SITE MANAGEMENT PLAN

In fulfillment of
Order WQ 2017-0023-DWQ

General Waste Discharge Requirements for Discharges of Waste Associated with Cannabis Cultivation Activities

Prepared for:

New Earth Farms, LLC – Staton Lane

APN: 524-072-010

and

California State Water Resources Control Board

Tier 1, Low Risk Discharger
WDID: 1B171453CHUM

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INTRODUCTION

This Site Management Plan (SMP) has been developed to satisfy the requirements of the Tier 1 enrollment conditions in the State Water Resource Control Board (SWRCB) Order No. WQ 2017-0023-DWQ (Order). The purpose of the Order is to implement the Cannabis Policy requirements for waste discharges associated with cannabis cultivation. The Policy provides a structure for managing water quality and instream flow impacts associated with cannabis cultivation. It also establishes criteria for personal use and site conditional exemptions and includes a tiered approach for permitting discharges of waste. All eligible dischargers developing land for cannabis cultivation activities are required to enroll in the program under the Order. Dischargers must implement Best Practical Treatment or Control (BPTC) measures and submit technical and monitoring reports to assure compliance with the Order. The SMP describes how the discharger is complying with the applicable BPTC measures listed in the Policy and how they are being implemented property-wide.

SITE INFORMATION

Registrant: New Earth Farms, LLC.
P.O. Box 470
Salyer, CA, 95563

Site Address: 600 Staton Lane, Willow Creek, CA, 95573

Parcels: Assessor Parcel Number: 524-072-010
Lat/Long: 40.889374°, -123.631620°

Zoning: General Plan: RA40 (Residential Agriculture)
Use code description: Improved, Rural Residential
Zone: U (Unclassified)

Acreage: 524-072-010 (30 acres assessed as per Humboldt County)
±21.74 acres as per Humboldt County Web GIS
Total Disturbed Area = 17,100 sf (0.39 acres)

Location: The project site is located at 600 Staton Lane, Willow Creek, CA. From Willow Creek, Ca, take Highway 299 south for approximately 4 miles before arriving at Friday Ridge Road edit (Co Route 8L100). Take Co Route 8L100 for approximately 2.43-miles before arriving at a paved road which turns right and upslope from the main road. Travel for an additional 0.13-miles before taking a right on Staton lane. Travel for approximately 0.57 miles on the gravel road before arriving at the project site (600 Staton Lane).

Site Description: The property is centered on a large meadow historically utilized as a homestead. The parcel runs from north to south and parallels Staton Lane. There is one watercourse which flows through the parcel, an unnamed ephemeral watercourse. The ephemeral watercourse leads to a legacy stock pond which is not currently utilized for cultivation. The enrolled property consists of a single parcel, APN: 524-072-010 (30 acres as assessed), hereafter referred to as the "Project Site". The parcel comprising the Project Site runs lengthwise north to south with dimensions approximately 1,557-feet by 640 feet in width.

The Project Site is zoned unclassified. The Project Site is primarily comprised of coniferous forests with a large central meadow consisting of grasses. The forested lands are composed of fir with some Oak and other coniferous species covering approximately 80% of the Project Site. Cultivation activities are outside of riparian areas and occur on the large flat meadow which appears to have been historically utilized for homesteading / ranching purposes. Buildings on the Project Site include a single residence (approximately 1,750 sf) and appurtenant shed building (approximately 280 sf) and a barn building (approximately 1,570 sf). Both residence and barn building were constructed pre-1988 *(per Google Earth Aerial Imagery)* and historically utilized for homesteading activities on the Project Site. The parcel has a PG&E power drop which delivers power to the residence and barn building, as well as supplying all needed power for cultivation related activities. The climate is characterized by hot dry summers and cool mild winters with occasional frost. Rainfall for the region averages 56-inches per year as measured from annual precipitation data spanning the years 1981-2010. *Data taken from* - (https://datagateway.nrcs.usda.gov/GDGHome.aspx). The parcel occupies a mid-slope setting with mountainous slopes descending from the west side. Cultivation operations on the Project Site consist of mixed light cultivation in hoop houses. All cultivation shall is conducted in soil bags or above ground grow pots.

In total 17,500 gallons of water storage exist on-site in the form of rigid plastic storage tanks (one (1) 5,000-gallon tank and five (5) 2,500-gallon tanks. Currently, water is sourced from two locations, a permitted groundwater well (see attached well log, permit no. 16/17-0181) and a shallow water well (Well-1 and Well-2 respectively). Waters from the wells shall be drafted for irrigation, domestic purposes and fire suppression.

TIER AND RISK DESIGNATION

The Cannabis Policy provides criteria for evaluating threats to water quality for cannabis cultivation sites based on three site characteristics: proximity to water body, total disturbed area, and slope of the disturbed area. Based on the criteria and site characteristics the subject property is designated as a **Tier 1 Discharger**. The total disturbed area is 0.39 acres (Table 1). The primary sum of disturbed area on the parcel is represented by cultivation areas followed by roads requiring upgrading, water storage structures & appurtenant buildings. Cultivation takes place on a large flat meadow area which was historically

utilized for homesteading and ranching activities. The previous landowner and current cultivator have taken advantage of the cleared areas.

In addition, a risk designation is assigned based on the slope of the disturbed areas and proximity to a waterbody. Based on these parameters, the subject property is designated as a **Low Risk** site**.** The total disturbed area of 0.39 acres exists on the Project Site, all of which is located on slopes less than 30%. All outdoor cultivation areas consisting of proposed 10,000 sq. ft of greenhouses are located outside of any riparian buffer zones of surface waters within the Project Site (Table 1).

Table 1: Disturbed Area Size, Slopes, and Setbacks

Disturbed Area Type	Area (ft^2)	Disturbed Area Slope	Distance to Water Body (ft.)	Water Body Type
Cultivation Areas	9,500	9.8%	>100	CIII fed Pond
Immature Plant Areas	4,800	8.2%	>150	CIII fed Pond
Road / portions needing upgrades / reconditioning	1,882	4.8%	-	-
Water Storage Tanks	278	10.5%	>50	Class III fed Pond
Structures (storage harvest sheds)	440	8.2%	>150	Class III fed Pond
Compost Location	200	16.4	>50	Class III watercourse
Total Disturbed Area	**17,100**	11.1% (avg)	-	-

The main road used to access the parcel is a private road accessible from Friday Ridge Road off California Highway 299. All cultivation takes place on naturally occurring flats. Outdoor Cultivation activities on the Project Site take place outside of all the riparian buffer zones on the property. Approximately 0.9 miles of private access road were assessed by NorthPoint staff on the Project Site. Roads on the Project Site are comprised of private access roads. For purposes of this document, the private access road has been categorized as “Access Driveway” and “Well-Flat Access Road” respectively.

This parcel was historically utilized for homestead/ranching activities. The road network consisting of “Access Driveway” & “Well-Flat Access Road” on the Project Site is pre-existing. Access Driveway leads directly to the barn and residence on the property, with an abandoned skid road continuing in a northern direction through the woods. Well-Flat Access Road is a low / no fill volume road upon which sub-angular road base rock has been added to provide access to an upper graded flat upon which Well-1 and a single 2,500-gallon rigid plastic water storage tank are located.

Disturbance areas calculated as part of the impacts on the Project Site have been taken to include cultivation sites, road portions which require remediation to prevent erosion, water storage structures and accessory buildings. The short lengths of road sections on the Project Site are generally in stable condition but lacked adequate drainage features to prevent ponding and minor erosion of the road surfaces. The roads are comprised of native material driving surfaces, some of which appear to have been rocked in the past. The largest threat of sediment delivery to surface waters was observed at a portion of “Access Driveway”

adjacent to the residence where a plugged ditch relief culvert (DRC) had caused water to pond along a low point on the road surface. Road upgrades including insloping and the construction of French drains and inboard ditches have been prescribed as part of this Site Management Plan (SMP) to prevent continued erosion along the road surface. In general, roads on the Project Site are maintained according to the guidance provided by the *Handbook for Forest, Ranch, and Rural Roads (Weaver, Weppner & Hagans, 2015)* ("Roads Handbook"). Thus, as described in section 1.1.2 below, only that portion of the road not meeting the design criteria for road performance has been included in the total disturbed area. A total disturbed area of 17,100 sf (0.39 acres) has been identified as part of this SMP. See the disturbance area callouts in Appendix A for areas included in the total calculation for disturbed area. See Table 1., above for disturbance area totals by category.

BEST PRACTICAL TREATMENT OR CONTROL (BPTC) MEASURES

BPTC measures are being utilized as part of the road maintenance program to protect water quality. The *Solid Waste Management, Construction Site Best Management Practices Manual* by the CA Department of Transportation (Caltrans) is referenced for the correct installation, maintenance, and monitoring of all applicable erosion control and sediment capture BPTC measures.

All straw mulch must be free of noxious weeds and all seed/plants must be non-invasive. A list of prohibited species can be found in the CA Invasive Plant Council's database. Erosion control measures shall not include synthetic monofilament netting, including photo- and biodegradable plastic netting. All netting shall be made of jute, coir fiber, hemp, or another product without welded weaves.

A schedule of BPTC measures to be implemented and maintained throughout the site is shown in Appendix C, and Appendix D includes specifications for BPTCs.

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1. SEDIMENT DISCHARGE BPTC MEASURES

1.1. SITE CHARACTERISTICS

1.1.1. SITE MAP

The site map shows all relevant site features: streams, stream crossings, storage areas, roads, buildings, cultivation areas, and other disturbed areas related to cultivation activities. Erosion prevention and sediment control BPTC measures are identified on the site map (see Appendix A).

1.1.2. ROAD CONDITIONS

The Project Site is accessed via privately maintained roads off CA Highway 299 (Friday Ridge road thence Staton Lane thence Access Driveway). The road network on the parcel was previously developed as part of legacy timber harvesting activities. The road network is believed to have then been utilized for homestead access and consists of native material roads with some rocked surfaces. A single access road provides ingress and egress to the site from the

private access road off Friday Ridge Road (Staton Lane). The shared use access road (Staton Lane) is in good condition without significant runs of erosion gullying or rilling. See section 1.2.1.1. for road upgrade descriptions.

Staton Lane receives an unknown number of daily vehicle trips at any point in the year. The private "Access Driveway" which terminates on the Project Site also provides access to neighboring parcels. During NorthPoint's field investigation of the Project Site, no traffic was observed on any of the access roads at any point during the approximately 3 - hour site inspection. Additional road maintenance is prescribed in section 1.2.1. below.

1.1.3. WATER BODIES, STREAM CROSSINGS, RIPARIAN SETBACKS

The Project Site occupies a mid-slope setting with a large naturally flat bench upon which a meadow of grasses and shrubs is sited. The site drains eastward toward the Trinity River, a Class I watercourse located approximately 1.2 miles away.

Two (2) surface water crossings were identified as part of NorthPoint's field investigation on the Project Site (STX-1 and Pond Outlet). Both crossings consisted of culverted crossings. STX-1 crosses a small access road, while Pond Outlet crosses an abandoned skid-road on the northern portion of the property. See section 1.2.1.3. for surface water crossing details.

Water is sourced from two wells, a bedrock well and a shallow water well (Well-1 and Well-2 respectively). A legacy pond created prior to 1988 is located on the Project Site & is fed by an ephemeral Class III watercourse. The pond is not currently utilized as a water source for cannabis cultivation but is proposed as a storage location for non-cannabis landscape irrigation and fire suppression waters.

A Lake or Streambed Alteration Agreement (LSAA) with the California Department of Fish and Wildlife (CDFW) has been submitted to address the use of both wells for domestic & irrigation purposes as well as the two surface water crossings (STX 1 & Pond Outlet). The use of the pond as a storage facility has also been requested in the submitted notification.

All proposed cultivation areas, proposed storage facilities and planned stockpiled materials on the Project Site are outside of the riparian buffer zones of any nearby surface waters. The property was acquired by the current landowner as of 2018. During the time of NorthPoint's field investigation the current landowner was in the process of cleaning the property from the previous occupants. Good housekeeping practices were being put into place on the Project Site at the time of NorthPoint's field investigation but additional cleaning of cultivation related wastes are required.

1.1.4. SOIL DISTURBANCE

Soil disturbance on the Project Site is minimal in nature and is mostly constrained to the development of Cultivation Areas. Minor amounts of earthmoving appear to have happened in the past to facilitate the placement of the hoop houses on the generally flat meadow. A cut slope approximately 8-feet high was identified in the northwestern most corner of the Cultivation Area. Due to the gentle topographic relief of the meadow setting, no fill slope was created or required as part of the past earth moving activities.

The cultivation area is located on a naturally flat meadow area. The operators of the cultivation area have taken advantage of those areas on the Project Site which featured the most naturally gentle topographic relief. No instabilities nor past or expected future failures as a result of any earthwork were visibly apparent (scarps, slumping, pressure cracks, etc.).

1.2. SEDIMENT EROSION PREVENTION AND SEDIMENT CAPTURE

1.2.1. EROSION PREVENTION BPTC MEASURES

1.2.1.1. ROADS

The road network consisting of “Access Driveway” & “Well-Flat Access Road” is short in length and lacks permanent drainage features adequate to break up hydrologic connectivity to surface waters. Emergent groundwater due to seasonal rains was observed seeping along the road in worn wheel ruts along the rocked road surface. Erosion from the pervasive flow appeared minimal due to the ephemeral nature of the flows and from the erosion resistant road surfacing.
To direct water off the running surface of the road network, the “Well Flat Access Road” is proposed to be in sloped for approximately 250-feet. An inboard ditch shall be constructed to convey and maintain stormwater and emergent groundwater off the road surface. The inboard ditch shall terminate at a series of two proposed sediment capture basins and DRC #1. DRC #1 shall outlet to a drainage swale / inboard ditch at the southern-most edge of the northern meadow to direct ditch flow and surface flows to DRC #2 and off the property.

Water was observed emerging from the toe of the cut slope along the northernmost corner of the Cultivation Area. Water was observed to run adjacent to the northernmost Hoop House and then continue southward along “Access Driveway” before reaching the area where ponding was observed at the existing DRC. A french drain is proposed to be installed along the toe of the cut slope at the northern edge of the Cultivation Area and extending along the eastern edge of the greenhouses to allow emergent groundwater to drain to an inboard ditch and pass through DRC #2.

See Appendix A for recommended locations of road drainage features.

Erosion prevention measures including the installation of the French drains and the in-sloping of access roads will be implemented during the dry summer months. The road construction standards described in the "Roads Handbook" will be adhered to for all road improvements. See Appendix C for the Schedule of BPTC Implementation and Maintenance.

1.2.1.2. DISTURBED AREAS

All cultivation activities occur on historically created graded flats. The flats appear to have been developed on naturally occurring flat locations where cut and fill earthwork efforts were minimal to create the maximum amount of usable space. All roads and developed or disturbed areas appear stable and settled, with no obvious indicators of failure (scarping, cracking, slumping) visibly apparent on any exposed surfaces. All cultivation area surfaces and fill slopes are well vegetated. The largest portion of disturbed area not covered by a cultivation facility (hoop house, storage building, etc.) lacking vegetation are those road surface portions requiring maintenance. The mitigation of potential erosion at these locations will consist of redirecting drainage patters to inboard ditches and / or French drains. Reshaping of the road surface is not anticipated with the exception of a possibility of the in-sloping of "Well-Flat Access Road" as described in section 1.2.1.1 above. Inboard ditch construction where upgrades to the ground surface denude existing vegetation shall be reseeded with erosion control seed and mulched with straw hay. Any exposed soil within disturbed areas will be seeded and mulched with straw and erosion control seed as described in section 1.1.4, above. All existing live mulch will be maintained as feasible. In addition to erosion control seed being applied, hay mulch will be applied over the seed for protection from physical erosion (wind & precipitation). Additionally, the seed and straw will protect the bare earth pad surfaces from physical erosion during the interim period as vegetation is re-established. There are no planned areas for disturbance / development at this time as part of continued operations on the Project Site.

1.2.1.3. STREAMS AND STREAM CROSSINGS

Two (2) surface water road crossings exist on the Project Site (STX-1 and Pond Outlet). Stream Crossing -1 (STX-1) features a 24-inch diameter HDPE culvert upon which "Well-Flat Access Road" crosses. Pond Outlet consists of an 18-inch diameter steel culvert which drains the pond fed by an ephemeral CIII watercourse (connected to STX-1 upstream).

Due to the moderate to low occurrence of forested cover in the drainage areas on the Project Site, a headwall to diameter ratio (HW/D) of 0.75 (designed to pass ~3/4 capacity of the total pipe diameter at Q=100) was selected as a key design parameter to account for passage of woody debris in transport as per "*Designing Watercourse Crossings for Passage of 100-Year Flood Flows, Wood, and Sediment" (*Cafferata et al, 2017). The low

observed amount of wood available for transport on the Project Site and the characteristics of the bedload minimize the likelihood of culvert failure due to plugging or racking of woody debris and justifies the design selection of a HW/D of 0.75.

STX-1: Located at: 40.139513°, -123.693828°, STX-1 consists of a small CIII watercourse which crosses a low fill-volume rocked access road via a 24-inch diameter corrugated plastic culvert pipe. The crossing is at grade, and in the natural orientation of the watercourse. The inlet of the culvert was slightly covered with some of the angular road rock utilized to build the road bench but did not appear to be threatening the hydraulic capacity of the conveyance structure, nor pose a threat to water quality. Channel observations made upstream of the crossing site of bedload, woody debris available for transport, and channel dimensions indicate that the existing crossing is sized adequately for a 100-year storm event. The crossing has minor diversion potential to the right. An existing shallow dip in the road lacks the definition necessary to ensure that water does not divert from the native channel in the event of a culvert failure. No evidence of erosion associated with this crossing site were observed. In general, the channel is thickly vegetated with grasses, blackberry bushes and other unidentified small woody shrubs. Channel characteristics were consistent with that of an ephemeral drainage, small weakly defined bed and banks and no riparian specific vegetation.

Expected 100-year flood flows for this crossing site are calculated to be approximately 10.883 cubic feet per second (cfs). The basin draining to the crossing site was measured to be 9.48 acres in total area. The crossing is calculated to be adequately sized for the expected 100-year streamflow event and associated debris and field observation indicate that the culvert is performing adequately. The culvert should be maintained and checked to ensure that no debris accumulates. A critical dip should be installed along the right hinge line of the crossing to prevent diversion in the event of a culvert failure (see Appendix A for recommended location).

Pond Outlet: Located at: 40.890054°, -123.631991°, Pond Outlet consists of an 18-inch diameter culvert which functions as a spillway for the onstream pond on the property. The pond receives ephemeral flow from the CIII watercourse which passes through STX-1, above. The outboard berm of the impoundment feature appears to have been constructed as part of the legacy skid road network which runs throughout the local area. The skid road is not used but could serve as an emergency escape route in the event of a fire. Observations of the running surface of the road (wheel ruts, vegetation patterns, etc.) indicate that the road has not been recently traversed by vehicular traffic. A gate consisting of t-posts and trellis netting has been erected blocking access of the road. The pond was constructed pre-1988 as per available aerial imagery. The existing culvert is in poor shape and is placed high in the fill. An approximate 2-foot drop

was observed at the outlet with significant undercutting noted below the outlet of the culvert. The outlet appeared to be broken and rusted through in several sections. Culvert sizing calculations indicate that the culvert is undersized for the expected 100-year streamflow event and associated debris. There did not appear to be diversion potential associated with this pond outlet.

Expected 100-year flood flows for this crossing site are calculated to be approximately 13.891 cfs. The basin draining to the crossing site was measured to be 12.1 acres in total area. The crossing should be upgraded to pass the expected 100-year streamflow event and associated debris with the installation of an armored spillway (see Appendix A for recommended locations).

Prescribed Action: The Pond Outlet will be upgraded with the installation of an adequately designed spillway, capable of passing the expected 100-year streamflow event and associated debris. The spillway consisting of an 18-inch diameter culvert shall be removed and replaced with a dipped and rocked spillway. Using the nomograph provided in Cafferata et al, 2017 for sizing rip rap (page 50, section IX., Rock Armored Crossing Design, 3. Simplified Approach to Design Rock Riprap Under Overtopping Flows) rock armor sufficient in size to resist erosive and shear tractive forces from the expected 100-year event have been determined to have a d50 (average diameter of median rock size) equal to 1.5-ft. The spillway will be constructed such that 2-feet of freeboard space are maintained by the containment berm at peak capacity.

DRC -1: Location: 40.889374°, -123.631620°, DRC -1 consists of a plugged 4-inch diameter PVC pipe which drains the cultivation area (field) and inboard ditch across the private access road utilized to gain access to the house on the subject parcel.

Prescribed Action: The existing 4-inch diameter pipe will be replaced with an 18-inch diameter ditch relief culvert to drain the inboard ditch and overland flow.

All culverts on the property shall be inspected for plugging potential (racking of sticks, small woody debris and aggradation of sediments) before the onset of the winter period each year. Any debris noted at the inlets of any culverts shall be removed and the openings cleared to maintain the hydraulic capacity of the culvert. Any removed sediment or debris will be stored outside of the riparian buffer zone where no threat of delivery to surface waters is present.

1.2.1.4. WINTERIZATION

Winterization measures will be implemented annually by November 1st and interim erosion prevention BPTC measures will be utilized as needed

throughout the year. To prevent erosion and sediment transport to streams, numerous measures for soil stabilization, runoff management, erosion and sediment prevention/retention are utilized throughout the seasonally dry period and prior to the onset of winter. Section 5 "Winterization BPTC Measures" has more information on proposed actions to protect water quality in the winter season.

1.2.2. SEDIMENT CAPTURE BPTC MEASURES

1.2.2.1. ROADS, STREAM CROSSINGS, AND SOIL DISTURBANCE

Cultivation operations on the Project Site occur in an area sufficiently far from channelized surface waters to prevent delivery of sediment. Cultivation occurs in above ground grow-pots within hoop houses. Soil will be amended annually and reused each season. In the event soil is to be "piled" to be reamended, proper BPTCs will be utilized to properly winterize the site. Any soil piles on the Project Site will be property winterized surround the pile with straw wattles and utilize cover crops or tarps to prevent precipitation and runoff from mobilizing sediment and the constituent components of many potting soils. If winter conditions preclude the use of cover cropping throughout the wet weather season, tarps or a constructed roof covering will be utilized to prevent piles from washing away and remaining nutrients from leaching into groundwater. Straw wattles will be utilized around soil piles to further mitigate sediment transport during wet weather events. Grow Pots containing potting soils and other growing media will be cover cropped or covered with an impermeable membrane (tarp, plastic sheeting, etc.) to prevent possible transport and delivery of sediment and to prevent leachate of residual nutrients and fertilizers into the groundwater.

See 1.2.1.1 for road related BPTCs and prescribed treatments.

As part of entraining possible sediment related to an unbroken section of proposed inboard ditch, two sediment capture basins have been proposed. The basins will be constructed of earthen material, compacted with side slope angles at a stable 2:1. The basins will measure approximately 10-feet in length by 4-feet in width with an approximately 2-foot deep basin. Both basins will be connected to the bottom most end of the inboard ditch along the in-sloped section of "well flat access road". The first sediment capture basin will feature a rocked outlet and lead into the second sediment capture basin. This basin will outlet flows via a proposed 18-inch diameter ditch relief culvert (DRC #1) into a proposed inboard ditch which will run eastward toward DRC #2 (18-inch diameter).

The area utilized for cultivation on the Project site is extensively vegetated with grasses to protect against erosion. The area is stable and does not appear to be actively eroding.

Stockpiled materials for construction and road maintenance will be stored offsite in a stable location and contained using appropriate BPTC measures. Other sediment control measures may be installed as needed to prevent discharges from entering waters of the state. See Appendix C for the schedule of all sediment control BPTC measures being employed on site.

1.2.3. MAINTENANCE ACTIVITIES – EROSION PREVENTION AND SEDIMENT CAPTURE

1.2.3.1. MONITORING

All long-term and interim erosion prevention and sediment capture BPTC measures that have been implemented will be monitored for effectiveness once monthly at a minimum (Table 1.2.3.1). Any vegetation planted on previously disturbed areas will be monitored for success and replanted as necessary. The cultivator will monitor erosion and sediment control measures during and after each storm event that produces at least 0.5 in/day or 1 in/7 days of precipitation. In addition, winterization measures that are implemented will be monitored for effectiveness (inspected during the first major winter storm event) before the site is closed for the winter. See Appendix H for a log of monthly BPTC monitoring and maintenance records.

Table 1.2.3.1. BPTC Effectiveness Monitoring

Monitoring Requirements	Description	Monitoring Frequency
Winterization Measures Implemented	Report winterization procedures implemented, any outstanding measures, and the schedule for completion.	October - May
Tier Status Confirmation	Report any change in the tier status. (Stabilization of disturbed areas may change the tier status of a facility. Contact the Regional Water Board if a change in status is appropriate).	Annually
Third Party Identification	Report any change in third party status as needed	Annually

1.2.3.2. MAINTENANCE

Year-round maintenance of all erosion prevention and sediment capture measures is required. All existing measures shall be maintained, repaired, or replaced as needed. Exotic or invasive species found in revegetated or disturbed areas shall be removed. Remaining exposed soil shall be reseeded/revegetated and have 2-4" of weed-free mulch reapplied. Any

captured sediment in inboard ditches/drainageways, culvert outfalls, sediment capture basins or against silt fences/straw wattles will be removed and stabilized on a designated flat area. Sediment capture basins should be monitored after rainfall events and before the onset of winter storms. Aggraded sediments and fines should be removed to maintain the designed basin volume of the capture basin. The sediment may be used for site improvement where it will not threaten water quality. Interim measures for sediment retention, such as mulching and wattling, require more regular monitoring and maintenance. See Appendix H for a log of monthly BPTC monitoring and maintenance records.

2. FERTILIZER, PESTICIDE, HERBICIDE, AND RODENTICIDE BPTC MEASURES

2.1. CULTIVATION PRODUCT STORAGE, USE, AND DISPOSAL

2.1.1. STORAGE

Currently, agricultural chemicals are stored within a supply shed. Agricultural chemicals including fertilizer and any other pesticides / herbicides / rodenticides that are deemed necessary are stored outside of all riparian buffers and are located adjacent to the residence and cultivation area for ease of access. The covered shed is secured from wildlife, and all agricultural chemicals shall be stored within secondary containment to prevent unintended release in the event of a containment failure. The containment vessels shall be sufficient in size to contain 110% of the volume contained within each vessel. The freeboard of the containment vessel should not be filled due to being stored under cover and out of the elements (see Site Map in Appendix A for storage location). Soil and fertilizers may temporarily be stored in or near the greenhouses within 48 hours prior to being applied but should be removed immediately post use to a secure location where they pose no threat of delivery to surface waters or leachate to groundwater.

Appropriate BPTC measures shall be utilized when storing, handling, mixing, applying, and disposing of all fertilizers, pesticides, herbicides, and rodenticides. Each year an inventory is conducted prior to the beginning of the grow season and necessary products are delivered to the site as needed. See Appendix G for a list of fertilizers and pesticides/herbicides used on site.

2.1.2. APPLICATION

Mixing of fertilizers in a 2,500-gallon storage tank shall be conducted in a designated area where the mix shall not enter surface waters. For all plants, the mix will be applied via controlled hand watering. A fertigation system may be implemented in the future but is not required for accurate application of nutrients / fertilizers. Spent soil shall be amended and reused as needed. Dry amendments are to be mixed into the soil bags / grow pots by hand at a rate specified by the manufacturers. The

application of any agricultural chemical products shall be conducted according the manufacturer's recommendation.

2.1.3. DISPOSAL AND SPILL PREVENTION/CLEANUP

Trash and recycling containers are currently located adjacent to the residence. Soil shall be cycled yearly and is only stored temporarily for reamendment when required. Soils are typically amended in place (grow-pots). A spill kit with plenty of sorbent pads will be kept on site in the event of a spill for any agricultural chemical or hazardous waste that is anticipated for use on site. All trash, empty product containers, and other recycling shall be hauled off-site on regular or weekly intervals to the nearest Waste Management Facility.

3. PETROLEUM PRODUCT BPTC MEASURES

3.1. PETROLEUM STORAGE, USE, AND DISPOSAL

Table 3.1. Petroleum Product List, Storage, and Use

Petroleum Product	Delivery Period	Storage Method	Use Type
Gasoline / Diesel	As needed throughout the year	N/A When onsite shall be stored within / Garage in 5-gallon gas cans	Power for garden tools / equipment
Lubricants	As needed throughout the year	N/A When onsite shall be stored in storage shed within secondary containment	Garden Equipment maintenance
Propane	As needed throughout the year	1,000 & 500-gallon slab mounted propane tanks	Domestic (heating, cooking, etc.)

3.1.1 STORAGE

There are currently several small fuel storage vessels on the Project Site (5-gallon). The parcel is grid tied with a PG&E power drop which provides electrical energy to the residence and barn building. The applicant is working with PG&E and an electrical engineer to distribute power to the greenhouses for fans (ventilation). Storage of petroleum products (when onsite) shall be stored within secondary containment within a storage container / shed building outside of any riparian setbacks.

