Section 2
Construction Management Practices (CPs)

Section 2 – Construction Management Practices

2.1 Introduction

This section presents the BMP fact sheets for the Construction Management Practices (CPs). CPs predominately focus on practices relating to construction site "Good Housekeeping" measures. Other frequently used practices that address containing or capturing pollutants are also included. The BMPs for contractor activities are suggested practices that may or may not apply in every case. The most effective BMP is a construction work force aware of the pollution potential of their activities and committed to properly implementing and maintaining the BMPs.

2.2 Management Practice Fact Sheets

This section contains the following BMP fact sheets.

Construction Management Practice Fact Sheets			
Fact Sheet ID	**Description**	**Fact Sheet ID**	**Description**
CP-01	Scheduling – Phase Construction/Clearing	**CP-11**	Sanitary/Septic Waste Management
CP-02	Dewatering Operations	**CP-12**	Vehicle and Equipment Cleaning and Maintenance
CP-03	Paving Operations	**CP-13**	Vehicle and Equipment Fueling
CP-04	Structure Construction and Painting	**CP-14**	Pesticides, Herbicides and Fertilizer Use
CP-05	Material Delivery, Storage and Use	**CP-15**	Employee/Subcontractor Training
CP-06	Spill Prevention and Control	**CP-16**	Dust Control
CP-07	Solid Waste Management	**CP-17**	Maintenance of Collection Facilities and Appurtenances
CP-08	Hazardous Waste Management	**CP-18**	Preservation and Maintenance of Existing Vegetation
CP-09	Contaminated Soil Management	**CP-19**	System Flushing
CP-10	Concrete Waste Management		

Each fact sheet has a quick reference guide indicating what pollutant constituents the BMP is targeting and implementation requirements. The BMPs presented in this section are intended to coincide with construction activity (lasting only as long as the construction activities themselves). Additional details are provided in sections covering Industrial/Commercial Runoff Management (ICP) for similar good housekeeping practices that are intended to be used for non-construction activities.

Scheduling – Phased Construction

CP-01

Hamilton County Water Quality Program

Description

The construction sequence schedule is an orderly listing of all major land-disturbing activities together with the necessary erosion and sedimentation control measures planned for a project. The construction schedule must be included in the SWPPP and be modified in the field as site conditions change. This type of schedule guides the contractor on work to be done before other work is started so that serious erosion and sedimentation problems can be avoided. If this management practice makes full use of the BMPs outlined in this text, significant reductions can be made in sediment and nutrient impact.

Approach

To minimize the erosion and sedimentation by performing land disturbing activities, installing EPSC measures, installing permanent stormwater controls and stabilization in accordance with a planned schedule. Note that phasing is a site management technique within an overall construction schedule, but should not be mistaken for the construction schedule itself.

All construction sites disturbing one or more acres are required to have a construction schedule in their SWPPP. However, sites that affect less than one acre can benefit from a planned construction schedule as well.

The construction sequence should be designed and written so that it is easily understood and followed by contractors and subcontractors. The sequence should clearly state the order in which erosion prevention and sediment control devices are to be installed; including stating what measures should be in place before other activities are begun.

An example of construction sequencing could be as follows:

- Install Construction entrance, mark sensitive areas, and designate equipment and chemical storage areas.
- Install sediment basins and traps, silt fencing, and other sediment barriers for Phase 1.
- Install runoff controls such as diversion structures, silt fence, wattles, and outlet protection for Phase 1.
- Perform land clearing and grading, installing EPSC components at the

earliest possible time during grading activities for Phase 1. Maintain EPSC measures throughout the grading process.

- ❖ Stabilize surfaces immediately in areas where work is delayed or completed.
- ❖ Mark sensitive areas and install perimeter measures for Phase 2.
- ❖ Clear and grub Phase 2.
- ❖ Install sediment traps and other internal controls. Maintain controls.
- ❖ Install permanent stabilization measures in Phases 1 and 2, such as seeding and mulching, sodding, and riprap at earliest possible time following completion of grading and construction activities.
- ❖ Remove temporary controls and stabilize all disturbed areas.

As in the CGP, project sites exceeding 50 acres of disturbance require phasing. In some cases individual construction sequences may be provided for each individual planned phase, while in other cases the designer may find it necessary to provide an overall construction sequence which interconnects the phases and encompasses the project as a whole.

Maintenance

Routinely verify that work is progressing in accordance with the schedule. If construction progress deviates, take corrective actions.

When changes are warranted, amend the sequence scheduling in advance to maintain control. Be sure all field supervisors and inspectors are aware of changes.

Limitations

Construction sequencing is done on every project to some degree by necessity due to the various trades that may be employed to construct a project. Erosion prevention and sediment control needs to be a factor considered in the construction schedule while balancing other scheduling demands. For example, a clearing contractor may want to make one trip to a project to clear the entire area even though active grading may progress more slowly resulting in cleared areas that will be subject to erosion for a long period of time placing a greater demand on sediment control measures.

References

Caltrans Storm Water Quality Handbooks, *Construction Contractor's Guide and Specifications*, April 1997

CDM et.al. for the California SWQTF, 1993. *California Storm Water Best Management Practice Handbooks, Construction and Industrial Handbooks*,

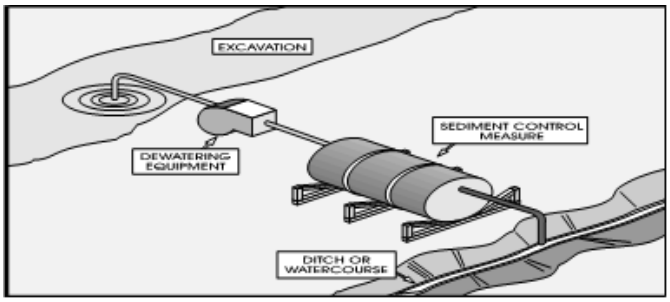
TDEC EPSC Handbook, 4th edition, 2012.

North Carolina Erosion and Sediment Control Planning and Design Manual

TDOT Design Division Drainage Manual

Dewatering Operations

CP-02



Hamilton County Water Quality Program

Description

Prevent or reduce the discharge of pollutants to stormwater from dewatering operations by using sediment controls and by testing the groundwater for pollutant accumulation. This management practice is likely to create a significant reduction in sediment and a partial reduction in toxic materials.

Approach

Water that is pumped from a construction site usually contains a large amount of sediment. A dewatering structure is typically needed to remove the sediment before water is released off-site. One of several types of dewatering structures may be constructed depending upon site conditions and type of operation. A well stabilized, onsite, vegetated area may serve as a dewatering device if the area is stabilized so that it can filter sediment and at the same time withstand the velocity of the discharged water without eroding. The discharge of sediment-laden water onto a vegetated area should not pose a threat to the survival of the existing vegetative stand through smothering by sedimentation. Where a grass filter strip alone is to be used to filter pumped water, a minimum filtering length of **75 feet** must be available in order for such a method to be feasible. Regardless, the runoff must not cause a water quality violation where it enters a stream or wetland.

Dewatering structures should not be placed within a jurisdictional wetland, stream buffer or within 20 feet of a stabilized outlet, stream, or other natural water resource.

A dewatering structure must be sized (and operated) to allow pumped water to flow through the filtering device without overtopping the structure. An excavated basin may be lined with geotextile to help reduce scour and to prevent the inclusion of soil from within the structure.

The minimum required volume of storage in cubic feet for a dewatering structure is obtained by multiplying the pumping rate (in gallons per minute) by 16. The recommended volume is based on 2 hours of pumping at the full rate shown on the drawing. In situations where it is likely that a pump will be operated for longer periods of time, the volume of the structure should be appropriately increased. Where the structure is to be placed in a sloping area, the available storage capacity will be reduced. It may be necessary to increase the size of the structure to compensate for this.

Construction Specifications

Portable Sediment Tank:

Materials: The sediment tank may be constructed with steel drums, sturdy wood or other material suitable for handling the pressure exerted by the volume of water. The structure should have a minimum depth of two feet.

Location: The location for the sediment tank should be chosen for easy clean-out and disposal of the trapped sediment, and to minimize the interference with construction activities.

Storage Volume: The following formula should be used to determine the storage volume of the sediment tank:

Pump discharge (gpm) x 16 = cubic feet of storage required

Operation: Once the water level nears the top of the tank, **the pump must be shut off** while the tank drains and additional capacity is made available. The tank should be designed to allow for emergency flow over the top of the tank. Clean-out of the tank is required once one-third of the original capacity is depleted due to sediment accumulation. The tank should be clearly marked showing the clean-out point.

Straw Bale/Silt Fence Pit:

Materials: The straw bale/silt fence pit should consist of straw bales, silt fence, washed stone (TDOT size 57) and an optional excavated wet storage pit.

Storage Volume: The following formula should be used to determine the storage volume of the straw bale/silt fence pit:

Pump discharge (gpm) x 16 = cubic feet of storage required

In calculating the capacity, include the volume available from the floor of the excavation to the top of the structure. Excavation may not be necessary to obtain the necessary storage volume.

Operation: Once the water level nears the top of the straw bales, **the pump must be shut off** while the structure drains down to at least half of the storage volume. Overtopping the dewatering structure is not allowed. If turbidity is not adequately addressed through the silt fence material, straw bales and washed stone, additional treatment must be considered. When the excavated area becomes filled to one-half of the excavated depth, accumulated sediment should be removed and properly disposed.

Sediment Filter Bag:

Materials: The filter bag should be constructed of non-woven geotextile material that will provide adequate filtering ability to capture the larger soil particles from the pumped water. The bag should be constructed so that there is an inlet neck that may be clamped around the dewatering pump discharge hose so that all of the pumped water passes through the bag.

Location: A temporary sediment filter bag may be used whenever sediment laden water is removed from an area by means of pumping and where there is insufficient room to use a temporary dewatering structure. A temporary sediment filter bag should not be placed within a jurisdictional wetland, a stream buffer, or within 20 feet of a stabilized outlet, stream or ditch line. A filled sediment bag can weigh as much as 7 tons. The designer should ensure that there will be adequate access for the equipment necessary for the disposal of the bag.

Design: A temporary sediment filter bag should be placed on a level pad a minimum of 6 inches thick composed of mineral aggregate (size 57). This pad should be constructed on an area with sufficient slope to allow water entering the pad to drain away from the project work area. However, it is necessary for the pad to be level in order to prevent the bag from rolling along the slope as water is pumped into the structure. The upper surface of the pad, including the slopes, should be lined with geotextile fabric. In addition, it should be separated from the existing ground by a layer of polyethylene sheeting. Off-site stormwater runoff should be diverted around the temporary dewatering filter bag location. The capacity of the sediment filter bag should be adequate to handle the dewatering pump discharge and should be based upon the manufacturer's recommendation on pump sizing. Failure to correlate the pump capacity and the bag capacity can result in failure of the bag. The filter bag must be equipped with a sleeve to receive the pump hose. Slitting the bag to make the hose connection is not acceptable.

Storage Volume: The capacity of the sediment filter bag should be adequate to handle the dewatering pump discharge, and should be based on the bag manufacturer's recommendation and expected sediment volume.

Operation: Pumping into the bag can only occur when being supervised. Unsupervised pumping is not allowed. Discharge from the filter bag cannot cause an objectionable color contrast with the receiving stream. Additional treatment may be necessary if an objectionable color contrast is observed.

Disposal: In determining the location for a proposed sediment filter bag, the designer should allow sufficient room and a clear path to allow access for the equipment needed for bag removal. When the filter bag has accumulated a 6-inch depth of sediment, it should be removed and replaced with a new filter bag.

Maintenance

Ensure the treatment practice is either cleaned out or removed once the storage is full. Visually verify that discharges are not turbid. Filter bag removal method must be considered before relying on a filter back for dewatering treatment. Accumulated sediment removed from a dewatering device must be spread on site and stabilized or disposed of at a disposal site. Inspect excavated areas daily for signs of contaminated water as evidenced by discoloration, oily sheen, or odors.

Limitations

The controls discussed in this BMP address sediment only. If the presence of polluted water is identified in the contract, the contractor shall implement dewatering pollution controls as required by the SWPP.

References

North Carolina Erosion and Sediment Control Planning and Design Manual

TDEC EPSC Handbook, 4th Edition, 2012.

