the end of the day. Compost filter berms and socks may be seeded to allow for quick vegetative growth and reduction in run-off velocity.

#### **Materials:**

New types of compost filter berms and socks are continuously being developed. The Texas Department of Transportation (TxDOT) has established minimum performance standards which must be met for any products seeking to be approved for use within any of TxDOT's construction or maintenance activities. Compost filter berms and socks used within any TxDOT construction or maintenance activities must meet material specifications in accordance with TxDOT specification 1059. TxDOT maintains a website at <http://www.dot.state.tx.us/des/landscape/compost/specifications.htm> that provides information on compost specification data. This website also contains information on areas where the Texas Commission on Environmental Quality (TCEQ) restricts the use of certain compost products.

Compost filter berms and socks used for projects not related to TxDOT should also be of quality materials by meeting performance standards and compost specification data. To ensure the quality of compost used as compost filter berms and socks, products should meet all applicable state and federal regulations, including but not limited to the United States Environmental Protection Agency (USEPA) Code of Federal Regulations (CFR), Title 40, Part 503 Standards for Class A biosolids and Texas Natural Resource Conservation Commission (now named TCEQ) Health and Safety Regulations as defined in the Texas Administration Code (TAC), Chapter 332, and all other relevant requirements for compost products outlined in TAC, Chapter 332. Testing requirements required by the TCEQ are defined in TAC Chapter 332, including Sections §332.71 Sampling and Analysis Requirements for Final Products and §332.72 Final Product Grades. Compost specification data approved by TxDOT are appropriate to use for ensuring the use of quality compost materials or for guidance.

Testing standards are dependent upon the intended use for the compost and ensures product safety, and product performance regarding the product's specific use. The appropriate compost sampling and testing protocols included in the United States Composting Council (USCC) Test Methods for the Examination of Composting and Compost (TMECC) should be conducted on compost products used for compost filter berms and socks to ensure that the products used will not impact public health, safety, and the environment and to promote production and marketing of quality composts that meet analytical standards. TMECC is a laboratory manual that provides protocols for the composting industry and test methods for compost analysis. TMECC provides protocols to sample, monitor, and analyze materials during all stages of the composting process. Numerous parameters that might be of concern in compost can be tested by following protocols or test methods listed in TMECC. TMECC information can be found at <http://www.tmecc.org/tmecc/index.html>. The USCC Seal of Testing Assurance (STA) program contains information regarding compost STA certification. STA program information can be found at [http://tmecc.org/sta/STA\\_program\\_description.html](http://tmecc.org/sta/STA_program_description.html).

#### **Installation:**

- Install in accordance with TxDOT Special Specification 1059.
- Compost filter berms shall be constructed at 1-1/2 feet high and 3 foot wide at locations shown on plans.
- Routinely inspect and maintain filter berm in a functional condition at all times. Correct deficiencies immediately. Install additional filter berm material as directed. Remove sediment after it has reached 1/3

of the height of the berm. Disperse filter berm or leave in place as directed.

- Compost filter socks shall be in 8 inch, 12 inch or 18 inch or as directed. Sock materials shall be designed allowing for proper percolation through.

## PERMIT COMPLIANCE CERTIFICATION

Permit Number:

Name of Permittee:

Date of Issuance:

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

Regulatory Branch  
CESWF-PER-R  
U.S. Army Corps of Engineers  
P.O. Box 17300  
Fort Worth, Texas 76102-0300

Please note that your permitted activity is subject to a compliance inspection by a U.S. Army Corps of Engineers representative. If you fail to comply with this permit you are subject to permit suspension, modification, or revocation.

**I hereby certify that the work authorized by the above referenced permit was completed in accordance with the terms and conditions of the said permit, and required mitigation was completed in accordance with the permit conditions.**

\_\_\_\_\_  
Signature of Permittee

\_\_\_\_\_  
Date