TOWN OF HOLLYWOOD PARK STORMWATER MANAGEMENT PLAN

IN COMPLIANCE WITH TCEQ GENERAL PERMIT TXR040000 FOR PHASE II (SMALL) MS4S

PREPARED FOR

TOWN OF HOLLYWOOD PARK
2 MECCA DR,
HOLLYWOOD PARK, TX 78232

JUNE 2019
REVISION JANUARY 2020

RESPEC

CEC
CIVIL ENGINEERING CONSULTANTS
DON DURDEN, INC.

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INTRODUCTION

This Stormwater Management Plan (SWMP) outlines management principles for the Town of Hollywood Park to address stormwater related environmental impacts. Runoff from natural events, such as rain, or manmade events, such as spills or over irrigation, can transport pollutants and sediment downstream to rivers, lakes, and the ocean. The practices outlined in this plan are intended to minimize adverse impacts of stormwater runoff in receiving water bodies. Specific measures are identified in this plan to reduce the impact of everyday activities.

OVERVIEW

The Federal Water Pollution Control Act was passed in 1972. After the law was amended in 1977, it became commonly known as the Clean Water Act (CWA). The Act established the structure for federal regulation of pollutant discharges into the waters of the United States, authorized the Environmental Protection Agency (EPA) to implement pollution control programs, extended the requirement to establish standards for surface water contaminants, and made it unlawful to discharge unpermitted point source pollutants into navigable waters. The Act also established funding for construction of sewage treatment plants and promoted planning to address non-point source pollution. To reduce stormwater pollution, amendments were made to the CWA in 1987, requiring stormwater discharges to be permitted in two phases.

Phase 1 applies to large cities with separate stormwater sewer systems. The regulations required those cities to obtain National Pollutant Discharge Elimination System (NPDES) permits. The permit process imposes controls on the cities to reduce pollution in stormwater discharges.

Phase 2 applies to smaller cities, including the Town of Hollywood Park. In 1999, the EPA issued final regulations for Phase 2. The Texas Commission on Environmental Quality (TCEQ) issued the original Texas Pollutant Discharge Elimination System (TPDES) General Permit Number TXR040000 (General Permit) for Phase 2 Stormwater on August 13, 2007 to create a mechanism for non-Phase I Texas cities with populations of over 1,000 to come into compliance with the federal regulations. The TCEQ renewed and expanded the original permit for an additional 5-Year term on December 13, 2013. TCEQ released a renewed 5-Year General Stormwater Permit for Phase II (Small) Municipal Separate Storm Sewer Systems (MS4s) on January 24, 2019.

Operators of small MS4s that were previously authorized under the 2013 TPDES General Permit TXR040000, shall submit a Notice of Intent (NOI) and a Stormwater Management Plan (SWMP) within 180 days following the effective date of the general permit as required in Part II.E.1(a).

The Implementation Program for the SWMP proposes to reduce stormwater pollution by increasing the city's control of pollution sources. The Implementation Program provides maps and photos (see Tab 2), which identify many of the points where stormwater is discharged from the city to other municipalities.

The plan must be fully implemented within 5 years of the TCEQ's issuance of the General Permit. The general schedule is as shown:

August 13, 2007	The TCEQ issued the Phase 2 General Permit.
February 11, 2008	Submitted original NOI and SWMP Implementation Program to the TCEQ.
August 13, 2012	The original SWMP was fully implemented.
December 13, 2013	The TCEQ issued the first renewed Phase 2 General Permit.
June 11, 2014	Submitted new NOI and a new SWMP Implementation Program to the TCEQ.
December 12, 2018	The first renewed SWMP was fully implemented.
January 24, 2019	The TCEQ issued the second renewed Phase 2 General Permit.
July 25, 2019	Submitted new NOI and a new SWMP Implementation Program to the TCEQ
December 12, 2024	The second renewed SWMP is fully implemented.

Steps to SWMP Approval:

1. Publish notice of the executive director's preliminary determination on the NOI and SWMP.
2. Receive public comment for at least 30 days. Hold a public meeting if a high level of interest exists. TCEQ staff will facilitate the meeting.
3. File a copy and an affidavit of the publication of notice(s).
4. The TCEQ shall, approve, approve with conditions, or deny the NOI.

There are unique terms and acronyms in the General Permit. A list of definitions from the TPDES General Permit is provided behind Tab 11.

A detailed, comprehensive schedule for the Implementation Program is provided behind Tab 8 of this document.

The Implementation Program proposes the means to develop, to implement, and to enforce a plan to reduce the discharge of pollutants to the maximum extent practicable (MEP). It identifies seven Minimum Control Measures (MCMs), which are required to be addressed by the General Permit:

1. **Public Education, Outreach and Involvement** – Distribute educational material and/or provide public presentations to inform citizens about stormwater pollution and provide opportunities for citizens to participate in program development and implementation. See Tab 1.
2. **Illicit Discharge Detection and Elimination** – Detect and eliminate illicit discharges to the storm system. See Tab 2.
3. **Construction Site Stormwater Runoff Control** – Control erosion and sediment in nonmunicipal construction activities. See Tab 3.
4. **Post-Construction Stormwater Management in New Development and Redevelopment** – Control pollutant discharges from new development and redevelopment areas. See Tab 4.
5. **Pollution Prevention/Good Housekeeping** – Prevent or reduce pollutant runoff from municipal operations. See Tab 5.
6. **Industrial Stormwater Sources (applicable to Level 4 MS4's)** – Identify and control pollutants in stormwater discharges to the MS4. See Tab 6.
7. **Municipal Construction Activities (optional)** – Control erosion and sedimentation on municipal projects. See Tab 7.

The Implementation Program proposes scheduling for each MCM and establishes criteria for measuring the success of the implementation. If new areas are added, then the Town of Hollywood Park is responsible for implementing the SWMP in new areas as expeditiously as possible but no later than three years from the addition of the new area as required in Part II.E.7 of the General Permit. The detailed proposals for each MCM are provided behind tabs which are numbered correspondingly.

The city must maintain records on and annually review the SWMP as required in Part II.E.4 in the General Permit. The city must submit an annual report to the TCEQ regularly and must document and submit other records to the TCEQ when requested. All applications and annual reports will be submitted electronically in compliance with the federal e-Reporting Rule requested by TCEQ. The records must include documentation pertaining to the effectiveness of BMPs and shall be included in the annual reports as required in Part IV.B.2. of the General Permit. The records must also be kept available to the public.

Any changes to the SWMP must be included in the annual report as described in Part IV.B.2. of the General Permit and must meet the requirements of Part II.E.3, 5, and 6. of the General Permit. The city must report non-compliance with the General Permit to the TCEQ and ensure the maintenance of accurate records at TCEQ offices. Additionally, the city is located within the Edwards Aquifer Recharge Zone and has submitted the required Water Pollution Abatement Plan, approved by the TCEQ, in accordance with the Edwards Aquifer Rule (30 TAC Chapter 213).

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MINIMUM CONTROL MEASURE NO. 1:

Public Education, Outreach, and Involvement on Stormwater Impacts

MINIMUM CONTROL MEASURE NO. 1:
PUBLIC EDUCATION, OUTREACH, AND INVOLVEMENT

The city will develop and implement a public education program which will distribute educational materials to the community and/or conduct equivalent outreach activities that will be used to inform the public. The city will direct its education and outreach efforts toward multiple segments of the population to promote a broad understanding among those who have the potential to impact stormwater quality. Emphasis will be placed on obtaining the public involvement by encouraging citizens and business owners to invest themselves more into preventing and reducing stormwater pollution, thereby increasing the effective resources in perceiving and in addressing stormwater pollution problems. Efforts will be directed toward residents, visitors, public service employees, businesses, commercial and industrial facilities, and construction site personnel. This MCM will inform the public about the impacts that stormwater runoff can have on water quality, hazards associated with illegal discharges and improper disposal of waste, and steps that can be taken by both the city and its citizens to reduce pollutants in stormwater runoff. Materials addressing individual educational components will be distributed to each component's target audience. The city will also develop and implement means for the public to become involved and to participate in the process of preventing or reducing stormwater pollution. The city will seek to encourage citizens and business owners to invest themselves more into preventing and reducing stormwater pollution and, thereby, to increase the effective resources in perceiving and in addressing stormwater pollution problems. The city will, as a minimum, comply with any state and local public notice requirements when implementing this public involvement/participation program. The general rule will be to open opportunities to participate in the SWMP development and implementation to all people in the city.

The city shall document the activities performed and materials used to fulfill this MCM. Documentation shall be detailed enough to demonstrate the amount of resources used to address each group. This documentation shall be included in the annual reports which are required in Part IV.B.2. of the General Permit.

Summary of Measurable Goals for MCM 1:

BMP	Target	Interval	Deadline
1.1 NOI and NOC Public Comment	Make SWMP available for public comment once in the permit cycle	Once every 5-year permit cycle	Anticipated March 2020
1.2 Recurring Public Comment	Provide opportunity for public comment regarding stormwater activities at least once annually during city council meetings	Annually	Dec-19
1.3 Brochures and Fact Sheets	Print two newsletter articles and display a poster in the City Hall twice a year	Twice Annually	Mar-19
1.4 State of Stormwater Pollution Prevention Address	Update City Manager and address City Council once per year	Annually	Jan-19
1.5 Public Service Announcement	Broadcast public service announcement daily (this is provided by SARA)	Daily	Jan-20
1.6 Drain Marking	Inspect 100% of storm drains for markers and maintenance once per year	Annually	Dec-19
1.7 Questionnaires	Distribute and review 100% of online questionnaires once every odd year	Every other year	Dec-19

Detailed discussion of stormwater Best Management Practices (BMPs) to be utilized in public education, outreach, and involvement stormwater pollution prevention follow:

BMP 1.1: NOI AND NOC PUBLIC COMMENT

Description – Post this SWMP Implementation Program in a public place at city hall for public review. The SWMP and annual report will also be posted on the city's public website as required in Part III.B.1.a.3. When comments from the TCEQ's Executive Director are received regarding this SWMP Implementation Program, publish in the city's official notice newspaper a notice that states that the comments have been received and that public review and comment are invited. Provide at least 30 days for public comment. If significant public interest exists, host a public meeting that would be facilitated by the TCEQ and that would allow for public participation.

Hollywood Park SWMP Website: https://hollywoodpark-tx.gov/community/

Frequency – This will occur when the NOI has been submitted and the initial comments are received from the Executive Director. It will also occur on a recurring basis at least to the extent required by the TCEQ when NOCs are submitted. NOCs are required when information in the NOI is updated or modified. A NOC form is required when changes are made to the SWMP following NOI approval.

Evaluation Criteria for Effectiveness – Record copies of the Executive Director's comments, the public newspaper notice, public meeting records, and any written public comments in the document file.

Implementation – Publish the newspaper notice inviting public review and comment within two weeks of receipt of the Executive Director's preliminary determination. Post a physical copy of this SWMP in city hall and a digital copy on the city's public website no later than 30 days after the approval date. Post the annual report no later than 30 days after the due date. Host the public meeting within 90 days of receipt of the Executive Director's preliminary determination. The same time frames will apply to the NOC process if required by the TCEQ.

BMP 1.2: RECURRING PUBLIC COMMENT

Description – Post this SWMP Implementation Program at city hall and on the city website and make it available for ongoing public review. Provide regular opportunities for attendees of city council meetings to address the council on matters concerning the SWMP and its Implementation Program. The regular "Citizens to Be Heard" item on the agenda (or its equivalent) will satisfy this requirement.

Frequency – This will occur approximately once per year, according to the regular city council meeting schedule and comments will be implemented at the end of every calendar year.

Evaluation Criteria for Effectiveness – Whenever stormwater issues are discussed, record copies of city council minutes and supplemental documents, if any, in the document file.

Implementation – The City has already implemented this BMP under the provisions of the original General Permit.

BMP 1.3: BROCHURES AND FACT SHEETS

Description – Develop or obtain informational brochures and fact sheets pertaining to the improvement and preservation of stormwater quality. Distribute through city newsletter. Place informational materials (such as posters or brochures) at public meeting places, including but not limited to City Hall. Coordinate with other government offices and/or utilities whenever possible to share resources in a productive manner.

Frequency and Target Population – Publication of informational brochures, issuance of fact sheets, or updating of materials at public meeting places will be accomplished two (2) times per year at a minimum. The BMP will be directed toward:

1. Residents through periodic residential newsletter mailings and through continuous postings at city hall,
2. Visitors through continuous postings in city hall,
3. Public service employees through continuous postings at city hall and in public works offices,
4. Businesses through direct periodic business contact,
5. Commercial and industrial facilities through direct periodic business contact, and
6. Construction site personnel through instructions attached to the building permit. The instructions will require contractors requiring building permits to prominently display a brochure or fact sheet on the project site in plain view for the workers to read.

Topics – Brochures and fact sheets will educate residents on how to maintain their homes in an environmentally-friendly manner such as proper lawn and garden activities, including fertilizer, herbicide, and pesticide use; proper waste disposal; water conservation practices; and proper septic system maintenance. Other brochures and fact sheets will address commercial, industrial, and institutional pollution issues.

Evaluation Criteria for Effectiveness – This BMP has been evaluated as reaching a broad segment of the targeted audience and has been selected for inclusion in the new SWMP. The city shall conduct research to maintain the accuracy of information provided to the public and update educational topics as necessary. The number and frequency of mailings and publishing's shall be recorded in the document file.

Implementation – The city has already implemented this BMP under the provisions of the original General Permit. The city will update the brochures fact sheets and educational materials regularly, introduce new topics as they become available, and will continue to implement the BMP throughout the entire permit term.

BMP 1.4: STATE OF STORMWATER POLLUTION PREVENTION ADDRESS

Description – The city's stormwater program manager will make presentations at city council meetings on program compliance status, stormwater pollution prevention efforts, and their effectiveness.

Frequency – The city council will be addressed whenever program milestones are reached, once annually every January at a minimum.

Target Population – The BMP will be directed toward all the following who attend city council meetings:

1. City leadership
2. Residents
3. Visitors
4. Public service employees
5. Businesses
6. Commercial and industrial facilities
7. Construction site personnel

Evaluation Criteria for Effectiveness – This BMP was presented as "Speakers to Address Public Groups" under the original permit. Evaluation of the BMP indicated that scheduling appropriate speakers was both ineffective and burdensome. This BMP as updated will allow the individual most knowledgeable regarding stormwater pollution prevention activities, the program manager, to educate and engage the broadest segment of the public. The number, frequency, and topic of the presentations shall be recorded in the document file.

Implementation – The city has already implemented this BMP under the provisions of the original General Permit. The stormwater program manager will address the public at city council meetings once annually at a minimum.

BMP 1.5: PUBLIC SERVICE ANNOUNCEMENT

Description – Continue to coordinate airing of stormwater Public Service Announcement (PSA) on local media outlets, such as the San Antonio River Authority (SARA). Work with other municipalities, agencies and utilities to coordinate efforts.

Frequency – Airing of PSA will be conducted on an ongoing basis during the entire permit term.

Target Population – The BMP will be directed toward all the following who view local television programming:

1. Residents,
2. Visitors,
3. Public service employees,
4. Businesses, and
5. Commercial and industrial facilities.

Evaluation Criteria for Effectiveness – This BMP was implemented under the previous permit and determined to be an effective tool for reaching a large public audience. PSA activities shall be recorded in the document file.

Implementation – San Antonio River Authority (SARA) airs educational PSAs on local television stations to inform the public on stormwater pollution prevention. Hollywood Park is located inside of SARA's jurisdiction; therefore, the residents receive the PSAs. These PSAs will be reviewed for applicability to Hollywood Park annually.

BMP 1.6: DRAIN MARKING

Description – Continue to survey public storm drains. As necessary, arrange for city stormwater staff to re-mark public storm drains with a durable paint, stamp, and/or plaque. Modify the city's drainage standards to require all new city inlets to be marked prior to the city's acceptance.

Frequency – Check the messages once every year and repaint or replace the messages as needed. Conduct this during the annual BMP inspections in December.

Target – The BMP will be directed to any drain within City limits, and 100% of drains will be inspected and verified to have markers.

Evaluation Criteria for Effectiveness – Record the location, date, stencil condition, and activity pertaining to each inlet in the document file.

Implementation – The city implemented this BMP under the previous permit and determined it to be an effective tool for reaching a large public audience.

BMP 1.7: QUESTIONNAIRES

Description – The city will issue a questionnaire periodically to invite comments and observations from the public regarding stormwater pollution. The questionnaire will be distributed through the city newsletter, the city web site, and/or utility mailings such as bills and notices. The questionnaire will also be publicized at city hall in a conspicuous and publicly accessible location. Responses to the

questionnaire will be evaluated by city personnel and/or consultants to determine if repairs, construction projects, ordinances, or changes in city practice are appropriate. City staff will make recommendations to council if appropriate.

Frequency – The questionnaire will be issued and tabulated every two years in odd-numbered years, starting December 2019.

Evaluation Criteria for Effectiveness – Copies of the completed questionnaires shall be kept in the document file, 100% of the questionnaires will be reviewed and, if action is required, documentation will occur.

Implementation – The city implemented this BMP under the previous permit and determined it to be an effective tool for reaching a large public audience. The city will consider local conditions, developing questions, and updating of the questionnaire from October 1, 2018 through September 30, 2019. The city will issue and tabulate results from its first batch of questionnaires by December 13, 2019.

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MINIMUM CONTROL MEASURE NO. 2:

Illicit Discharge Detection and Elimination

MINIMUM CONTROL MEASURE NO. 2:
ILLICIT DISCHARGE DETECTION AND ELIMINATION

The city will continue to implement a program to detect and to eliminate illicit discharges to the MS4; Ordinance 877 is included in this program. This MCM specifies the techniques to be used to detect illicit discharges, provides actions for eliminating the illicit discharges, and provides the basis for maintaining and updating the ordinance. The ordinance is, to the extent allowable under state and local law, to establish enforcement procedures for removing the source of an illicit discharge.

For procedures to detect and address illicit discharge into the MS4, see **Appendix A - Illicit Discharge Detection & Elimination Plan.**

For information regarding field staff training, see **Appendix B - Municipal Employee Pollution Prevention Handbook.** In addition, the MS4 provides staff training on an annual basis.

The following non-stormwater flows (from lists in Part II.C and Part VI.B of the General Permit) do not need to be considered as illicit discharges requiring elimination unless the Operator of the MS4 or the Executive Director identifies the flow as a significant source of pollutants to the MS4:

1. Water line and fire hydrant flushing (excluding discharges of hyper chlorinated water, unless the water is first dechlorinated, and discharges are not expected to adversely affect aquatic life);
2. Runoff or return flow from landscape irrigation, lawn irrigation, and other irrigation utilizing potable water, groundwater, or surface water sources;
3. Discharges from potable water sources;
4. Diverted stream flows;
5. Rising ground waters and springs;
6. Uncontaminated ground water infiltration;
7. Uncontaminated pumped ground water;
8. Foundation and footing drains;
9. Air conditioning condensation;
10. Water from crawl space pumps;
11. Individual residential vehicle wash water;
12. Flows from wetlands and riparian habitats;

13. Dechlorinated swimming pool discharges that do not violate Texas Surface Water Quality Standards;
14. Street wash water excluding street sweeper wastewater;
15. Uncontaminated water used to control dust;
16. Discharges or flows from emergency fire-fighting activities (fire-fighting activities do not include washing of trucks, run-off water from training activities, test water from fire suppression systems, and similar activities);
17. Other allowable non-stormwater discharges listed in 40 CFR §122.26(d)(2)(iv)(B)(1);
18. Non-stormwater discharges that are specifically listed in the TPDES Multi Sector General Permit (MSGP) or the TPDES Construction General permit (CGP);
19. Discharges that are authorized by a TPDES or NPDES permit or that are not required to be permitted; and
20. Other similar occasional incidental non-stormwater discharges.

The listed sources are not expected to be significant sources of pollutants because of the nature of their discharges. Consequently, no special controls or conditions are established.

Any changes to the SWMP must be included in the annual report as described in Part IV.B.2. of the General Permit and must meet the requirements of Part II.D.3 and Part II.E.6. of the General Permit. The city shall maintain and update inspection forms and document MS4 inspections and the results of the inspections. This documentation shall be retained in the annual reports which are required in Part IV.B.2. of the General Permit.

Per Part III, Section B.2(5)(ii) of the TPDES General Permit No. TXR0400000, effective January 24, 2019: “All permittees shall report to the TCEQ **immediately** upon becoming aware of the occurrence of any illicit flows believed to be an immediate threat to human health of the environment”.

Summary of Measurable Goals for MCM 2:

BMP	Target	Interval	Deadline
2.1 Storm Sewer Map	Review and update storm sewer map once per year	Annually	Dec-19
2.2 Illicit Discharge Detection Plan	Maintain and review plan once annually, review inspection techniques, forms, and staff assignments	Annually	Dec-19
2.3 Illicit Discharge and Dumping Hotline	Maintain phone line, forms, procedures, and staffing for hotline. Record and report 100% of complaints annually.	Annually	Dec-19
2.4 Illicit Discharge Ordinance	Support and review ordinance enforcement annually, record 100% of violations	Annually	Dec-19

Discussions of the Best Management Practices (BMPs) to be utilized in illicit discharge detection and elimination follow:

BMP 2.1: STORM SEWER MAP

Description – The city has mapped the storm sewer system. The map, with its source cited, is found in this section (Tab 2) following the list of BMPs.

The map includes the location of all outfalls, the names and locations of all waters of the U.S. that receive discharges from the outfalls, zones pertaining to inspection schedules, and additional information required to implement the SWMP. The source of information used to develop the storm sewer map is cited on the map. A description of how the outfalls were verified will be maintained and updated with photos, where possible.

Photos of some outfalls and other significant storm conveyance features are keyed to the map (Tab 2) and are found following the map within the same section (Tab 2). The Storm Sewer Map will be updated periodically based on inspection records and construction drawings for recently completed projects that affect the drainage system.

Frequency – The Storm Sewer Map will be revised every year in December post inspection as needed.

Evaluation Criteria for Effectiveness – At least one copy of the completed/revised Storm Sewer Map, marked with the latest revision date, shall be recorded in the document file.

Implementation – The city will continue making site visits, performing surveys, and/or reviewing construction documents through the end of the permit term. The map will be updated every two years.

BMP 2.2: ILLICIT DISCHARGE DETECTION PLAN

Description – The city has implemented a plan listing technique to be used to detect illicit discharges as well as forms to be used to document the results of inspections. The plan identifies city staff that will perform, and training methods for conducting the inspections. Inspection techniques may include visual observation, conventional photography, in-pipe photography, sampling and analysis of water quality and water characteristics, dye testing, and smoke testing. The plan also provides actions for eliminating the illicit discharges as established by Hollywood Park Ordinance 877. The city will use the most current edition of the Storm Sewer Map to update the inspection plan as necessary. The map divides the city into inspection zones. The plan designates a regular time each year for each zone to be inspected for illicit discharges. The plan facilitates public reporting of illicit discharges and provides response procedures for discharges and complaints.

Frequency –The inspections will occur annually during the month of December, during dry weather, when illicit discharges are easier to identify. Allowance shall be made for the fact that weather does not always permit inspections to occur at the scheduled times.

Evaluation Criteria for Effectiveness – The city shall file completed inspection forms documenting MS4 inspections and the results of the inspections in the document file with photos and other supporting documents as appropriate.

Implementation – The city will continue implementation for the renewed permit during the calendar year 2019 and each year thereafter. Inspections of all zones, based on the most current edition of the Storm Sewer Map, will be completed in accordance with the inspection plan.

BMP 2.3: ILLICIT DISCHARGE AND DUMPING HOTLINE

Description – The city has established a phone number for reporting illicit discharges and publishes the phone number in places that are readily accessible to the public. At the special number, the phone will be answered by trained staff that will be equipped with forms for recording incoming phone calls and trained in how to refer the information for action. A recording system will accept phone calls after hours.

Hotline:
Fire Marshall
(210)494-2023 ext. 232

Frequency – The hotline will be maintained on an ongoing basis.

Evaluation Criteria for Effectiveness – Completed forms, showing the nature of incoming phone calls and the resulting actions will be filed in the document file. 100% of reports will be recorded for records.

Implementation – The city has implemented the hotline and will continue to maintain it beginning the effective date of permit renewal.

BMP 2.4: ILLICIT DISCHARGE ORDINANCE

Description – Under the previous General Permit, the city passed Ordinance No. 877 which identifies illicit discharges, prohibits illicit discharges, and establishes enforcement procedures for removing the sources of illicit discharges. The city shall continually monitor changes in conditions and regulations, and update the ordinance as necessary, once during the permit term at a minimum.

Frequency – The ordinance will be enforced on an ongoing basis and amend as necessary. 100% of violations and actions will be recorded on an annual basis.

Evaluation Criteria for Effectiveness – A copy of the adopted ordinance has been placed in the city code book and in the document file.

Implementation – The city will continue enforcement of the current ordinance.

STORM SEWER MAP

3

MINIMUM CONTROL MEASURE NO. 3:

Construction Site Stormwater Runoff Control

MINIMUM CONTROL MEASURE NO. 3:
CONSTRUCTION SITE STORMWATER RUNOFF CONTROL

The city has, to the extent allowable under State and local law, implemented and enforces a program to reduce pollutants in construction stormwater runoff from projects that disturb areas of one or more acres of land or projects that are part of a larger common plan of development or sale that would disturb one or more acres of land. The plan will not pertain to sites where the construction site operator has obtained a waiver from permit requirements under NPDES or TPDES construction permitting requirements based on a low potential for erosion. The program includes the implementation of Ordinance No. 883, which requires erosion and sediment controls with sanctions to ensure compliance to the extent allowable under state and local law; requirements for construction site contractors to control erosion and sediment; requirements for controlling construction waste; procedures for the city's review of site plans; procedures for receiving information and complaints; and procedures for the city to inspect construction sites and to enforce controls.

The Storm Water Control Guidelines for Construction Sites and Ordinance No. 883 can be found in **Appendix C - Construction**

The city shall document the activities conducted and materials used to fulfill this MCM, this documentation shall be retained in the annual reports which are required in Part IV.B.2. of the General Permit.

Summary of Measurable Goals for MCM 3:

BMP	Target	Interval	Deadline
3.1 Technical Manual for Construction Runoff	Maintain and review manual and review with four (4) City staff once per year	Annually	Dec-19
3.2 Site Plan Review Program	Maintain program to review site plans and storm water pollution prevention plans for proposed Construction and record 100% of activities	Annually	Dec-19
3.3 Construction Site Inspection Program	Maintain program to review construction sites for erosion and other sources of storm water pollution. Record 100% of total site inspections.	Annually	Dec-19
3.4 Construction Runoff Hotline	Maintain phone line, forms, procedures, and staffing for hotline. Compile 100% of incoming calls at the end of the year.	Annually	Dec-19
3.5 Construction Stormwater Management Ordinance	Support and review ordinance enforcement and compile 100% of reports once per year	Annually	Dec-19

Discussions of the Best Management Practices (BMPs) to be utilized in construction stormwater runoff control follow:

BMP 3.1: TECHNICAL MANUAL FOR CONSTRUCTION RUNOFF

Description – The city has developed the Stormwater Control Guidelines for Construction Sites manual to explain appropriate erosion and sedimentation controls for construction sites, the manual provides alternative solutions and gives guidance as to when those alternatives are appropriate, the manual also establishes minimum control thresholds and proper maintenance criteria. The construction site operator is required to implement BMPs to:

1. Control erosion and sediment
2. Stabilize soil
3. Control pollutants from equipment and vehicle washing and other wash waters
4. Minimize exposure to stormwater of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste and other materials
5. Minimize the discharge of pollutants from spills and leaks.

The manual was developed with the intent of establishing consistency with other small cities in the region and providing a streamlined approach that will be user-friendly for designers and contractors.

Frequency – The technical manual will be maintained at city offices with building permits and reviewed on an ongoing basis.

Evaluation Criteria for Effectiveness – The city has officially adopted the technical manual and incorporated it into the building permit process. A copy of the technical manual will be recorded in the document file. This manual must be reviewed with at least four (4) city staff on an annual basis.

Implementation – The city will maintain and update the manual. Developers and contractors are required to conform to the manual, the manual will be reviewed for updates at least every three years.

BMP 3.2: SITE PLAN REVIEW PROGRAM

Description – A program has been developed that requires city staff to review site plans and stormwater pollution prevention plans for eligible projects. The review process will be attached to the building permit process and will ensure that proper measures are incorporated into the construction procedures that will control erosion, sedimentation, and other sources of stormwater pollution. The plan identifies city staff to perform the reviews.

