Cultivation and Operations Plan

Applicant: Emerald Dragonfly Farms, LLC

Owner: Janet Mattson

Agent: Lydia Baird-Adams
Agent Phone : (707)-725-5182

APN: 206-191-019
Planning Application Number: PLN-2019-15889
Application Number: 45646
Permit Number: ZCC 16-004

Date: December 5, 2019

Introduction

Commercial Cannabis Cultivation Ordinance Number 2599 Section 314-55.4.11 of Humboldt County Code requires a Cultivation and Operations Plan. The purpose of this document is to address and describe elements of the operation such as irrigation, water sources, water budget, onsite wastewater treatment, and employee safety.

This document will also address the cannabis operations performance standards for Section 55.4.12 such as Biological Resources Protection, Waste and Hazardous Materials Management, Light Pollution Control, Energy Use, Noise Pollution Control, Soils Management, and Invasive Species Control. Any supplementary documents required will be provided separately by qualified candidates. Please see other documentation for all other elements not referenced in this document.

Cultivation Project Description

The parcel where the commercial cannabis cultivation operation (site) will take place is owned by Janet Mattson and the company is operated by Emerald Dragonfly Farms, LLC. The site is located approximately 30 miles south-southeast of the city of Eureka, CA at 400 Corbett Ranch Lane, Carlotta, CA. The parcel designation is APN:206-191-019, is 84.0 acres, and is zoned as agricultural exclusive. The site is accessed by a small gravel road off California Highway 36. The site is located approximately 300 feet north of the Van Duzen River and 1000 feet south-southwest of Cummings Creek. None of the cultivation activities are near any sensitive receptors and no buildings with a nexus to the cannabis operation are proposed currently.

Cultivation and Operations

Emerald Dragonfly Farms, LLC is requesting an additional 5,000 sqft to the already existing 10,000 sqft of cultivation. The cannabis will be grown in full-sun with the exception of the immature plant propagation area. The property owner, and up to eight seasonal employees will conduct all aspects of the cultivation operation

The cultivation period will last approximately five months out of the year. The process starts with the propagation of "clones" in May. The young plants are started in small pots then the plants are then moved to larger pots outdoors where they will remain until harvest season. The plants mature in September and will be hand-harvested, bucked down and dried beginning in October/November.

Water allocated for the operation will be contained in 27 5,000 gallon water tanks located directly adjacent to the outdoor cultivation area. All plants will be hand watered as necessary depending on demand/weather. If, for some reason, the plants cannot be hand watered, irrigation line with metered and timed electronic control units will be used. Vertical posts, wire, natural fiber, or other cordage will be used to support the weight of flowering plants.

Organic and natural soil amendments (worm castings, chicken mature, kelp...etc) will be used. Spent soil, organic cultivation, and other soil amenders will be recycled onsite using a compost pile. Other soil amendments that cannot be recycled or have not been used will be stored in watertight containers to prevent spill/leakage until they are moved offsite.

Most of the power will be supplied by Pacific Gas and Electric (PG&E). When power has been interrupted or is for some reason inaccessible a generator will be used for supplemental power. Lighting will only be used in the plant propagation area to maintain the mother plants and produce clones. The lighting will typically utilize 250 Watt compact florescent bulbs. Light will be controlled either by electronic controllers or tarps to ensure that no light pollution is created from the cannabis operation post sunset and prior to sunrise.

Processing Plan

Plants ready for harvest will be processed by hand. The plants will be cut down and transferred to the drying barn. The estimated eight employees will complete the operation. Harvesting duties will consist of "bucking" the plants into individual branches, removal of large leaves, and hanging the branches. The drying facility is an enclosed structure equipped with electronic/physical tools to aid the drying process. Power for drying will be supplied by PG&E unless rendered inaccessible or frequent interruption occurs, in which case a generator will be used.

Security Plan

The cultivation operation and facility are monitored using cameras. If required a fence will be installed with a locked gate as a barrier for entry. All facilities containing cannabis will be lockable with access only given to high-level employees. Any entry that can be locked will be done so after business hours.

Parking Plan

Employees will be responsible for their own transportation to and from the cultivation site. Eight gravel parking spaces will be provided including an extra ADA parking space. If required further parking will be provided close to the drying facility.

Irrigation Plan

All irrigation of cannabis is completed by hand to ensure judicious usage and reduce over-watering. Water usage varies throughout the year, the highest or peak usage typically occurs in the summer. The site will use 27 5,000-gallon tanks as storage. The water is taken from a well, the well completion report is supplied with the other materials for this project. No surface diversion, water deliver, or other water allocation methods will be utilized. Below is a table of the project usage of the operation.

Table 1: Project Water Usage

Water Usage Schedule						
Month	Janurary	Feburary	March	April	May	June
Gallons	0	0	0	0	8400	10800
Month	July	August	September	October	November	December
Gallons	33600	33600	33600	10800	0	0
Total Usage (Gallons)	130800					

Watershed Protection

The cultivation site is located approximately 300 feet north of the Van Duzen River. All cultivation activity will take place outside of the required 100-foot streamside management area. The cannabis cultivation activities will take place outdoors in full sun on a relatively flat area (0-2% slope). No new runoff is anticipated as a result of the project. Natural drainage and vegetation will be maintained on all non-cultivation and all undeveloped areas. Further information on drainage control and Stormwater Management are detailed in the Stormwater Management Plan submitted separate from this document.

Water Source and Water Right Documentation

The primary sources of water for Emerald Dragonfly Farms, LLC is a well. Supplementary water storage is provided by 27 5,000-gallon water tanks. A well competition log has been submitted for this project separately from this document.

Onsite Waste Treatment and Sewage Disposal Plan

The operation currently has an onsite wastewater treatment system in the form of a septic system. Wastewater created by employees will be treated by a septic system. The wastewater will be from hand washing and one toilet on site.

Employee Safety

All employees will be supplied gloves and facemasks for their use at their discretion. Employees who are handling or processing cannabis will be required to wash hands at the start of their shift, before they eat, after they eat, or after using the bathroom. Gloves can also be used in conjunction with the activities mentioned above.

Contact information for emergency services, poison control center, and the owner will be posted in an area clearly visible to the employees. Employee safety training will be done annually and will include

1. Emergency action response plan (evacuation routes, location of emergency phone numbers.)
2. Employee accident reporting and response protocol
3. Fire prevention (identification of fire hazards, location of fire extinguishers..etc)
4. Materials handling, Hazardous Material Identification, and Spill Prevention and Response
5. Location and use of personal protective equipment.

Archaeological, Tribal, Cultural and Historical Resources Protection

The project site is not known to contain any archaeological or tribal cultural resources. If required, stipulated, or in addition to the county's referral to the National Information Center, the applicant will hire an archaeologist to conduct an archaeological records search before any new land disturbance activity is initiated. If any archaeological or cultural resources is found during any earthmoving activities the applicant will agree to cease all work within a 100-foot area, radially, around the discovery. The project operator will then contact the County Planning and Building Department to identify the appropriate qualified specialist to evaluate the discovery and develop a treatment plan to address impacts that cannot be avoided. No structures over 45 years of age will be removed as part of the project, and therefore there is no threat to historical resources.

Light Pollution Control Plan

The immature plant propagation area is the only artificially lit or light assisted growing facility. No light will escape the immature plant propagation area between sunset and sunrise because an automated blackout tarp system or scheduled tarp covering will be used. All security lighting will be designed to ensure no light escapes the property or shines outside of the area that requires illumination. Motion sensors will be installed as needed so all outdoor lighting is used minimally.

Energy Plan

The current energy budget is difficult to calculate and is not currently known. In general, energy for the operation will be used to power automated bulbs, pumps, dehumidifiers, and fans. All loads will be powered by PG&E, except if power interruption occurs, a generator will be used judiciously. The generator fuel will be stored in a spill safe container off-site and will be refueled as needed from the back of a truck.

Noise Source Assessments and Mitigation Plan

There are no expected noise impacts associated with the operation. There are no sensitive receptors near the cultivation site and noise levels are not expected to be above 3 dB at any property line. Aside from that, the operation is surrounded by heavily trafficked Highway 36 and a farm to the north. If required, as stipulated by the county, a noise study will be completed after the operation is permitted to assess the actual noise level created by the operation. Once the cultivation operation begins, follow-up measurements will be taken once more to verify noise level limits are not exceeded. A shed will be used to house the generator to decrease noise attenuation if stipulated by the county.

Irrigation, Metering, and Record Keeping

The water storage tank levels will be monitored weekly to determine the water usage of the operation. Records will be collected and maintained at the site per section 55.4.12.7.7. The use records will be included in the annual report to the county and submitted at least 30 days before the annual permit inspection.

The water is supplied by a well on parcel #206-451-007. Water will not be taken out of the well for cannabis use during the low flow season of May 15-Oct. 15. During this time the well is monitored with an installed meter. A limit of 1,000gal/day is allowed for residential and livestock use. A well log will be submitted to SWRCB by December 31 each year.

Water Storage Plan

The primary water source for the operation is a permitted well. Water tanks are the primary storage method for the operation and are located near the cultivation operation which will provide 135,000 gallons of water storage. The tanks will be inspected and replaced as needed.

Soils Management Plan

The project will try to use as much compost created onsite as possible. However, other methods of amended soil may be bought onsite to support the cultivation operation. All soil onsite will be used as many times as possible. Typical amendments that would be used are chicken manure, bat guano, and worm casting. All soil piles will be covered with secured tarps and surrounded by straw waddles.

Hazardous Waste Storage

Hazardous waste will be stored in a covered container until it can to hauled to a waste facility.

STORMWATER MANAGEMENT PLAN

Applicant: Emerald Dragonfly Farms, LLC

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Date: December 3, 2019

STORMWATER MANAGEMENT PLAN
EMERALD DRAGONFLY FARMS, LLC
APN: 206-191-019

Introduction

The purpose of this document is to satisfy the criteria for a Stormwater Management Plan under Humboldt County Ordinance Number 2599 section 55.4.12.1.12 for Cannabis Cultivation Application Requirements 2.0. The contents of this report and any information gathered and reported herein are taken from multiple sources such as United States Geologic Survey (USGS) Topography Maps, Google Earth Pro, California Stormwater Quality Association (CASQA) Best Management Practices, Humboldt County GIS, as well as information from the applicant.

This document is not to be used for the North Coast Regional Water Quality Control Board, EPA NPDES, California Coastal Commission, or any other stormwater quality regulatory agency. It is on the applicant not the preparer of this document to follow all bmp guidelines and maintain compliance for the lifetime of the project and will update their operational methods, management, or operation to adhere to any regulatory agency.

Current Cultivation/Proposed Expansion

Emerald Dragonfly Farms is currently cultivating 10,000 square feet (sqft) of cannabis with an immature plant propagation area. The applicant is also applying for an addition 5,000 sqft of cultivation area. No further expansion is projected currently, and no permanent structures are proposed for future cultivation activities.

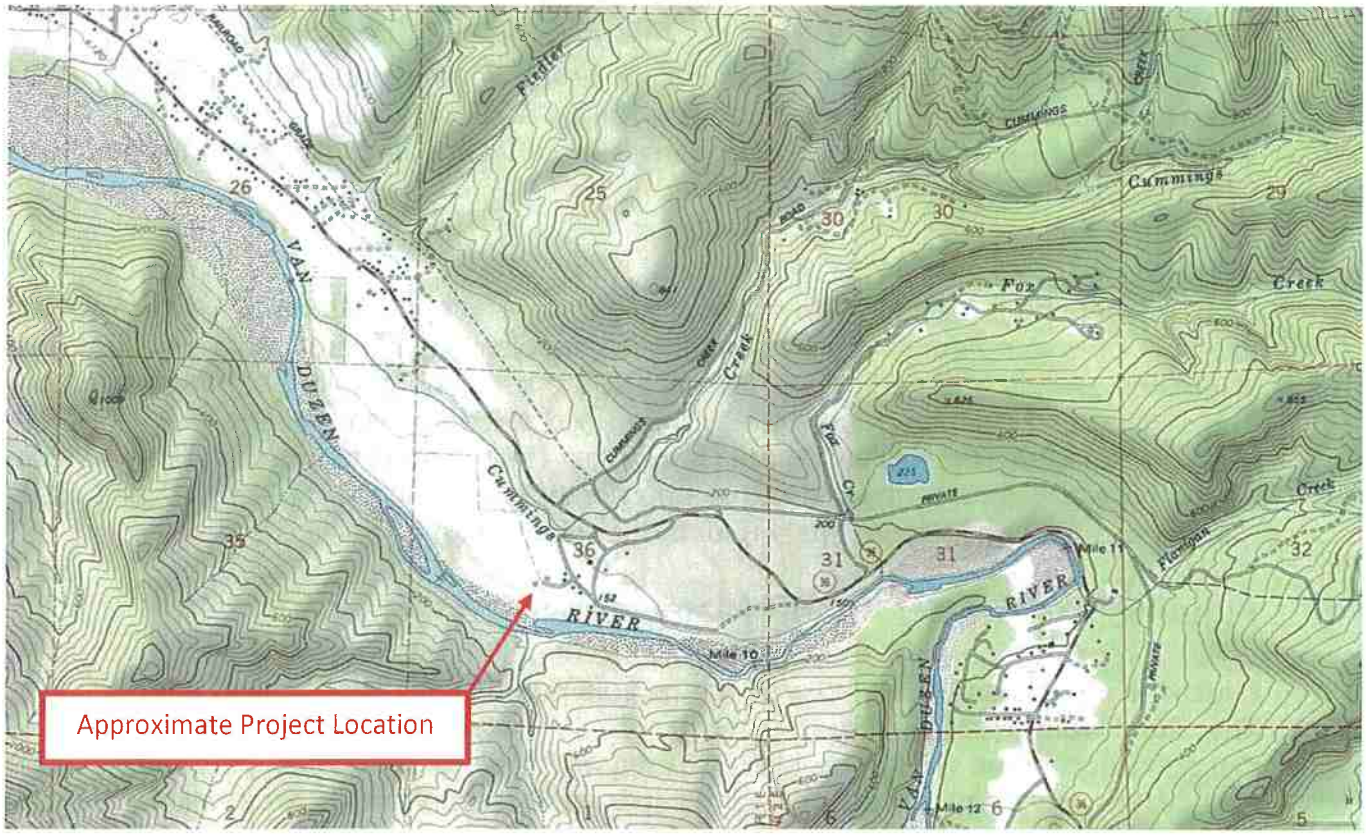
Cultivation Location

Emerald Dragonfly Farms is located at 400 Corbett Ranch Lane in Carlotta, CA approximately 30 miles south-southeast of Eureka. The parcel is accessed via a gravel driveway off Highway 36. The parcel is 86.0 Acres and is designated as APN:206-191-019.

The cultivation area is near a Class I Perennial Stream, the Van Duzen River, located 300 feet south of the area. The Van Duzen river is a jurisdictional water feature and is most likely considered a water of the state. The channel contains riparian habitat and an ordinary high-water mark, bank erosion, and scouring. Another watercourse located approximately 1,000 feet north of the operation is Cummings Creek.

Site Investigation

Aerial information and information from the applicant determined that the cultivation site where the greenhouses are to be located is accessed by a small road. The site is unpaved, flat (slopes 5% or less), and immediately surrounded by grassy fields with trees at least 100 feet away. There are existing buildings on the site that have no nexus with the cannabis cultivation operation and no further proposed permanent structures such as metal buildings, barns, or storage facilities for the cultivation operation are to be constructed at this time. The area has some fencing and contains 18 5,000 gallon water tanks. Another 9 more 5,000 gallon water tanks will be added with the approval of the 5,000 sqft license. (see attached documentation for Google Earth Pro aerial). On the next page is a topographical map of the project site.



