Water Resource Protection Plan

APN 317-023-010

WDID# 1B170376CHUM

Prepared by:

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Revised: 6/1/2018

Purpose

This Water Resource Protection Plan (WRPP) has been prepared on behalf of the Discharger at Assessor's Parcel Number 317-023-010, by agreement and in response to the California Water Code Section 13260(a), which requires that any person discharging waste or proposing to discharge waste within any region that could affect the quality of the waters of the state, other than into a community sewer system, shall file with the appropriate regional water board a Report of Waste Discharge (ROWD) containing such information and data as may be required by the Regional Water Board. The Regional Water Board may waive the requirements of Water Code section 13260 for specific types of discharges if the waiver is consistent with the Basin Plan and in the public interest. Any waiver is conditional and may be terminated at any time. A waiver should include monitoring requirements to verify the adequacy and effectiveness of the waiver's conditions. Order R1-2015-0023 conditionally waives the requirement to file a ROWD for discharges and associated activities described in finding 4.

Scope of Report

Order No. R1-2015-0023 states that "Tier 2 Discharger's and Tier 3 Discharger's who intend to cultivate cannabis before, during, or following site cleanup activities shall develop and implement a water resource protection plan that contains the elements listed and addressed below. Discharger's must keep this plan on site, and produce it upon request by Regional Water Board staff. Management practices shall be properly designed and installed, and assessed periodically for effectiveness. If a management measure is found to be ineffective, the plan must be adapted and implemented to incorporate new or additional management practices to meet standard conditions. Discharger's shall certify annually to the Regional Water Board individually or through an approved third party program that the plan is being implemented and is effectively protecting water quality, and report on progress in implementing site improvements intended to bring the site into compliance with all conditions of this Order."

Methods

The methods used to develop this WRPP include both field and office components. The office component consisted of aerial photography review and interpretation, existing USGS quad map review, GIS mapping of field data, review of on-site photography points, streamflow calculations, and general planning. The field component included identifying and accurately mapping all watercourses, wet areas, and wetlands located downstream of the cultivation areas, associated facilities, and all appurtenant roads accessing such areas. An accurate location of the Waters of the State is necessary to make an assessment of whether potential and existing erosion sites/pollution sites have the potential to discharge waste to an area that could affect waters of the State (including groundwater). Next, all cultivation areas, associated facilities, and all appurtenant roads accessing such areas were assessed for discharges and related controllable water quality factors from the activities listed in Order R1-2015-0023, Finding 4a-j. The field assessment also included an evaluation and determination of compliance with the Standard Conditions per Provision I.B of Order No. R1-2015-0023. The water resource protection plans required under Tier 2 are meant to describe the specific measures a Discharger implements to achieve compliance with standard conditions. Therefore, all required components of the water resource protection plan per Provision I.B of Order No. R1-2015-0023 were physically inspected and evaluated. A comprehensive summary of each Standard Condition as it relates to the subject property is appended.