Frequency – All (100%) site plans will be reviewed on an ongoing basis as the plans are submitted to the city for review. This list will be recorded and filed annually.

Evaluation Criteria for Effectiveness – Review all eligible projects, execute review forms and record results with photos and other pertinent materials in the document file.

Implementation –The program will be reviewed for updates at least annually.

BMP 3.3: CONSTRUCTION SITE INSPECTION PROGRAM

Description – The city has developed procedures for inspecting construction sites for erosion, sedimentation, and other sources of stormwater pollution. The program identifies which city staff will perform inspections. It also provides a protocol for inspectors and includes inspection forms.

Frequency – Inspections will be conducted on an ongoing basis as new construction and redevelopment projects are approved during the city's building permit application process.

Evaluation Criteria for Effectiveness – Inspect all eligible projects. Resolve 100% of instances of non-compliance. Record all (100%) copies of completed inspection forms and related documents, such as photos, in the document file.

Implementation – The city has already implemented this BMP under the provisions of the original General Permit. The program will be reviewed for updates at least annually.

BMP 3.4: CONSTRUCTION RUNOFF HOTLINE

Description – The city has established a phone number for reporting illicit discharges and construction erosion and sedimentation and publishes the phone number in places that are readily accessible to the public. At the special number, the phone will be answered by trained staff that will be equipped with forms for recording incoming phone calls and trained in how to refer the information for action. A recording system will accept phone calls after hours.

Hotline: Fire Marshall
(210)494-2023 ext. 232

Frequency – The hotline will be maintained on an ongoing basis.

Evaluation Criteria for Effectiveness – Completed forms, showing the nature of incoming phone calls and the resulting actions will be filed in the document file. 100% of calls and complaints are required to be filed annually.

Implementation – The city has implemented the hotline and will maintain it beginning the effective date of permit renewal.

BMP 3.5: CONSTRUCTION STORMWATER MANAGEMENT ORDINANCE UPDATE

Description – The city has adopted an ordinance which, to the extent allowable under State and local law, establishes eligibility for construction sites to be inspected and enforced by the city; establishes requirements for contractors to reduce pollutants in construction stormwater runoff; specifies sanctions to ensure compliance; establishes requirements to control construction waste; and requires city review of site plans,

Frequency – The ordinance will be enforced on an ongoing basis and amended as necessary.

Evaluation Criteria for Effectiveness – Adopted ordinance and supplemental documents, if any, will be maintained in the city code and in the document file. 100% of violations and enforcement actions will be recorded annually.

Implementation – The city will continue enforcement of the current ordinance.

4

MINIMUM CONTROL MEASURE NO. 4:

Post-Construction Stormwater Management

MINIMUM CONTROL MEASURE NO. 4:

POST-CONSTRUCTION STORMWATER MANAGEMENT IN NEW DEVELOPMENT AND REDEVELOPMENT

The city has, to the extent allowable under State and local law, implemented and enforces a program to address stormwater runoff from eligible new development and redevelopment projects. The program applies to projects that disturb one acre of land or more and smaller projects that are part of a larger common plan of development or sale that will result in a total disturbance of one or more acres. The program will continue to ensure that controls are implemented to prevent or to minimize water quality impacts. The program provides for continued implementation of strategies which include a combination of structural and/or non-structural BMPs appropriate for the community. The city has adopted an ordinance to address post-construction runoff and ensure adequate long-term operation and maintenance of the implemented BMPs.

The city shall document the activities performed and materials used to fulfill this MCM, this documentation shall be retained in the annual reports which are required in Part IV.B.2. of the General Permit.

Summary of Measurable Goals for MCM 4:

BMP	Target	Interval	Deadline
4.1 Technical Manual for Post-Construction Runoff	Maintain and review manual regarding post- construction runoff once a year	Annually	Dec-19
4.2 Site Plan Review Program for Post-Construction Runoff	Maintain review program for site plans, compile records once a year	Annually	Dec-19
4.3 Long-Term Inspection and Maintenance Plan for Post-Construction Runoff	Maintain program for post-construction stormwater control inspection, compile 100% of inspections once a year	Annually	Dec-19
4.4 Post-Construction Stormwater Management Ordinance Update	Record 100% of code enforcement violations and review actions once per year	Annually	Dec-19

Discussions of the Best Management Practices (BMPs) to be utilized in post-construction stormwater management in new development and redevelopment follow:

BMP 4.1: TECHNICAL MANUAL FOR POST-CONSTRUCTION RUNOFF

Description – The city has developed the Preliminary Site Plan Review for Post-construction Runoff manual to explain appropriate erosion, sedimentation, and other pollutant controls for developed sites. The manual provides alternative solutions and gives guidance as to when those alternatives are appropriate, the manual also establishes minimum control thresholds and proper maintenance criteria. The manual is intended to establish consistency with other small cities in the region and provide a streamlined approach that is user-friendly for developers.

Frequency – The technical manual will be maintained at city offices with building permits.

Evaluation Criteria for Effectiveness – The city has adopted the technical manual and incorporated it into the building permit process. A copy of the technical manual will be recorded in the document file.

Implementation – The city has already implemented this BMP under the provisions of the original General Permit. The city will maintain and update the manual. Developers and contractors are required to conform to the manual. The manual will be reviewed for updates at least every three years.

BMP 4.2: SITE PLAN REVIEW PROGRAM FOR POST-CONSTRUCTION RUNOFF

Description – A program has been developed that requires city staff to review site plans and stormwater pollution prevention plans for eligible projects. The review process will be attached to the building permit process and will ensure that proper measures are incorporated into the construction procedures that will control erosion, sedimentation, and other sources of stormwater pollution. The plan identifies city staff to perform the reviews.

Frequency – All eligible plans will be reviewed.

Evaluation Criteria for Effectiveness – Review all eligible projects. Execute review forms and record results with photos and other pertinent materials in the document file.

Implementation – The program will continue from the original implementation date of December 13, 2013. The program will be reviewed for updates at least annually.

BMP 4.3: LONG-TERM INSPECTION AND MAINTENANCE PLAN FOR POST-CONSTRUCTION RUNOFF

Description – A program has been implemented for city staff to inspect post-construction stormwater management controls on a long-term basis. The program identifies which city staff will

perform inspections, identifies control performance criteria, establishes the means for determining what maintenance is required, and establishes a protocol for inspectors to follow.

Frequency – All eligible projects will be reviewed on an ongoing basis.

Evaluation Criteria for Effectiveness – Record copies of the forms, checklists, and written procedures in the document file. Compile report documenting 100% of inspections annually.

Implementation– The program will continue from the original implementation date of December 13, 2013. The program will be reviewed for updates at least annually.

BMP 4.4: POST-CONSTRUCTION STORMWATER MANAGEMENT ORDINANCE UPDATE

Description – The city has adopted Ordinance 883, which establishes requirements for stormwater quality controls for post-construction conditions; specifies sanctions to ensure compliance; establishes long-term inspection and maintenance requirements; and requires city review of proposed long-term stormwater pollution prevention plans.

Frequency – The ordinance is enforced on an ongoing basis.

Evaluation Criteria for Effectiveness – Record copies of adopted ordinance and supplemental documents, if any, will be maintained in the document file. Record 100% of violations and actions on an annual basis.

Implementation – The city will continue enforcement of the current ordinance.

5

MINIMUM CONTROL MEASURE NO. 5:

Pollution Prevention W/Good Housekeeping Measures for Municipal Operations

MINIMUM CONTROL MEASURE NO. 5:
POLLUTION PREVENTION AND GOOD HOUSEKEEPING FOR MUNICIPAL OPERATIONS

The city has developed and implemented an operation and maintenance program with the goal of preventing or reducing pollutant runoff from municipal operations. Examples of municipal operations include, but are not limited to:

1. Park and open space maintenance;
2. Street, road, or highway maintenance;
3. Fleet and building maintenance;
4. Stormwater system maintenance;
5. New construction and land disturbances;
6. Municipal parking lots;
7. Vehicle and equipment maintenance and storage yards;
8. Waste transfer stations; and
9. Salt/sand storage locations.

The program provides employee training and a list of applicable BMPs. The training program applies to all employees who are responsible for municipal operations that are subject to the pollution prevention good housekeeping program. The training program includes training materials directed at preventing and reducing stormwater pollution from municipal operations. The city has developed a maintenance plan for structural BMPs that establishes the frequency and manner of approach and preserves the effectiveness of the BMPs. The plan also addresses the disposal of waste, including dredge spoil; accumulated sediments; and floatables. The program includes a list of municipal operations that are subject to the operation, maintenance, or training program developed under the conditions of this section; and municipally owned or operated industrial activities that are subject to TPDES industrial stormwater regulations.

The city shall document the activities performed and materials used to fulfill this MCM. This documentation shall be retained in the annual reports which are required in part of the General Permit.

Summary of Measurable Goals for MCM 5:

BMP	Target	Interval	Deadline
5.1 Municipal Employee Pollution Prevention Manual	Maintain manual to help city employees protect storm water quality and review with four (4) employees once a year	Annually	Dec-19
5.2 Municipal Employee Training	Provide instruction to four (4) city employees on pollution prevention techniques during municipal operations once per year	Annually	Dec-19
5.3 Sediment Trap Planning	Maintain plan for design/maintenance of traps and inspect 100% of structures every year	Annually	Dec-19
5.4 Trash Trap Planning	Maintain plan for design/maintenance of traps and inspect 80% of traps per year	Annually	Dec-19
5.5 Disposal of Waste Materials	Review program procedures once a year	Annually	Dec-19
5.6 Contractor Oversight Procedures	Oversee contactors to prevent storm water pollution and record 100% of project activities	Annually	Dec-19
5.7 Inventory of Facilities and Stormwater Controls	Maintain complete inventory and review and update 80% of inventory once per year	Annually	Dec-19
5.8 Assessment of Operations and Maintenance Activities	Provide report to City Manager and Public Works Director once per year	Annually	Dec-19

For information regarding field staff training, see **Appendix B - Municipal Employee Pollution Prevention Handbook.** In addition, the MS4 provides staff training on an annual basis. Discussions of the Best Management Practices (BMPs) to be utilized in pollution prevention/good housekeeping for municipal operations follow:

BMP 5.1: MUNICIPAL EMPLOYEE POLLUTION PREVENTION MANUAL

Description – The city developed a comprehensive written manual for city employee reference related to proper handling of processes which may impact stormwater quality. The manual specifies what methods will be used to reduce the potential for polluting, and what methods should be used to clean up spills and other types of pollution. The manual provides a basis for training as listed in BMP 5.2.

Frequency – The manual is updated as required by new or changing accepted practices and/or regulations, or whenever new information becomes available.

Evaluation Criteria for Effectiveness – The completed manual is recorded in the document file. The manual was distributed to all city employees during the first municipal training session conducted under the previous permit. Copies are also distributed to all new hires to city public works staff. This document must be reviewed with at least four (4) city employees annually.

Implementation – The manual was initially implemented during the previous permit term. Updates to the manual will be made on an annual basis, at a minimum.

BMP 5.2: MUNICIPAL EMPLOYEE TRAINING

Description – The city developed a program to train city employees who handle processes which may impact stormwater quality. The program identifies what processes have the potential to impact stormwater, identifies what employees should receive training, specifies what methods will be used to train them, and what forms and methods are used to certify that the training has been accomplished.

Frequency – The city will provide training on an annual basis and when employees are introduced to pertinent processes. Employee training will fall in December of each year of the permit.

Evaluation Criteria for Effectiveness – Copies of the completed program shall be recorded in the document file. The training completion documentation shall also be recorded in the document file. Instruction shall be provided to at least four (4) city staff annually.

Implementation – Training began during the previous permit term. Training of all municipal employees involved in pertinent processes is conducted once annually, at a minimum.

BMP 5.3: SEDIMENT TRAP PLANNING

Description – The city's storm sewer system was inspected and studied during the previous permit term to determine if it is discharging an excess sediment load that could be contributing stormwater pollutants. The system was reviewed to see if there are any locations that would be suitable for feasible sediment traps. Sediment loading will continue to be monitored, and if appropriate, the design, installation, and maintenance of sediment traps will be implemented.

Frequency –Visual inspection will occur annually in the month of December by trained city employees or contractors.

Evaluation Criteria for Effectiveness – Issue brief report updates and record with photos and other pertinent materials in the document file. Document and inspect 100% of sediment trap structures annually.

Implementation – The original study was conducted in August 2011. Since 2011 the site has been inspected, maintained, and reported on annually.

BMP 5.4: TRASH TRAP PLANNING

Description – The city's storm sewer system was inspected and studied during the previous permit term to determine if it is discharging an excess trash load that could be contributing stormwater pollutants. The system was reviewed to see if there are any locations that would be suitable for feasible trash traps. Trash loading will continue to be monitored, and if appropriate the design, installation, and maintenance of trash traps will be implemented.

Frequency – Visual inspection will occur annually in the month of December by trained city employees.

Evaluation Criteria for Effectiveness – Issue brief report updates and record with photos and other pertinent materials in the document file. Inspect 80% of trash traps annually.

Implementation – The original study was conducted in August 2011. Since 2011 the site has been inspected, maintained, and reported on annually.

BMP 5.5: DISPOSAL OF WASTE MATERIALS

Description – The city will review waste disposal procedures and processes for both municipal solid waste and hazardous materials. The city will ensure that all materials removed from the MS4 are disposed of in accordance with Chapters 330 and 335 of Title 30, Texas Administrative Code, as applicable. Compliance will be maintained by including 30 TAC requirements during municipal employee training as described in BMP 5.2.

Frequency – Monitoring of municipal solid waste and hazardous materials waste disposal procedures and processes will be undertaken on an ongoing basis and incorporated into the training program in accordance with the implementation schedule.

Evaluation Criteria for Effectiveness – Training completion documentation, which will include waste material disposal regulations, shall be recorded in the document file.

Implementation – Compliance monitoring by city public works supervision and municipal employee training is ongoing. Information on waste disposal was incorporated into municipal employee pollution prevention training during the previous permit period.

BMP 5.6: CONTRACTOR OVERSIGHT PROCEDURES

Description – Contractors hired by the city to perform maintenance activities on city-owned facilities will be contractually required to comply with all the stormwater control measures, good housekeeping practices, and facility-specific stormwater operating procedures described in Parts III.B.5.(2-6) of the General Permit. The city will provide oversight of contractor activities to ensure that they are using appropriate control measures and SOP's.

Frequency – Contractual obligations will be enforced on an ongoing basis to ensure compliance with stormwater control measures.

Evaluation Criteria for Effectiveness – Contractor oversight procedures, once completed, shall be recorded in the document file. Record 100% of projects annually.

Implementation – Contractor oversight procedures were developed in December 2015 and enforcement of contractual requirements have been implemented since.

BMP 5.7: INVENTORY OF FACILITIES AND STORMWATER CONTROLS

Description – The city maintains an inventory of facilities and stormwater controls that it owns and operates within the regulated area of the city's MS4. Where feasible, the inventory will include all applicable permit numbers, registration numbers, and/or authorizations for each facility or control. The inventory will be available for review by the TCEQ and will include, at a minimum, the following facilities and/or controls, as applicable:

1. Composting facilities;
2. Equipment storage and maintenance facilities;
3. Fuel storage facilities;
4. Hazardous waste disposal facilities;
5. Hazardous waste handling and transfer facilities;
6. Incinerators;
7. Landfills;
8. Materials storage yards;

9. Pesticide storage facilities;
10. Buildings, including schools, libraries, police stations, fire stations, and office buildings;
11. Parking lots;
12. Golf courses;
13. Swimming Pools;
14. Public works yards;
15. Recycling facilities;
16. Salt storage facilities;
17. Solid waste handling and transfer facilities;
18. Street repair and maintenance sites;
19. Vehicle storage and maintenance yards; and
20. Structural stormwater controls.

Frequency – An inventory of facilities and stormwater controls was implemented in the previous permit and will be updated as necessary, once annually in December at a minimum.

Evaluation Criteria for Effectiveness – At least 80% of inventory shall be inspected and recorded in the document file.

Implementation – An inventory was completed in December 2018. Inventory will be reviewed and inspected annually.

BMP 5.8: ASSESSMENT OF OPERATIONS AND MAINTENANCE ACTIVITIES

Description – The city will evaluate municipal operations and maintenance (O&M) activities for their potential to discharge pollutants in stormwater. The assessment will include (but not be limited to):

1. Road and parking lot maintenance, including pothole repair, pavement marking, sealing, and repaving;
2. Bridge maintenance including such areas as re-chipping, grinding, and saw cutting;
3. Cold weather operations including sanding, plowing, and application of deicing and anti-icing compounds, and maintenance of any snow disposal areas; and
4. Right-of-way maintenance including mowing, herbicide and pesticide application, and planting of vegetation;

The city will identify pollutants of concern that could be discharged from the above O&M activities (for example, metals; chlorides; hydrocarbons such as benzene; toluene; ethyl benzene; and xylenes; sediment; and trash). The city will develop and implement a set of pollution prevention measures that will reduce the discharge of pollutants in stormwater from the above activities, these pollution prevention measures may include the following:

1. Replacing materials and chemicals with more environmentally benign materials or methods;
2. Changing operations to minimize the exposure or mobilization of pollutants to prevent them from entering surface waters; and
3. Placing barriers around or conducting runoff away from chemical storage areas to prevent discharge into surface waters.

Frequency – Evaluation of operations and maintenance practices are conducted on an annual basis in the month of December.

Evaluation Criteria for Effectiveness – The controls or measures utilized in implementation will be inspected once annually, at a minimum, and records of the inspections will be kept in the documentation file. A report outlining inspection status and maintenance requirements will be provided to the public works director once on an annual basis.

Implementation – Evaluation was completed December 12, 2016. Pollution prevention measures were selected on December 12, 2017. Inspections will be conducted on an annual basis, at a minimum.

6

MINIMUM CONTROL MEASURE NO. 6:

Industrial Stormwater Sources

MINIMUM CONTROL MEASURE NO. 6:
INDUSTRIAL STORMWATER SOURCES

This MCM would require the city to identify and control pollutants in stormwater discharges to the MS4 from landfills; other treatment, storage, or disposal facilities for municipal waste (for example, transfer stations and incinerators); hazardous waste treatment, storage, disposal, and recovery facilities, and facilities that are subject to Emergency Planning and Community Right-to-Know Act (EPCRA) Title III, Section 313; and any other industrial or commercial discharge the city determines is contributing substantial pollutant loading to the MS4. The program would include priorities and procedures for inspections, and for implementing control measures for such discharges.

However, under the provisions of the permit, MCM6 applies only to level 4 MS4's. Level 4 MS4s serve a population of 100,000 or more; Hollywood Park has a population of 3,203, as of 2013.The city does not currently meet the population threshold requiring compliance with the MCM. Since the city is not presently required to comply with this MCM, no documentation will be required.

7

MINIMUM CONTROL MEASURE NO. 7:

Municipal Construction Activities

MINIMUM CONTROL MEASURE NO. 7:

AUTHORIZATION FOR CONSTRUCTION ACTIVITIES WHERE THE SMALL MS4 IS THE SITE OPERATOR

This MCM would establish a city procedure for permitting its own eligible municipal construction activities instead of the default requirement to obtain coverage under TPDES General Permit TXR150000. However, this MCM is optional and the city has elected not to use this MCM. The reason for non-implementation of this MCM is twofold. First, most of the city's projects are too small to require permitting under TPDES General Permit TXR150000. Second, most of the city's projects are performed by contractors who are hired by the city. Conformance to TPDES General Permit TXR150000 is routinely made part of the construction contract.

If the city elects to implement this MCM in the future, it will be authorized within the regulated area to discharge stormwater and certain non-stormwater from construction activities where the permittee can meet the definition of "construction site operator" as defined in the General Permit. A NOC would have to be submitted notifying the executive director of the change. If implemented, the MCM would have to include:

1. A description of how construction activities will generally be conducted by the permittee to take into consideration local conditions of weather, soils, and other site-specific considerations;
2. A description of the area that this MCM will address and where the permittee's construction activities are covered;
3. A general description of how a SWP3 shall be developed, according to part VI.E. of the general permit, for each construction site; and
4. A description of how the permittee will supervise or maintain oversight over contractor activities to ensure that the SWP3 requirements are properly implemented at the construction site, or a description of how the permittee will make certain that contractors have a separate authorization for stormwater discharges.

Since the city elects not to implement this MCM at this time, no documentation will be required.

8

COMPREHENSIVE SCHEDULE

9

RECEIVING WATERS

OF IMPAIRED QUALITY APPEARING ON THE CLEAN WATER ACT

The city has no receiving waters of impaired quality appearing on the latest EPA approved Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d) lists.

10

SUMMARY OF BEST MANAGEMENT PRACTICES

Summary of Best Management Practices

BMP	Activity	Target	Deadline
1.1 NOI and NOC Public Comment	Make SWMP available for public comment once in the permit cycle	Once every 5-year permit cycle	Anticipated March 2020
1.2 Recurring Public Comment	Provide opportunity for public comment regarding stormwater activities at least once annually during city council meetings	Annually	Dec-19
1.3 Brochures and Fact Sheets	Print two newsletter articles and display a poster in the City Hall twice a year	Twice Annually	Mar-19
1.4 State of Stormwater Pollution Prevention Address	Update City Manager and address City Council once per year	Annually	Jan-19
1.5 Public Service Announcement	Broadcast public service announcement daily (this is provided by SARA)	Daily	Jan-20
1.6 Drain Marking	Inspect 100% of storm drains for markers and maintenance once per year	Annually	Dec-19
1.7 Questionnaires	Distribute and review 100% of online questionnaires once every odd year	Every other year	Dec-19
2.1 Storm Sewer Map	Review and update storm sewer map once per year	Annually	Dec-19
2.2 Illicit Discharge Detection Plan	Maintain and review plan once annually, review inspection techniques, forms, and staff assignments	Annually	Dec-19
2.3 Illicit Discharge and Dumping Hotline	Maintain phone line, forms, procedures, and staffing for hotline. Record and report 100% of complaints annually.	Annually	Dec-19
2.4 Illicit Discharge Ordinance	Support and review ordinance enforcement annually, record 100% of violations	Annually	Dec-19
3.1 Technical Manual for Construction Runoff	Maintain and review manual and review with four (4) City staff once per year	Annually	Dec-19
3.2 Site Plan Review Program	Maintain program to review site plans and storm water pollution prevention plans for proposed Construction and record 100% of activities	Annually	Dec-19

3.3 Construction Site Inspection Program	Maintain program to review construction sites for erosion and other sources of storm water pollution. Record 100% of total site inspections.	Annually	Dec-19
3.4 Construction Runoff Hotline	Maintain phone line, forms, procedures, and staffing for hotline. Compile 100% of incoming calls at the end of the year.	Annually	Dec-19
3.5 Construction Stormwater Management Ordinance	Support and review ordinance enforcement and compile 100% of reports once per year	Annually	Dec-19
4.1 Technical Manual for Post-Construction Runoff	Maintain and review manual regarding post- construction runoff once a year	Annually	Dec-19
4.2 Site Plan Review Program for Post-Construction Runoff	Maintain review program for site plans, compile records once a year	Annually	Dec-19
4.3 Long-Term Inspection and Maintenance Plan for Post-Construction Runoff	Maintain program for post-construction stormwater control inspection, compile 100% of inspections once a year	Annually	Dec-19
4.4 Post-Construction Stormwater Management Ordinance Update	Record 100% of code enforcement violations and review actions once per year	Annually	Dec-19
5.1 Municipal Employee Pollution Prevention Manual	Maintain manual to help city employees protect storm water quality and review with four (4) employees once a year	Annually	Dec-19
5.2 Municipal Employee Training	Provide instruction to four (4) city employees on pollution prevention techniques during municipal operations once per year	Annually	Dec-19
5.3 Sediment Trap Planning	Maintain plan for design/maintenance of traps and inspect 100% of structures every year	Annually	Dec-19
5.4 Trash Trap Planning	Maintain plan for design/maintenance of traps and inspect 80% of traps per year	Annually	Dec-19
5.5 Disposal of Waste Materials	Review program procedures once a year	Annually	Dec-19
5.6 Contractor Oversight Procedures	Oversee contactors to prevent storm water pollution and record 100% of projects.	Annually	Dec-19

5.7 Inventory of Facilities and Stormwater Controls	Maintain complete inventory and review and update 80% of inventory once per year	Annually	Dec-19
5.8 Assessment of Operations and Maintenance Activities	Provide report to City Manager and Public Works Director once per year	Annually	Dec-19

11

DEFINITIONS AND ACRONYMS

The following explanations of stormwater management terminology are from the TCEQ's TPDES General Permit No. TXR040000.

DEFINITIONS

Arid Areas – Areas with an average annual rainfall of less than ten (10) inches.

Best Management Practices (BMPs) – Schedules of activities, prohibitions of practices, maintenance procedures, structural controls, local ordinances, and other management practices to prevent or reduce the discharge of pollutants. BMPs also include treatment requirements, operating procedures, and practices to control runoff, spills or leaks, waste disposal, or drainage from raw material storage areas.

Catch Basins – Storm drain inlets and curb inlets to the storm drain system. Catch basins typically include a grate or curb inlet that may accumulate sediment, debris, and other pollutants,

Classified Segment – refers to a water body that is listed and described in Appendix A or Appendix C of the Texas Surface Water Quality Standards, at 30 TAC §307.10.

Clean Water Act (CWA) – The Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972, Pub.L. 92-500, as amended Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483 and Pub. L. 97-117, 33 U.S.C. 1251 et,seq.

Common Plan of Development or Sale – A construction activity that is completed in separate stages, separate phases, or in combination with other construction activities. A common plan of development or sale is identified by the documentation for the construction project that identifies the scope of the project, and may include plats, blueprints, marketing plans, contracts, building permits, a public notice or hearing, zoning requests, or other similar documentation and activities.

Construction Activity – Soil disturbance, including clearing, grading, and excavating; and not including routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of the site (e.g., the routine grading of existing dirt roads, asphalt overlays of existing roads, the routine clearing of existing rights-of-way, and similar maintenance activities). Regulated construction activity is defined in terms of small and large construction activity.

Small Construction Activity is construction activity that results in land disturbance of equal to or greater than one (l) acre and less than five (5) acres of land. Small construction activity also includes the disturbance of less than one (1) ace of total land area that is part of a larger common plan of development or sale if the larger common plan will ultimately disturb equal to or greater than one (1) and less than five (5) acres of land.

Large Construction Activity is construction activity that results in land disturbance of equal to or greater than five (5) acres of land. Large construction activity also includes the disturbance of less than five (5) acres of total land area that is part of a larger common plan of development or sale if the larger common plan will ultimately disturb equal to or greater than five (5) acres of land.

Construction Site Operator – The person or persons associated with a small or large construction project that meets either of the following two criteria:

a. The entity or entities that have operational control over construction plans and specifications (including approval of revisions) to the extent necessary to meet the requirements and conditions of this general permit; or
b. The entity or entities that have day-to-day operational control of those activities at a construction site that are necessary to ensure compliance with a stormwater pollution prevention plan (SWP3) for the site or other permit conditions (e.g. they are authorized to direct workers at a site to carry out activities required by the Stormwater Pollution Prevention Plan or comply with other permit conditions).

Control Measure – Any BMP or other method used to prevent or reduce the discharge of pollutants to water in the state.

Conveyance – Curbs, gutters, man-made channels and ditches, drains, pipes, and other constructed features designed or used for flood control or to otherwise transport stormwater runoff.

Discharge – When used without a qualifier, refers to the discharge of stormwater runoff or certain non-stormwater discharges as allowed under the authorization of this general permit.

Edwards Aquifer – As defined in 30 TAC §213.3 (relating to the Edwards Aquifer), that portion of an arcuate belt of porous, water-bearing, predominantly carbonate rocks known as the Edwards and Associated Limestones in the Balcones Fault Zone trending from west to east to northeast in Kinney, Uvalde, Medina, Bexar, Comal, Hays, Travis, and Williamson Counties; and composed of the Salmon Peak Limestone, McKnight Formation, West Nueces Formation, Devil's River Limestone,

Person Formation, Rainer Formation, Edwards Formation, and Georgetown Formation. The permeable aquifer units generally overlie the less-permeable Glen Rose Formation to the south, overlie the less permeable Comanche Peak and Walnut Formations north of the Colorado River, and underlie the less-permeable Del Rio Clay regionally.