TDOT Design Division Drainage Manual

TDOT Erosion Control Standard Drawing EC-STR-1

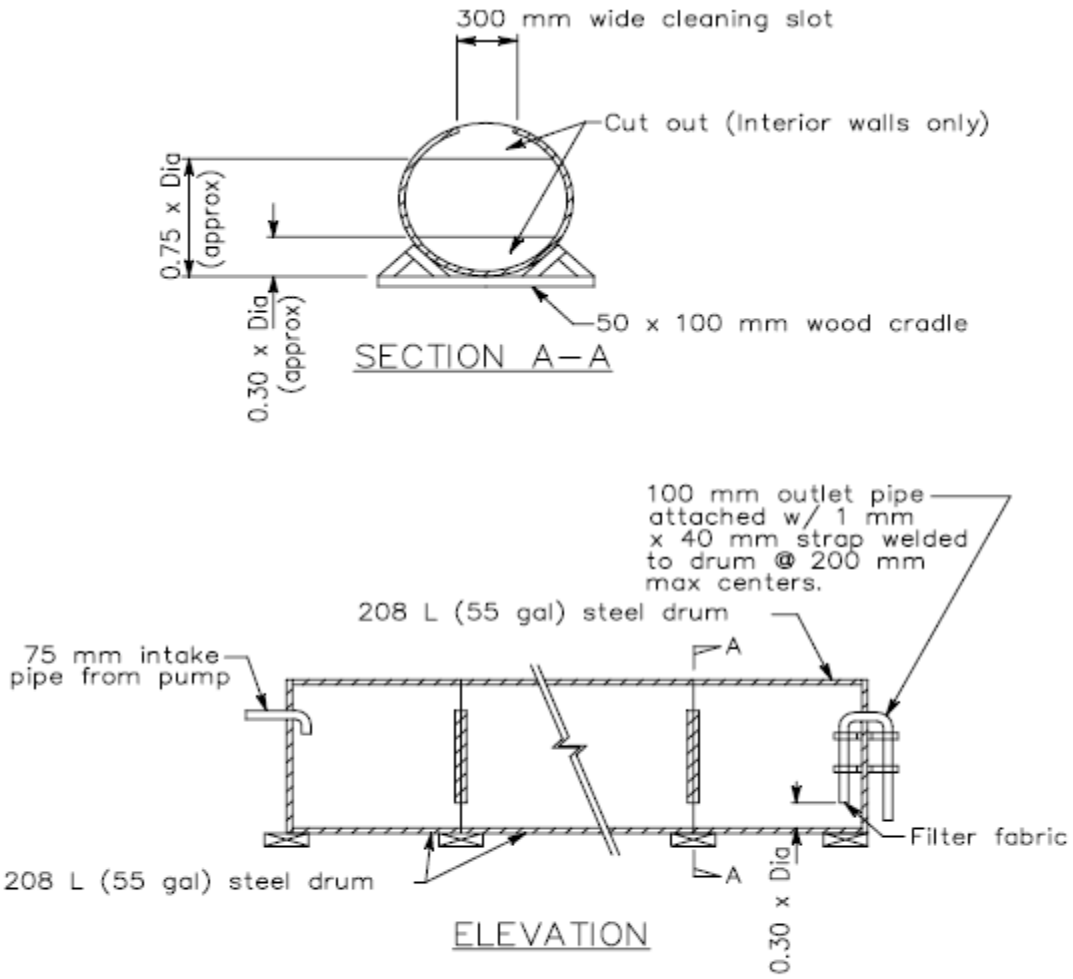


Figure CP-02-1
Typical Portable Sediment Tank

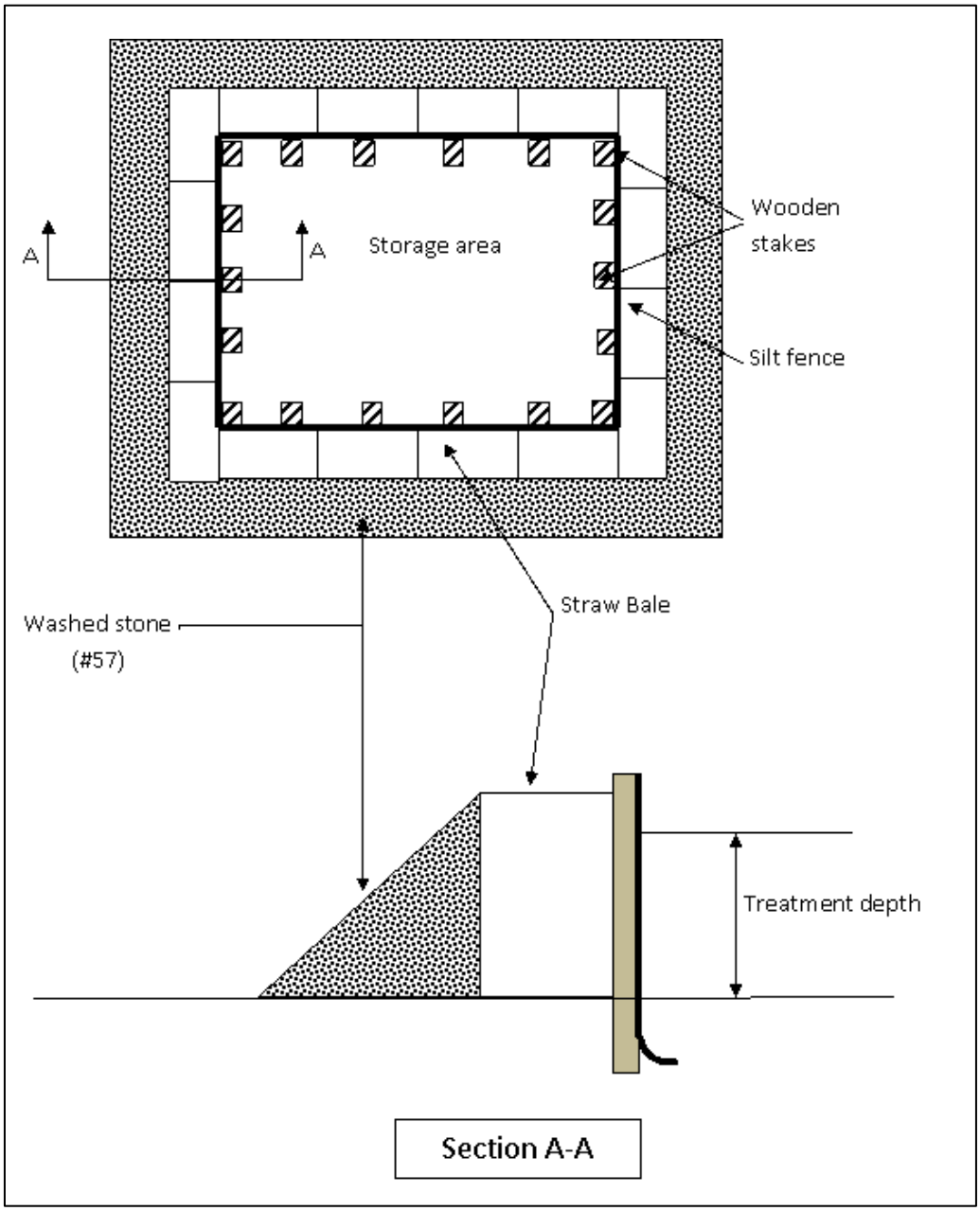


Figure CP-02-2
Typical Silt Fence and Straw Bale Pit

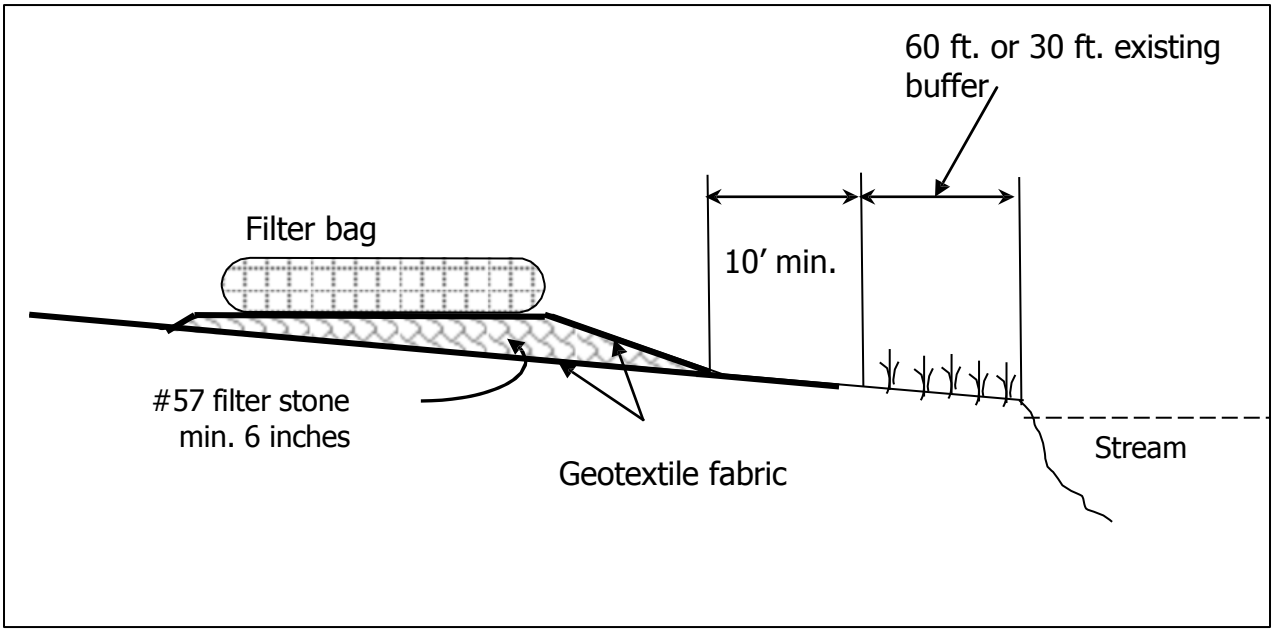
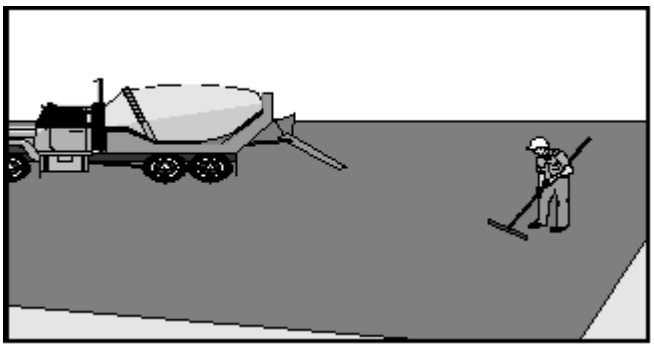


Figure CP-02-3
Typical Sediment Filter Bag

Paving Operations

CP-03



Hamilton County Water Quality Program

Description

Prevent or reduce the discharge of pollutants from paving operations, using measures to prevent run-on and run-off pollution, properly disposing of wastes, and training of employees and subcontractors. This management practice is likely to create partial reductions in sediment, toxic materials, and oil and grease.

Approach

Avoid paving during wet weather.

Store materials away from water courses to prevent stormwater run-on (see CP-5: Material Delivery, Storage, and Use).

Protect water courses, particularly in areas with a grade, by employing BMPs to divert runoff or trap/filter sediment (see the TDEC E&SC Handbook for Sediment Trap, Sediment Basin, Diversion, Slope Drain, Inlet Protection and Outlet Protection).

Leaks and spills from paving equipment can contain toxic levels of heavy metals and oil and grease. Place drip pans or absorbent materials under paving equipment when not in use. Clean up spills with absorbent materials rather than burying. See CP-13: Vehicle and Equipment Fueling and CP-06: Spill Prevention and Control in this section.

Cover catch basins and manholes when applying seal coat, tack coat, slurry seal, fog seal, etc.

There are several commercially available covers that magnetically seal flat catch basins and inlets. Shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to contain slurry.

If paving involves Portland cement concrete, see CP-10: Concrete Waste Management in this section.

If paving involves asphaltic concrete, follow these steps:

- Do not allow sand or gravel placed over new asphalt to wash into storm drains, streets, or creeks by sweeping. Properly dispose of this waste by

referring to CP-07: Solid Waste Management in this section.

- ❖ Old asphalt must be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible.
- ❖ If paving involves an on-site mixing plant, follow the stormwater permitting requirements for industrial activities.

Train employees and subcontractors about the importance of these practices.

Maintenance

Inspect and maintain machinery regularly to minimize leaks and drips.

Maintain inlet protection so that water is not allowed to back up onto areas subject to traffic. If water begins to backup and flood areas subject to traffic, the protective device must be removed and alternative measures deployed.

Clean inlet protection measures when sediment reaches the sediment storage capacity. Repair inlet protection measures as needed.

Inspect employees and subcontractors to ensure that measures are being followed.

Keep ample supplies of drip pans or absorbent materials on-site.

Limitations

There are no major limitations to this best management practice.

References

CDM et.al. for the California SWQTF, 1993. *California Storm Water Best Management Practice Handbooks, Construction and Industrial Handbooks*,

CDM et.al. for the California Department of Transportation, 1997 .*Caltrans Storm Water Quality Handbooks*.

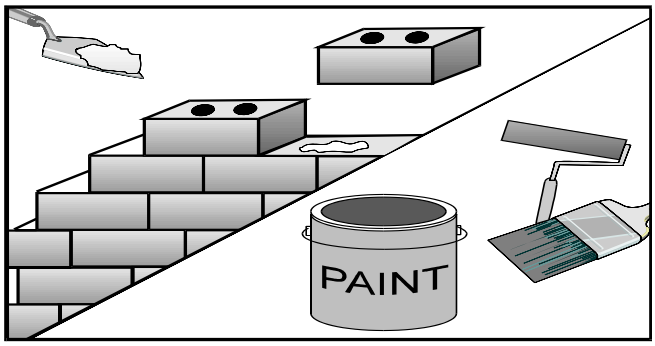
City of Franklin Stormwater Best Management Practices Manual, City of Franklin, Stormwater Management Program, January 2014.

Santa Clara Valley Nonpoint Source Pollution Control Program, 1992.*Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention*.

U.S. Army Corps of Engineers, 1991. *Hot-mix Asphalt Paving Handbook*, AC 150/5370-14, Appendix I.

Structure Construction and Painting

CP-04



Hamilton County Water Quality Program

Description

Prevent or reduce the discharge of pollutants to stormwater from structure construction and painting by enclosing, covering, or berming building material storage areas, using good housekeeping practices, using safer alternative products, and training employees and subcontractors. This management practice is likely to cause a significant reduction in floatable materials and other construction wastes as well as a partial reduction of toxic materials.

Approach

Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep the area regularly.

Use soil erosion control techniques if bare ground is exposed. See Temporary Construction Site Runoff Management Practices.