Stormwater Management Improvements

The topography of the site, existing vegetation, and pervious areas located directly adjacent to it allows the applicant to retain, attenuate, and infiltrate the stormwater runoff onsite sufficiently as required by Humboldt County if the following improvements and recommendations are followed.

Monitoring, Maintenance, and Streamside Management Protection

Any soil disturbances, building development, driving, manmade drainages, and cannabis cultivation will be conducted outside of the 100 foot Streamside Management Area protecting the Van Duzen River. If possible, any of the above activities will take place further than the minimal SMA distance.

Prior and after any forecasted storms all manmade drainages, roads, impervious disconnect areas, swales and other stormwater control structures will be inspected. If loss of functionality occurs or if a storm greater than three inches within 24 hours occurs management measures and/or observations will be recorded.

Vehicles/Equipment

All vehicle maintenance, cleaning, or repair will be done outside of the SMA whenever possible and will be completed using CAQSA guidelines WE-1, TC-1, TC-2, TC-3, NS-3, NS-8, NS-9, NS-10. Please see the attached documentation for the these CAQSA guidelines.

Swale Features/Dikes

Vegetated swales, earthern berms, and small earthen dikes will be used to control the flow of water near roads, greenhouses, and immature plant propagation areas. Vegetated swales and earthern dikes will also be used to attenuate stormwater runoff. The swales and earthen berms will also be used to control and reduce flow from any gravel areas where the cultivation area is located. The methods for the vegetated swales, earthern berms, and earthern dikes will be constructed using CAQSA EC-2 and EC-9 (please see attached documentation for further clarification).

Building Stormwater Runoff Management

If required the existing buildings will be retrofitted to allow rainwater to be routed directly to a pervious vegetated area for the sole purpose of infiltration and attenuation of any stormwater runoff from the buildings. All vegetated self-retaining/impervious disconnection areas will not be altered in anyway that will reduce it's permeability. The size of the any required self-retaining/impervious disconnection area will be directly proportional or 1:1 to the total area of the impervious area created by the buildings. For example, if there is 1500 sqft of total impervious area created by a roof, the impervious area disconnect will be 1500 sqft. Splash ways or other methods of energy dissipation will be implemented to reduce the impact and velocity of the rainwater from the gutter. Below is further information on the above mentioned recommendation.

Rooftop and Impervious Area Disconnection

Description

Disconnection of rooftop and impervious areas from the storm drain system helps reduce runoff and provide pollutant removal as the re-directed water travels over and through vegetation and soil instead of being directly piped and discharged into the storm drain. Roof runoff is directed to spread over a pervious area such as a stream setback and buffers, areas of soil quality improvement, or other appropriate infiltration areas.

The following are examples of ways to implement rooftop disconnection:

Splash Block
Splash blocks reduce the velocity and impact of water exiting the roof downspout and direct water to a pervious area.

Pop-up Drainage Emitter
Pop-up drainage emitters are useful in conveying storm water from roof downspouts into vegetated areas. Roof runoff is piped then released through a capped device that opens with water pressure, allowing the storm water to flow out of the emitter and into the vegetated area.

Figure 1: Humboldt County Low Impact Stormwater Development Manual

Figure 2: Rain gutter Splash Way/Energy Dissipator

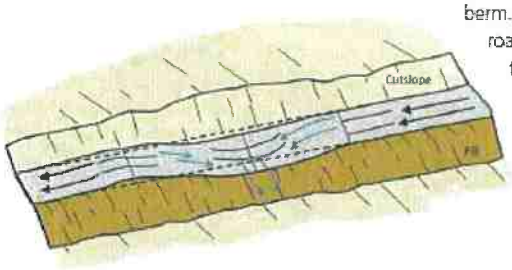
Roads

Access to the cultivation area is provided by small dirt roads. Construction, maintenance, and usage of roads will be completed using the following guidelines as well as the requirements from both CASQA and *Handbook for Forest, Ranch, and Rural Roads*

- New roads will be planned and designed to stay as far away from watercourses as possible and to minimize the number of watercourse crossings.
- Roads will be decommissioned or relocated roads away from riparian zones whenever possible.
- Any existing road improvements will be completed in dry weather, but will be sprayed so moisture is still present in soil to minimize dust and maximize compaction to prevent fine sediments from discharging from the road surface.
- No sidecasting of bladed materials to areas where it can enter a water body directly or be delivered to a water body during a storm event.
- Out-sloping of roads will be completed wherever possible to prevent the concentration of storm water flow within an inboard/inside ditch, to promote even drainage of the road surface, and to minimize disruption of the natural sheet flow pattern off a hill slope to a stream.

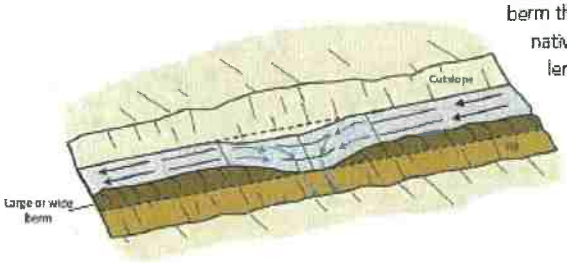
- If the applicant is unable to eliminate inboard/inside ditches, they will line them with geotextile fabric and/or rock ensure adequate ditch relief culverts to prevent down-cutting of the ditch and to reduce water runoff concentration and velocity.
- Neither in-sloped nor out-sloped roads will be allowed to develop or show evidence of surface rutting or gullying. Water bars and rolling dips will be used to break-up slope length, diverting water to well-vegetated or armored areas. The distance between water bars and/or rolling dips will not exceed 150 feet, and that distance will be shortened for roads with steep grades (greater than 15%) or with an easily erodible surface.
- Gravel will be used to "weatherproof" roads used during the winter or wet weather periods.
- All road watercourse crossing structures should allow for the unrestricted passage of water and will be designed to accommodate the 100-year flood flow. Consult CAL FIRE 100 year Watercourse Crossings document for examples and calculations (minimum of 18" diameter for all culverts) http://www.calfire.ca.gov/resource_mgt/downloads/reports/ForestryReport1.pdf
- Culverts used at watercourse crossings will be of sufficient length to extend beyond fill/sidecast material, and will be installed at the same level and gradient of the stream bed in which they are being placed.
- Culverts used at watercourse crossings will be designed to direct flow and debris toward the inlet using wing-walls, beveling of the pipe, rock armoring, etc.
- Low-water or ford style watercourse crossings should be armored along the bed and banks with clean durable rock of a sufficient size as not to move downstream during high flow periods, yet without creating a damming effect on the flow.
- Rock will also be placed on either side to the break in slope to prevent water from diverting around the material.
- Stream crossing structures will be designed, constructed, and maintained to prevent stream diversion plugging or impoundedment.

Type 1 Rolling Dip
(Standard)



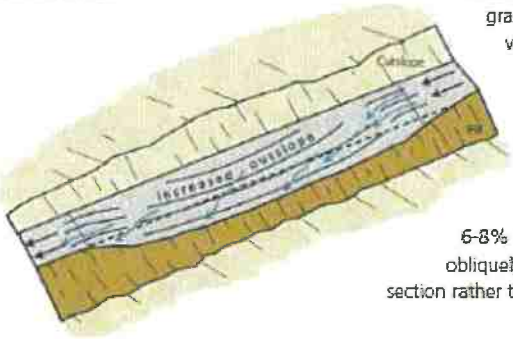
Type 1 rolling dips are used where road grades are less than about 12-14% and road runoff is not confined by a large through cut or berm. The axis of the dip should be perpendicular to the road alignment and sloped at 3-4% across the road tread. Steep roads will have longer and more abrupt dip dimensions to develop reverse grade through the dip axis. The road tread and/or the dip outlet can be rocked to protect against erosion, if needed.

Type 2 Rolling Dip
(Through-cut or thick berm road reaches)



Type 2 rolling dips are constructed on roads up to 12-14% grade where there is a through cut up to 3 feet tall, or a wide or tall berm that otherwise blocks road drainage. The berm or native through cut material should be removed for the length of the dip, or at least through the axis of the dip, to the extent needed to provide for uninterrupted drainage onto the adjacent slope. The berm and slope material can be excavated and endhauled, or the material can be sidecast onto native slopes up to 45%, provided it will not enter a stream.

Type 3 Rolling Dip
(Steep road grade)



Type 3 rolling dips are utilized where road grades are steeper than about 12% and it is not feasible to develop a reverse grade that will also allow passage of the design vehicle (steep road grades require more abrupt grade reversals that some vehicles may not be able to traverse without bottoming out).

Instead of relying on the dip's grade reversal to turn runoff off the roadbed, the road is built with an exaggerated outslope of 6-8% across the dip axis. Road runoff is deflected obliquely across the dip axis and is shed off the outsloped section rather than continuing down the steep road grade.

Figure 3: Rolling Dip Types Handbook for Forest, Ranch, and Rural Roads.

Figure 4: Access Roads Showing Vegetated Shoulders allowing Infiltration and Attenuation of Stormwater Runoff

Figure 5: Vegetated Self-Retaining/ Impervious Disconnect Areas for Greenhouses

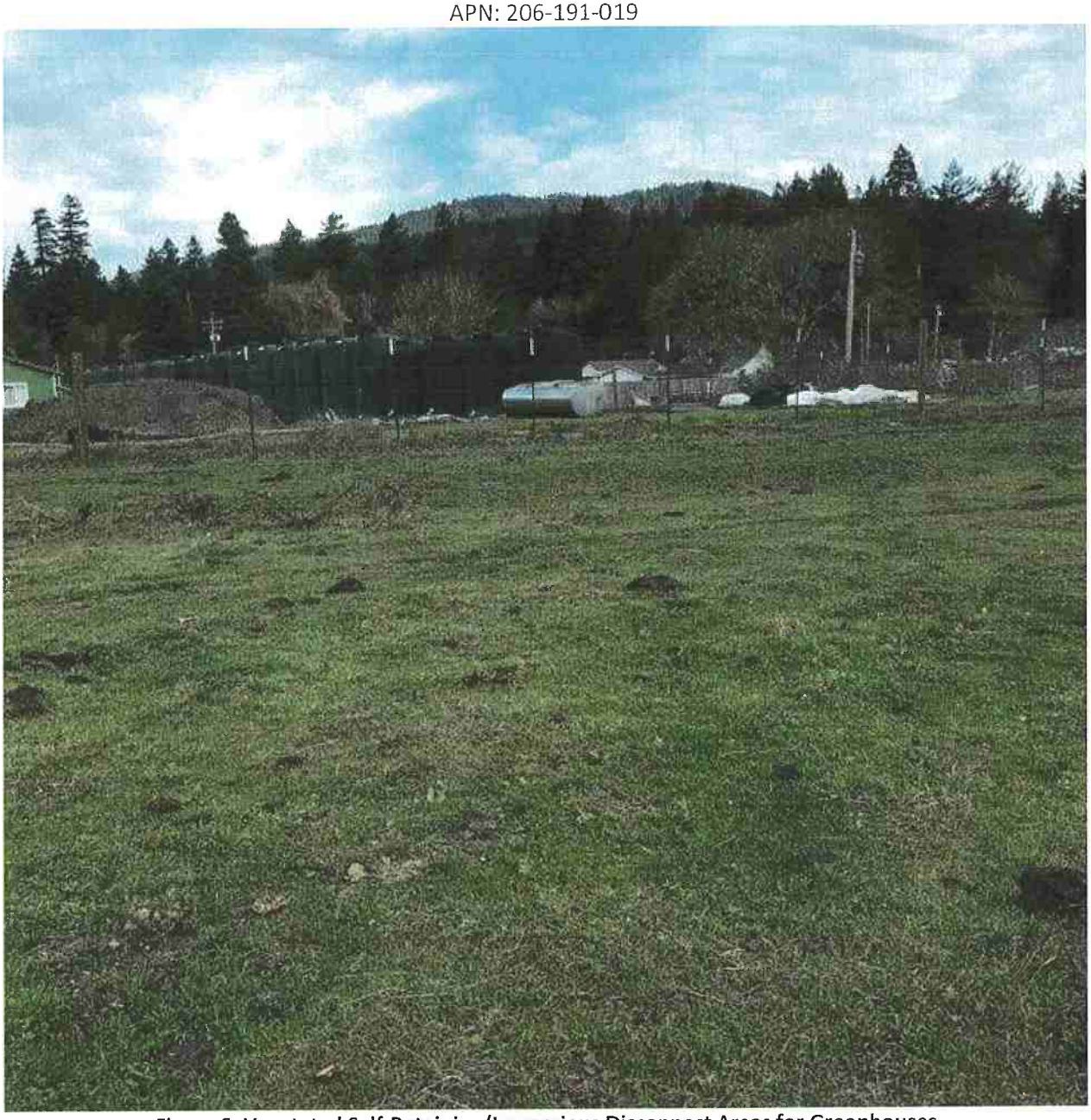


Figure 6: Vegetated Self-Retaining/Impervious Disconnect Areas for Greenhouses

References

California Stormwater Quality Association, January 2003, California Stormwater Best Management Practices Handbook – Construction. Available @ www.cabmphandbooks.com

Humboldt County California, Humboldt County Low Impact Development Stormwater Design Manual, June 2016.