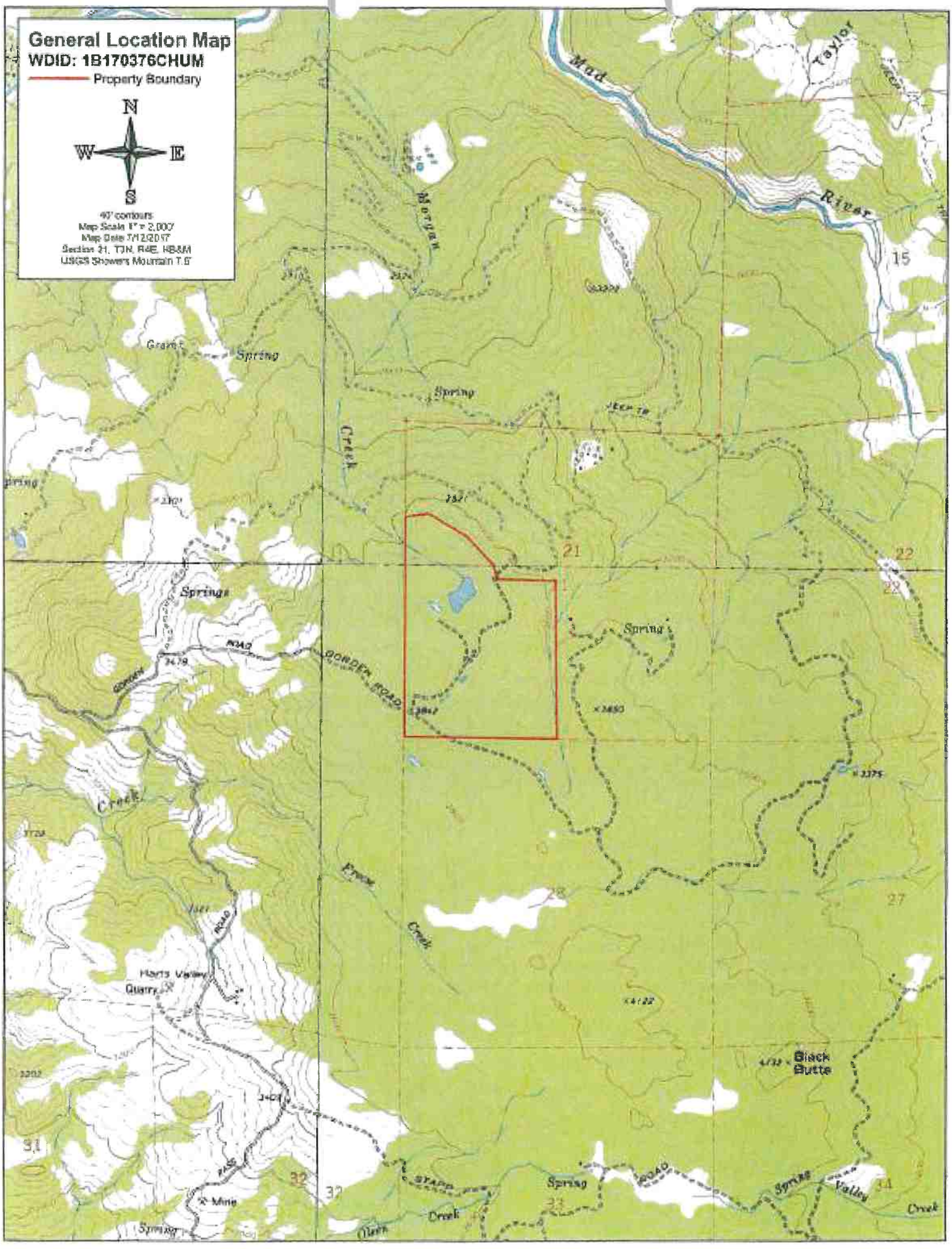
Property Description
The property assessed consists of a 193-acre parcel located near the end of Gorden Road. The property is primarily timberland with two residences and associated structures. Portions of Morgan Creek, a Class II watercourse, drain off the property, as well as un-named Class II and Class III watercourses that are tributaries of the Mad River. The property is located in Section 21, Township 3N, Range 4E, Humboldt Base & Meridian, of the USGS Showers Mountain 7.5' quadrangle.

Monitoring Plan
Tier 2 Discharger's shall include a monitoring element in the water resource protection plan that at a minimum provides for periodic inspection of the site, checklist to confirm placement and efficacy of management measures, and document progress on any plan elements subject to a time schedule. Tier 2 Discharger's shall submit an annual report (Appendix C) by March 31 of each year that documents implementation and effectiveness of management measures during the previous year. Tier 2 annual reporting is a function that may be provided through an approved third party program.

Monitoring of the site includes visual inspection and photographic documentation of each feature of interest listed on the site map, with new photographic documentation recorded with any notable changes to the feature of interest. At a minimum, all site features must be monitored annually, to provide the basis for completion of the annual re-certification process. Additionally, sites shall be monitored at the following times to ensure timely identification of changed site conditions and to determine whether implementation of additional management measures is necessary to iteratively prevent, minimize, and mitigate discharges of waste to surface water: 1) just prior to October 15 to evaluate site preparedness for storm events and storm water runoff, 2) following the accumulation of 3" total precipitation or by November 15, whichever is sooner, and 3) following any rainfall event with an intensity of 3" precipitation in 24 hours. Precipitation data can be obtained from the National Weather Service Forecast Office (e.g. by entering the zip code of the parcel location at http://www.srh.noaa.gov/forecast).