Buy recycled or less hazardous products to the maximum extent practicable.

Conduct painting operations consistent with local air quality and OSHA regulations.

Properly store paints and solvents. See CP-05: Material Delivery, Storage and Use in this section.

Properly store and dispose waste materials generated from the activity. See the waste management BMPs CP-7, 8, 9, 10 and 11 in this section.

Recycle residual paints, solvents, lumber, and other materials to the maximum extent practicable.

Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.

Clean the storm drain system in the immediate construction area after construction is completed.

Educate employees who are doing the work of the importance of keeping pollutants

out of the stormwater system.

Inform subcontractors of company policy on these matters and include appropriate provisions in their contract to make certain proper housekeeping and disposal practices are implemented.

For a quick reference on disposal alternatives for specific wastes, see the table presented in the Employee/Subcontractor Training BMP fact sheet.

For oil-based paints, paint out brushes to the extent practical, and filter and reuse thinners and solvents.

Never clean paintbrushes or rinse paint containers into a street, gutter, storm drain or watercourse.

Dispose of any paint, thinners, residue, and sludge that cannot be recycled as hazardous waste. For a quick reference on disposal alternatives for paint, thinners, residue and sludge see the table presented in the Employee/Subcontractor Training BMP fact sheet.

Latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and are no longer hazardous, may be disposed of with other construction debris.

Use recycled and less hazardous products when practical.

Recycle residual paints, solvents, lumber, and other materials.

Maintenance

Check employees and subcontractors at least monthly throughout the job to ensure appropriate practices are being employed.

Limitations

Safer alternative products may not be available, suitable, or effective in every case.

Hazardous waste that cannot be re-used or recycled must be disposed of by a licensed hazardous waste hauler.

Be certain that actions to help stormwater quality are consistent with State-and Fed-OSHA and air quality regulations.

Additional Information

Construction and painting activities can generate pollutants that can reach stormwater if proper care is not taken. The sources of these contaminants may be solvents, paints, paint and varnish removers, finishing residues, spent thinners, soap cleaners, kerosene, asphalt and concrete materials, adhesive residues, and old asbestos insulation. For specific information on some of these wastes, see the following BMPs in this section:

CP-07 Solid Waste Management

CP-08 Hazardous Waste Management
CP-09 Contaminated Soil Management
CP-10 Concrete Waste Management

More specific information on structure construction practices is listed below.

Erosion and Sediment Control
If the work involves exposing large areas of soil or if old buildings are being torn down and not replaced in the near future, employ the appropriate soil erosion and control techniques described in Temporary Construction Site Runoff Management Practices (Section 3).

Storm/Sanitary Sewer Connections
Carefully install all plumbing and stormwater systems. Cross connections between the sanitary and storm drain systems, as well as any other connections into the stormwater system from inside a building, are illegal. Color code or flag pipelines on the project site to prevent such connections, and train construction personnel. See CP-11: Sanitary/Septic Waste Management for additional details.

Painting
Local air pollution regulations may, in many areas of the state, specify painting procedures that if properly carried out are usually sufficient to protect stormwater quality. These regulations may require that painting operations be properly enclosed or covered to avoid drift. Use temporary scaffolding to hang drop cloths or draperies to prevent drift. Application equipment that minimizes overspray also helps. When using sealants on wood, pavement, roofs, etc., quickly clean up spills. Remove excess liquid with absorbent material or rags.

If painting requires scraping or sand blasting of the existing surface, use a drop cloth to collect most of the chips. Dispose the residue properly. If the paint contains lead or tributyl tin, it is considered a hazardous waste. Refer to the waste management BMPs in this section for more information.

Mix paint indoors, in a containment area, or in a flat unpaved area not subject to significant erosion. Do so even during dry weather because cleanup of a spill will never be 100% effective. Dried paint will erode from sloped surfaces and be washed away by storms. If using water based paints, clean the application equipment in a sink that is connected to the sanitary sewer or in a containment area where the dried paint can be readily removed. Properly store leftover paints if they are to be kept for the next job or dispose of properly.

Roof Work
When working on roofs, if small particles have accumulated in the gutter, either sweep out the gutter or wash the gutter and trap the particles at the outlet of the downspout. A sock or geofabric placed over the outlet may effectively trap the materials. If the downspout is lined tight, place a temporary plug at the first convenient point in the storm drain and pump out the water with a vactor truck, and

clean the catch basin sump where you placed the plug.

References

CDM et.al. for the California SWQTF, 1993.*California Storm Water Best Management Practice Handbooks, Construction and Industrial Handbooks.*

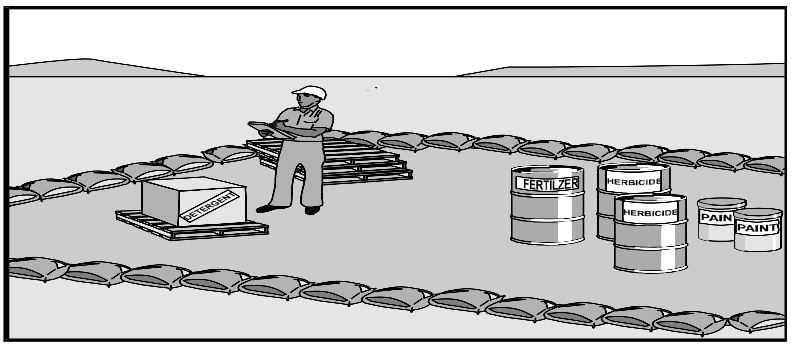
CDM et.al. for the California Department of Transportation, 1997.*Caltrans Storm Water Quality Handbooks*.

City of Franklin, Stormwater Management Program, January 2014. *City of Franklin Stormwater Best Management Practices Manual.*

Santa Clara Valley Nonpoint Source Pollution Control Program, 1992. *Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention*.

Material Delivery, Storage, and Use

CP-05



Hamilton County Water Quality Program

Description

Prevent or reduce the discharge of pollutants to stormwater from material delivery and storage by minimizing the storage of hazardous materials on-site, storing materials in a designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see CP-06: Spill Prevention and Control. For information on wastes, see the waste management BMPs CP-7, 8, 9, 10 and 11 in this section.

Approach

The following materials are commonly stored on construction sites:

- Soil
- Concrete compounds
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster or other products
- Petroleum products such as fuel, oil, and grease
- Other hazardous chemicals such as acids, lime, glues, paints, solvents, and curing compounds.

Storage of these materials on-site can pose various degrees of the following risks:

- Stormwater pollution
- Injury to workers or visitors
- Groundwater pollution
- Soil contamination.

Therefore, the following steps should be taken to minimize your risk:
Designate areas of the construction site for material delivery and storage.

- Place near the construction entrances and away from waterways.
- Avoid transport near drainage paths or waterways.
- Surround with earth berms, dikes, swales or other containment

practices.
- ❖ Place in an area which will be paved.

Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.

Follow manufacturer's instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.

For a quick reference on disposal alternatives for specific wastes, see the table presented in the Employee/Subcontractor Training BMP fact sheet.

Keep an accurate, up-to-date inventory of materials delivered and stored on-site.
Keep your inventory as close to "when you need it" levels as possible.

Minimize hazardous materials stored on-site and handle hazardous materials as infrequently as possible. Consider storing materials in a covered area. Store materials in secondary containment such as an earthen dike, horse trough, or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in 'bus boy' trays or concrete mixing trays. Do not store chemicals, drums, or bagged materials directly on the ground unless otherwise contained. Place these items on a pallet and, when possible, in secondary containment.

Try to keep chemicals in their original containers, and keep them well labeled. If other containers are used then be sure they are well marked and can be adequately sealed and stored in an appropriate place.

Train employees and subcontractors. Employees trained in emergency spill cleanup procedures should be present when dangerous materials or liquid chemicals are unloaded. Personnel who use pesticides should be trained in their use.

Do not over-apply fertilizers, herbicides, and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydroseeding. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried off-site by runoff. Do not apply these chemicals just before it rains.

If significant residual materials remain on the ground after construction is complete, properly remove materials and any contaminated soil. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

Stockpile soil in a central location and protect the stockpile from run-on. Apply suitable controls to remove sediment from runoff from the stockpile by measures such as silt fences, straw bale barriers, sand bag barriers, sediment traps or basins. If the stockpile will be inactive for an extended period, plant temporary vegetation or install long-term perimeter controls. Smaller stockpiles may be protected with tarps.

Have proper storage instructions posted at all times in an open and conspicuous location. Periodically review this with field supervisors and inspectors.

Contain and clean up any spill immediately.

Maintenance

Keep the designated storage area clean and well organized.

Conduct routine weekly inspections and check for external corrosion of material containers.

Keep an ample supply of spill cleanup materials near the storage area.

Inspect storage areas before and after rainfall events, and at least weekly during other times.

Repair and/or replace perimeter controls, containment structures, and covers as needed to keep them properly functioning.

References

Best Management Practices and Erosion Control Manual for Construction Sites; Flood Control District of Maricopa County, AZ, September 1992.

Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992.

California Storm Water Best Management Practice Handbooks, Construction and Industrial Handbooks, CDM et.al. for the California SWQTF, 1993.

Caltrans Storm Water Quality Handbooks, CDM et.al. for the California Department of Transportation, 1997.

City of Franklin, Stormwater Management Program, January 2014. *City of Franklin Stormwater Best Management Practices Manual.*

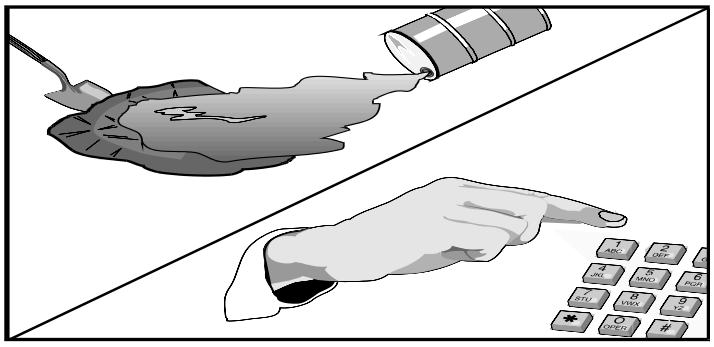
USEPA, April 1992. *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, Working Group Working Paper.

USEPA, April 1992. *Storm Water Management for Construction Activities:*

Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005.

Spill Prevention and Control

CP-06



Hamilton County Water Quality Program

Description

Prevent or reduce the discharge of pollutants to stormwater from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees. This management practice is likely to create a partial reduction in toxic materials and oil and grease.

This best management practice covers only spill prevention and control. However, CP-05: Material Delivery, Storage, and Use also contains useful information, particularly on spill prevention. For information on wastes, see the waste management BMPs in this section.

Spill prevention and control applies to chemicals and hazardous substances including, but not limited to:

- Soil stabilizers
- Palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals
- Fuels
- Lubricants
- Other Petroleum distillates

This management practice is likely to create a partial reduction in the impacts caused by toxic materials and oil and grease.

Approach

The following steps will help reduce the stormwater impacts of leaks and spills:

Define "*Significant Spill*". Different materials pollute in different amounts. Make sure that each employee knows what a "significant spill" is for each material they use, and what is the appropriate response for "significant" and "insignificant" spills. A significant spill should be defined after review of the Materials Safety Data Sheet or other descriptive documentation that presents the contents and proper handling procedures.

Hazardous materials and wastes should be stored in covered containers and protected from vandalism.

Place a stockpile of spill cleanup materials where it will be readily accessible. Train employees in spill prevention and cleanup procedures for the site. Educate employees and subcontractors on potential dangers to humans and the environment from spills and leaks. Hold regular meetings to discuss and reinforce appropriate disposal procedures (incorporate into regular safety meetings). Establish a continuing education program to indoctrinate new employees. Designate a foreman or supervisor to oversee and enforce proper spill prevention and control measures.

Cleanup

Clean up leaks and spills immediately. On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste. Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See the waste management BMPs in this section for specific information.

Minor Spills

- Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.
- Use absorbent materials on small spills rather than hosing down or burying the spill.
- Remove the absorbent materials promptly and dispose of properly.
- The practice commonly followed for a minor spill is:
- Contain the spread of the spill.
- Recover spilled materials.
- Clean the contaminated area and/or properly dispose of contaminated materials.

Semi-Significant Spills

- Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.
- Clean up spills immediately:
    1. Notify the project foreman immediately. The foreman shall notify the Engineer or Safety Manager.
    2. Determine if spill response construction personnel are qualified to perform the cleanup in a safe manner. Alert additional trained personnel if necessary including a Haz-Mat team or dial 911 for local authorities.

3. Contain spread of the spill.
4. If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
5. If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
6. If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

Significant/Hazardous Spills

- For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps shall be taken:
  1. Notify the local emergency response by dialing 911. In addition to 911, the contractor will notify the proper county officials. It is the contractor's responsibility to have all emergency phone numbers at the construction site.
  2. Notify the Engineer immediately and follow up with a written report.
  3. For spills of state reportable quantities or into a waterbody or adjoining shoreline, the contractor shall notify the TDEC general hotline – environmental assistance at 1-888-891-TDEC (8332).
  4. For spills of federal reportable quantities or into a waterbody or adjoining shoreline, the contractor shall notify the National Response Center at (800) 424-8802.
  5. Notification should first be made by telephone and followed up with a written report.
  6. The services of a spills contractor or a Haz-Mat team shall be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staff has arrived at the job site.
  7. Other agencies which may need to be consulted include, but are not limited to, the Fire Department, the Public Works Department, the City/County Police Department, OSHA, etc.