Edwards Aquifer Recharge Zone -- Generally, that area where the stratigraphic units constituting the Edwards Aquifer crop out, including the outcrops of other geologic formations in proximity to the Edwards Aquifer, where caves, sinkholes, faults, fractures, or other permeable features would create a potential for recharge of surface waters into the Edwards Aquifer. The recharge zone is identified as that area designated as such on official maps located in the offices of the TCEQ or the TCEQ website.

Final Stabilization – A construction site where either of the following conditions are met:

a. All soil disturbing activities at the site have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed,

b. For individual lots in a residential construction site by either:

    1. The homebuilder completing final stabilization as specified in condition (a) above; or

    2. The homebuilder establishing temporary stabilization for an individual lot prior to the time of transfer of the ownership of the home to the buyer and after informing the homeowner of the need for, and benefits of, final stabilization.

c. For construction activities on land used for agricultural purposes (e.g. pipelines across crop or range land), final stabilization may be accomplished by returning the disturbed land to its preconstruction agricultural use. Areas disturbed that were not previously used for agricultural activities, such as buffer strips immediately adjacent to a surface water and areas which are not being returned to their preconstruction agricultural use must meet the final stabilization conditions of condition (a) above.

d. In arid, semi-arid, and drought-stricken areas only, all soil -disturbing activities at the site have been completed and both of the following criteria have been met:

    1. Temporary erosion control measures (e.g., degradable rolled erosion control product) are selected, designed, and installed along with an appropriate seed base to provide erosion control for at least three years without active maintenance by the operator, and

2. The temporary erosion control measures are selected, designed, and installed to achieve 70 percent vegetative coverage within three years.

General Permit – A permit issued to authorize the discharge of waste into or adjacent to water in the state for one or more categories of waste discharge within a geographical area of the state or the entire state as provided by Texas Water Code (TWC) §26.040.

Groundwater Infiltration – For the purposes of this permit, groundwater that enters a municipal separate storm sewer system (including sewer service connections and foundation drains) through such means as defective pipes, pipe joints, connections, or manholes.

High Priority Facilities – High priority facilities are facilities with a high potential to generate stormwater pollutants. These facilities must include, at a minimum, the MS4 operator's maintenance yards, hazardous waste facilities, fuel storage locations, and other facilities where chemicals or other materials have a high potential to be discharged in stormwater. Among the factors that must be considered when giving a facility a high priority ranking are: the amount of urban pollutants stored at the site, the identification of improperly stored materials, activities that must not be performed outside (for example, changing automotive fluids, vehicle washing), proximity to waterbodies, proximity to sensitive aquifer recharge features, poor housekeeping practices, and discharges of pollutant(s) of concern to impaired water(s).

Hyperchlorinated Water – Water resulting from hyperchlorination of waterlines or vessels, with a chlorine concentration greater than 10 milligrams per liter (mg/L).

Illicit Connection – Any man-made conveyance connecting an illicit discharge directly to a municipal separate storm sewer.

Illicit Discharge – Any discharge to a municipal separate storm sewer that is not entirely composed of stormwater, except discharges pursuant to this general permit or a separate authorization and discharges resulting from emergency firefighting activities.

Impaired Water – A surface water body that is identified on the latest approved CWA §303(d) list as not meeting applicable state water quality standards. Impaired waters include waters with approved or established total maximum daily loads (TMDLs), and those where a TMDL has been proposed by TCEQ but has not yet been approved or established.

Indian Country – Defined in 18 USC Section (') 1151, means (a) all land within the limits of any Indian reservation under the jurisdiction of the United States Government, notwithstanding the issuance of any patent, and including rights-of-way running through the reservation; (b) all dependent Indian communities within the borders of the United States whether within the original or subsequently acquired territory thereof, and whether within or without the limits of a state, and (c) all Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same. This definition includes all land held in trust for an Indian tribe.

Indicator Pollutant -- An easily measured pollutant, that may or may not impact water quality that indicates the presence of other stormwater pollutants.

Industrial Activity – Any of the ten (10) categories of industrial activities included in the definition of "stormwater discharges associated with industry activity" as defined in 40 Code of Federal Regulations (CFR) §122.26(b)(14)(i)-(ix) and (xi).

Maximum Extent Practicable (MEP) – The technology-based discharge standard for municipal separate storm sewer systems (MS4s) to reduce pollutants in stormwater discharges that was established by CWA §402(p). A discussion of MEP as it applies to small MS4s is found at 40 CFR §122.34.

MS4 Operator – For this permit, the public entity or the entity contracted by the public entity, responsible for management and operation of the small municipal separate storm sewer system that is subject to the terms of this general permit.

Municipal Separate Storm Sewer System (MS4) – A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

a. Owned or operated by the U.S., a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to state law) having jurisdiction over the disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under state law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under the CWA §208 that discharges to surface water in the state;

b. That is designed or used for collecting or conveying stormwater;

c. That is not a combined sewer; and

d. That is not part of a publicly owned treatment works (POTW) as defined in 40 CFR §122.2.

Non-traditional Small MS4 – A small MS4 that often cannot pass ordinances and may not have the enforcement authority like a traditional small MS4 would have to enforce the stormwater management program. Examples of non-traditional small MS4s include counties, transportation authorities (including the Texas Department of Transportation), municipal utility districts, drainage districts, military bases, prisons and universities.

Notice of Change (NOC) – Written notification from the permittee to the executive director providing changes to information that was previously provided to the agency in a notice of intent.

Notice or Intent (NOI) – A written submission to the executive director from an applicant requesting coverage under this general permit.

Notice of Termination (NOT) – A written submission to the executive director from a permittee authorized under a general permit requesting termination of coverage under this general permit.

Outfall – A point source at the point where a small MS4 discharges to waters of the U.S. and does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels, or other conveyances that connect segments of the same stream or other waters of the U.S. and are used to convey waters of the U.S. For the purpose of this permit, sheet flow leaving a linear transportation system without channelization is not considered an outfall. Point sources such as curb cuts; traffic or right-of-way barriers with drainage slots that drain into open culverts, open swales or an adjacent property, or otherwise not actually discharging into waters of the U.S. are not considered an outfall.

Permittee – The MS4 operator authorized under this general permit.

Point Source – (from 40 CFR §122.22) any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural stormwater runoff.

Pollutant(s) of Concern – For the purpose of this permit, includes biochemical oxygen demand (BOD), sediment or a parameter that addresses sediment (such as total suspended solids (TSS), turbidity or siltation), pathogens, oil and grease, and any pollutant that has been identified as a

cause of impairment of any water body that will receive a discharge from an MS4. (Definition from 40 CFR §122.32(e)(3)).

Redevelopment – Alterations of a property that changed the "footprint" of a site or building in such a way that there is a disturbance of equal to or greater than one (1) acre of land. This term does not include such activities as exterior remodeling, routine maintenance activities, and linear utility installation.

Semiarid Areas -- Areas with an average annual rainfall of at least ten (10) inches, but less than 20 inches.

Small Municipal Separate Storm Sewer System (MS4) – A conveyance or system of conveyances (including roads with drainage systems, municipal streets catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

a. Owned or operated by the United States, a state, city, town, borough, county, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under CWA §208;
b. Designed or used for collecting or conveying stormwater;
c. Which is not a combined sewer;
d. Which is not part of a publicly owned treatment works (POTW) as defined at 40 CFR §122.2; and
e. Which was not previously regulated under a NPDES or TPDES individual permit as a medium or large municipal separate storm sewer system, as defined in 40 CFR §§122.26(b)(4) and (b)(7).

This term includes systems like separate storm sewer systems at military bases, large hospital or prison complexes, and highways and other thoroughfares. This term does not include separate storm sewers in very discrete areas, such as individual buildings. For the purpose of this permit, a very discrete system also includes storm drains associated with certain municipal offices and education facilities serving a nonresidential population, where those storm drains do not function as a system, and where the buildings are not physically interconnected to an MS4 that is also operated by that public entity.

Stormwater and Stormwater Runoff – Rainfall runoff, snow melt runoff, and surface runoff and drainage.

Stormwater Associated with Construction Activity – Stormwater runoff from an area where there is either a large construction activity or a small construction activity.

Stormwater Management Program (SWMP) – A comprehensive program to manage the quality of discharges from the municipal separate storm sewer system.

Structural Control (or Practice) – A pollution prevention practice that requires the construction of a devices or the use of a device, or the use of a device, to capture or prevent pollution in stormwater runoff. Structural controls and practices may include but are not limited to: wet ponds, bioretention, infiltration basins, stormwater wetlands, silt fences, earthen dikes, drainage swales, vegetative lined ditches, vegetative filter strips, sediment traps, check dams, subsurface drains, storm drain inlet protection, rock outlet protection, reinforced soil retaining systems, gabions, and temporary or permanent sediment basins.

Surface Water in the State – Lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, wetlands, marshes, inlets, canals, the Gulf of Mexico inside the territorial limits of the state (from the mean high water mark (MHWM) out 10.36 miles into the Gulf), and all other bodies of surface water, natural or artificial, inland or coastal fresh or salt, navigable or non-navigable, and including the beds and banks of all water-courses and bodies of surface water, that are wholly or partially inside or bordering the state or subject to the jurisdiction of the state; except that waters in treatment systems which are authorized by state or federal law, regulation, or permit, and which are created for the purpose of waste treatment are not considered to be water in the state.

Total Maximum Daily Load (TMDL) – The total amount of a substance that a water body can assimilate and still meet the Texas Surface Water Quality Standards.

Traditional Small MS4 – A small MS4 that can pass ordinances and have the enforcement authority to enforce the stormwater management program. An example of traditional MS4s includes cities.

Urbanized Area (UA) – An area of high population density that may include multiple MS4s as defined and used by the U.S. Census Bureau in the 2000 decennial census.

Waters of the United States – (from 40 CFR §122.2) Waters of the United States or waters of the U.S. means:

a. All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

b. All interstate waters, including interstate wetlands;

c. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds that the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:

    1. Which are or could be used by interstate or foreign travelers for recreational or other purposes;

    2. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

    3. Which are used or could be used for industrial purposes by industries in interstate commerce;

d. All impoundments of waters otherwise defined as waters of the United States under this definition;

e. Tributaries of waters identified in paragraphs (a) through (d) of this definition;

f. The territorial sea; and

g. Wetlands adjacent to waters (other than waters that are wetlands) identified in paragraphs (a) through (f) of this definition.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR § 423.11(m) which also meet the criteria of this definition) are not waters of the United States. This exclusion applies only to manmade bodies of water which neither were originally created in waters of the United States (such as disposal area in wetlands) nor resulted from the impoundment of waters of the United States. Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the CWA, the final authority regarding CWA jurisdiction remains with EPA.

BMP	Best Management Practice
CFR	Code of Federal Regulations
CGP	Construction General Permit, TXRI 50000
CWA	Clean Water Act
DMR	Discharge Monitoring Report
EPA	Environmental Protection Agency
FR	Federal Register
IP	Implementation Procedures
MCM	Minimum Control Measure
MSGP	Multi-sector General Permit, TXR050000
MS4	Municipal Separate Storm Sewer System
NOC	Notice of Change
NOD	Notice of Deficiency
NOI	Notice of Intent
NOT	Notice of Termination (to terminate coverage under a general permit)
NPDES	National Pollutant Discharge Elimination System
SWMP	Stormwater Management Program
SWP3, SW3P, SWPPP	Stormwater Pollution Prevention Plan
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TPDES	Texas Pollutant Discharge Elimination System
TWC	Texas Water Code

Appendix A – Illicit Discharge Detention & Elimination Plan

TOWN OF HOLLYWOOD PARK, TEXAS
ILLICIT DISCHARGE DETECTION & ELIMINATION PLAN

Introduction and Field Screening Efforts:

The Town of Hollywood Park identified all major storm sewer outfall points. This activity was completed to fulfill a portion of the Illicit Discharge Detection and Elimination requirement of the City's TPDES General Permit (No. TXR040000).

A coded map dividing the City into seven (7) Inspection Zones was developed showing the location of all outfalls and storm sewer inspection sites. This map was developed by Givler Engineering, Inc.

Schedule for On-Going Annual Inspections of Storm Water System:

The City's Storm Water Engineering Consultant and/or his employees or designees will inspect all of the inlets and outfalls serving the City for illicit discharges annually, according to the schedule below. This schedule reflects that inspections should ideally be conducted during dry weather, based on historic annual rainfall data. Inspection, remediation and maintenance records will be maintained by the Storm Water Engineering Consultant.

- Zone 1 – January and August
- Zone 2 & 3 – February and September
- Zone 4 & 5 – March and October
- Zone 6 – April and November
- Zone 7 – June and December

Authorized Enforcement Agency:

The City's *Storm Water Illicit Discharge Detection and Elimination Ordinance,* Ordinance designates the City Manager and all employees or designees of said Manager, including, but not limited to, the City Engineer, the City's Storm Water Engineering Consultant, Building Inspector and Director of Public Works, as the authorized enforcement agency.

Procedures for Responding to Known or Suspected Sanitary or Wastewater Illicit Discharges:

If dry weather field screening efforts reveal discharges with color, odor, turbidity, oil sheen, or surface scum, a field analysis shall be conducted that includes testing of the discharge for detergents and ammonia. This testing shall be completed to determine whether the flow is contaminated with sanitary or wastewater, and whether the source is tap water or a natural source of water.

The City will notify the Texas Commission on Environmental Quality (TCEQ), in accordance with Title 30 of the Texas Administrative Code, immediately upon discovering a spill or hazardous substance which may result in discharge of pollutants to waters of the state. The TCEQ can be notified by calling its environmental hotline at **1-888-777-3186**. The City will

cooperate with the TCEQ in efforts to investigate and prevent such discharges from polluting waters of the state.

TPDES STORM WATER PERMIT ILLICIT DISCHARGE RESPONSE PROCEDURES

1. Pollution Concern Hotline

The City's main telephone number shall also serve as a complaint hotline. Callers may use the hotline to make a discharge or pollutant complaint directed to the Director of Public Works so that citizens can easily report illicit discharge and pollution concerns. Calls will be taken on a daily basis and all concerns will be logged in on an Illicit Discharge Concern Inventory.

The City Manager or his/her designee will review the reported concerns within 48 hours of notification and direct the appropriate City staff to field investigate the concern. Initial field investigation will consist of visual inspection of the surface waters and storm sewer manholes for evidence of discharge in the highlighted area, and completing an Illicit Discharge Tracking Sheet. Results of this field investigation will be reported to the City Manager or his/her designee for further action.

2. Drainage Area Investigations

If the City Manager or his/her designee determines that there is reasonable evidence of an illicit discharge, the next step will be a drainage area investigation. This process can be performed by a number of City staff, such as the City Engineer, the City Storm Water Engineering consultant, Director of Public Works, or the Building Inspector. This investigation consists of a parcel by parcel analysis of potential generating sites within the drainage area of a problem outfall. Techniques used to investigate the drainage area include:

- Land Use Investigations
- SIC code review
- Building Permit review
- As-built construction plan review
- Property ownership research through County Tax Inquiry

The results of the drainage area investigation will be reported to the City Manager or his/her designee and it will be determined whether Storm Drain Network Investigations are necessary or if the City can proceed directly to On-Site Discharge Investigations.

3. Storm Drain Network Investigations

When a drainage area is identified, storm drain investigations can narrow the source of a discharge problem to a single segment of a storm sewer. The investigation should start at the outfall and work progressively up the trunk sewer. If necessary, the City Engineer will coordinate with the City's Storm Water Engineering consultant and any outside contractors, to perform the following tasks:

- Smoke Testing
- Video Taping
- Dye Testing
- Water Sampling

The results of the Storm Drain Network Investigation will be reported to the City Manager or his/her designee and it will be determined whether On-Site Discharge Investigations will be necessary.

4. On-Site Discharge Investigations

Once the illicit discharge has been isolated to a specific section of storm sewer, an on-site investigation can be performed. On-site investigations will typically be performed by observation and water sampling and/or dye testing the plumbing systems of households and buildings. The Storm Water Engineering consultant and/or his/her employees or designees shall perform the on-site investigations and report findings to the City Engineer for enforcement action.

5. Correction and Enforcement

Whenever the City finds a person has violated a prohibition or failed to meet a requirement of the City's Illicit Discharge Detection and Elimination Ordinance as determined through the procedures above, the City may order compliance by written notice of violation to the responsible person. Such notice may require without limitation the actions listed in the City's Illicit Discharge Ordinance.

Town of Hollywood Park Contacts for Illicit Discharge Issues:

Illicit Discharge Hotline (Fire Marshall)
(210) 494-2023 Ext. 232

Appendix B – Permanent Pollution Abatement Measures

THE TOWN OF HOLLYWOOD PARK
STORMWATER MANAGEMENT

MUNICIPAL EMPLOYEE POLLUTION PREVENTION HANDBOOK

Prepared for: The Town of Hollywood Park, Texas

By:

GIVLER ENGINEERING, INC.
1901 NW Military Hwy, Ste. 201
San Antonio, Texas 78213
(210) 342-3991

Contents

Executive Summary

The purpose of this manual is to provide assistance to municipal employees that work in cities subject to stormwater permitting requirements. The Phase II Pollution Prevention/Good Housekeeping Minimum Control Measure (MCM) requires municipalities to train employees about pollution prevention practices. Municipal employees using this manual will receive an introduction to Pollution Prevention/Good Housekeeping, learn how to begin and maintain a pollution prevention program at their facility, and receive guidance on a series of Good Housekeeping Practices (GHPs) and Best Management Practices (BMPs). A total of 14 GHPs/BMPs are included in this manual. Each practice includes a description, cost information, measurable goals (which are required for each Phase II MCM), and other information that municipal employees should know when applying these practices in their work.

We appreciate your consideration of this training manual to help your jurisdiction fulfill its stormwater permitting requirements. If you have any questions or would like additional Pollution Prevention/Good Housekeeping information, please feel free to contact the City Engineer by calling (210) 342-3991 x203.

Introduction

The U.S. EPA requires Phase II municipalities to implement six Minimum Control Measures (MCMs):

1. Public Education and Outreach
2. Public Participation/Involvement
3. Illicit Discharge Detection and Elimination
4. Construction Site Runoff Control
5. Post-Construction Runoff Control
6. Pollution Prevention/Good Housekeeping

The sixth measure, Pollution Prevention/Good Housekeeping, has three components:

- An operations and maintenance program designed to prevent or reduce stormwater runoff from municipal facilities and operations.
- A training program for municipal employees.
- Measurable goals with Best Management Practices (BMPs) to meet them. Measurable goals are expectations set by each municipality to help measure their progress and determine compliance of their stormwater program. (Office of Water 9)

Non-structural Pollution Prevention/Good Housekeeping techniques are typically called Good Housekeeping Practices (GHPs). This manual provides municipal employees with the information for common GHPs and BMPs. Each practice outlined in this manual is a way to reduce or eliminate stormwater pollution. This manual should be used only for guidance and can be tailored to your jurisdiction's regulations, resolutions, or ordinances.

Common Stormwater Pollutants

Figure 1: Examples of common stormwater pollutants. (Clockwise: Moderate Resolution Imaging Spectroradiometer. 2001. National Aeronautics and Space Administration (NASA). http://en.wikipedia.org/wiki/File: Mississippi_River_Delta_and_Sediment_Plume.jpg (accessed April 5, 2010); Gapinksi, Spencer, Orantes, Laura, Mentzel, Emily, and Gillaspie, Yoshi. 2002. Cadmium. ROCK. http://drake.marin.k12.ca.us/stuwork/ROCKwater/ hev%20met/hevmet.html (accessed February 1, 2010); Office of Water. 1995. U.S. EPA. http://www.epa.gov/nps/ toolbox/print/psatlawn.pdf (accessed May 7, 2010); Greater Washington. Photo gallery. http://www. trashfreeanacostia.http://www.trashfreeanacostia.com/index.cgi?page=images (accessed May 6, 2010); Jastremski, Michael. Leaves in puddle. http://openphoto.net/gallery/image.html?image_id=5463 (accessed April 5, 2010); Warren County Public Service Project Group. 2007. Vehicle maintenance. Institute of Environmental Sciences.)

Sediments are often neglected as a stormwater pollutant. Sediments, particularly from industrial and agricultural areas, may contain heavy metals, toxic residues, or bacteria. Metals and toxins accumulate in fish and harm aquatic life. Sediments also cause cloudiness (known as turbidity), which impair fish respiration and reduce light penetration affecting productivity. Large amounts of sediment reduce water depth limiting the area for wildlife to inhabit (Krantz and Kifferstein).

There are numerous heavy metals that are found in stormwater including mercury, arsenic copper, zinc, iron, and aluminum. Often these enter streams via sediments from street runoff because of vehicles. Fish that accumulate heavy metals pass on the metals to organisms that eat them causing fish consumption advisories for humans.

Nutrients are a significant source of stormwater pollution. Nutrients include phosphorus, nitrogen, potassium, and other chemicals found in fertilizers. Over-fertilizing lawns allows nutrients not used by grass or plants to wash into storm drains. Excess nutrients cause eutrophication to occur, which means the water body produces more plant-life than needed.

Algae are a sign of eutrophication that leads to odors and fish kills. A type of blue-green algae, known as cyanobacteria, is very harmful to human health.
Road salt is applied in winter to melt snow and ice so it is safe to drive. In the spring when snow melts completely, road salt gets transported to streams. Excess chlorine in streams increases conductivity and harms fish and vegetation. There are other options for road salt with environmental benefits, but they can be more expensive. As a result, pollution from road salt is a very difficult problem to correct.

Oil in streams is usually the result of improper disposal of oils during vehicle maintenance or oil leaks from vehicles. Oil is easily noticed because of the sheen it produces on the surface of pools in streams.

Trash in streams can be harmful, but it is more of a concern to aesthetics. Trash often contains all of the aforementioned pollutants. Plastic, glass, and aluminum cans that are dumped in streams could be recycled.

Common Stormwater Polluting Activities

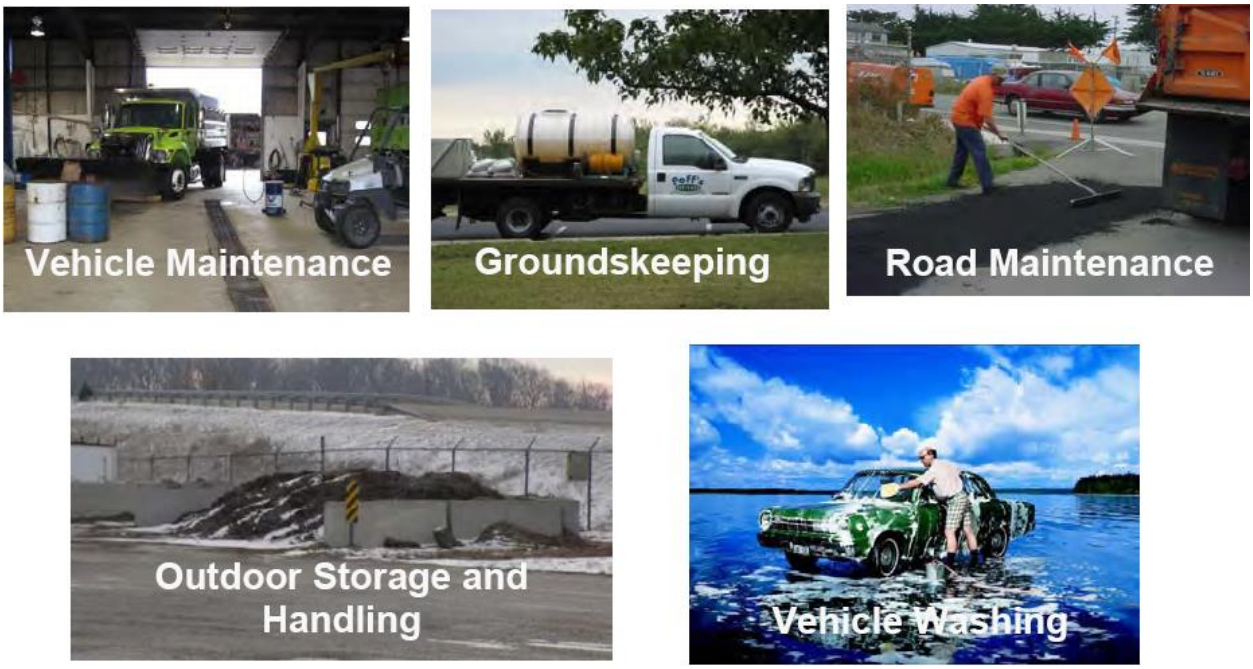


Figure 2: Examples of common stormwater polluting activities. Most municipalities perform these tasks on a regular basis and it is important that employees use pollution prevention techniques to reduce the negative environmental impacts. (Clockwise: Warren County Public Service Project Group. 2007. Institute of Environmental Sciences (2 photos); San Mateo County Public Works. Patching. http://www.co.sanmateo.ca.us/vgn/images/portal/cit_611/57/51/733396478Patching.JPG; Office of Water. 1995. U.S. EPA. http://www.epa.gov/nps/toolbox/print/psatautowash.pdf (accessed May 6, 2010); Hensley, Ann-Drea. 2010. Outdoor storage pile. Toledo Metropolitan Area Council of Governments)

Effects of Stormwater Pollution

Figure 3: Stormwater pollution has several negative effects for jurisdictions. Pollution can reduce residents' ability to use the stream for fishing or recreation due to health concerns. Odors from algal blooms and brown, murky water due to excess sediment are other unappealing effects of pollution. (Clockwise: Jones, Adrian. 2003. Fish kill in Choptank River. IAN Image and Video Library. http://ian.umces.edu/imagelibrary/displayimage-topn-12-58.html (accessed May 11, 2010); Andrews, Felix. 2005. Algal bloom in a village river. http://en.wikipedia.org/wiki/File:River_algae_Sichuan.jpg (accessed April 5, 2010); Helbig, Jörg. 1991. Whitewater kayaking. http://en.wikipedia.org/wiki/File:Whitewater_kayaking_Isere.jpg (accessed April 5, 2010); Redlands597198. 1991. No swimming sign. http://commons.wikimedia.org/wiki/File:Gosford_sign_no_swimming.jpg (accessed April 5, 2010).)

Hazardous Materials Storage & Handling

Figure 4: Danger: Chemical Storage sign. "Warning" or "Danger" signs notifying employees of hazardous chemicals decrease the risk of spills because employees are reminded to take extra care when working in the area. (Warren Co. Public Service Project Group-2007. Institute of Env. Sciences.)

Hazardous materials not only pose a risk to streams, but are dangerous to human beings. Storing materials properly, especially hazardous materials, is a very useful way to protect stormwater and those who work in municipal facilities. Proper storage prevents spills or at least contains any spills that may occur.

Proper storage:

- Provides sufficient aisle space, in a low traffic area.
- Uses secondary containment:
  - Containment pallets.
  - Concrete wall barriers sized slightly larger than the maximum storage capacity of the primary container.
  - Safety storage containers (when materials are safe to store this way).
  - Bins.

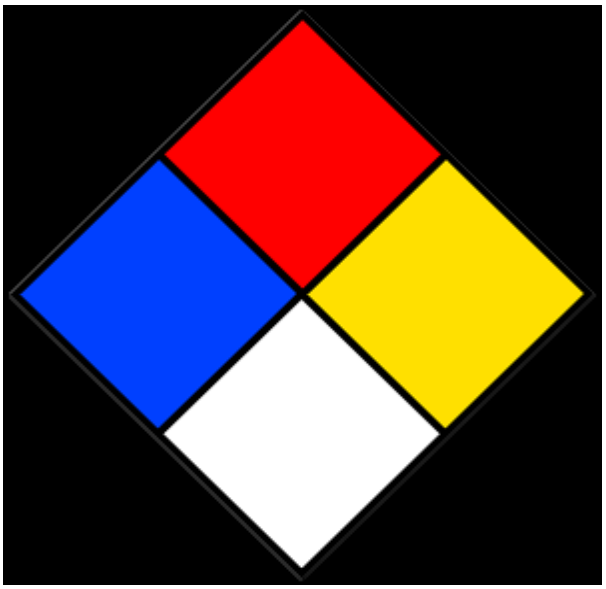


Figure 5: NFPA Diamond Rating System. The diamond rating system called the National Fire Protection Association 704 is one of several chemical labeling systems (National Fire Protection Association 2010). Each colored diamond represents a different category of danger on a scale from 0 to 4 with 4 being a severe hazard. Blue = Health. Red = Flammability. Yellow = Instability. White = Special hazards. It is useful for alerting fire fighters as it assumes fire is present for the scale. (Denelson83. 2006. NFPA 704. http://en.wikipedia.org/wiki/File:NFPA_704.svg.)