Monitoring Plan Reporting Requirements
Order No. R1-2015-0023, Appendix C must be submitted to the Regional Water Board or approved third party program upon initial enrollment in the Order (NOI) and annually thereafter by March 31. Forms submitted to the Regional Water Board shall be submitted electronically to northcoast@waterboards.ca.gov. If electronic submission is infeasible, hard copies can be submitted to: North Coast Regional Water Quality Control Board, 5550 Skylane Boulevard, Suite A, Santa Rosa, CA 95403.

Assessment of Standard Conditions
Assessment of Standard Conditions consisted of field examinations on 5/22/2017 & 6/9/2017. The examination evaluated areas near, and areas with the potential to directly impact, watercourses for sensitive conditions including, but not limited to, existing and proposed roads, skid trails and landings, unstable and erodible watercourse banks, unstable upslope areas, debris, jam potential, inadequate flow capacity, changeable channels, overflow channels, flood prone areas, and riparian zones. Field examinations also evaluated all roads and trails on the property, developed areas, cultivation sites, and any structures and facilities appurtenant to cultivation on the property. Anywhere the Standard Conditions are not met on the property, descriptions of the assessments and the prescribed treatments are outlined following each associated section below.


General Location Map
WDID: 1B170376CHUM
Property Boundary
N
W
E
S
40' contours
Map Scale 1" = 2,000'
Map Date 7/12/2017
Section 21, T3N, R4E, MD&M
USGS Showers Mountain 7.5'
Mad
River
Taylor
Morgan
Spring
Creek
Springs
ROAD
BOWDEN ROAD
Black Butte
Harts Valley
Quarry
Mine
Valley
15
21
22
27
28
31
32
33

Summary of Standard Conditions Compliance

1. Site maintenance, erosion control, and drainage features Y☐/N☒
2. Stream crossing maintenance Y☒/N☐
3. Riparian and wetland protection and management Y☒/N☐
4. Spoils management Y☒/N☐
5. Water storage and use Y☒/N☐
6. Irrigation runoff Y☒/N☐
7. Fertilizers and soil amendments Y☒/N☐
8. Pesticides and herbicides Y☒/N☐
9. Petroleum products and other chemicals Y☐/N☒
10. Cultivation-related wastes Y☒/N☐
11. Refuse and human waste Y☒/N☐

A. Standard Conditions, Applicable to All Discharger's

1. **Site maintenance, erosion control and drainage features** (Compliance: Y☐/ N☒)

   a. Roads shall be maintained as appropriate (with adequate surfacing and drainage features) to avoid developing surface ruts, gullies, or surface erosion that results in sediment delivery to surface waters.

The main access road is in poor shape without adequate road surface rock and drainage features. There are some locations where road surface rock and sediment is discharging into watercourses. Other access roads on the property are in good shape with adequate surface rock and drainage features. In order to improve drainage conditions on the road, treatments are proposed to maintain and repair existing features. These treatments are designed to reduce and prevent potential erosion. See the Mitigation Report and Better Management Practices (BMPs) for further information.

Main access road from gate to Cultivation Site – The main access road is lacking grading. Grade the main access road from the entrance of the property to the cultivation site.

Road Point 1 – Winter traffic and poor road surfacing has resulted in the formation of ruts and pot holes that deliver sediment to the riparian buffer of a Class III watercourse. The Discharger shall install a rocked rolling dip per attached specifications. The Discharger shall install staked wattles at the outflow of the rocked rolling dip. The Discharger shall then resurface and rock the road.

Road Point 2 – Road runoff is bypassing a failing rolling dip, resulting in erosion past the rolling dip and sediment discharge to a Class III watercourse. The Discharger shall install a

rocked rolling dip per attached specifications and rock the surface of the road. The Discharger shall place rock and install wattles at the outflow of the rocked rolling dip.

Road Point 3 – Road runoff is bypassing a failing rolling dip, resulting in erosion of the surface of the road past the rolling dip and sediment discharge to a Class III watercourse. The Discharger shall install a rocked rolling dip per attached specifications and rock the surface of the road to Road Point 2. The Discharger shall install a shallow inside ditch leading up to Road Point 2 and inslope the road into the inside ditch. The Discharger shall place rock and install wattles at the outflow of the rocked rolling dip.