See CP-13 and 14 for details about spill prevention and control while maintaining or fueling vehicles and equipment.

Maintenance

Keep ample supplies of spill control and cleanup materials on-site, near storage, unloading, and maintenance areas. Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals on-site.

Limitations

Use only a reputable, licensed spill cleanup company to clean up large spills. Procedures and practices presented in this BMP are general. Contractor shall identify appropriate practices for the specific materials used or stored on site.

References

CDM et.al. for the California SWQTF, 1993.California Storm Water Best Management Practice Handbooks, Construction and Industrial Handbooks.

CDM et.al. for the California Department of Transportation, 1997.Caltrans Storm Water Quality Handbooks.

City of Franklin, Stormwater Management Program, January 2014. City of Franklin Stormwater Best Management Practices Manual.

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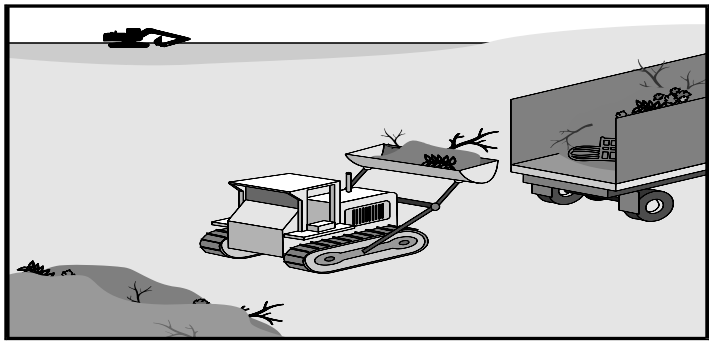
Solid Waste Management

CP-07



Hamilton County Water Quality Program

Description

Prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors. This management practice is likely to create a significant reduction in floatable materials and other construction wastes as well as a partial reduction in sediment.

Approach

Solid waste is one of the major pollutants resulting from construction. Construction debris includes:

- Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction;
- Packaging materials including wood, paper and plastic;
- Scrap or surplus building materials including scrap metals, rubber, plastic, glass pieces, and masonry products;
- Concrete, brick, and mortar;
- Pipe and electrical cuttings;
- Pavement planning or grinding and removal;
- Wood framing or falsework; and
- Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, and plastic wrappers, and cigarettes.

The following steps will help keep a clean site and reduce stormwater pollution:

- Designate waste storage areas that are away from storm drain inlets, stormwater facilities, or watercourses.
- Provide containers in areas where employees congregate for breaks and lunch.
- Inform trash hauling contractors that you will accept only watertight dumpsters for on-site use. Inspect dumpsters for leaks or open drain valves and repair any dumpster that is not watertight and tightly close the drain valve.
- Do not hose out dumpsters on the construction site. Leave dumpster cleaning to trash hauling contractor.
- Arrange for regular waste collection before containers overflow.

- If a container does spill, clean up immediately.
- Locate storage containers in a covered area and/or in secondary containment.
- Segregate potentially hazardous waste from nonhazardous construction site waste.
- Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it's windy.
- Plan for additional containers and more frequent pickup during the demolition phase of construction.
- Collect site trash daily, especially during rainy and windy conditions.
- Erosion and sediment control devices tend to collect litter. Remove this solid waste promptly.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Salvage or recycle any useful material. For example, trees and shrubs from land clearing can be used as a brush barrier or converted into wood chips, then used as mulch on graded areas.
- Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas.
- Train employees and subcontractors in proper solid waste management.
- Require that employees and subcontractors follow solid waste handling and storage procedures.

For a quick reference on disposal alternatives for specific wastes, see the table presented in the Employee/Subcontractor Training BMP fact sheet.

Maintenance

Collect site trash daily. Inspect construction waste area regularly. Arrange for regular waste collection.

References

CDM et.al. for the California SWQTF, 1993.California Storm Water Best Management Practice Handbooks, Construction and Industrial Handbooks.

CDM et.al. for the California Department of Transportation, 1997.Caltrans Storm Water Quality Handbooks.

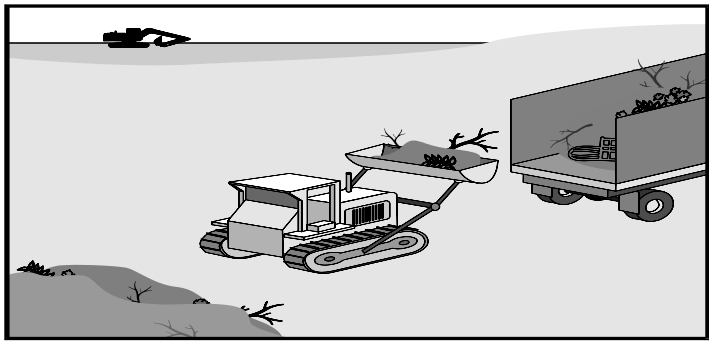
Santa Clara Valley Nonpoint Source Pollution Control Program, 1992. Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention.

USEPA, 430/9-73-007, 1973.*Processes, Procedures, and Methods to Control Pollution Resulting from all Construction Activity*.

USEPA, April 1992.*Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices*, EPA 832-R-92005.

Hazardous Waste Management

CP-08



Hamilton County Water Quality Program

Description Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors. This management practice is likely to create a partial reduction in toxic materials.

Approach Many of the chemicals used on-site can be hazardous materials which become hazardous waste upon disposal. These wastes may include:

- Paints and solvents;
- Petroleum products such as oils, fuels, and grease;
- Herbicides and pesticides;
- Acids for cleaning masonry; and
- Concrete curing compounds.

In addition, sites with existing structures may contain wastes which must be disposed of in accordance with Federal, State, and local regulations. These wastes include:

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints;
- Asbestos; and
- PCBs (particularly in older transformers).

The following steps will help reduce stormwater pollution from hazardous wastes:

<u>Material Use</u>

Use the entire product before disposing of the container. Do not remove the original product label; it contains important safety and disposal information. Material Safety Data Sheets should be provided for each product being handled. All persons using or handling the product should be made aware of the safety information and the location of the readily available Material Safety Data Sheets. Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive, environmentally harmful and generally doesn't provide the intended additional benefit. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried off-site by runoff. Do not apply these

chemicals just before it rains. People applying pesticides must be trained and certified in accordance with Federal and State regulations. Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. "Paint out" brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and re-use thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.

Waste Recycling/Disposal

Select designated hazardous waste collection areas on-site. Regularly schedule hazardous waste removal to minimize on-site storage. Hazardous materials and wastes should be stored in covered containers and protected from vandalism. They should be stored in the original containers or in other well marked containers. Place hazardous waste containers in secondary containment.

Storage Procedures

- Ensure that adequate hazardous waste storage volume is available.
- Ensure that hazardous waste collection containers are conveniently located.
- Designate hazardous waste storage areas on site, away from storm drains or watercourses.
- Minimize production or generation of hazardous materials and hazardous waste on the jobsite.
- Use containment berms in fueling and maintenance areas and where the potential for spills is high.
- Segregate potentially hazardous waste from nonhazardous construction site debris.
- Store hazardous materials and wastes in covered containers and protected from vandalism.
- Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drums or similar) and under cover.
- Clearly mark on all hazardous waste containers which materials are acceptable for the container.
- Place hazardous waste containers in secondary containment.
- Do not allow potentially hazardous waste materials to accumulate on the ground.
- Do not mix wastes as this can cause unforeseen chemical reactions, make recycling impossible and complicate disposal.
- Recycle any useful material such as used oil or water-based paint.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for non-hazardous construction debris.
- Arrange for regular waste collection before containers overflow.
- Make sure that hazardous waste (e.g. excess oil-based paint and sludge) is collected, removed, and disposed of only at authorized disposal areas.
- For a quick reference on disposal alternatives for specific wastes, see the table presented in the Employee/Subcontractor Training BMP fact sheet.

Training

Educate employees and subcontractors on hazardous waste storage and disposal procedures. Educate employees and subcontractors of potential dangers to humans and the environment from hazardous wastes. Instruct employees and subcontractors on safety procedures for common construction site hazardous wastes. Instruct employees and subcontractors in identification of hazardous and solid waste. Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings). Designate a foreman or supervisor to oversee and enforce proper solid waste management procedures and practices. Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas. Train employees and subcontractors in proper hazardous waste management including review of material safety data sheets. Warning signs should be placed in areas recently treated with chemicals. Place a stockpile of spill cleanup materials where it will be readily accessible. If a container does spill, clean up immediately.

Maintenance

Inspect hazardous waste receptacles and surrounding area regularly.
Arrange for regular hazardous waste collection.

References

CDM et.al. for the California SWQTF, 1993.California Storm Water Best Management Practice Handbooks, Construction and Industrial Handbooks.

CDM et.al. for the California Department of Transportation, 1997.Caltrans Storm Water Quality Handbooks.

City of Franklin, Stormwater Management Program, January 2014. City of Franklin Stormwater Best Management Practices Manual.

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USEPA, 1973. Processes, Procedures, and Methods to Control Pollution Resulting from all Construction Activity; USEPA, 430/9-73-007.

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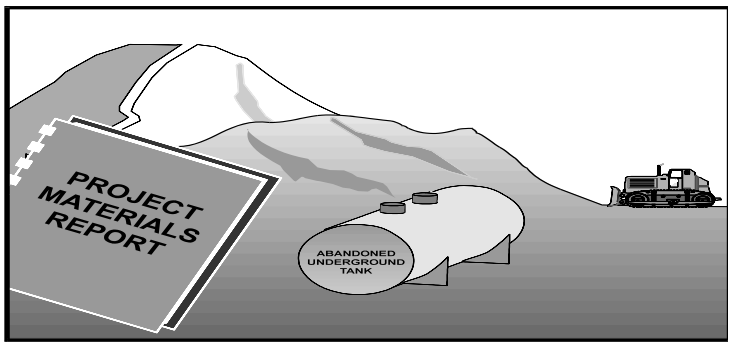
Contaminated Soil Management

CP-09



Hamilton County Water Quality Program

Description

Prevent or reduce the discharge of pollutants to stormwater from contaminated soil and highly acidic or alkaline soils by conducting pre-construction surveys, inspecting excavations regularly, and remediating contaminated soil promptly. This management practice is likely to create a significant reduction in toxic materials as well as a partial reduction in sediment.

Approach

Contaminated soils are often identified in the project material report with known locations identified in the plans and specifications. The contractor shall review applicable reports and investigate appropriate callouts in the plans and specifications.

Contaminated soils may occur on your site for several reasons including:

- Past site uses and activities;
- Detected or undetected spills and leaks; and
- Acid or alkaline solutions from exposed soil or rock formations high in acid or alkaline-forming elements.

Most developers conduct pre-construction environmental assessments as a matter of routine. Recent court rulings holding contractors liable for cleanup costs when they unknowingly move contaminated soil, highlight the need for contractors to confirm that a site assessment is completed before earth moving begins.

The following steps will help reduce stormwater pollution from contaminated soil:

- Conduct thorough site planning including pre-construction geologic surveys.
- Look for contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris.
- Prevent leaks and spills to the maximum extent practicable. Contaminated soil can be expensive to treat and/or dispose of properly. However, addressing the problem before construction is much less expensive than after the structures are in place.
- For a quick reference on disposal alternatives for specific wastes, see the table presented in the Employee/Subcontractor Training BMP fact sheet.

Water Control

- Take all necessary precautions and preventive measures to prevent the flow of water, including ground water, from entering hazardous material or underground storage tank excavations. Such preventative measures may consist of, but are not limited to berms, cofferdams, grout curtains, freeze walls, and seal course concrete or any combination thereof.

- If water does enter an excavation and becomes contaminated, such water, when necessary to proceed with the work, shall be discharged to clean, closed top, watertight, transportable holding tanks, and disposed of in accordance with federal, state, and local laws.

Maintenance

- Inspect excavated areas daily for indications of contaminated soil.
- Implement CP-06: Spill Prevention and Control, to prevent leaks and spills as much as possible.
- Monitor air quality continuously during excavation operations at all locations containing hazardous material.
- Coordinate contaminated soils and hazardous material management with the appropriate federal, state, and local agencies.
- Inspect hazardous waste receptacles and areas regularly.

Limitations

- The procedures and practices presented in this BMP are general. The contractor shall identify appropriate practices and procedures for the specific contaminants known to exist or discovered on site.
- Contaminated soils that cannot be treated on-site must be disposed of off-site by a licensed hazardous waste hauler.
- The presence of contaminated soil may indicate contaminated water as well. See CP-02: Dewatering Operations for more information.

References

CDM et.al. for the California SWQTF, 1993.California Storm Water Best Management Practice Handbooks, Construction and Industrial Handbooks.

CDM et.al. for the California Department of Transportation, 1997.Caltrans Storm Water Quality Handbooks.

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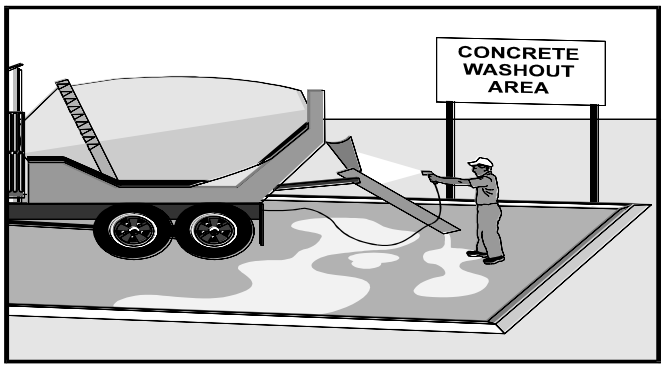
USEPA, April 1992. *Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices*, EPA 832-R-92005.