- Has adequate signage:
  - Labeled with common and chemical name.
  - Date opened or stored.
  - Pen markings showing how much of the material has been used.
  - National Fire Protection Association (NFPA) hazard identification system (four diamond rating) (National Fire Protection Association 2010).
- Does not rely on unstable stacking or weak shelves.

(Georgia Department of Community Affairs; Office of Water 5)

Figure 6: The Hazardous Material Identification System. The Hazardous Material Identification System uses the same color scheme, but the rating scale can be different even for the same chemical. (Tylermenezes. 2008. HMIS color bar.http://en.wikipedia.org/wiki/

Limitations

The type of material being stored will affect what secondary containment you should choose. Even materials in secondary containment systems can leak and should be inspected regularly. Fire and building codes must be observed in all storage areas (Georgia Department of Community Affairs).

Costs

Temporary containment methods (containment pallets or bins) are typically far cheaper than the cost of clean-up of hazardous materials, but initial costs can be moderate to high (Glover et. al 2008). Permanent containment methods (concrete overflow containment) typically cost more than temporary methods due to the amount of concrete needed.

Examples of Measurable Goals

- Inspect for leaks and log all findings for facilities at least once a week (or more where required).
- Purchase secondary containment for every storage unit at each facility within a set time frame.
- Reduce the number of spills by a certain amount over time.

Illicit Discharge & Illegal Dumping Control

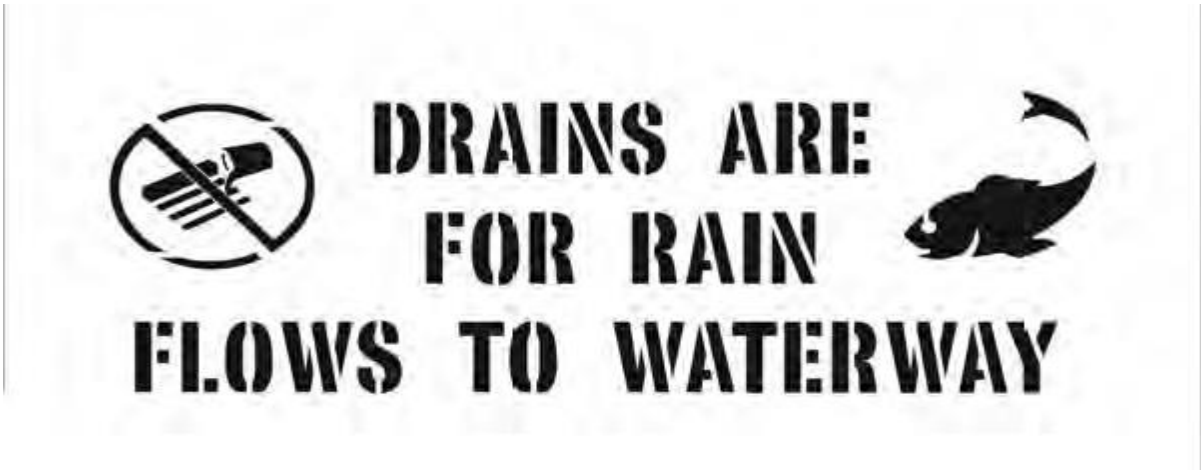


Figure 7: Example of a storm drain stencil. These stencils are painted near storm drains to remind residents not to dump into the drain. (Partners for Clean Streams. 2010. Storm drain stencil)

Illegal dumping control is necessary to help reduce the number of pollutants entering the storm drains, where only stormwater is supposed to go. While illegal dumping is addressed under the third minimum control measure, Illicit Discharge Detection and Elimination (IDDE), municipal employees can approach IDDE during the course of their Pollution Prevention/Good House-keeping Activities. Involving the public in clean-up or watching for illegal dumping can help fulfill the Public Participation/Involvement measure as well. Jurisdictions should offer a way to report illegal dumping from residents, such as a hotline, website, or e-mail address.

Public Works employees can look for signs of pollution or dumping during maintenance. **If any spills or dumping into storm drains or streams is apparent, notify your supervisor or stormwater "point-person" contact.** Municipalities should increase awareness of stormwater issues by posting signage near high risk storm drains.

As a municipal employee, you should look for:

- If "No Dumping" signs are present.
- Signs, stickers, or markings informing people not to dump into storm drains.
- Trash or debris near storm drain inlets or on roads/roadsides.
- Staining, such as from paints or fluids, leading into a storm drain.
- Suspicious activities near storm drain inlets.
- Unusual odors or colored water.

Limitations

Illegal dumping regulations need to be enforceable to have any chance of curbing behavior (Waste, Pesticides, and Toxics Division 1998), but often the person or people responsible for the dumping are not apparent. Logging locations and an estimated time frame of illegal dumping can help curb repeat dumpers. Reports from residents about illegal dumping may be unreliable.

Costs

There is a minimal cost consideration for monitoring illegal dumping as it is easily combined with other measures or the typical duties of certain municipal employees (e.g. road maintenance employees). Clean-up costs can be significant, but labor costs can be reduced by requesting volunteers from the community to clean up non-hazardous materials, such as trash (Georgia Department of Community Affairs).

Examples of Measurable Goals

- Reduce illegal dumping by a certain percentage.
- Post "No Dumping" signs/stickers near all environmentally sensitive areas.

Additional Issues

Often, illegal dumping is a result of residents' inability to recycle or dispose of materials cheaply (Waste Pesticides and Toxics Division 1998). Consider implementing programs at low or no cost to residents who want to dispose of materials. As with other best management practices, clean-up of improperly disposed materials will frequently cost more than proper disposal.

"No dumping" storm drain stencils can help fulfill your Public Participation/Involvement requirements if you use the public in a program. Youth groups and volunteers in the area can be trained to apply stencils at a low cost to jurisdictions; youth groups/volunteers are unpaid and training is minimal.

Figure 8: Applying a storm drain stencil. Girl Scouts in the Toledo, Ohio area applying a storm drain stencil near a storm drain grate. Stencils are applied facing either the street or the sidewalk so that motorists or those using the sidewalks can read the message. (Blair, Cherie. 2010. Global Youth Services Day storm drain stenciling project. Partners for Clean Streas.)

Integrated Pest Control

Integrated pest control (IPC) uses several techniques to remove unwanted pests on lawns and landscapes rather than the traditional use of pesticides, which can be harmful to aquatic life, even in small amounts (Pesticides: Topical and Chemical Factsheets). Insecticides (pesticides that kill insects) often remove beneficial insects along with harmful ones. Integrated pest control reduces the need for harmful pesticides in turn reducing the chance these chemicals end up in waterways.

Figure 9: An adult convergent lady beetle. Convergent lady beetles are an example of a beneficial insect. (Wsiegmund. 2006.)

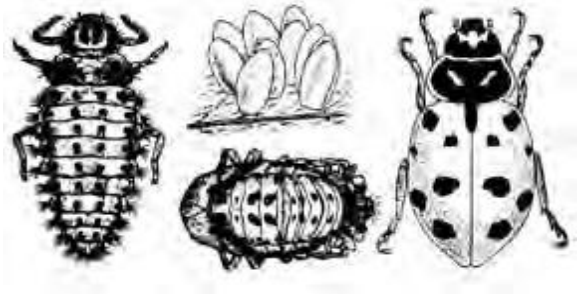


Figure 10: Life cycle of the lady beetle. (Lyon, William F. Horticulture and crop science. http:// ohioline.osu.edu//hyg-fact/2000/2002.html.

Follow the four-tiered approach:

- **Monitor pests:** Many types of weeds and insects/organisms are noxious or harmful, but some are actually beneficial to landscapes. Groundskeepers should know which organisms are pests and which are helpful prior to acting to remove them. *Removing helpful insects or plants may disrupt the balance and lead to more harmful pests or damage to plants*.
- **Set action thresholds:** Once pests have been identified, lower levels of pests may be acceptable, but higher levels may not be. Determine the level of pests that will cause economic or environmental damage to the landscape. Control the pests only after the threshold is reached.
- **Prevent:** Preventing pests in the first place is often more cost-effective than attempting to control them. It may be necessary to remove plants that draw harmful insects or remove sources of food and nutrients, including shallow pools of water or reducing the amount of fertilizers used.

Figure 11: A gypsy moth caterpillar. Gypsy moths are an example of a harmful insect that will strip trees and plants. (SB Johnny. 2004. Fifth instar larva of gypsy moth *Lymantria dispar* (L.). http://en.wikipedia.org/wiki/File:Gypsy_th_larva.jpg)

- **Control:** IPC promotes control measures where abundant pesticide use is a "last resort." Mechanical removal activities, such as trapping or weeding, should be attempted prior to spraying. Sprays should be made of natural or pheromone-specific compounds before using synthetic chemicals (for a list of organic pesticides, see *An Overview of Some Common Organic Garden Pesticides*, Iannotti). If all natural methods fail, synthetic pesticides and herbicides should be limited only to the area where pests are present or where they may spread. Spraying chemicals not targeted to the specific pest(s) may kill beneficial plants or insects and cause more harm than good. These chemicals will often end up in storm drains as well. (Adapted from the Pesticides: Topical and Chemical Factsheets, U.S. EPA)

Figure 12: Mulch. Mulch is useful to keep weeds from growing around plants and flowers. (Red58Bill. 2009. Spring daffodils in fresh shredded mulch.)

Costs

Costs may be reduced because of the lessened need for pesticides. At first, groundskeeping employees may require additional work hours to implement these practices. Once IPM is established, maintenance costs should be similar to that of conventional duties.

Examples of Measurable Goals

- Reduce the amount of pesticides found in streams by a set percentage over time.
- Reduce pesticide purchases/use by a set percentage.

Landscaping & Lawn Care

Landscaping and lawn care practices have a significant impact on stormwater runoff. Conventional lawn care practices often include watering too frequently, over-fertilizing, and the use pesticides/herbicides to rid lawns of unwanted pests and nuisance or invasive plants. Excess nutrients and pesticides wash away during rain events or when lawns are over-watered (Stormwater Coalition 2008). The stormwater management approach to lawn care uses a variety of techniques to reduce pollution in stormwater runoff from lawns.

Figure 13: The Texas Mountain Laurel Sophora secundiflora, is an example of a native flowering shrub. Native plants and shrubs are suited to the climate of South Central Texas and have deeper root systems than non-native plants. (Gordy-Stith, Bo. 2007. Marsh blue violet (Viola cuculatta). http://en.wikipedia.org/wiki/File:Viola_cucullata.jpg)

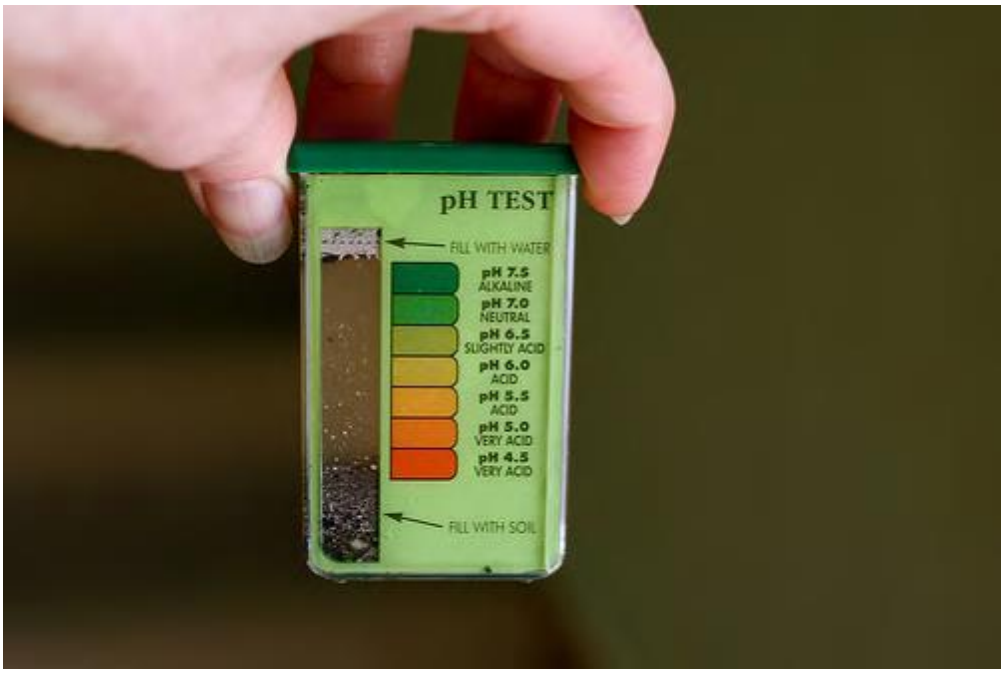


Figure 14: A pH soil test. Soil tests are critical to lawn care because plants grow best in the proper pH and nutrient levels. Often jurisdictions will apply more fertilizer than is actually needed, resulting in excess nutrients instreams. (Chiot's Run. 2009. pH test of soil in flower beds. http://www.flickr.com/photos/chiotsrun/3459134327)

The recommended practices for stormwater-friendly lawn care include:

- Choose native plants. Native plants have deeper, thicker root systems than grass and are acclimated to our climate in South Central Texas.
- Test soils. Soils often have the correct amount of nutrients and pH without needing more fertilizer (Novotney and Winer 2008). If fertilizer is needed, only use enough to correct nutrient deficiencies.
- Mixing compost with soil during planting.
- Limit grass areas in favor of natural landscaping or pervious surfaces.
- Install water bags on trees and using rain from rain barrels to water lawns (Glover et. al 2008).
- Lay mulch at least three inches thick. This keeps soil moist, prevents weeds, and prevents soil erosion.
- Regular maintenance.
- Use organic alternatives when fertilizers (e.g. compost, plant rotation) or pesticides (i.e. spraying soap or jalapeno water on plants) are necessary.
- Fertilizers should not be used within 5 feet of pavement, within 25 feet of catch basins, and within 50 feet of a stream (Novotney and Winer 2008).

Limitations

Lawns with reduced turf/grass often appear "wild" if they are not properly maintained or the

public is not aware of the management practice in place (i.e. native prairie grass). Public education about the benefits of less fertilizer and pesticides and the ability to maintain a green lawn without them are critical to the success of this management practice (for a printable newsletter, see Appendix C *Fertilize Your Lawn if You Must, But Don't Fertilize the Water*, TMACOG). Safety, especially if trees or shrubs are near roadways, as well as pest control should be considered.

Costs

Limiting the use of chemicals can reduce costs, but alternatives can be more expensive than traditional lawn care products. Homemade products like compost from food waste or mild dish soap are an inexpensive alternative to conventional fertilizer and pest control methods. Many municipalities have the ability to compost.

Educational materials for residents would include the flyers and work hours to distribute them. At around 10 cents for a sheet of three, door hangers are an inexpensive way to educate residents and can be distributed by volunteers (Partners for Clean Streams). Note: Flyers should never be distributed into mailboxes.

Necessary Equipment

Composters may be needed if cheap compost is not available or cannot be made. Grass clippings, leaves, and other plant matter can be put into composters along with food waste to produce compost onsite (Novotney and Winer 2008). Organic alternatives can be used in place of chemical fertilizers/pesticides, but may require additional equipment to use.

Examples of Measurable Goals

- Replace all chemical fertilizers and pesticides with organic alternatives.
- Purchase and distribute informational flyers to all residents in sensitive areas about stormwater friendly lawn care.
- Use tree watering bags on all young trees.
- Install compost bins at all municipal facilities.

Materials Management

Figure 15: A closed dumpster. Dumpster lids should be closed when not in use. (Hensley, Ann-Drea. 2010. GHP images at Northwest Ohio facilities. Toledo Metropolitan Area Council of Governments.)

Materials management is the way chemicals, products, or other materials are chosen, purchased, stored, handled, used, and eventually disposed of. Stormwater is at a major risk of contamination from improper materials management techniques, especially during outdoor activities.

Proper storage includes:

- Labeling;
- Indoor storage where possible;
- Secondary containment–containment pallets, outer storage units, overflow barriers; and
- Hazardous materials labeling.

Proper handling and use tips:

- Do not overload pallets or handling equipment.
- Get help to carry large objects. Do not strain yourself to carry something.
- Close materials when not in use.
- Document how much product was used to help identify leaks.

Figure 16: Organizing inventory supplies will help reduce wastefulness and keep the work-place free of clutter, making it less likely for spills to occur. (Warren County Public Service Project Group. 2007. Institute of Environmental Sciences.)

Proper disposal tips:

- Never dispose of products into storm drains.
- Label waste containers properly to avoid contamination with recycling bins.
- Dumpsters should have closed lids and should not be overfilled.
- Recycle products when you can. Ohio EPA maintains a list of vendors that offer recycling (for full list of vendors, see OEPA Recyclers and Environmental Vendors).

Table 1: Traditional and alternative products: Products that have safer alternatives, produce less waste, or are less likely to cause spills.

Traditional Product	**Alternative Product**
Aerosols	Pump-type or non-aerosol product
Art supplies	Water-based paints/inks that do not contain metals or toxics
Batteries	Rechargeable batteries
Chemical fertilizers	Compost or limited amounts of manure
Cleaning products	GreenSeal™ products
Gasoline	Electric vehicles, such as golf carts, for onsite travel
Motor oil	Re-refined oil
Pesticides	Use plants that keep pests away naturally; use integrated pest management (see section titled "Integrated Pest Control")

Adapted from *Water resources: A Toolkit for Local Governments*. Georgia Department of Community Affairs.

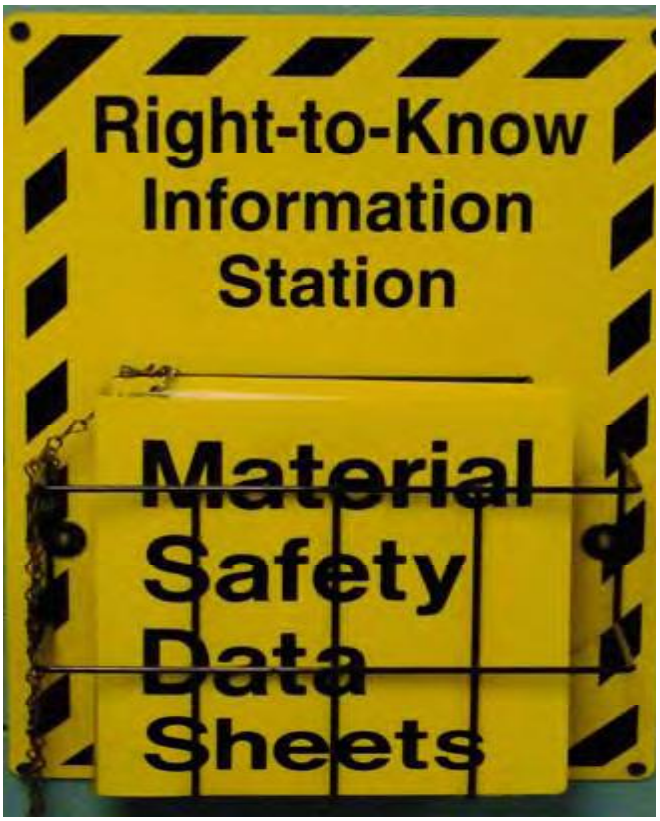


Figure 17: Materials Safety Data Sheet (MSDS) books. The MSDS information should be available to all employees. Routine review (as determined by your jurisdiction and OSHA rules) of MSDS information by the point-person should be per-formed. Any chemicals that could get into stormwater should be noted and caution taken when used. (See resource 12)

Limitations

Proper materials management should always be implemented, but some management practices are more expensive or easier to use than others. Alternative products are not always available or as effective in all situations (Georgia Department of Community Affairs).

Costs

Staff training on proper practices is the primary cost (Georgia Department of Community Affairs), but the practices themselves can be easily integrated into municipal activities. They often make work more efficient because products are easier to identify and are stored for accessibility. *Fewer spills and accidents mean fewer injuries for employees and a safer working environment.* Alternative products may increase costs, but these costs are often offset by reduced disposal fees because they are not hazardous and lower clean-up costs in the event of a spill. Lucas and Wood County Solid Waste Districts offer education programs on waste disposal to communities within their counties.

Examples of Measurable Goals

- Provide secondary containment for all materials stored on the site.
- Hold a certain number of training sessions for employees each year and provide posters or flyers on materials management in municipal buildings.
- Replace all hazardous cleaning products by a certain date.

Pet Waste Collection

Figure 18: A pet waste collection station. Pet waste stations are essential at all parks where dogs are allowed. These stations provide waste bags and remind park patrons to pick up their pet's waste. (Warren County Public Service Project. 2007. Institute of Environmental Sciences.)

Pet waste can be a huge problem for stormwater in public parks and in residential areas. When park patrons or residents walk their dogs, only around 60% of people pick up the waste (Georgia Department of Community Affairs, Stormwater Coalition 2008). Pet waste collection stations at parks provide collection bags (and sometimes disposable gloves) to encourage pet owners to clean up pet waste on their walks as well as a place to drop off the waste. This reduces the tendency for park patrons to leave the waste where it is made. Factsheets, such as TMACOG Stormwater Coalition's *Don't Let Your Pet Pollute*, provide residents with information about the proper disposal of pet waste in their own yards (Stormwater Coalition 2008).

Limitations

- Pet waste collection stations do not guarantee patrons will use them and only prevent pet waste near where they are placed (Glover et al., Georgia Dept. of Comm. Affairs).
- There must be enough collection stations that are optimally located where most of the park patrons travel or near sensitive areas.
- Directions must be provided on the collection stations for park patrons who may not know how to use them.
- Stations need to be cleaned frequently by staff to avoid filling and ensure proper bag stocking, which can be difficult for parks that receive little maintenance.

Table 2: Reasons for and against picking up pet waste: Pet owners have numerous reasons why they do not pick up waste, but there are also many important reasons to do so.

Reasons For Not Picking Up Waste	**Reasons For Picking Waste Up**
Because it eventually goes away	It's the law
Too much work	Environmental reasons
Use as fertilizer	Hygiene/health reasons
It is in my yard	Neighborhood courtesy
It is in the woods	Keep the yard clean
Not prepared (with refuse bags)	It's the right thing to do
Small dog, small waste	
Sanitary reasons	
Own a cat or other kind of pet	
No reason/Just because	

Costs

Pet waste collection units cost anywhere from $60-400 depending on the model and features. Bags can be purchased in bulk at a price of 5-20 cents per bag (Washington State Department of Ecology). Labor costs should be factored in if there is no permanent staff to install or clean the collection units.

Examples of Measurable Goals

- Install pet waste collection units in all public parks by a set year.
- Collect a set amount of pet waste at parks.
- Reduce coliform bacteria in streams by a set percentage through pet collection stands and public education efforts.

Additional Issues

- Pet waste stations can display additional signage about the Dos and Don'ts of walking pets in the park.
- Proper kitty litter disposal should be included in any factsheets or information distributed to residents.
- Pet waste clean-up may be outsourced to other companies. However, this is a very costly approach.

Equipment & Vehicle Maintenance

Figure 19: Parts washer in a vehicle maintenance facility. A parts washer should be used to clean parts that have oil or solvents on them. (Hensley, Ann-Drea. 2010. GHP images at Northwest Ohio facilities.

Proper vehicle maintenance includes:

- Performing maintenance activities indoors.
- Limiting washing in maintenance bays and never washing maintenance bay floors with doors open.
- Disposing of waste materials (antifreeze, solvents, batteries, fuels, lubricants, etc.) or parts properly.
- Recycling spent fluids (such as motor oil) where possible.
- Fueling vehicles away from catch basins and streams.
- Keeping spill clean-up materials easy to access.
- Regularly inspecting on-site vehicles for leaks.

(Glover et. al 2008; Georgia Department of Community Affairs; Kentucky Transportation Cabinet)

Limitations

- Replacing maintenance area drains that connect to storm drains with those that connect to sanitary sewers may not be economically feasible. If drains are not connected to sanitary sewers, they should be plugged.
- Drip pans or wet/dry vacuums will be required to collect fluids.
- Recycling of spent fluids may not be possible if the facility cannot use them on-site.
- Spent fluids should be treated as solid waste if they are not recycled on-site or collected by licensed EPA haulers for proper disposal (Div of Haz Waste Mgt 2006).
- Materials cannot be sold to a third party unless the municipality is classified as a Marketer and follows specific requirements (Div. of Haz. Waste Management 2006).

Costs

Recycling materials may cost more than disposing them with the proper agency. Additional practices that are not currently being used may add costs to vehicle maintenance operations. Overall, Good Housekeeping Practices (GHPs) should not add significant costs to maintenance facilities if incorporated in the regular routines (Georgia Department of Community Affairs).

Necessary Equipment

Clean-up equipment and proper waste storage containers are needed. Waste clean-up equipment includes:

- Absorbents for wet spills and corrosive materials,
- Brooms and dust pans/shovels for dry spills, and
- Dumpsters or waste containers with closeable lids.

Examples of Measurable Goals

- Install a certain number of used motor oil heaters for winter to use spent motor oil.
- Achieve a set percentage reduction in solvents use.
- Hold one complete site inspection each month.

Streets, Roads & Bridge Maintenance

Existing roads and bridges require periodic maintenance. These maintenance activities often generate stormwater pollutants such as heavy metals, sediments, solvents, oils, and fuels.

Pollution Prevention Tips for Road and Bridge Maintenance Activities:

- Always sweep or vacuum dry material wastes during saw cutting, road stripe removal, or other activities that create dust/sediment.
- Use drip pans for paving machines, garbage trucks, street sweepers, and other equipment that may leak fluids.
- Do not apply road striping paint during windy, wet, or rainy conditions.
- If wet saws must be used:
  - ✓ Place drip pans under or watertight barriers around equipment when not in use.
  - ✓ Turn cooling water off when saw is off.
  - ✓ Protect storm drains during use.

  (Novotney and Winer 2008)

Figure 20: A concrete saw. Concrete saws frequently used in road maintenance activities can be a large source of stormwater pollution if precautions are not taken. (Paris, Josh. 2007.)

Figure 21: A yellow road stripe. Road striping is necessary for driving, but to protect stormwater, striping should only be performed on clear days with little wind. (Tan, Sherman. 2007.)

Figure 22: An example of dredging near a road. A Pollution Prevention/ Good House-keeping technique in this case would be placing a mat over nearby storm drains or temporarily berming the work area or storm drain (putting a barrier around it). (Warren County Public Service Project Group. 2007 Institute of Environmental Sciences)

Maintenance does provide jurisdictions an opportunity to replace less effective, conventional stormwater management practices with best management practices (BMPs). These BMPs are often referred to as *green infrastructure* or *Low Impact Development* (LID) when used in site design. Some options during maintenance or new construction include (Georgia Dept. of Comm. Affairs):

- Design roadway islands and ditches as bioretention areas or vegetated swales
- Use permeable pavement where practical and economical to do so, such as along sidewalks, strips next to curbs, street parking spaces, alleys, and other applicable locations. Parking lots can be strategically built with pervious pavements in certain sections to get the benefit of pervious pavement without significant additional costs.
- Clean scupper drains on bridges regularly.
- Remove scupper drains from bridges and retrofit with catch basins or direct outflows to bioretention areas.

Figure 23: Example of a Bioswale. (English, Jennifer. 2009. Defiance Soil and Water Conservation District)

A good resource for these and other low impact development options can be found in American Rivers' *Low Impact Development Manual for the Lower Maumee and Ottawa River Watersheds*

Limitations

Municipalities should consider safety a priority when implementing these options. Planning and design protocols may limit the ability to implement green infrastructure in roadway maintenance or new construction (Georgia Department of Community Affairs). The characteristics of the location may also limit the options for pollution prevention designs. Maintenance on all BMPs will be required, which is true of any constructed project, even traditional methods.

Costs

Table 3: A comparison of road/parking lot surface options:

Type of Surface	**Cost (per sq. ft.)***	**Considerations**
Asphalt	$0.50-1.00**	Replacement due to winter weather (potholes, etc.)
Grass/Gravel Pavers	$1.50-5.75	Mowing; replacing lost gravel; compaction issues
Porous Concrete	$2.00-6.50	Vacuum cleaning required
Interlocking Concrete Paver Blocks	$5.00-10.00	Vacuum cleaning required

(Paver Search, Inc. 2005)
*Price ranges in 2005 dollars.
**Does not include costs of stormwater management. Price when including stormwater controls grows to $9.50 and $11.50 per square foot of installed pavement.

Table 4: A comparison of Best Management Practice options.