As per the Order, all petroleum containers must be stored within secondary containment and under cover sufficient to prevent precipitation from filling the freeboard of the containment vessel or berm. It is the intention of the operator to both cover and provide secondary containment for all petroleum storage to comply with the Order.

Any petroleum powered machines shall be regularly monitored for leakage.

3.1.2. APPLICATION

Fueling and maintenance of water pumps, vehicles, and other machines shall be conducted in a designated area that prohibits discharge to waters of the state.

3.1.3. DISPOSAL AND SPILL PREVENTION/CLEANUP

Special care will be taken when transporting and handling all petroleum products. When and if petroleum products are brought onsite, spill prevention/cleanup BPTC measures will be utilized; a spill kit with plenty of sorbent pads shall be kept on site in the event of a spill. Spill kits shall be kept in areas where fuel transfers or refueling is expected to occur. When staff are to be onsite, they shall be trained in the use and location of the spill kits to ensure that in the event a spill occurs, any available hands shall be trained to apply BPTC measures. Spent petroleum products and related trash will be kept in secondary containment, specifically for hazardous waste, before being transferred to the waste management facility. No waste oil or petroleum products were observed onsite during the field investigation.

4. TRASH/REFUSE AND DOMESTIC WASTEWATER BPTC MEASURES

4.1. HOUSEHOLD TRASH AND CULTIVATION-RELATED WASTE

All trash / refuse generated on site shall be placed in lidded plastic storage bins as well as plastic bags. Trash kept adjacent to the cultivation area will be done so in a lidded trash can and ultimately stored within a storage shed to prevent wildlife intrusion. In general, trash and recycling should be kept and stored in a storage location that prevents both elemental and wildlife intrusion (storage shed). These enclosed and designated areas designed to prevent contact with wildlife and precipitation will ensure compliance with the Order. Expected trash/refuse generated on site will be comprised of domestic wastes including food and sanitation items as well as cultivation related wastes (empty nutrient containers, associated packaging and consumable items). All trash items shall be kept in a designated area (see site map in Appendix A) where it will not migrate or leach into waters of the state. Cultivation-related organic wastes are stored in a designated area and stabilized with the appropriate BPTC measures (see Appendix A, Site Plan for location). Non-organic cultivation related wastes shall be taken to the nearest waste management facility along with all other disposable wastes generated onsite at regular (weekly) intervals. Wastes shall not be stored onsite for prolonged periods of time.

4.2. RESIDENTS, EMPLOYEES, AND VISITORS

There is a single residence on the Project Site. Several residents are on site during the growing season. The farm shall be run with approximately 2 employees in addition to the owner / operator of the site. Employees will commute to the site from nearby residential areas in Willow Creek.

4.2.1 DOMESTIC WASTEWATER – GENERATION

The Project Site produces blackwater from the residence which utilizes a septic system. The permit status of the septic system is unknown, but the system is reportedly functioning adequately for the current level of use. While the system is being permitted and evaluated by a septic professional to ensure that the system is capable of handling the expected level of uses, portable toilets may be brought onsite and serviced at regular intervals. The portable toilets will ensure that the sanitary needs of the site operators are met while satisfying the waste water requirements of local and state agencies.

4.2.2 DOMESTIC WASTEWATER – DISPOSAL

Household greywater and wastewater are generated on the Project Site within the residence. Greywater is disposed of in the household septic system. Domestic wastewater is not expected to be generated outside of that contained within the septic system during cultivation operations. The cultivator shall make sure that no substances that are hazardous to fish and wildlife (e.g. trash, paint, concrete washings, treated wood) are used, located, or disposed of where they can contaminate waters of the state. Human and animal waste shall also be disposed of properly.

5. WINTERIZATION BPTC MEASURES

5.1. ACTIVITIES AND MAINTENANCE

5.1.1 ROADS AND STREAM CROSSINGS

Appropriate erosion prevention and sediment control measures will be installed, maintained, and monitored for effectiveness prior to the winter season. Road work requiring heavy machinery (water bar installation, insloping, french drain installation, etc.) shall be conducted only during the dry season, unless the cultivator is authorized by an agency with jurisdiction to make emergency repairs. See section 1.2.1.1. for road related upgrades and treatments.

Winterization of the access roads includes temporary and long-term runoff management. Winterization of the site will include the installation of appropriate BPTC measures relevant to the mitigation of sheet flow and erosion on the graded pads which contain bare or exposed soils at. All winterization BPTC measures will be monitored and maintained prior to site closure for the winter.

5.1.2. DISTURBED AREAS

Areas that have exposed soil shall be seeded and mulched to prevent erosion and sediment delivery to any waterbody. Any revegetation shall take place at the onset or at the end of the precipitation season to ensure establishment. All disturbed areas will be inspected for potential and active erosion issues. Such sites will be repaired/controlled as needed using appropriate BPTC measures. For all areas of concern, if any BPTC measures cannot be installed prior to winter, the Regional Water Board

must be contacted to establish a compliance schedule to protect water quality. At the time of Northpoint's field investigation, no "disturbed areas" that threatened to deliver sediment to surface waters were identified outside of the previously listed road section along the "Access Driveway" road.

The flat upon which cultivation is occurring is well vegetated. Proposed road upgrades and BPTC implementation on the Project Site (stream crossing upgrades) are expected to disturb existing vegetation and will be revegetated with erosion control seed and mulched to protect against erosion. BPTCs should include the use of seed and straw mulch or hydroseed and staked straw wattles or silt fences on the toe of fill at the break in slope to prevent sheet flow from carrying entrained particulate from exposed soils. As per Attachment A of the Order (pg. 47, no. 128) cannabis cultivators shall apply linear sediment controls along the toe of the slope, face of the slope and at the grade breaks of exposed slopes to comply with sheet flow length restrictions. For slopes (percent slope) between 25-50%, sheet flow length shall not exceed 15-feet. For slopes greater than 50%, sheet flow length shall not exceed 10-feet. Thus, at each break in slope, toe of slope, or unbroken length of disturbed slope measuring 10 or 15-feet in length or greater depending on slope, a linear sediment control must be utilized until vegetation is re-established such that sheet flow does not result in erosion or scour of bare soil. This degree of slope exposure is expected along fill slopes when upgrading the Pond Outlet.

5.1.3. STORAGE AND STOCKPILED MATERIALS

5.1.3.1. CULTIVATION-RELATED PRODUCTS AND WASTE

All fertilizers, pesticides, herbicides, and rodenticides will be stored where they will not enter surface waters or pose a threat to wildlife. The cultivator will have all liquid products stored in secondary containment and stored along with all other cultivation-related products, protected from the elements. Waste associated with cultivation will be removed from the site and taken to the nearest waste transfer facility prior to closing the site for winter.

5.1.3.2. VEHICLES, MACHINES, AND PETROLEUM PRODUCTS / WASTE

Prior to winter, any remaining vehicles or machines on-site will be stored out of the elements where any potential leaks will not enter surface waters or pose a threat to wildlife. All storage facilities will be locked to prevent wildlife intrusion. Petroleum products will be kept in compatible secondary containment within their own storage container. Any spent petroleum containers and related trash will be removed and appropriately disposed of at the nearest waste management facility.

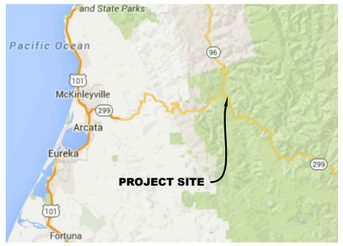
5.1.3.3. STOCKPILED MATERIALS

Appropriate BPTC measures shall be used for all stockpiled materials that have the potential to migrate to surface waters or that may be hazardous to wildlife. Stockpiled materials include bark, sawdust, potting soil, amendments, rock, compost, treated wood, polytube and other irrigation equipment, greenhouse plastic sheeting, and any other materials used for cultivation and site development, improvement, and management. They shall be stabilized in an upland area, covered, and/or stored in a storage shed/container.

Appendix A: Site Map

NEW EARTH FARMS, LLC
SPECIAL PERMIT - SITE PLAN

APN: 524-072-010



VICINITY MAP
NOT TO SCALE

DIRECTIONS TO SITE:

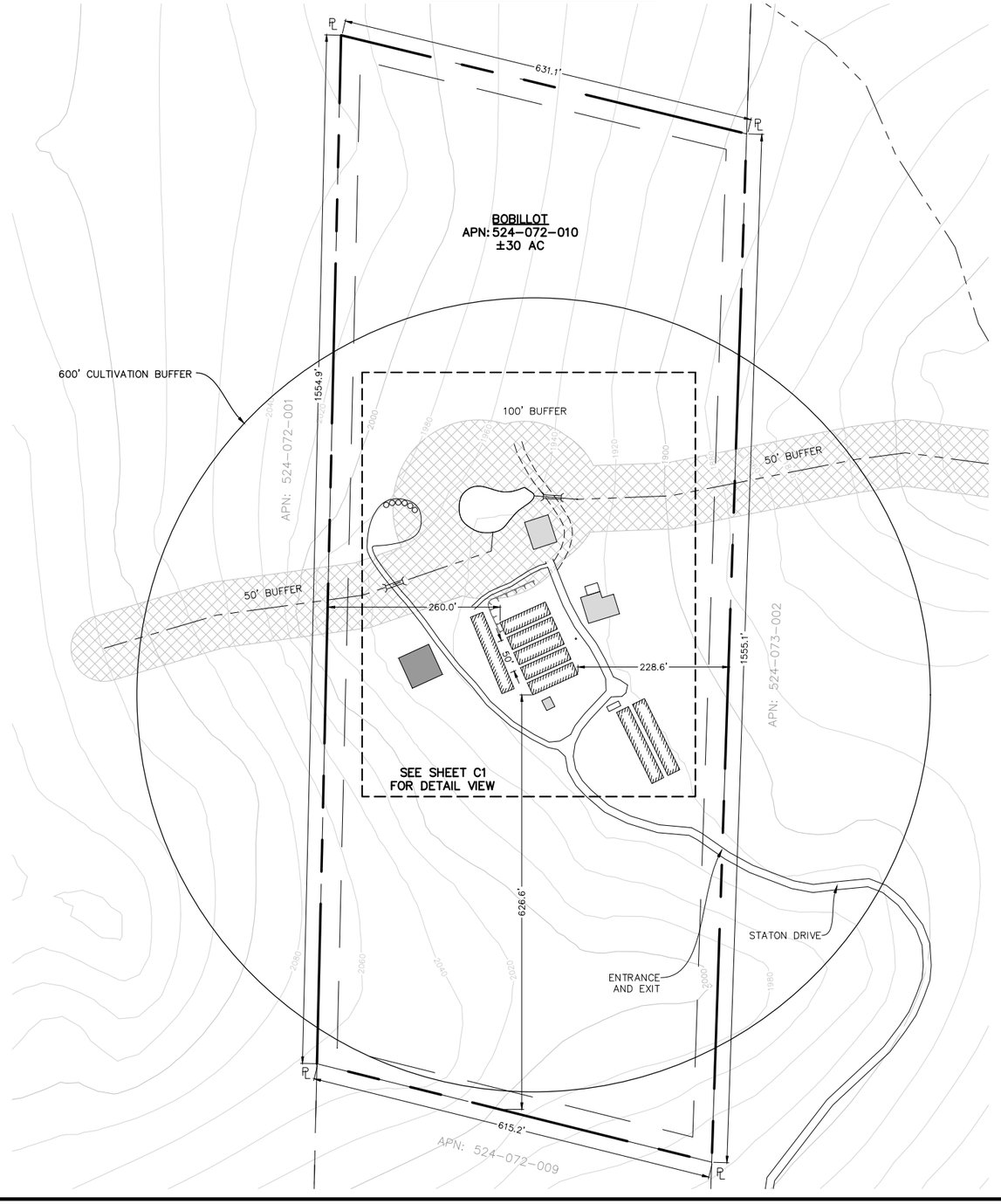
FROM EUREKA, CA
-HEAD EAST ON CA-299
-TURN RIGHT AT MARTIN DRIVE
-CONTINUE UP SLOPE TO COUNTY RTE 8L100
-TURN RIGHT ONTO STATON LANE
-CONTINUE STRAIGHT FOR 0.4 MILES

PROJECT DESCRIPTION:

NEW EARTH FARMS, LLC IS PROPOSING TO PERMIT EXISTING CANNABIS CULTIVATION ACTIVITIES IN ACCORDANCE WITH THE COUNTY OF HUMBOLDT'S (COUNTY) COMMERCIAL CANNABIS MARIJUANA LAND USE ORDINANCE (CCMLUO), ORDINANCE NO. 2554. THE EXISTING OPERATION INCLUDES APPROXIMATELY 10,000 SQUARE FEET (SF) OF CULTIVATION AREA.

GENERAL NOTES:

1. DRAWING SCALE AS NOTED. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS.
2. THIS IS NOT A BOUNDARY SURVEY. BOUNDARY INFORMATION DEPICTED HAS BEEN OBTAINED FROM HUMBOLDT COUNTY 2015 GIS DATA. NORTHPOINT CONSULTING GROUP, INC. HAS NOT VERIFIED THIS PROPERTY BOUNDARY.
3. THERE ARE NO NEARBY SCHOOLS, SCHOOL BUS STOPS, PLACES OF WORSHIP, PUBLIC PARKS OR TRIBAL RESOURCES WITHIN 600 FEET OF THE PROPOSED CULTIVATION AREA.



PROJECT INFORMATION:

APPLICANT:
NEW EARTH FARMS, LLC
P.O. BOX 153
WILLOW CREEK, CA 95573

PROPERTY OWNER:
SECOND 707 REALITY, LLC
P.O. BOX 153
WILLOW CREEK, CA 95573

APPLICANTS AGENT:
NORTHPOINT CONSULTING GROUP, INC
1117 SAMOA BLVD.
ARCATA, CA 95521
(707) 798-6438

SITE ADDRESS:
APN: 524-072-010
600 STATON LANE
WILLOW CREEK, CA 95573

EXISTING OUTDOOR CULTIVATION AREA	=10,000 SF
PROPOSED OUTDOOR CULTIVATION AREA	=10,000 SF
EARTH WORK QUANTITIES	=TBD
WATER	=PRIVATE
SEWER	=PRIVATE
PROPERTY SIZE (WEBGIS)	=±21.74 ACRES
PROPERTY SIZE (ASSESSED)	=±30 ACRES
ZONING	=U (UNCLASSIFIED)
GENERAL PLAN DESIGNATION	=RA40

BUILDING SETBACK

	U	SRA
FRONT	20'	30'
SIDE	5'	30'
REAR	10'	30'

SRA AREA	=YES
IN COASTAL ZONE	=NO
IN 100 YR FLOOD ZONE	=NO

SHEET INDEX:

PLOT PLAN
22x34 SHEET: 1"=100'
11x17 SHEET: 1"=200'
0 50 100 200

NORTHPOINT CONSULTING GROUP, INC.
1117 Samoa Blvd., Arcata, CA 95521

NEW EARTH FARMS, LLC
600 STATON LN. WILLOW CREEK, CA 95537 / APN: 524-072-010
SPECIAL PERMIT - SITE PLAN

PROJ. MGR.: PS
DRAWN BY: CC
DATE: 09/02/20
SCALE: AS SHOWN

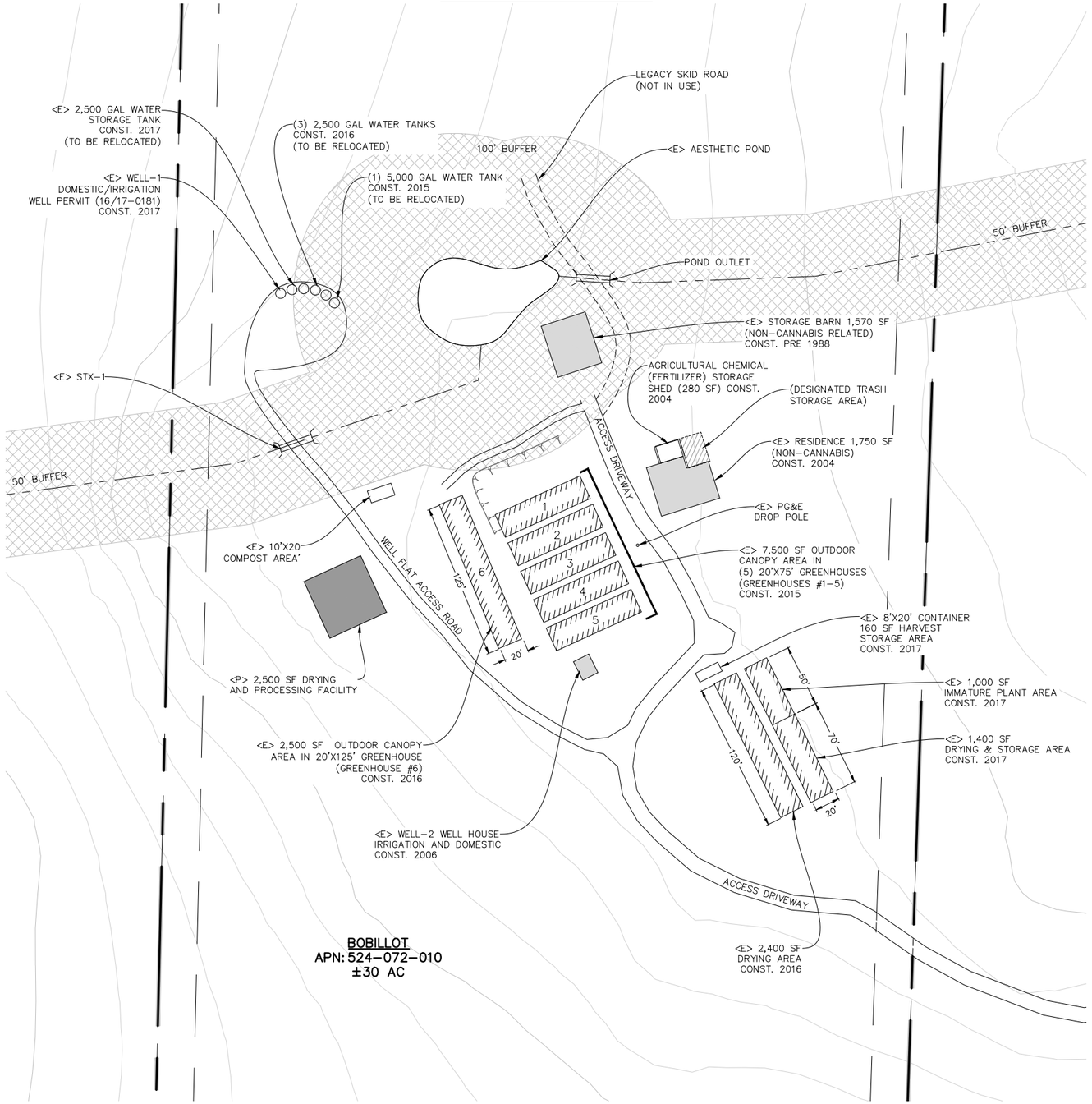
SHEET
C0
18-124

September 2, 2020 - 11:00 Dwg Name: P:\Bobillot, Michael-New Earth Farms- Staton Rd\ 18-124\CAD\BOBILLOT 2CC.dwg Updated By: Chang Cheng

NEW EARTH FARMS, LLC

SITE PLAN DETAIL

APN: 524-072-010



SITE DETAIL

22x34 SHEET: 1"=50'
11x17 SHEET: 1"=100'

0 25 50 100

N

September 2, 2020 - 11:00 Dwg Name: P:\Bobillot, Michael-New Earth Farms- Staton Rd. 18-124\CAD\BOBILLOT PDC.dwg Updated By: Chong Chang

DRAWN BY	REVISIONS	DATE

NORTHPOINT CONSULTING GROUP, INC.
1117 Samoa Blvd., Arcata, CA 95521

NEW EARTH FARMS, LLC
600 STATON LN. WILLOW CREEK, CA 95537 / APN: 524-072-010
SPECIAL PERMIT - SITE PLAN DETAIL

PROJ. MGR.:	PS
DRAWN BY:	CC
DATE:	09/02/20
SCALE:	AS SHOWN

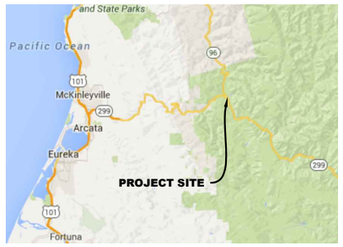
SHEET
C1
18-124

Appendix B: Disturbed Area Map

NEW EARTH FARMS, LLC

DISTURBED AREA MAP

APN: 524-072-010



VICINITY MAP
NOT TO SCALE

DIRECTIONS TO SITE:

FROM EUREKA, CA
-HEAD EAST ON CA-299
-TURN RIGHT AT MARTIN DRIVE
-CONTINUE UP SLOPE TO COUNTY RTE 8L100
-TURN RIGHT ONTO STATON LANE
-CONTINUE STRAIGHT FOR 0.4 MILES

DISTURBANCE AREA MAP:

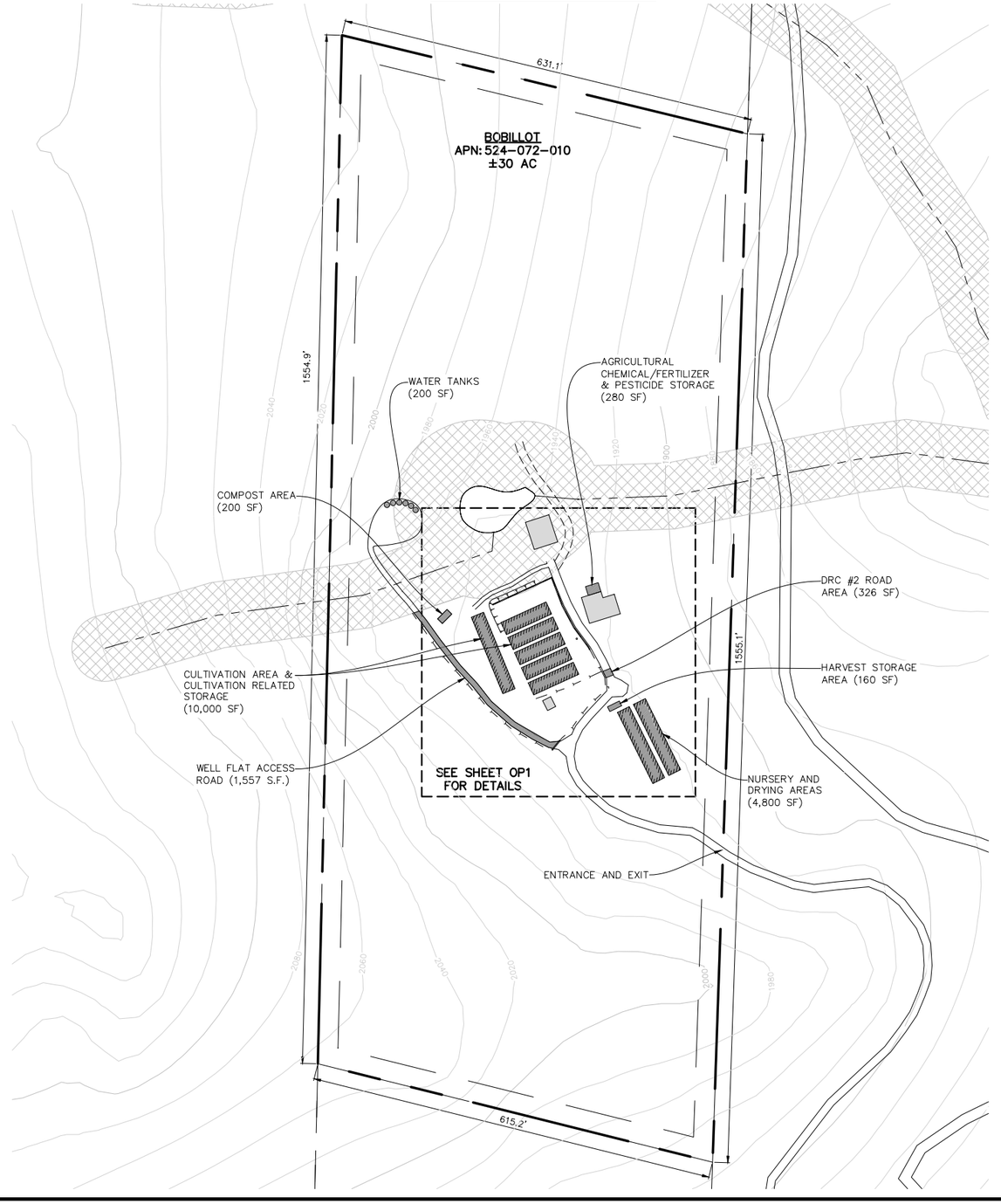
A TOTAL DISTURBED AREA OF 17,100 HAS BEEN IDENTIFIED AS PART OF THE SITE MANAGEMENT PLAN.

GENERAL NOTES:

1. DRAWING SCALE AS NOTED. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS.
2. THIS IS NOT A BOUNDARY SURVEY. BOUNDARY INFORMATION DEPICTED HAS BEEN OBTAINED FROM HUMBOLDT COUNTY 2015 GIS DATA. NORTHPOINT CONSULTING GROUP, INC. HAS NOT VERIFIED THIS PROPERTY BOUNDARY.

LEGEND:

= DISTURBED AREA



PROJECT INFORMATION:

APPLICANT:
NEW EARTH FARMS, LLC.
P.O. BOX 470
SALYER, CA 95563

PROPERTY OWNER:
MICHAEL BOBILLOT
P.O. BOX 470
SALYER, CA 95563

APPLICANTS AGENT:
RAIN & ZEPP, PLC
517 THIRD STREET, SUITE 30
EUREKA, CA 95501
(707)445-5925

SITE ADDRESS:
APN: 524-072-010
600 STATON LANE
WILLOW CREEK, CA 95573

EXISTING OUTDOOR CULTIVATION AREA =10,000 SF

PROPOSED OUTDOOR CULTIVATION AREA =10,000 SF

EARTH WORK QUANTITIES =TBD

WATER =PRIVATE
SEWER =PRIVATE

PROPERTY SIZE (WEBGIS) =±21.74 ACRES
PROPERTY SIZE (ASSESSED) =±30 ACRES
ZONING =U (UNCLASSIFIED)
GENERAL PLAN DESIGNATION =RA40

BUILDING SETBACK

	U	SRA
FRONT	20'	30'
SIDE	5'	30'
REAR	10'	30'

SRA AREA =YES
IN COASTAL ZONE =NO
IN 100 YR FLOOD ZONE =NO

SHEET INDEX:

PLOT PLAN
22x34 SHEET: 1"=100'
11x17 SHEET: 1"=200'
0 50 100 200

N

REVISIONS	DATE	DRAWN BY

NORTHPOINT
CONSULTING GROUP, INC.
317 3rd Street, Ste. 15 Eureka, CA 95501

NEW EARTH FARMS, LLC.
600 STATON LN. WILLOW CREEK, CA 95537/APN: 524-072-010
DISTURBANCE AREA MAP

PROJ. MGR.: RJ
DRAWN BY: CC
DATE: 07/17/19
SCALE: AS SHOWN

SHEET
D1
18-124

NEW EARTH FARMS, LLC

SITE PLAN DETAIL

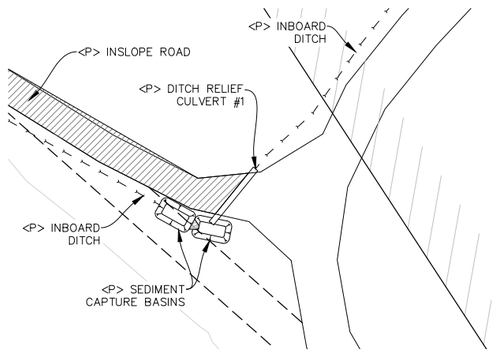
APN: 524-072-010

LEGEND

FRENCH DRAIN

INBOARD DITCH (IBD)

DETAIL 1



22x34 SHEET: 1"=20'
11x17 SHEET: 1"=40'

0 10 20 40

<E> 2,500 GAL WATER STORAGE TANK CONST. 2017

<E> WELL-1 DOMESTIC/IRRIGATION WELL PERMIT (16/17-0181) CONST. 2017

(3) 2,500 GAL WATER TANKS CONST. 2016

(1) 5,000 GAL WATER TANK CONST. 2015

LEGACY SKID ROAD (NOT IN USE)

<E> AESTHETIC POND

POND OUTLET

<E> STX-1

<E> STORAGE BARN 1,570 SF (NON-CANNABIS RELATED) CONST. PRE 1988

AGRICULTURAL CHEMICAL (FERTILIZER) STORAGE SHED (280 SF) CONST. 2004

(DESIGNATED TRASH STORAGE AREA)

<E> RESIDENCE 1,750 SF (NON-CANNABIS) CONST. 2004

<E> PG&E DROP POLE

<E> 9,000 SF OUTDOOR CANOPY AREA IN (6) 20'X75' GREENHOUSES (GREENHOUSES #1-6) CONST. 2015/2016

<P> FRENCH DRAIN

ACCESS DRIVEWAY

<E> 10'X20' COMPOST AREA

<E> 1,000 SF OUTDOOR CANOPY AREA IN HALF OF 20'X100' GREENHOUSE (GREENHOUSE #7) CONST. 2016

WELL FLAT ACCESS ROAD

100'

50'

20'

1 2 3 4 5

<P> INBOARD DITCH

<P> DITCH RELIEF CULVERT #2

<P> INSLOPE ROAD

<E> 8'X20' CONTAINER 160 SF HARVEST STORAGE AREA CONST. 2017

<E> 20'X50' PESTICIDE AND AGRICULTURAL CHEMICAL STORAGE (½ OF HOOP HOUSE, NO CANOPY) CONST. 2016

<P> INBOARD DITCH

<E> WELL-2 WELL HOUSE IRRIGATION AND DOMESTIC CONST. 2006

<P> DITCH RELIEF CULVERT #1

SEE DETAIL 1

120'

120'

20'

<E> 2,400 SF IMMATURE PLANT AREA CONST. 2017

<P> SEDIMENT CAPTURE BASINS

<P> INBOARD DITCH

ACCESS DRIVEWAY

<E> 2,400 SF PROCESSING AREA CONST. 2016

ENTRANCE AND EXIT

BOBILLOT
APN: 524-072-010
±30 AC

OFF-SITE PACKAGING

PLOT PLAN

22x34 SHEET: 1"=50'
11x17 SHEET: 1"=100'

0 25 50 100

DRAWN BY | REVISIONS | DATE

NORTHPOINT CONSULTING GROUP, INC.
317 3rd Street, Ste. 15 Eureka, CA 95501

NEW EARTH FARMS, LLC.
600 STATON LN. WILLOW CREEK, CA 95537/APN: 524-072-010
SITE PLAN DETAIL

PROJ. MGR.: RJ
DRAWN BY: PAE
DATE: 7/17/19
SCALE: AS SHOWN

SHEET
0P1
18-124

Appendix C: BPTC Implementation and Maintenance Schedule

CULTIVATION ACTIVITIES SCHEDULE

Highlight or check off the months when the following activities will take place.