Pacific Watershed Associates, Handbook for Forest, Ranch, and Rural Roads, April 2015

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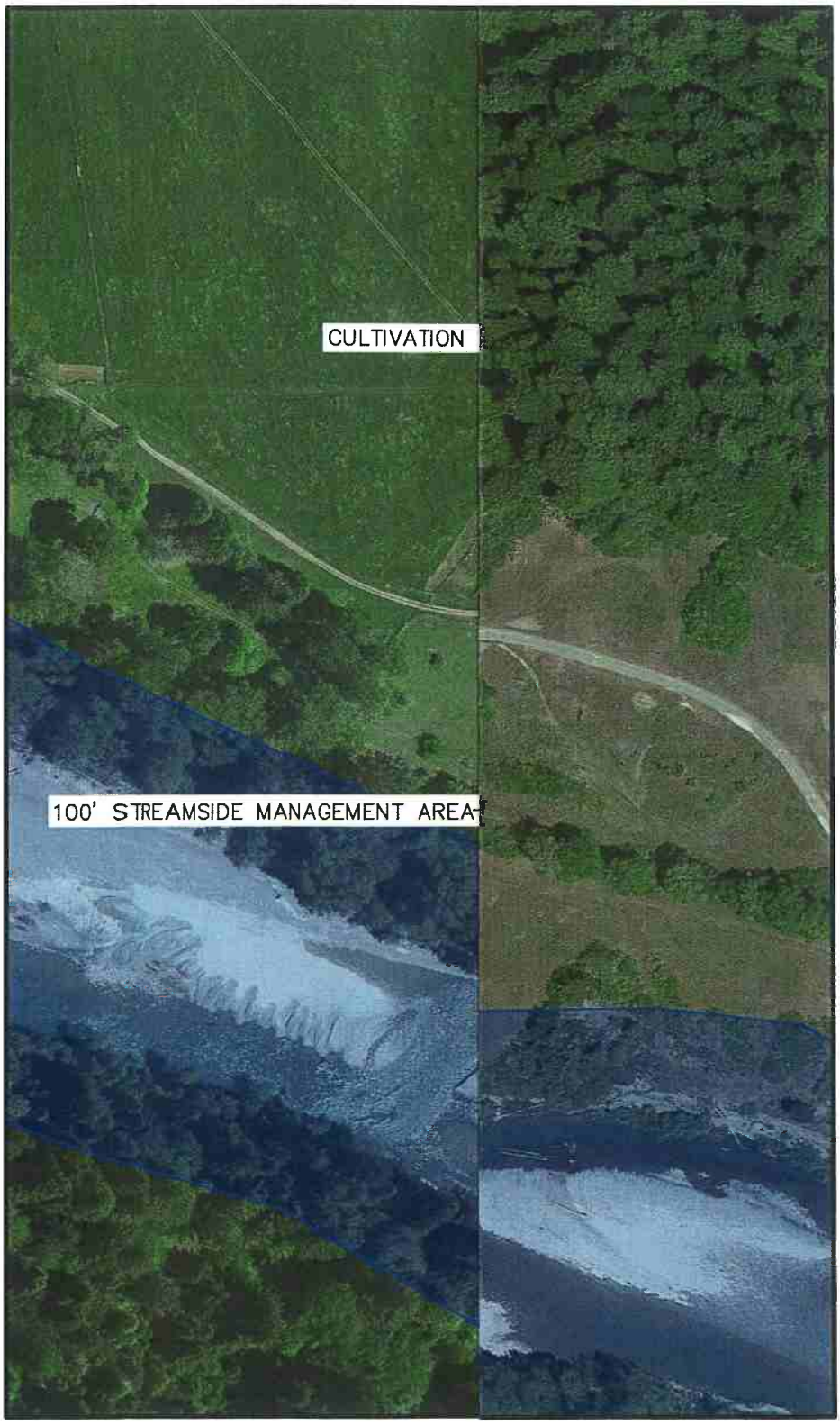

SCALE 1"=200'

0 100 200 400

LEGEND

SELF-RETAINING AREAS

STREAMSIDE MANAGEMENT AREA

ACCESS ROAD

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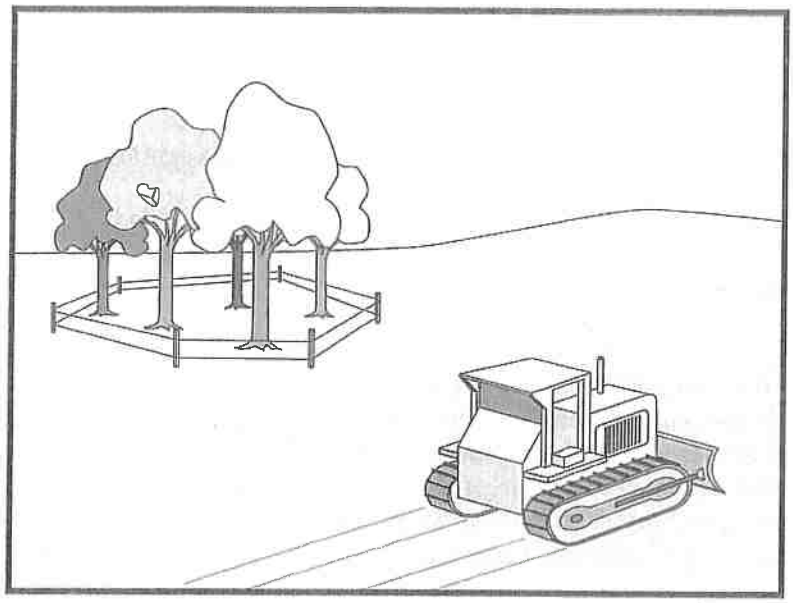
APPENDIX

Preservation Of Existing Vegetation EC-2



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.

Suitable Applications

Preservation of existing vegetation is suitable for use on most projects. Large project sites often provide the greatest opportunity for use of this BMP. Suitable applications include the following:

- Areas within the site where no construction activity occurs, or occurs at a later date. This BMP is especially suitable to multi year projects where grading can be phased.
- Areas where natural vegetation exists and is designated for preservation. Such areas often include steep slopes, watercourse, and building sites in wooded areas.
- Areas where local, state, and federal government require preservation, such as vernal pools, wetlands, marshes, certain oak trees, etc. These areas are usually designated on the plans, or in the specifications, permits, or environmental documents.
- Where vegetation designated for ultimate removal can be temporarily preserved and be utilized for erosion control and sediment control.

EC-2 Preservation Of Existing Vegetation

Limitations

- Requires forward planning by the owner/developer, contractor, and design staff.
- Limited opportunities for use when project plans do not incorporate existing vegetation into the site design.
- For sites with diverse topography, it is often difficult and expensive to save existing trees while grading the site satisfactory for the planned development.

Implementation

The best way to prevent erosion is to not disturb the land. In order to reduce the impacts of new development and redevelopment, projects may be designed to avoid disturbing land in sensitive areas of the site (e.g., natural watercourses, steep slopes), and to incorporate unique or desirable existing vegetation into the site's landscaping plan. Clearly marking and leaving a buffer area around these unique areas during construction will help to preserve these areas as well as take advantage of natural erosion prevention and sediment trapping.

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 erosion control. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion. In addition, vegetation helps 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.

Timing

- Provide for preservation of existing vegetation prior to the commencement of clearing and grubbing operations or other soil disturbing activities in areas where no construction activity is planned or will occur at a later date.

Design and Layout

- Mark areas to be preserved with temporary fencing. Include sufficient setback to protect roots.
  - Orange colored plastic mesh fencing works well.
  - Use appropriate fence posts and adequate post spacing and depth to completely support the fence in an upright position.
- Locate temporary roadways, stockpiles, and layout areas to avoid stands of trees, shrubs, and grass.
- Consider the impact of grade changes to existing vegetation and the root zone.
- Maintain existing irrigation systems where feasible. Temporary irrigation may be required.
- Instruct employees and subcontractors to honor protective devices. Prohibit heavy equipment, vehicular traffic, or storage of construction materials within the protected area.

Costs

There is little cost associated with preserving existing vegetation if properly planned during the project design, and these costs may be offset by aesthetic benefits that enhance property values. During construction, the cost for preserving existing vegetation will likely be less than the cost of applying erosion and sediment controls to the disturbed area. Replacing vegetation inadvertently destroyed during construction can be extremely expensive, sometimes in excess of $10,000 per tree.

Inspection and Maintenance

During construction, the limits of disturbance should remain clearly marked at all times. Irrigation or maintenance of existing vegetation should be described in the landscaping plan. If damage to protected trees still occurs, maintenance guidelines described below should be followed:

- Verify that protective measures remain in place. Restore damaged protection measures immediately.
- Serious tree injuries shall be attended to by an arborist.
- Damage to the crown, trunk, or root system of a retained tree shall be repaired immediately.
- Trench as far from tree trunks as possible, usually outside of the tree drip line or canopy. Curve trenches around trees to avoid large roots or root concentrations. If roots are encountered, consider tunneling under them. When trenching or tunneling near or under trees to be retained, place tunnels at least 18 in. below the ground surface, and not below the tree center to minimize impact on the roots.
- Do not leave tree roots exposed to air. Cover exposed roots with soil as soon as possible. If soil covering is not practical, protect exposed roots with wet burlap or peat moss until the tunnel or trench is ready for backfill.
- Cleanly remove the ends of damaged roots with a smooth cut.
- Fill trenches and tunnels as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots.
- If bark damage occurs, cut back all loosened bark into the undamaged area, with the cut tapered at the top and bottom and drainage provided at the base of the wood. Limit cutting the undamaged area as much as possible.
- Aerate soil that has been compacted over a trees root zone by punching holes 12 in. deep with an iron bar, and moving the bar back and forth until the soil is loosened. Place holes 18 in. apart throughout the area of compacted soil under the tree crown.
- Fertilization
  - Fertilize stressed or damaged broadleaf trees to aid recovery.
  - Fertilize trees in the late fall or early spring.

- Apply fertilizer to the soil over the feeder roots and in accordance with label instructions, but never closer than 3 ft to the trunk. Increase the fertilized area by one-fourth of the crown area for conifers that have extended root systems.

- Retain protective measures until all other construction activity is complete to avoid damage during site cleanup and stabilization.

References

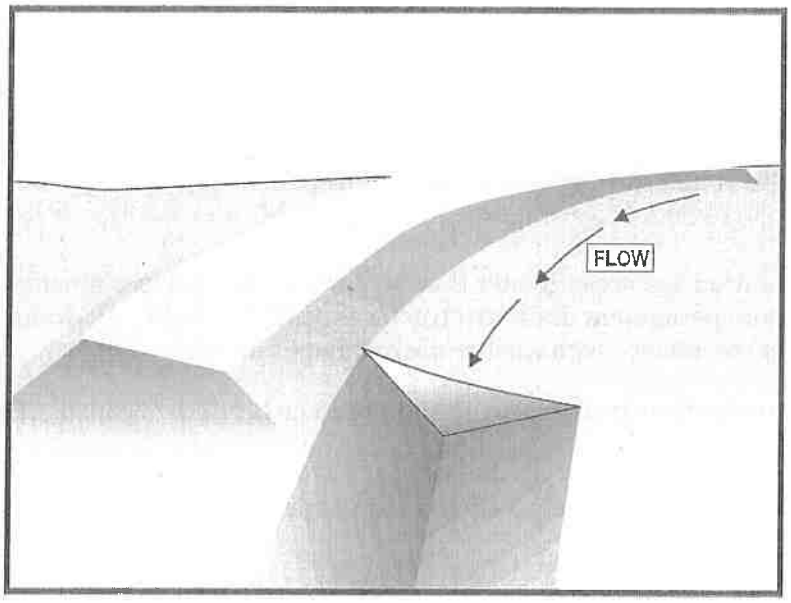
County of Sacramento Tree Preservation Ordinance, September 1981.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Earth Dikes and Drainage Swales EC-9



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

An earth dike is a temporary berm or ridge of compacted soil used to divert runoff or channel water to a desired location. A drainage swale is a shaped and sloped depression in the soil surface used to convey runoff to a desired location. Earth dikes and drainage swales are used to divert off site runoff around the construction site, divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.

Suitable Applications

Earth dikes and drainage swales are suitable for use, individually or together, where runoff needs to be diverted from one area and conveyed to another.

- Earth dikes and drainage swales may be used:
  - To convey surface runoff down sloping land
  - To intercept and divert runoff to avoid sheet flow over sloped surfaces
  - To divert and direct runoff towards a stabilized watercourse, drainage pipe or channel
  - To intercept runoff from paved surfaces
  - Below steep grades where runoff begins to concentrate
  - Along roadways and facility improvements subject to flood drainage

- At the top of slopes to divert runon from adjacent or undisturbed slopes
- At bottom and mid slope locations to intercept sheet flow and convey concentrated flows
- Divert sediment laden runoff into sediment basins or traps

Limitations

Dikes should not be used for drainage areas greater than 10 acres or along slopes greater than 10 percent. For larger areas more permanent drainage structures should be built. All drainage structures should be built in compliance with local municipal requirements.

- Earth dikes may create more disturbed area on site and become barriers to construction equipment.
- Earth dikes must be stabilized immediately, which adds cost and maintenance concerns.
- Diverted stormwater may cause downstream flood damage.
- Dikes should not be constructed of soils that may be easily eroded.
- Regrading the site to remove the dike may add additional cost.
- Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties.
- Temporary drains and swales must conform to local floodplain management requirements.
- Earth dikes/drainage swales are not suitable as sediment trapping devices.
- It may be necessary to use other soil stabilization and sediment controls such as check dams, plastics, and blankets, to prevent scour and erosion in newly graded dikes, swales, and ditches.

Implementation

The temporary earth dike is a berm or ridge of compacted soil, located in such a manner as to divert stormwater to a sediment trapping device or a stabilized outlet, thereby reducing the potential for erosion and offsite sedimentation. Earth dikes can also be used to divert runoff from off site and from undisturbed areas away from disturbed areas and to divert sheet flows away from unprotected slopes.

An earth dike does not itself control erosion or remove sediment from runoff. A dike prevents erosion by directing runoff to an erosion control device such as a sediment trap or directing runoff away from an erodible area. Temporary diversion dikes should not adversely impact adjacent properties and must conform to local floodplain management regulations, and should not be used in areas with slopes steeper than 10%.

Slopes that are formed during cut and fill operations should be protected from erosion by runoff. A combination of a temporary drainage swale and an earth dike at the top of a slope can divert runoff to a location where it can be brought to the bottom of the slope (see EC-11, Slope Drains). A combination dike and swale is easily constructed by a single pass of a bulldozer or grader and

compacted by a second pass of the tracks or wheels over the ridge. Diversion structures should be installed when the site is initially graded and remain in place until post construction BMPs are installed and the slopes are stabilized.

Diversion practices concentrate surface runoff, increasing its velocity and erosive force. Thus, the flow out of the drain or swale must be directed onto a stabilized area or into a grade stabilization structure. If significant erosion will occur, a swale should be stabilized using vegetation, chemical treatment, rock rip-rap, matting, or other physical means of stabilization. Any drain or swale that conveys sediment laden runoff must be diverted into a sediment basin or trap before it is discharged from the site.

General

- Care must be applied to correctly size and locate earth dikes, drainage swales. Excessively steep, unlined dikes, and swales are subject to erosion and gully formation.
- Conveyances should be stabilized.
- Use a lined ditch for high flow velocities.
- Select flow velocity based on careful evaluation of the risks due to erosion of the measure, soil types, overtopping, flow backups, washout, and drainage flow patterns for each project site.
- Compact any fills to prevent unequal settlement.
- Do not divert runoff onto other property without securing written authorization from the property owner.
- When possible, install and utilize permanent dikes, swales, and ditches early in the construction process.
- Provide stabilized outlets.

Earth Dikes

Temporary earth dikes are a practical, inexpensive BMP used to divert stormwater runoff. Temporary diversion dikes should be installed in the following manner:

- All dikes should be compacted by earth moving equipment.
- All dikes should have positive drainage to an outlet.
- All dikes should have 2:1 or flatter side slopes, 18 in. minimum height, and a minimum top width of 24 in. Wide top widths and flat slopes are usually needed at crossings for construction traffic.
- The outlet from the earth dike must function with a minimum of erosion. Runoff should be conveyed to a sediment trapping device such as a Sediment Trap (SE-3) or Sediment Basin (SE-2) when either the dike channel or the drainage area above the dike are not adequately stabilized.

- Temporary stabilization may be achieved using seed and mulching for slopes less than 5% and either rip-rap or sod for slopes in excess of 5%. In either case, stabilization of the earth dike should be completed immediately after construction or prior to the first rain.
- If riprap is used to stabilize the channel formed along the toe of the dike, the following typical specifications apply:

Channel Grade	Riprap Stabilization
0.5-1.0%	4 in. Rock
1.1-2.0%	6 in. Rock
2.1-4.0%	8 in. Rock
4.1-5.0%	8 in. -12 in. Riprap

- The stone riprap, recycled concrete, etc. used for stabilization should be pressed into the soil with construction equipment.
- Filter cloth may be used to cover dikes in use for long periods.
- Construction activity on the earth dike should be kept to a minimum.

Drainage Swales

Drainage swales are only effective if they are properly installed. Swales are more effective than dikes because they tend to be more stable. The combination of a swale with a dike on the downhill side is the most cost effective diversion.

Standard engineering design criteria for small open channel and closed conveyance systems should be used (see the local drainage design manual). Unless local drainage design criteria state otherwise, drainage swales should be designed as follows:

- No more than 5 acres may drain to a temporary drainage swale.
- Place drainage swales above or below, not on, a cut or fill slope.
- Swale bottom width should be at least 2 ft
- Depth of the swale should be at least 18 in.
- Side slopes should be 2:1 or flatter.
- Drainage or swales should be laid at a grade of at least 1 percent, but not more than 15 percent.
- The swale must not be overtopped by the peak discharge from a 10-year storm, irrespective of the design criteria stated above.
- Remove all trees, stumps, obstructions, and other objectionable material from the swale when it is built.
- Compact any fill material along the path of the swale.