Road Point 4 – The surface of the road, the existing rolling dip, and inside ditch is discharging sediment into a Class II watercourse. At the outlet of the rolling dip, a perched fill has formed from the collection of sediment in road surface runoff. The Discharger shall remove the perched fill from the edge of the roads fill prism. The Discharger shall then install a rocked rolling dip per attached specifications and rock the surface of the road to Road Point 3. The Discharger shall place rock and install wattles at the outflow of the rocked rolling dip and the ditch relief culvert. The Discharger shall also install an 18" ditch relief culvert per attached specifications and clear the existing connected inside ditch of road fill material. The Discharger shall further extend the inside ditch and inslope the road into the inside ditch to Road Point 3. The Discharger shall then rock line the inside ditch for 100' before the ditch relief culvert.

Road Point 5 – Storm waters are not being drained off the surface of the road. The Discharger shall install a rolling dip per attached specifications.

Road Point 6, 7, & 8 – Road runoff is being constrained and pooling on the surface of the road, resulting in the formation of ruts and sediment delivery to a wet area. The Discharger shall install a rocked rolling dip per attached specifications. The Discharger shall also resurface and rock the approaches approximately shown on the attached site maps. Surface rock shall be applied approximately no less than 50' on either approach into the rocked rolling dip.

Road Point 9 – Recent work on the access trail to the point of diversion's water works has resulting in disturbed soils on a slope into the lake. The Discharger shall seed and mulch the disturbed ground and install staked wattles.

Road Point 10 – Road runoff is being constrained and pooling on the surface of the road, resulting in the formation of ruts and sediment delivery to a wet area. The Discharger shall install a rocked rolling dip per attached specifications. The Discharger shall also resurface and rock the approaches approximately shown on the attached site maps. Surface rock shall be applied approximately no less than 50' on either approach into the rocked rolling dip. The Discharger shall also fill in the pothole above the rocked rolling dip that is resulting in erosion of the surface of the road leading into the rocked rolling dip.

b. Roads, driveways, trails, and other defined corridors for foot or vehicle traffic of any kind shall have adequate ditch relief drains or rolling dips and/or other measures to prevent or minimize erosion along the flow paths and at their respective outlets.

Addressed under Standard Condition A.1.a.

c. Roads and other features shall be maintained so that surface runoff drains away from potentially unstable slopes or earthen fills. Where road runoff cannot be drained away from an unstable feature, an engineered structure or system shall be installed to ensure that surface flows will not cause slope failure.

Physical reconnaissance of the property revealed no active unstable areas. There are no Geomorphic Features Map for the Showers Mountain 7.5' Quadrangle, Humboldt County, California.

d. Roads, clearings, fill prisms, and terraced areas (cleared/developed areas with the potential for sediment erosion and transport) shall be maintained so that they are not hydrologically connected[1], as feasible, from surface waters, including wetlands, ephemeral, intermittent and perennial streams.

Clearings and terraced areas are not hydrologically connected to surface waters. The road and associated fill prism is hydrologically connected at Stream Crossing 1, Road Points 2, 3, & 4. Complete hydrologic disconnect of this road is not feasible, measures to mitigate discharge are addressed under Standard Condition A.1.a and Standard Condition A.2. Poor road drainage is resulting is discharge into a Class II pond and wet area at Road Points 6, 7, & 8. Measures to mitigate discharge are addressed under Standard Condition A.1.a.

e. Ditch relief drains, rolling dip outlets, and road pad or terrace surfaces shall be maintained to promote infiltration/dispersal of outflows and have no apparent erosion or evidence of soil transport to receiving waters.

Measures to mitigate or eliminate soil transport to receiving waters from ditch relief drains, rolling dip outlets, and road pad surfaces are addressed under Standard Conditions A.1.a and A.2. There are no terraced surfaces.

f. Stockpiled construction materials are stored in a location and manner so as to prevent their transport to receiving waters.

[1] Connected roads are road segments that deliver road surface runoff, via the ditch or road surface, to a stream crossing or to a connected drain that occurs within the high delivery potential portion of the active road network. A connected drain is defined as any cross-drain culvert, water bar, rolling dip, or ditch-out that appears to deliver runoff to a defined channel. A drain is considered connected if there is evidence of surface flow connection from the road to a defined channel or if the outlet has eroded a channel that extends from the road to a defined channel. (http://www.forestsandfish.com/documents/Road_Mgmt_Survey.pdf)

No stockpiled construction materials are on the property where they can enter surface waters. In the future, all construction materials shall be stored to prevent their transport to receiving waters.