Concrete Waste Management

CP-10



Hamilton County Water Quality Program

Description

Concrete washouts are used to contain concrete and liquids when the chutes of concrete mixers and hoppers of concrete pumps are rinsed at the construction site after delivery. The washout facilities consolidate solids for easier disposal and prevent runoff of liquids. The wash water is typically alkaline and contains high levels of chromium. This could contaminate surface and groundwater thus harming aquatic life. Solids that are improperly disposed of can clog storm drainpipes and cause flooding. Installing concrete washout facilities not only prevents pollution but also is a matter of good housekeeping at your construction site.

This guideline describes the different types of concrete washout facilities that can be used at your site and outlines how they should be sited, designed, and maintained.

Approach

Types of Concrete Washout Facilities

- *Prefabricated Washout Containers*

A growing number of companies offer sturdy, prefabricated concrete washout containers that are delivered to the site. Some services provide the containers alone without providing maintenance and disposal of materials, while other companies offer complete service that includes delivery of containers and regular pickups of solid and liquid waste materials. The prefabricated containers resist damage and protect against spills and leaks, and the full-service option relieves the site superintendent of the burden of disposing of materials. To prevent leaks on the jobsite, ensure that prefabricated washout containers are watertight. Additionally, some companies offer prefabricated washout containers with ramps to accommodate concrete pump trucks.

When selecting a company to handle concrete waste, ensure that they are properly disposing of all materials and give preference to companies that recycle collected materials.

- *Self-installed Concrete Washouts*

A concrete washout facility can be built onsite. There are many design options for the washout, but they are preferably built below-grade to prevent breaches and reduce the likelihood of runoff. Above-grade structures can also be used if they are sized and constructed correctly are leak proof and are diligently maintained. One of the most common problems with self-installed concrete washout facilities is that they can leak or be

breached as a result of constant use, so care should be taken to use quality materials and inspect the facilities on a daily basis.

Washouts should be sized to handle solids, wash water, and rainfall to prevent overflow. Concrete Washout Systems, Inc., (2006) estimates that 7 gallons of wash water are used to wash one truck chute and 50 gallons are used to wash out the hopper of a concrete pump truck.

For larger sites, a below-grade washout should be at least 10 feet wide and sized to contain all liquid and solid waste you expect to generate in between cleanout periods (CASQA, 2003). Washouts at smaller sites, such as a single-family residential lot, should be sized to accommodate the expected load and can be smaller than 10 feet wide. Include a minimum 12-inch freeboard in the sizing calculations. Line the pit with plastic sheeting of at least 10-mil thickness that has no holes or tears to prevent leaching of liquids into the ground (CASQA, 2003). Concrete wash water should never be placed in a pit that is connected to the storm drain system or that drains to nearby waterways.

Washouts at smaller sites can be smaller according to the expected capacity needed. Include a 4-inch freeboard in the sizing calculations (CASQA, 2003). Structures can be made from sandbags double- or triple-lined with plastic sheeting of at least 10-mil thickness that has no holes or tears.

According to CASQA (2003), you should not place concrete washout facilities within 50 feet of storm drains, open ditches, or waterbodies. Concrete washout facilities need to be located in an area that allows convenient access for concrete trucks, preferably near the area where the concrete is being poured. Appropriate gravel or rock should cover paths to concrete washout facilities if the facilities are located on undeveloped property. These areas should be far enough away from other construction traffic to reduce the likelihood of accidental damage and spills. The number of facilities you install should depend on the expected demand for storage capacity. On large sites with extensive concrete work, concrete truck drivers should place washouts in multiple locations for ease of use.

Maintenance

Material Removal

Check all concrete washout facilities daily to determine if they have been filled to 75 percent capacity, which is when materials need to be removed. Both above- and below- ground self-installed washouts should be inspected daily to ensure that plastic linings are intact and sidewalls have not been damaged by construction activities. Prefabricated washout containers should be inspected daily as well to ensure the container is not leaking or nearing 75 percent capacity. Inspectors should note whether the facilities are being used regularly; if drivers wash out their chutes or hoppers in other locations, the site superintendent may need to provide more education, install additional signage, or place additional washouts in more convenient locations.

Inspection

Concrete washouts are designed to promote evaporation where feasible. However, if stored liquids have not evaporated and the washout is nearing capacity, vacuum and dispose of them in an approved manner - check with the local sanitary sewer authority to determine if there are

special disposal requirements for concrete wash water. Remove liquids or cover the structures before predicted rainstorms to prevent overflows. Companies that offer prefabricated and watertight washout containers generally offer a vacuum service to remove the liquid material.

Hardened solids can be removed while whole or can be broken up first depending on the type of equipment available at your site. Solids can be reused onsite or haul them away for recycling - crushed concrete makes excellent aggregate for roadbeds and other building applications. Check with the local recycling agency to identify opportunities for concrete recycling. When materials are removed from the concrete washout, build a new structure or, if the previous structure is still intact, inspect the structure for signs of weakening or damage and make any necessary repairs. Line the structure with new plastic that is free of holes or tears and replace signage if necessary. It is very important that new plastic is used after every cleaning because pumps and concrete removal equipment can damage the existing liner.

Contractor Education

An important factor that dictates the success of concrete washout facilities is whether or not concrete truck drivers use concrete washouts. The site superintendent needs to make drivers aware of the presence of these facilities. The site superintendent can educate concrete subcontractors, post signage indicating the location and designated use of these areas, and provide careful oversight to inspect for evidence of improper dumping of concrete waste and wash water. Include requirements in contracts with concrete delivery companies that drivers must use designated concrete washout facilities.

References

California Stormwater Quality Association (CASQA), 2003. *Stormwater Best Management Practice Handbook: Construction. http://www.cabmphandbooks.com/Construction.asp.*

CASQA Concrete Waste Management Fact Sheet in the California BMP Handbook: Construction. http://www.cabmphandbooks.com/Construction.asp.

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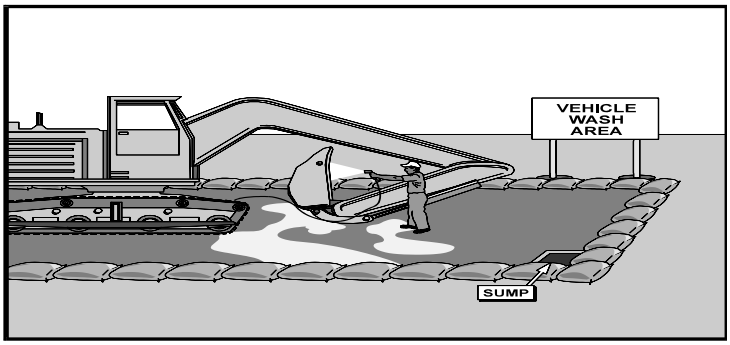
Concrete Washout Systems, Inc. 2006. Industry Problems: Facts and Figures. http://www.concretewashout.com/ pages/industry_problems/concrete_washout_facts_figures/. Accessed May 10, 2006.

USEPA, Office of Wastewater Management (OWM), April 09, 2007. "National Menu of Stormwater Best Management Practices". http://cfpub1.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=117

Vehicle and Equipment Cleaning and Maintenance

CP-12



Hamilton County Water Quality Program

Description

Prevent or reduce the discharge of pollutants to stormwater from vehicle and equipment cleaning by using off-site facilities, washing in designated, contained areas only, eliminating discharges to the storm drain by infiltrating or recycling the wash water, and training employees and subcontractors. This management practice is likely to cause a partial reduction in toxic materials and oil and grease.

Approach

Vehicle maintenance and washing BMPs prevent construction site spills of wash water, fuel, or coolant from contaminating surface or ground water. They apply to all construction sites. Appropriate BMPs include the following:

- Using a covered, paved area dedicated to vehicle maintenance and washing
- Ensuring that the service and wash areas are properly contained and treated before discharge to a storm drain system
- Developing a spill prevention and cleanup plan
- Preventing hazardous chemical leaks by properly maintaining vehicles and equipment
- Properly covering and providing secondary containment for fuel drums and toxic materials
- Properly handling and disposing of vehicle wastes and wash water
- For a quick reference on disposal alternatives for specific wastes, see Table CP-15-1.

Inspect construction vehicles daily, and repair any leaks immediately. Dispose of all used oil, antifreeze, solvents and other automotive-related chemicals according to manufacturer instructions. These wastes require special handling and disposal. Used oil, antifreeze, and some solvents can be recycled at designated facilities, but other chemicals must be disposed of at a hazardous waste disposal site. Local government agencies can help identify such facilities.

Designate special paved areas for vehicle repair. To direct washwater to sanitary sewer systems or other treatment facilities, ensure that vehicle washing areas are impervious and are bermed. Use blowers or vacuums instead of water to remove dry materials

from vehicles if possible. Because water alone can remove most dirt adequately, use high-pressure water spray without detergents at vehicle washing areas. Clearly mark all washing areas, and inform workers that all washing must occur in this area. Do not perform other activities, such as vehicle repairs, in the wash area.

Maintenance

Minimal, some berm repair may be necessary, inspect weekly. Service sump regularly.

Limitations/ Additional Information

Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades.

Sending vehicles/equipment off-site should be done in conjunction with a stabilized construction entrance and mud tracking removal.

The local sewer authority may require pretreatment and monitoring of wash water discharges to the sanitary sewer and should be consulted first.

Primary References

City of Franklin, Stormwater Management Program, January 2014. *City of Franklin Stormwater Best Management Practices Manual.*

Department of Environmental Protection and Energy, Trenton, NJ.
Santa Clara Valley NPS Control Program. Best Management Practices for Industrial Stormwater Pollution Control. Santa Clara Valley Nonpoint Source Pollution Control Program, San Jose, CA.

NJDEPE (New Jersey Department of Environmental Protection and Energy). 1992. Ground Water Protection Practices for Motor Vehicle Services. New Jersey.

USEPA (U.S. Environmental Protection Agency). 1992a. Stormwater 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. September 1992.

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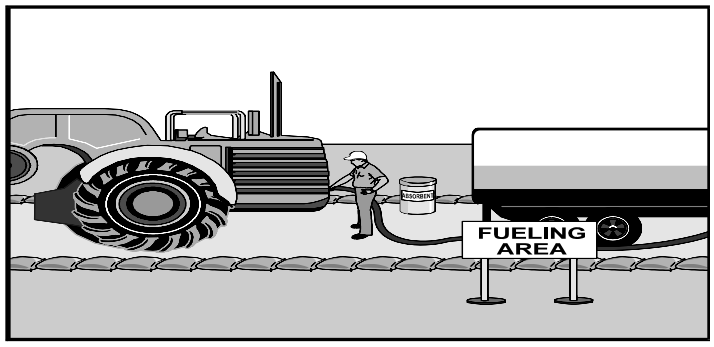
Vehicle and Equipment Fueling

CP-13



Hamilton County Water Quality Program

Description

Prevent fuel spills and leaks, and reduce their impacts to stormwater by using off-site facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors. This management practice is likely to create a partial reduction in toxic materials and oil and grease.

Approach

Use off-site fueling stations as much as possible. Fueling vehicles and equipment outdoors or in areas where fuel may spill/leak onto paved surfaces or into drainage pathways can pollute stormwater. If you fuel a large number of vehicles or pieces of equipment, consider using an off-site fueling station. These businesses are better equipped to handle fuel and spills properly. Performing this work off-site can also be economical by eliminating the need for a separate fueling area at your site.

If fueling must occur on-site, use designated areas, located away from drainage courses, to prevent the run-on of stormwater and the runoff of spills.

Discourage “topping-off” of fuel tanks.

Always use secondary containment, such as a drain pan or drop cloth, when fueling to catch spills/leaks.

Place a stockpile of spill cleanup materials where it will be readily accessible.

Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.

Carry out all Federal and State requirements regarding stationary above ground storage tanks with special attention given to secondary containment.

Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and perhaps forklifts, most vehicles should be able to travel to a designated area with little lost time.

For a quick reference on disposal alternatives for specific wastes, see the table presented in the Employee/Subcontractor Training BMP fact sheet.

Locate fueling areas on a paved surface where practical.

Protect fueling areas with berms and/or dikes to prevent run-on, runoff, and to contain spills.

Use vapor recovery nozzles to help control drips as well as air pollution where required by Air Quality Management Districts.

Maintenance

Keep ample supplies of spill cleanup materials on-site. Inspect fueling areas and storage tanks on a regular schedule.

Limitations

Sending vehicles/equipment off-site should be done in conjunction with a stabilized construction entrance.

References

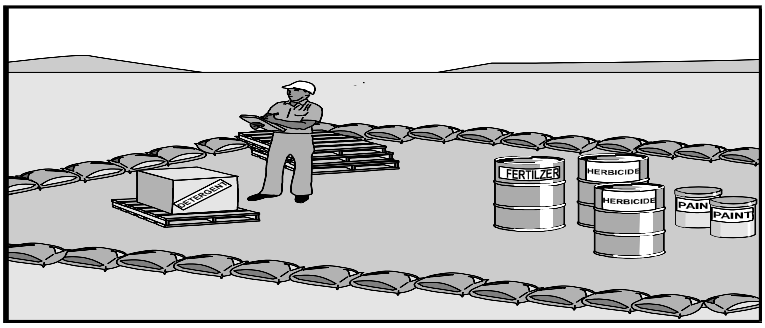
CDM et.al. for the California SWQTF, 1993.California Storm Water Best Management Practice Handbooks, Construction and Industrial Handbooks.