- Stabilize all swales immediately. Seed and mulch swales at a slope of less than 5 percent, and use rip-rap or sod for swales with a slope between 5 and 15 percent. For temporary swales, geotextiles and mats (EC-7) may provide immediate stabilization.
- Irrigation may be required to establish sufficient vegetation to prevent erosion.
- Do not operate construction vehicles across a swale unless a stabilized crossing is provided.
- Permanent drainage facilities must be designed by a professional engineer (see the local drainage design criteria for proper design).
- At a minimum, the drainage swale should conform to predevelopment drainage patterns and capacities.
- Construct the drainage swale with a positive grade to a stabilized outlet.
- Provide erosion protection or energy dissipation measures if the flow out of the drainage swale can reach an erosive velocity.

Costs

- Cost ranges from $15 to $55 per ft for both earthwork and stabilization and depends on availability of material, site location, and access.
- Small dikes: $2.50 - $6.50/linear ft; Large dikes: $2.50/yd3.
- The cost of a drainage swale increases with drainage area and slope. Typical swales for controlling internal erosion are inexpensive, as they are quickly formed during routine earthwork.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect ditches and berms for washouts. Replace lost riprap, damaged linings or soil stabilizers as needed.
- Inspect channel linings, embankments, and beds of ditches and berms for erosion and accumulation of debris and sediment. Remove debris and sediment and repair linings and embankments as needed.
- Temporary conveyances should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction

References

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursetynsky, P.E., McGraw Hill Book Company, 1986.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

National Association of Home Builders (NAHB). Stormwater Runoff & Nonpoint Source Pollution Control Guide for Builders and Developers. National Association of Home Builders, Washington, D.C., 1995

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

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

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

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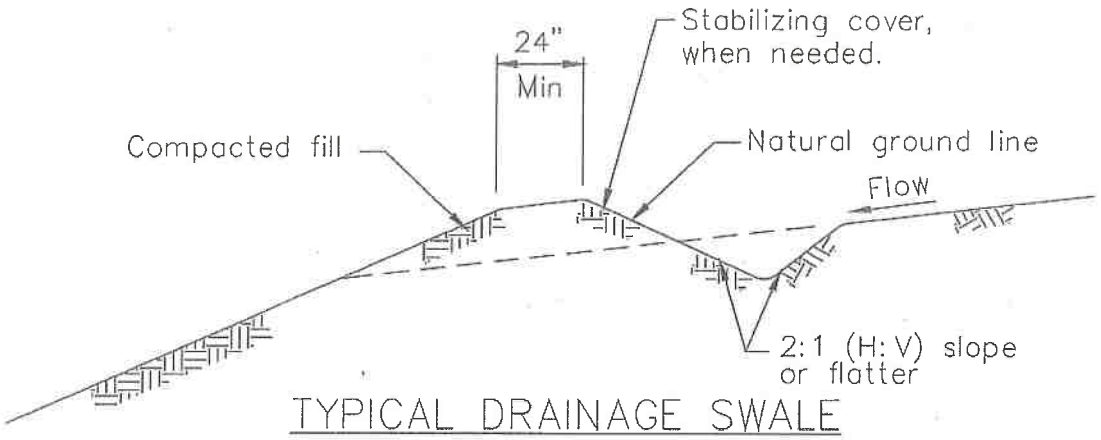
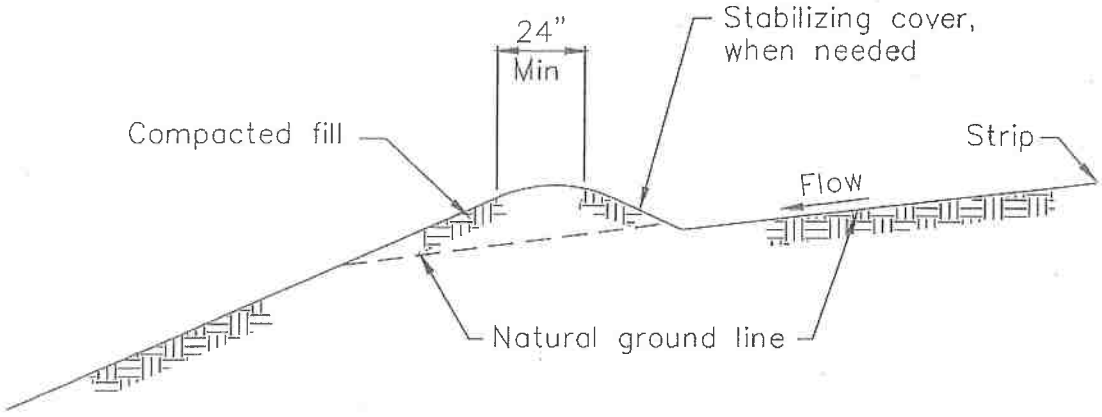


TYPICAL DRAINAGE SWALE
NOT TO SCALE

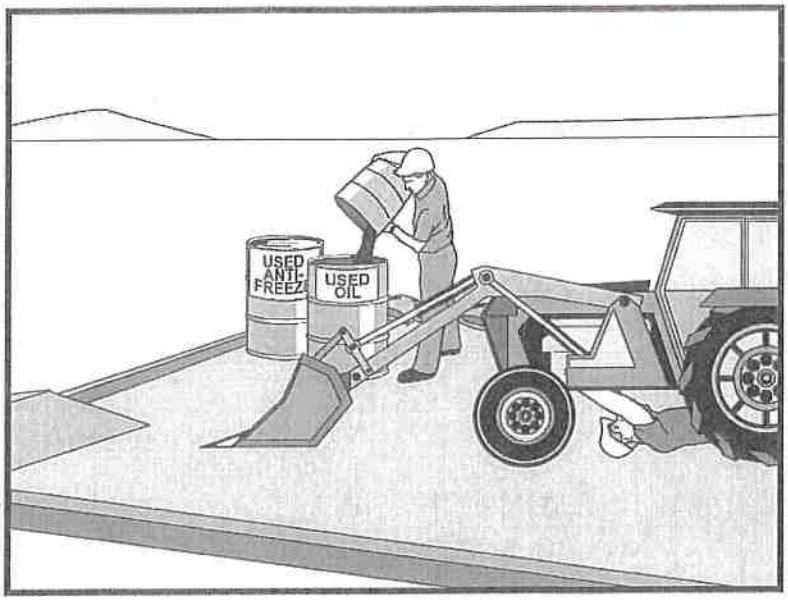
NOTES:

1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade.



TYPICAL EARTH DIKE
NOT TO SCALE

Vehicle & Equipment Maintenance NS-10



Objectives

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SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the contamination of stormwater resulting from vehicle and equipment maintenance by running a "dry and clean site". The best option would be to perform maintenance activities at an offsite facility. If this option is not available then work should be performed in designated areas only, while providing cover for materials stored outside, checking for leaks and spills, and containing and cleaning up spills immediately. Employees and subcontractors must be trained in proper procedures.

Suitable Applications

These procedures are suitable on all construction projects where an onsite yard area is necessary for storage and maintenance of heavy equipment and vehicles.

Limitations

Onsite vehicle and equipment maintenance should only be used where it is impractical to send vehicles and equipment offsite for maintenance and repair. Sending vehicles/equipment offsite should be done in conjunction with TR-1, Stabilized Construction Entrance/Exit.

Outdoor vehicle or equipment maintenance is a potentially significant source of stormwater pollution. Activities that can contaminate stormwater include engine repair and service, changing or replacement of fluids, and outdoor equipment storage and parking (engine fluid leaks). For further information on vehicle or equipment servicing, see NS-8, Vehicle and Equipment Cleaning, and NS-9, Vehicle and Equipment Fueling.

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NS-10 Vehicle & Equipment Maintenance

Implementation

- Use offsite repair shops as much as possible. These businesses are better equipped to handle vehicle fluids and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate maintenance area.
- If maintenance must occur onsite, use designated areas, located away from drainage courses. Dedicated maintenance areas should be protected from stormwater runon and runoff, and should be located at least 50 ft from downstream drainage facilities and watercourses.
- Drip pans or absorbent pads should be used during vehicle and equipment maintenance work that involves fluids, unless the maintenance work is performed over an impermeable surface in a dedicated maintenance area.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- All fueling trucks and fueling areas are required to have spill kits and/or use other spill protection devices.
- Use adsorbent materials on small spills. Remove the absorbent materials promptly and dispose of properly.
- Inspect onsite vehicles and equipment daily at startup for leaks, and repair immediately.
- Keep vehicles and equipment clean; do not allow excessive build-up of oil and grease.
- Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic and transmission fluids. Provide secondary containment and covers for these materials if stored onsite.
- Train employees and subcontractors in proper maintenance and spill cleanup procedures.
- Drip pans or plastic sheeting should be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than 1 hour.
- For long-term projects, consider using portable tents or covers over maintenance areas if maintenance cannot be performed offsite.
- Consider use of new, alternative greases and lubricants, such as adhesive greases, for chassis lubrication and fifth-wheel lubrication.
- Properly dispose of used oils, fluids, lubricants, and spill cleanup materials.
- Do not place used oil in a dumpster or pour into a storm drain or watercourse.
- Properly dispose of or recycle used batteries.
- Do not bury used tires.
- Repair leaks of fluids and oil immediately.

Vehicle & Equipment Maintenance NS-10

Listed below is further information if you must perform vehicle or equipment maintenance onsite.

Safer Alternative Products

- Consider products that are less toxic or hazardous than regular products. These products are often sold under an "environmentally friendly" label.
- Consider use of grease substitutes for lubrication of truck fifth-wheels. Follow manufacturers label for details on specific uses.
- Consider use of plastic friction plates on truck fifth-wheels in lieu of grease. Follow manufacturers label for details on specific uses.

Waste Reduction

Parts are often cleaned using solvents such as trichloroethylene, trichloroethane, or methylene chloride. Many of these cleaners are listed in California Toxic Rule as priority pollutants. These materials are harmful and must not contaminate stormwater. They must be disposed of as a hazardous waste. Reducing the number of solvents makes recycling easier and reduces hazardous waste management costs. Often, one solvent can perform a job as well as two different solvents. Also, if possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous materials. For example, replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check the list of active ingredients to see whether it contains chlorinated solvents. The "chlor" term indicates that the solvent is chlorinated. Also, try substituting a wire brush for solvents to clean parts.

Recycling and Disposal

Separating wastes allows for easier recycling and may reduce disposal costs. Keep hazardous wastes separate, do not mix used oil solvents, and keep chlorinated solvents (like,-trichloroethane) separate from non-chlorinated solvents (like kerosene and mineral spirits). Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around. Provide cover and secondary containment until these materials can be removed from the site.

Oil filters can be recycled. Ask your oil supplier or recycler about recycling oil filters.

Do not dispose of extra paints and coatings by dumping liquid onto the ground or throwing it into dumpsters. Allow coatings to dry or harden before disposal into covered dumpsters.

Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Costs

All of the above are low cost measures. Higher costs are incurred to setup and maintain onsite maintenance areas.

NS-10 Vehicle & Equipment Maintenance

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Keep ample supplies of spill cleanup materials onsite.
- Maintain waste fluid containers in leak proof condition.
- Vehicles and equipment should be inspected on each day of use. Leaks should be repaired immediately or the problem vehicle(s) or equipment should be removed from the project site.
- Inspect equipment for damaged hoses and leaky gaskets routinely. Repair or replace as needed.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

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

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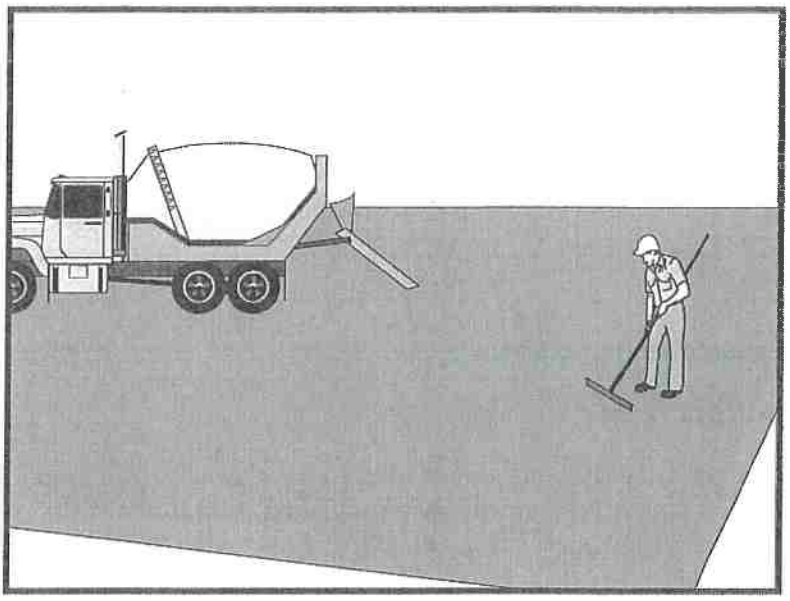
Paving and Grinding Operations NS-3



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Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants from paving operations, using measures to prevent runon and runoff pollution, properly disposing of wastes, and training employees and subcontractors.

Suitable Applications

These procedures are implemented where paving, surfacing, resurfacing, or sawcutting, may pollute stormwater runoff or discharge to the storm drain system or watercourses.

Limitations

- Finer solids are not effectively removed by filtration systems.
- Paving opportunities may be limited during wet weather.

Implementation

General

- Avoid paving during the wet season when feasible.
- Reschedule paving and grinding activities if rain is in the forecast.
- Train employees and sub-contractors in pollution prevention and reduction.
- Store materials away from drainage courses to prevent stormwater runon (see WM-1, Material Delivery and Storage).

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- Protect drainage courses, particularly in areas with a grade, by employing BMPs to divert runoff or to trap and filter sediment.
- If paving involves an onsite mixing plant, follow the stormwater permitting requirements for industrial activities.
- Stockpile material removed from roadways away from drain inlets, drainage ditches, and watercourses, These materials should be stored consistent with WM-3, Stockpile Management.
- Disposal of PCC and AC waste should be in conformance with WM-8, Concrete Waste Management.

Saw Cutting, Grinding, and Pavement Removal

- Shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to contain slurry.
- When paving involves AC, the following steps should be implemented to prevent the discharge of grinding residue, uncompacted or loose AC, tack coats, equipment cleaners, or unrelated paving materials:
  - AC grindings, pieces, or chunks used in embankments or shoulder backing must not be allowed to enter any storm drains or watercourses. Install silt fence until structure is stabilized or permanent controls are in place. Examples of temporary perimeter controls can be found in EC-9, Earth Dikes and Drainage Swales; SE-1, Silt Fence; or SE-5, Fiber Rolls.
  - Collect and remove all broken asphalt and recycle when practical. Old or spilled asphalt must be recycled or disposed.
  - Any AC chunks and pieces used in embankments must be placed above the water table and covered by at least 1 ft of material.
- Do not allow saw-cut slurry to enter storm drains or watercourses. Residue from grinding operations should be picked up by means of a vacuum attachment to the grinding machine, should not be allowed to flow across the pavement, and should not be left on the surface of the pavement. See also WM-8, Concrete Waste Management, and WM-10, Liquid Waste Management.
- Dig out activities should not be conducted in the rain.
- Collect dig out material by mechanical or manual methods. This material may be recycled for use as shoulder backing or base material.
- If dig out material cannot be recycled, transport the material back to an approved storage site.