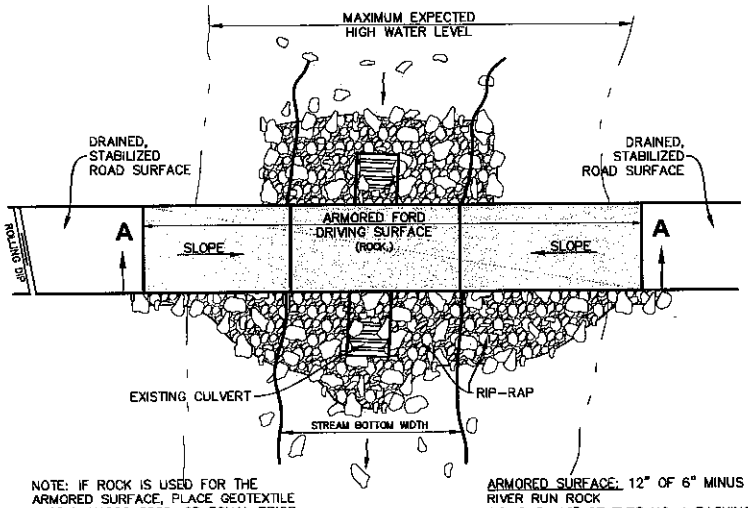
APPENDIX C: BPTC IMPLEMENTATION & MAINTENANCE SCHEDULE

Type			Measures	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EROSION PREVENTION	Physical	Runoff Management	Rolling Dips, Rocked Dips, Rock Armor Placement, Stream Crossing Upgrades												
		Soil Stabilization	Non-Vegetative Soil Cover - Mulching, Slope Protection, Riprap, Fiber Rolls and other Rolled Erosion Control Products (RECP), Plastic Sheet Cover												
	Biological	Soil Stabilization	Temporary/Permanent Seeding, Live Mulching, Vegetation Preservation/Replacement												
SEDIMENT CONTROL	Physical	Sediment Barriers	Straw Bale Dikes, Drain Inlet Filters,Fiber Rolls												
		Mud and Dust Control	Road Stabilization, Waterway Crossing												
	Biological	Soil Stabilization	Hydroseeding, Seed and Mulch, Vegetated Outfalls												
INTERIM EROSION & SEDIMENT CONTROL MEASURES			Installed and Maintained as Needed												

Appendix D: BPTC Measure Specification

Table of Contents

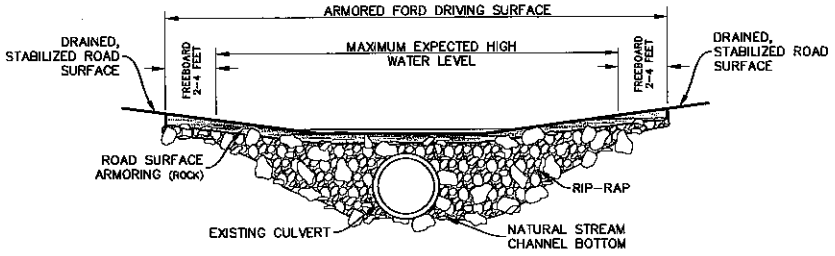
RD-1.1 MODIFIED LOW WATER ROCK FORD



NOTE: IF ROCK IS USED FOR THE ARMORED SURFACE, PLACE GEOTEXTILE FABRIC AMOCO 2002, OR EQUAL PRIOR TO ROCK INSTALLATION.

ARMORED SURFACE: 12" OF 6" MINUS RIVER RUN ROCK
RIP-RAP: 12" OF TYPE NO. 1 BACKING ROCKS (0-5% 200 LBS, 50-100% 75 LBS, AND 90-100% 25 LBS)

PLAN VIEW



SECTION A-A

RD-1.2 FORDS

DESCRIPTION

Fords work well on small to medium sized streams where there is a stable stream bottom and traffic is light. However, "construction" of fords and other unimproved stream crossings on well traveled roads should be avoided where water is flowing because of their potential to impact water quality. In certain situations, where flash floods, high seasonal flood peaks or floating debris are problems, fords may be a practical answer for crossing a poorly incised, shallow stream.

BEST MANAGEMENT PRACTICES

- Fords in flowing streams, called "wet fords," are typically composed of streambed gravels, fill, or concrete structures built in contact with the streambed so that vehicles can cross the channel (Figure 1).
- Fords should be designed to allow low summer flows seep through the fill, and high water discharges flow over the top (Figure 2).
- Paving fords across flowing streams may be necessary to maintain water quality if there is to be regular traffic. Paving consists of a concrete, slightly dish-shaped slab across the watercourse, and a discharge apron or energy dissipater on the downstream side to prevent scour during high flows.
- On small, poorly incised, ephemeral or intermittent streams a ford may be needed if there is insufficient channel depth to install a culvert. In fact, a rock lined rolling dip with a rock apron face is generally desirable to permanent culverts on these swales and small watercourses. Fords have the advantage, over culverted fills, of never plugging.
- Fords on small streams should be rock armored to prevent erosion of the road surface and fill during periods of runoff. The fill face on the downstream side of the fill can either be protected with rock armor or fitted with a large overside drain (berm drain) to prevent erosion (Figure 3).
- Unimproved fords, which consist of a stream channel that has been filled with a substantial quantity of soil and left unprotected by armor or surfacing is a hazard to water quality and should not be constructed.

Figure 1. Wet ford on Class II perennial stream. Clean rock aggregate has been imported for the travelling surface and coarse rock armor protects the outer edge of the road bed. It is important that rock aggregate used in a ford be large enough to resist transport during winter flows. Fords should not be used if high winter flows would cut off access to inspect and maintain drainage structures further out the road. From Weaver and Hagans (1994).

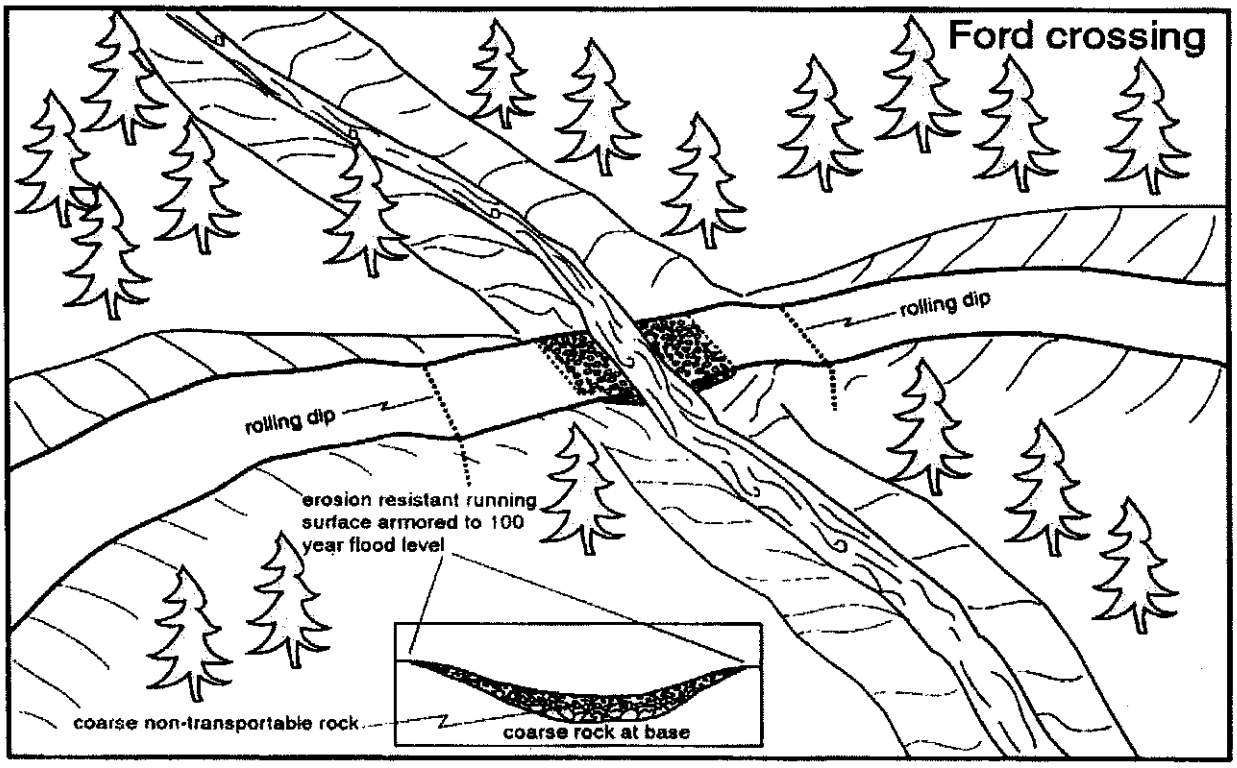


Figure 2. Typical ford stream crossing. From CDFG (2006).

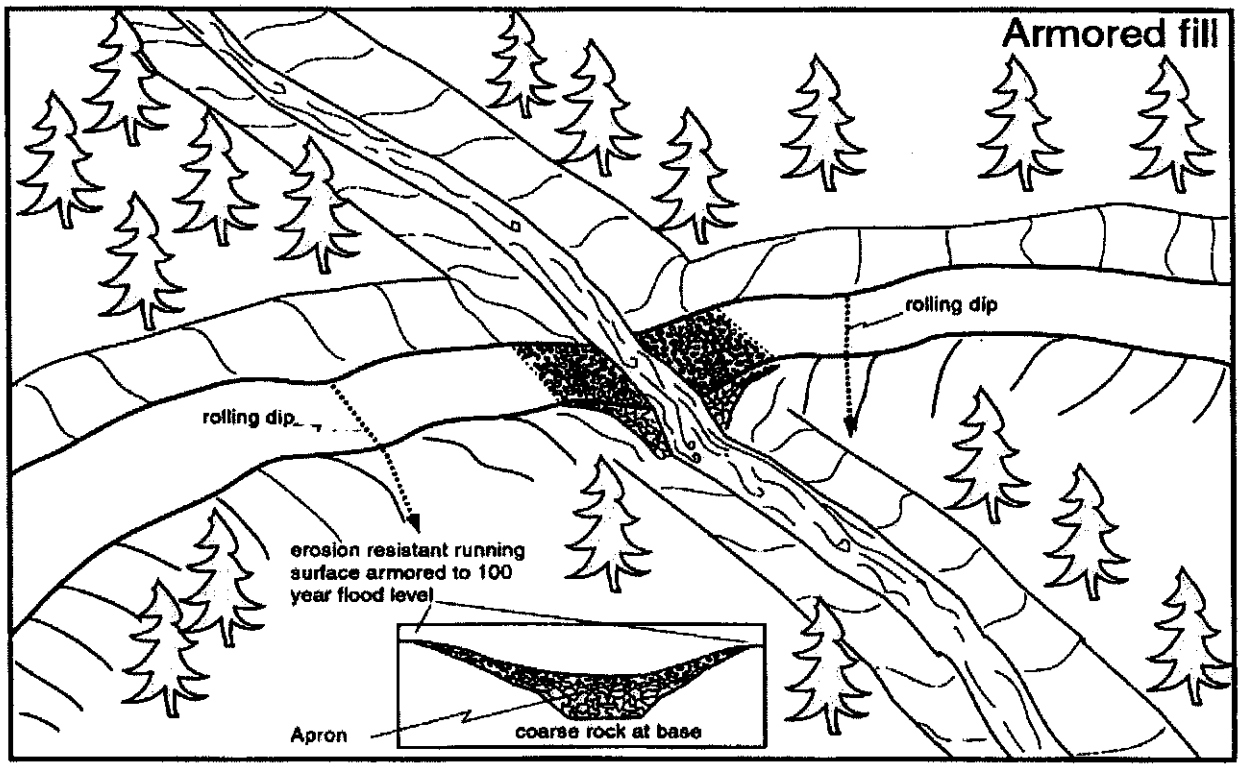


Figure 3. Typical armored stream crossing. From CDFG (2006).

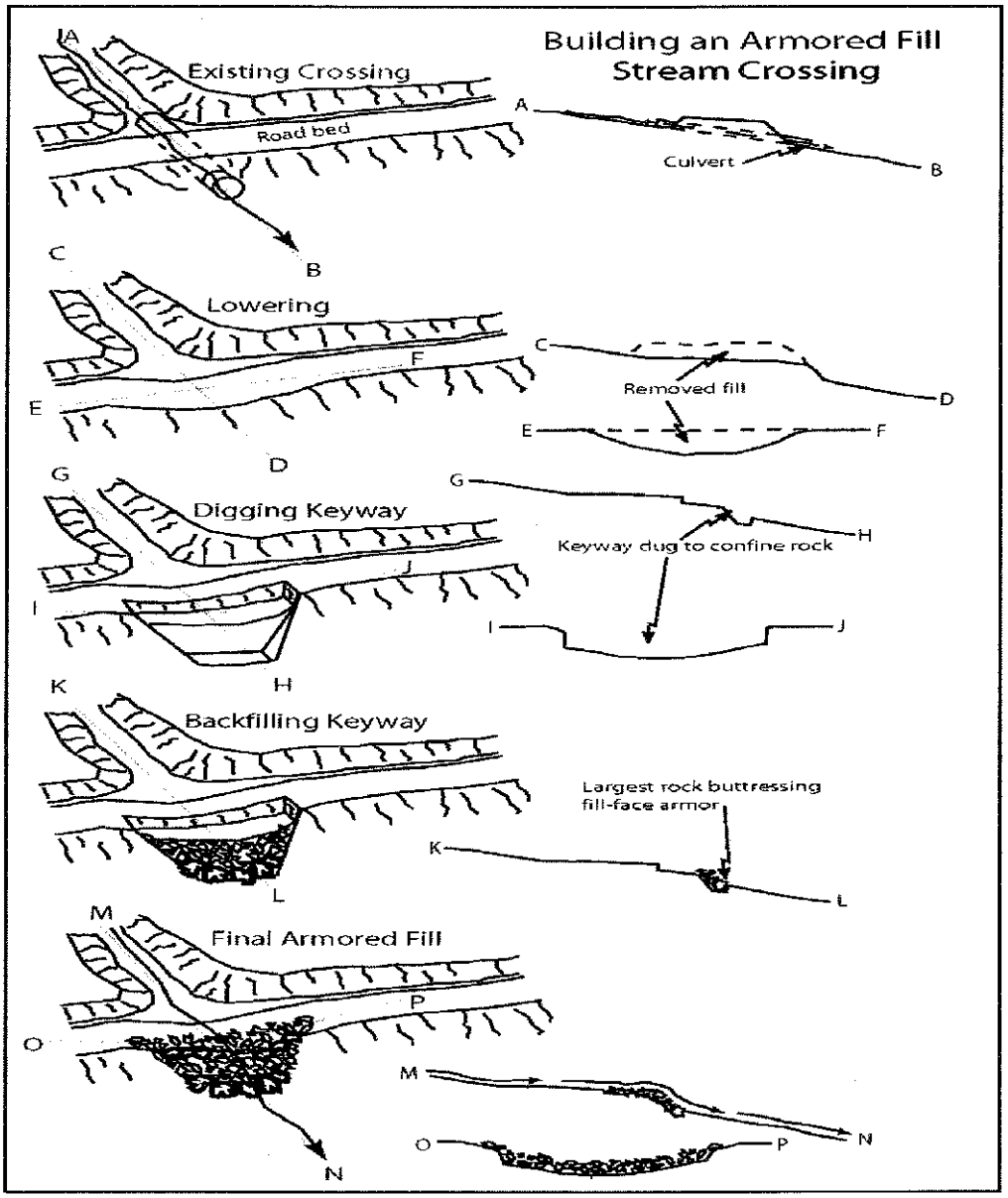


Figure 4. Design elements of a typical armored fill crossing. Note: where geotextile fabric may interfere with passage of amphibians in any Class 2 or 3 crossing, bury geotextile fabric with at least 6 inches of rock. Do not expose geotextile fabric in the bed of fish-bearing stream channels. From CDFG (2206).

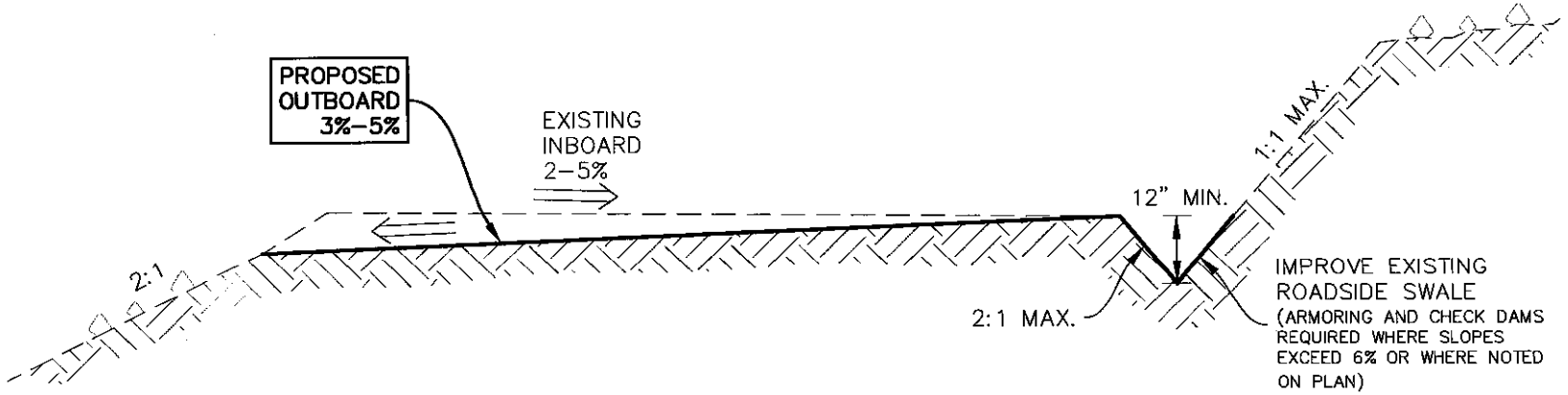
Source Material for Road BMP RD-2.7 Fords

2006. California Department of Fish and Game. Part X - Upslope Erosion Inventory and Sediment Control Guidance, California Salmonid Stream Habitat Restoration Manual.

1994. Weaver W.E. and D.K. Hagans. Handbook for Forest and Ranch Roads. Mendocino County Resource Conservation District

RD-1.3 OUTSLOPED ROAD W/ INBOARD SWALE

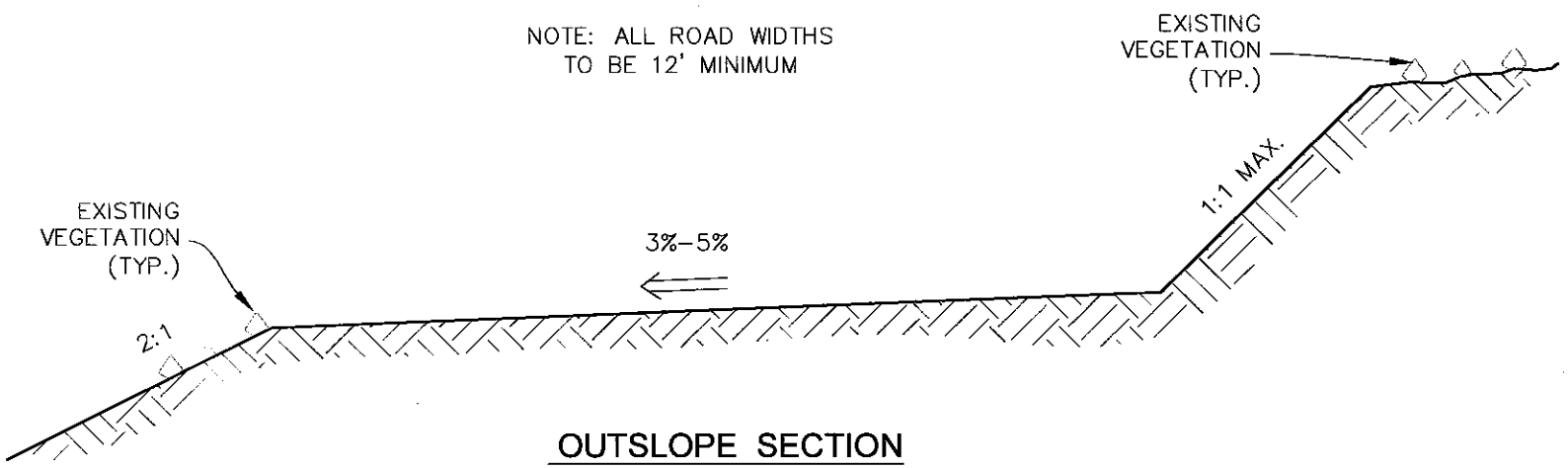
NOTE: ALL ROAD WIDTHS TO BE 12' MINIMUM AND ROCKED/REINFORCED WITH 2"MINIMUM AGG. BASE FROM ON SITE SOURCE



OUTSLOPE ROAD W/ INBOARD SWALE

RD-1.4 OUTSLOPED ROAD

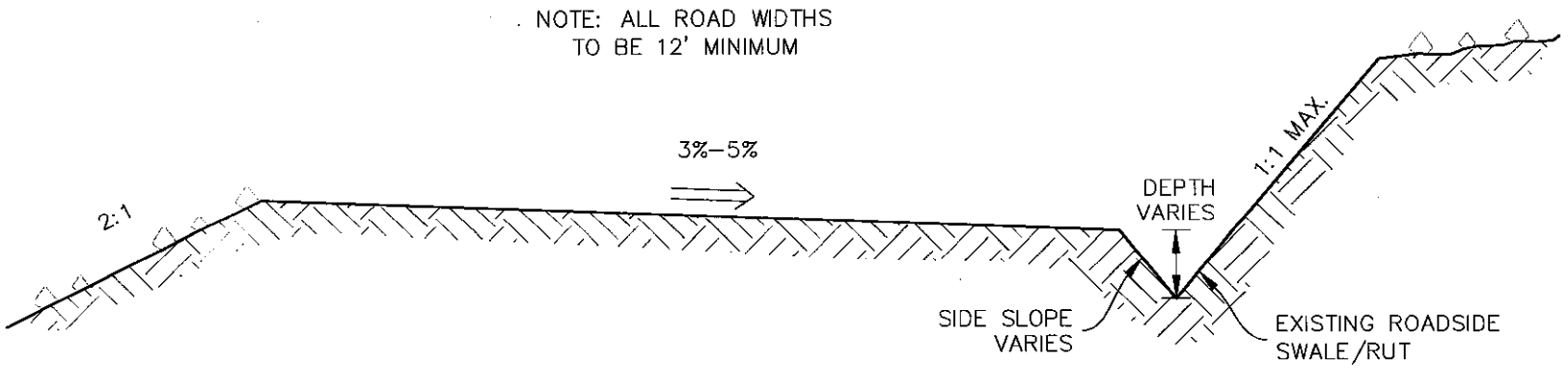
NOTE: ALL ROAD WIDTHS TO BE 12' MINIMUM AND ROCKED/REINFORCED WITH 2"MINIMUM AGG. BASE FROM ON SITE SOURCE



OUTSLOPE SECTION

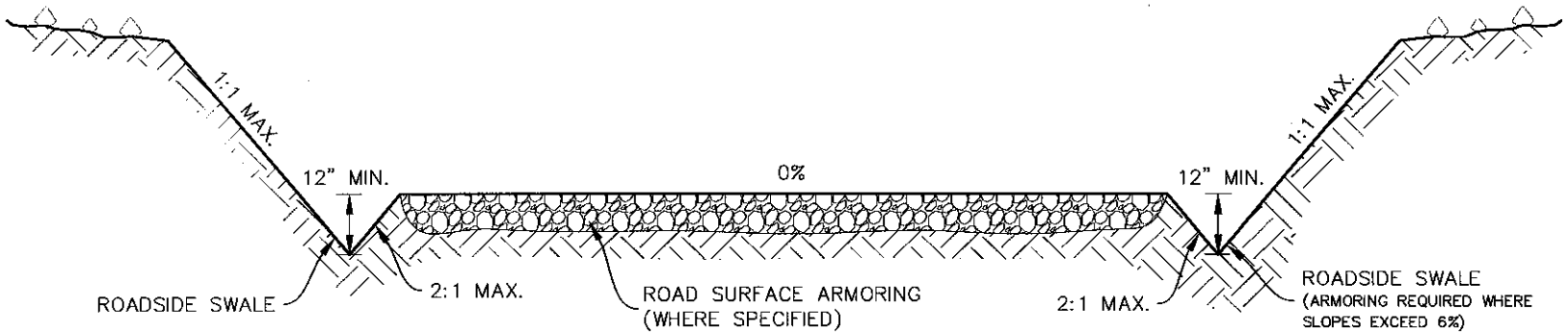
RD-1.5 INSLOPE ROAD

NOTE: ALL ROAD WIDTHS TO BE 12' MINIMUM AND ROCKED/REINFORCED WITH 2"MINIMUM AGG. BASE FROM ON SITE SOURCE



INSLOPE SECTION

RD-1.6 THRU CUT ROAD



NOTE: IF ROCK IS USED FOR THE ARMORED SURFACE, PLACE GEOTEXTILE FABRIC AMOCO 2002, OR EQUAL PRIOR TO ROCK INSTALLATION.

ARMORED SURFACE: 12" OF CLASS 2 AGGREGATE BASE (3" MINUS, WELL GRADED AND LESS THAN 5% CLAYS)

RD-1.7 CRITICAL DIPS

DESCRIPTION

A critical dip is a rolling dip constructed on or close to the down-road hinge-line of a stream crossing, displaying a diversion potential. Build a critical dip at all stream crossings in order to prevent stream diversions when a culvert plugs and water flows out onto the road. Construction may be similar to Road BMP RD-1.8 Rolling Dips.

BEST MANAGEMENT PRACTICES

- Stream crossings should be constructed to prevent diversion of flood overflow if the culvert were to become plugged. This can be done by designing the road to dip into and out of the stream at the crossing site or by installing a broad rolling dip on the down-road side of the crossing. This will allow the overflow to be directed back into the natural stream channel (Figure 1).
- Critical dips should be designed to handle the 100-year flow event for the stream it is installed at.
- Road surface and fill slopes at the critical dip should be rocked or otherwise stabilized.
- Must be deep enough that it is not obliterated by normal grading, but not so deep that it is difficult to negotiate or a hazard to normal traffic (Table 1).
- See Road BMP RD-1.8 Rolling Dips for more details.

Road grade %	Upslope approach (distance from up-road start of rolling dip to trough) (ft)	Reverse grade (distance from trough to crest) (ft)	Depth below average road grade at discharge end of trough (ft)	Depth below average road grade at upslope end of trough (ft)
<6	55	15-20	0.9	0.3
8	65	15-20	1.0	0.2
10	75	15-20	1.1	.01
12	85	20-25	1.2	.01
>12	100	20-25	1.3	.01

Table 1. Table of rolling dips dimensions. Design principles apply to critical dip. From CDFG (2006).