2. Stream Crossing Maintenance (Compliance: Y☒/ N☐)

a. Culverts and stream crossings shall be sized to pass the expected 100-year peak streamflow.

b. Culverts and stream crossings shall be designed and maintained to address debris associated with the expected 100-year peak streamflow.

c. Culverts and stream crossings shall allow passage of all life stages of fish on fish-bearing or restorable streams, and allow passage of aquatic organisms on perennial or intermittent streams.

d. Stream crossings shall be maintained so as to prevent or minimize erosion from exposed surfaces adjacent to, and in the channel and on the banks.

e. Culverts shall align with the stream grade and natural stream channel at the inlet and outlet where feasible.[2]

f. Stream crossings shall be maintained so as to prevent stream diversion in the event that the culvert/crossing is plugged, and critical dips shall be employed with all crossing installations where feasible.[3]

Work in watercourses at Stream Crossing 1, 2, 3, and the pond overflow has been approved by CDFW per Lake and Streambed Alteration agreement (Agreement 1600-2016-0586).

Stream Crossing 1 – Class III watercourse consisting of an 18-inch diameter steel culvert, twenty foot in length. This culvert is slightly undersized for the 100-year storm, too short, and filled with sediment because it was installed with a lower gradient than the natural stream channel. The Discharger shall install a 24-inch diameter culvert with a minimum 30-foot length set slightly steeper in grade per the attached specifications.

Stream Crossing 2 – Class III watercourse crossing consisting of a 12-inch diameter plastic culvert on a seasonal access road. This crossing is significantly undersized and shall be upgraded to a minimum 30-inch diameter culvert installed per the attached specifications.

Stream Crossing 3 – Class III watercourse crossing consisting of a 10-inch diameter steel culvert. This culvert is plugged at the outlet, undersized, and too short. The Discharger shall replace the culvert with an 18-inch diameter culvert per the attached specifications.

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[2] At a minimum, the culvert shall be aligned at the inlet. If infeasible to align the culvert outlet with the stream grade or channel, outlet armoring or equivalently effective means may be applied.

[3] If infeasible to install a critical dip, an alternative solution may be chosen.

Stream Crossing 4 – Class III watercourse crossing/lake overflow consisting of a 24-inch diameter steel culvert. The culvert is lacking an energy dissipater at the outflow. The Discharger shall install an energy dissipater at the outflow of the culvert. The culvert was inspected by CDFW and Timberland Resource Consultants on May 22, 2017. CDFW determined the culvert to be adequate and not in need of replacement, upgrading or notification for installation of an energy dissipater.

Stream Crossing 5 – Class II watercourse crossing consisting of a 60-inch diameter steel culvert. The culvert and associated road was installed in 2010 under timber harvest plan 1-10-006-HUM by Green Diamond Resource Company. The culvert was inspected and found to be in good condition and functioning adequately.

Stream Crossing 6 – Class III watercourse crossing consisting of a 24-inch diameter steel culvert. The culvert and associated road was installed in 2010 under timber harvest plan 1-10-006-HUM by Green Diamond Resource Company. The culvert was inspected and found to be in good condition and functioning adequately.

Pond Overflow – The pond's outlet is showing signs of minor erosion. The Discharger shall install large cobbles and small boulders along the pond's outlet.

The permanent culvert upgrades have been sized for 100-year flood flow utilizing methods recommended in *"Designing Watercourse Crossings for Passage of 100-year Flood Flows, Wood, and Sediment"*. 2004 Peter Cafferata, Thomas Spittler, Michael Wopat, Greg Bundros, and Sam Flanagan. This report recommends that the rational method be limited to watersheds less than 100 acres. The 100-year Return-Period precipitation data is from: http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ca.