CDM et.al. for the California Department of Transportation, 1997.Caltrans Storm Water Quality Handbooks.

City of Franklin, Stormwater Management Program, January 2014. City of Franklin Stormwater Best Management Practices Manual.

Pesticides, Herbicides, and Fertilizer Use

CP-14



Hamilton County Water Quality Program

Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, herbicides, and pesticides. This management practice is likely to create a significant reduction in nutrients, toxic materials, and oxygen demanding substances. Related information is provided in CP-06: Spill Prevention and Control.

Approach

Integrate this best management practice as much as possible with your existing programs. For a quick reference on disposal alternatives for specific wastes, see the table presented in the Employee/Subcontractor Training BMP fact sheet.

Contractors/subcontractors should develop controls on the application of pesticides, on-site. Controls may include:

- List of approved pesticides and selected uses.
- Product and application information for users.
- Equipment use and maintenance procedures.
- Record keeping and public notice procedures.

The following discussion provides some general information on good housekeeping:

- Always use caution when handling any pesticide or fertilizer product. Many products contain toxic chemicals that can cause severe injury or death.
- Store pesticide or fertilizer products securely and away from children, pets, and sources of heat, sparks, and flames.
- Store products in their original containers and keep them well labeled. Do not store chemicals in food containers.
- Read and follow use instructions provided on packaging and in Material Safety Data Sheets. Periodically review the Material Safety Data Sheets and discuss use and handling precautions with people using or handling the pesticides, herbicides, or fertilizers.
- Avoid contact with eyes and skin. Wear gloves and eye protection when using or handling hazardous substances. Do not wear contact lenses, which can absorb hazardous vapors.
- Work in only well ventilated areas.
- Use up the entire product before disposing the container.
- Do not dispose of pesticide or fertilizer wastes in trash, down storm drains or into creeks, onto the ground, or by burning.

- ❖ Do dispose of hazardous wastes at household hazardous waste collection events or facilities.

Requirements

Training: Contractor and subcontractor employees who handle potentially harmful materials should be trained in good housekeeping practices. Personnel who use pesticides must be trained in their use.

References

California Department of Toxic Substance Control. *Hazardous Household Products: A guide to the Disposal of Hazardous Household Products and the Use of Non-Hazardous Alternatives* (No date).

CDM et.al. for the California SWQTF, 1993.*California Storm Water Best Management Practice Handbooks, Construction and Industrial Handbooks.*

CDM et.al. for the California Department of Transportation, 1997.*Caltrans Storm Water Quality Handbooks.*

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Household Hazardous Waste Project, 1989. *Guide to Hazardous Products Around the Home* (Booklet).

Golden Empire Health Planning Center. *Household Cleaners and Polishes: Chemical Hazards in the Home* (Brochure) (No date).

Golden Empire Health Planning Center. *Solvents, Chemical Hazards in the Home* (Brochure) (No date).

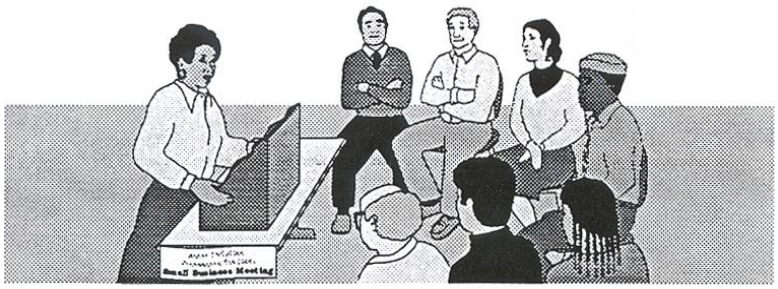
San Francisco Household Hazardous Waste Program, 1992. *Your Guide to Less Toxic Shopping: Safer Alternatives for Your Home and Life!* (Booklet).

Santa Clara County and City of Palo Alto, 1992.*Take Me Shopping: A Consumer Guide to Safe Alternatives for Household Hazardous Products* (Booklet).

Santa Clara Valley Nonpoint Source Pollution Control Program, 1992. *Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention.*

Employee/Subcontractor Training

CP-15



Hamilton County Water Quality Program

Description

Employee/subcontractor training, such as maintenance of a piece of equipment, is not so much a best management practice as it is a method by which to implement BMPs. This fact sheet highlights the importance of training and of integrating the elements of employee/subcontractor training from the individual source controls into a comprehensive training program as a part of a Storm Water Pollution Prevention Plan (SWPPP).

The specific employee/subcontractor training aspects of each of the source controls are highlighted in the individual fact sheets. The focus of this fact sheet is more general, and includes the overall objectives and approach for assuring employee/subcontractor training in stormwater pollution prevention. Accordingly, the organization of this fact sheet differs somewhat from the other fact sheets in this section.

Objective

Employee/subcontractor training should be based on four objectives:

1. Promote a clear identification and understanding of the problem, including activities with the potential to pollute stormwater;
2. Identify solutions (BMPs);
3. Promote employee/subcontractor ownership of the problems and the solutions;
4. Integrate employee/subcontractor feedback into training and BMP implementation.

Approach

Integrate training regarding stormwater quality management with existing training programs that may be required for your business by other regulations such as the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) standard (29 CFR 1910.120); and the Spill Prevention Control and Countermeasure (SPCC) Plan (40 CFR 112).

Supervisors and inspectors should receive additional annual 8-hour refresher courses. Businesses, particularly smaller ones that may not be regulated by Federal, State, or local regulations, may use the information in this BMP Manual to develop a training program to reduce their potential to pollute stormwater. Use the quick reference on disposal alternatives (Table CP-15-1) to train employee/ subcontractors in proper and consistent methods for disposal. Consider posting the

quick reference table around the job site or in the on-site office trailer to reinforce training. Train employee/subcontractors in standard operating procedures and spill cleanup techniques described in the fact sheets. Employee/subcontractors trained in spill containment and cleanup should be present during the loading/unloading and handling of materials. Personnel who use pesticides should be trained in their use. Proper education of off-site contractors is often overlooked. The conscientious efforts of well-trained employee/subcontractors can be lost by unknowing off-site contractors, so make sure they are well informed about what they are expected to do on-site.

References

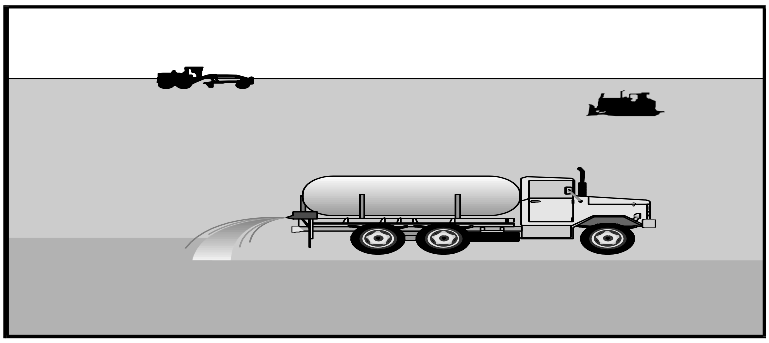
CDM et.al. for the California SWQTF, 1993.*California Storm Water Best Management Practice Handbooks, Construction and Industrial Handbooks.*

CDM et.al. for the California Department of Transportation, 1997.*Caltrans Storm Water Quality Handbooks.*

City of Franklin, Stormwater Management Program, January 2014. *City of Franklin Stormwater Best Management Practices Manual.*

Dust Control

CP-16



Hamilton County Water Quality Program

Description

Dust control measures are used to stabilize soil from wind erosion, and reduce dust generated by construction activities. This thereby reduces the amount of eroded materials available for stormwater runoff. Dust control is considered primarily as a temporary measure-an intermediate treatment between disturbance in construction, paving, or vegetation. This management practice is likely to create a significant reduction in sediment as well as partial reductions in toxic materials and oil and grease.

Suitable Applications

- Clearing and grading activities.
- Construction vehicle traffic on temporary or unpaved roads or construction site access paths.
- Drilling and blasting activities.
- Sediment tracking onto paved roads.
- Soil and debris storage piles.
- Batch drop from front end loaders.
- Areas with unstabilized soil.
- Final grading/site stabilization usually is sufficient to control post-construction dust sources.
- Dust control should be practiced at all construction sites by performing phased clearing and grading operations, using temporary stabilization methods, and/or placing undisturbed vegetative buffers of at least 50 ft. (15 m) length between areas being graded and those areas to remain undeveloped.
- Dust control is particularly important in windy or wind-prone areas.

Approach

Schedule construction activities to minimize exposed area by clearing only areas where phased construction is to take place. Quickly stabilize exposed soils using vegetation, mulching, spray-on adhesives, calcium chloride, sprinkling, and stone/gravel layering. Identify and stabilize key access points prior to commencement of construction. See TDEC's E&SC Handbook for Tire Washing Facility and Construction Road Stabilization management practices. Minimizing the impact of dust by anticipating the direction of prevailing winds. Direct most construction traffic to stabilized roadways within the project site.

Dust control BMP's generally stabilize exposed surfaces and minimize activities that

suspend or track dust particles. Table CP-17-1 shows which Dust Control BMPs apply to site conditions which cause dust. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel or asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications. Permanent or temporary vegetation and mulching and sand fences can be employed for areas of occasional or no construction traffic.

Preventive measures would include minimizing surface areas to be disturbed, limiting on-site vehicle traffic to 15 miles per hour (24 km per hour), and controlling the number and activity of vehicles on a site at any given time.

- Pave, vegetate, or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.
- Provide covers for haul trucks transporting materials that contribute to dust.
- Provide for wet suppression or chemical stabilization of exposed soils.
- Provide for rapid clean-up of sediments deposited on paved roads. Furnish stabilized construction road entrances and vehicle wash down areas.
- Stabilize unpaved haul roads, parking and staging areas. Reduce speed and trips on unpaved roads.
- Implement dust control measures for material stockpiles.
- Prevent drainage of sediment-laden stormwater onto paved surfaces.
- Stabilize abandoned construction sites using vegetation or chemical stabilization methods.

For the chemical stabilization, there are many products available for chemically stabilizing gravel roadways and stockpiles. The types of chemicals available and recommendations for their use are tabulated in Table CP-17-2, Commonly Used Chemicals for Dust Control.

Selection of Methods

Selection of dust control agents should be based primarily on cost-effectiveness and environmental hazards.

Chemical methods are dust suppressant or binding agents that are used on the soil surface to bind finer particles together. Chemical dust control agents must be environmentally benign, easily applied, easily maintained, economical and not significantly detrimental to traffic ability.

Approximately three-quarters of chemical dust control agents are inorganic compounds which are compatible with soil and biota. After application, the compounds dampen and penetrate into the soil; a hygroscopic reaction pulls moisture from the atmosphere into the surface and adheres fines to aggregate surface particles. The compounds may not penetrate soil surfaces made up primarily of silt and clay, so soil tests are required.

Key factors in determining the method include the following:

- Soil types and surface materials - both fines and moisture content are key

properties of surface materials.

- Properties of the agents - the five most important properties are penetration, evaporation, resistance to leaching, abrasion, and aging.
- Traffic volumes – the effectiveness and life span of dust control agents decreases as traffic increases. For high traffic areas, agents need to have strong penetrating and stabilizing capabilities.
- Climate - some hygroscopic agents lose their moisture-absorbing abilities with lower relative humidity, and some may lose resilience. Under rainy conditions, some agents may become slippery or even leach out of the soil.
- Environmental requirements - the primary environmental concern is the presence and concentration of heavy metals in the agent that may leach into the immediate ecosystem, depending on the soil properties.
- Frequencies of application - rates and frequencies of application are based on the type of agent selected, the degree of dust control required, subgrade conditions, surface type, traffic volumes, types of vehicles and their speeds, climate, and maintenance schedule.

Application of Methods

For dust control agents, once all factors have been considered, the untreated soil surface must first contain sufficient moisture to assist the agent in achieving uniform distribution (except when using a highly resinous adhesive agent). The following steps should be followed in general:

- Ideally, application should begin in late spring, after seasonal rains - not during or just before heavy rainfall- so that subgrade and surface materials will not have dried.
- If the surface has minimal natural moisture, the area to be protected must be pre-wetted so that the chemicals can uniformly penetrate the surface.
- In general, cooler and/or more humid periods result in decreased evaporation, increased surface moisture, and thus significant increase in control efficiency. However, chemical and organic agents should not be applied under frozen conditions, rainy conditions, or when the temperature is below 4^{o} C (40^{o} F). Tar and bitumen agents should not be applied in fog or in rain or below 13^{o} C (55^{o}F).
- More than one treatment with salts or organic compounds per year is often necessary, although the second treatment should probably be significantly diluted.

Maintenance

Most dust control measures require frequent, often daily, attention. The primary maintenance requirement is the reapplication of the selected dust control agent at intervals appropriate to the agent type. High traffic areas shall be inspected on a daily basis, and lower traffic areas shall be inspected on a weekly basis.

Limitations

Watering prevents dust only for a short period and should be applied daily (or more often) to be effective. Overwatering may cause erosion. This potential can be limited through use of buffer/filter strips, silt fences, straw bales, vegetation, etc. Oil should not be used for dust control because the oil may migrate into drainage ways and/or

seep into the soil. Chemically treated subgrades may make the soil water repellant, interfering with long-term infiltration, and the vegetation/re-vegetation of the site. Some chemical dust suppressants may be subject to freezing and may contain solvents and should be handled properly. Asphalt, as a mulch tack or chemical mulch, requires a 24 hour curing time to avoid adherence to equipment, worker shoes, etc. Application should be limited because asphalt surfacing may eventually migrate into the drainage system. In compacted areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system.