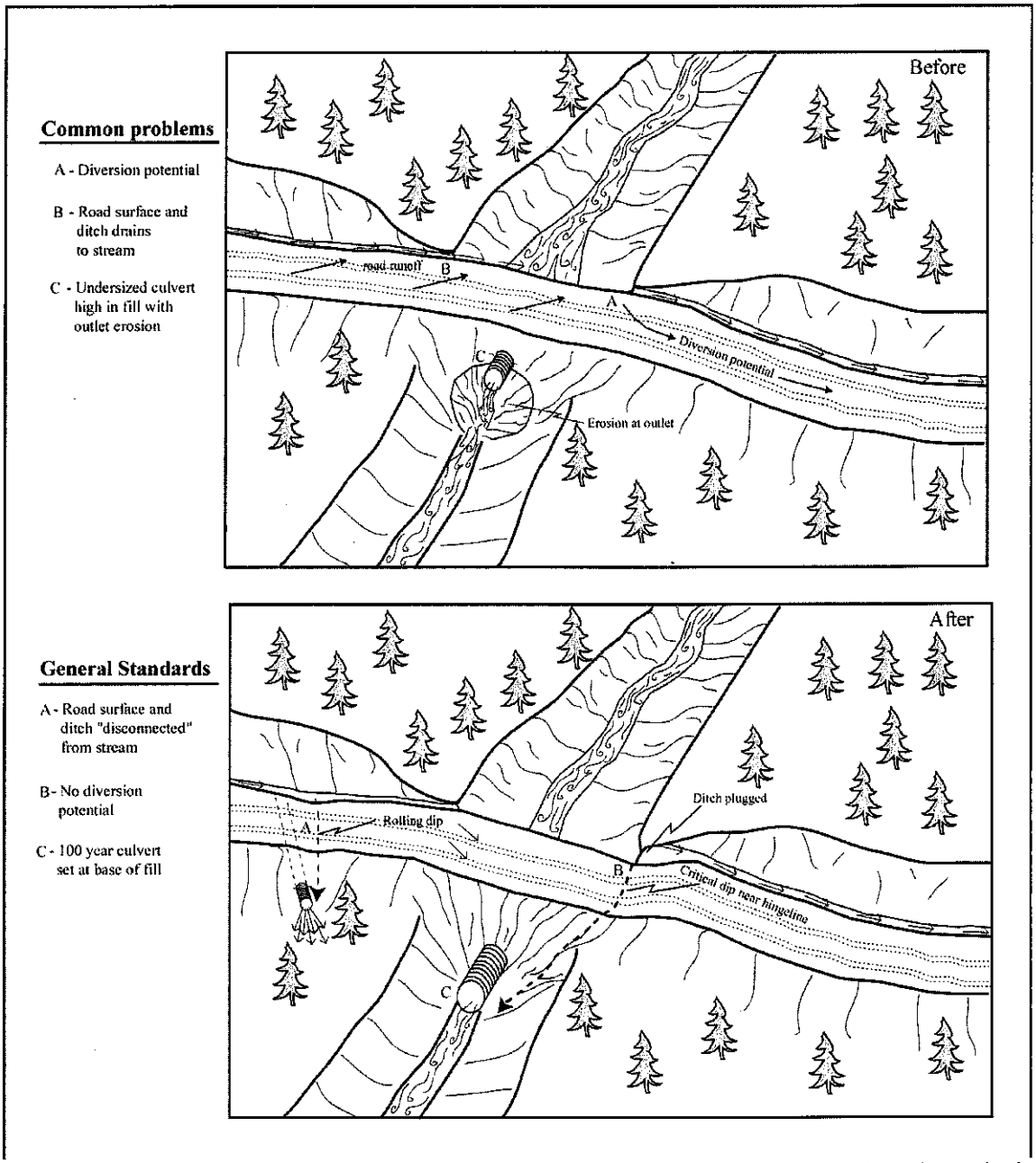


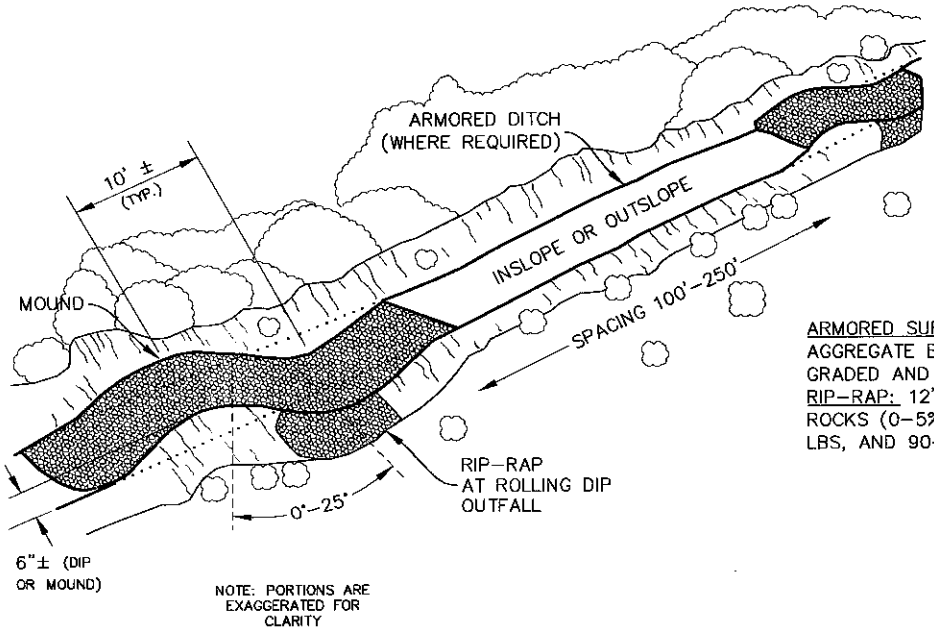
Figure 1. Install critical dips to prevent diversion prevention at stream crossings. Critical dips should be designed to handle the flow from a 100-year storm event. From CDFG (2006).

Source Material for Road BMP 2.9 Critical Dips

2006. California Department of Fish and Game. Part X - Upslope Erosion Inventory and Sediment Control Guidance, California Salmonid Stream Habitat Restoration Manual.

2004. FishNet 4C. Guidelines for Protecting Aquatic Habitat and Salmon Fisheries for County Road Maintenance.

RD-1.8 ROLLING DIP



NOTE: PORTIONS ARE EXAGGERATED FOR CLARITY

ROLLING DIP DETAIL
NOT TO SCALE

ARMORED SURFACE: 12" OF CLASS 2 AGGREGATE BASE (3" MINUS, WELL GRADED AND LESS THAN 5% CLAYS)
RIP-RAP: 12" OF TYPE NO. 1 BACKING ROCKS (0-5% 200 LBS, 50-100% 75 LBS, AND 90-100% 25 LBS)

TABLE 1: ROLLING DIP AND DITCH RELIEF CULVERT RECOMMENDATIONS	
ROAD GRADE (%)	SOIL ERODIBILITY EROSIVE SOILS (FT)
0-3	250
4-6	160
7-9	130
10-12	115
12+	100

RD-1.9 GRADING UNPAVED ROAD SURFACES

DESCRIPTION

Good maintenance practices on unpaved road surfaces prevent roadway erosion, deterioration or failure; helps with sediment and dust control, and provides a safe roadway surface for the traveling public.

BEST MANAGEMENT PRACTICES

- Fit grading to the surrounding terrain.
- Blade and compact a smooth surface and compact loose soils as needed.
- Crown or slope the road to avoid ponding or concentration of runoff. Outslope all roads where possible and safe.
- Preserve existing vegetation to the greatest extent feasible.
- Minimize the length and steepness of slopes.
- Maintain natural drainage patterns in watershed.
- Preserve or improve surface drainage in the vicinity of the road.
- Disconnect road drainage features from watershed hydrology.
- Make sure drainage is self-maintaining.
- Keep runoff velocities low, using energy dissipating control measures.
- Minimize amount of road-related sediment that gets into watercourses.
- Prevent dust abatement chemicals from getting into watercourses or riparian areas.

SEASONAL CONCERNS

- Perform routine road surface maintenance during the dry season. Avoid working in wet conditions and during the wet season (October 15- April 15), except for emergencies. Disturbed soil combined with rainfall, greatly increase the risk of exposed sediment runoff into streams.
- Inspect roads and associated drainage facilities for signs of erosion or deterioration at least twice annually with at least one inspection during or after first storm events of the season with additional follow-up for severe storm events. Inspect all road and drainage facilities after a large storm event. Note locations of road surfaces, drainage features, cutslopes and fillslopes that appear to be failing and contributing sediment to streams in order to prioritize maintenance or repair.

SPOILS AND SIDECASTING

- Avoid sidecasting of soil in all cases where it could be delivered into a watercourse, riparian area, roadside ditch or storm drain. In some instances, under the following guidelines (Table 1), sidecasting is allowable given remote distances from spoils storage sites. In these cases, the setback distance required depends on slope and vegetation. The presence of vegetation helps to slow the travel of sediment downslope, so good judgment is needed to assess the situation. *Do not sidecast at all* if the slope is sparsely vegetated and it appears that sediment will travel with rain runoff into a stream or estuary system, even if setback distances are applied. On slopes of 5:1 (20% gradient) or less, sidecasting is allowed beyond 150 feet of a watercourse, stream crossing, riparian area, roadside ditch or storm drain. On 2:1 slopes (50%) or less, sidecasting is allowed beyond 300 feet of a watercourse, stream crossing, riparian area, roadside ditch or storm drain. On slopes greater than 2:1, typically sidecasting is *not recommended*, however there may be rare instances on slopes greater than 2:1 where sidecasting is acceptable given very long distances from waterbodies and good vegetative cover. Seek advice from local fisheries agency staff when in doubt. Avoid concentrating sidecasting repeatedly in the same place. Never sidecast large amounts of soil from major landslides.

- Temporary spoils stockpiles should be located in areas that are relatively level; relatively free of vegetation and away from streams and wetlands areas (see Erosion Control BMP EC-1.5 Stockpile Management). The primary concern is to keep stockpiled materials from eroding into stream or wetland systems. Apply erosion control BMPs when needed. Do not place temporary spoils piles at the top of unstable slopes or at the edges of slopes where water will carry sediment into watercourses. Remove temporary stockpiles to permanent disposal locations before the rainy season. If emergency work is conducted during the rainy season, remove stockpile as soon as feasible and before the next rain storm.

SLOPE GRADIENT	DISTANCE FROM WATERCOURSE, STREAM CROSSING, RIPARIAN AREA, ROADSIDE DITCH, STORM DRAIN	SIDECASTING RULE
Any slope	Appears that sediment will travel with rainwater into watercourse.	Not allowed
5:1 (20%) or less	150 feet or more	Allowed using good judgment
2:1 (50%) or less	300 feet or more	Allowed using good judgment
Greater than 5:1 (50%)	Vegetated slope long distance from watercourse	Allowed
Greater than 5:1 (50%)	Sparsely vegetated slope and it appears that sediment will travel with rain into watercourse	Not allowed

Table 1. Sidecasting guidelines. From: FishNet 4C (2004)

BERMS

- Do not leave loose soil piled in berms alongside the road or ditch. Loose or exposed soil berms are erodible and readily flushed into waterways and storm drains.

- If any berm is left in place for public safety reasons it must be compacted and stabilized with seeding or asphalt. Frequent well placed breaks in the berms are necessary to allow water to drain from road, preserving the natural drainage pattern of the slope.

Source Material for Road BMP RD-3.2 Grading

2004. FishNet 4C. Guidelines for Protecting Aquatic Habitat and Salmon Fisheries for County Road Maintenance.

2002. Five Counties Salmon Conservation Program. A Water Quality and Stream Habitat Protection Manual for County Road Maintenance.

RD-1.10 WATERBARS

DESCRIPTION

Waterbars are shallow, abrupt excavated dips or troughs with an adjacent, downslope hump or mounded berm, that are built at an oblique angle across the road (Figure 1 and 2). Waterbars are useful only on low standard seasonal or temporary, unsurfaced roads where winter use will not occur, because traffic easily cuts through the soft berm and fills the adjacent dip. Waterbars should be constructed at proper spacing according to the grade of the road (Table 3). Waterbars are usually regraded (smoothed out) at the beginning of each operating season, and then reconstructed at the beginning of each winter period.

Waterbars are high maintenance drainage structures that are prone to failure if not properly built and maintained. Unauthorized winter traffic is likely to break down waterbars and result in serious road surface erosion and water pollution.

BEST MANAGEMENT PRACTICES

- Waterbars and rolling dips should be spaced along the road close enough together that the road surface is not gullied (Table 3). Appropriate spacing of surface drainage structures depends on soil credibility and runoff rates. Look at local roads to determine the maximum spacing that will work in your specific area.

Table 3. Maximum distance between waterbreaks on roads and trails (feet)[1]

Erosion Hazard Rating (for surface erosion)	Road or Trail Gradient (%)			
	10%, or less	11-25%	26-50%	over 50%
Extremely high	100'	75'	50'	50'
High	150'	100'	75'	50'
Moderate	200'	150'	100'	75'
Low	300'	200'	150'	100'

Table 3. From Weaver and Hagans (1994). [1] Adapted from California Forest Practice Rules. This is the maximum distance between waterbars: when in doubt, reduce the spacing. Soils are nonrenewable and waterbars are inexpensive.

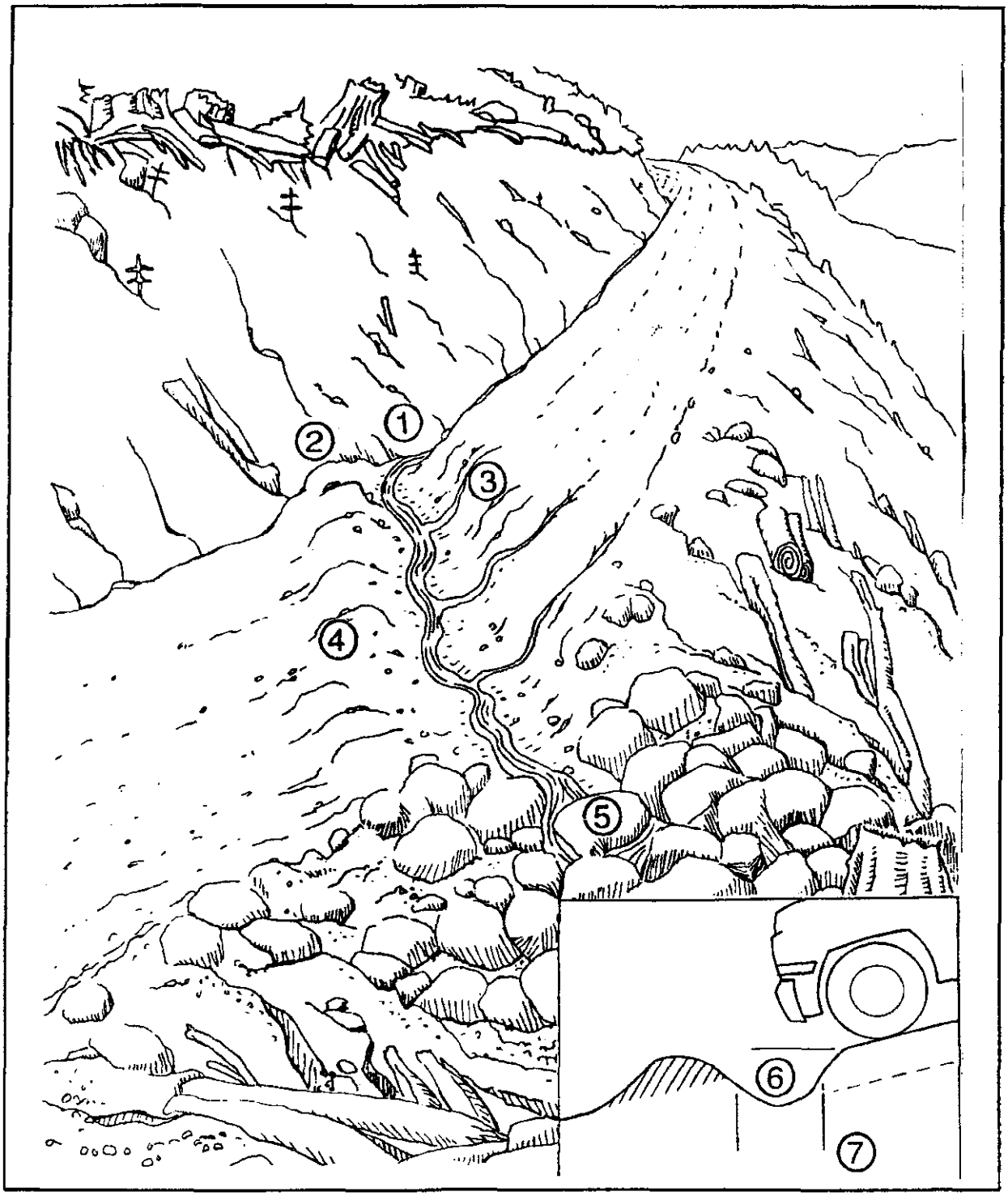


Figure 1. Waterbars are constructed on unsurfaced forest and ranch roads that will have little or no traffic during the wet winter period. The waterbar should be extended to the cutbank to intercept all ditch flow (I) and extend beyond the shoulder of the road. A berm (2) must block and prevent ditch flow from continuing down the road during flood flows. The excavated waterbar (3) should be skewed 30° to the ditch-line with the excavated material bermed on the downhill grade of the road (4). Water should always be discharged onto the downhill side on a stable slope protected by rip rap or vegetation (5). The cross ditch depth (6)

and width (7) must allow vehicle cross-over without destroying the function of the drain (B.CM.F., 1991). From Weaver and Hagans (1994).

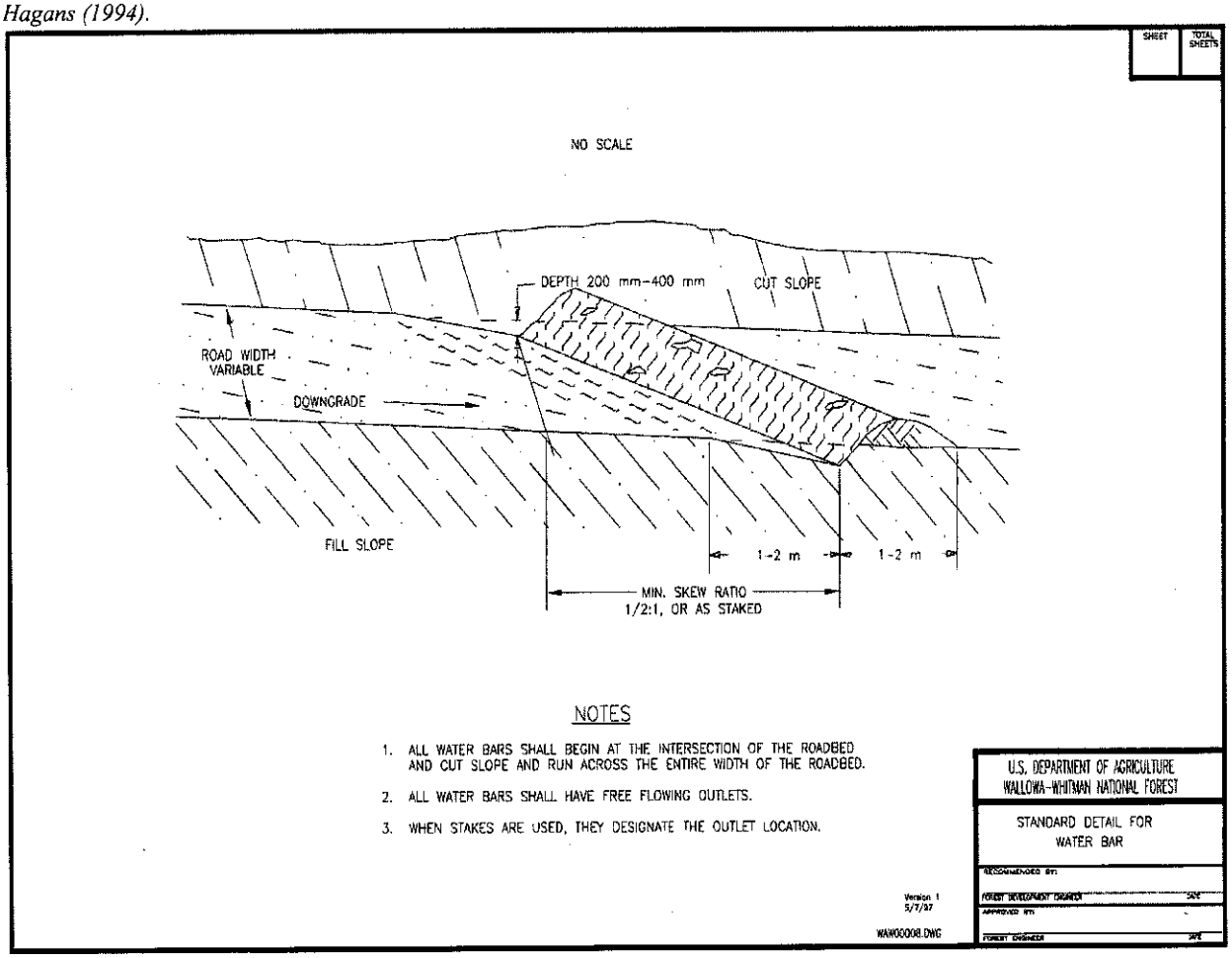


Figure 2. Typical design of a waterbar. From US Forest Service.

Source Material for Road BMP RD-7.8 Waterbars

1994. Weaver W.E. and D.K. Hagans. Handbook for Forest and Ranch Roads. Mendocino County Resource Conservation District

RD-1.11 DITCH RELIEF CULVERT INSTALLATION

DESCRIPTION

Ditch relief culverts (DRCs) divert water from an inside road ditch to an outside area beyond the outer edge of the road fill. DRCs take the flow through or beneath the road surface. Ditch relief culverts may also be used to filter water in a buffer zone prior to entering a waterway.

BEST MANAGEMENT PRACTICES

- Culverts should be designed and installed at intervals along the road that are close enough to prevent erosion of the ditch and at the culvert outfall, and at locations where collected water and sediment is not discharged directly into watercourses (Table 1).

- Install ditch relief culverts at an oblique (typically 30 degree) angle to the road so that ditch flow does not have to make a sharp angle turn to enter the pipe (Figure 1). On low gradient roads (<5%), where ditch flow is slow, ditch relief culverts can be installed at right angles to the road.

- Ditches should ***neither*** be discharged directly into the inlet of a watercourse crossing culvert, nor should ditch relief culverts discharge into a watercourse via surface flow without first directing flow through an adequate filter strip (Figure 2).

- In addition to installing ditch relief culverts on either approach to watercourse crossings, it is also advisable to consider installing ditch drains before curves, above and below through-cut road sections, and before and after steep sections of the road.

- If the ditch is on an insloped or crowned road that is very close to a stream, consider using outsloping to drain the road surface (see Road BMP RD-1.3, 1.4 Outslope Road). The ditch and the ditch relief culvert would then convey only spring flow from the cutbank, and not turbid runoff from the road surface.

- Do not discharge flow from ditch relief culverts onto unstable or highly erodible hillslopes

- Culverts should be installed at the gradient of the original ground slope, so it will emerge on the ground surface beyond the base of the fill. If not, either the fill below the culvert outlet should be armored with rock, or the culvert should be fitted with an anchored downspout to carry erosive flow past the base of the fill (Figure 1).

- Downspouts longer than 20 feet should be secured to the hillslope for stability. Full round downspouts are preferred over half-round downspouts.

Table 1. Maximum suggested spacing for ditch relief culverts[1] (ft)

Road grade (%)	Soil credibility				
	very high	high	moderate	slight	very low
2	600-800[2]				
4	530	600-800[2]			
6	355	585	600-800[2]		
8	265	425	525	600-800[2]	
10	160	340	420	555	
12	180	285	350	460	600-800[2]
14	155	245	300	365	560
16	135	215	270	345	490
18	118	190	240	310	435

[1]*Adapted from Transportation Handbook USDA Forest Service, R-6, 1966. Culvert spacing may be too great in locations where ditch runoff is accumulated and discharged onto steep hillslopes that are prone to gullying. Spacing is designed to control ditch erosion, not culvert outfall erosion, and are based on 25-year storm and precipitation rate of 1-2 in/hr for 15 minutes. If less, multiply by the intensity 0.50, 030, etc. If 2-3 in/hr, divide distance in table by 1.50; if3 -4 in/hr, divide by 1.75; and if 4-5 in/hr, divide by 2.00. The U.S. Forest Service also publishes abundant information on preventing and controlling gully erosion below culvert outfalls. From Hagans and Weaver (1994).*

[2]*Even with stable ditches, ditch relief culvert spacing greater than about 600 to 800 feet is generally not recommended due to the large volume of road surface and cutslope runoff that would be discharged through the culvert and onto lower slopes during peak runoff periods. Culvert outlet erosion may occur with less than 800 feet of contributing ditch line, so observe local conditions to determine the upper limit of acceptable spacing in your area.*

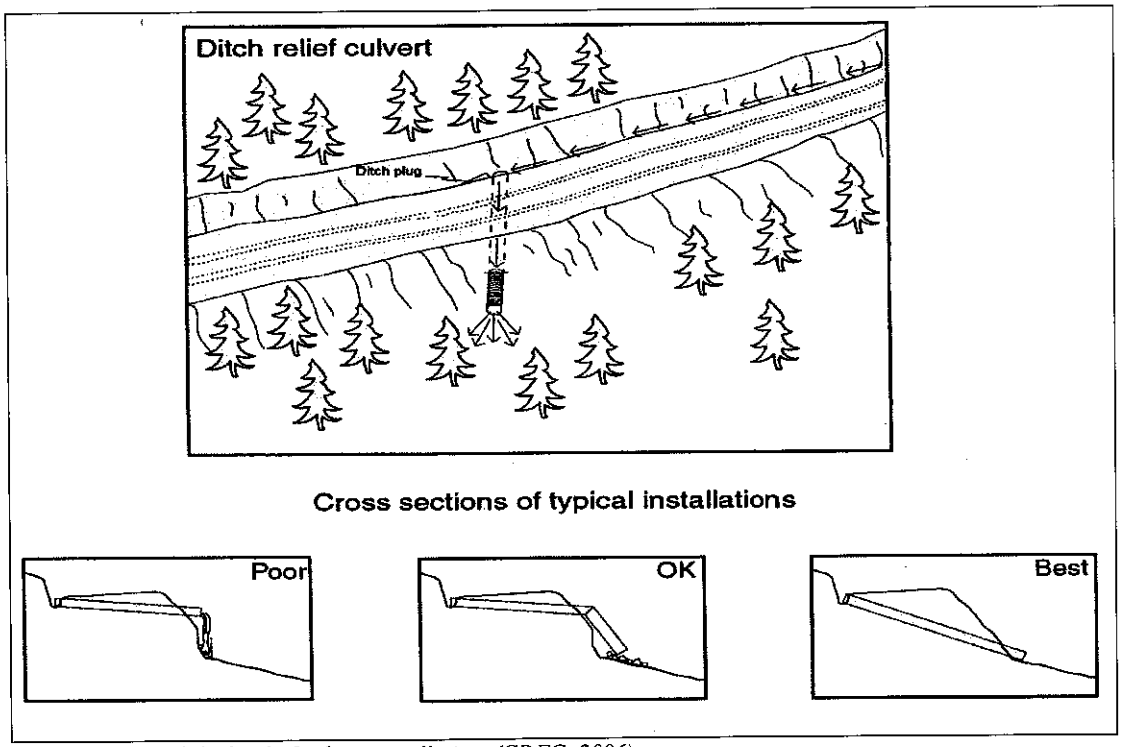


Figure 1. Typical ditch relief culvert installation. (CDFG, 2006)

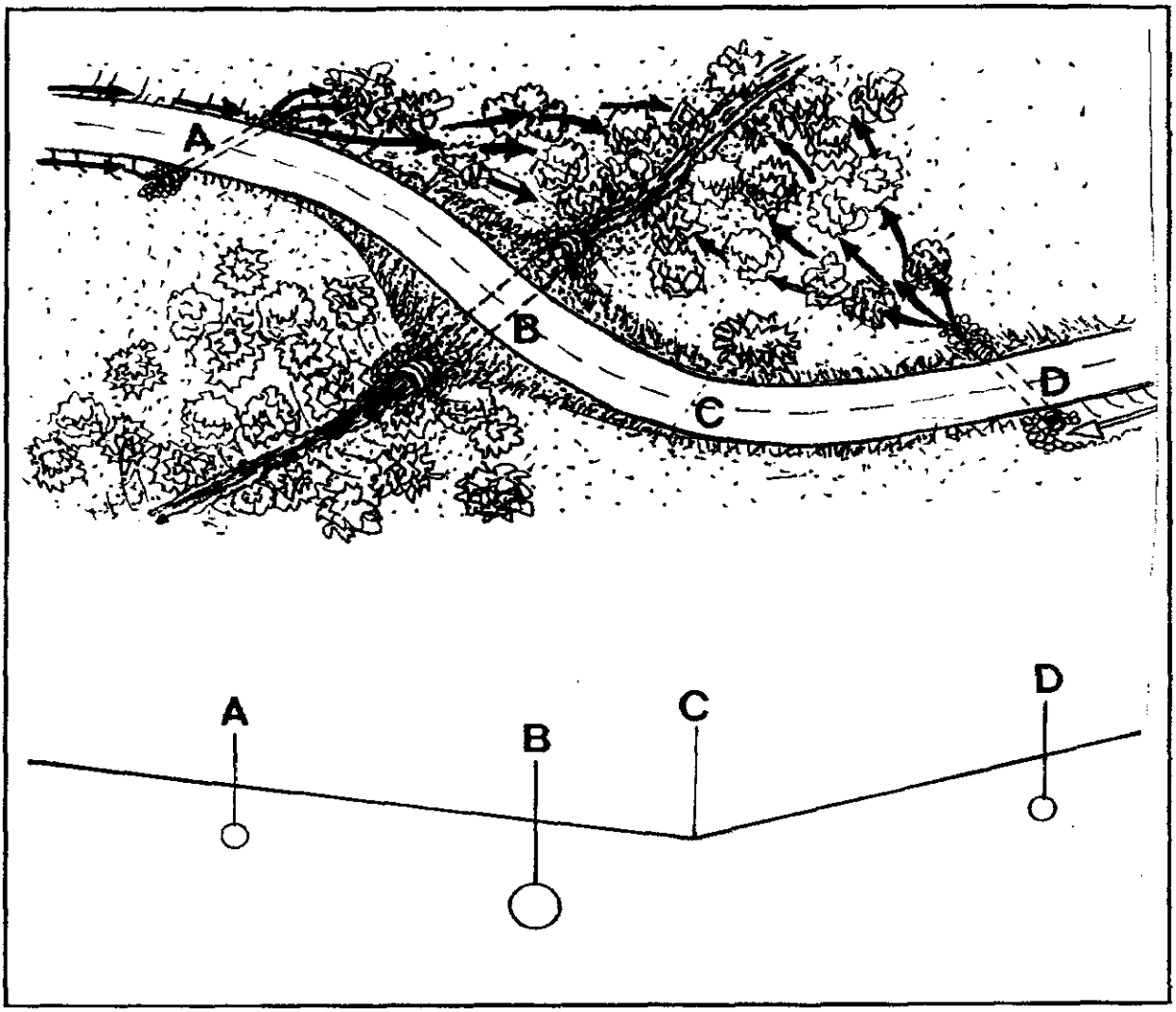


Figure 2. Where a road approaches a stream crossing (B), ditch flow should be culverted across the road (A,D) and discharged into a vegetated buffer that can filter the runoff before it reaches the watercourse. If the stream culvert plugs with debris or is topped by flood flows, flow will spillover the road at the change in grade at location "C" and back into the stream channel (modified from M.D.S.L. 1991). From Weaver and Hagans (1994).