Asphaltic Concrete Paving

- If paving involves asphaltic cement concrete, follow these steps:

- Do not allow sand or gravel placed over new asphalt to wash into storm drains, streets, or creeks. Vacuum or sweep loose sand and gravel and properly dispose of this waste by referring to WM-5, Solid Waste Management.

- Old asphalt must be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible.

Portland Cement Concrete Paving

- Do not wash sweepings from exposed aggregate concrete into a storm drain system. Collect and return to aggregate base stockpile or dispose of properly.

- Allow aggregate rinse to settle. Then, either allow rinse water to dry in a temporary pit as described in WM-8, Concrete Waste Management, or pump the water to the sanitary sewer if allowed by the local wastewater authority.

Sealing Operations

- During chip seal application and sweeping operations, petroleum or petroleum covered aggregate must not be allowed to enter any storm drain or water courses. Apply temporary perimeter controls until structure is stabilized.

- Drainage inlet structures and manholes should be covered with filter fabric during application of seal coat, tack coat, slurry seal, and fog seal.

- Seal coat, tack coat, slurry seal, or fog seal should not be applied if rainfall is predicted to occur during the application or curing period.

Paving Equipment

- 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 NS-10, Vehicle and Equipment Maintenance, WM-4, Spill Prevention and Control, and WM-10, Liquid Waste Management.

- Substances used to coat asphalt transport trucks, and asphalt spreading equipment should not contain soap and should be non-foaming and non-toxic.

- Use only non-toxic substances to coat asphalt transport trucks and asphalt spreading equipment.

- Paving equipment parked onsite should be parked over plastic to prevent soil contamination.

- Clean asphalt coated equipment offsite whenever possible. When cleaning dry, hardened asphalt from equipment, manage hardened asphalt debris as described in WM-5, Solid Waste Management. Any cleaning onsite should follow NS-8, Vehicle and Equipment Cleaning.

Thermoplastic Striping

- Thermoplastic striper and pre-heater equipment shutoff valves should be inspected to ensure that they are working properly to prevent leaking thermoplastic from entering drain inlets, the stormwater drainage system, or watercourses.
- Pre-heaters should be filled carefully to prevent splashing or spilling of hot thermoplastic. Leave six inches of space at the top of the pre-heater container when filling thermoplastic to allow room for material to move when the vehicle is deadheaded.
- Do not pre-heat, transfer, or load thermoplastic near drain inlets or watercourses.
- Clean truck beds daily of loose debris and melted thermoplastic. When possible, recycle thermoplastic material.

Raised/Recessed Pavement Marker Application and Removal

- Do not transfer or load bituminous material near drain inlets, the stormwater drainage system, or watercourses.
- Melting tanks should be loaded with care and not filled to beyond six inches from the top to leave room for splashing when vehicle is deadheaded.
- When servicing or filling melting tanks, ensure all pressure is released before removing lids to avoid spills.
- On large-scale projects, use mechanical or manual methods to collect excess bituminous material from the roadway after removal of markers.

Costs

- All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Keep ample supplies of drip pans or absorbent materials onsite.
- Inspect and maintain machinery regularly to minimize leaks and drips.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

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

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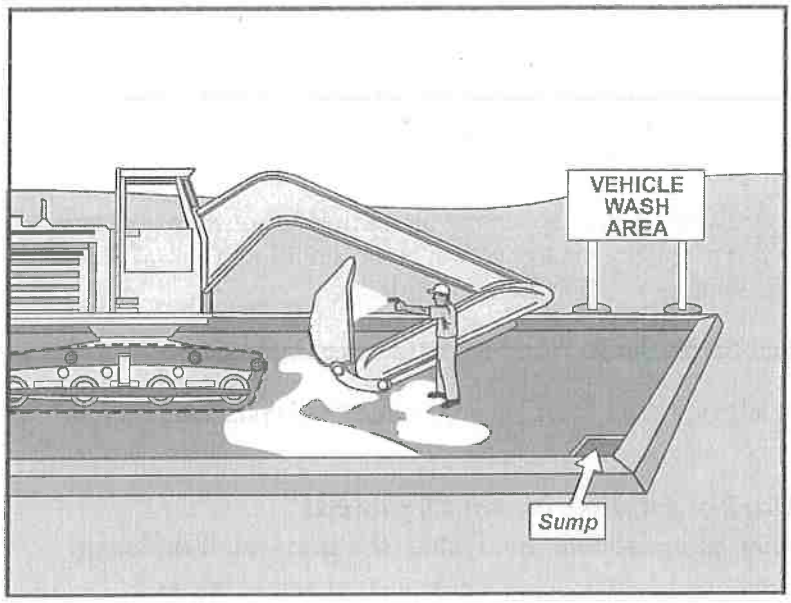
Vehicle and Equipment Cleaning NS-8



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Targeted Constituents

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Nutrients	☑
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Vehicle and equipment cleaning procedures and practices eliminate or reduce the discharge of pollutants to stormwater from vehicle and equipment cleaning operations. Procedures and practices include but are not limited to: using offsite facilities; washing in designated, contained areas only; eliminating discharges to the storm drain by infiltrating the wash water; and training employees and subcontractors in proper cleaning procedures.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment cleaning is performed.

Limitations

Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades. Sending vehicles/equipment offsite should be done in conjunction with TR-1, Stabilized Construction Entrance/Exit.

Implementation

Other options to washing equipment onsite include contracting with either an offsite or mobile commercial washing business. These businesses may be better equipped to handle and dispose of the wash waters properly. Performing this work offsite can also be economical by eliminating the need for a separate washing operation onsite.

If washing operations are to take place onsite, then:

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- Use phosphate-free, biodegradable soaps.
- Educate employees and subcontractors on pollution prevention measures.
- Do not permit steam cleaning onsite. Steam cleaning can generate significant pollutant concentrates.
- Cleaning of vehicles and equipment with soap, solvents or steam should not occur on the project site unless resulting wastes are fully contained and disposed of. Resulting wastes should not be discharged or buried, and must be captured and recycled or disposed according to the requirements of WM-10, Liquid Waste Management or WM-6, Hazardous Waste Management, depending on the waste characteristics. Minimize use of solvents. Use of diesel for vehicle and equipment cleaning is prohibited.
- All vehicles and equipment that regularly enter and leave the construction site must be cleaned offsite.
- When vehicle and equipment washing and cleaning must occur onsite, and the operation cannot be located within a structure or building equipped with appropriate disposal facilities, the outside cleaning area should have the following characteristics:
  - Located away from storm drain inlets, drainage facilities, or watercourses
  - Paved with concrete or asphalt and bermed to contain wash waters and to prevent runon and runoff
  - Configured with a sump to allow collection and disposal of wash water
  - No discharge of wash waters to storm drains or watercourses
  - Used only when necessary
- When cleaning vehicles and equipment with water:
  - Use as little water as possible. High-pressure sprayers may use less water than a hose and should be considered
  - Use positive shutoff valve to minimize water usage
  - Facility wash racks should discharge to a sanitary sewer, recycle system or other approved discharge system and must not discharge to the storm drainage system, watercourses, or to groundwater

Costs

Cleaning vehicles and equipment at an offsite facility may reduce overall costs for vehicle and equipment cleaning by eliminating the need to provide similar services onsite. When onsite cleaning is needed, the cost to establish appropriate facilities is relatively low on larger, long-duration projects, and moderate to high on small, short-duration projects.

Inspection and Maintenance

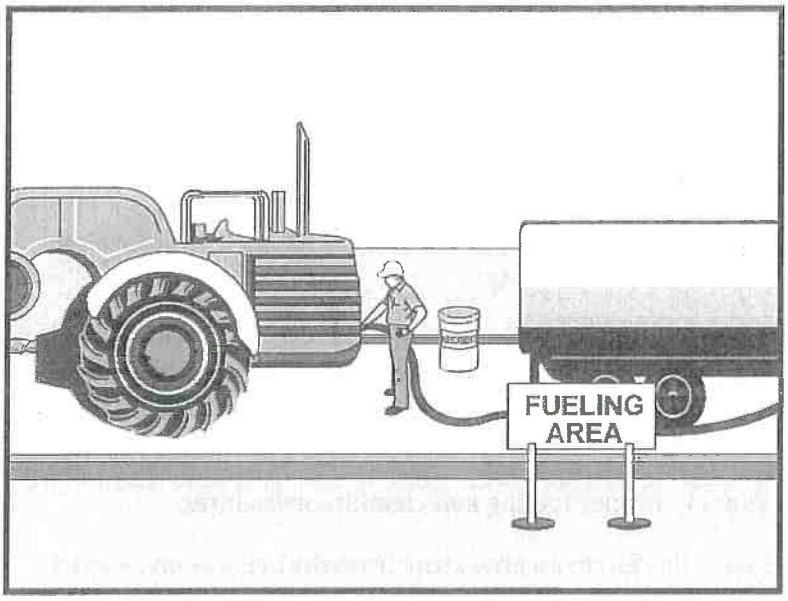
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspection and maintenance is minimal, although some berm repair may be necessary.
- Monitor employees and subcontractors throughout the duration of the construction project to ensure appropriate practices are being implemented.
- Inspect sump regularly and remove liquids and sediment as needed.
- Prohibit employees and subcontractors from washing personal vehicles and equipment on the construction site.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Swisher, R.D. Surfactant Biodegradation, Marcel Decker Corporation, 1987.

Vehicle and Equipment Fueling NS-9



Objectives

EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Vehicle equipment fueling procedures and practices are designed to prevent fuel spills and leaks, and reduce or eliminate contamination of stormwater. This can be accomplished by using offsite facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors in proper fueling procedures.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment fueling takes place.

Limitations

Onsite vehicle and equipment fueling should only be used where it is impractical to send vehicles and equipment offsite for fueling. Sending vehicles and equipment offsite should be done in conjunction with TR-1, Stabilized Construction Entrance/ Exit.

Implementation

- Use offsite fueling stations as much as possible. These businesses are better equipped to handle fuel and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate fueling area at a site.
- Discourage "topping-off" of fuel tanks.

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- Absorbent spill cleanup materials and spill kits should be available in fueling areas and on fueling trucks, and should be disposed of properly after use.
- Drip pans or absorbent pads should be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.
- Use absorbent materials on small spills. Do not hose down or bury the spill. Remove the adsorbent materials promptly and dispose of properly.
- 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 large excavators, most vehicles should be able to travel to a designated area with little lost time.
- Train employees and subcontractors in proper fueling and cleanup procedures.
- When fueling must take place onsite, designate an area away from drainage courses to be used. Fueling areas should be identified in the SWPPP.
- Dedicated fueling areas should be protected from stormwater runon and runoff, and should be located at least 50 ft away from downstream drainage facilities and watercourses. Fueling must be performed on level-grade areas.
- Protect fueling areas with berms and dikes to prevent runon, runoff, and to contain spills.
- Nozzles used in vehicle and equipment fueling should be equipped with an automatic shutoff to control drips. Fueling operations should not be left unattended.
- Use vapor recovery nozzles to help control drips as well as air pollution where required by Air Quality Management Districts (AQMD).
- Federal, state, and local requirements should be observed for any stationary above ground storage tanks.

Costs

- All of the above measures are low cost except for the capital costs of above ground tanks that meet all local environmental, zoning, and fire codes.

Inspection and Maintenance

- Vehicles and equipment should be inspected each day of use for leaks. Leaks should be repaired immediately or problem vehicles or equipment should be removed from the project site.
- Keep ample supplies of spill cleanup materials onsite.
- Immediately clean up spills and properly dispose of contaminated soil and cleanup materials.

References

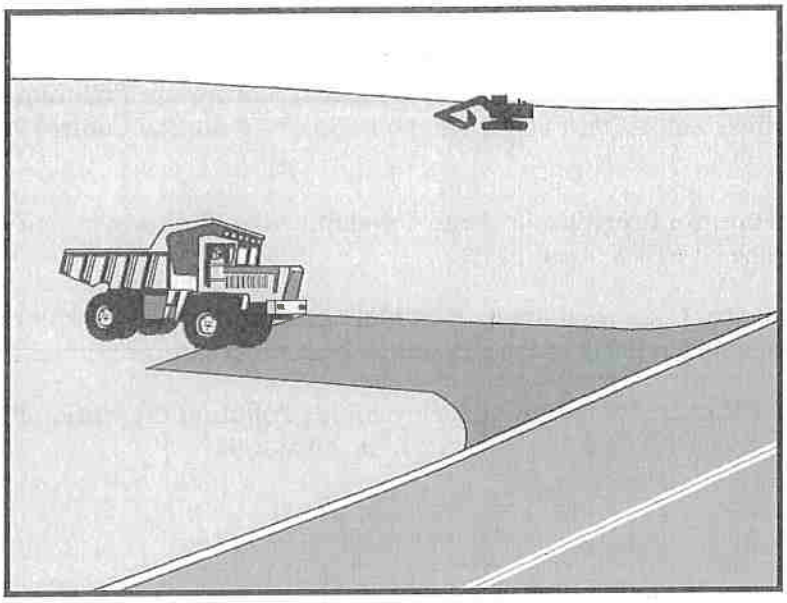
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

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

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Stabilized Construction Entrance/Exit TC-1



Objectives

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

A stabilized construction access is defined by a point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

Suitable Applications

Use at construction sites:

- Where dirt or mud can be tracked onto public roads.
- Adjacent to water bodies.
- Where poor soils are encountered.
- Where dust is a problem during dry weather conditions.

Limitations

- Entrances and exits require periodic top dressing with additional stones.
- This BMP should be used in conjunction with street sweeping on adjacent public right of way.
- Entrances and exits should be constructed on level ground only.
- Stabilized construction entrances are rather expensive to construct and when a wash rack is included, a sediment trap of some kind must also be provided to collect wash water runoff.

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Implementation

General

A stabilized construction entrance is a pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right of way, street, alley, sidewalk, or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights of way or streets. Reducing tracking of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains and production of airborne dust.

Where traffic will be entering or leaving the construction site, a stabilized construction entrance should be used. NPDES permits require that appropriate measures be implemented to prevent tracking of sediments onto paved roadways, where a significant source of sediments is derived from mud and dirt carried out from unpaved roads and construction sites.

Stabilized construction entrances are moderately effective in removing sediment from equipment leaving a construction site. The entrance should be built on level ground. Advantages of the Stabilized Construction Entrance/Exit is that it does remove some sediment from equipment and serves to channel construction traffic in and out of the site at specified locations. Efficiency is greatly increased when a washing rack is included as part of a stabilized construction entrance/exit.

Design and Layout

- Construct on level ground where possible.
- Select 3 to 6 in. diameter stones.
- Use minimum depth of stones of 12 in. or as recommended by soils engineer.
- Construct length of 50 ft minimum, and 30 ft minimum width.
- Rumble racks constructed of steel panels with ridges and installed in the stabilized entrance/exit will help remove additional sediment and to keep adjacent streets clean.
- Provide ample turning radii as part of the entrance.
- Limit the points of entrance/exit to the construction site.
- Limit speed of vehicles to control dust.
- Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.
- Route runoff from stabilized entrances/exits through a sediment trapping device before discharge.
- Design stabilized entrance/exit to support heaviest vehicles and equipment that will use it.
- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. Do not use asphalt concrete (AC) grindings for stabilized construction access/roadway.

- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth, or place aggregate to a depth recommended by a geotechnical engineer. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.
- Designate combination or single purpose entrances and exits to the construction site.
- Require that all employees, subcontractors, and suppliers utilize the stabilized construction access.
- Implement SE-7, Street Sweeping and Vacuuming, as needed.
- All exit locations intended to be used for more than a two-week period should have stabilized construction entrance/exit BMPs.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMPs are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect local roads adjacent to the site daily. Sweep or vacuum to remove visible accumulated sediment.
- Remove aggregate, separate and dispose of sediment if construction entrance/exit is clogged with sediment.
- Keep all temporary roadway ditches clear.
- Check for damage and repair as needed.
- Replace gravel material when surface voids are visible.
- Remove all sediment deposited on paved roadways within 24 hours.
- Remove gravel and filter fabric at completion of construction

Costs

Average annual cost for installation and maintenance may vary from $1,200 to $4,800 each, averaging $2,400 per entrance. Costs will increase with addition of washing rack, and sediment trap. With wash rack, costs range from $1,200 - $6,000 each, averaging $3,600 per entrance.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, USEPA Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

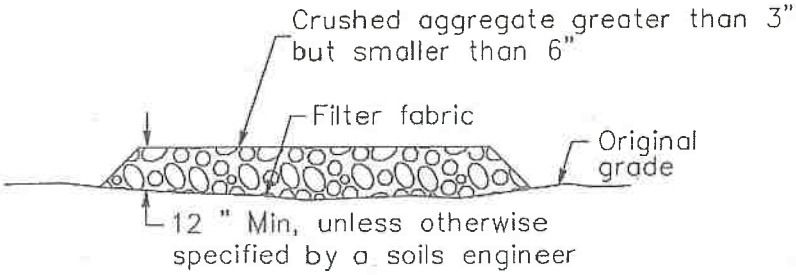
Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters, EPA 840-B-9-002, USEPA, Office of Water, Washington, DC, 1993.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Stabilized Construction Entrance/Exit TC-1



SECTION B–B
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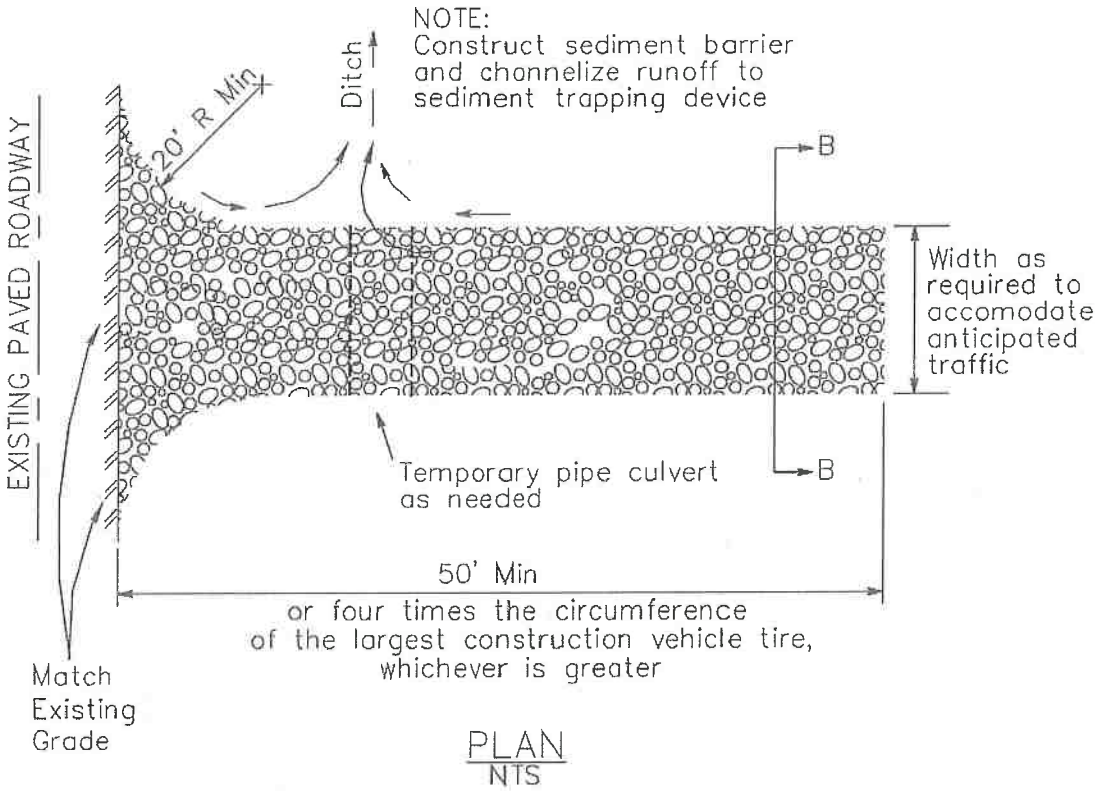

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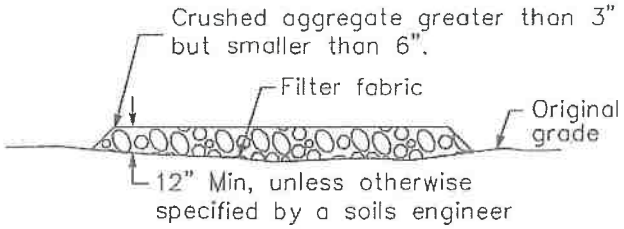
Stabilized Construction Entrance/Exit TC-1



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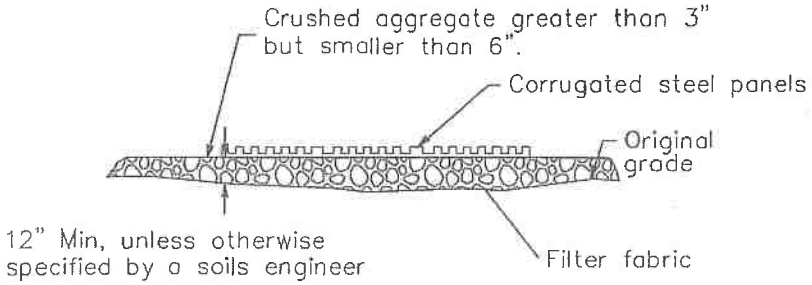

SECTION A–A
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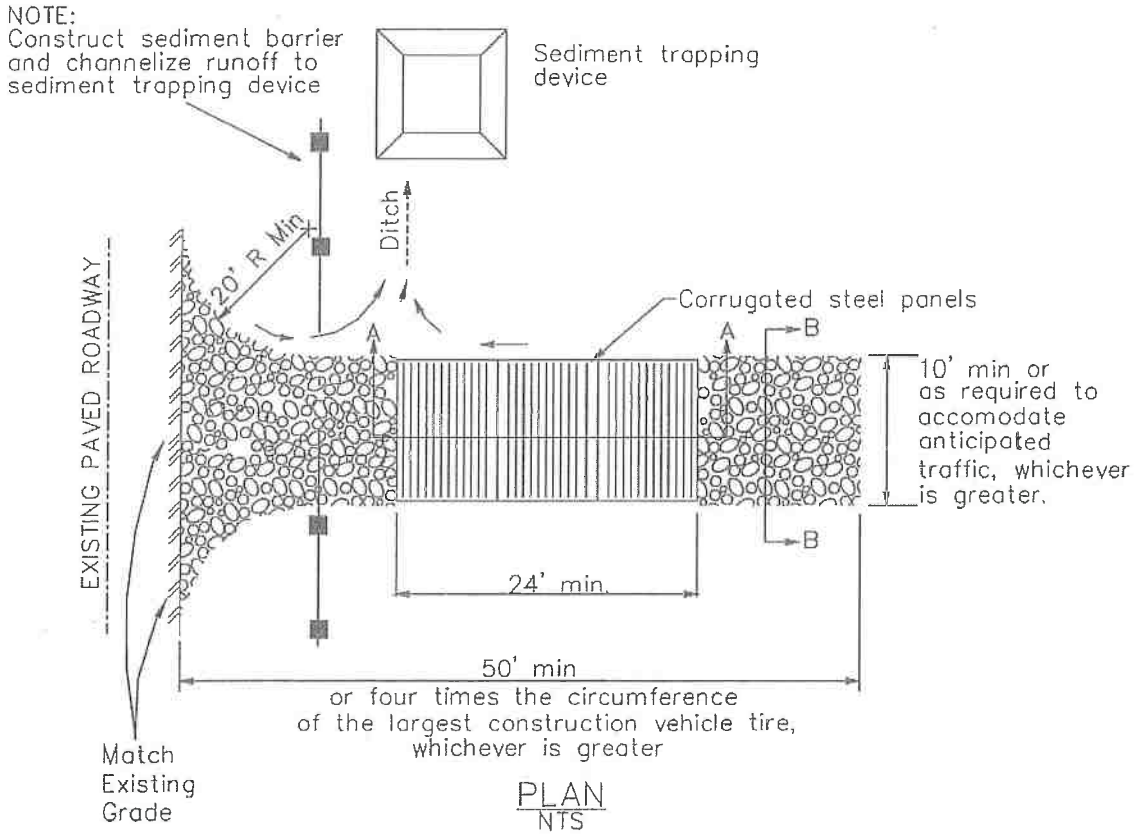

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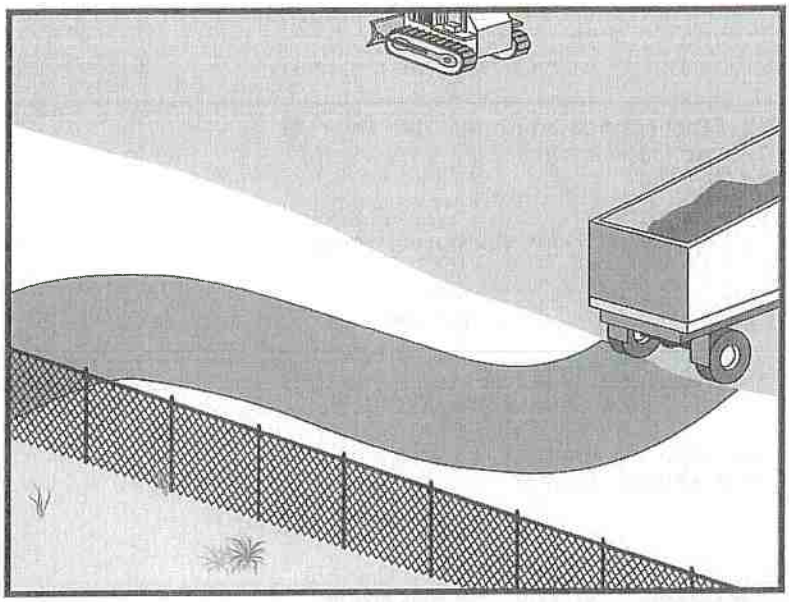
Stabilized Construction Roadway TC-2



Objectives

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Access roads, subdivision roads, parking areas, and other onsite vehicle transportation routes should be stabilized immediately after grading, and frequently maintained to prevent erosion and control dust.

Suitable Applications

This BMP should be applied for the following conditions:

- Temporary Construction Traffic:
  - Phased construction projects and offsite road access
  - Construction during wet weather
- Construction roadways and detour roads:
  - Where mud tracking is a problem during wet weather
  - Where dust is a problem during dry weather
  - Adjacent to water bodies
  - Where poor soils are encountered

Limitations

- The roadway must be removed or paved when construction is complete.

- Certain chemical stabilization methods may cause stormwater or soil pollution and should not be used. See WE-1, Wind Erosion Control.
- Management of construction traffic is subject to air quality control measures. Contact the local air quality management agency.
- Materials will likely need to be removed prior to final project grading and stabilization.
- Use of this BMP may not be applicable to very short duration projects.

Implementation

General

Areas that are graded for construction vehicle transport and parking purposes are especially susceptible to erosion and dust. The exposed soil surface is continually disturbed, leaving no opportunity for vegetative stabilization. Such areas also tend to collect and transport runoff waters along their surfaces. During wet weather, they often become muddy quagmires that generate significant quantities of sediment that may pollute nearby streams or be transported offsite on the wheels of construction vehicles. Dirt roads can become so unstable during wet weather that they are virtually unusable.

Efficient construction road stabilization not only reduces onsite erosion but also can significantly speed onsite work, avoid instances of immobilized machinery and delivery vehicles, and generally improve site efficiency and working conditions during adverse weather

Installation/Application Criteria

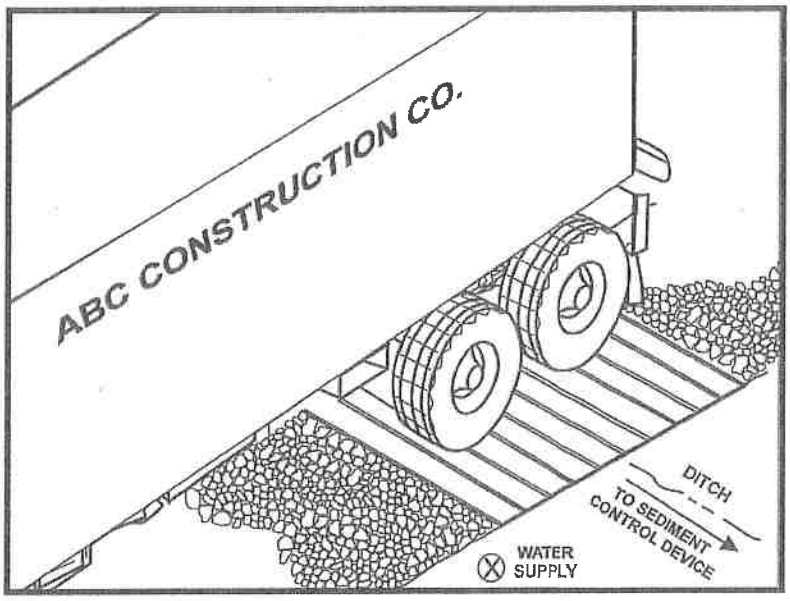
Permanent roads and parking areas should be paved as soon as possible after grading. As an alternative where construction will be phased, the early application of gravel or chemical stabilization may solve potential erosion and stability problems. Temporary gravel roadway should be considered during the rainy season and on slopes greater than 5%.

Temporary roads should follow the contour of the natural terrain to the maximum extent possible. Slope should not exceed 15%. Roadways should be carefully graded to drain transversely. Provide drainage swales on each side of the roadway in the case of a crowned section or one side in the case of a super elevated section. Simple gravel berms without a trench can also be used.

Installed inlets should be protected to prevent sediment laden water from entering the storm sewer system (SE-10, Storm Drain Inlet Protection). In addition, the following criteria should be considered.

- Road should follow topographic contours to reduce erosion of the roadway.
- The roadway slope should not exceed 15%.
- Chemical stabilizers or water are usually required on gravel or dirt roads to prevent dust (WE-1, Wind Erosion Control).
- Properly grade roadway to prevent runoff from leaving the construction site.
- Design stabilized access to support heaviest vehicles and equipment that will use it.

Entrance/Outlet Tire Wash TC-3



Objectives

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

TC-1 Stabilized Construction Entrance/Exit

Description and Purpose

A tire wash is an area located at stabilized construction access points to remove sediment from tires and under carriages and to prevent sediment from being transported onto public roadways.

Suitable Applications

Tire washes may be used on construction sites where dirt and mud tracking onto public roads by construction vehicles may occur.

Limitations

- The tire wash requires a supply of wash water.
- A turnout or doublewide exit is required to avoid having entering vehicles drive through the wash area.
- Do not use where wet tire trucks leaving the site leave the road dangerously slick.

Implementation

- Incorporate with a stabilized construction entrance/exit. See TC-1, Stabilized Construction Entrance/Exit.
- Construct on level ground when possible, on a pad of coarse aggregate greater than 3 in. but smaller than 6 in. A geotextile fabric should be placed below the aggregate.
- Wash rack should be designed and constructed/manufactured for anticipated traffic loads.