Type of BMP	**Cost**	**Considerations**
Vegetative Swales	Seed: $1.00/linear ft. Sod: $4.50-$8.50/ linear ft.	Mowing required
Rain Gardens/ Bioretention Cell	Construction: $3.00/sq. ft. Design: $1.00/sq. ft. Planting: $3.00-$4.00/sq. ft. Plants: $2.50-$4.50/sq. ft. Total Cost: $11.00-$13.00/sq. ft.	Regular maintenance required
Pocket Wetlands	Excavation: $0.25 per sq. ft. Hauling: $0.25 per sq. ft. Grading: $0.36 per sq. ft. Plants: $2.00 per sq. ft. Plant Installation: $0.30 per sq. ft. Cutlet Structure: $50.00 per sq. ft.	May bring unwanted wildlife; significant maintenance required
Green Roof	***Extensive: $8-20 per sq. ft. ***Intensive: $15-25 per sq. ft.	Possible roof insurance issues; maintenance

(Glover et. al 2008)
***Source: Green Roof Installation Project, Great Lakes Water Institute.

Examples of Measurable Goals

- Reduce use of herbicides/pesticides on roadway ditches by a certain percentage.
- Replace a percentage of bridge scupper drains.
- Convert a certain area of islands or ditches to bioretention areas.
- Replace alley conventional pavement with pervious pavement by a set year (for more information about pervious alleys, see *The Chicago Green Alley Handbook: An Action Guide to Create a Greener, Environmentally Sustainable Chicago*, Daley and Byrne, Chicago Department of Transportation).

Septic System Controls

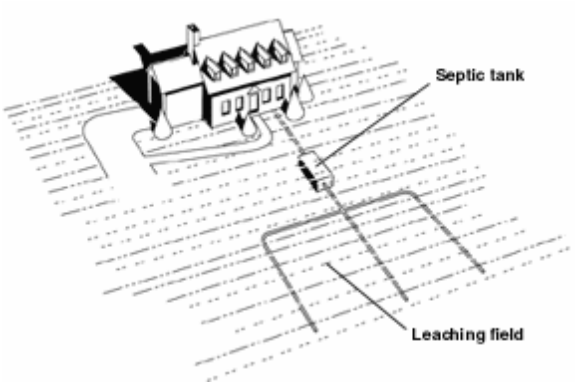


Figure 24: An example of a septic system design. Failed septic tanks can release large amounts of fecal matter and contaminants into storm-water and streams. (United States Geological Survey (USGS). Septic tank: Illustration shows how an underground septic tank is connected to a house and leaching field. http://commons.wikimedia.org.wiki/File:Landpeople_s_cc8.PNG.)

Many jurisdictions have residents with septic systems. With septic systems, wastewater from homes flows to an underground storage unit rather than a sanitary sewer. This storage unit allows solids to settle and the liquid to filter into the soil. By creating outreach programs on Good Housekeeping Practices for residents with septic systems, the jurisdiction will help prevent septic system failures, a major source of illicit discharges into streams.

Outreach Programs Should Educate Residents On:

- Source reduction practices:
  - ✓ Water conservation indoors.
  - ✓ Roof and surface water diversion away from septic systems.
  - ✓ Limiting phosphates.
- Scheduling regular inspections (annually) and pumping the septic system every three years.
- What materials are appropriate to go down drains. Non-degradable materials and some household chemicals are inappropriate for septic systems.
- Drainfield safety.
  - ✓ Keep heavy equipment and vehicles off.
  - ✓ Impermeable surfaces should not be placed on top of drainfields.
- Using caution with garbage disposals which add greatly to the amount of solids in the system.

Limitations

Many residents will be unaware of the maintenance requirements for their septic system or may be unwilling to perform required inspections (Georgia Department of Community Affairs). Educational outreach programs need to inform residents on the potential dangers of failing to maintain their septic system in addition to how to do it.

Costs

The cost of the outreach program depends on the scope (for detailed cost information, see *Water Resources: A Toolkit for Local Governments,* Georgia Department of Community Affairs). If there are staff members dedicated to the outreach program, by creating new materials or holding training sessions, the costs will be in the thousands of dollars. Jurisdictions can save on outreach

programs by using existing materials and involving volunteers to distribute the information. Training sessions will incur varying costs depending on the length of the training session, the location, the parking availability, and other conditions associated with event planning. The cost of materials is the other significant cost, but this can be reduced by adding information to the jurisdiction's existing website or creating a downloadable newsletter on the topic.

Examples of Measurable Goals

- Distribute flyers to all residents within a certain number of years.
- Provide at least two training sessions for septic tank installers each year (set this at any minimum number, but two is recommended).
- Create an ordinance/resolution limiting the amount of phosphates in detergents.

Spill Prevention & Response

Spill prevention and response is one of the most important Good Housekeeping Practices for municipal operations. In the course of daily activities, municipal employees handle, transport, load, and use products that can be harmful to our streams if they enter storm drains.

Figure 25: Hazmat crews training for spill response. Hazmat crews need to be notified when spills are hazardous or potentially hazardous to human health. (Henderson, Win. 2005. Hazmat training. Federal Emergency Management Agency (FEMA).)

Prevention:

- Maintain sufficient aisle space in storage areas.
- Stack items safely at heights where materials are easily accessible.
- When working with liquids outdoors, cover storm drains with mats or berms **prior** to beginning work.
- Do not overload pallets, shelves, transportation equipment, or yourself with materials.
- Refill materials in secondary containment, or indoors.
- Install leak detection devices, overflow controls, and diversion berms.
- Monitor storage units for leaks, cracks, rust, or other signs of structural degradation.

Figure 26: (left) A containment pallet under a liquid storage unit. Containment pallets are useful in preventing slow leaks from spilling onto the floor or ground. They are not useful for large breaches in primary containers. (Warren County Public Service Project Group. 2007. Institute of Environmental Sciences)

Figure 27: (right) Concrete barrier. Concrete barriers are the ideal method for secondary containment: they contain all the liquid in the primary container(s) if designed with adequate volume. (See ref. 23)

Response: Post signs on the spill response procedure in all municipal facilities.

- Determine scope of spill. Is it containable by yourself, or are there hazardous materials involved requiring the fire department or Hazmat teams?
- Remove the source of the spill. Plug the hole or turn off equipment.
- Protect stormwater by containing the spill.
- Notify necessary employees, staff, or cleanup contacts.
- Use spill absorbents to clean up wet spills. Sweep up dry spills – never hose them!
- Dispose of the waste responsibly.
- Restocking used cleanup materials is an important, but often forgotten, spill response practice.
- Keep a logbook to record all spills.

Limitations

It is very important that every employee is aware of these procedures in case the stormwater point person is not available. Proper spill response programs require regular training to remind employees of safety and cleanup procedures. Holding mock spill response training sessions can prepare employees for real spills.

Costs

Spill response training sessions will take time out of municipal employees' workdays. Posters or other training materials will incur some cost, which can be reduced by printing them "in-house" or using existing materials from other jurisdictions.

Necessary Equipment

Every municipal facility should have spill response kits in all buildings on their facility and outdoors near fueling or loading stations. A spill response kit contains:

- Absorbents
- Broom/dust pan
- Shovel
- Berms/socks
- Paper or cloth towels
- Safety goggles and gloves
- Phone numbers for appropriate cleanup authorities

Figure 28: Absorbents. Kitty litter or other absorbents should be used to clean up liquid spills. Any absorbents used to clean up hazardous materials should be treated as hazardous waste and disposed of properly. (See ref. 23)

Examples of Measurable Goals

- Hold one training session every year at each municipal facility.
- Hang "shop posters" in all municipal facilities.

Additional Issues

Spill response programs should include proper documentation (Office of Water 2). When audits are performed, the EPA or auditing authority will want to know how many spills occurred on the site. They will also want to know how the spill was handled and what has been done to prevent it from happening in the future. Most jurisdictions have chosen to create a standard form for all spills that include the date, what was spilled, where it was spilled, time of spill and of cleanup completion, what caused the spill, and who cleaned up the spill (see Appendix B). This will allow your facility to update your spill response plan on a site specific basis. [33] See reference 31.

Storm System Cleaning

Municipal storm systems need regular maintenance to work efficiently. When storm drains are clogged with larger debris, such as leaves or trash, water cannot flow through the storm drain and streets become flooded. Storm system cleaning can be performed by the municipality or by a contracted company.

Figure 29: Storm pipe cleaning using the flushing method. Storm drains and pipes should be cleaned at least once a year to remove debris that has collected in the drain. (Office of Water. 2009.)

Costs

Costs are dependent on how your jurisdiction chooses to clean the storm system. Vacuum trucks, which are the trucks necessary to suck materials from catch basins, are around $50,000 (for used trucks) to $200,000 (Georgia Department of Community Affairs). Dedicated municipal employees contribute to costs if the jurisdiction does the cleaning itself. If outside sources are used, the cost of labor per hour is around $175 (in 1997 dollars) (Georgia Department of Community Affairs). A benefits-cost analysis that considers the footage of storm sewer pipes and number of catch basins will determine which method is the most cost-effective.

Figure 30: Catch basin vacuum truck. Vacuum trucks pump materials from catch basins to be disposed of in a landfill rather than flushing it into the stream. (Warren County Public Service Project Group-2007. Inst. of Env. Sciences.)

Limitations

Accessibility is a huge issue when cleaning catch basins and storm sewers. It may be necessary to post signs informing residents of the cleaning and to limit street parking during those times (Office of Water 3). Winter months can be difficult, as well, when snow and ice are present. This can be avoided by ensuring all storm sewers are cleaned before winter weather.

Examples of Measurable Goals

- Install catch basin inserts in a certain percentage of catch basins.
- Clean all catch basins and pipes each year.

Additional Issues

Because the process of storm system cleaning can be expensive or time consuming, it is important to know when a catch basin or piping system needs cleaning. More frequent cleaning may not provide a significant improvement in efficiency. If your jurisdiction has catch basin inserts, these may need more cleaning than traditional catch basins because they may catch sediment as well. However, these are usually efficient even with up to 80-95% of the insert clogged and they trap sediment and leaves, which clog piping systems (Glover et. al 2008).

Figure 31: Catch basin with smaller grate size to catch leaves. Catch basins have varying grate sizes. Some jurisdictions use grates with smaller holes or catch basin inserts to trap smaller debris. The drawback is they require cleaning more often for efficiency. (See reference 27.)

Street & Parking Lot Sweeping

Regular street and parking lot sweeping (using sweeper trucks/equipment) removes debris, such as dust and pollutants, which typically end up in streams after being washing into catch basins. Sweeping should be performed at least twice a year on all roads and preferably more in areas of concern, including near streams, land use (industrial areas vs. residential) or heavily trafficked areas (Georgia Department of Community Affairs).

Figure 32: (left) A leaf collector. In the fall, leaves are a source of stormwater pollution because many residents rake their leaves into the street. Leaf collectors will remove leaves which then can be disposed of in a landfill or composted. The important factor in effective leaf pickup is to inform residents in advance to sweep their leaves close to the street, typically the right-of-way, rather than dump them into the street or burn them. (Warren County Public Service Project Group-2007)

Figure 33: (right) A street sweeper. Street sweeping is necessary to remove dust, dirt, and other pollutants from the street before they can enter the storm drain. The collected materials must then be treated as solid waste or hazardous waste (if hazardous materials are present). (See ref. 29)

Limitations

Street sweepers cannot operate as efficiently where vehicles are parked on roads. Limits to street parking may need to be imposed during sweeping (Environmental Department, SEMCOG). The collected street sweeping materials may need to be tested for hazardous materials prior to disposal, especially in industrial areas. Note: If hazardous materials are detected, they must be treated as hazardous waste rather than solid waste. If they are not detected, treat normally as solid waste.

37 Warren County Public Service Project Group. 2007. Institute of Environmental Sciences.

38 See resource 37.

Costs

Cost is a limiting factor in street sweeping programs. Programs that are already well established may need to adjust street sweeping schedules if operation costs become too high and should consider the lifetime of street sweeping equipment. Municipalities interested in starting programs that include street sweeping equipment should expect to pay from tens of thousands of dollars for equipment and operation costs up to hundreds of thousands of dollars depending on the equipment that is purchased and the street sweeping schedule (Georgia Department of Community Affairs).

Examples of Measurable Goals

- Implement a street sweeping program to reduce sediments in streams by a certain amount.
- Collect and dispose of a set weight or amount of street debris each year.

Additional Issues

There are three types of street sweepers: mechanical, regenerative air, and vacuum filter (Glover et. al 2008). Each type has advantages and disadvantages that should be considered before purchasing. Trade journals and stormwater websites are a useful tool for determining which type to purchase based on the following criteria:

- Cost
- Lifetime of equipment (e.g. when will it need to be replaced)
- Targeted pollutants
  - Large vs. particles less than 10 microns in diameter (PM_{10}).
  - Hazardous vs. non-hazardous
- Surface types that might be swept
- Travel distance
- Travel speed and brush speed of sweeper
- Noise ordinances (time of sweeping)

(The Stormwater Manager's Resource Center 2)

A good rule of thumb is to have more than one type of sweeper in the fleet to accommodate varying road sizes and conditions.

Used Oil Generation & Recycling

Some municipal processes may result in used oil generation. Used oil is defined in Table 5. (Division of Hazardous Waste 2006). If your municipal activities generate used oil there are several options depending primarily on whether you will need to follow the used oil transporter requirements (see Table 6). You will not need to follow the used oil transporter requirements as long as you transport the oil in your own or an employee's vehicle and the amount is less than 55 gallons at a time.

Figure 34: Crushed oil can. Crushing oil cans and recycling oil filters removes excess oil from them and reduces the chance that oil will contaminate streams. (Warren County Public Service Project Group, 2007; Institute of Environmental Sciences.)

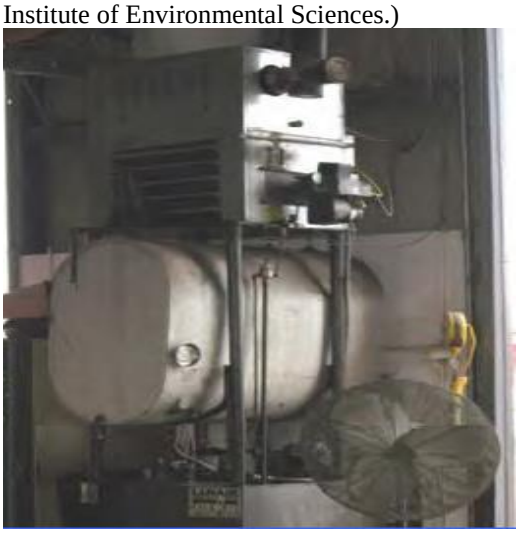


Figure 35: Waste oil heater. Waste oil can be used in waste oil heaters as long as no other materials are in the oil. **Never** dump waste chemicals like antifreeze or solvents into waste oil. (See ref. 31)

Table 5: What is "used oil?" Anything listed as used oil can be combined and recycled as used oil. Materials from the "Not Used Oil" category should never be mixed with used oil unless the municipality is disposing of it as hazardous waste:

Used oil includes:	***Used oil does not include:***
Engine oils from vehicles and equipment	Products made from oil
Lubricating oil	Clean-up materials from oil spills
Brake fluids	Animal oils
Transmission fluid	Vegetable oils
Hydraulic fluid	Oil sludge from virgin oil storage tanks
Insulating oils	Antifreeze
Metal cutting fluids	Kerosene (unless used as lubricant)
Industrial process oils	Petroleum distillates used as solvents
Compression refrigerant oils	

Adapted from *Recycled Used Oil Management Standards*, Division of Hazardous Waste Management.

Table 6: Disposal options for used oil generators. We have several options to dispose of used oil.

Disposal options for used oil generators:	***Capacity:***
1. Take to a registered used oil collection site. The TCEQ maintains a list of used oil collectors.	55 gallons or less
2. Take to an aggregate site or facility owned by your jurisdiction.	55 gallons or less.
3. Recycle with a TCEQ approved recycler. The TCEQ maintains a list of used oil recyclers.	Any amount of used oil.
4. Burn used oil on-site for heating requirements. Oil must be used to heat facility with an on-site space heater. A maximum energy generation of 0.5 million BTUs is allowed with ventilation of gases leading outside.	Any amount of used oil.

(Division of Hazardous Waste 2006)

Limitations

Used oil recycling will be limited if materials are mixed with anything else. **Never** mix used oil with anything else other than used oil or it may be considered a hazardous waste. Recyclers and disposal authorities must be licensed. There also may be liability issues with employees using their own vehicles to transport 55 gallons or less of oil.

Costs

Costs will depend on the amount of oil that is generated and will need to be disposed of properly. Contact the local waste hauler or recycler for their prices. It may be cheaper to purchase a waste oil heater than to pay a licensed hauler to transport oil to a recycling center. Waste oil heaters range in prices from $4000 to $10,000 (Lanair Products, LLC) with a payback period on the initial costs of about two years (Doityourself® 2010).

Examples of Measurable Goals

- Install on-site used oil heaters at all municipal facilities that generate used oil.
- Create a campaign to inform local businesses of used oil recycling options that increases recycling by a certain percentage.

Additional Issues

Used oil filters have different requirements for disposal depending on the type of oil filter. For oil filters that are non-terne plated and hot-drained, the filter (after draining for 12 hours) may be disposed of with the municipal waste as it will not be considered hazardous (Division of Hazardous Waste 2006); they can also be recycled for scrap metal (Filter Manufacturer's Council; Georgia Department of Community Affairs). Waste oil is then treated as used oil and disposed of using the aforementioned procedures.
Outreach programs will help both do-it-yourselfers and private maintenance garages dispose of used oil and filters properly (Georgia Department of Community Affairs).

Vehicle Washing

Figure 36: Vehicle washing. Vehicle washing on impervious surfaces or even lawns sends polluted water directly into the storm drain. This image represents how washing vehicles in the wrong location, such as a driveway or street, is like washing your car directly on a stream. (Office of Water. 1995. U.S. EPA. http://www.epa.gov/nps/toolbox/print/psatautowash.pdf.)

Municipal vehicles including fire trucks, emergency vehicles, and road maintenance fleets typically have sediments, oil, road salt, or other particles on them that end up in streams when they are washed or blow off the vehicles. Soap, detergents, and vehicle/equipment cleaners are often used in the washing process. These pollutants, especially detergents, can have harmful effects on streams. For these reasons, it is necessary to protect stormwater by washing vehicles in the appropriate location.

The ideal location for washing vehicles is at a commercial vehicle wash. Commercial vehicle washes have the ability to recycle their water on-site as well as to contain water so it will not enter the storm drain. If no commercial vehicle washes are available, then vehicles should be washed indoors (that will drain to sanitary sewers) or on grass/pervious surfaces.

Limitations

Municipalities may not be able to secure an agreement with a commercial vehicle wash or be able to find car washes that will accommodate larger trucks. Equipment, such as lawn mowers, would need to be hauled to commercial vehicle washes, which adds to the costs. Furthermore,

some municipal facilities do not have the ability to wash vehicles indoors because the facility either has no drains or has indoor drains that improperly lead to storm sewers (which should be closed off regardless of indoor practices).

Costs

Costs depend on whether the jurisdiction chooses to perform vehicle washing on the site or to take vehicles to a commercial vehicle washing facility. Washing on-site will require the purchase of equipment and other associated costs (Dultmeier Sales, LLC) If ordinances/regulations allow, the municipality can also open up a municipal car wash that is open to the public and used by municipal employees (for information on how to start a municipal car wash see Additional Resources: Dultmeier Sales, LLC; Hi-Performance Wash Systems, Inc. 2010). If taken to a commercial vehicle wash, the costs will be based on the contract with the washing facility. Without a contract, individual car washes can cost up from $5-$10 per wash.

Necessary Equipment

If your municipality decides to do vehicle washing indoors, it will need to purchase the proper equipment. Some equipment necessary for vehicle washing:

- Sprayers (high pressure, but lower flow to save money and conserve water),
- Soap/cleaner,
- Brushes,
- Vehicle bays (unless washing in previously built facilities),
- Suction devices, and
- Hoses.

Examples of Measurable Goals

- Wash all vehicles on a regular schedule (e.g. weekly, bi-weekly, monthly)
- Ensure all vehicle washes occur indoors or at commercial vehicle washes by a set date (e.g. switch from washing outdoors to indoors).

Appendix C – Construction

Storm Water Control Guidelines for Construction Sites

The Town of Hollywood Park

Bexar County, Texas

April 2009

Storm Water Control Guidelines for Construction Sites

Introduction

The 1972 amendments to the Federal Clean Water Pollution Control Act, later referred to as the Clean Water Act, prohibit the discharge of any pollutant to navigable waters of the United States from a point source unless the discharge is authorized by a National Pollutant Discharge Elimination System (NPDES) permit. Efforts to improve water quality under the NPDES program began with reducing pollutants in industrial process wastewater and municipal sewage treatment plant discharges. Now the efforts have been expanded to address more diffuse sources of water pollution, such as storm water runoff from construction sites.

The Texas Pollutant Discharge Elimination System (TPDES) program implements the federal NPDES program in the state of Texas. Under the TPDES program, the Texas Commission on Environmental Quality (TCEQ) specifies Phase II general permit requirements for construction activity. These guidelines, "Storm Water Runoff Control Guidelines for Construction Sites," are intended to help the City to comply with the TPDES program and the Phase II general permit requirements. These guidelines establish standards for implementing and enforcing a program to reduce pollutants in storm water runoff that is discharged to the Municipal Separate Storm Sewer System (MS4).

These guidelines apply to construction activities disturbing:

1. A land area greater than or equal to one acre and less than 5 acres, and
2. A land area less than one acre if that construction activity is part of a larger common plan of development or sale that would disturb one acre or more.

Construction activities disturbing:

1. 5 or more acres of land, or
2. less than 5 acres that are part of a larger plan of development or sale that is 5 or more acres in size, and

that discharge storm water into the MS4 or waters of the U.S., require coverage by the EPA Region 6 **Construction General Permit** (63 FR 36490) and are not directly regulated by the City. The construction activity operator must seek coverage under the Construction General Permit from the appropriate authority and copies of the proper erosion and sedimentation control plan or storm water pollution prevention plan (SWPPP) must be submitted to the City as a part of its building permit process.

These guidelines are part of a program that includes:

1. Ordinance No. 883, which requires erosion and sediment controls according to these guidelines and, which establishes sanctions to ensure compliance;
2. Requirements for construction site operators to implement appropriate erosion and sediment control (ESC) best management practices (BMPs);
3. Requirements for construction site operators to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality;
4. Procedures for site plan review which incorporate consideration of potential water quality impacts;
5. Procedures for receipt and consideration of information submitted by the public, and
6. Procedures for site inspection and enforcement of control measures.

This document and these guidelines are based on information provided by the Environmental Protection Agency (EPA) and the TCEQ at the following web sites:

1. http://www.tnrcc.state.tx.us/permitting/waterperm/wwperm/construct.html,
2. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/con_site.cfm, and
3. http://cfpub.epa.gov/npdes/stormwater/phase2.cfm.

As some areas of the city fall within the Edwards Aquifer Recharge Zone (EARZ), additional requirements may apply to construction sites. The guidelines in this document do not mitigate any pertinent rules and regulations that may apply for protection of the aquifer. Construction sites within the EARZ will be governed by the most stringent rules and regulations that apply. Please refer to 30 TAC 213 (Texas Administrative Code) and the Edwards Aquifer Authority Rules.

Land Grading

Submittal

Submit a grading plan that establishes:

1. Areas of the site to be graded,
2. Drainage patterns,
3. Runoff velocities,
4. The schedule for earthwork (start and stop dates),
5. The degree and length of finished slopes,
6. Disposal sites,
7. Borrow locations,
8. The location and design of berms, diversions, and other BMPs that require excavation or fill.

Limit grading to only those areas necessary for building activities and equipment traffic. When reasonable, maintain undisturbed temporary or permanent buffer zones down slope of the grading operation to provide a low-cost sediment control measure that will help reduce runoff and off-site sedimentation.

Inspection

The site may be inspected by the city for improper grading practices, erosion, and sedimentation. Make sure that grading crews carefully follow the approved plan.

Maintenance

The contractor must periodically check all graded areas and supporting erosion and sediment control practices, especially after rainfall. All sediment should be removed from diversions and other storm water conveyances promptly. If washouts or breaks occur, they must be repaired immediately. Promptly repair eroded areas to prevent them from becoming larger.

Permanent Diversions

Description

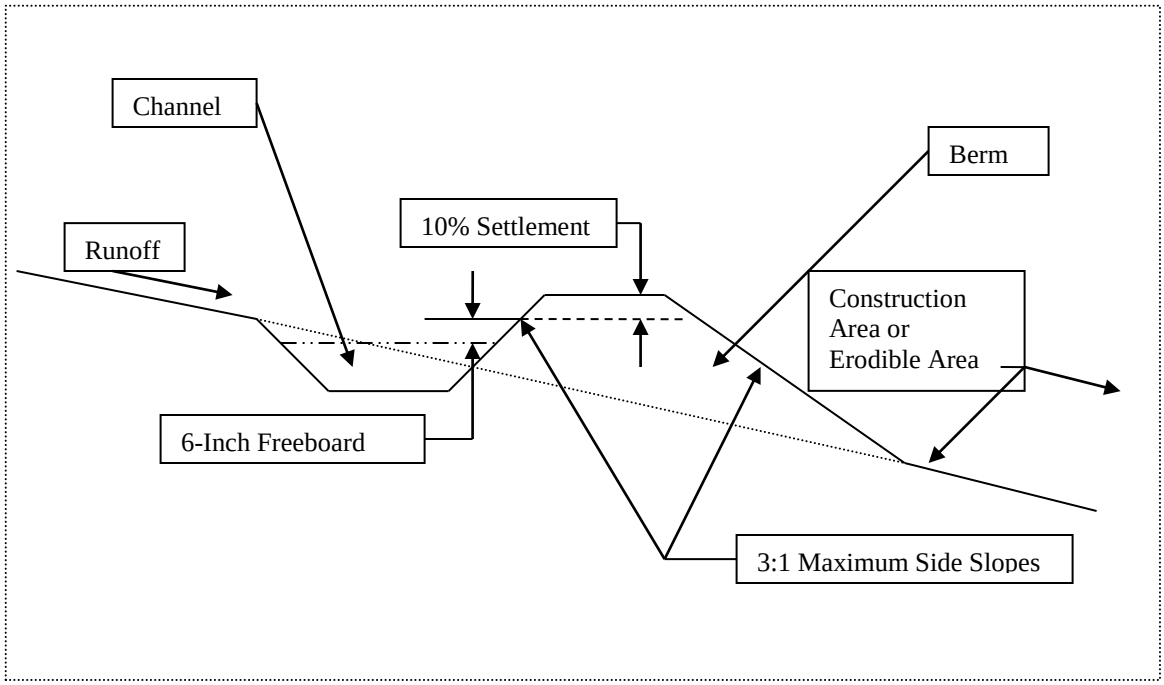
Diversions are used in areas where runoff from areas of higher elevation poses a threat of erosion and undesirable vegetative damage. Diversions protect disturbed areas and erodible areas by reducing the size of contributing drainage areas and, consequently, by reducing the amount of runoff that contacts the area to be protected. Diversions are often constructed by cutting channels across a slope and by constructing a berm or earthen ridge immediately down slope of the channel.

Design

1. *Berm*. Must be constructed from compacted clay. The cross section of the berm or earthen ridge must have side slopes no steeper than 3:1; a width at the design water elevation of at least 4 feet; a minimum freeboard of 0.3 feet; and an allowance for 10 percent settlement included in the design.
2. *Outlet*. Four elements of an outlet channel system are:

    1. *Earth channel*. A permanent waterway designed with a vegetative lining to resist erosion and to have adequate discharge capacity. The following general specifications are required for channel construction:

        - Remove obstructions and unsuitable material, such as trees, roots, brush, stumps, and excess soil from the channel area and dispose of properly.
        - Use the Manning Equation in areas outside of the FEMA floodplain to design the channel grade and cross section to have adequate capacity, to be erosion resistant, and to prevent sedimentation.
        - Compact fill to ensure equal settlement and to prevent erosion.
        - Design pilot channels in large channels adequate to convey the 2-year flood or base flow, whichever is larger.
        - Design channel outfalls to be erosion-resistant.



Typical Cross Section for Channel and Berm

2. *Level spreader*. An outfall configured to spread concentrated flow out over a broad area to reduce flow velocities. The lower velocities reduce the potential for erosion and sometimes help to improve infiltration. A level spreader is usually constructed by excavating a depression in the soil. One side of the depression has a low edge that is constant in elevation (level). The low edge must be adjacent to and discharge runoff to a well-vegetated, flat, mild-sloped area. The following general specifications are required for level spreader construction:

- Construct on natural soils and not on fill material or easily erodible soils.
- Construct a level discharge from the spreader to ensure the flow can be evenly distributed.
- Prevent heavy equipment and traffic on the level spreader, as they can cause compaction of soil and disturbance of the slope grade.
- Regrade the spreader if ponding or erosion channels develop.
- Maintain dense vegetation and repair damaged areas when necessary.