Source Material for Road BMP 2.10 Ditch Relief Culvert Installation

2006. California Department of Fish and Game. Part X - Upslope Erosion Inventory and Sediment Control Guidance, California Salmonid Stream Habitat Restoration Manual.

2004. FishNet 4C. Guidelines for Protecting Aquatic Habitat and Salmon Fisheries for County Road Maintenance.

1994. Weaver W.E. and D.K. Hagans. Handbook for Forest and Ranch Roads. Mendocino County Resource Conservation District

RD-1.12 STREAM CROSSING INSTALLATION

DESCRIPTION

During road building, the construction of culverted stream crossings has the greatest potential of all activities to cause immediate sediment pollution. Culverts should be properly aligned, bedded, backfilled and covered, or they will be subject to eventual failure. In all cases, disturbance to the stream banks and streambed should be minimized during stream crossing construction.

BEST MANAGEMENT PRACTICES

- Culverts should be aligned with the natural stream channel. Correct alignment is critical for the culvert to function properly. Misalignment can result in bank erosion and debris plugging problems (Figure 69a).

- Stream crossing culverts should be placed at the base of the fill, and at the grade of the original streambed (Figure 1) (Figure 69d).

- Culvert should be inset slightly into the natural streambed so that water drops several inches as it enters the pipe. Culvert inlets set too low can plug with debris and those set too high can allow water to undercut the culvert (Figure 69b). Culverts placed midway up the outside of the fill are more likely to plug with sediment or organic debris, because their ability to pass materials is reduced, or to cause erosion of the fill below the culvert outlet (Figure1).

- The culvert bed may be composed of either compacted rock-free soil, or gravel. If gravel is used for the bed, filter fabric will be needed to separate the gravel from the soil to minimize the potential for soil piping. Bedding beneath the culvert should provide for even distribution of the load over the length of the pipe.

- Inlet and outlet of the culvert should be armored. A metal, concrete, sandbag or rock head-wall can be constructed to prevent inlet erosion. A trash protector can be installed just upstream from the inlet where there is a hazard of floating limbs and wood chunks plugging the culvert inlet. This is especially important on logging roads where the upslope areas have recently been harvested or are slated for harvesting in the future.

- Stream crossings that are not at grade can be retrofitted with a downspout with rock placed at the outlet for armoring against hillslope erosion.

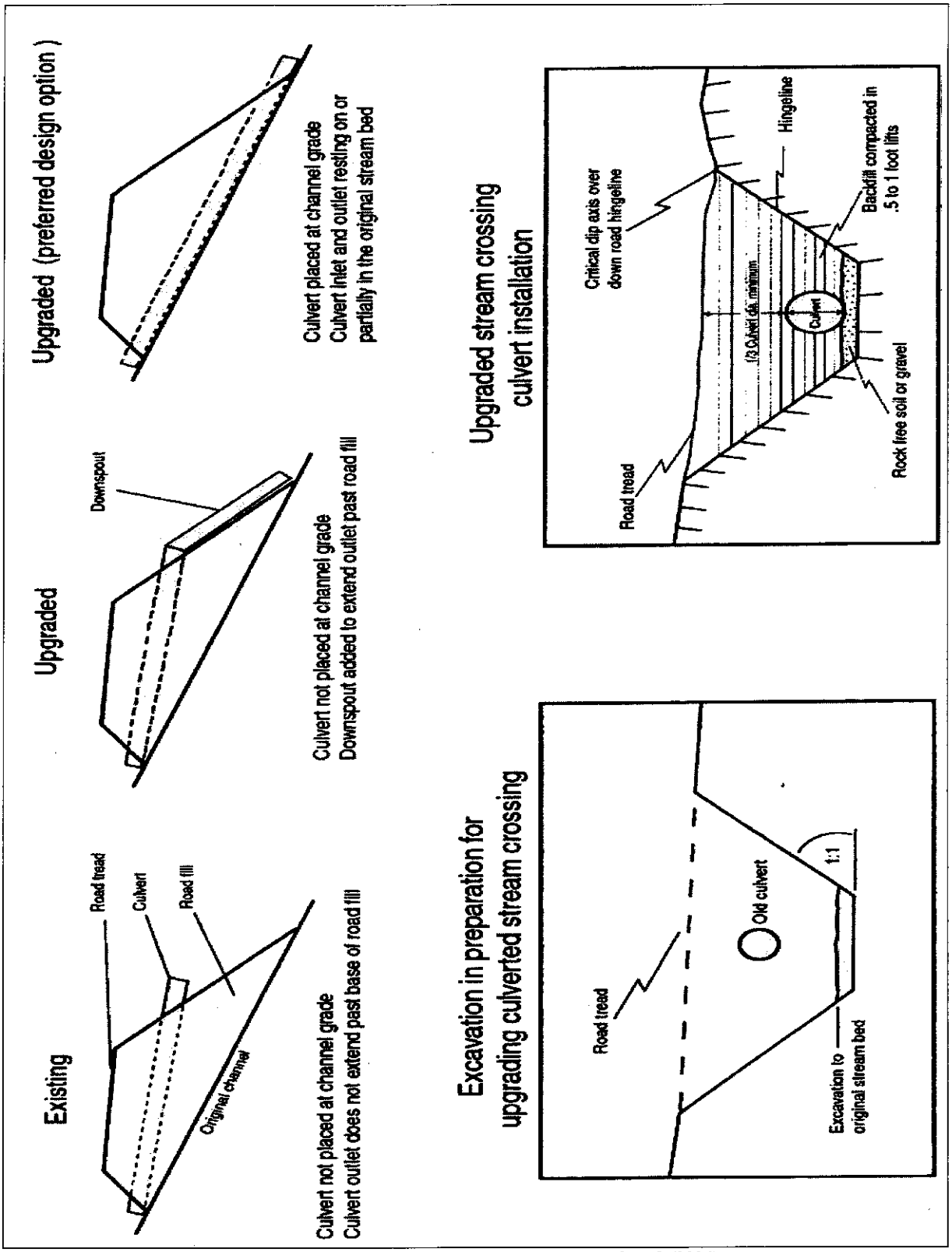


Figure 1. Typical stream crossing installation on non fish-bearing streams. From CDFG (2006).

Figure 69a, b. Proper culvert installation involves correct culvert orientation, setting the pipe slightly below the bed of the original stream, and backfilling and compacting the fill as it is placed over the culvert. Installing the inlet too low in the streambed (A) can lead to culvert plugging, yet if it set too high (B) flow can undercut the inlet (fromM.D.SL.,1991).

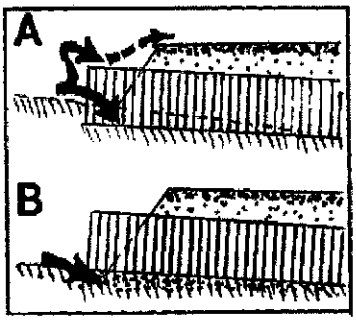
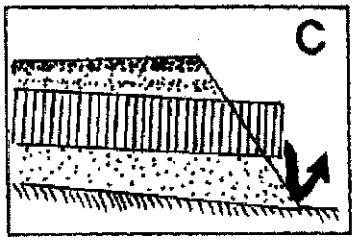


Figure 69c. If the culvert outlet is placed too high in the fill (C), flow at the outfall will erode the fill.



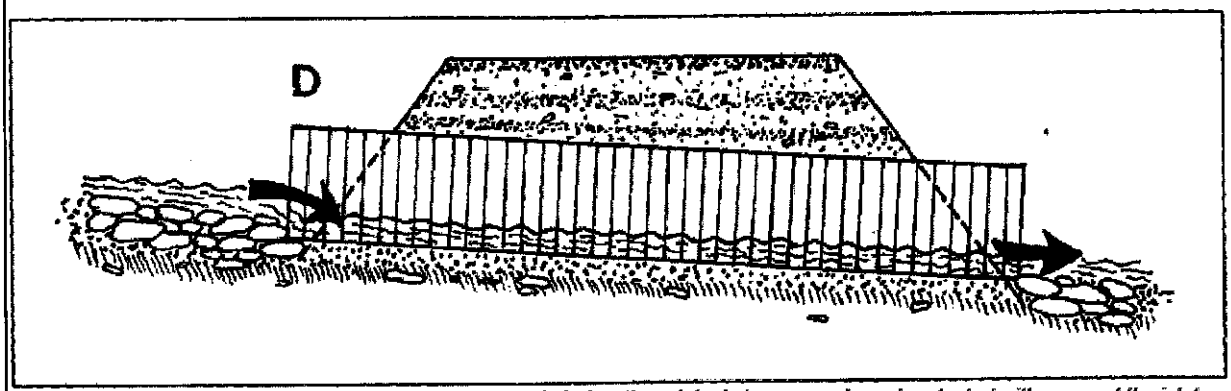


***Figure 69d.** Placed correctly (D), the culvert is set slightly below the original stream, grade and protected with armor at the inlet and outlet.*

Figures 69a,b,c,d. Typical stream crossing installation. From Hagans and Weaver (1994).

Source Material for Road BMP RD-2.8 Stream Crossing Installation

2006. California Department of Fish and Game. Part X - Upslope Erosion Inventory and Sediment Control Guidance, California Salmonid Stream Habitat Restoration Manual.

1994. Weaver W.E. and D.K. Hagans. Handbook for Forest and Ranch Roads. Mendocino County Resource Conservation District

RD-1.13 DRAINAGE FOR UNPAVED ROAD SURFACES

DESCRIPTION

Roads should be designed and constructed to cause minimal disruption of natural drainage patterns. Provisions for two components of road drainage should be included in every road project: 1) road surface drainage (including drainage which *originates* from the cutbank, road surface, and fillslope); and 2) hillslope drainage (including drainage from large springs, gullies, and streams which *cross* the road alignment).

BEST MANAGEMENT PRACTICES

- Maintain natural drainage patterns in watershed through installing drainage features to keep water within sub-basins.
- Crown or slope the road to avoid ponding or concentration of runoff. Outslope all roads where possible and safe (see Road BMP RD-1.3,1.4 Outslope).
- Use rolling dips instead of ditch relief culverts (DRCs) when possible (Table 1) (Figure 1). Rolling dips require less maintenance and are less prone to failure than culverts (see Road BMP RD-1.8 Rolling Dips).
- Disconnect road drainage features from watershed hydrology. Shorten ditch lengths to stream crossings by installing a ditch relief culvert or rolling dip before the watercourse (see Road BMP RD-1.11 Ditch Relief Culvert Installation).
- In addition to installing DRCs on either approach to the stream crossings, it is also advisable to consider installing ditch drains before curves, above and below through-cut road sections, and before and after steep sections of the road.
- Ditches should neither be discharged directly into the inlet of a stream crossing culvert, nor should DRCs discharge into a watercourse without first directing flow through an adequate filter strip.
- Culverts should be designed and installed at intervals along the road that are close enough to prevent erosion of the ditch and at the culvert outfall. They should be installed at locations where collected water and sediment is not discharged directly into watercourses (Table 2).
- DRCs should not be used on erosive slopes without a downspout (see Construction BMP SS-11 Slope Drain).
- In areas of high erosion and/or storm runoff, *minimum* ditch relief culvert sizes should be 18 inches in diameter, and never less than 12 inches in other areas.
- A 10% grade to the culvert will usually be self cleaning. The culvert grade should also be at least 2% greater than the ditch which feeds it. The culvert should be placed at a 30 degree skew to the ditch to improve inlet efficiency and prevent plugging and erosion at the inlet.

- Stream crossings culverts and DRCs should be installed at the gradient of the original ground slope, so it will emerge on the ground surface beyond the base of the fill. If not, either the fill below the culvert outlet should be armored with rock, or the culvert should be fitted with an anchored downspout to carry erosive flow past the base of the fill (Figure 2) (see Road BMP RD1.12 Stream Crossing Installation).

- Culverts should be covered by a minimum of 1 foot of compacted soil, or a depth of 30% of its diameter, whichever is greater.

- Inlet protection, such as rock armoring or drop structures, can be used to help minimize erosion.

- DRCs must be spaced frequently enough to carry ditch and road surface waters without creating erosive concentrated flows. See attached table for spacing guidelines.

Road grade %	Upslope approach (distance from up-road start of rolling dip to trough) (ft)	Reverse grade (distance from trough to crest) (ft)	Depth below average road grade at discharge end of trough (ft)	Depth below average road grade at upslope end of trough (ft)
<6	55	15-20	0.9	0.3
8	65	15-20	1.0	0.2
10	75	15-20	1.1	.01
12	85	20-25	1.2	.01
>12	100	20-25	1.3	.01

Table 1. Table of rolling dips dimensions. From CDFG (2006).

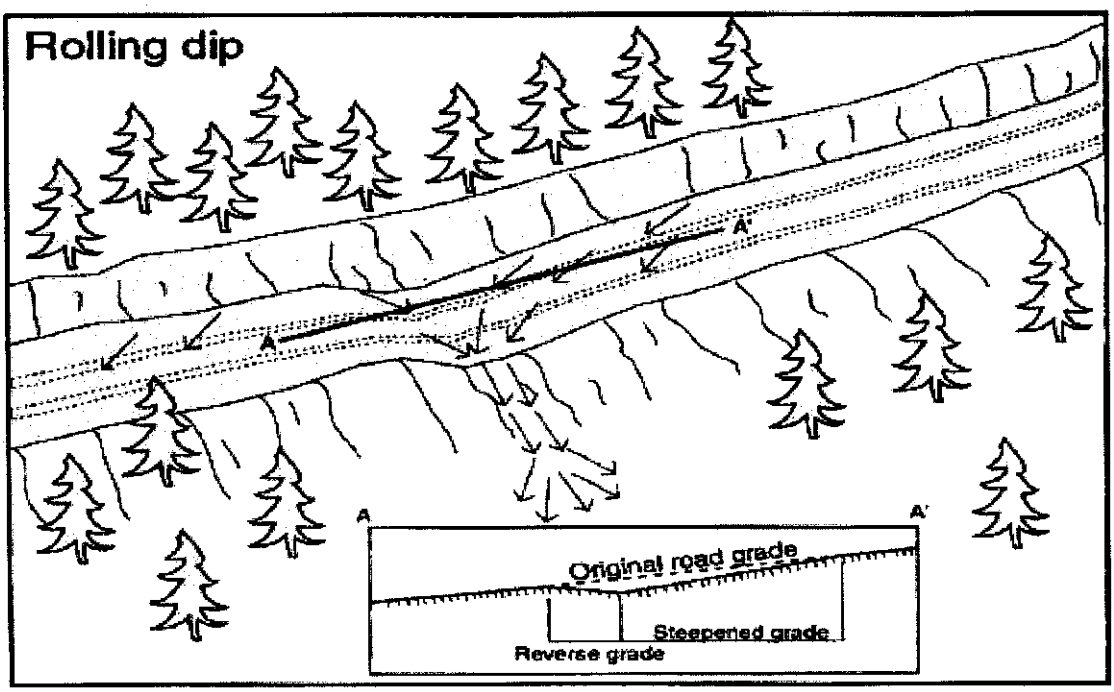


Figure 1. Use of rolling dips to reduce ditch erosion and surface runoff. Rolling dips must drain the road surface and be driveable for the expected traffic. From CDFG (2006).

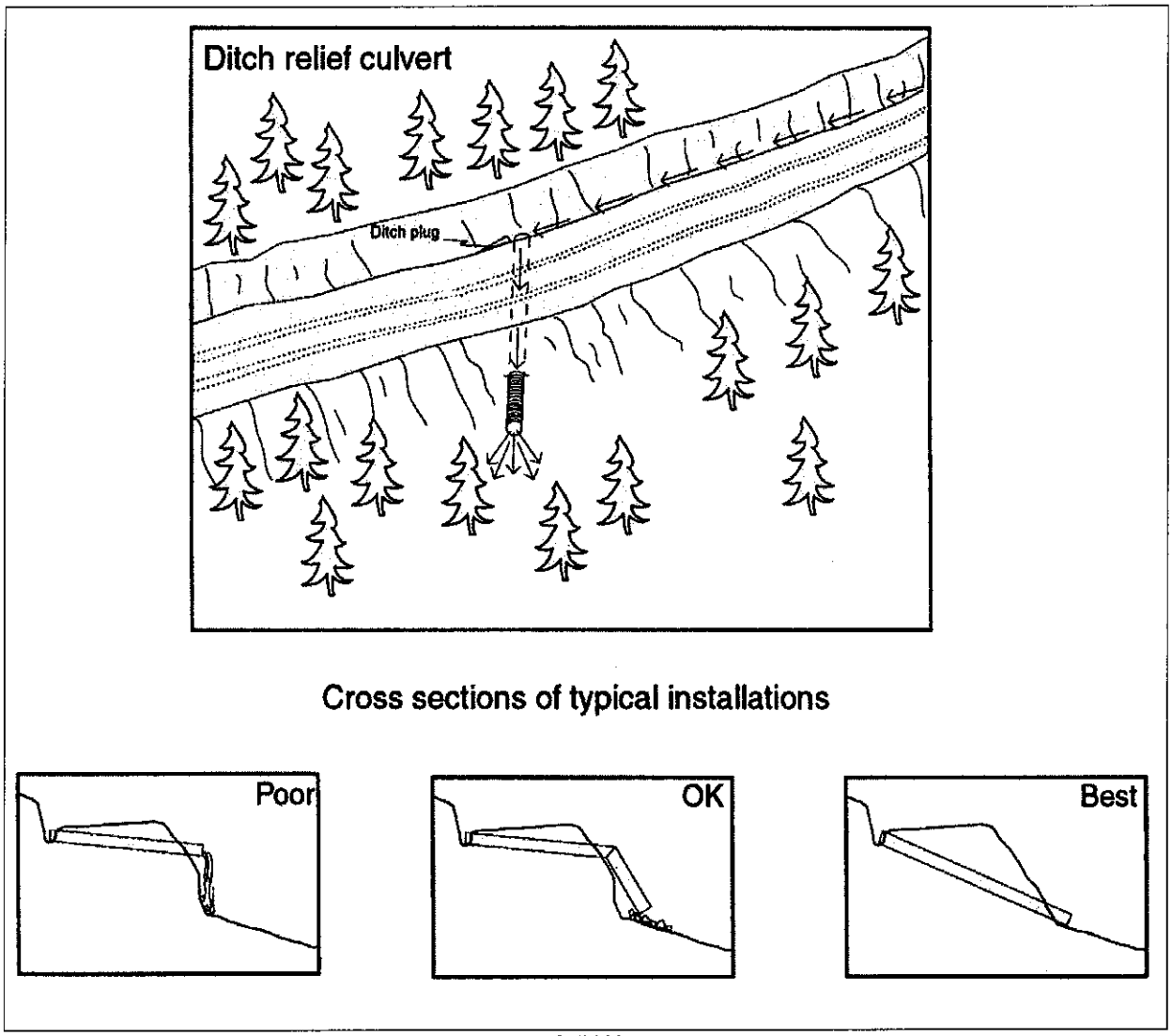


Figure 2. Typical ditch relief culvert installation. From CDFG (2002).

Table 2. Maximum suggested spacing for ditch relief culverts[1] (ft)

Road grade (%)	Soil credibility				
	very high	high	moderate	slight	very low
2	600-800[2]				
4	530	600-800[2]			
6	355	585	600-800[2]		
8	265	425	525	600-800[2]	
10	160	340	420	555	
12	180	285	350	460	600-800[2]
14	155	245	300	365	560
16	135	215	270	345	490
18	118	190	240	310	435

[1]Adapted from Transportation Handbook USDA Forest Service, R-6, 1966. Culvert spacing may be too great in locations where ditch runoff is accumulated and discharged onto steep hillslopes that are prone to gullying. Spacing is designed to control ditch erosion, not culvert outfall erosion, and are based on 25-year storm and precipitation rate of 1-2 in/hr for 15 minutes. If less, multiply by the intensity 0.50, 030, etc. If 2-3 in/hr, divide distance in table by 1.50; if3 -4 in/hr, divide by 1.75; and if 4-5 in/hr, divide by 2.00. The U.S. Forest Service also publishes abundant information on preventing and controlling gully erosion below culvert outfalls. From Hagans and Weaver (1994).

[2]Even with stable ditches, ditch relief culvert spacing greater than about 600 to 800 feet is generally not recommended due to the large volume of road surface and cutslope runoff that would be discharged through the culvert and onto lower slopes during peak runoff periods. Culvert outlet erosion may occur with less than 800 feet of contributing ditch line, so observe local conditions to determine the upper limit of acceptable spacing in your area.

Source Material for Road BMP RD-1.3 Road Drainage for Unpaved Road Surface

2006. California Department of Fish and Game. Part X - Upslope Erosion Inventory and Sediment Control Guidance, California Salmonid Stream Habitat Restoration Manual.

1994. Weaver W.E. and D.K. Hagans. Handbook for Forest and Ranch Roads. Mendocino County Resource Conservation District

RD-1.14 ROAD SURFACE UPGRADE

DESCRIPTION

The road surface can be a big source of stream sediment. In some watersheds, it may be the primary source of accelerated (human-caused) erosion and sediment yield from the road system. Proper road construction and surfacing can significantly reduce this source of fine sediment. Permanent roads that are to be used for winter and wet weather hauling, including ranch roads and roads used for commercial hauling of forest products, need to be surfaced to improve trafficability and reduce erosion. Roads which receive heavy use should be inspected regularly to discover early signs of damage. Serious damage to road surfaces usually begins with the build up of thick (1-4 inch) accumulations of dry dust during the summer, or excess water (and mud) during the winter. Standing water is a sign of poor road drainage and ruts indicate that road strength is deteriorating.

BEST MANAGEMENT PRACTICES

- Follow Road BMPS in RD-1.4 Road Surfacing.

- A stable and well drained subgrade is essential for a good road. The load bearing capacity of a road depends upon the subgrade's soil strength, drainage and compaction characteristics (Table 23). Native material is often suitable, and can be used for the road's subgrade. Weak or wet subgrades (soils unable to support a load by themselves) need to be strengthened by adding loose or crushed rock or gravel to provide ballast and distribute the stress placed on the soil.

- Wet, low strength soils may be stabilized by the use of synthetic fabrics (geotextiles) designed specifically for this application. The fabric is spread over the subgrade and then covered with a layer of rock. Water passes through the membrane, but the wet soil remains below and does not mix with the surface aggregate. As a result, the road dries faster and the fabric spreads the wheel loading pressures over a large surface area.

- The running surface of the road should be smooth and hard-wearing, and it should not be subject to blowing or washing away. The most commonly used surfacing materials are angular (crushed) rock. In the past, river-run gravel was frequently used where crushed rock was not readily available. However, rounded material is not as well suited as long lasting surfacing material and may be difficult to keep in-place.

- First, a "base course" of 2 to 3 inch diameter angular rock is usually dumped on the compacted native road surface using dump trucks, spread to a uniform depth using a grader or tractor and then compacted. The use of true compaction equipment (instead of tractors) will provide the best, longest lasting road surface. Geotextile engineering fabrics can be used beneath the base course material if soil conditions are wet. A finer "surface course" several inches in thickness is then spread over the compacted base coarse material to provide a dense, smooth running surface. The resulting layers of angular, interlocking rock will provide a low impact road surface that can be used during much of the winter (Table 24) (Figure 1).

- For all-weather use, angular rock should be placed to a total depth of 6-10 inches, or more, which will then compact to a finished depth of 4 to 6 inches under normal use. Table 24 lists the volume of aggregate needed to surface one mile of road, ranging from 10-20 feet wide, to a depth of 1-6 inches.

Table 23. Soil characteristics for road subgrade materials[1]

Material type	Strength, compaction and foundation suitability	Drainage	Reaction to frost	Common symbols of soil types[2]
Clean gravels and clean sand[3]	Good to excellent	Excellent	None to slight	GW, GP, SW, SP
Gravels and sands with non-plastic[4] fines	Good to excellent	Fair to poor	Slight to high	GMd, SMd
Gravels and sands with plastic[4] fines	Fair to good	Poor to impervious	Slight to high	GMu, GC, SMu, SC
Non-plastic and slightly plastic[4] silts and clays	Poor to fair	Fair to impervious (mostly poor)	Medium to high	ML, CL, OL
Medium and highly plastic[4] silts and clays	Very poor to poor	Pair to impervious (mostly poor)	Medium to very high	MH,CH
Peat and other highly organic soils	Very unstable, poor compaction	Fair to poor	Slight	Pt

[1] W.D.N.R. (1982)

[2] Unified Soil Classification System (USCS) symbol

[3] "Clean" means less than about 12% of the material is smaller than 1/64" (the smallest particle visible to the naked eye)

[4] Plasticity can be tested by simple field methods, including lightly wetting a hand sample, rolling the fines into a ball and then into a thread before it crumbles:

Non-plastic: a thread cannot be formed, regardless of the moisture content. Low plasticity: after 2-3 times, the molded ball will crumble.

Medium plasticity: After 3-5 times, the ball will easily crumble with moderate force (pressed between thumb and forefinger.

High plasticity: ball will not crumble, even with moderate force, after five times.

Table 23. From Weaver and Hagans (1994).

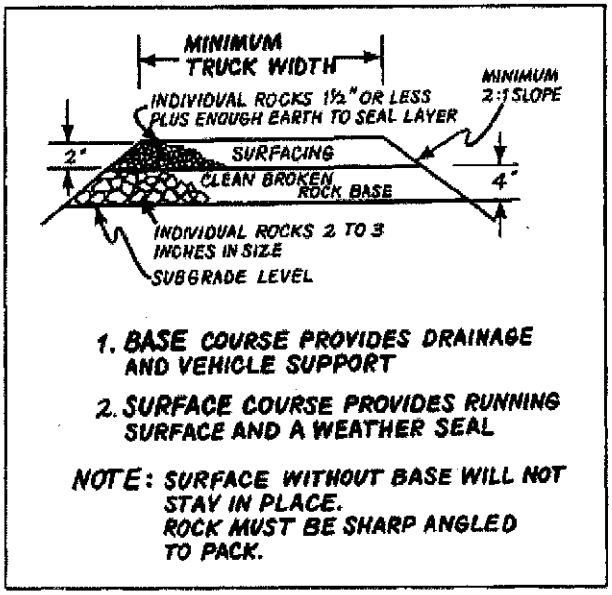


Figure 1. Cross section diagram showing typical base-course and surface-course application for forest and rand roads (USDA_SCS, 1983). From Weaver and Hagans (1994).