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- Provide a drainage ditch that will convey the runoff from the wash area to a sediment trapping device. The drainage ditch should be of sufficient grade, width, and depth to carry the wash runoff.
- Use hoses with automatic shutoff nozzles to prevent hoses from being left on.
- Require that all employees, subcontractors, and others that leave the site with mud caked tires and undercarriages to use the wash facility.
- Implement SC-7, Street Sweeping and Vacuuming, as needed.

Costs

Costs are low for installation of wash rack.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Remove accumulated sediment in wash rack and/or sediment trap to maintain system performance.
- Inspect routinely for damage and repair as needed.

References

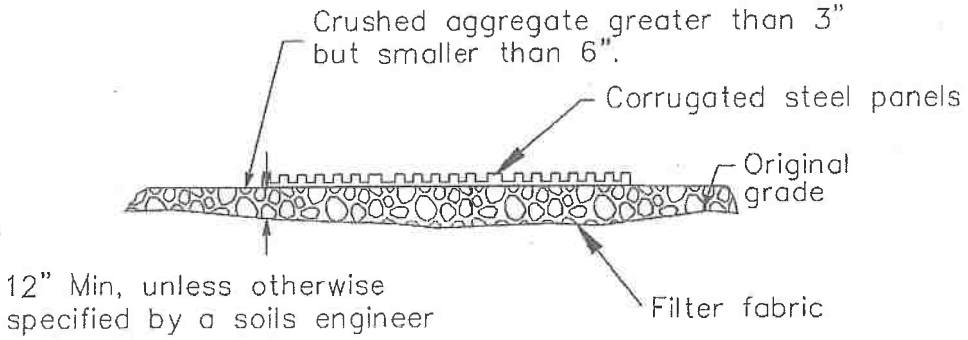
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

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

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



SECTION A–A
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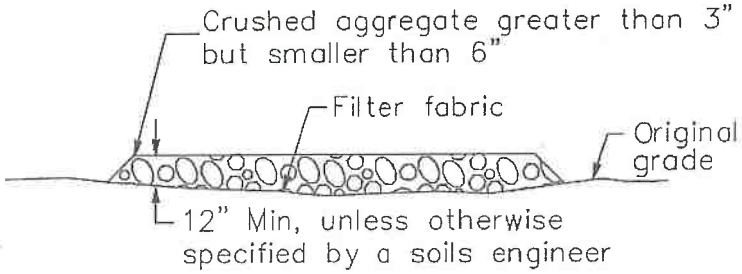

SECTION B–B
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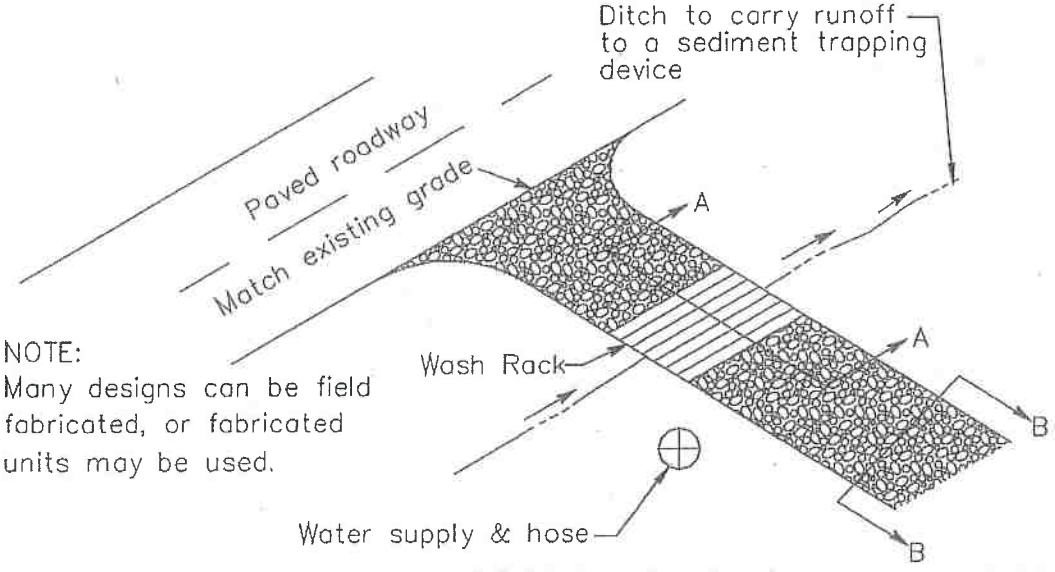
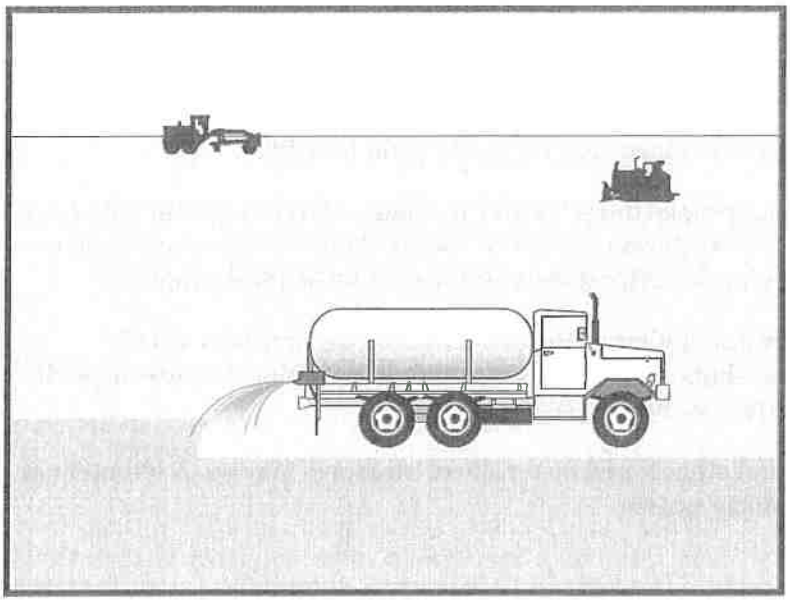


NOTE:
Many designs can be field fabricated, or fabricated units may be used.

TYPICAL TIRE WASH
NOT TO SCALE

Wind Erosion Control WE-1



Objectives

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	☑
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Wind erosion or dust control consists of applying water or other dust palliatives as necessary to prevent or alleviate dust nuisance generated by construction activities. Covering small stockpiles or areas is an alternative to applying water or other dust palliatives.

Suitable Applications

Wind erosion control BMPs are suitable during the following construction activities:

- Construction vehicle traffic on unpaved roads
- Drilling and blasting activities
- Sediment tracking onto paved roads
- Soils and debris storage piles
- Batch drop from front-end loaders
- Areas with unstabilized soil
- Final grading/site stabilization

Limitations

- Watering prevents dust only for a short period and should be applied daily (or more often) to be effective.
- Over watering may cause erosion.

- Oil or oil-treated subgrade should not be used for dust control because the oil may migrate into drainageways and/or seep into the soil.
- Effectiveness depends on soil, temperature, humidity, and wind velocity.
- Chemically treated sub grades 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.

Implementation

General

California's Mediterranean climate, with short wet seasons and long hot dry seasons, allows the soils to thoroughly dry out. During these dry seasons, construction activities are at their peak, and disturbed and exposed areas are increasingly subject to wind erosion, sediment tracking and dust generated by construction equipment.

Dust control, as a BMP, is a practice that is already in place for many construction activities. Los Angeles, the North Coast, and Sacramento, among others, have enacted dust control ordinances for construction activities that cause dust to be transported beyond the construction project property line.

Recently, the State Air Resources Control Board has, under the authority of the Clean Air Act, started to address air quality in relation to inhalable particulate matter less than 10 microns (PM-10). Approximately 90 percent of these small particles are considered to be dust. Existing dust control regulations by local agencies, municipal departments, public works department, and public health departments are in place in some regions within California.

Many local agencies require dust control in order to comply with local nuisance laws, opacity laws (visibility impairment) and the requirements of the Clean Air Act. The following are measures that local agencies may have already implemented as requirements for dust control from contractors:

- Construction and Grading Permits: Require provisions for dust control plans.
- Opacity Emission Limits: Enforce compliance with California air pollution control laws.
- Increase Overall Enforcement Activities: Priority given to cases involving citizen complaints.
- Maintain Field Application Records: Require records of dust control measures from contractor;
- Stormwater Pollution Prevention Plan: (SWPPP): Integrate dust control measures into SWPPP.

Dust Control Practices

Dust control BMPs generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. The following table shows dust control practices that can be applied to site conditions that cause dust. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel 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 can be employed for areas of occasional or no construction traffic. Preventive measures would include minimizing surface areas to be disturbed, limiting onsite vehicle traffic to 15 mph, and controlling the number and activity of vehicles on a site at any given time.

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

Additional preventive measures include:

- Schedule construction activities to minimize exposed area (EC-1, Scheduling).
- 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.
- Minimize the impact of dust by anticipating the direction of prevailing winds.
- Direct most construction traffic to stabilized roadways within the project site.
- Water should be applied by means of pressure-type distributors or pipelines equipped with a spray system or hoses and nozzles that will ensure even distribution.
- All distribution equipment should be equipped with a positive means of shutoff.
- Unless water is applied by means of pipelines, at least one mobile unit should be available at all times to apply water or dust palliative to the project.

- If reclaimed waste water is used, the sources and discharge must meet California Department of Health Services water reclamation criteria and the Regional Water Quality Control Board requirements. Non-potable water should not be conveyed in tanks or drain pipes that will be used to convey potable water and there should be no connection between potable and non-potable supplies. Non-potable tanks, pipes, and other conveyances should be marked, "NON-POTABLE WATER - DO NOT DRINK."
- Materials applied as temporary soil stabilizers and soil binders also generally provide wind erosion control benefits.
- Pave 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 inactive construction sites using vegetation or chemical stabilization methods.
- Limit the amount of areas disturbed by clearing and earth moving operations by scheduling these activities in phases.

For chemical stabilization, there are many products available for chemically stabilizing gravel roadways and stockpiles. If chemical stabilization is used, the chemicals should not create any adverse effects on stormwater, plant life, or groundwater.

Costs

Installation costs for water and chemical dust suppression are low, but annual costs may be quite high since these measures are effective for only a few hours to a few days.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Check areas protected to ensure coverage.
- Most dust control measures require frequent, often daily, or multiple times per day attention.

References

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

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

Caltrans, Standard Specifications, Sections 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative".

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, April 1991.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Invasive Species Control Plan

EMERALD DRAGONFLY FARMS, LLC

Humboldt County, CA

A FAMILY OWNED BUSSINESS

Applicant: Emerald Dragonfly Farms, LLC

Owner: Janet Mattson

Agent: Lydia Baird-Adams
Agent Phone : (707)-725-5182

APN: 206-191-019
Planning Application Number: PLN-2019-15889
Application Number: 45646
Permit Number: ZCC 16-004

Date: December 14, 2019

consensus with all partners including the nursery industry are marked with a green X. All other species are only listed by Cal-IPC.

Regions based on Sunset Climate Zones were developed by PlantRight (see source online).

Region	Sunset Zones
Sierra and Coastal Mountains	1-3
Central Valley	7-9
Desert	10-13
North/Central Coast and Delta	14-17
South Coast	18-24

Notes		
E	Edible	This plant species has edible fruit and is grown for human consumption. Though birds may spread seeds, these plants can be grown relatively safely if fruit is harvested. Particular care should be taken near riparian areas. Fruitless varieties may be available for landscaping, and can be grown safely.
F	Forage	This plant species is used for forage and is already widespread in California. Additional use is unlikely to increase the plant's spread.
T	Turfgrass	This plant species is used for turfgrass and may be used safely for sports fields and landscaping if properly tended within borders.

Checklist of Invasive Plants

			Regions
Acacia dealbata	silver wattle		◆◆ ◆◆
Acacia melanoxylon	blackwood acacia		◆◆ ◆◆
Agrostis stolonifera[T]	creeping bentgrass[T]		◆◆ ◆◆◆
Ailanthus altissima	tree-of-heaven	X	
Arctotheca calendula	fertile capeweed	X	
Arctotheca prostrate	South African capeweed		◆ ◆◆
Arundo donax	giant reed	X	
Asparagus asparagoides	bridal creeper		◆ ◆◆
Asphodelus fistulosus	onionweed	X	
Atriplex semibaccata	Australian saltbush		◆ ◆◆
Briza maxima	big quakinggrass		◆◆ ◆◆
Carpobrotus chilensis	iceplant		◆◆
Carpobrotus edulis	highway iceplant	X	◆◆
Centaurea debeauxii	meadow knapweed	X	
Chrysanthemum coronarium	garland chrysanthemum		◆◆
Cordyline australis	giant draceaena		◆◆
Cortaderia jubata	jubatagrass	X	◆◆ ◆◆◆
Cortaderia selloana	pampasgrass	X	◆ ◆◆
Cotoneaster franchetii	cotoneaster		◆◆
Cotoneaster lacteus	Parney's cotoneaster		◆◆
Cotoneaster pannosa	silverleaf cotoneaster		◆◆ ◆◆
Cotula coronopifolia	common brassbuttons		◆◆ ◆◆
Crataegus monogyna	English hawthorn		◆◆ ◆
Crocosmia x crocosmiiflora	montbretia		◆
Cynara cardunculus	artichoke thistle	X	
Cynodon dactylon[T]	Bermuda grass[T]		◆◆ ◆◆◆
Cynoglossum officinale	beggar's-lice		◆
Cytisus scoparius	Scotch broom	X	
Cytisus striatus	Portuguese broom		◆ ◆◆
Dactylis glomerata[F]	orchard grass[F]		◆◆ ◆◆◆
Delairea odorata	Cape-ivy	X	
Digitalis purpurea	foxglove		◆◆ ◆◆
Dipsacus fullonum	common teasel		◆◆ ◆◆
Echium candicans	pride-of-Madeira		◆◆
Egeria densa	Brazilian egeria		◆◆ ◆

X - illegal per CDFA regulation
X - on PlantRight's voluntary list

E – edible
F – forage
T – turfgrass

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◆	Sierra and Coastal Mountains	1-3
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Prepared by California Invasive Plant Council, www.cal-ipc.org

Eichhornia crassipes	water hyacinth	X		◆		◆	◆
Elaeagnus angustifolia	Russian olive		◆	◆	◆	◆	◆
Erica lusitanica	Spanish heath					◆	
Erodium cicutarium	filaree		◆	◆	◆	◆	◆
Eucalyptus camaldulensis	red gum		◆	◆		◆	◆
Eucalyptus globulus	Tasmanian bluegum					◆	◆
Euphorbia esula	leafy spurge	X					
Euphorbia oblongata	oblong spurge	X					
Festuca arundinacea[T]	alta fescue[T]		◆	◆	◆	◆	◆
Ficus carica[E]	edible fig[E]		◆	◆	◆	◆	◆
Foeniculum vulgare[E]	fennel[E]		◆	◆	◆	◆	◆
Gazania linearis	gazania					◆	◆
Genista monspessulana	French broom	X					
Hedera canariensis	Algerian ivy		◆	◆		◆	◆
Hedera helix	English ivy		◆	◆		◆	◆
Helichrysum petiolare	licorice plant					◆	◆
Hirschfeldia incana	Mediterranean mustard		◆	◆	◆	◆	◆
Holcus lanatus	common velvet grass		◆	◆		◆	◆
Hypericum canariense	Canary Island St.	X					
Hypericum perforatum	klamathweed	X					
Ilex aquifolium	English holly		◆			◆	
Iris pseudacorus	yellowflag iris	X		◆		◆	◆
Isatis tinctoria	dyer's woad	X					
Kochia scoparia[F]	kochia[F]		◆	◆	◆	◆	◆
Leucanthemum vulgare	ox-eye daisy		◆	◆		◆	◆
Linaria genistifolia ssp. Dalmatica	Dalmatian toadflax	X					
Linaria vulgaris	yellow toadflax		◆			◆	
Lobularia maritime	sweet alyssum		◆	◆	◆	◆	◆
Lolium multiflorum[F]	Italian ryegrass[F]		◆	◆	◆	◆	◆
Ludwigia hexapetala	creeping waterprimrose	X					
Ludwigia peploides	creeping waterprimrose		◆	◆		◆	◆
Lythrum salicaria	purple loosestrife	X					
Marrubium vulgare	horehound		◆	◆	◆	◆	◆
Mentha pulegium	pennyroyal		◆	◆		◆	◆
Mesembryanthemum crystallinum	crystalline iceplant					◆	◆
Myoporum laetum	ngaio tree					◆	◆
Myosotis latifolia	common forget-me-not		◆			◆	
Myriophyllum aquaticum	parrotfeather		◆	◆	◆	◆	◆
Nicotiana glauca	tree tobacco		◆	◆	◆	◆	◆