Rational Method for 100-year flood flow (A < 200 acres) **APN 317 023 010**

$T_c = 60((11.9 \times L^3)/H)^{0.385}$				$Q_{100} = CIA$			
Crossing	Channel length (to top of basin) (mi) L	Elevation difference (ft) H	Concentration time (min) Tc	Runoff coefficient C	100-year Return-Period Precipitation (in/hr) I*	Area (acres) A	100-yr flood flow (cfs) Q100
1				0.35	3.81	5	6.7
2				0.35	3.81	13	17.3
3				0.35	3.81	4	5.3

HW/D	CD18	CD24	CD30	CD36	CD42	CD48	CD54	CD60	CD72	CD84	CD96
1.0	5.6	11.6	20	32	47	66	89	115	190	265	375
1.1	6.4	13	23	33	53	75	99	128	200	300	425
1.2	7	14.5	25	40	59	83	109	140	230	330	475
1.3	7.9	16.5	28	44	64	90	120	155	250	370	520
1.4	8.2	16.9	30	46	68	96	125	165	260	390	545
1.5	8.9	18	32	50	72	101	133	175	290	420	590
1.6	9.2	19	34	52	77	108	143	189	300	440	620
1.7	9.8	20	35	55	80	111	150	195	310	460	650
1.8	10	21	36	57	84	118	155	203	330	480	675
1.9	10.5	21.9	37	60	88	122	164	212	340	500	700
2.0	11	22.1	39	61	90	128	170	220	350	520	730
2.2	11.5	24	41	66	95	133	180	232	375	550	780
2.4	12.2	25	44	70	100	142	190	250	390	590	830
2.6	12.9	26.5	46	72	105	150	199	260	420	630	860
2.8	13.6	27.5	48	78	110	156	210	270	440	640	900
3.0	14	29	50	80	118	163	220	282	450	690	945
3.2	14.5	30	52	82	120	168	225	295	470	695	975
3.4	15	31	54	85	125	175	235	310	490	710	1000
3.6	15.5	33	55	89	129	183	240	320	500	750	1050
3.8	16	34	58	91	132	189	251	330	510	760	1080
4.0	16.5	35	60	93	139	193	255	340	540	795	1100
4.5	17.5	38	63	100	145	205	275	360	575	850	1190
5	19	39	68	105	154	220	290	380	600	900	1230
5.5	20	40.5	70	110	161	230	305	400	630	935	1300
6	21	43	75	116	170	240	325	420	680	990	1390

The recommended minimum culvert sizes recommended are based on the premise that the culvert should pass a design flow without allowing the inlet to become submerged. Therefore, the proposed culvert sizes specified in this 1600 Notification are based upon a headwall height to diameter ratio of 1.

3. Riparian and Wetland Protection and Management (Compliance: Y☒/ N☐)

a. For Tier 1 Discharger's, cultivation areas or associated facilities shall not be located within 200 feet of surface waters. While 200-foot buffers are preferred for Tier 2 sites, at a minimum, cultivation areas and associated facilities shall not be located or occur within 100 feet of any Class I or II watercourse or within 50 feet of any Class III watercourse or wetlands. The Regional Water Board or its or its Executive Officer may apply additional or alternative[4] conditions on enrollment, including site-specific riparian buffers and other BMPs beyond those identified in water resource protection plans to ensure water quality protection.

The Cultivation Site is located approximately 160' and 170' away from seasonal wet areas, 230' away from a Class II watercourse, 290' away from a Class I lake.

b. Buffers shall be maintained at natural slope with native vegetation.

Riparian buffers remain undisturbed throughout the property. Buffers are at natural slope, undeveloped, and heavily vegetated with native trees and brush and are sufficiently wide enough to filter any discharges from production lands.

c. Buffers shall be of sufficient width to filter wastes from runoff discharging from production lands and associated facilities to all wetlands, streams, drainage ditches, or other conveyances. Riparian and wetland areas shall be protected in a manner that maintains their essential functions, including temperature and microclimate control, filtration of sediment and other pollutants, nutrient cycling, woody debris recruitment, groundwater recharge, streambank stabilization, and flood peak attenuation and flood water storage.

The Cultivation Site is located outside the minimum buffers for their respective nearest watercourses.

In order to remain in compliance, riparian buffers will continue to be excluded from operations and protected in a manner that maintains their essential functions. The Discharger shall maintain a 50' buffer from Class III watercourses, 100' from Class I or II watercourses, in the vicinity of all current and future grading or terracing activities. The Discharger can contact Timberland Resource Consultants for establishment of buffers prior to future development.

[4] Alternative site-specific riparian buffers that are equally protective of water quality may be necessary to accommodate existing permanent structures or other types of structures that cannot be relocated.