Table 24. Aggregate (yds[3]) required to one mile of road[1]

Road width (ft)	Depth of uncompacted rock (inches)					
	2"	4"	6"	8"	10"	12"
10'	326	652	978	1,304	1,630	1,956
12'	391	782	1,174	1,564	1,956	2,348
14'	456	913	1,369	1,826	2,282	2,738
16'	522	1,043	1,565	2,086	2,608	3,130
18'	587	1,174	1,760	2,348	2,934	3,520
20'	652	1,304	1,956	2,608	3,260	3,912

[1] USDA (1978). Uncompacted, 16.3 yds[3] equals 1 inch deep by 1 foot wide by 1 mile long. When aggregate is compacted, increase volumes required by 15-30%, depending on type and gradation of material.

From Weaver and Hagans (1994).

Source Material for Road BMP RD-6.2 Road Surface Upgrade

1994. Weaver W.E. and D.K. Hagans. Handbook for Forest and Ranch Roads. Mendocino County Resource Conservation District

RD-1.15 ROUTING AND LOCATION

DESCRIPTION

Roads should be plotted and located by a person with some knowledge of the area to be served by the road and of the terrain where the road is to be built. An engineer or geologist should be consulted in routing forest system roads to identify unstable terrain and to protect aquatic resources.

LIMITATIONS

Road system layout is influenced by many factors, including topography, property lines, obstacles (rock outcrops, unstable areas, etc), and proposed land use activities. Controls on the location of a road include both natural features and man-made elements (Table 1).

Table 1. Some Man-Made Controls Which Affect Road Location[1]

Control	Comment
Legal	Boundary lines limit the location of a road. Talk with adjacent landowners and work out written right-of-way agreements to share roads and reduce road construction.
Specific Location	The beginning and ending points of a road are often fixed. These represent major controls.
Safety	Each class of road and level of use have specific safety requirements. Common sense should be applied in setting speed, grades, curve radius, sight distance, and turnouts.
Pollution Control	Roads should avoid problem areas. Allow ample room to trap sediment in a buffer before it reaches a stream. Do not allow any direct discharge points where road runoff flows directly into the stream. Avoid flood plains, landslides, credible soils, etc., as well as slopes over 40% wherever possible.
Design Elements	Physical limits for curve radius, road grade, pitch grade, stopping distance and separation from streams are set by you. Design to reduce maintenance costs and pollution potential.
Migrating Fish	Observe and maintain substantial buffers. Know what species use your streams, their habitat requirements, the susceptible periods of their life cycle, and their environmental tolerance limits. Permits may be needed from the Department of Fish and Game.
Approach Roads Permits	Issued by California Department of Transportation of the County for roads connecting to public highways. Location for intersections may be restricted.

From Hagans and Weaver (1994). [1] Adapted from USD A-SCS (1981).

BEST MANAGEMENT PRACTICES

- Identify and map the following conditions on the ground during the road layout process (Table 10):
    - favorable topography (especially benches and low gradient areas for landings turnouts and spoil disposal)
    - control points (the beginning and ending points, saddles and other sites)
    - obstacles (especially unstable or erodible soils, large rock outcrops and wet areas)
    - stream channels (including their degree of incision)
    - inner gorge locations
    - areas of steep slopes
    - any other obvious hazards or controls

Table 10. Some natural controls which affect road location[1]

Control		Comment
Saddles		Major control for road location
Ridges		Major control and often a satisfactory road site.
Stream crossings		Major control. Seek locations with gentle side slopes and locations wide enough to accommodate the road. Good sites for bridges or culverts are needed. Evaluate for migratory fish where needed. Will need Fish and Game 1603 permit.
Benches		Often a good location for road junctions, switchbacks, landings, turnouts, etc.
Cliffs or rock outcrops		Cross above or below at a safe location. Rock which can be ripped is less costly to remove than hard rock needing blasting.
Slides		Major control. Avoid or cross at the safest point. Ask for professional geotechnical assistance.
Wetlands (bogs, swamps, wet meadows)		Major control. Avoid where possible or cross quickly at best point. May need Fish and Game clearance.
Valley floor	wide	Low gradient, desirable road location if above the flood line. If crossing, cross and get out of floodplain quickly. Little excavation required. Fish and Game permit may be required.
	narrow	Poor location because of flooding, erosion and pollution potential and high costs to cross the stream if it meanders. Keep road above floodplain. Fish and Game 1603 permit may be required.
Slopes	>40%, but <60%	Avoid sidecasting and sliver fills (thin blankets of fill placed on steep slopes) in which large bare areas are exposed to erosion. This loose sediment may be difficult to control because of long buffers needed.
	≥60%	Construction in unstable areas should be avoided. Full bench road construction and endhauling material may be needed where slopes remain steep alongside stream channels. **Proceed only with extreme caution.** Avoid road construction on these steep slopes if possible.
	ridge crest	Good alignment and little excavation. Good drainage. Few culverts required. Adverse grade encountered on uneven ridges. Spur roads will have an adverse grade.
Aspect		Maintenance requirements in moist climates can be minimized by placing roads on south-facing slopes to promote drying and snow melt. In dry climates, the north-facing slopes have more vegetation and may have less erosion. Extremely wet or dry climate negates this effect.
Rock slope (dip)		Place roads on the hillside where rocks dip (slant) into the hillside, not parallel to or out of the hillslope. Consult a geologist for other problems and advice.
Soils		Where possible, avoid road building on naturally erodible soils. Check soils maps for potential problems and ask extension agents or the SCS for advice. Frozen soils require special care; ask for assistance.

From Weaver and Hagans (1994). [1] Adapted from USDA-SCS (1981)

- Identify and evaluate nearby rock outcrops for potential rock aggregate for road surfacing materials.
- Identify broad ridge crests and benches as possible locations for landings, road turnouts and spoil disposal sites (Figure 1).
- Locate switchback with little or no grade so that trucks and equipment can pass safely and so they won't tear up the road surface while turning the comer and continuing up the road.

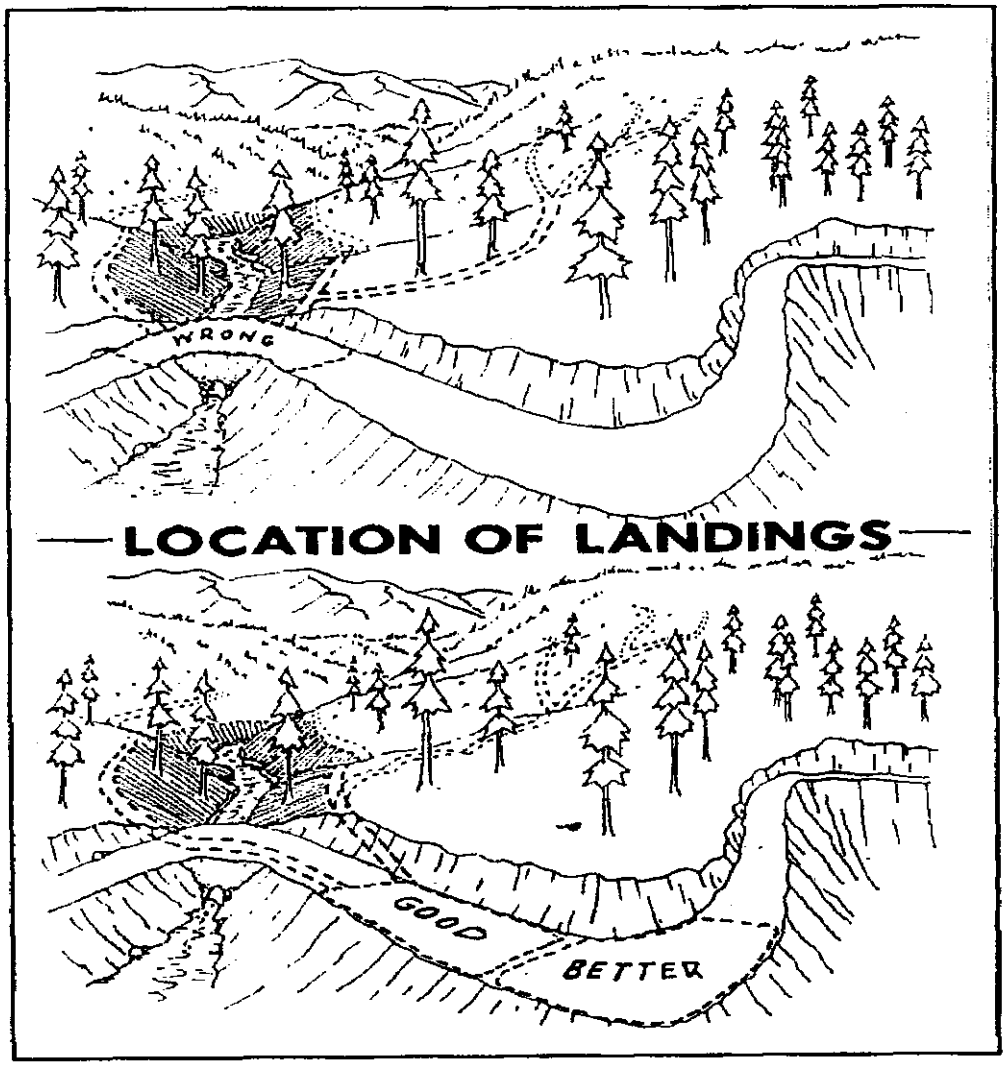


Figure 1.. Log landings on forest road systems should be kept to the absolute minimum size necessary to accommodate yarding, loading and hauling equipment and the minimum number needed to remove timber resources. Landings constructed on gentle ground and broad ridge crests far removed from stream channels are least likely to cause water quality problems, whereas landings built on steep slopes and near watercourses can result in severe impacts. From Weaver and Hagans (1994). Adapted from (USFS, 1963).

For more information, see Handbook for Forest and Ranch Roads. Weaver and Hagans (1994) and consult a trained engineer or geologist before construction. A trained wildlife biologist may be required to investigate for endangered species or species of special concern. An archaeologist may occasionally be needed to identify cultural sites that have to be avoided or mitigated before construction can begin.

Source Material for Road BMP RD-1.2 Routing and Location

1994. Weaver W.E. and D.K. Hagans. Handbook for Forest and Ranch Roads. Mendocino County Resource Conservation District

RD-1.16 UNDERSTANDING ROAD REMOVAL

DESCRIPTION

Approaches to removing roads may be divided into six categories: closure, abandonment, reclassification as trail, decommissioning, conversion to trail, and obliteration (Figure 1).

REMOVAL OPTIONS

Closure

Some agencies close roads with gates, berms, or deep ditches (tank traps) as an approach to road removal (see Road BMP RD-7.3 Road Closure). On-the-ground surveys indicate that conventional closure devices are ineffective at stopping road use by people intent on accessing restricted areas. With an effective device that prohibits motorized access, however, closure may reduce a road's terrestrial impacts by providing wildlife security. Even so, closure is an ineffective approach to removing a road, because the road continues to disrupt natural drainage patterns, cause soil erosion, and potentially initiate mass failures; in short, a closed road continues to impact aquatic ecosystems.

Abandonment

When a road is "abandoned," it is no longer maintained and may or may not be driveable based on physical conditions or the presence of vegetation. The Forest Service considers road abandonment a "no-action treatment" (Moll 1996). Like a closed road with an effective closure device, abandoned roads that no longer receive motorized use may reduce a road's terrestrial impacts by providing wildlife security. Simply discontinuing maintenance and abandoning a road, however, rarely prevents continuing and potential hydrologic problems. The presence of vegetation may provide the false idea that the road is recovering and is no longer problematic. Culverts can become plugged, and roads may continue to function as surface flow paths for water. Road fills may remain unstable and susceptible to failure. Because an abandoned road continues to impact aquatic ecosystems, abandonment is an ineffective approach to removing a road.

Reclassification as Trail

Reclassifying a road as a trail without restoring drainage patterns and stabilizing fill materials is not an effective approach to removing a road, especially if motorized use continues. Even if wildlife security is improved by stopping motorized use, simply reclassifying a road as a trail does not address a road's aquatic impacts; this type of approach is basically the same as abandonment. If a road is changed to a trail, it must be actively converted (see "Conversion to trail" below) by first stabilizing fill materials and dispersing concentrated water.

Decommissioning

Decommissioning is carried out to minimize shortterm sediment production, while "storing" a road for future use. Major treatments include removing stream crossings and stabilizing sidecast fill material. Site-specific drainage treatments such as constructing cross road drains, removing inboard ditches, and/or outsloping also help disperse concentrated water. Road surfaces may be mechanically scarified to facilitate revegetation. The goal of decommissioning is to leave much of the road prism intact so the road can be reconstructed in the future with only minimal effort. Decommissioning preserves most of the original construction investment, while reducing road-caused erosion and avoiding maintenance and/or repair costs. Other common terms used to indicate road removal with plans for future reconstruction

include storm-proofing, flood-proofing, erosion-proofing, putting-to-bed, deactivation, reclamation, hydrologic closure, hydrologic obliteration, and storage for future use. Planning for reconstruction and leaving much of the road prism intact may result in treating a road too lightly during removal. Future plans may change; post-decommissioning is too late to further treat the road for the long-term. Even if decommissioning stops road-related erosion in the shortterm, it is not the same as obliterating a road because the road is expected to be reconstructed. Even if roads may be reconstructed in the future, they should be removed as if reconstruction will not occur.

Conversion to Trail

Converting a road to a modest walking trail can be an effective approach to removing a road if all fill materials are stabilized before the trail is constructed. Some road-to-trail conversions are implemented by only partially recontouring a road, which may not stabilize all fill materials. Conversion is ineffective when ORVs are allowed because impacts associated with motorized use continue. Though trails are less intrusive and damaging than roads, they can cause similar impacts, such as stream sedimentation and facilitation of non-native species invasions.

Obliteration

Obliteration involves removing a road with no plans for future reconstruction. To be most effective, obliteration restores the original landform to the greatest extent possible. Stream crossings are removed and slopes are recontoured. Road surfaces and fill sites are ripped to improve subsurface water flow. Coarse woody debris placed on the recontoured road surface provides erosion protection, long-term nutrient sources, and wildlife habitat. Revegetation is also actively carried out with native species collected near the site. Fully obliterating roads speeds the restoration and recovery of hydrologic function, as well as ecological and evolutionary processes. If implemented appropriately, obliteration is the most effective approach to road removal since it addresses both terrestrial and aquatic impacts caused by roads.

Road impact considerations	How different approaches to removing roads address road impact considerations					
	Close	Abandon	Reclassify as trail	Decommission	Convert to trail	Obliterate
Is wildlife security improved?	Yes* (short-term)	Yes (long-term)	Depends on extent of trail use	Yes* (short-term)	Depends on extent of trail use	Yes* (long-term)
Are fill stability problems fixed?	No	No	No	Yes* (short-term)	Yes*	Yes*
Is surface erosion controlled?	No	No	No	Yes* (short-term)	No* (much reduced)	Yes*
Will the road be reopened or reconstructed?	Yes	No	No	Yes	No	No
Is motorized use accommodated?**	Yes	Yes (unless overgrown)	Yes	No*	Yes	No*
Will continued maintenance and repair funding be necessary?	Yes	No	Yes	No* (until reconstructed)	Yes	No*
* if implemented effectively ** decommissioned and obliterated roads may continue to accommodate winter use by snowmobiles						

Figure 1. From Bagley (1998).

REMOVAL TREATMENT OPTIONS

Specific road removal treatments include removing stream crossings, constructing cross road drains, ripping, recontouring, and outsloping. Each treatment is summarized below.

Stream Crossing

Stream crossing removal is a fundamental treatment for removing roads. When done correctly, stream crossings are removed by excavating All fill materials and restoring the original channel and valley shape. Simply removing culverts is not enough, because any remaining road fill will erode into the channel. Materials excavated from stream crossings can be used to recontour road segments to their natural slope, essentially returning fill to the location from which it was cut. Endhauling is necessary when the amount of fill removed is greater than that needed for recontouring. Any road removal project that does not remove stream crossings (or does not remove all fill materials) is not effective and may cause more ecological damage by causing additional sedimentation.

Cross Road Drains

Cross road drains are deep ditches excavated across road surfaces (similar to waterbars, but more substantial) to facilitate drainage on closed roads. They are too deep and steep to be cleared by motor vehicles. Unless spaced frequently enough to disperse concentrated water, cross road drains may cause erosion downslope. They must be constructed more frequently on roads with steep grades, but are not necessary if roads are fully recontoured or outsloped steeply.

Ripping

Ripping involves decompacting road surfaces and fill sites to a depth of two to three feet. The goal is to enhance subsurface water flow by reducing soil density and increasing porosity, infiltration, and percolation. Ripping relatively impermeable fill sites reduces the chance of fill saturation and failure. Some soil settling occurs since organic matter is limited in sterile road soils. Therefore, adding organic matter to the ripped soil can greatly accelerate the recovery of hydrologic function, including both infiltration and percolation (Luce 1997). Ripping also increases revegetation success.

Recontouring

Recontouring involves placing all fill materials back into locations where fill was removed during road construction. Recontouring restores the original slope as much as possible, dispersing concentrated water and greatly enhancing slope stability. Full recontouring is sometimes impossible, especially on very steep slopes, since the sidecast material may have slid downhill out of reach. In some cases, cutslopes will be so high and road cuts so narrow, that replaced fill material will not blend with the original undisturbed slope. Even so, slope recontouring to the extent possible generally results in the most stable landform shape, restores natural surface runoff patterns, and deters motorized access.

Outsloping

Outsloping involves filling inboard ditches with sidecast fill material and sloping the road surface to disperse water to the downhill side of the road. Some sidecast fill materials remain, but saturation and potential failure is reduced because water cannot concentrate in inboard ditches or on the road surface. The remaining fill slope materials may still cause stability problems, especially on steep slopes.

Source Material for Road BMP RD-7.2 Understanding Road Removal

1983. Bagley, Scott. The Road-Ripper's Guide to Wildland Road Removal. Wildlands Center for Preventing Roads

1994. Weaver W.E. and D.K. Hagans. Handbook for Forest and Ranch Roads. Mendocino County Resource Conservation District

RD-1.17 ROAD CLOSURE

DESCRIPTION

Road closure is an effective tool in managing road systems to protect private property, road systems, water quality, and sensitive landscapes. Choosing the access control treatment depends on the type of vehicle assess to be discouraged and the length of the closure (Table 1). For example, closure treatments can to designed to discourage motorized traffic, but allow mountain biking or walking access. Closure treatments can also be designed to permanently close a road or allow seasonal treatments. The closure treatment chosen should reflect both the short term and long term use of the road system.

BEST MANAGEMENT PRACTICES

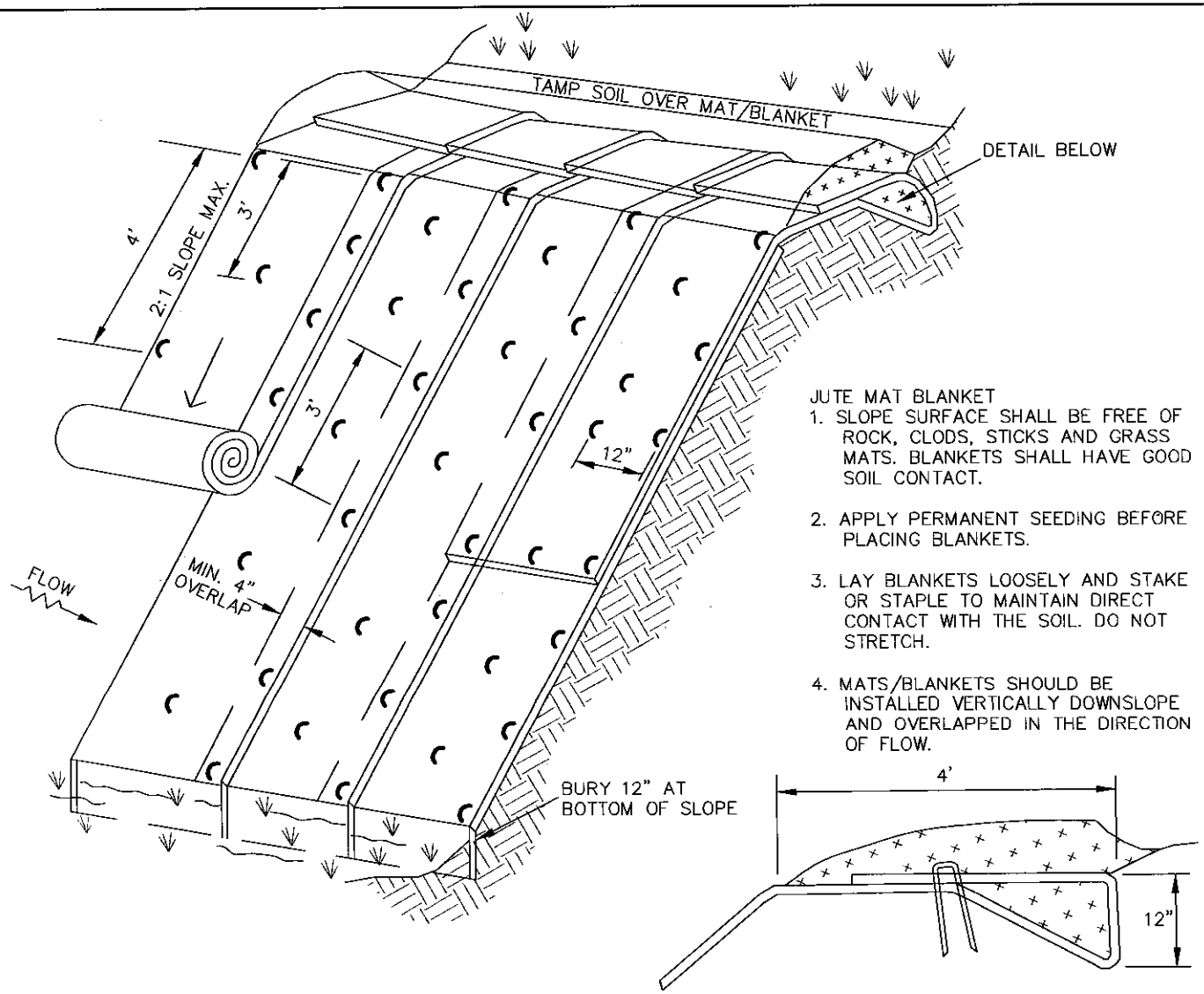
Closure Type	Description	Purpose Application
Blockage with On-Site Materials	Rock, logs, stumps, slash piles, posts, water bars, tank traps, decomposition	Discourage use, economical, dependent on-site and available material
Vegetative Planting, Seeding	Trees, shrubs, cactus, and grass seeding, recycled paper mulch, chip and spread slash	Discourage use, camouflage road, speed revegetation and healing of site, provide browse and forage
Imported Material	Fences, gates, posts, guardrails, concrete barriers	Discourage use, lack of on-site material or inappropriate site for use of on-site materials
Pole Fences Wood Barriers	Onsite or imported poles, reinforce with metal strips to deter chain-sawing	Discourage use, can be dismantled for emergency access, aesthetically pleasing
Closure Devices	Materials used include metal telescoping tubing, pipe, and well casing. Available in single lane to double lane widths	Discourage use, allow quick easy access, single or multiple locks, signing
Obliteration	Re-contour road junction or entire road. Combine with other closure treatments. Removal of drainage structures, bridges, and associated embankments	Eliminate travelway, return corridor to resource production, reduce modifications to hydrology and aesthetics, camouflage road

Table 1. Access Control Treatments. Adapted from US Forest Service 1996.

Source Material for Road BMP RD-7.3 Road Closure

1996. US Forest Service. A Guide for Road Closure and Obliteration in the Forest Service. Technology and Development Program. Publication: 9677 1205.

EC-1.1 JUTE MAT BLANKET



EC-1.2 CULVERT OUTLET ENERGY DISSIPATER

DESCRIPTION

An energy dissipater is a structure designed to control erosion at the outlet of a culvert or conduit by reducing the velocity of flow and dissipating the energy (see BMP SS-10 Outlet Protection/ Velocity Dissipation Devices).

LIMITATIONS

- Do not use this BMP below the mean high water line of any water body before obtaining appropriate permits. Due to issues relative to Corps 404 jurisdiction sometimes energy dissipaters are not placed below the ordinary high water mark which results in increased erosion.
- Consider other energy dissipaters such as concrete impact basins, paved outlet structures, or a half culvert where site conditions warrant.
- Rock/riprap dissipaters may require containment in mattresses to maintain their effectiveness.

BEST MANAGEMENT PRACTICES

- Size rock to handle high velocity storm events.
- Key rock into sides of fillslope to prevent undercutting (Figure 1).
- Best results are obtained when sound, durable, angular rock is used (Figure 2).
- Inspect after each significant rain for erosion and/or disruption of the rock, and repair immediately.

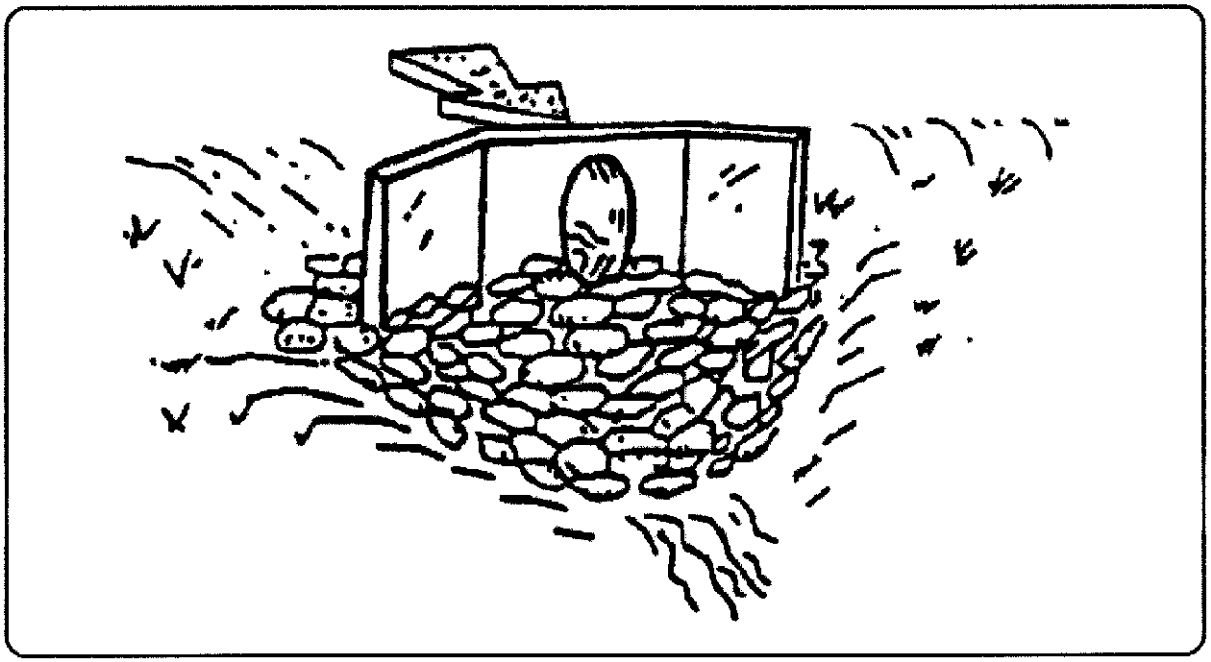


Figure 1. Flared outlet with rock energy dissipater. From Weber County, UT.