3. *Outfall protection*. Construct lined aprons or other energy-dissipating devices at the outlets of pipes and channels to reduce the velocity of storm water flows and to thereby prevent scouring at storm water outfalls, to protect the outlet structure, and to minimize potential for erosion downstream. The following general specifications are required for outfall construction:

- Avoid horizontal bends.

- Construct the apron bottom horizontal in a longitudinal direction.
- Construct the invert of an apron to match the elevation of the receiving channel. It may not be higher than the receiving channel.
- Receiving channels may not have side slopes steeper than 3:1.
- Line aprons with rock riprap, grouted rock riprap, concrete riprap, or gabion baskets.
- Place geotextile or filter fabric between rock riprap and the underlying soil to prevent any soil movement through the riprap.
- Grout for grouted riprap must be one part Portland cement for every 3 parts sand, mixed thoroughly with water. Once stones are in place, the spaces between them are to be filled with grout to a minimum depth of 6 inches, with the deeper portions choked with fine material.
- Construct the downstream invert of a paved channel to smoothly join the receiving channel section. The invert may not be higher than the invert of a receiving earth channel.

4. *Paved channel. A* permanent channel that is lined with concrete, rock, asphalt, pavers, etc. to reduce the potential for erosion. The following general specifications are required for paved channels:

The subgrade must be constructed to required elevations, with all soft portions and unsuitable material removed and replaced with suitable material, must be thoroughly compacted and smoothed to a uniform surface, and must be moist when the concrete is poured.

- Design the paved channel for adequate capacity outside FEMA floodplains using the Manning Equation.
- Grade subgrade to required elevations. Remove all soft and unsuitable material from the subgrade. Compact the subgrade to 95% of optimum density and smooth to a uniform surface.
- Moisten the subgrade prior to placing concrete.
- Construct the slope of the structure at 1.5:1 or less.
- Construct toe-downs at the upstream and downstream ends of any paved channels that are not adjoined to another structure. Extend Toe-downs the full width of the channel. Construct toe-downs at least 6 inches thick and at least 18 inches into the soil under the channel. Large channels will require greater thicknesses and depths.
- Construct anchor lugs no more than 10 feet apart on center, monolithic with the channel lining. Construct lugs the full bottom width of the channel, at least 6 inches thick, and extending at least 1 foot into the soil under the channel.
- Concrete linings shall be class A-3, at least 4 inches thick, and shall be reinforced with rebar or welded wire fabric.
- Construct transverse joints at 20-foot intervals, maximum, and at locations where more than 45 minutes elapses between adjoining concrete placements.
- Construct expansion joints approximately every 90 feet.
- Protect paved channel outlets erosion through the use of an energy-dissipating device and/or outfall protection.

Stabilization. Seed and mulch or sod berms, earth channels, and disturbed areas immediately after they are constructed. Keep sediment-trapping measures in place until the upslope area is stabilized to prevent soil from moving into the diversion.

Maintenance

Inspect after every rainfall and a minimum of once every 2 weeks before final stabilization. Clear sediment, make repairs, and seed or sod damaged areas if a vegetative cover is not established.

References

Smolen, M.D., D.W. Miller, L.C. Wyatt, J. Lichthardt, and A.L. Lanier. 1988. *Erosion and Sediment Control Planning and Design Manual*. North Carolina Sedimentation Control Commission, North Carolina Department of Environment, Health, and Natural Resources, and Division of Land Resources Land Quality Section, Raleigh, NC.

USEPA. 1992. *Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.* EPA 832-R-92-005. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1992. *Storm Water Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices.* EPA 832-R-92-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Virginia Department of Conservation and Recreation. 1995. *Virginia Erosion & Sediment Control Field Manual. Second Edition.* Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, Richmond, VA.

Preserving Natural Vegetation

Description

Avoid clearing and disturbing land that does not need to be used for construction. The natural vegetation will help to provide erosion control, storm water detention, bio-filtration, and aesthetic value to a site during and after construction activities.

Design

Mark vegetation to be preserved before clearing activities begin. Develop a site plan with the locations of trees and boundaries of environmentally sensitive areas and buffer zones to be preserved. Plan the location of roads, buildings, and other structures to avoid these areas. Manage construction activities to minimize the impact on existing vegetation. Protect larger trees (6-inch diameter, minimum) that are located near construction zones. Mark boundaries around larger tree drip lines to protect the root zone from damage. Prevent filling and excavation within the drip line of the larger trees.

Consider the following factors when selecting trees for preservation:

- *Tree vigor*. Preserve healthy trees that will be less susceptible to damage, disease, and insects. Indicators of poor vigor include dead tips of branches, stunted leaf growth, sparse foliage, and pale foliage color. Hollow, rotten, split, cracked, or leaning trees also have less chance of survival.
- *Tree age.* Older trees are more aesthetically pleasing. Make sure they are healthy before marking them for preservation.
- *Tree species. Preserve s*pecies well-suited to present and future site conditions.

- *Wildlife benefits. Preserve t*rees that are preferred by wildlife for food, cover, and nesting.

Consider the following when preserving natural vegetation:

- Maintain the natural ground contours and maintain preconstruction drainage patterns as much as possible. Altering the hydrology may kill vegetation intended for preservation.
- Do not nail boards to trees during building operations.
- Do not cut tree roots inside the drip line.
- Install barriers to prevent equipment from entering protected areas.
- Do not place equipment, construction materials, topsoil, or fill dirt within preservation areas or within the drip lines of trees to be preserved.
- Remove barriers from preserved areas and trees only after construction is complete.

References

Smolen, M.D., D.W. Miller, L.C. Wyall, J. Lichthardt, and A.L. Lanier. 1988. *Erosion and Sediment Control Planning and Design Manual*. North Carolina Sedimentation Control Commission, North Carolina Department of Environment, Health, and Natural Resources, and Division of Land Resources Land Quality Section, Raleigh, NC.

USEPA. 1992. *Storm Water Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices*. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Construction Entrances

Description

Construction entrances are stabilized driveways located where construction traffic leaves the site. The stabilized surface provides a rugged substrate that promotes the removal of mud from equipment tires before vehicles leave the site. This reduces the amount of sediment that the vehicle will track offsite and onto the city right-of-way. The construction entrance also reduces erosion and rutting of the soil beneath the stabilization structure.

Sometimes the construction entrance is not enough to prevent equipment from tracking sediment offsite. In such cases, add a vehicle wash station to complete the removal of sediment from equipment wheels. Divert runoff from vehicle wash stations into a sediment trap to help ensure that sediment removed from vehicles is kept on-site and disposed of properly.

Design

Stabilize the entrances to a site that will be used by equipment and vehicles by placing a filter fabric over the entrance area and by placing rock on top of the filter fabric. The depth of rock must not be less than 6 inches. Stabilize prior to disturbing the site. Make stabilized entrances long enough and wide enough to accommodate the largest construction vehicle that will be on site. Make the entrance wide enough for two lanes of traffic if needed. Flare the end of the construction entrance that abuts the public street so that long vehicles do not

leave the stabilized area when turning. Install a bridge or culvert if the construction site entrance crosses a stream, swale, or other depression. Use stone that large enough that it will not be carried offsite with vehicle traffic. Avoid using sharp-edged stone to reduce the possibility of puncturing vehicle tires.

Maintenance

Maintain the construction entrance in a stabilized condition until the construction site has been fully stabilized. Add rock periodically as needed to keep the entrance effective. Soil that is tracked offsite should be swept up immediately for proper disposal. Construct and maintain sediment traps for wash racks, when used, for the duration of the project. Periodically remove sediment from the traps to ensure their continued effectiveness.

References

Corish, K. 1995. *Clearing and Grading Strategies for Urban Watersheds*. Metropolitan Washington Council of Governments, Washington, DC.

USEPA. 1992. *Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices*. EPA 832-R-92-005. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. EPA 840-B-92-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Filter Berms

Description

A filter berm is a temporary ridge made up of loose gravel, stone, or crushed rock that slows runoff, filters sediment, and promotes sedimentation on site.

Design

Use the following guidelines to construct and to build the berm:

- Use well-graded gravel or crushed rock.
- Space berms according to the steepness of the slope, with berms spaced closer together as the slope increases. Install only on moderate to mild slopes.

Maintenance

Inspect filter berms every two weeks and after every rain event. Remove accumulated sediment and repair damage. Replace clogged filter material.

References

Fifield, S.J. 1997. *Field Manual for Effective Sediment and Erosion Control Methods*. Hydrodynamics, Inc., Parker, CO.

USEPA. 1992. *Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.* EPA 832-R-92-005. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Grass-Lined Channels

Description

Lining channels with vegetation reduces the flow velocity and reduces the potential for erosion. Grass-lined channels usually are not designed to control peak runoff loads by themselves and are often used in combination with other BMPs, such as subsurface drains and riprap stabilization.

Design

The channel should not receive direct sedimentation from disturbed areas and should be sited only on the perimeter of a construction site to convey relatively clean storm water runoff. Channels should be separated from disturbed areas by a vegetated buffer or other BMP to reduce sediment loads.

Use the following guidelines for design and construction:

- Use vegetated buffers or other BMPs to separate channels from disturbed areas.
- Construct and vegetate the channel before beginning grading and paving activities.
- Use sod, netted mulch, or geotextiles to stabilize the channel until the vegetation is fully established.
- Install outlet stabilization structures if required to prevent erosion.
- Design channels to convey runoff from a 10-year flood without erosion by keeping the design velocity below 6 feet per second. Design channels to convey a 2-year flood without sedimentation by keeping the design velocity greater than 2 feet per second.
- Slope channel sides at 3:1 or less.
- Remove trees, brushes, stumps, and other debris during construction.

Maintenance

Maintain a dense and vigorous growth of turf. Check for sediment and debris every two weeks and after rain events. Mow regularly after the vegetation is established to maintain hydraulic capacity.

References

FHWA. 1995. *Best Management Practices for Erosion and Sediment Control*. FHWA-SLP-94-005. Federal Highway Administration, Sterling, VA.

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SWRPC. 1991. *Costs of Urban Nonpoint Source Water Pollution Control Measures*. Technical Report No. 31. Southeast Wisconsin Regional Planning Commission, Waukesha, WI.

Rock Riprap

Description

Rock riprap is a permanent, erosion-resistant layer made of stones. It is used to protect soil from erosion in areas of concentrated runoff, such as channels, outlet aprons, culverts, and stream banks. Riprap may also be used to stabilize slopes that are unstable because of seepage problems.

Design

Riprap may be unstable on very steep slopes, especially when rounded rock is used. For slopes steeper than 2:1, consider using materials other than riprap for erosion protection. If riprap is being planned for the bottom of a permanently flowing channel, the bottom can be modified to enhance fish habitat. This can be done by constructing riffles and pools which simulate natural conditions. These riffles promote aeration and the pools provide deep waters for habitats.

Use the following guidelines to design and to construct rock riprap:

- *Gradation*. Use a well-graded mixture of rock instead of one uniform size.
- *Quality of stone*. Rock riprap must be durable.
- *Riprap depth*. Design the thickness of riprap layers to be at least 2 times the maximum stone diameter.
- *Filter material*. Filter material is usually required between rock riprap and the underlying soil surface to prevent the rock from settling into the soil. Use a filter fabric or a suitably-sized layer of gravel for the filter.
- *Riprap Limits*. Cover the entire channel bottom with riprap. Extend coverage up the channel sides to the maximum flow depth (plus super elevation on curves) or to a point where vegetation will be satisfactory to control erosion.
- *Curves*. Cover the entire channel with rock riprap throughout the curve and upstream and downstream of the curve for a distance of five times the bottom width. Account for super elevation of the water surface.
- *Riprap Size*. Use standard charts to size the rock riprap and filters based on velocity.
- *Slope*. Use slopes less than or equal to 2:1.

Maintenance

Inspect rock riprap after rainfall events. Repair damaged areas promptly to prevent a progressive failure. If repairs are needed repeatedly at one location, evaluate the conditions to determine if the original design needs to be modified. Control weed and brush growth.

References

FHWA. 1995. *Best Management Practices for Erosion and Sediment Control*. FHWA-SLP-94-005. Federal Highway Administration, Sterling, VA.

Mayo, L., D. Lehman, L. Olinger, B. Donavan, and P. Mangarella. 1993. *Urban BMP Cost and Effectiveness Summary Data for 6217(g) Guidance: Erosion and Sediment Control During Construction*. Woodward-Clyde Consultants.

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SWRPC. 1991. *Costs of Urban Nonpoint Source Water Pollution Control Measures*. Technical Report No. 31. Southeast Wisconsin Regional Planning Commission, Waukesha, WI.

Chemical Stabilization

Description

Chemical stabilizers, also known as soil binders or soil palliatives, provide temporary soil stabilization, especially where temporary seeding and permanent vegetation are not effective. Materials made of vinyl, asphalt, or rubber are sprayed onto the surface of exposed soils to hold the soil in place and to protect against erosion from runoff and wind. Chemicals used for stabilization are easily applied to the surface of the soil, can be effective in stabilizing areas where vegetative practices cannot be established, and provide immediate protection.

Design

Follow the application rates and procedures recommended by the manufacturer. Prevent the products from forming ponds and avoid creating impervious areas where storm water cannot infiltrate.

Maintenance Considerations

Inspect chemically stabilized areas every two weeks and after rain events for signs of erosion. Reapply stabilizers if necessary.

References

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Mulching

Description

Mulching is a temporary erosion control practice in which materials such as grass, hay, wood chips, wood fibers, straw, or gravel are placed on exposed or recently planted soil surfaces. Mulching is often used in conjunction with vegetation establishment and can reduce storm water runoff velocity. Mulching can aid plant growth by holding seeds, fertilizers, and topsoil in place; preventing birds from eating seeds; retaining moisture; and insulating plant roots against extreme temperatures.

Mulch mattings are materials such as jute or other wood fibers that are formed into sheets and are more stable than loose mulch. Jute and other wood fibers, plastic, paper, or cotton can be used individually or combined into mats to hold mulch to the ground. Netting can be used to stabilize soils while plants are growing, although netting does not retain moisture or insulate against extreme temperatures. Sometimes mulch binders, consisting of asphalt or synthetic materials, are used instead of netting.

Applicability

Mulching is often used in areas where temporary seeding cannot be used because of environmental constraints. Mulching can provide immediate, effective, and inexpensive erosion control. On steep slopes and critical areas such as waterways, mulch matting is used with netting or anchoring to hold it in place. Mulches can be used on seeded and planted areas where slopes are steeper than 2:1 or where sensitive seedlings require insulation from extreme temperatures or moisture retention.

Design

When possible, use organic mulches such as loose straw, netting, wood cellulose, or agricultural silage for erosion control and plant material establishment. All materials should be free of seed, and loose hay or straw should be anchored by applying a tackifier, stapling netting over the top, or crimping with a mulch crimping tool. Materials that are heavy enough to stay in place (gravel, bark or wood chips on flat slopes) do not need anchoring. Other examples include hydraulic mulch products with 100-percent post-consumer paper content, yard trimming composts, and wood mulch from recycled stumps and tree parts. Inorganic mulches such as pea gravel or crushed granite can be used in unvegetated areas.

Mulches may or may not require a binder, netting, or tacking. Effective use of netting and matting material requires firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil and erosion will occur underneath the material. Grading is not necessary before mulching.

Ensure adequate coverage to prevent erosion, washout, and poor plant establishment. If an appropriate tacking agent is not applied, or is applied in insufficient amounts, mulch will be lost to wind and runoff. The channel grade and liner must be appropriate for the amount of runoff, or there will be resulting erosion of the channel bottom. Also, hydromulch is an acceptable method to apply mulch. Table 1 presents guidelines for installing mulches.

Table 1. Typical mulching materials and application rates

Material	Rate per Acre	Requirements	Notes
Organic Mulches			
Straw	1 - 2 tons	Dry, unchopped, unweathered; avoid weeds.	Spread by hand or machine; must be tacked or tied down.
Wood fiber or wood cellulose	½ - 1 ton		Use with hydroseeder; may be used to tack straw. Do not use in hot, dry weather.
Wood chips	5 - 6 tons	Air dry. Add fertilizer N, 12 lb/ton.	Apply with blower, chip handler, or by hand. Not for fine turf areas.
Bark	35 yd^3	Air dry, shredded, or hammermilled, or chips.	Apply with mulch blower, chip handler, or by hand. Do not use asphalt tack.
Nets and Mats			
Jute net	Cover area	Heavy, uniform; woven of single jute yarn. Used with organic mulch.	Withstands water flow.
Excelsior (wood fiber) mat	Cover area		
Fiberglass roving	½ - 1 ton	Continuous fibers of drawn glass bound together with a non-toxic agent.	Apply with compressed air ejector. Tack with emulsified asphalt at a rate of 25 - 35 gal./1000 $ft.^2$

Maintenance

Anchor mulches to resist wind displacement. Remove netting when protection is no longer needed and dispose of properly. Inspect mulched areas every two weeks and after every rain event to identify areas where mulch has loosened or has been removed. Reseed exposed seed beds and replace the mulch cover immediately. Replace netting as required. Continue inspections until vegetation is firmly established.

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Permanent Seeding

Description

Permanent seeding is used to control runoff and erosion on disturbed areas by establishing perennial vegetative cover from seed. It is used to reduce erosion, to decrease sediment yields from disturbed areas, and to provide permanent stabilization. This practice is economical, adaptable to different site conditions, and allows selection of the most appropriate plant materials.

Design

Select plants that are suitable for the site. Prepare seed beds adequately and fertilize as required. Water and maintain as required. Consult with a landscaper to ensure proper growth and coverage.

Maintenance

Inspect seeded areas twice a week and after rain events. Make repairs and reseed as soon as possible. If a stand has inadequate cover, the choice of plant materials and quantities of lime and fertilizer should be reevaluated. Depending on the condition of the stand, areas can be repaired by overseeding or reseeding after complete seedbed preparation. If the season is wrong for reseeding, overseed with rye grain or German millet to thicken the stand until a suitable time for seeding perennials. Consider seeding temporary, annual species if the season is not appropriate for permanent seeding. If vegetation fails to grow, soil should be tested to determine if low pH or nutrient imbalances are responsible.

On a typical disturbed site, full plant establishment usually requires refertilization in the second growing season. Soil tests can be used to determine if more fertilizer needs to be added. Do not fertilize cool season grasses in late May through July. Grass that looks yellow may be nitrogen deficient. Do not use nitrogen fertilizer if the stand contains more than 20 percent legumes.

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Sodding

Description

Sodding is a permanent erosion control practice that involves laying a continuous cover of grass sod on exposed soils. Sodding stabilizes soils and reduces the velocity of storm water runoff. Sodding can provide immediate vegetative cover for critical areas and stabilize areas that cannot be vegetated by seed. It also can stabilize channels or swales that convey concentrated flows and can reduce flow velocities.

Design

Sodding eliminates the need for seeding and mulching and produces more reliable results with less maintenance. Sod can be laid during times of the year when seeded grasses are likely to fail. The sod must be watered frequently within the first few weeks of installation. The type of sod selected should be composed of plants adapted to site conditions. Sod composition should reflect environmental conditions as well as the function of the area where the sod will be laid. The sod should be of known genetic origin and be free of noxious weeds, diseases, and insects. The sod should be machine cut at a uniform soil thickness of 0.6 inches to 1 inch (15 to 25 mm) at the time of establishment (this does not include top growth or thatch).

Prepare the soil and add lime and fertilizer as needed; soils should be tested to determine if amendments are needed. Lay sod in strips perpendicular to the direction of flow and staggered in a brick-like pattern. Staple the corners and middle of each strip firmly. Peg jute or plastic netting over the sod for further protection against washout during establishment, if necessary. Clear areas to be sodded of trash, debris, roots, branches, stones and clods larger than 2 inches in diameter. Sod should be harvested, delivered, and installed within a period of 36 hours.

Consult a landscaper to ensure proper establishment.

Maintenance

Watering is very important to maintain adequate moisture in the root zone and to prevent dormancy, especially within the first few weeks of installation, until it is fully rooted. Mowing should not result in the removal of more than one-third of the shoot. Grass height should be maintained between 2 and 3 inches. After the first growing season, sod might require additional fertilization or liming. Permanent, fine turf areas require yearly maintenance fertilization. Warm-season grass should be fertilized in late spring to early summer, and cool-season grass, in late winter and again in early fall.

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Soil Roughening

Description

Soil roughening is a temporary erosion control practice often used in conjunction with grading. Soil roughening involves increasing the relief of a bare soil surface with horizontal grooves, stair-stepping (running parallel to the contour of the land), or tracking using construction equipment. Slopes that are not fine graded and that are left in a roughened condition can also reduce erosion. Soil roughening reduces runoff velocity, increases infiltration, reduces erosion, traps sediment, and prepares the soil for seeding and planting by giving seed an opportunity to take hold and grow.

Soil roughening is appropriate for all slopes. Soil roughening works well on slopes greater than 3:1, on piles of excavated soil, and in areas with highly erodible soils. This technique is especially appropriate for soils that are frequently mowed or disturbed because roughening is relatively easy to accomplish. To slow erosion, roughening should be done as soon as possible after the vegetation has been removed form the slope. Roughening can be used with both seeding and planting and temporary mulching to stabilize an area. For steeper slopes and slopes that will be left roughened for longer periods of time, a combination of surface roughening and vegetation is appropriate. Roughening should be performed immediately after grading activities have ceased (temporarily or permanently) in an area.

Soil roughening is not appropriate for rocky slopes. Soil compaction might occur when roughening with tracked machinery. Soil roughening is of limited effectiveness in anything more than a gentle or shallow depth rain.

Design

Roughen slope surfaces to allow surface ponding and to lengthen flow paths. Avoid excessive compacting of the soil surface, especially when tracking, because soil compaction inhibits vegetation growth and causes higher runoff velocity. Limit roughening with tracked machinery to sandy soils that do not compact easily and avoid tracking on heavy clay soils, particularly when wet. Seed as quickly as possible after roughening. Implement proper dust control procedures when soil roughening. Select an appropriate method of roughening, depending on the type of slope and the available equipment.

- *Cut slope roughening for areas that will not be mowed. Use s*tair-step grades or groove-cut slopes for gradients steeper than 3:1. Stair-step grading should be used on any erodible material that is soft enough to be ripped with a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair-step grading. The vertical cut distance should be less than the horizontal distance, and the horizontal portion of the step should be slightly sloped toward the vertical wall. Individual vertical cuts should not be made more than 2 feet deep in soft materials or more than 3 feet deep in rocky materials.
- *Grooving*. This technique uses machinery to create a series of ridges and depressions that run across the slope along the contour. Grooves should be made using any appropriate implement that can be safely operated on the slope, such as disks, tillers, spring harrows, or the teeth on a front-end loader bucket. The grooves should be made more than 3 inches deep and less than 15 inches apart.
- *Fill slope roughening for areas that will not be mowed.* Fill slopes with a gradient steeper than 3:1 should be placed in lifts less than 9 inches, and each lift should be properly compacted. The face of the slope should consist of loose, uncompacted fill 4 to 6 inches deep. Grooving should be used as described above to roughen the face of the slopes, if necessary. The final slope face should not be bladed or scraped.
- *Cuts, fills, and graded areas that will be mowed.* Mowed slopes should be made no steeper than 3:1. These areas should be roughened with shallow grooves less than 10 inches apart and more than 1 inch deep using normal tilling, disking, or harrowing equipment (a cultipacker-seeder can also be used). Excessive roughness is undesirable where mowing is planned.

Roughening with tracked machinery. Roughening with tracked machinery should be limited to sandy soils to avoid undue compaction of the soil surface. Tracked machinery should be operated perpendicular to the slope to leave horizontal depressions in the soil. Tracking is generally not as effective as other roughening methods.

Maintenance

Inspect roughened areas after rain events. Regular inspection of roughened slopes will indicate where additional erosion and sediment control measures are needed. If rills (small watercourses that have steep sides and are usually only a few inches deep) appear, they should be filled, graded again, and reseeded immediately. Use proper dust control methods.

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Geotextiles

Description

Geotextiles are porous fabrics also known as filter fabrics, road rugs, synthetic fabrics, construction fabrics, or simply fabrics. Geotextiles are manufactured by weaving or bonding fibers made from synthetic materials such as polypropylene, polyester, polyethylene, nylon, polyvinyl chloride, glass, and various mixtures of these materials. As a synthetic construction material, geotextiles are used for a variety of purposes such as separators, reinforcement, filtration and drainage, and erosion control (USEPA, 1992). Some geotextiles are made of biodegradable materials such as mulch matting and netting. Mulch mattings are jute or other wood fibers that have been formed into sheets and are more stable than normal mulch. Netting is typically made from jute, wood fiber, plastic, paper, or cotton and can be used to hold the mulching and matting to the ground. Netting can also be used alone to stabilize soils while the plants are growing; however, it does not retain moisture or temperature well. Mulch binders (either asphalt or synthetic) are sometimes used instead of netting to hold loose mulches together. Geotextiles can aid in plant growth by holding seeds, fertilizers, and topsoil in place. Fabrics are relatively inexpensive for certain applications. A wide variety of geotextiles exist to match the specific needs of the site.

Geotextiles can be used alone for erosion control. Geotextiles can be used as matting, which is used to stabilize the flow of channels or swales or to protect seedlings on recently planted slopes until they become established. Matting may be used on stream banks, where moving water is likely to wash out new plantings. They can also be used to protect exposed soils immediately and temporarily, such as when active piles of soil are left overnight. Geotextiles are also used as separators; for example, as a separator between riprap and soil. This "sandwiching" prevents the soil from being eroded from beneath the riprap and maintains the riprap's base.

Design

There are many types of geotextiles available. Therefore, the selected fabric should match its purpose. State or local requirements, design procedures, and manufacturer recommendations should be considered. Effective netting and matting require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil, and erosion will occur underneath the material.

Maintenance

Regular inspections should be made to determine if cracks, tears, or breaches have formed in the fabric; if so, it should be repaired or replaced immediately. It is necessary to maintain contact between the ground and the geotextile at all times. Trapped sediment should be removed after each storm event.

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Gradient Terraces

Description

Gradient terraces are made of either earthen embankments or ridge and channel systems that are properly spaced and are constructed with an adequate grade. They reduce damage from erosion by collecting and redistributing surface runoff to stable outlets at slower speeds and by increasing the distance of overland runoff flow. They also surpass smooth slopes in holding moisture and help to minimize sediment loading of surface runoff.

Gradient terraces are most suitable for use in areas with an existing or expected water erosion problem and no vegetation, and they are only effective when there are suitable runoff outlets provided. They are usually limited to use on long, steep slopes with a water erosion problem, or where it is anticipated that water erosion will be a problem. They should not be constructed on slopes containing rocky, sandy, or shallow soil.

Design

Gradient terraces should be designed with adequate and appropriate outlets and should be installed according to a well-developed plan after conducting an engineering survey and layout. Acceptable outlets include grassed waterways, vegetated areas, or tile outlets. Any outlet that is used should be able to redirect surface runoff away from the terraces and toward an area that is not susceptible to erosion or other damage. Avoid the potential for sloughing failures.

General specifications require that:

- Whenever possible, vegetative cover should be used in the outlet.
- At the junction of the terrace and the outlet, the terrace's water surface design elevation should be no lower than the outlet's water surface design elevation when both are performing at design flow.
- During construction of the terrace system, dust control procedures should be followed.

- Proper vegetation/stabilization practices should be followed while constructing these features.

Maintenance

Inspect the terraces after any major storms and at least once a year to ensure that they are structurally sound and have not been subject to erosion.

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Soil Retention

Description

Soil retention measures are structures or practices that are used to hold soil in place or to keep it contained within a site boundary. They may include grading or reshaping the ground to lessen steep slopes or shoring excavated areas with wood, concrete, or steel structures. Some soil-retaining measures are used for erosion control, while others are used for protection of workers during construction projects such as excavations.

Grading to reduce steep slopes can be implemented at any construction site by assessing site conditions before breaking ground and reducing steep slopes where possible. Reinforced soil-retaining structures should be used when sites have very steep slopes or loose, highly erodible soils that cause other methods, such as chemical or vegetative stabilization or regrading, to be ineffective. The preconstruction drainage pattern should be maintained to the extent possible.