References

California Air Resources Board, April 1991. *Prospects for Attaining the State Ambient Air Quality Standards for Suspended Particulate Matter (PM10), Visibility Reducing Particles, Sulfates, Lead, and Hydrogen Sulfide*.

California Air Resources Board, 1992. *California Air Pollution Control Laws*.

CalTrans, Standard Specifications, Sections 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative" (no date).

CDM et.al. for the California SWQTF, 1993. *California Storm Water Best Management Practice Handbooks, Construction and Industrial Handbooks*,

City of Franklin Stormwater Best Management Practices Manual, City of Franklin, Stormwater Management Program, January 2014.

Flood Control District of Maricopa County, Arizona, September 1992. *Best Management Practices and Erosion Control Manual for Construction Sites*.

Sacramento County, *Winterization Ordinance & Dust Control Ordinance* (example) (no date).

USDA Soil Conservation Service, *"Guides for Erosion and Sediment Control" (no date)*.

Maintenance of Collection Facilities and Appurtenances

CP-17

Hamilton County Water Quality Program

Description

Maintain catch basins and stormwater inlets on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, and restore the catch basins' sediment trapping capacity. A catch basin is distinguished from a stormwater inlet by having at its base a sediment sump designed to catch and retain sediments below the overflow point.

Proper maintenance and siltation removal is required on both a routine and corrective basis to promote effective stormwater pollutant removal efficiencies for wet/dry detention pond and infiltration devices. This management practice is likely to create a significant reduction in sediment, heavy metals, floatable materials, oxygen demanding substances, oil and grease, and bacteria and viruses.

Approach

Regular maintenance of catch basins and inlets is necessary to ensure their proper functioning. Clogged catch basins are not only useless but may act as a source of sediments and pollutants.

In the same way, if sediment traps and basins, dry detention and wet detention ponds are not routinely cleaned and dredged then they can act as pollutant sources under certain storm conditions. Proper maintenance of detention pond and infiltration device systems is a source control procedure necessary to ensure effective stormwater pollutant removal efficiency. Routine and corrective maintenance needs should be monitored after storms for proper function of wet ponds, detention basins, and infiltration device structures. Proper maintenance of these structures requires periodic silt/sediment and trash debris removal, as well as timely vegetation control. They should be cleaned out when it is recognized that they have filled from 1/5 to 1/3 of their pollutant (sediment) storage capacity.

More frequent sediment removal is recommended, especially in areas where roadway drainage provides a significant runoff component. High accumulation rates of heavy metal contaminants (lead, zinc, and copper) have been identified in these BMP structures adjacent to high traffic areas. In order to avoid situations of hazardous waste disposal, sediment dredging and excavation should be given frequent priority.

Clean catch basins in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

Catch basins should be inspected weekly and cleaned if necessary to reduce the possibility of sediment and other pollutants from leaving the construction site. This should be checked after all areas have been stabilized and at the end of the project.

To prevent sediment and pollutant build-up in on-site catch basins, be sure to follow the guidelines set out in TDEC's E&SC Handbook for Inlet Protection.

Maintain a clean work site, free of litter that can build-up and clog catch basins and downstream conveyance systems.

Do not allow dumping into catch basins and stormwater inlets.

Clean accumulated sediment and silt out of pre-treatment inlets when they have reached 1/3 of their capture volume.

Removal of accumulated paper, trash, and debris should occur weekly or as needed to prevent clogging of control devices throughout the construction project.

Vegetation growth in stormwater quality devices should not be allowed to exceed 24 inches (0.61 m) in height.

Mow the slopes periodically and check for clogging, erosion and tree growth on the embankment.

Corrective maintenance may require more frequent attention (as required).

Maintenance of accurate logs to evaluate materials removed and improvements made.

Requirements

- Cost Considerations
  - Frequent sediment removal can be labor intensive and costly. However, properly designed ponds allow for easy removal of accumulated sediments at relatively minor cost.
  - Cost of waste material for transport and disposal.

- Maintenance crews may require access vehicles, dump trucks, bulldozers, and dredging/excavation equipment. Manual use equipment (such as rakes, shovels, sickles, and machetes) may suffice for maintenance of dry detention ponds and infiltration device systems. Staffing will require a minimum of two (2) person crews for health and safety reasons and effective structural BMP maintenance.
- Training
  - Crews must be trained in proper maintenance, including record keeping and disposal.
  - Appropriate excavation and maintenance procedures.
  - Proper waste disposal procedures.

- Channel maintenance and use of heavy equipment.
- Identification and handling of hazardous materials/wastes.

❖ Application of this technique in "blue line" streams requires permits from the U.S. Army Corps of Engineers, Tennessee Department of Environment and Conservation, and the Tennessee Valley Authority.

Limitations

Wet detention pond dredging can produce slurried waste that often exceeds the requirements of many landfills. See CP-02: Dewatering Operations. Frequent sediment removal is labor and cost intensive. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation by TDEC.

References

Alameda County Urban Runoff Clean Water Program, 1992. *Best Management Practices for Storm Drainage Facilities* (Draft), Maintenance Subcommittee.

American Public Works Association, 1978. *Street Cleaning Practice*.

CDM et.al. for the California SWQTF, 1993.*California Storm Water Best Management Practice Handbooks, Construction and Industrial Handbooks.*

CDM et.al. for the California Department of Transportation, 1997.*Caltrans Storm Water Quality Handbooks*.

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Ferguson, B.K. 1991. *Urban Stream Reclamation* p. 324-328, Journal of Soil and Water Conservation.

Florida Department of Environmental Regulation, 1988. *Florida Development Manual: A Guide to Sound Land and Water Management, Storm water and Erosion and Sediment Control BMPs for Developing Areas*.

Minnesota Pollution Control Agency, 1989. *Protecting Water Quality in Urban Areas: Best Management Practices for Minnesota*.

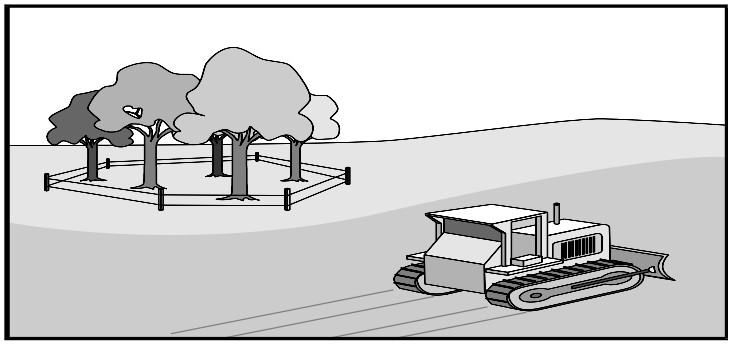
Washington State Department of Ecology, 1992. *Stormwater Management Manual for the Puget Sound Basin (The Technical Manual): Volume IV – Urban Land Use BMPs*.

	Table CP-17-1 DUST CONTROL BMPs for Given Site Conditions								
SITE CONDITION	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt Surfacing	Silt or Sand Fences	Temporary Gravel Construction Entrances/ Equipment Wash Down	Haul Truck Covers	Minimize Extent of Area Disturbed
Disturbed Areas not Subject to Traffic	X	X	X	X	X				X
Disturbed Areas Subject to Traffic			X	X	X				X
Material Stock Pile Stabilization			X	X		X			X
Demolition			X				X	X	
Clearing/ Excavation			X	X					X
Truck Traffic on Unpaved Roads			X	X	X			X	
Mud/Dirt Carry-Out					X		X		

Table CP-17-2 Commonly Used Chemicals For Dust Control			
	SALTS	**ORGANIC, NON PETROLEUM-BASED**	**PETROLEUM BASED PRODUCTS** [1]
CHEMICAL TYPES	# Magnesium Chloride # Natural Brines	# Calcium Lignosulfonate # Sodium Lignosulfonate # Ammonium Lignosulfonate	# Bunker Oil # Asphalt Primer # Emulsified Asphalt
LIMITATIONS	Can lose effectiveness in dry periods with low humidity. Leaches from road in heavy rain. Not recommended for gravel road surfaces with low fines. Recommended 10-20% fines.	Not affected by dry weather and low humidity. Leached from road in heavy rain if not sufficiently cured. Best performance on gravel roads with high surface fines (10-30%) and dense compact surface with loose gravel.	Generally effective regardless of climatic conditions may pothole in wet weather. Best performance on gravel roads with 5-10% fines.
COMMENTS	Calcium Chloride is popular. May become slippery when wet on gravel surfaces with high fines.	Ineffective on gravel surfaces low in fines. May become slippery when wet on gravel surfaces with high fines content.	Creates a hardened crust.

Preservation and Maintenance of Existing Vegetation

CP-18



Hamilton County Water Quality Program

Description

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs and/or grasses that serve as erosion controls or otherwise stabilize soil or slopes. This management practice is likely to create a significant reduction in sediment, nutrients, floatable materials, and oxygen demanding substances.

Suitable Applications

This technique is applicable to all types of construction sites. Areas where preserving vegetation can be particularly beneficial are floodplain, buffers, wetlands, stream banks, steep slopes, and other areas where erosion control would be difficult to establish, install, and maintain, or areas where there are critical resources downstream.

Preservation of existing vegetation should be practiced in the following locations:

- Areas within site where construction activity is not permitted (such as buffers) or does not occur or occurs at a later date.
- Sensitive areas where natural vegetation exists and should be preserved, such as: steep slopes, watercourses, and building sites in wooded areas.
- Areas where local, state and federal government requires preservation, such as: vernal pools, wetlands, marshes, certain oak trees, etc.

Installation/ Application Criteria

Preservation of vegetation on a site should be planned before any site disturbance begins. Preservation requires good site management to minimize the impact of construction activities on existing vegetation, which may adversely affect their respiration, food processing, and growth.

During a pre-construction conference, vegetation preservation and protection measures for that project should be reviewed with the contractor and any subcontractors.

Planning

The following planning steps should be taken to preserve existing vegetation:

A plan for vegetation preservation should be completed before clearing and construction begins.

Critical areas, such as floodplains, buffers, steep slopes, and wetlands should be left in their natural condition unless disturbance is unavoidable and permitted by buffer and floodplain/floodway requirements.

Decisions on which vegetation to save should be based on the following considerations:

- Life expectancy and present age
- Health and disease susceptibility
- Structure
- Cleanliness
- Aesthetic values
- Comfort relative to site temperature variations and wind
- Wildlife benefits
- Adaptability to the proposed project
- Survival needs of the vegetation
- Relationship to other vegetation

Areas for buffers where construction is not permitted should be delineated in the field with flags or colored temporary construction fencing.

All vegetation to be retained should be delineated and identified (species and size) on the site plan and identified in the field by an easily seen colored flag.

Plans should include the maintenance of existing grade around vegetation to be preserved. Most vegetation damage due to construction activities is to the root zone, which can result in the vegetation dying within a few years. Raising the grade can suffocate roots, and lowering the grade may expose roots.

Plans for tree preservation should: avoid compaction of the soil within the drip line of a tree which can block off air and water from the roots and avoid changes in soil chemistry that can result from refuse of chemicals deposited on the soil surface.

Temporary roadways should be located to minimize damage to shrub and tree stands, following contours to reduce cutting and filling.

Locate multiple utilities in the same trench to minimize trenching. Excavations should be outside the drip line of trees.

Construction material storage and crew parking should be noted on the site plan and located where they will not cause root compaction. They can eventually kill a tree.

For retention of existing trees in paved areas, at least 5 ft. (1.5 m) of ungraded ground beyond the drip line should be left to help ensure tree survival.

Soil stabilization measures should be located at the limits of clearing to prevent sediment deposition within the area where vegetation is being preserved.

Wind damage can result from exposure of vegetation to increased wind velocities, therefore this must be considered when removing adjacent vegetation.

Equipment must be kept away from trees to be preserved to avoid trunk damage caused by equipment nicking or scarring the trunk.

Timing

The following timing considerations should be taken to preserve existing vegetation:

- Preservation of existing vegetation should be planned before any site disturbance begins. Preservation of existing vegetation should be planned during the design stages by the design engineer and the contractor should meet onsite with the design engineer.

- No vegetation should be destroyed or altered until the design of roads, buildings, and utility systems is finalized.

Tree and Vegetation Marking and Protection

Clearing limits should be outside of the drip line of any retained tree, and at a minimum of 5 ft. (1.5 m) from the trunk regardless of the size of the tree. A protective device, such as a colored temporary construction fence, to guard against damage to roots, trunk, and tops of trees, should be placed at these limits.

Individual trees, stands of trees, and areas of vegetation to be retained should be marked before construction at a height visible to equipment operators. Orange-colored plastic construction fencing or other suitable material should be used. Within 40 ft. (12 m) of a proposed building or excavation, however, retained trees should be protected by fencing. The following are alternatives for tree and vegetation protection:

- Board fencing on 4-in. (100-mm) square posts set securely and 6 ft. (1.8 m) apart, and protruding at least 4 ft. (1.2 m) above the ground, placed at clearing limits.

- A cord fence with 2 rows of cord at least 3 in. (6 mm) in thickness running between posts. Each post should be at least 2 in. (50 mm) thick set securely and 6 ft. (1.8 m) apart, protruding at least 4 ft. (1.2 m) above the ground placed at clearing limits. Strips of colored surveyor's flagging should be tied securely to the cord at intervals of no more than 3 ft. (90 cm).