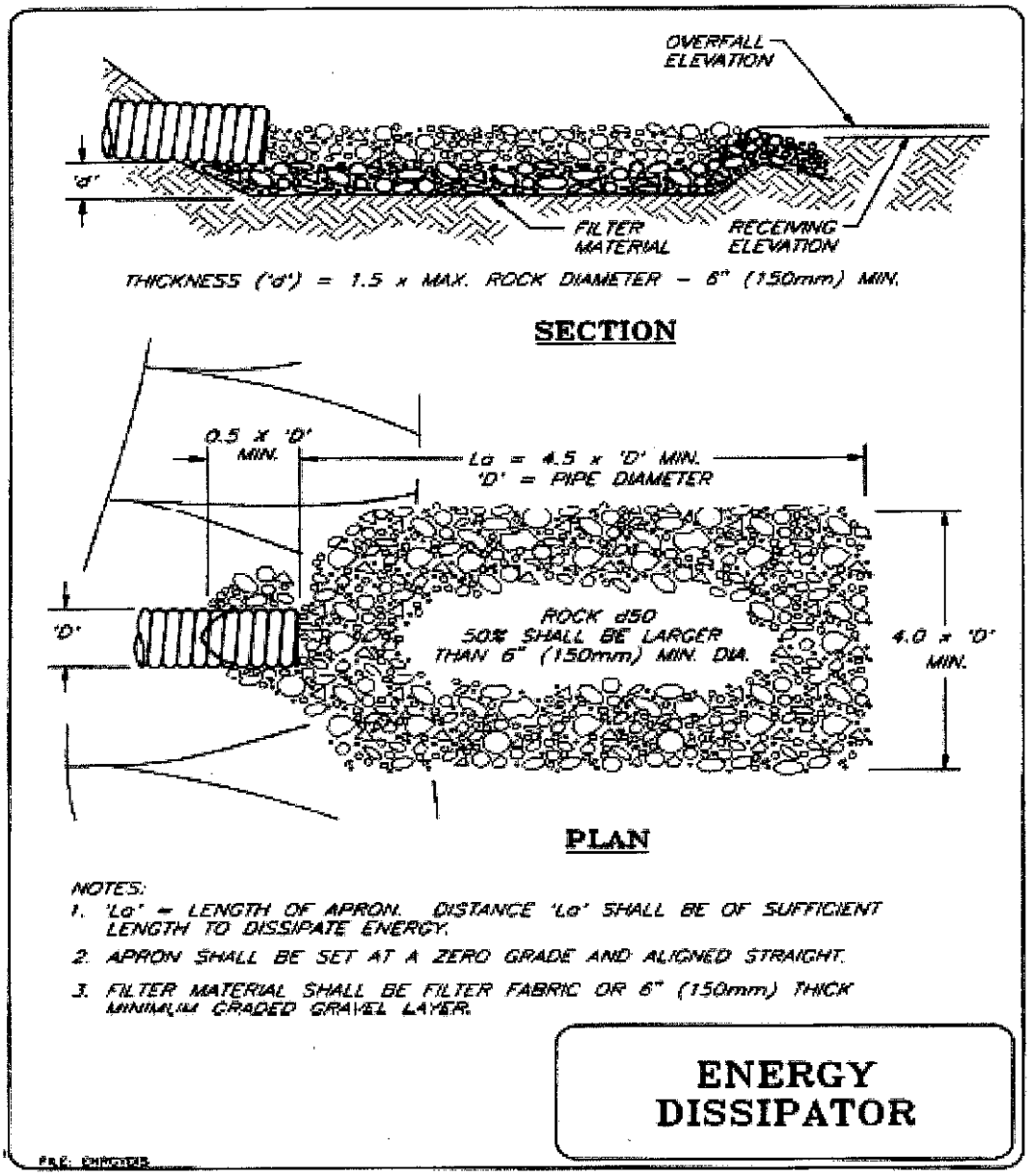


Figure 2.Rock energy dissipater. From 2004 Fishnet 4C. Adapted from 1994 McCullah.

Source Material for Road BMP RD-2.12 Culvert Outlet Energy Dissipater

2004. FishNet 4C. Guidelines for Protecting Aquatic Habitat and Salmon Fisheries for County Road Maintenance.

N/A. Weber County, Engineering Department. Ogden, Utah.

EC-1.3 OUTLET PROTECTION

DESCRIPTION

A rock outlet protection is a physical device composed of rock, riprap, grouted riprap, or concrete rubble which is placed at the outlet of a pipe to prevent scour of the soil caused by high pipe flow velocities, and to absorb flow energy to produce nonerosive velocities (see Construction BMP SS-10 Outlet Protection/ Velocity Dissipation Devices).

APPLICATIONS:

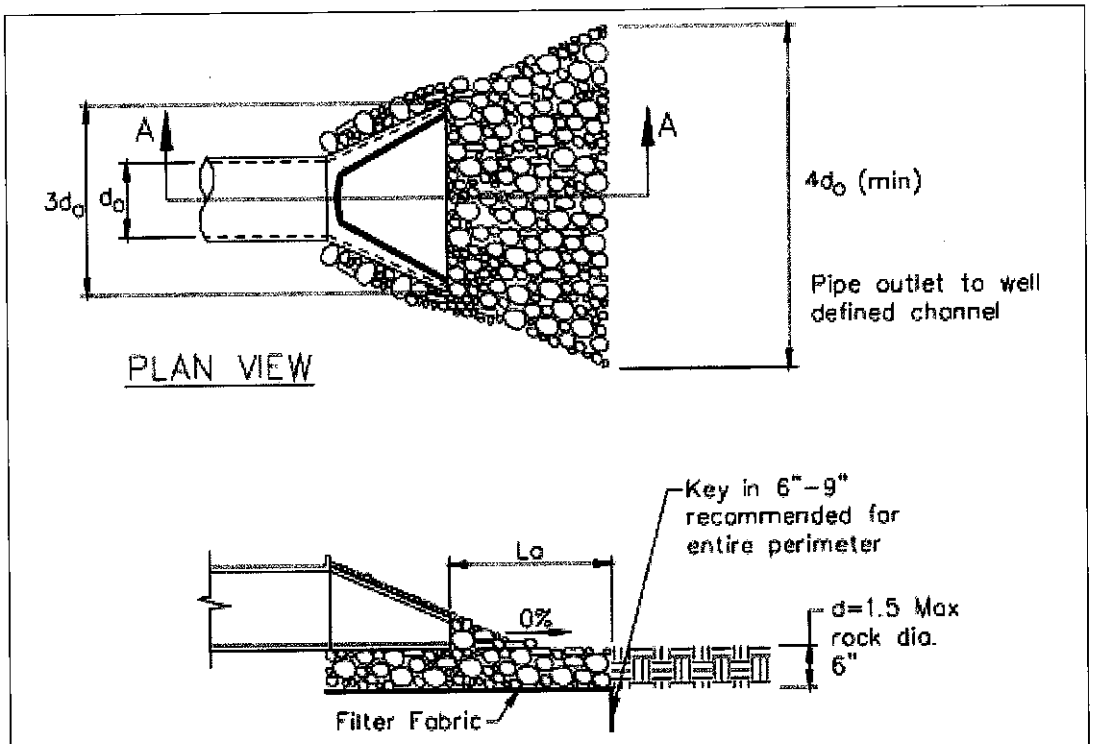
- Wherever discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach.
- Rock outlet protection is best suited for temporary use during construction because it is usually less expensive and easier to install than concrete aprons or an energy dissipater (Figure 1) (see Erosion Control BMP EC-1.3 Energy Dissipater).
- A sediment trap below the pipe outlet is recommended if runoff is sediment laden (Figure 2).
- Permanent rock riprap protection should be designed and sized by the engineer as part of the culvert, conduit or channel design (Figure 2).
- Grouted riprap should be avoided in areas of freeze and thaw because the grout will break up.

LIMITATIONS

- Large storms often wash away the rock outlet protection and leave the area susceptible to erosion.
- Sediment captured by the rock outlet protection may be difficult to remove without removing the rock.
- Outlet protection may negatively impact the channel habitat in streams.

BEST MANAGEMENT PRACTICES

- Size rock to handle high velocity storm events (Figure 3).
- Key rock into sides of fillslope to prevent undercutting.
- Best results are obtained when sound, durable, angular rock is used.
- Inspect after each significant rain for erosion and/or disruption of the rock, and repair immediately.



Pipe Diameter inches	Discharge ft^3/s	Apron Length, La ft	Rip Rap D_{50} Diameter Min inches
12	5	10	4
	10	13	6
18	10	10	6
	20	16	8
	30	23	12
	40	26	16
24	30	16	8
	40	26	8
	50	26	12
	60	30	16

Figure 1. Flared outlet with energy dissipater. From Caltrans (2003). (Adapted from USDA-SCS).

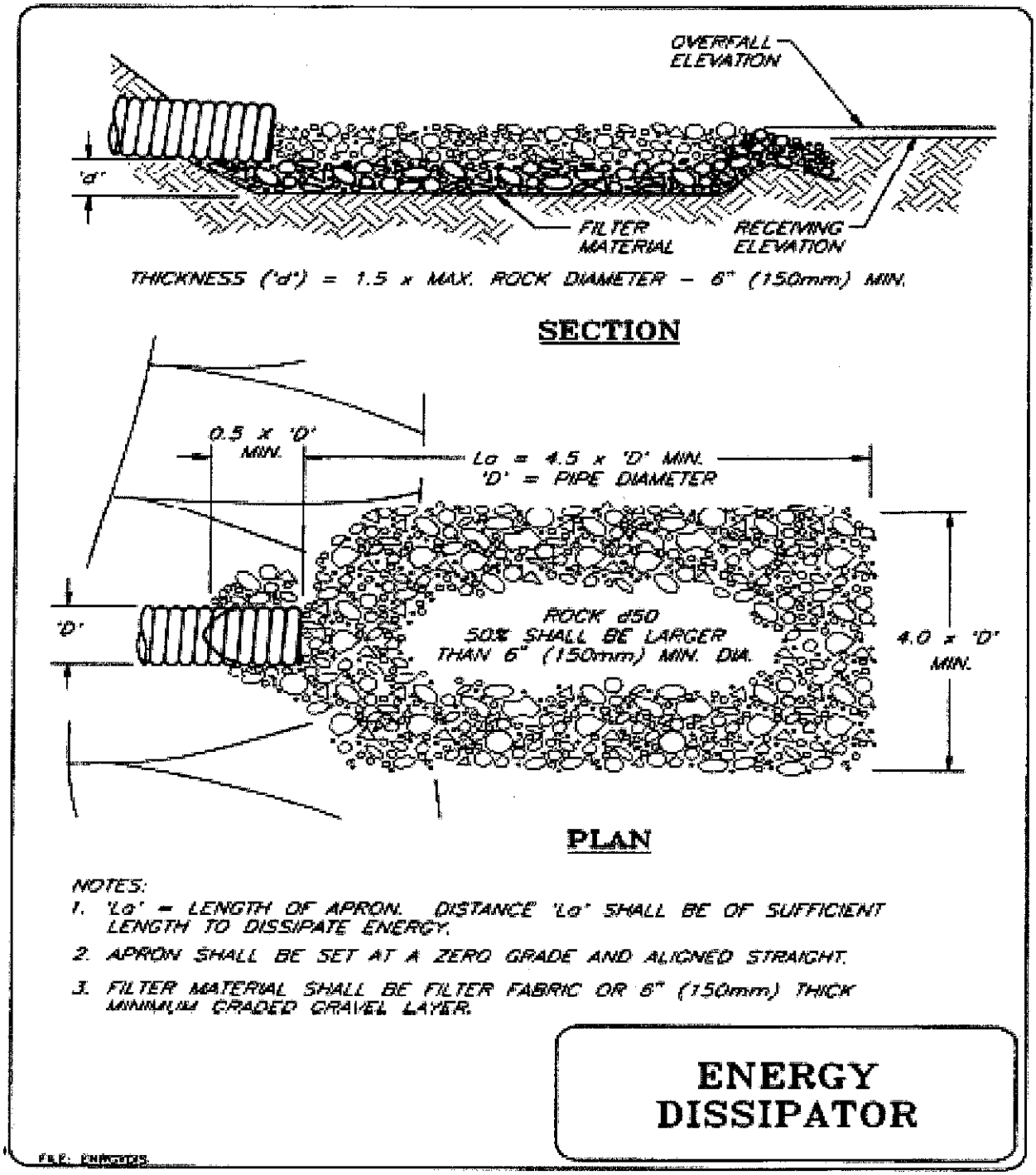


Figure 2. Rock energy dissipater. From 2004 Fishnet 4C. Adapted from 1994 McCullah.

Figure 3. Rock armoring on shotgun culvert outlet. Photo Courtesy of California Department of Transportation (Caltrans).

Source Material for Road BMP RD-2.11 Outlet Protection

2003. California Department of Transportation (CALTRANS). Storm Water Quality Handbooks – Construction Site Best Management Practices (BMPs) Manual.

2004. FishNet 4C. Guidelines for Protecting Aquatic Habitat and Salmon Fisheries for County Road Maintenance.

EC-1.4 STOCKPILE MANAGEMENT

DESCRIPTION

This activity involves the selection of sites in advance of the need for long-term and short-term stockpiling of materials for road maintenance activities and disposing of excess materials from excavations, grading and culvert basin cleaning. The general watershed criteria for selecting any disposal site is a site where the material will not erode into any part of the channel network, and where it will not initiate a formerly dormant landslide.

ENVIRONMENTAL CONCERNS

- Filling wetlands with spoil material.
- Discharge of sediment, debris, or organic material into the stream or storm water discharge system.
- Destruction or harm to aquatic, riparian or wetland habitat, or to endangered or threatened plant and animal species due to placement of fill material.
- Surface or groundwater impacts from leachate formed in organic material disposal sites.
- Damage to endangered or threatened plant species on site.
- Slope stability of both the disposal site and the spoil pile.

BEST MANAGEMENT PRACTICES

Site Selection

- Determine the location of existing disposal sites, potential disposal sites, and locations of significant spoil generation along roads.
  - Conduct site investigations of existing and potentially suitable disposal sites. Site investigations should include the disposal area size, distance to watercourses, potential slope instabilities, listed species habitat, archaeological sites, nearby residential areas, access, and other limiting factors.
  - Prepare a map and data set indicating sites (existing and potential) with acceptable site characteristics (see below). Prioritize acceptable sites.
  - Develop site plans for sites adjacent to or near riparian areas or streams to identify erosion and sediment control needs, and to ensure stability of the material.
- Follow these acceptable site characteristics in the site election & design process:
  - Seek a stable site where sediment cannot reach the stream during any high water event.
  - Avoid adjacent riparian corridors or any area within the 100-year floodplain.
  - Avoid all wetland sites as these sites are protected from disposal activities and permits will be required and may not be granted.
  - Avoid placing spoil on unstable slopes, where the added weight could trigger a land movement. Excessive loading of clay or silt soils could also trigger a failure.
  - Use wide, stable locations such as rock pits, ridges, and benches as places to dispose of fill. Avoid locations where ground water emerges or a thick organic layer is present. Do not leave loose soil piled in berms alongside the road or ditch.

- Avoid sites with endangered or threatened plant species. Search the California Natural Diversity Database (www.dfg.ca.gov/whdab/html/cnddb.html) for any known listed plant sites in the area. Seek site evaluations by qualified botanists during the appropriate season before selecting a new site.

Implementation

- Locate stockpiles a minimum of 50 ft away from concentrated flows of stormwater, drainage courses, and inlets.
- Protect all stockpiles from stormwater run-on using a temporary perimeter sediment barrier such as berms, dikes, fiber rolls, silt fences, gravel bags, or straw bale barriers.
- During the rainy season, soil stockpiles should be covered or protected with soil stabilization measures and a temporary perimeter sediment barrier at all times.
- During the non-rainy season, soil stockpiles should be covered or protected with a temporary perimeter sediment barrier prior to the onset of precipitation (Figure 1).
- Apply erosion and sediment control BMPs as needed.
- Place bagged materials on pallets and under cover.
- Implement wind erosion control practices as appropriate on all stockpiled material. For specific information.
- The performance of erosion control BMPs should be monitored routinely during construction, especially during and after storm events. BMPs should be maintained or upgraded as needed.
- Manage stockpiles of contaminated soil in accordance with State and Federal Regulations.
- Avoid sidecasting of soil in all cases where it could be delivered into a watercourse, riparian area, roadside ditch or storm drain. Do not sidecast outside of the landowner right-of-way without landowner's permission. In some instances, under the following guidelines (See Table 1), sidecasting is allowable given remote distances from spoils storage sites. In these cases, the setback distance required depends on slope and vegetation. The presence of vegetation helps to slow the travel of sediment downslope, so good judgment is needed to assess the situation. *Do not sidecast at all* if the slope is sparsely vegetated and it appears that sediment will travel with rain runoff into a stream or estuary system, even if setback distances are applied. On slopes of 5:1 (20% gradient) or less, sidecasting is allowed beyond 150 feet of a watercourse, stream crossing, riparian area, roadside ditch or storm drain. On 2:1 slopes (50%) or less, sidecasting is allowed beyond 300 feet of a watercourse, stream crossing, riparian area, roadside ditch or storm drain. On slopes greater than 2:1, typically sidecasting is *not recommended*, however there may be rare instances on slopes greater than 2:1 where sidecasting is acceptable given very long distances from waterbodies and good vegetative cover. Seek advice from local fisheries agency staff when in doubt. Avoid concentrating sidecasting repeatedly in the same place. Never sidecast large amounts of soil from major landslides.

SLOPE GRADIENT	DISTANCE FROM WATERCOURSE, STREAM CROSSING, RIPARIAN AREA, ROADSIDE DITCH, STORM DRAIN	SIDECASTING RULE
Any slope	Appears that sediment will travel with rainwater into watercourse.	Not allowed
5:1 (20%) or less	150 feet or more	Allowed using good judgment
2:1 (50%) or less	300 feet or more	Allowed using good judgment
Greater than 2:1 (50%)	Vegetated slope long distance from watercourse	Allowed
Greater than 2:1 (50%)	Sparsely vegetated slope and it appears that sediment will travel with rain into watercourse	Not allowed

Table 1. Sidecasting BMP. From FishNet 4C (2004).

Figure 1. Stock piles should be covered with erosion and sediment control BMPs employed to keep sediment on site. From Caltrans (2003).

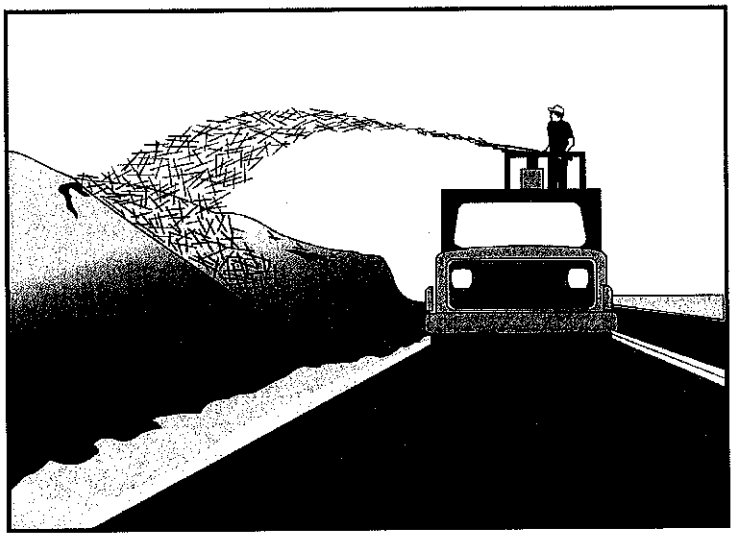
Source Material for Road BMP RD-2.16 Stockpile Management

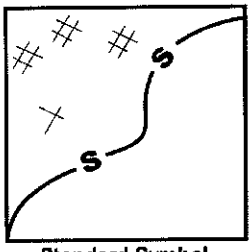
2003. California Department of Transportation (CALTRANS). Storm Water Quality Handbooks – Construction Site Best Management Practices (BMPs) Manual.

2004. FishNet 4C. Guidelines for Protecting Aquatic Habitat and Salmon Fisheries for County Road Maintenance.

Straw Mulch

SS-6





Standard Symbol

BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ● Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or anchoring it with a stabilizing emulsion. This is one of five temporary soil stabilization alternatives to consider.

Appropriate Applications

- Straw mulch is typically used for soil stabilization as a temporary surface cover on disturbed areas until soils can be prepared for revegetation and permanent vegetation is established.
- Also typically used in combination with temporary and/or permanent seeding strategies to enhance plant establishment.

Limitations

- Availability of erosion control contractors and straw may be limited prior to the rainy season due to high demand.
- There is a potential for introduction of weed-seed and unwanted plant material.
- When straw blowers are used to apply straw mulch, the treatment areas must be within 45 m (150 ft) of a road or surface capable of supporting trucks.
- Straw mulch applied by hand is more time intensive and potentially costly.
- May have to be removed prior to permanent seeding or soil stabilization.
- "Punching" of straw does not work in sandy soils.

Straw Mulch

SS-6

Standards and Specifications

- Straw shall be derived from wheat, rice, or barley.
- All materials shall conform to Standard Specifications Sections 20-2.06, 20-2.07 and 20-2.11.
- A tackifier is the preferred method for anchoring straw mulch to the soil on slopes.
- Crimping, punch roller-type rollers, or track-walking may also be used to incorporate straw mulch into the soil on slopes. Track walking shall only be used where other methods are impractical.
- Avoid placing straw onto the traveled way, sidewalks, lined drainage channels, sound walls, and existing vegetation.
- Straw mulch with tackifier shall not be applied during or immediately before rainfall.

Application Procedures

- Apply loose straw at a minimum rate of 3,570 kg/ha (4,000 lb/ac), or as indicated in the project's special provisions, either by machine or by hand distribution.
- If stabilizing emulsion will be used to anchor the straw mulch in lieu of incorporation, roughen embankment or fill areas by rolling with a crimping or punching-type roller or by track walking before placing the straw mulch. Track walking should only be used where rolling is impractical.
- The straw mulch must be evenly distributed on the soil surface.
- Anchor the mulch in place by using a tackifier or by "punching" it into the soil mechanically (incorporating).
- A tackifier acts to glue the straw fibers together and to the soil surface. The tackifier shall be selected based on longevity and ability to hold the fibers in place.
- A tackifier is typically applied at a rate of 140 kg/ha (125 lb/ac). In windy conditions, the rates are typically 200 kg/ha (178 lb/ac).
- Methods for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions and longevity. If the selected method is incorporation of straw mulch into the soil, then do as follows:
  - Applying and incorporating straw shall follow the requirements in Standard Specifications Section 20-3.03.
  - On small areas, a spade or shovel can be used.

Straw Mulch

SS-6

- On slopes with soils, which are stable enough and of sufficient gradient to safely support construction equipment without contributing to compaction and instability problems, straw can be "punched" into the ground using a knife-blade roller or a straight bladed coulter, known commercially as a "crimper."
- On small areas and/or steep slopes, straw can also be held in place using plastic netting or jute. The netting shall be held in place using 11 gauge wire staples, geotextile pins or wooden stakes. Refer to BMP SS-7, "Geotextiles, Plastic Covers and Erosion Control Blankets/Mats."

Maintenance and Inspections

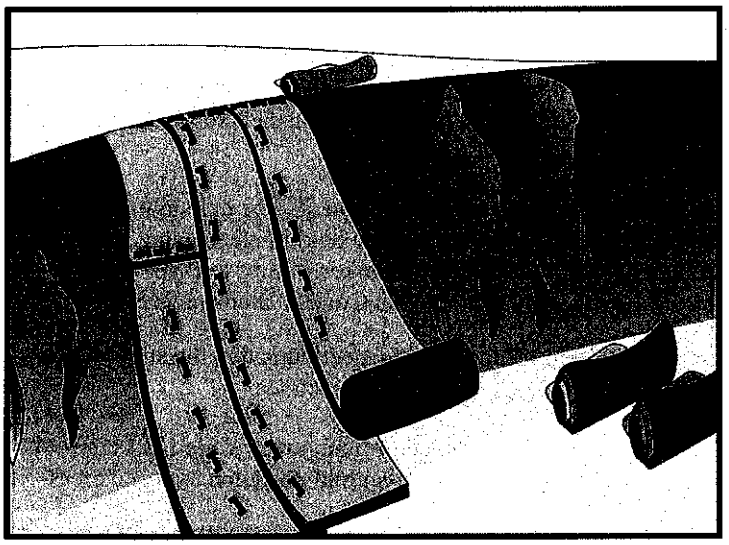
- The key consideration in Maintenance and Inspection is that the straw needs to last long enough to achieve erosion control objectives.
- Maintain an unbroken, temporary mulched ground cover while DSAs are non-active. Repair any damaged ground cover and re-mulch exposed areas.
- Reapplication of straw mulch and tackifier may be required by the Resident Engineer (RE) to maintain effective soil stabilization over disturbed areas and slopes.
- After any rainfall event, the Contractor is responsible for maintaining all slopes to prevent erosion.

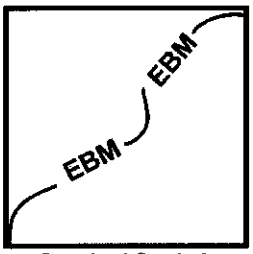
Source Material for Construction BMP SS-6

2003. State of California Department of Transportation. Caltrans Storm Water Quality Handbook Construction Site BMP Manual.

Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

SS-7





Standard Symbol

BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ● Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

This Best Management Practice (BMP) involves the placement of geotextiles, mats, plastic covers, or erosion control blankets to stabilize disturbed soil areas and protect soils from erosion by wind or water. This is one of five temporary soil stabilization alternatives to consider.

Appropriate Applications

These measures are used when disturbed soils may be particularly difficult to stabilize, including the following situations:

- Steep slopes, generally steeper than 1:3 (V:H).
- Slopes where the erosion potential is high.
- Slopes and disturbed soils where mulch must be anchored.
- Disturbed areas where plants are slow to develop.
- Channels with flows exceeding 1.0 m/s (3.3 ft/s).
- Channels to be vegetated.
- Stockpiles.
- Slopes adjacent to water bodies of Environmentally Sensitive Areas (ESAs).

Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

SS-7

Limitations

- Blankets and mats are more expensive than other erosion control measures, due to labor and material costs. This usually limits their application to areas inaccessible to hydraulic equipment, or where other measures are not applicable, such as channels.
- Blankets and mats are generally not suitable for excessively rocky sites, or areas where the final vegetation will be mowed (since staples and netting can catch in mowers).
- Blankets and mats must be removed and disposed of prior to application of permanent soil stabilization measures.
- Plastic sheeting is easily vandalized, easily torn, photodegradable, and must be disposed of at a landfill.
- Plastic results in 100% runoff, which may cause serious erosion problems in the areas receiving the increased flow.
- The use of plastic shall be limited to covering stockpiles, or very small graded areas for short periods of time (such as through one imminent storm event), until alternative measures, such as seeding and mulching, may be installed.
- Geotextiles, mats, plastic covers, and erosion control covers have maximum flow rate limitations; consult the manufacturer for proper selection.

Standards and Specifications

Material Selection

There are many types of erosion control blankets and mats, and selection of the appropriate type shall be based on the specific type of application and site conditions. Selection(s) made by the Contractor must be approved by the Resident Engineer (RE); certification of compliance shall be in accordance with Standard Specifications Section 6-1.07.

Site Preparation

- Proper site preparation is essential to ensure complete contact of the blanket or matting with the soil.
- Grade and shape the area of installation.
- Remove all rocks, clods, vegetation or other obstructions so that the installed blankets or mats will have complete, direct contact with the soil.
- Prepare seedbed by loosening 50 mm (2 in) to 75 mm (3 in) of topsoil.

Seeding

Seed the area before blanket installation for erosion control and revegetation. Seeding after mat installation is often specified for turf reinforcement application. When seeding prior to blanket installation, all check slots and other areas disturbed during installation must be re-seeded. Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

SS-7

Maintenance and Inspection

Areas treated with temporary soil stabilization shall be inspected as specified in the special provisions. Areas treated with temporary soil stabilization shall be maintained to provide adequate erosion control. Temporary soil stabilization shall be reapplied or replaced on exposed soils when area becomes exposed or exhibits visible erosion.

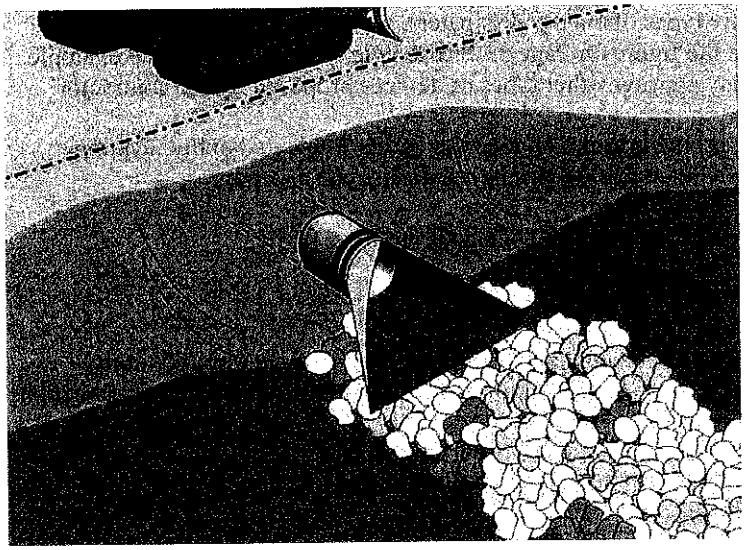
- All blankets and mats shall be inspected periodically after installation.
- Installation shall be inspected after significant rain storms to check for erosion and undermining. Any failures shall be repaired immediately.
- If washout or breakage occurs, re-install the material after repairing the damage to the slope or channel.

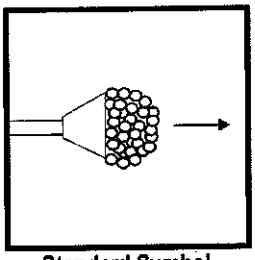
Source Material for Construction BMP SS-7 Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

2003. State of California Department of Transportation. Caltrans Storm Water Quality Handbook Construction Site BMP Manual.