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Olea europaea[E]	European olive[E]		◆◆ ◆◆
Onopordum acanthium	Scotch thistle	X	
Pennisetum setaceum	green fountain grass	X	◆ ◆◆◆
Phalaris aquatic	hardinggrass		◆◆ ◆◆
Phoenix canariensis	Canary Island date palm		◆◆ ◆◆
Phytolacca Americana	common pokeweed		◆◆ ◆◆
Plantago lanceolata	buckhorn plantain		◆◆ ◆◆◆
Poa pratensis[T]	Kentucky bluegrass[T]		◆◆ ◆◆
Polygonum cuspidatum	Japanese knotweed	X	
Prunus cerasifera	cherry plum		◆◆ ◆◆
Pyracantha angustifolia, P. crenulata, P.	firethorn		◆◆ ◆◆
Ranunculus repens	creeping buttercup		◆◆ ◆
Retama monosperma	bridal veil broom	X	
Ricinus communis	castor bean		◆◆ ◆◆
Robinia pseudoacacia	black locust		◆◆ ◆◆◆
Rubus armeniacus	Himalayan blackberry		◆◆ ◆◆◆
Rumex acetosella	sheep sorrel		◆◆ ◆◆
Saccharum ravennae	ravennagrass	X	
Salvia aethiopis	Mediterranean sage	X	
Saponaria officinalis	bouncing-bet		◆◆ ◆◆
Schinus molle	Peruvian pepper tree		◆◆◆◆
Schinus terebinthifolius	Brazilian pepper tree		◆◆◆◆
Sesbania punicea	scarlet wisteria	X	
Silybum marianum	milk thistle		◆◆ ◆◆
Spartium junceum	Spanish broom	X	
Stipa tenuissima	Mexican feathergrass	X	◆◆ ◆◆◆
Tamarix parviflora	smallflower tamarisk	X	
Tamarix aphylla	athel		◆◆ ◆◆◆
Tamarix ramosissima, T. gallica, T. chinensis	saltcedar	X	
Tanacetum vulgare	common tansy		◆◆ ◆◆
Triadica sebifera	Chinese tallow tree	X	◆
Verbascum thapsus	wooly mullein		◆◆ ◆◆
Vinca major	bigleaf periwinkle	X	◆◆ ◆◆◆
Washingtonia robusta	Mexican fan palm		◆◆ ◆◆
Watsonia meriana	watsonia		◆
Zantedeschia aethiopica	calla lily		◆◆ ◆◆

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Prepared by California Invasive Plant Council, www.cal-ipc.org

Record of Changes

2017.09.07 – Corrected *Cordyline australis* regions. Updated Cal-IPC description and logo.

2018 05.08 – Corrected *Crocosmia* regions.

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Materials Management Plan

EMERALD DRAGONFLY FARMS, LLC

Humboldt County, CA

A FAMILY OWNED BUSSINESS

Applicant: Emerald Dragonfly Farms, LLC

Owner: Janet Mattson

Agent: Lydia Baird-Adams
Agent Phone : (707)-725-5182

APN: 206-191-019
Planning Application Number: PLN-2019-15889
Application Number: 45646
Permit Number: ZCC 16-004

Date: December 14, 2019

Introduction

Commercial Cannabis Cultivation Ordinance Number 2599 Section 314-55.4.12.1.13 of Humboldt County Code requires a Waste and Hazardous Materials Plan. The purpose of this document is to address and describe a plan for the disposal of waste including plant material, greenhouse framing, plastics, household trash, packing containers, propagation containers, electric lightning fixtures, cleaning materials, chemical handling procedures...etc.

Cultivation Project Description

The parcel where the commercial cannabis cultivation operation (site) will take place is owned by Janet Mattson and the company is operated by Emerald Dragonfly Farms, LLC. The site is located approximately 30 miles south-southeast of the city of Eureka, CA at 400 Corbett Ranch Lane, Carlotta, CA. The parcel designation is APN:206-191-019, is 84.0 acres, and is zoned as agricultural exclusive. The site is accessed by a small gravel road off California Highway 36. The site is located approximately 300 feet north of the Van Duzen River and 1000 feet south-southwest of Cummings Creek. None of the cultivation activities are near any sensitive receptors and no buildings with a nexus to the cannabis operation are proposed currently. Below is an topographical map of the project site.

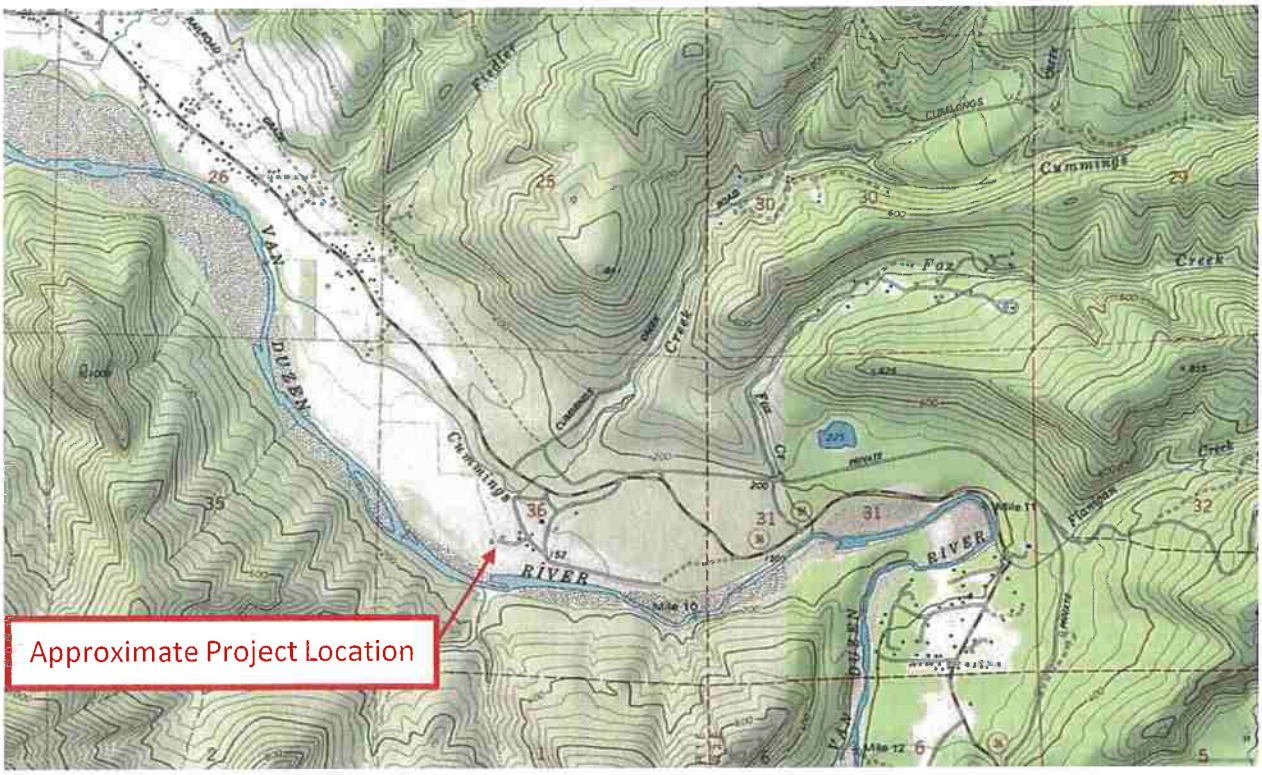

Figure 1: Project Site Location

Cultivation and Operations

Emerald Dragonfly Farms, LLC is requesting an additional 5,000 sqft to the already existing 10,000 sqft of cultivation. The cannabis will be grown in full-sun with the exception of the immature plant propagation area. The property owner, and up to eight seasonal employees will conduct all aspects of the cultivation operation

The cultivation period will last approximately five months out of the year. The process starts with the propagation of "clones" in May. The young plants are started in small pots then the plants are then moved to larger pots outdoors where they will remain until harvest season. The plants mature in September and will be hand-harvested, bucked down and dried beginning in October/November.

Water allocated for the operation will be contained in 27 5,000 gallon water tanks located directly adjacent to the outdoor cultivation area. All plants will be hand watered as necessary depending on demand/weather. If, for some reason, the plants cannot be hand watered, irrigation line with metered and timed electronic control units will be used. Vertical posts, wire, natural fiber, or other cordage will be used to support the weight of flowering plants.

Allowable Methods for Cannabis Waste Disposal

California Code of Regulations Title 3. Food and Agriculture Division 8 Cannabis Cultivation Chapter 1 Cannabis Program requires cannabis plant waste to be rendered unusable and unrecognizable before disposal. Licensees can dispose of cannabis waste in three ways: 1. on-site composting 2. Permitted waste hauler, and/or 3. Self-hauling to a licensed solid waste facility. Most cannabis waste created by the applicant will be disposed of onsite using method 1.

Storage and Disposal of Cannabis Waste

Onsite composting is the chosen method for the majority of waste disposal for the operation and the most sustainable way to render cannabis waste unusable and unrecognizable. The process begins by grinding the plant and other organic cannabis material then combining the debris with cellulose waste (paper, cardboard, yardwaste..etc) and growing media, or soil. Grinding the material increases the rate of decomposition and renders the plant unusable.

After each harvest the applicant will store any cannabis waste in totes until it can be processed. If any of the cannabis waste cannot be composted for whatever reason the applicant will store it onsite in totes until it can be moved off-site. When the applicant is ready, they will move the cannabis waste to a manned station at Eel River Recology in Fortuna, CA. Any non-cannabis waste will also be stored onsite in water tight/resistant trash receptacles until they can be moved to a manned waste management facility such as Humboldt Waste Management Authority in Eureka, CA.

Any transportation of cannabis waste will be completed by the applicant. The applicant will use a trailer specifically devoted to hauling of cannabis waste, the trailer will be stored on the property in-between usage. The trailer will be tarped and the waste itself will be placed in garbage bags, totes, or other difficult to access water tight/resistant receptacles.

The trailer and motor vehicle will be driven by the applicant or employees over the age of 21. The applicant will obtain a certified weight ticket or other receipt documentation prepared by the facility of choice receiving the cannabis waste. All records of cannabis waste

transportation, weight, and other waste disposal/management activities will be kept and maintained by the applicant.

The applicant will provide a short training for the storage, transportation, and disposal of waste. No waste will be moved or disposed of without any of the proper permits for local and state regulatory authorities. The applicant will also provide any required training for record keeping methods and creation for any of the activities mentioned above.

Soil Management

Composted soil generated onsite will stockpiled and used exclusively. The applicant will not use offsite soil. Below is a table of nutrient requirements by volume for each season.

Table 1: Nutrient Use (Estimate)

Nutrient Use	
Product	Volume
Bloom 2-2-10	11.5 Gallons
Grow 15-5-5	4.5 Gallons

Nutrients, Fertilizer, and Pesticide Storage

The applicant will follow all directions, precautionary statements, and recommendations when any pesticide is used. Pesticides will be stored according to the product labels for the protection of humans and environmental health. The pesticides will be stored in a locked building on the parcel. Any nutrient, fertilizer, and pesticide will be stored in a locked storage facility on shelves away and off the ground.

Training and instruction will be provided for spill containment and cleanup, fertilizer storage, pesticide application, and personal protective equipment. Pesticides will be applied as minimally as possible, not when pollinators are present, and will not be sprayed in conditions that will cause drift in wind and off the surface of the ground. Employees will be trained in pesticide agricultural use requirements, method of application, and restricted entry intervals. The applicant will not apply pesticides that may reach ground or surface water.

General Refuse and Recycling

Household waste and general refuse will be generated by the applicant. The waste created by the applicant includes and is not limited to greenhouse sheathing, coverings, product packaging, irrigation tubing, pots, containers, and household trash. The applicant will have designated recycling and general refuse storage receptacles for their waste. The receptacles will be emptied weekly or as needed. Training will be provided to all employees to ensure recyclable material is properly disposed of and does not contaminate other types of waste.

Disposal of Electrical and Lighting Equipment

Lightbulbs, electrical lighting fixtures, wiring, and Compact Florescent Lighting containing mercury will be disposed of under the recommendations of the manufactures and/or Humboldt Waste Management Authority. Any waste considered "E-Waste" containing rare earth metals, cadmium, chromium...etc will be disposed of at the following facilities.

Table 2:Electrical Disposal Facilities

Eureka Recycling Center	Humboldt Sanitation	Recology Eel River
1059 W Hawthorne Street	2585 Central Avenue	965 Riverwalk Drive
Eureka, CA	McKinleyville, CA	Fortuna, CA

Hazardous Waste

Cannabis facilities contain similar hazardous waste to any conventional agricultural operation. Common hazardous materials include but are not limited to soil amendments, fungicides, herbicides, insecticides, cleaners, sanitizers, and vehicle lubricants.

Every pesiticide, fungicide, herbicide, insceticides...etc will be disposed of according to the product recommendations and directions. In additions to the recommendations and directions the applicant will contact the local waste facility on how to properly and safely dispose of spent material. The items mentioned above used for the operation will be kept and disposed of separately from household waste, cannabis organic material, and general waste.

All vehicle lubricants and fuel used for the operation will be stored safely away from surface water as far as possible. Any spent motor oil will be stored in a spill proof container and taken to a certified collection center. If the applicant has more than five gallons of spent motor oil the applicant will contact a registered California Hazardous Waste Transporter for pick up. Any spent fuels, cleaners, and/or sanitizers will be disposed of at the Humboldt Waste Management Authority Household Hazardous Waste Facility in Eureka.

The applicant will most likely not use enough hazardous materials to the threshold that requires reporting. However, if the applicant does, the applicant will prepare a materials management plan which details the following; operating procedures and processes, associated equipment and cleaning procedures, chemical requirements and reactions, waste volumes, storage areas, chemical handling procedures, and emergency equipment. This will be completed and reported to the Humboldt County Department of Environmental Health and the applicant will also register with the California Environmental Reporting System (CERS).

Waste Reduction

The applicant will try as much as possible to reduce waste and recycle. The applicant will also use green chemistry substitutes whenever possible. The applicant will buy a single year supply of products to prevent excess material from expiring or becoming obsolete as regulations change. The applicant will only prepare the minimal recommended amount of dosage required for each pesticide, herbicide, fungicide, and insecticide application. The applicant will purchase long lasting bulbs or LEDS whenever possible.