Design

Some examples of reinforced soil retaining structures include:

- *Skeleton sheeting*. An inexpensive soil bracing system that requires soil to be cohesive and consists of construction grade lumber being used to support the excavated face of a slope
- *Continuous sheeting*. Involves using a material that covers the entire slope continuously, with struts and boards placed along the slope to support the slope face - steel, concrete, or wood should be used as the materials
- *Permanent retaining walls*. Walls of concrete masonry or wood (railroad ties) that are left in place after construction is complete in order to provide continued support of the slope

The proper design of reinforced soil-retaining structures is crucial for erosion control and safety. To ensure safety of the retaining structure, it should be designed by a qualified

engineer who understands all of the design considerations, such as the nature of the soil, location of the ground water table, and the expected loads. Care should be taken to ensure that hydraulic pressure does not build up behind the retaining structure and cause failure.

To be effective, soil-retention structures must be designed to handle expected loads. However, heavy rains or mass wasting may damage or destroy these structures and result in sediment inputs to waterbodies. They must be properly installed and maintained to avoid failure.

Maintenance

Soil-stabilization structures should be inspected periodically, particularly after rainstorms, to check for erosion, damage, or other signs of deterioration. Any damage to the actual slope or ditch, such as washouts or breakage, should be repaired prior to any reinstallation of the materials for the soil-stabilization structure.

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Temporary Slope Drain

Description

A temporary slope drain is a flexible conduit extending the length of a disturbed slope and serving as a temporary outlet for a diversion. Temporary slope drains, also called pipe slope drains, convey runoff without causing erosion on or at the bottom of the slope. This practice is a temporary measure used during grading operations until permanent drainage structures are installed and until slopes are permanently stabilized. They are typically used for less than 2 years.

Temporary slope drains can be used on most disturbed slopes to eliminate gully erosion problems resulting from concentrated flows discharged at a diversion outlet.

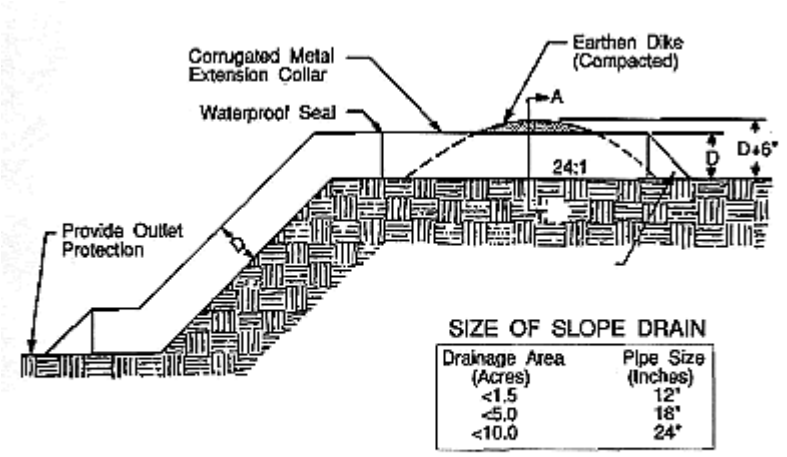
Design

Recently graded slopes that do not have permanent drainage measures installed should have a temporary slope drain and a temporary diversion installed. A temporary slope drain used in conjunction with a diversion conveys storm water flows and reduces erosion until permanent drainage structures are installed.

The following are design recommendations for temporary slope drains:

- The drain should consist of heavy-duty material manufactured for the purpose and have grommets for anchoring at a spacing of 10 feet or less.
- Minimum slope drain diameters should be observed for varying drainage areas.
- The entrance to the pipe should consist of a standard flared section of corrugated metal; the corrugated metal pipe should have watertight joints at the ends; the rest of the pipe is typically corrugated plastic or flexible tubing, although for flatter, shorter slopes, a polyethylene-lined channel is sometimes used.
    - The height of the diversion at the pipe should be the diameter of the pipe plus 0.5 foot.
    - The outlet should be located at a reinforced or erosion-resistant location.

The area drained by a temporary slope drain should not exceed 5 acres. Physical obstructions substantially reduce the effectiveness of the drain. Other concerns are failures from overtopping because of inadequate pipe inlet capacity, and reduced diversion channel capacity and ridge height.



Drains can be installed along a steep exposed slope to divert runoff and prevent erosion (Source: Urban Drainage and Flood Control District, 1999)

Maintenance

The slope drain should be inspected after each rainfall to determine if capacity was exceeded or if blockages occurred. Repairs should be made promptly. Construction equipment and vehicular traffic must be rerouted around slope drains.

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Temporary Stream Crossings

Description

A temporary steam crossing is a structure erected to provide a safe and stable way for construction vehicle traffic to cross a running watercourse. The primary purpose of such a structure is to provide streambank stabilization, reduce the risk of damaging the streambed or channel, and reduce the risk of sediment loading from construction traffic. A temporary stream crossing may be a bridge, a culvert, or a ford.

Temporary stream crossings are applicable wherever heavy construction equipment must be moved from one side of a stream channel to the other, or where lighter construction vehicles will cross the stream a number of times during the construction period. In either case, an appropriate method for ensuring the stability of the streambanks and preventing large-scale erosion is necessary.

A bridge or culvert is the best choice for most temporary stream crossings. If properly designed, each can support heavy loads and materials used to construct most bridges, and culverts can be salvaged after they are removed. Fords are appropriate in steep areas subject to flash flooding, where normal flow is shallow or intermittent across a wide channel. Fords should be used only where stream crossings are expected to be infrequent.

Design

Because of the potential for stream degradation, flooding, and safety hazards, stream crossings should be avoided on a construction site whenever possible. Consideration should be given to alternative routes to accessing a site before arrangements are made to erect a temporary stream crossing. If it is determined that a stream crossing is necessary, an area where the potential for erosion is low should be selected. If possible, the stream crossing structure should be selected during a dry period to reduce sediment transport into the stream.

If needed, over-stream bridges are generally the preferred temporary stream crossing structure. The expected load and frequency of the stream crossing, however, will govern the selection of a bridge as the correct choice for a temporary stream crossing. Bridges usually cause minimal disturbance to a stream's banks and cause the least obstruction to stream flow and fish migration. They should be constructed only under the supervision and approval of a qualified engineer.

As general guidelines for constructing temporary bridges, clearing and excavation of the stream shores and bed should be kept to a minimum. Sufficient clearance should be provided for floating objects to pass under the bridge. Abutments should be parallel to the stream and on stable banks. If the stream is less than 8 feet wide at the point a crossing is needed, no additional in-stream supports should be used. If the crossing is to extend across a channel wider than 8 feet (as measured from top of bank to top of bank), the bridge should be designed with one in-water support for each 8 feet of stream width.

A temporary bridge should be anchored by steel cable or chain on one side only to a stable structure on shore. Examples of anchoring structures include large-diameter trees, large boulders, and steel anchors. By anchoring the bridge on one side only, there is a decreased risk of downstream blockage or flow diversion if a bridge is washed out.

When constructing a culvert, filter cloth should be used to cover the streambed and streambanks to reduce settlement and improve the stability of the culvert structure. The filter cloth should extend a minimum of 6 inches and a maximum of 1 foot beyond the end of the culvert and bedding material. The culvert piping should not exceed 40 feet in length and should be of sufficient diameter to allow for complete passage of flow during peak flow periods. The culvert pipes should be covered with a minimum of 1 foot of aggregate. If multiple culverts are used, at least 1 foot of aggregate should separate the pipes.

Fords should be constructed of stabilizing material such as large rocks.

Bridges can be considered the greatest safety hazard of all temporary stream crossing structures if not properly designed and constructed. Bridges might also prove to be more costly in terms of repair costs and lost construction time if they are washed out or collapse (Smolen et al., 1988).

The construction and removal of culverts are usually very disturbing to the surrounding area, and erosion and downstream movement of soils is often great. Culverts can also create obstructions to flow in a stream and inhibit fish migration. Depending on their size, culverts can be blocked by large debris in a stream and are therefore vulnerable to frequent washout.

If given a choice between building a bridge or a culvert as a temporary stream crossing, a bridge is preferred because of the relative minimal disturbance to streambanks and the opportunity for unimpeded flow through the channel.

The approaches to fords often have high erosion potential. In addition, excavation of the streambed and approach to lay riprap or other stabilization material causes major stream disturbance. Mud and other debris are transported directly into the stream unless the crossing is used only during periods of low flow.

Maintenance

Temporary stream crossings should be inspected at least once a week and after all significant rainfall events. If any structural damage is reported to a bridge or culvert, construction traffic should stop use of the structure until appropriate repairs are made. Evidence of streambank erosion should be repaired immediately.

Fords should be inspected closely after major storm events to ensure that stabilization materials remain in place. If the material has moved downstream during periods of peak flow, the lost material should be replaced immediately.

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Vegetated Buffer

Description

Vegetated buffers are areas of either natural or established vegetation that are maintained to protect the water quality of neighboring areas. Buffer zones reduce the velocity of storm water runoff, provide an area for the runoff to permeate the soil, contribute to ground water recharge, and act as filters to catch sediment. The reduction in velocity also helps to prevent soil erosion.

Vegetated buffers can be used in any area that is able to support vegetation but they are most effective and beneficial on floodplains, near wetlands, along streambanks, and on steep, unstable slopes. They are also effective in separating land use areas that are not compatible and in protecting wetlands or waterbodies by displacing activities that might be potential sources of nonpoint source pollution.

Design

To establish an effective vegetative buffer, the following guidelines should be followed:

- Soils should not be compacted.
- Slopes should be less than 5 percent.
- Buffer widths should be determined after careful consideration of slope, vegetation, soils, depth to impermeable layers, runoff sediment characteristics, type and quantity of storm water pollutants, and annual rainfall.
- Buffer widths should increase as slope increases.
- Zones of vegetation (native vegetation in particular), including grasses, deciduous and evergreen shrubs, and understory and overstory trees, should be intermixed.
- In areas where flows are concentrated and velocities are high, buffer zones should be combined with other structural or nonstructural BMPs as a pretreatment.

Vegetated buffers require plant growth before they can be effective, and land on which to plant the vegetation must be available. If the cost of the land is very high, buffer zones might not be cost-effective. Although vegetated buffers help to protect water quality, they usually do not effectively counteract concentrated storm water flows to neighboring or downstream wetlands.

Maintenance

Keeping vegetation healthy in vegetated buffers requires routine maintenance, which (depending on species, soil types, and climatic conditions) can include weed and pest control, mowing, fertilizing, liming, irrigating, and pruning. Inspection and maintenance are most important when buffer areas are first installed. Once established, vegetated buffers do not require much maintenance beyond the routine procedures listed earlier and periodic inspections of the areas, especially after any heavy rainfall and at least once a year. Inspections should focus on encroachment, gully erosion, density of vegetation, evidence of concentrated flows through the areas, and any damage from foot or vehicular traffic. If there is more than 6 inches of sediment in one place, it should be removed.

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Construction Sequencing

Description

Construction sequencing requires creating and following a work schedule that balances the timing of land disturbance activities and the installation of measures to control erosion and sedimentation, in order to reduce on-site erosion and off-site sedimentation.

Construction sequencing can be used to plan earthwork and erosion and sediment control (ESC) activities at sites where land disturbances might affect water quality in a receiving waterbody.

Design

Construction sequencing schedules should, at a minimum, include the following:

- The ESC practices that are to be installed
- Principal development activities
    - Which measures should be installed before other activities are started
    - Compatibility with the general contract construction schedule

Table 1 summarizes other important scheduling considerations in addition to those listed above.

Table 1. Scheduling considerations for construction activities.

Construction Activity	Schedule Consideration
Construction access—	entrance to site, construction routes, areas designated for equipment parking. This is the first land-disturbing activity. As soon as construction begins, stabilize any bare areas with gravel and temporary vegetation.
Sediment traps and barriers—	basin traps, sediment fences, outlet protection. After construction site is accessed, principal basins should be installed, with the addition of more traps and barriers as needed during grading.
Runoff control—	diversions, perimeter dikes, water bars, outlet protection. Key practices should be installed after the installation of principal sediment traps and before land grading. Additional runoff control measures may be installed during grading.
Runoff conveyance system—	stabilize stream banks, storm drains, channels, inlet and outlet protection, slope drains. If necessary, stabilize stream banks as soon as possible, and install principal runoff conveyance system with runoff control measures. The remainder of the systems may be installed after grading.
Land clearing and grading—	site preparation (cutting, filling, and grading, sediment traps, barriers, diversions, drains, surface roughening). Implement major clearing and grading after installation of principal sediment and key runoff-control measures, and install additional control measures as grading continues. Clear borrow and disposal areas as needed, and mark trees and buffer areas for preservation.
Surface stabilization—temporary and permanent seeding, mulching, sodding, riprap	Temporary or permanent stabilizing measures should be applied immediately to any disturbed areas where work has been either completed or delayed.
Building construction—buildings, utilities, paving	During construction, install any erosion and sedimentation control measures that are needed.
Landscaping and final stabilization—topsoiling, trees and shrubs, permanent seeding, mulching, sodding, riprap	This is the last construction phase. Stabilize all open areas, including borrow and spoil areas, and remove and stabilize all temporary control measures.

Weather and other unpredictable variables may affect construction sequence schedules. However, the proposed schedule and a protocol for making changes due to unforeseen problems should be plainly stated in the ESC plan.

Maintenance

The construction sequence should be followed throughout the project and the written plan should be modified before any changes in construction activities are executed. The plan can be updated if a site inspection indicates the need for additional erosion and sediment control.

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Dust Control

Description

Dust control measures are practices that help reduce surface and air movement of dust from disturbed soil surfaces. Construction sites are good candidates for dust control measures because land disturbance from clearing and excavation generates a large amount of soil disturbance and open space for wind to pick up dust particles. To illustrate this point, limited research at construction sites has established an average dust emission rate of 1.2 tons/acre/month for active construction (WA Dept. of Ecology, 1992). These airborne particles pose a dual threat to the environment and human health. First, dust can be carried off-site, thereby increasing soil loss from the construction area and increasing the likelihood of sedimentation and water pollution. Second, blowing dust particles can contribute to respiratory health problems and create an inhospitable working environment.

Dust control measures are applicable to any construction site where dust is created and there is the potential for air and water pollution from dust traveling across the landscape or through the air. Dust control measures are particularly important in arid or semiarid regions, where soil can become extremely dry and vulnerable to transport by high winds. Also, dust control measures should be implemented on all construction sites where there will be major soil disturbances or heavy construction activity, such as clearing, excavation, demolition, or excessive vehicle traffic. Earthmoving activities are the major source of dust from construction sites, but traffic and general disturbances can also be major contributors (WA Dept. of Ecology, 1992). The particular dust control measures that are implemented at a site will depend on the topography and land cover of a given site, as well as the soil characteristics and expected rainfall at the site.

Design

When designing a dust control plan for a site, the amount of soil exposed will dictate the quantity of dust generation and transport. Therefore, construction sequencing and disturbing only small areas at a time can greatly reduce problematic dust from a site. If land must be disturbed, additional temporary stabilization measures should be considered prior to disturbance. A number of methods can be used to control dust from a site. The following is a brief list of some control measures and their design criteria. Not all control measures will be applicable to a given site. The owner, operator, and contractors responsible for dust control at a site will have to determine which practices accommodate their needs based on specific site and weather conditions.

- *Sprinkling/Irrigation*. Sprinkling the ground surface with water until it is moist is an effective dust control method for haul roads and other traffic routes (Smolen et al., 1988). This practice can be applied to almost any site.
- *Vegetative Cover*. In areas not expected to handle vehicle traffic, vegetative stabilization of disturbed soil is often desirable. Vegetative cover provides coverage to surface soils and slows wind velocity at the ground surface, thus reducing the potential for dust to become airborne.
- *Mulch*. Mulching can be a quick and effective means of dust control for a recently disturbed area (Smolen et al., 1988).
- *Wind Breaks*. Wind breaks are barriers (either natural or constructed) that reduce wind velocity through a site and therefore reduce the possibility of suspended particles. Wind breaks can be trees or shrubs left in place during site clearing or constructed barriers such as a wind fence, snow fence, tarp curtain, hay bale, crate wall, or sediment wall (USEPA, 1992).
- *Tillage*. Deep tillage in large open areas brings soil clods to the surface where they rest on top of dust, preventing it from becoming airborne.
- *Stone*. Stone may be an effective dust deterrent for construction roads and entrances or as a mulch in areas where vegetation cannot be established.
- *Spray-on Chemical Soil Treatments (palliatives)*. Examples of chemical adhesives include anionic asphalt emulsion, latex emulsion, resin-water emulsions, and calcium chloride. Chemical palliatives should be used only on mineral soils. When considering chemical application to suppress dust, consideration should be taken as to whether the chemical is biodegradable or water-soluble and what effect its application could have on the surrounding environment, including waterbodies and wildlife.

Table 1 shows application rates for some common spray-on adhesives, as recommended by Smolen et al. (1988).

Table 1. Application rates for spray-on adhesives (Source: Smolen et al., 1988)

Spray-on Adhesive	Water Dilution	Type of Nozzle	Application (gal/ac)
Anionic Asphalt Emulsion	7:1	Coarse Spray	1,200
Latex Emulsion	12.5:1	Fine Spray	235
Resin in Water	4:1	Fine Spray	300

In areas where evaporation rates are high, water application to exposed soils may require near constant attention. If water is applied in excess, irrigation may create unwanted excess runoff from the site and possibly create conditions where vehicles could track mud onto public roads. Chemical applications should be used sparingly and only on mineral soils (not muck soils) because their misuse can create additional surface water pollution from runoff or contaminate ground water. Chemical applications might also present a health risk if excessive amounts are used.

Maintenance Considerations

Because dust controls are dependent on specific site and weather conditions, inspection and maintenance are unique for each site. Generally, however, dust control measures involving

application of either water or chemicals require more monitoring than structural or vegetative controls to remain effective. If structural controls are used, they should be inspected for deterioration on a regular basis to ensure that they are still achieving their intended purpose.

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Temporary Diversion Dikes, Earth Dikes, & Interceptor Dikes

Description

Earthen perimeter controls usually consist of a dike or a combination dike and channel constructed along the perimeter of a disturbed site. Simply defined, an earthen perimeter control is a ridge of compacted soil, often accompanied by a ditch or swale with a vegetated lining, located at the top or base of a sloping disturbed area. Depending on their location and the topography of the landscape, earthen perimeter controls can achieve one of two main goals.

Located on the upslope side of a site, earthen perimeter controls help to prevent surface runoff from entering a disturbed construction site. An earthen structure located upslope can improve working conditions on a construction site by preventing an increase in the total amount of sheet flow runoff traveling across the disturbed area and thereby lessen erosion on the site.

Alternatively, earthen perimeter control structures can be located on the downslope side of a site to divert sediment-laden runoff created onsite to onsite sediment trapping devices, preventing soil loss from the disturbed area.

These control practices can be referred to by a number of terms, including temporary diversion dikes, earth dikes, or interceptor dikes. Generally speaking, however, all earthen perimeter controls are constructed in a similar fashion with a similar objective—to control the velocity and/or route of sediment-laden storm water runoff.

Temporary diversion dikes are applicable where it is desirable to divert flows away from disturbed areas such as cut or fill slopes and to divert runoff to a stabilized outlet (EPA, 1992). The dikes can be erected at the top of a sloping area or in the middle of a slope to divert storm water runoff around a disturbed construction site. In this way, earth dikes can be used to reduce the length of the slope across which runoff will travel, thereby reducing the erosion potential of the flow. If placed at the bottom of a sloping disturbed area, diversion dikes can divert flow to a sediment trapping device. Temporary diversion dikes are usually appropriate for drainage basins smaller than 5 acres, but with modifications they can be capable of servicing areas as large as 10 acres. With regular maintenance, earthen diversion dikes have a useful life span of approximately 18 months.

To prevent storm water runoff from entering a site, earthen perimeter controls can be used to divert runoff from areas upslope around the disturbed construction site. This is accomplished by constructing a continuous, compacted earthen mound along the upslope perimeter of the site. As an additional control measure, a shallow ditch can accompany the earthen mound.

Design

The siting of earthen perimeter controls depends on the topography of the area surrounding a specific construction site and on whether the goal is to prevent sediment-laden runoff from entering the site or to keep storm water runoff from leaving the site. When determining the appropriate size and design of earthen perimeter controls, the shape of the surrounding landscape and drainage patterns should be considered. Also, the amount of runoff to be diverted, the velocity of runoff in the diversion, and the erodibility of soils on the slope and within the diversion channel or swale are essential design considerations (WSDE, 1992).

Diversion dikes should be constructed and fully stabilized prior to commencement of major land disturbance. This will maximize the effectiveness of the diversion measure as an erosion and sediment control device.

The top of earthen perimeter controls designed as temporary flow diversion measures should be at least 2 feet wide. Bottom width at ground level is typically 6 feet. The minimum height for earthen dikes should be 18 inches, with side slopes no steeper than 2:1. For points where vehicles will cross the dike, the slope should be no steeper than 3:1 and the mound should be constructed of gravel rather than soil. This will prolong the life of the dike and increase effectiveness at the point of vehicle crossing.

If a channel is excavated along the dike, its shape can be parabolic, trapezoidal, or V-shaped. Prior to excavation or mound building, all trees, brush, stumps and other objects in the path of the diversion structure should be removed and the base of the dike should be tilled before laying the fill. The maximum design flow velocity should range from 1.5 to 5.0 feet per second, depending on the vegetative cover and soil texture.

Most earthen perimeter structures are designed for short-term, temporary use. If the expected life span of the diversion structure is greater than 15 days, it is strongly recommended that both the earthen dike and the accompanying ditch be seeded with vegetation immediately after construction. This will increase the stability of the perimeter control and can decrease the need for frequent repairs and maintenance.

Earth dikes are an effective means of diverting sediment-laden storm water runoff around a disturbed area. However, the concentrated runoff in the channel or ditch has increased erosion potential. To alleviate this erosion capability, diversion dikes must be directed to sediment trapping devices, where erosion sediment can settle out of the runoff before being discharged to surface waters. Examples of appropriate sediment trapping devices that might

be used in conjunction with temporary diversion structures include a sediment basin, a sediment chamber/filter, or any other structure designed to allow sediment to be collected for proper disposal.

If a diversion dike crosses a vehicle roadway or entrance, its effectiveness can be reduced. Wherever possible, diversion dikes should be designed to avoid crossing vehicle pathways.

Maintenance

Earthen diversion dikes should be inspected after each rainfall to ensure continued effectiveness. The dike should be maintained at the original height, and any decrease in height due to settling or erosion should be repaired immediately. To remain effective, earth dikes must be compacted at all times. Regardless of rainfall frequency, dikes should be inspected at least once every 2 weeks for evidence of erosion or deterioration.

When properly placed and maintained, earth dikes used as temporary diversions are effective for controlling the velocity and direction of storm water runoff. Used by themselves, they do not have any pollutant removal capability. Diversion dikes must be used in combination with an appropriate sediment trapping device at the outfall of the diversion channel.

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Silt Fence

Description

Silt fences are used as temporary perimeter controls around sites where there will be soil disturbance due to construction activities. They consist of a length of filter fabric stretched between anchoring posts spaced at regular intervals along the site perimeter. The filter fabric should be entrenched in the ground between the support posts. When installed correctly and inspected frequently, silt fences can be an effective barrier to sediment leaving the site in storm water runoff.

Silt fences are generally applicable to construction sites with relatively small drainage areas. They are appropriate in areas where runoff will be occurring as low-level shallow flow, not exceeding 0.5 cfs. The drainage area for silt fences generally should not exceed 0.25 acre per 100-foot fence length. Slope length above the fence should not exceed 100 feet (NAHB, 1995).

Design

Material for silt fences should be a pervious sheet of synthetic fabric such as polypropylene, nylon, polyester, or polyethylene yarn, chosen based on minimum synthetic fabric requirements, as shown in Table 1.

Table 1. Minimum requirements for silt fence construction (Sources: USEPA, 1992; VDCR, 1995)

Physical Property	Requirements
Filtering Efficiency	75 - 85% (minimum): highly dependent on local conditions
Tensile Strength at 20% (maximum) Elongation	Standard Strength: 30 lbs/linear inch (minimum) Extra Strength: 50 lbs/linear inch (minimum)
Ultraviolet Radiation	90% (minimum)
Slurry Flow Rate	0.3 gal/ft2/min (minimum)

If a standard strength fabric is used, it can be reinforced with wire mesh behind the filter fabric. This can increase the effective life of the fence. In any case, the maximum life expectancy for synthetic fabric silt fences is approximately 6 months, depending on the amount of rainfall and runoff for a given area. Burlap fences have a much shorter useful life span, usually only up to 2 months.

Stakes used to anchor the filter fabric should be either wooden or metal. Wooden stakes should be at least 5 feet long and have a minimum diameter of 2 inches if a hardwood such as oak is used. Softer woods such as pine should be at least 4 inches in diameter. When using metal post in place of wooden stakes, they should have a minimum weight of 1.00 to 1.33 lb/linear foot. If metal posts are used, attachment points are needed for fastening the filter fabric using wire ties.

A silt fence should be erected in a continuous fashion from a single roll of fabric to eliminate unwanted gaps in the fence. If a continuous roll of fabric is not available, the fabric should overlap from both directions only at stakes or posts with a minimum overlap of 6 inches. A trench should be excavated to bury the bottom of the fabric fence at least 6 inches below the ground surface. This will help prevent gaps from forming near the ground surface that would render the fencing useless as a sediment barrier.

The height of the fence posts should be between 16 and 34 inches above the original ground surface. If standard strength fabric is used in combination with wire mesh, the posts should be spaced no more than 10 feet apart. If extra-strength fabric is used without wire mesh reinforcement, the support posts should be spaced no more than 6 feet apart (VDCR, 1995).

The fence should be designed to withstand the runoff from a 10-year peak storm event, and once installed should remain in place until all areas up-slope have been permanently stabilized by vegetation or other means.

Silt fences should not be installed along areas where rocks or other hard surfaces will prevent uniform anchoring of fence posts and entrenching of the filter fabric. This will greatly reduce the effectiveness of silt fencing and can create runoff channels leading off site. Silt fences are not suitable for areas where large amounts of concentrated runoff are likely. In addition, open areas where wind velocity is high may present a maintenance challenge, as high winds may accelerate deterioration of the filter fabric. Silt fences should not be installed across streams, ditches, or waterways (Smolen et al., 1988).

When the pores of the fence fabric become clogged with sediment, pools of water are likely to form on the uphill side of fence. Siting and design of the silt fence should account for this and care should be taken to avoid unnecessary diversion of storm water from these pools that might cause further erosion damage.

Maintenance

Silt fences should be inspected regularly and frequently as well as after each rainfall event to ensure that they are intact and that there are no gaps at the fence-ground interface or tears along the length of the fence. If gaps or tears are found, they should be repaired or the fabric should be replaced immediately. Accumulated sediments should be removed from the fence base when the sediment reaches one-third to one-half the height of the fence. Sediment removal should occur more frequently if accumulated sediment is creating noticeable strain on the fabric and there is the possibility of the fence failing from a sudden storm event. When the silt fence is removed, the accumulated sediment also should be removed.

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Sediment Basins and Rock Dams

Description

Sediment basins and rock dams are two ways to capture sediment from storm water runoff before it leaves a construction site. Both structures allow a shallow pool to form in an excavated or natural depression where sediment from storm water runoff can settle. Basin dewatering is achieved either through a single riser and drainage hole leading to a suitable outlet on the downstream side of the embankment or through the gravel of the rock dam. In both cases, water is released at a substantially slower rate than would be possible without the control structure.

A sediment basin can be constructed by excavation or by erecting an earthen embankment across a low area or drainage swale. The basin can be either a temporary (up to 3 years) structure or a permanent storm water control measure. Sediment basins can be designed to drain completely during dry periods, or they can be constructed so that a shallow, permanent pool of water remains between storm events. However, depending on the size of the basin constructed, the basin may be considered a wet pond and subject to additional regulation.

Rock dams are similar in design to sediment basins with earthen embankments. These damming structures are constructed of rock and gravel and release water from the settling pool gradually through the spaces between the rock aggregate.

Sediment basins are usually used for drainage areas of 5 to 100 acres. They can be temporary or permanent structures. Generally, sediment basins designed to be used for up to 3 years are described as temporary, while those designed for longer service are said to be permanent. Temporary sediment basins can be converted into permanent storm water runoff management ponds, but they must meet all regulatory requirements for wet ponds.