- Plastic fencing of 40 in. (1.0 m) high orange polyethylene webbing, secured to metal "T" or "U" posts driven to a depth of at least 18 in. (450 mm), on 6 ft. (1.8 m) minimum centers, placed at the clearing limits. The posts should be chemically inert to most chemicals and acids.

- An earth berm constructed according to specifications, but only if its presence does not conflict with drainage patterns. The base of the berm on the tree or vegetation side should be located at the clearing limits.

- Leaving a buffer zone of existing trees between the trunks of retained trees and the clearing limits. Trees in this buffer zone should be a maximum of 6 ft. (1.8 m) apart so that equipment and material cannot pass. These trees should be re-examined before construction is completed to check for and ensure survival or be removed.

- As a last resort, a tree trunk may be armored with burlap wrapping and 2-in. (50-mm) studs wired vertically, no more than 2 in. (50 mm) apart encircling the trunk to a height of 5 ft. (1.5 m). No nailing should ever be done to a retained tree. The root zone, however, will still require protection.

Employees and subcontractors should be instructed to honor protective devices. No heavy equipment, vehicular traffic, or storage piles of any construction materials should be permitted within the drip line of any tree to be retained. Removed trees should not be felled, pushed, or pulled into any retained trees. Fires should not be permitted within 100 ft. (30 m) of the drip line of any retained trees. Any fires should be of limited size, and should be kept under continual surveillance. No toxic or construction materials including paint, acid, nails, gypsum board, chemicals, fuels, and lubricants should be stored within 50 ft. (15 m) of the drip line of any retained trees, nor disposed of in any way which would injure vegetation. This also precludes vehicle fueling or maintenance in these areas.

Grade Protection

If the ground level must be raised around an existing tree or tree group, a tree well can be constructed. A professional arborist should be consulted if a tree well appears to be warranted or desired. A well may be created around the tree slightly beyond the drip line to retain the natural soil in the area of the feeder roots.

If the grade is being lowered, trees can be protected by constructing a surrounding tree wall of large stones, brick, or block, filled with topsoil. Fertilizer and water should be applied thoroughly and drainage provided so that water does not accumulate.

- Remove vegetation and organic matter from beneath the retained tree(s) to at least 3 ft. (1 m) beyond the drip line, loosening the soil to at least 3 in. (75 mm) in depth without damaging roots.

- Apply fertilizer to the loosened soil at rates not to exceed those recommended by the fertilizer manufacturer.

- Construct a dry well to allow for trunk growth. Provide 12 in. (300 mm) between the trunk and the wall for older, slow-growing trees, and at least 24 in. (600 mm) for younger trees.

- The well should be just above the level of the proposed fill, and the wall should taper away from the trunk by 1 in./ft. (80 mm/m) of wall height.

- The well wall should be constructed of large stone, brick, building tile, concrete blocks, or cinder blocks, with openings left in the wall for the flow of air and water. Mortar should be used only near the top of the well and above the porous fill.

- Drain lines beginning at the lowest point inside the well should be built extending outward from the trunk in a radial pattern with the trunk as the hub. They should be made of 4-in. (100-mm) drain tiles, sloping away from the well at a rate of 0.125 in./ft. (10 mm/m). A circumferential line of tiles should be located beneath the drip line; vertical tiles or pipes should be placed over the intersections of the two tile systems for fills greater than 24 in. (600 mm) in depth, held in place with stone fill. All tile joints should be tight. Drainage may be improved by extending a few radial tiles beyond each intersection and slope sharply downward. Coarse gravel may be substituted for tile in areas where water drainage is not a problem. Stones, crushed rock, and gravel may be added instead of vertical tiles or pipes, so the upper level of these porous materials slopes toward the surface near the drip line.

- Tar paper or an approved equivalent should be placed over the tile or pipe joint to prevent clogging, and a large stone placed around and over drain tiles or pipes for protection.

- Layer 2 in. (50 mm) to 6 in. (150 mm) of stone over the entire area under the tree from the well outward at least to the drip line. For fills up to 24 in. (600 mm) deep, a layer 8 in. (200 mm) to 12 in. (300 mm) should be adequate. Deeper fills require thicker layers of stone to be built to a maximum of 30 in. (760 mm).

- A layer of 0.75-in. (19-mm) to 1-in. (25-mm) stone covered by straw, fiberglass mat, or filter fabric should be used to prevent soil clogging between stones. Do not use cinders as fill material.

- Complete filling with porous soil (to sustain vegetation) until the desired grade is reached.

- Crushed stone should be placed inside the dry well over the openings of the radial tiles to prevent clogging of the drain lines. Vertical tiles should also be filled with crushed rock and covered with a screen.

- The area between the trunk and the well wall should be covered by an iron grate or filled with a 1:1 mixture of crushed charcoal and sand to prevent anyone from falling into the well or to prevent leaves, debris, rodents, or mosquitoes from accumulating.

One-half of these systems may be constructed if the grade is being raised on only one side

of the tree(s).

Trenching and Tunneling

Trenching should be as far away from tree trunks as possible, usually outside of the tree crown. Curve trenches around trees to avoid large roots or root concentrations. If roots are encountered, consider tunneling under them. When trenching and/or tunneling proximate to trees to be retained, tunnels should be at least 18 in. (450 mm) below the ground surface, and not below the tree center to minimize impact on the roots.

Tree roots should not be left exposed to air; they should be covered with soil as soon as possible, protected, and kept moistened with wet burlap or peat moss until the tunnel and/or trench can be completed.

The ends of damaged or cut roots should be cut off smoothly and protected by painting them with a tree-wound dressing.

Trenches and tunnels should be filled as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots. Be careful not to over-compact as this can smother and kill the tree.

To induce and develop root growth, peat moss should be added to the fill material.

The tree should be mulched to conserve moisture and fertilized to stimulate new root growth.

Remove any trees intended for preservation if those trees are damaged seriously enough to affect their survival. If replacement is desired or required, the new tree should be of similar species and of at least 2-in. (50-mm) caliper balled and bur lapped nursery stock, unless otherwise required by the contract documents.

Because protected trees may be destroyed by carelessness during the final cleanup and landscaping, fences and barriers should be removed last, after all other work is complete.

Vegetation Control

Mechanical control of vegetation includes mowing, “bush-hogging”, and hand cutting. Large scale mowing is typically done by tractor-type mowers similar to farm machinery. “Bush-hogging” usually refers to tractor mounted mowing equipment with hydraulically mounted cutting machinery. On smaller areas, lawn tractors or push mowers may be used. In areas that are inaccessible by machinery, such as steep grades and rocky terrain, hand cutting using gas powered weed trimmers and scythes may be used.

Clippings and cuttings are the primary waste produced by mowing and trimming. Clippings and cuttings are almost exclusively leaf and woody materials. Minimize transportation of clippings and cuttings into the stormwater conveyance system. Compost piles are encouraged to create mulch and topsoil for landscaping.

Clippings/cuttings carried into the stormwater system and receiving streams can degrade water quality in several ways. Suspended solids will increase causing turbidity problems. Since most of the constituents are organic, the biological oxygen demand will increase causing a lowering of the available oxygen to animal life. In areas where litter and other solid waste pollution exist, toxic materials may be released into receiving streams with a resulting degradation of water quality.

Mowing should be performed at optimal times (e.g., when it is dry). Mowing should not be performed if significant rain events are predicted.

Mulching mowers may be recommended for certain areas. Mulching mowers should be encouraged for homeowners in flat areas. Mulching mowers have the added benefit of reducing the fertilizer demand through reuse of organic material. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs. Alternatively, the grass clippings can be bagged and used in composting.

Maintenance

During construction, the limits of disturbance should remain clearly marked at all times. Irrigation or maintenance of existing vegetation should conform to the requirements in the landscaping plan.

If damage to protected trees still occurs, maintenance guidelines described below should be followed:

- Soil, which has been compacted over a tree's root zone, should be aerated by punching holes 12 in. (300 mm) deep with an iron bar, and moving the bar back and forth until the soil is loosened. Holes should be placed 18 in. (450 mm) apart throughout the area of compacted soil under the tree crown.

- Any damage to the crown, trunk, or root system of a retained tree should be repaired immediately.

    - Damaged roots should be immediately cut cleanly inside the exposed area and surfaces painted with approved tree paint, and moist soil or soil amendments should be spread over this area.
    - If bark damage occurs, all loosened bark should be cut back into the undamaged area, with the cut tapered at the top and bottom, and drainage provided at the base of the wound. Cutting of the undamaged area should be as limited as is possible.
    - Serious tree injuries should be attended to by an arborist, forester or tree specialist.
    - Stressed or damaged broadleaf trees should be fertilized to aid recovery.
    - Trees should be fertilized in the late fall or early spring.
    - Fertilizer should be applied to the soil over the roots and in accordance with label instructions, but never closer than 3 ft. (1 m) to the trunk. The fertilized area should be increased by one-fourth of the crown area for conifers that have extended root systems.

Limitations

Protecting existing vegetation requires detailed planning, and may constrict the area available for construction activities.

It is appropriate to evaluate the existing vegetation for species type for use in landscaping plans. Natural vegetation and invasive or "alien" species should be delineated. The use of natural vegetation is preferred.

Additional Information

The best way to prevent excessive erosion is to minimize the disturbance of the land. On a construction site, where extensive land disturbance is necessary, a reasonable BMP would be to not disturb land in sensitive areas of the site which need not be altered for the project to be viable (e.g., natural watercourses, steep slopes), and to design the site to incorporate particularly unique or desirable existing vegetation into the site landscaping plan. Clearly marking and leaving a buffer area around these unique areas will both help to preserve these areas as well as take advantage of natural erosion prevention and sediment trapping in naturally vegetated areas. Saving existing vegetation and mature trees on-site, beautifies the area and may save money by reducing new landscaping requirements. Mature trees also increase property values and satisfy consumer aesthetic needs.

Existing vegetation to be preserved on the site must be protected from mechanical and other injury while the land is being developed. The purpose of protecting existing vegetation is to ensure the survival of desirable vegetation for shade, beautification, and slope and erosion protection. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion and contributing to slope stabilization. Also, vegetation helps to keep soil from drying rapidly and becoming susceptible to erosion. To effectively save existing vegetation, no disturbances of any kind should be allowed within a defined area around the vegetation. For trees, no construction activity should occur within the drip line of the tree.

Preserving and protecting existing vegetation can often result in more stable soil conditions during construction. Careful site planning and identification of plantings to preserve can provide erosion and sedimentation controls during construction, and contribute to the aesthetics of the development.

For new developments in particular, the easiest and least expensive measure is to leave the existing vegetation in place. Native vegetation typically requires much less maintenance than introduced vegetation. Consider mowing or trimming vegetation, both native and introduced, less frequently, thereby generating less waste. If introduced vegetation is necessary, consider planting low maintenance grasses and shrubs. Another advantage to these strategies is considerable water savings.

Once this vegetative waste is generated the main concern is to avoid transport of clippings/cuttings to receiving water bodies. It is necessary to pick up and properly dispose of clippings/cuttings on the slopes and bottom of drainage facilities, including stormwater detention/retention facilities. In addition, the presence of clippings/ cuttings in and around catch basins should be avoided by either using bagging equipment or manually picking the material up. Clippings/cuttings on flat surfaces are generally not transported by stormwater runoff unless the event is particularly intense. Therefore, it is not necessary to pick up or bag clippings/cuttings on flat or nearly flat surfaces. Operators should be trained to use good judgment in determining whether clippings/cuttings should be left in place or collected for disposal or composting.

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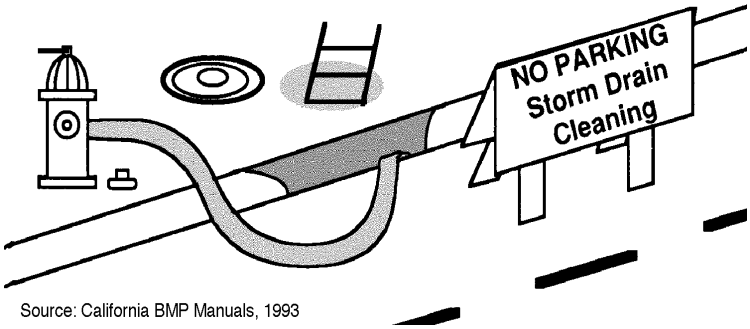
System Flushing

CP-19



Source: California BMP Manuals, 1993

Hamilton County Water Quality Program

Description

A storm drain is "flushed" with water to suspend and remove deposited materials. Flushing is particularly beneficial for storm drain pipes with grades too flat to be self-cleansing. Flushing helps ensure pipes convey design flow and removes pollutants from the storm drain system. This management practice is likely to create a significant reduction in sediment if flushed effluent is properly collected or treated.

Approach

Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.

Whenever possible, flushed effluent should be collected and pumped to a sediment trap, or basin, or a detention pond.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, releasing the backed up water and resulting in the cleaning of the storm drain segment.

If the flushed water does not drain to a stormwater treatment device (e.g., detention pond or swale), then a second inflatable device, placed well downstream, may be used to re-collect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to a stormwater treatment practice. In some cases, an interceptor structure may be more practical or required to re-collect the flushed waters.

Requirements

TDEC regulations exist prohibiting the discharge of soil, debris, refuse, hazardous waste, and other pollutants that may hinder the designed conveyance capacity or damage stormwater quality or habitat in the storm drain system. This includes flushing a system to "Waters of the State". TDEC should be consulted if this practice is planned.

Additional Information

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed

should not exceed 700 feet (213.3 m). At this maximum recommended length, the percent removal efficiency from the pipe at the time of flushing ranges between 65-75 percent for organics and 55-65 percent for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm sewer flushing.

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