Outlet Protection/Velocity Dissipation Devices

SS-10





Standard Symbol

BMP Objectives
- ● Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

These devices are placed at pipe outlets to prevent scour and reduce the velocity and/or energy of storm water flows.

Appropriate Applications

- These devices may be used at the following locations:
  - Outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels.
  - Outlets located at the bottom of mild to steep slopes.
  - Discharge outlets that carry continuous flows of water.
  - Outlets subject to short, intense flows of water, such as flash floods.
  - Points where lined conveyances discharge to unlined conveyances.
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the Resident Engineer (RE).

Limitations

- Loose rock may have stones washed away during high flows.
- Grouted riprap may break up in areas of freeze and thaw.
- If there is not adequate drainage, and water builds up behind grouted riprap, it may cause the grouted riprap to break up due to the resulting hydrostatic pressure.

Outlet Protection/Velocity Dissipation Devices

SS-10

Standards and Specifications

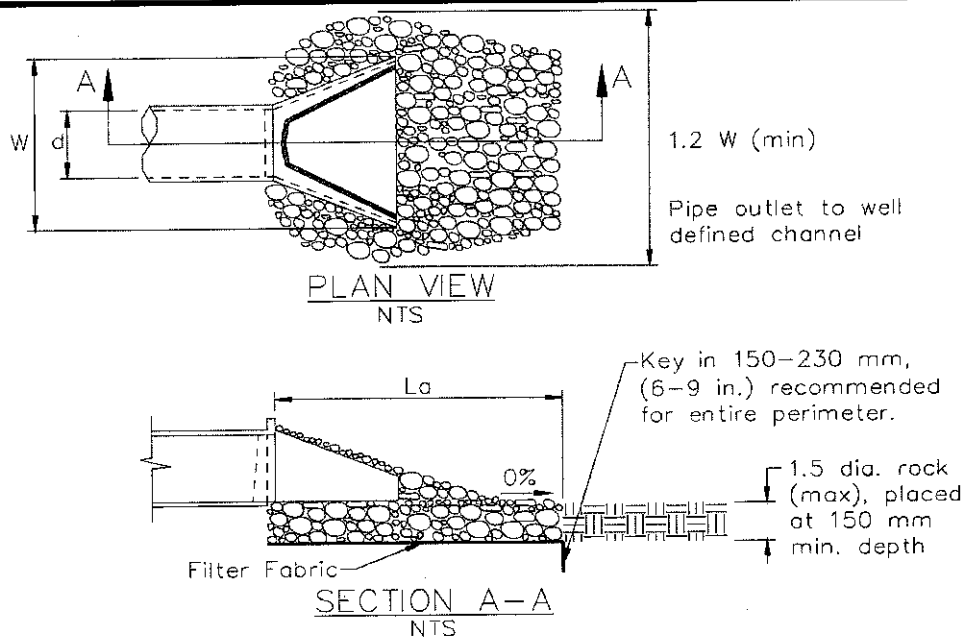
- There are many types of energy dissipaters, with rock being the one that is represented in the figure on Page 3. Please note that this is only one example and the RE may approve other types of devices proposed by the contractor.
- Install riprap, grouted riprap, or concrete apron at selected outlet. Riprap aprons are best suited for temporary use during construction.
- Carefully place riprap to avoid damaging the filter fabric.
- For proper operation of apron:
  - Align apron with receiving stream and keep straight throughout its length. If a curve is needed to fit site conditions, place it in upper section of apron.
  - If size of apron riprap is large, protect underlying filter fabric with a gravel blanket.
- Outlets on slopes steeper than 10% shall have additional protection.

Maintenance and Inspection

- Inspect temporary measures prior to the rainy season, after rainfall events, and regularly (approximately once per week) during the rainy season.
- Inspect apron for displacement of the riprap and/or damage to the underlying fabric. Repair fabric and replace riprap that has washed away.
- Inspect for scour beneath the riprap and around the outlet. Repair damage to slopes or underlying filter fabric immediately.
- Temporary devices shall be completely removed as soon as the surrounding drainage area has been stabilized, or at the completion of construction.

Outlet Protection/Velocity Dissipation Devices

SS-10



Pipe Diameter mm	Discharge m^3/s	Apron Length, La m	Rip Rap D_{50} Diameter Min mm
300	0.14	3	100
	0.28	4	150
450	0.28	3	150
	0.57	5	200
	0.85	7	300
	1.13	8	400
600	0.85	5	200
	1.13	8	200
	1.42	8	300
	1.70	9	400
For larger or higher flows, consult a Registered Civil Engineer			

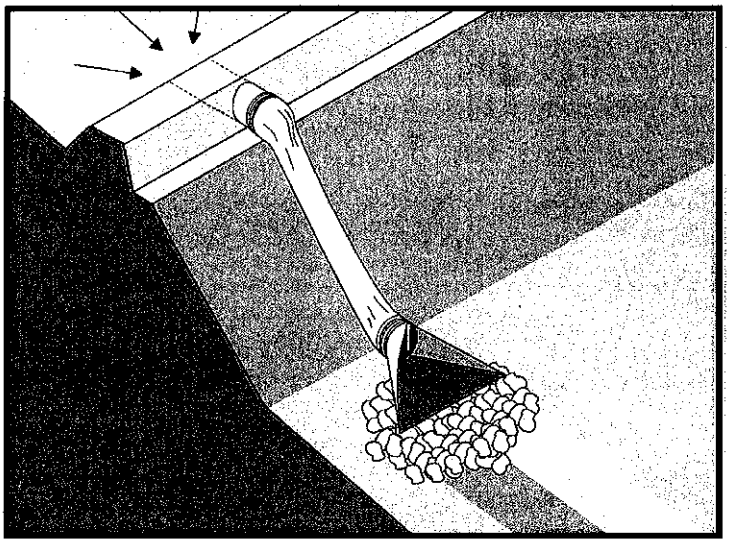
Source: USDA – SCS

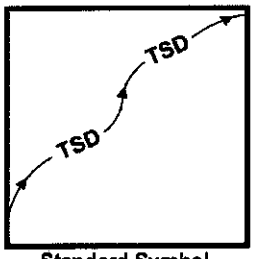
Source Material for Construction BMP SS-10 Outlet Protection

2003. State of California Department of Transportation. Caltrans Storm Water Quality Handbook Construction Site BMP Manual.

Slope Drains

SS-11





Standard Symbol

BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A slope drain is a pipe used to intercept and direct surface runoff or groundwater into a stabilized watercourse, trapping device or stabilized area. Slope drains are used with lined ditches to intercept and direct surface flow away from slope areas to protect cut or fill slopes.

Appropriate Applications

- Slope drains may be used on construction sites where slopes may be eroded by surface runoff.
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the Resident Engineer (RE).

Limitations

- Severe erosion may result when slope drains fail by overtopping, piping, or pipe separation.

Standards and Specifications

- When using slope drains, limit drainage area to 4 ha (10 ac) per pipe. For larger areas, use a rock-lined channel or a series of pipes.
- Maximum slope generally limited to 1:2 (V:H), as energy dissipation below steeper slopes is difficult.
- Direct surface runoff to slope drains with interceptor dikes. See BMP SS-8, "Earth Dikes/Drainage Swales, and Lined Ditches."
- Slope drains can be placed on or buried underneath the slope surface.
- Recommended materials are PVC, ABS, or comparable pipe.
- When installing slope drains:
  - Install slope drains perpendicular to slope contours.

Slope Drains

SS-11

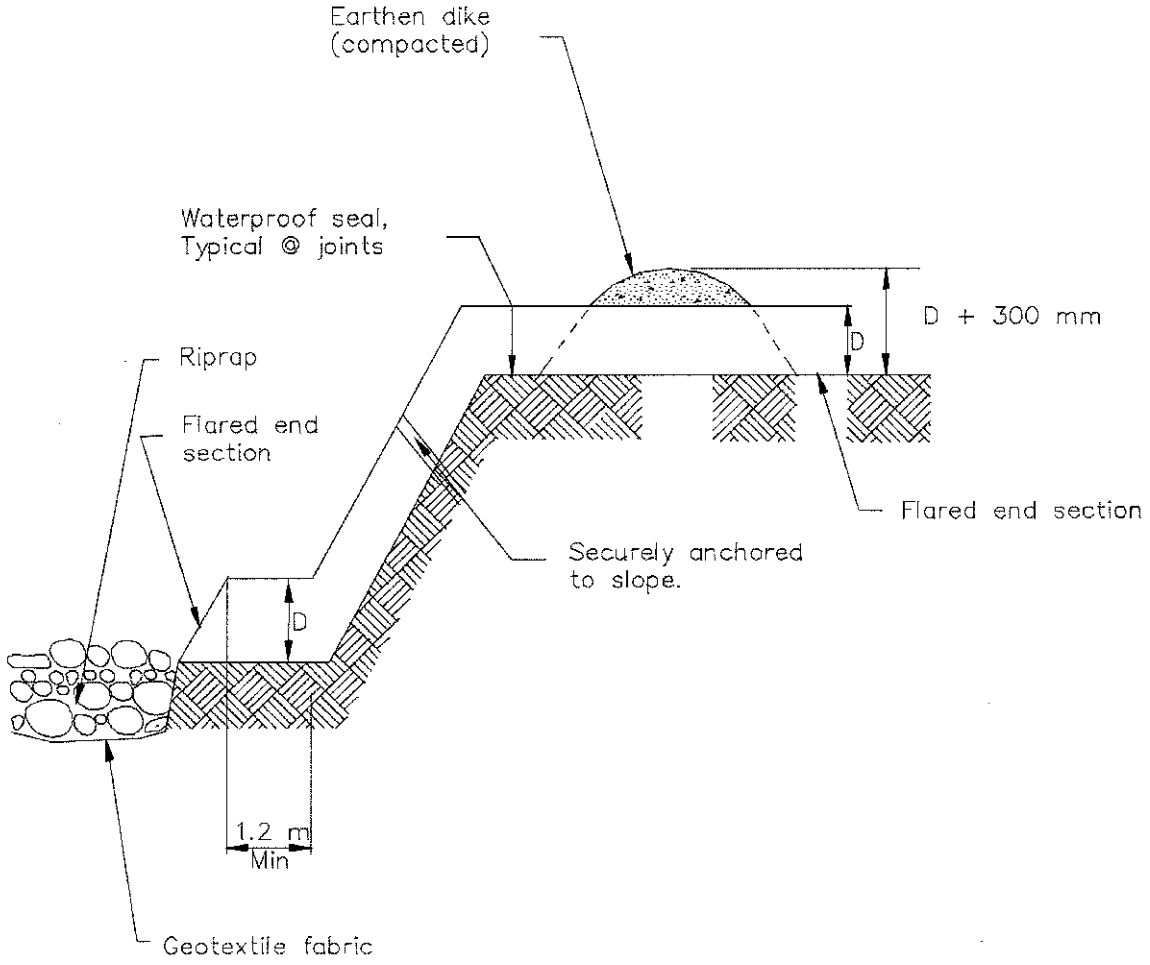
- Compact soil around and under entrance, outlet, and along length of pipe.
- Securely anchor and stabilize pipe and appurtenances into soil.
- Check to ensure that pipe connections are water tight.
- Protect area around inlet with filter cloth. Protect outlet with riprap or other energy dissipation device. For high energy discharges, reinforce riprap with concrete or use reinforced concrete device.
- Protect inlet and outlet of slope drains; use standard flared end section at entrance and exit for pipe slope drains 300 mm (12in) and larger.

Maintenance and Inspection

- Inspect before and after each rain storm, and twice monthly until the tributary drainage area has been stabilized. Follow routine inspection procedures for inlets thereafter.
- Inspect outlet for erosion and downstream scour. If eroded, repair damage and install additional energy dissipation measures. If downstream scour is occurring, it may be necessary to reduce flows being discharged into the channel unless other preventative measures are implemented.
- Inspect slope drainage for accumulations of debris and sediment.
- Remove built-up sediment from entrances, outlets, and within drains as required.
- Make sure water is not ponding onto inappropriate areas (e.g., active traffic lanes, material storage areas, etc.).

Slope Drains

SS-11

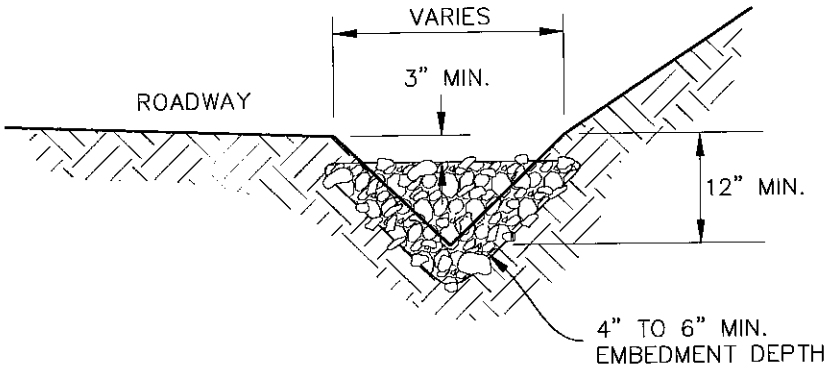


TYPICAL SLOPE DRAIN
NOT TO SCALE

Source Material for Construction BMP SS-11 Slope Drains

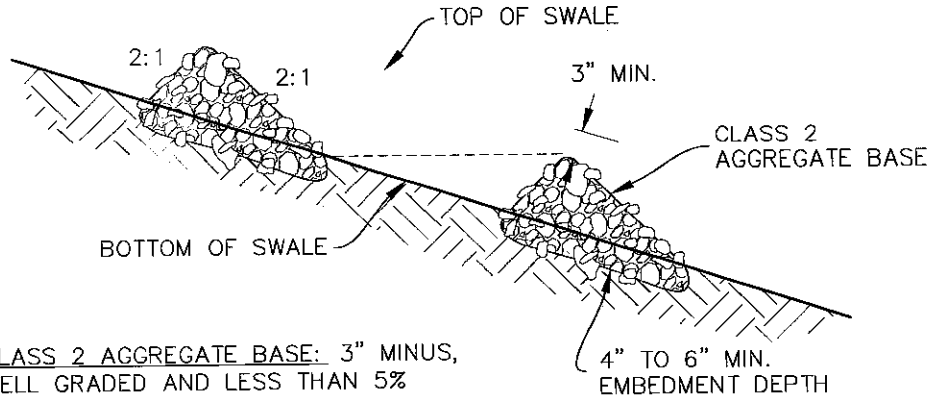
2003. State of California Department of Transportation. Caltrans Storm Water Quality Handbook Construction Site BMP Manual.

SC-1.1 CHECK DAMS



SECTION VIEW

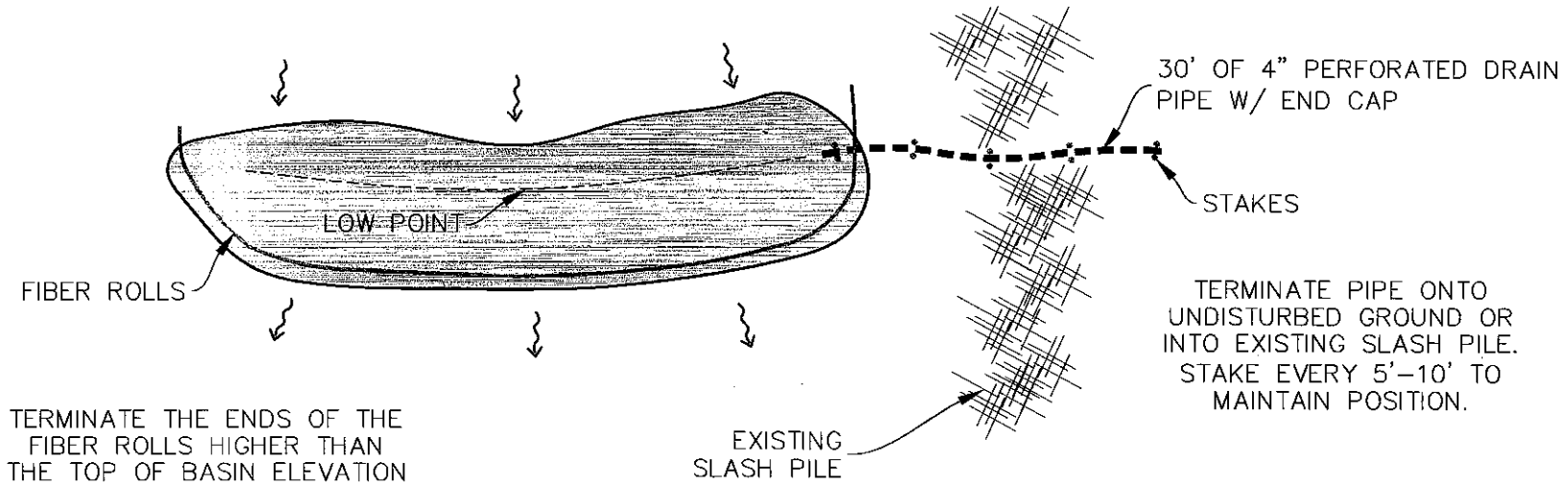
CHECK DAMS:
1. CHECK DAMS SHALL BE INSTALLED AT ALL LOCATIONS INDICATED ON THE WRPP, AND AT ANY OTHER LOCATION DEEMED NECESSARY BY THE SITE CONTRACTOR.
2. CHECK DAMS SHOULD BE SPACED SO THAT THE TOE OF CHECK DAM IS THE SAME ELEVATION AS THE TOP OF THE CHECK DAM BELOW.
3. CHECK DAMS SHOULD BE IMBEDDED IN CHANNEL A MINIMUM OF 4"–6"
4. CHECK DAMS THAT EXCEED A HEIGHT OF 3' SHOULD BE DESIGNED BY A QUALIFIED ENGINEER, GEOLOGIST, OR EROSION CONTROL SPECIALIST.
5. CHECK DAMS SHALL BE INSPECTED PERIODICALLY THROUGHOUT THE COURSE OF CONSTRUCTION, ONCE AFTER EACH RAINFALL EVENT, AND ONCE EVERY 24 HOURS DURING EXTENDED RAINFALL EVENTS. ANY SPLIT, TORN, UNRAVELED OR SLUMPING FIBER ROLLS SHALL BE REPAIRED OR REPLACED IMMEDIATELY.



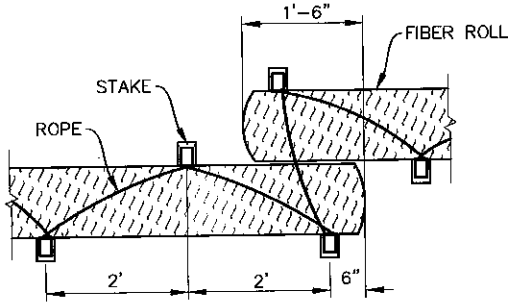
CLASS 2 AGGREGATE BASE: 3" MINUS, WELL GRADED AND LESS THAN 5% CLAYS

CHCECK DAM SPACING

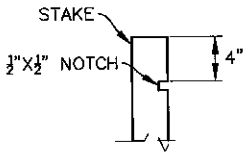
SC1.2 TEMPORARY SEDIMENT BASIN

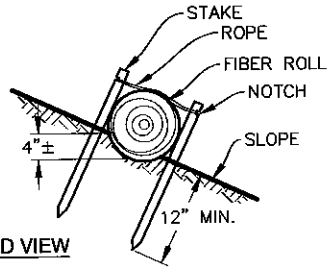


SC-1.3 FIBER ROLLS



PLAN VIEW

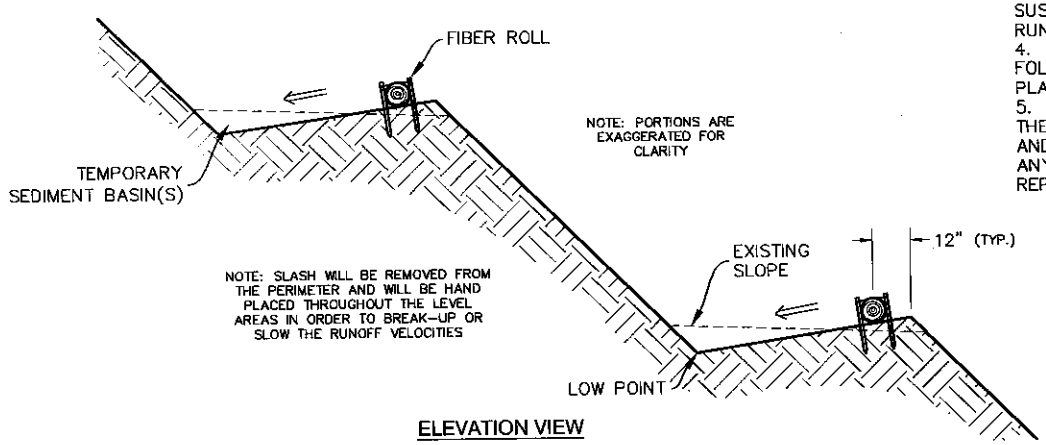




ENLARGED VIEW

FIBER ROLLS:

1. FIBER ROLLS SHALL BE INSTALLED AT ALL LOCATIONS INDICATED ON THE WRPP, AND AT ANY OTHER LOCATION DEEMED NECESSARY BY THE SITE CONTRACTOR.
2. FIBER ROLLS SHOULD BE USED ALONG THE FACE OF EXPOSED SLOPES TO SHORTEN SLOPE LENGTH AND DECREASE FLOW VELOCITY; AT GRADE BREAKS WHERE SLOPES TRANSITION TO STEEPER SLOPES; AND ALONG STREAM BANKS TO ASSIST STABILIZATION, AND IN DRAINAGE SWALES TO SLOW FLOWS. ON 1:1 SLOPES PLACE FIBER ROLLS SPACED AT 10' INTERVALS PARALLEL TO SLOPE, ON 1.5:1 SLOPES PLACE FIBER ROLLS SPACED AT 15' INTERVALS PARALLEL TO SLOPE, AND ON 2:1 SLOPES PLACE FIBER ROLLS SPACED AT 20' INTERVALS PARALLEL TO SLOPE.
3. FIBER ROLLS SHALL CONSIST OF BIODEGRADABLE FIBERS STUFFED INTO A PHOTO-DEGRADABLE OPEN WEAVE NETTING. THEY SHALL BE DESIGNED TO ALLOW WATER TO PASS THROUGH THE FIBERS; TO TRAP SUSPENDED SEDIMENT; INCREASE FILTRATION RATES; AND TO SLOW RUNOFF.
4. FIBER ROLLS SHALL BE PLACED SUCH THAT THEY OVERLAP AND FOLLOW THE CONTOUR LINES OF THE SLOPE ON WHICH THEY ARE PLACED.
5. FIBER ROLLS SHALL BE INSPECTED PERIODICALLY THROUGHOUT THE COURSE OF CONSTRUCTION, ONCE AFTER EACH RAINFALL EVENT, AND ONCE EVERY 24 HOURS DURING EXTENDED RAINFALL EVENTS. ANY SPLIT, TORN, UNRAVELED OR SLUMPING FIBER ROLLS SHALL BE REPAIRED OR REPLACED IMMEDIATELY.



ELEVATION VIEW

ROAD BMP RESOURCES

DESCRIPTION

Listed below are some of the resource materials for Road BMPs that are available for landowners.

2006. California Department of Fish and Game. Part X - Upslope Erosion Inventory and Sediment Control Guidance, California Salmonid Stream Habitat Restoration Manual.

Available at:
California Department of Fish and Game
Inland Fisheries Division
ATTN: Salmonid Habitat Restoration Coordinator
1416 Ninth Street, Sacramento, CA 95814 (916) 654-5997
or
www.dfg.ca.gov/fish/resources/habitatmanual.asp

2003. California Department of Transportation (CALTRANS). Storm Water Quality Handbooks – Construction Site Best Management Practices (BMPs) Manual.

Available at:
www.dot.ca.gov/hq/construc/stormwater/CSBMPM_303_Final.pdf

2009. California Stormwater Quality Association (CASQA). California Stormwater BMP Handbook.

Available at:
California Stormwater Quality Association
PO Box 2105
Menlo Park, CA 94026
or
www.cabmphandbooks.com

2004. FishNet 4C. Guidelines for Protecting Aquatic Habitat and Salmon Fisheries for County Road Maintenance.

Available at:
3820 Cypress Dr., Suite 11
Petaluma, CA 94954 Phone: 707.762.1336
or
http://fishnet.marin.org/projects_roads_manual.html

2002. Five Counties Salmon Conservation Program. A Water Quality and Stream Habitat Protection Manual for County Road Maintenance.

Available at:
www.5counties.org/Projects/FinalGeneralProjectPages/RoadsManual800.htm

1996. US Forest Service. A Guide for Road Closure and Obliteration In the Forest Service. Technology and Development Program. Publication: 9677 1205.

Available at:
www.fs.fed.us/eng/pubs/pdfimage/96771205.pdf

2014. Weaver W.E., Wepner E. and Hagans D.K. Handbook for Forest, Ranch, and Rural Roads. Mendocino County Resource Conservation District.

Available at:
Mendocino County Resource Conservation District
404 Orchard Avenue, Ukiah, CA 95482 (707) 468-9223
Or
http://mcrcd.org/wp-content/uploads/Handbook_for_Forest_Ranch&Rural_Roads.pdf

Appendix E: References

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1. Humboldt County Web GIS. (2018, May). Humboldt County Planning and Building Department. Retrieved from http://webgis.co.humboldt.ca.us/HCEGIS2.0/
2. State of California, Department of Forestry and Fire Protection. (2018, January). *California Forest Practice Rules: Title 14, California code of regulations, chapters 4, 4.5 and 10 with the Z'Berg Nejedley Forest Practice Act, the Professional Foresters law, and the Registration of Professional Foresters Rules*. Sacramento, CA: The California Department of Forestry and Fire Protection.
3. California Natural Diversity Database (CNDDB) Maps and Data. (2018). California Department of Fish and Wildlife. Retrieved from https://www.wildlife.ca.gov/Data/CNDDB/Maps-and-Data#43018408-cnddb-in-bios
4. State of California, North Coast Regional Water Quality Control Board. (2015, August). *Order No. R1-2015-0023: Waiver of Waste Discharge Requirements and General Water Quality Certification.* Retrieved from https://www.waterboards.ca.gov/northcoast/board_decisions/adopted_orders/pdf/2015/15_0023_Cannabis_Order.pdf
5. State of California, State Water Resources Control Board. (2017, October). *Cannabis Cultivation Policy: Principles and Guidelines for Cannabis Cultivation.* Retrieved from https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2017/final_cannabis_policy_with_att_a.pdf
6. State of California, State Water Resources Control Board. (2017, October). *Order No. WQ 2017-0023-DWQ: General Waste Discharge Requirements and Waiver of Waste Discharge Requirements for Discharges of Waste Associated with Cannabis Cultivation Activities.* Retrieved from https://www.waterboards.ca.gov/water_issues/programs/cannabis/docs/finaladoptedcango101717.pdf
7. State of California, California Department of Transportation, Division of Environmental Analysis, Stormwater Program. (2017, May). CTSW-RT-17-314.18.1: *Construction Site Best Management Practices (BMP) Manual.* Retrieved from http://www.dot.ca.gov/hq/construc/stormwater/CSBMP-May-2017-Final.pdf
8. Weaver, W.E., Weppner, E.M. and Hagans, D.K. (2015, April). *Handbook for Forest, Ranch and Rural Roads: A Guide for Planning, Designing, Constructing, Reconstructing, Upgrading, Maintaining and Closing Wildland Roads.* Ukiah, California: Mendocino County Conservation Resource District.
9. Cafferata, P., Lindsay, D., Spittler, T., Wopat, M., Bundros, G., Flanagan, S., Coe, D., Short, W. (2017, August). *Designing Watercourses Crossings for Passage of 100-Year Flood Flows, Wood and Sediment (Updated 2017). Retrieved from http://calfire.ca.gov/resource_mgt/downloads/100%20yr%20revised%208-08-17%20(final-a).pdf*

Appendix F: Water Use Records

Appendix G: Fertilizer, Pesticide, Herbicide, and Rodenticide Product List and Records

APPENDIX G: FERTILIZER, PESTICIDE, HERBICIDE, AND RODENTICIDE PRODUCT RECORDS

**Gallons or pounds applied each month*

Year: _____

Product	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec

Appendix H: Monthly BPTC Monitoring and Maintenance Records

Appendix H: Monthly BPTC Monitoring and Maintenance Records

Monitoring Data Sheet for SWRCB Cannabis Regulatory Program
(BPTC Effectiveness Monitoring)

Inspector(s): _____ Date:_____

Owner: _____ APN:_____524-072-010_____

Inspection Period (Circle) < Oct 15, < Dec 15, 0.5 in/day or 1 in/7 days

Other:_____

Map Point	BPTC	*Condition: G/M/R	Comment

* **G** – Good Condition (working as designed), **M** – Maintenance (needs maintenance to work properly), **R** – Replacement (needs to be reconstructed)

Map Point	BPTC	*Condition: G/M/R	Comment

* **G** – Good Condition (working as designed), **M** – Maintenance (needs maintenance to work properly), **R** – Replacement (needs to be reconstructed)