Sediment basins are applicable in drainage areas where it is anticipated that other erosion controls, such as sediment traps, will not be sufficient to prevent off-site transport of sediment. Choosing to construct a sediment basin with either an earthen embankment or a stone/rock dam will depend on the materials available, location of the basin, and desired capacity for storm water runoff and settling of sediments.

Rock dams are suitable where earthen embankments would be difficult to construct or where riprap is readily available. Rock structures are also desirable where the top of the dam structure is to be used as an overflow outlet. These riprap dams are best for drainage areas of less than 50 acres. Earthen damming structures are appropriate where failure of the dam will not result in substantial damage or loss of property or life. If properly constructed, sediment basins with earthen dams can handle storm water runoff from drainage basins as large as 100 acres.

Design

The potential sites for sediment basins should be investigated during the initial site evaluation. Basins should be constructed before any grading takes place within the drainage area. For structures that will be permanent, the design of the basin should be completed by a qualified professional engineer experienced in the design of dams.

Sediment basins with rock dams should be limited to a drainage area of 50 acres. Rock dam height should be limited to 8 feet with a minimum top width of 5 feet. Side slopes for rock dams should be no steeper than 2:1 on the basin side of the structure and 3:1 on the outlet side. The basin side of the rock dam should be covered with fine gravel from top to bottom for a minimum of 1 foot. This will slow the drainage rate from the pool that forms and allow time for sediments to settle. The detention time should be at least 8 hours.

Sediment basins with earthen embankments should be outfitted with a dewatering pipe and riser set just above the sediment removal cutoff level. The riser pipe should be located at the deepest point of the basin and extend no farther than 1 foot below the level of the earthen dam. A water-permeable cover should be placed over the primary dewatering riser pipe to prevent trash and debris from entering and clogging the spillway. To provide an additional path for water to enter the primary spillway, secondary dewatering holes can be drilled near the base of the riser pipe, provided the holes are protected with gravel to prevent sediment from entering the spillway piping.

To ensure adequate drainage, the following equation can be used to approximate the total area of dewatering holes for a particular basin (Smolen et al., 1988):

$$A_o = (A_s \times (2h) / (T \times C_d \times 20{,}428)$$

where

A_o = total surface area of dewatering holes, ft^2;

A_s = surface area of the basin, ft^2;

h = head of water above the hole, ft;

C_d = coefficient of contraction for an orifice, approximately 0.6; and

T = detention time or time needed to dewater the basin, hours.

In all cases, such structures should be designed by an appropriate professional based on local hydrologic, hydraulic, topographic, and sediment conditions.

Neither a sediment basin with an earthen embankment nor a rock dam should be used in areas of continuously running water (live streams). The use of sediment basins is not intended for areas where failure of the earthen or rock dam will result in loss of life, or damage to homes or other buildings. In addition, sediment basins should not be used in areas where failure will prevent the use of public roads or utilities.

Maintenance

Routine inspection and maintenance of sediment basins is essential to their continued effectiveness. Basins should be inspected after each storm event to ensure proper drainage from the collection pool to determine the need for structural repairs. Erosion from the earthen embankment or stones moved from rock dams should be replaced immediately. Sediment basins must be located in an area that is easily accessible to maintenance crews for removal of accumulated sediment. Sediment should be removed from the basin when its storage capacity has reached approximately 50 percent. Trash and debris from around dewatering devices should be removed promptly after rainfall events.

Effectiveness

The effectiveness of a sediment basin depends primarily on the sediment particle size and the ratio of basin surface area to inflow rate (Smolen et al., 1988). Basins with a large surface area-to-volume ratio will be most effective. Studies have shown that the following equation relating surface area and peak inflow rate gives a trapping efficiency greater than 75 percent for most sediment in the Coastal Plain and Piedmont regions of the Southeastern United States (Barfield and Clar, in Smolen et al., 1988):

$$A = 0.01q$$

where A is the basin surface area in acres and q is the peak inflow rate in cubic feet per second.

USEPA (1993) estimates an average total suspended solids (TSS) removal rate for all sediment basins from 55 percent to 100 percent, with an average effectiveness of 70 percent.

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Sediment Filters and Sediment Chambers

Description

Sediment filters are a class of sediment-trapping devices typically used to remove pollutants, primarily particulates, from storm water runoff. Generally speaking, sediment filters have four basic components: (1) inflow regulation, (2) pretreatment, (3) filter bed, and (4) outflow mechanism. Sediment chambers are merely one component of a sediment filter system.

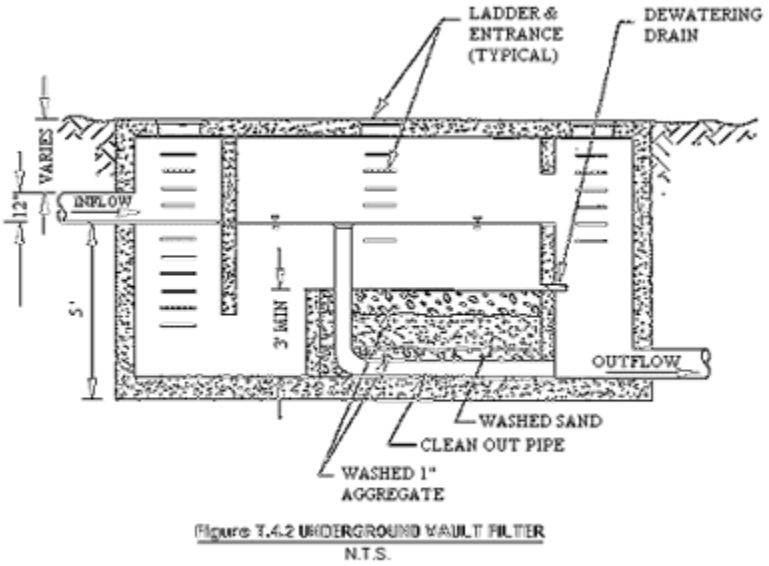
Inflow regulation refers to the diversion of storm water runoff into the sediment-trapping device. After runoff enters the filter system, it enters a pretreatment sedimentation chamber. This chamber, used as a preliminary settling area for large debris and sediments, usually consists of nothing more than a wet detention basin. As water reaches a predetermined level, it flows over a weir into a filter bed of some filter medium. The filter medium is typically sand, but it can consist of sand, soil, gravel, peat, compost, or a combination of these materials. The purpose of the filter bed is to remove smaller sediments and other pollutants from the storm water as it percolates through the filter medium. Finally, treated flow exits the sediment filter system via an outflow mechanism to return to the storm water conveyance system.

Sediment filter systems can be confined or unconfined, on-line or off-line, and aboveground or belowground. Confined sediment filters are constructed with the filter medium contained in

a structure, often a concrete vault. Unconfined sediment filters are constructed without encasing the filter medium in a confining structure. As one example, sand might be placed on the banks of a permanent wet pond detention system to create an unconfined filter. On-line systems are designed to retain storm water in its original stream channel or storm drain system. Off-line systems are designed to divert storm water.

Applicability

Sediment filters may be a good alternative for smaller construction sites where the use of a wet pond is being considered as a sediment-trapping device. Their applicability is wide ranging, and they can be used in urban areas with large amounts of highly impervious area. Because confined sand filters are man-made soil systems, they can be applied to most development sites and have few constraining factors (MWCOG, 1992). However, for all sediment filter systems, the drainage area to be serviced should be no more than 10 acres.



Schematic representation of a sediment filter

The type of filter system chosen depends on the amount of land available and the desired location within the site. Examples of sediment filter systems include the "Delaware" sand filter and the "Austin" sand filter. The Austin sand filter, so named because it first came into widespread use in Austin, Texas, is a surface filter system that can be used in areas with space restrictions. If space is at a premium, an underground filter may be the most appropriate choice. For effective storm water sediment control at the perimeter of a site, the Delaware sand filter might be a good choice. This configuration consists of two parallel, trench-like chambers installed at a site's perimeter. The first trench (sediment chamber) provides pretreatment sediment settling before the runoff spills into the second trench (filter medium).

Design

Available space is likely to be the most important siting and design consideration when choosing an appropriate sediment-filtering system. As mentioned previously, the decision as to which configuration is implemented on a particular site is dependent on the amount of space on a site. Another important consideration when deciding to install sediment-filtering systems is the amount of available head. Head refers to the vertical distance available

between the inflow of the filter system and the outflow point. Because most filtering systems depend on gravity as the driving force to move water through the system, if a certain amount of head is not available, the system will not be effective and might cause more harm than good. For surface and underground sand filters, a minimum head of 5 feet is suggested (Claytor and Schueler, 1996). Perimeter sand filters such as the two-chambered Delaware sand filter should have a minimum available head of 2 to 3 feet (Claytor and Schueler, 1996).

The depth of filter media will vary depending on media type, but for sand filters it is recommended that the sand (0.04-inch diameter or smaller) be at least 18 inches deep, with a minimum of 4 to 6 inches of gravel for the bed of the filter. Throughout the life of a sediment filter system, there will be a need for frequent access to assess continued effectiveness and perform routine maintenance and emergency repairs. Because most maintenance of sediment filters requires manual rather than mechanical removal of sediments and debris, filter systems should be located to allow easy access.

Sediment filters are usually limited to the removal of pollutants from storm water runoff. They must be used in combination with other storm water management practices to provide flood protection. Sediment filters should not be used on fill sites or near steep slopes (Livingston, 1997). In addition, sediment filters are likely to lose effectiveness in cold regions because of freezing conditions.

Maintenance Considerations

Maintenance of storm water sediment filters can be relatively high compared to other sediment-trapping devices. Routine maintenance includes raking the filter medium and removal of surface sediment and trash. These maintenance chores will likely need to be accomplished by manual labor rather than mechanical means. Depending on the medium used in the structure, the filter material may have to be changed or replaced up to several times a year. This will depend, among other things, on rainfall intensity and the expected sediment load.

Sediment filters of all media types should be inspected monthly and after each significant rainfall event to ensure proper filtration. Trash and debris removal should be removed during inspections. Sediment should be removed from filter inlets and sediment chambers when 75 percent of the storage volume has been filled. Because filter media have the potential for high loadings of metals and petroleum hydrocarbons, the filter medium should be periodically analyzed to prevent it from reaching levels that would classify it as a hazardous waste. This is especially true on sites where solvents or other potentially hazardous chemicals will be used. Spill prevention measures should be implemented as necessary. The top 3 to 4 inches of the filter medium should be replaced on an annual basis, or more frequently if drawdown does not occur within 36 hours of a storm event.

References

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Sediment Trap

Description

Sediment traps are small impoundments that allow sediment to settle out of runoff water. They are usually installed in a drainageway or other point of discharge from a disturbed area. Temporary diversions can be used to direct runoff to the sediment trap (USEPA, 1993). Sediment traps are used to detain sediments in storm water runoff and trap the sediment to protect receiving streams, lakes, drainage systems, and the surrounding area.

Sediment traps are formed by excavating an area or by placing an earthen embankment across a low area or drainage swale. An outlet or spillway is often constructed using large stones or aggregate to slow the release of runoff (USEPA, 1992).

Sediment traps are generally temporary control measures to slow concentrated runoff velocity and catch sediment, and they can be used with other temporary storm water control measures. They are commonly used at the outlets of storm water diversion structures, channels, slope drains, construction site entrance wash racks, or any other runoff conveyance that discharges waters containing erosion sediment and debris. Sediment traps can also be used as part of a storm water drop intake protection system when the inlet is located below a disturbed area and will receive runoff with large amounts of sediment.

Design

Sediment traps can simplify the storm water control plan design process by trapping sediment at specific spots at a construction site (USEPA, 1992). Therefore, they should be installed as early in the construction process as possible. Natural drainage patterns should be noted, and sites where runoff from potential erosion can be directed into the traps should be selected. Sediment traps should not be located in areas where their failure due to storm water runoff excess can lead to further erosive damage of the landscape. Alternative diversion pathways should be designed to accommodate these potential overflows.

A sediment trap should be designed to maximize surface area for infiltration and sediment settling. This will increase the effectiveness of the trap and decrease the likelihood of backup during and after periods of high runoff intensity. Although site conditions will dictate specific design criteria, the approximate storage capacity of each trap should be at least 1,800 ft^3 per acre of total drainage area (Smolen et al., 1988). The volume of a natural sedimentation trap can be approximated by the following equation (Smolen et al., 1988):

$$\text{Volume } (ft^3) = 0.4 \times \text{surface area } (ft^2) \times \text{maximum pool depth (ft)}$$

Care should be taken in the siting and design phase to situate sediment traps for easy access by maintenance crews. This will allow for proper inspection and maintenance on a periodic basis. When excavating an area for sediment trap implementation, side slopes should not be steeper than 2:1 and embankment height should not exceed 5 feet from the original ground surface. All embankments should be machine compacted to ensure stability. To reduce flow rate from the trap, the outlet should be lined with well-graded stone.

The spillway weir for each temporary sediment trap should be at least 4 feet long for a 1-acre drainage area and increase by 2 feet for each additional drainage acre added, up to a maximum drainage area of 5 acres.

Sediment traps should not be used for drainage areas greater than 5 acres (USEPA, 1993). The effective life span of these temporary structures is usually limited to 24 months (Smolen et al., 1988). Although sediment traps allow for settling of eroded soils, because of their short detention periods for storm water they typically do not remove fine particles such as silts and clays.

Maintenance

The primary maintenance consideration for temporary sediment traps is the removal of accumulated sediment from the basin. This must be done periodically to ensure the continued effectiveness of the sediment trap. Sediments should be removed when the basin reaches approximately 50 percent sediment capacity. A sediment trap should be inspected after each rainfall event to ensure that the trap is draining properly. Inspectors should also check the structure for damage from erosion. The depth of the spillway should be checked and maintained at a minimum of 1.5 feet below the low point of the trap embankment.

Sediment trapping efficiency is a function of surface area, inflow rate, and the sediment properties (Smolen et al., 1988). Those traps that provide pools with large length-to-width ratios have a greater chance of success. Sediment traps have a useful life of approximately 18 to 24 months (USEPA, 1993), although ultimately effectiveness depends on the amount and intensity of rainfall and erosion, and proper maintenance. USEPA (1993) estimates an average total suspended solids removal rate of 60 percent. An efficiency rate of 75 percent can be obtained for most Coastal Plain and Piedmont soils by using the following equation (Barfield and Clar, in Smolen et al., 1988):

Surface area at design flow (acres) = (0.01) peak inflow rate (cfs)

References

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Storm Drain Inlet Protection

Description

Storm drain inlet protection measures are controls that help prevent soil and debris from site erosion from entering storm drain drop inlets. Typically, these measures are temporary controls that are implemented prior to large-scale disturbance of the surrounding site. These controls are advantageous because their implementation allows storm drains to be used during even the early stages of construction activities. The early use of storm drains during

project development significantly reduces the occurrence of future erosion problems (Smolen et al., 1988).

Three temporary control measures to protect storm drain drop inlets are

- Excavation around the perimeter of the drop inlet
- Fabric barriers around inlet entrances
- Block and gravel protection.

Excavation around a storm drain inlet creates a settling pool to remove sediments. Weep holes protected by
gravel are used to drain the shallow pool of water that accumulates around the inlet. A fabric barrier made of porous material erected around an inlet can create an effective shield to erosion sediment while allowing water flow into the storm drain. This type of barrier can slow runoff velocity while catching soil and other debris at the drain inlet. Block and gravel inlet protection uses standard concrete blocks and gravel to form a barrier to sediments while permitting water runoff through select blocks laid sideways.

In addition to the materials listed above, limited temporary storm water drop inlet protection can also be achieved with the use of straw bales or sandbags to create barriers to sediment. For permanent storm drain drop inlet protection after the surrounding area has been stabilized, sod can be installed as a barrier to slow storm water entry to storm drain inlets and capture erosion sediments. This final inlet protection measure can be used as an aesthetically pleasing way to slow storm water velocity near drop inlet entrances and to remove sediments and other pollutants from runoff.

All temporary controls should have a drainage area no greater than 1 acre per inlet. It is also important for temporary controls to be constructed prior to disturbance of the surrounding landscape. Excavated drop inlet protection and block and gravel inlet protection are applicable to areas of high flow where overflow is anticipated into the storm drain. Fabric barriers are recommended for smaller, relatively flat drainage areas (slopes less than 5 percent leading to the storm drain). Temporary drop inlet control measures are often used in combination with each other and other storm water control techniques.

Design

With the exception of sod drop inlet protection, these controls should be installed before any soil disturbance in the drainage area. Excavation around drop inlets should be dug a minimum of 1 foot deep (2 feet maximum) with a minimum excavated volume of 35 yd^3 per acre disturbed. Side slopes leading to the inlet should be no steeper than 2:1. The shape of the excavated area should be designed such that the dimensions fit the area from which storm water is anticipated to drain. For example, the longest side of an excavated area should be along the side of the inlet expected to drain the largest area.

Fabric inlet protection should be staked close to the inlet to prevent overflow on unprotected soils. Stakes should be used with a minimum length of 3 feet, spaced no more than 3 feet apart. A frame should be constructed for fabric support during overflow periods and should be buried at least 1 foot below the soil surface and rise to a height no greater than 1.5 feet above ground. The top of the frame and fabric should be below the down-slope ground elevation to prevent runoff bypassing the inlet.

Block and gravel inlet barrier height should be 1 foot minimum (2 feet maximum), and mortar should not be used. The bottom row of blocks should be laid at least 2 inches below the soil surface flush against the drain for stability. One block in the bottom row should be placed on

each side of the inlet on its side to allow drainage. Wire mesh (1/2 inch) should be placed over all block openings to prevent gravel from entering the inlet, and gravel (3/4 to 1/2 inch in diameter) should be placed outside the block structure at a slope no greater than 2:1.

Sod inlet protection should not be considered until the entire surrounding drainage area is stabilized. The sod should be laid so that it extends at least 4 feet from the inlet in each direction to form a continuous mat the around inlet, laying sod strips perpendicular to the direction of flows. The sod strips should be staggered such that strip ends are not aligned, and the slope of the sodded area should not be steeper than 4:1 approaching the drop inlet.

Storm water drop inlet protection measures should not be used as stand-alone sediment control measures. To increase inlet protection effectiveness, these practices should be used in combination with other measures, such as small impoundments or sediment traps (USEPA, 1992). Temporary storm drain inlet protection is not intended for use in drainage areas larger than 1 acre. Generally, storm water inlet protection measures are practical for relatively low-sediment, low-volume flows. Frequent maintenance of storm drain control structures is necessary to prevent clogging. If sediment and other debris clog the water intake, drop intake control measures can actually cause erosion in unprotected areas.

Maintenance

All temporary control measures must be checked after each storm event. To maintain the sediment capacity of the shallow settling pools created from these techniques, accumulated sediment should be removed from the area around the drop inlet (excavated area, around fabric barrier, or around block structure) when the sediment capacity is reduced by approximately 50 percent. Additional debris should be removed from the shallow pools on a periodic basis. Weep holes in excavated areas around inlets can become clogged and prevent water from draining out of shallow pools that form. Should this happen, unclogging the water intake may be difficult and costly.

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General Construction Site Waste Management

Description

Building materials and other construction site wastes must be properly managed and disposed of to reduce the risk of pollution from materials such as surplus or refuse building materials or hazardous wastes. Practices such as trash disposal, recycling, proper material handling, and spill prevention and cleanup measures can reduce the potential for storm water runoff to mobilize construction site wastes and contaminate surface or ground water.

The proper management and disposal of wastes should be practiced at any construction site to reduce storm water runoff. Waste management practices can be used to properly locate refuse piles, to cover materials that may be displaced by rainfall or storm water runoff, and to prevent spills and leaks from hazardous materials that were improperly stored.

Design

The following steps should be taken to ensure proper storage and disposal of construction site wastes:

- Designate a waste collection area onsite that does not receive a substantial amount of runoff from upland areas and does not drain directly to a waterbody.
- Ensure that containers have lids so they can be covered before periods of rain, and keep containers in a covered area whenever possible.
- Schedule waste collection to prevent the containers from overfilling.
- Clean up spills immediately. For hazardous materials, follow cleanup instructions on the package. Use an absorbent material such as sawdust or kitty litter to contain the spill.
    - During the demolition phase of construction, provide extra containers and schedule more frequent pickups.
    - Collect, remove, and dispose of all construction site wastes at authorized disposal areas. A local environmental agency can be contacted to identify these disposal sites.

The following steps should be taken to ensure the proper disposal of hazardous materials:

- Local waste management authorities should be consulted about the requirements for disposing of hazardous materials.
- A hazardous waste container should be emptied and cleaned before it is disposed of to prevent leaks.
- The original product label should never be removed from the container as it contains important safety information. Follow the manufacturer's recommended method of disposal, which should be printed on the label.
- If excess products need to be disposed of, they should never be mixed during disposal unless specifically recommended by the manufacturer.

State or local solid waste regulatory agencies or private firms should be consulted to ensure the proper disposal of contaminated soils that have been exposed to and still contain hazardous substances. Some landfills might accept contaminated soils, but they require laboratory tests first.

Paint and dirt are often removed from surfaces by sandblasting. Sandblasting grits are the byproducts of this procedure and consist of the sand used and the paint and dirt particles that are removed from the surface. These materials are considered hazardous if they are removed from older structures because they are more likely to contain lead-, cadmium-, or chrome-based paints. To ensure proper disposal of sandblasting grits, a licensed waste management or transport and disposal firm should be contracted.

The following practices should be used to reduce risks associated with pesticides or to reduce the amount of pesticides that come in contact with storm water:

- Follow all federal, state, and local regulations that apply to the use, handling, or disposal of pesticides.
- Do not handle the materials any more than necessary.
- Store pesticides in a dry, covered area.
- Construct curbs or dikes to contain pesticides in case of spillage.
- Follow the recommended application rates and methods.
- Have equipment and absorbent materials available in areas where pesticides are stored and used in order to contain and clean up any spills that occur.

The following management practices should be followed to reduce the contamination risk associated with petroleum products:

- Store petroleum products and fuel for vehicles in covered areas with dikes in place to contain any spills.
- Immediately contain and clean up any spills with absorbent materials.
- Have equipment available in fuel storage areas and in vehicles to contain and clean up any spills that occur.

Phosphorous- and nitrogen-containing fertilizers are used on construction sites to provide nutrients necessary for plant growth, and phosphorous- and nitrogen-containing detergents are found in wash water from vehicle cleaning areas. Excesses of these nutrients can be a major source of water pollution. Management practices to reduce risks of nutrient pollution include the following:

- Apply fertilizers at the minimum rate and to the minimum area needed.
- Work the fertilizer deeply into the soil to reduce exposure of nutrients to storm water runoff.
- Apply fertilizer at lower application rates with a higher application frequency.
- Limit hydroseeding, which is the simultaneous application of lime and fertilizers.
- Ensure that erosion and sediment controls are in place to prevent fertilizers and sediments from being transported off-site.
- Use detergents only as recommended, and limit their use onsite. Wash water containing detergents should not be dumped into the storm drain system—it should be directed to a sanitary sewer or be otherwise contained so that it can be treated at a wastewater treatment plant.

An effective waste management system requires training and signage to promote awareness of the hazards of improper storage, handling, and disposal of wastes. The only way to be sure that waste management practices are being followed is to be aware of worker habits and to inspect storage areas regularly. Extra management time may be required to ensure that all workers are following the proper procedures.

Maintenance

Containers or equipment that may malfunction and cause leaks or spills should be identified through regular inspection of storage and use areas. Equipment and containers should be inspected regularly for leaks, corrosion, support or foundation failure, or any other signs of deterioration and should be tested for soundness. Any found to be defective should be repaired or replaced immediately.

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Spill Prevention and Control Plan

Description

Spill prevention and control plans should clearly state measures to stop the source of a spill, contain the spill, clean up the spill, dispose of contaminated materials, and train personnel to prevent and control future spills.

Spill prevention and control plans are applicable to construction sites where hazardous wastes are stored or used. Hazardous wastes include pesticides, paints, cleaners, petroleum products, fertilizers, and solvents.

Design

Identify potential spill or source areas, such as loading and unloading, storage, and processing areas, places where dust or particulate matter is generated, and areas designated for waste disposal. Also, spill potential should be evaluated for stationary facilities, including manufacturing areas, warehouses, service stations, parking lots, and access roads.

Define material handling procedures and storage requirements, and take actions to reduce spill potential and impacts on storm water quality. This can be achieved by

- Recycling, reclaiming, or reusing process materials and thereby reducing the amount of process materials that are brought into the facility
- Installing leak detection devices, overflow controls, and diversion berms
- Disconnecting any drains from processing areas that lead to the storm sewer

- Performing preventative maintenance on storm tanks, valves, pumps, pipes, and other equipment
- Using material transfer procedures or filling procedures for tanks and other equipment that minimize spills
- Substituting less or non-toxic materials for toxic materials.

Provide documentation of spill response equipment and procedures to be used, ensuring that procedures are clear and concise. Give step-by-step instructions for the response to spills at a particular facility. This spill response plan can be presented as a procedural handbook or a sign. The spill response plan should

- Identify individuals responsible for implementing the plan
- Define safety measures to be taken with each kind of waste
- Specify how to notify appropriate authorities, such as police and fire departments, hospitals, or publicly owned treatment works for assistance
- State procedures for containing, diverting, isolating, and cleaning up the spill
- Describe spill response equipment to be used, including safety and cleanup equipment.

A spill prevention and control plan must be well planned and clearly defined so that the likelihood of accidental spills can be reduced and any spills that do occur can be dealt with quickly and effectively. Training might be necessary to ensure that all workers are knowledgeable enough to follow procedures. Equipment and materials for cleanup must be readily accessible and clearly marked for workers to be able to follow procedures.

Maintenance

Update the spill prevention and control plan to accommodate any changes in the site or procedures. Regularly inspect areas where spills might occur to ensure that procedures are posted and cleanup equipment is readily available.

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Vehicle Maintenance & Washing Areas

Description

Maintenance and washing of vehicles should be conducted using environmentally responsible practices to prevent direct, untreated discharges of nutrient-enriched wastewater or hazardous wastes to surface or ground waters. This involves designating covered, paved areas for maintenance and washing, eliminating improper connections from these areas to the storm drain system, developing a spill prevention and cleanup plan for shop areas, maintaining vehicles and other equipment that may leak hazardous chemicals, covering fuel drums and other materials that are stored outdoors, and properly handling and disposing of automotive wastes and wash water.

Environmentally friendly vehicle maintenance and washing practices are applicable for every construction site to prevent contamination of surface and ground water from wash water and fuel, coolant, or antifreeze spills or leaks.

Design

Construction vehicles should be inspected for leaks daily and repaired immediately. All used products, including oil, antifreeze, solvents, and other automotive-related chemicals, should be disposed of as directed by the manufacturer. These products are hazardous wastes that require special handling and disposal. Used oil, antifreeze, and some solvents can be recycled at a designated facility, but other chemicals must be disposed of at a hazardous waste disposal site. A local environmental agency can help to identify such facilities.

Special paved areas should be designated for a vehicle repair area and a separate vehicle washing area in which runoff and wastewater from these areas is directed to the sanitary sewer system or other treatment facility as industrial process waste. Vehicle washing facilities should use high-pressure water spray without any detergents as water can remove most dirt adequately. If detergents must be used, phosphate- or organic-based cleansers should be avoided to reduce nutrient enrichment and biological oxygen demand in wastewater. Only biodegradable products should be used—they should not contain halogenated solvents. If possible, blowers or vacuums should be used instead of water to remove dry materials from vehicles. Washing areas must be clearly marked and workers should be informed that all washing must occur in this area. No other activities, such as vehicle repairs, should be conducted in the wash area. If vehicles or equipment are heavily greased or soiled, the area should be bermed and covered to prevent contamination of runoff from these pollutants.

Limitations

Limitations for vehicle maintenance areas include the cost of waste disposal (a fee may be charged by a hazardous waste disposal facility), the cost of providing an enclosed maintenance area with proper connections to an industrial sanitary sewer, and extra labor required to follow proper storage, handling, and disposal procedures. Vehicle wash areas might require permits, depending on the volume of wastewater produced and the type of detergents used, and it might be expensive to designate an area for vehicle washing with proper connections to the industrial waste handling system.

Maintenance

Vehicle maintenance areas produce a substantial amount of hazardous waste that requires regular disposal. Spills must be cleaned up and cleanup materials disposed of immediately. Equipment and storage containers should be inspected regularly to identify leaks or signs of deterioration. Maintenance of vehicle wash areas is minimal and involves maintenance of berms and drainage to the sanitary sewer system.

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