4. Spoils Management (Compliance: Y☒/ N☐)

a. Spoils[5] shall not be stored or placed in or where they can enter any surface water.

b. Spoils shall be adequately contained or stabilized to prevent sediment delivery to surface waters.

c. Spoils generated through development or maintenance of roads, driveways, earthen fill pads, or other cleared or filled areas shall not be sidecast in any location where they can enter or be transported to surface waters.

Cultivation related soil spoils are kept in their beds and containers over winter and show no sign of movement where they can enter a watercourse. There are no spoil piles generated from development or maintenance of roads, driveways, earthen fill pads, or other cleared or filled areas where they can enter or be transported to surface waters.

5. Water Storage and Use (Compliance: Y☒/ N☐)

a. Size and scope of an operation shall be such that the amount of water used shall not adversely impact water quality and/or beneficial uses, including and in consideration with other water use by operations, instream flow requirements and/or needs in the watershed, defined at the scale of a HUC-12[6] watershed or at a smaller hydrologic watershed as determined necessary by the Regional Water Board Executive Officer.

This project consists of a cultivation site totaling 43,450-square feet of cultivation area. The Cultivation Site consists of fourteen 12' x 100' hoop houses and a half acre full term out door on a level field with slope less than 15%.

The previous Discharger stated that they used approximately 225,000-gallons of water during the 2016 cultivation season. The current Discharger shall install water meters to better document usage.

b. Water conservation measures shall be implemented. Examples include use of rainwater catchment systems or watering plants with a drip irrigation system rather than with a hose or sprinkler system.

There are signs that water conservation measures are used during the cultivation season. The Discharger conserves water by using drip line irrigation, planting in ground beds, and hand watering. The Discharger shall install float-valves on appropriate storage tanks to prevent overflowing and unnecessary diversion of water.

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[5] Spoils are waste earthen or organic materials generated through grading or excavation, or waste plant growth media or soil amendments. Spoils include but are not limited to soils, slash, bark, sawdust, potting soils, rock, and fertilizers.

[6] See definition and link to maps at: http://water.usgs.gov/GIS/huc.html

c. For Tier 2 Discharger's, if possible, develop off-stream storage facilities to minimize surface water diversion during low flow periods.

The Discharger currently diverts surface waters for cultivation purposes. However, due to the issuance of State Water Resources Control Board's Order WQ 2017-0023-DWQ the Discharger will no longer be able to divert surface waters from the on-stream lake. To comply with Order WQ 2017-0023-DWQ, the Discharger will be installing a well(s) in the spring of 2019.

The Discharger currently has adequate off-stream and on-stream storage facilities that provide adequate water resources to minimize surface water diversion during low flow periods. The Discharger does not have a forbearance period from surface water diversions from the lake adjacent to the cultivation area per California Department of Fish & Wildlife Lake & Streambed agreement 1600-2016-0586. The Discharger has approximately 29,370,000-gallons of dedicated water storage for cultivation (6 x 5,000-gallon tanks, estimated 29,340,000-gallon lake at peak level).

d. Water is applied using no more than agronomic rates.[7]

There is no evidence to conclude that the Discharger irrigates at a greater rate than the growth medium can facilitate. No signs of over watering are present on-site.

e. Diversion and/or storage of water from a stream should be conducted pursuant to a valid water right and in compliance with reporting requirements under Water Code section 5101.

The Discharger has an approved Lake and Stream Bed Alteration agreement with California Department of Fish and Wildlife for diversion structures and jurisdictional activities in watercourses (1600-2016-0586). The Discharger must follow the requirements of the approved Lake and Stream Bed Alteration agreement with California Department of Fish and Wildlife.

The Discharger is currently diverting and storing surface water without an appropriative water right. If the Discharger continues to divert surface waters for cultivation purposes, the Discharger will then need to apply for a Small Irrigation Use Registration once available. The Discharger cannot comply with Standard Condition A.5.e. until the Small Irrigation Use program is completed and made available by the State Water Control Board *or* the Discharger discontinues use of surface water diversions to storage for cultivation purposes and uses a well or rain catchment as the only source of water.

f. Water storage features, such as ponds, tanks, and other vessels shall be selected, sited, designed, and maintained so as to insure integrity and to prevent release into waters of the state in the event of a containment failure.

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[7] "Agronomic rates" is defined as the rates of fertilizer and irrigation water that a plant needs to enhance soil productivity and provide the crop or forage growth with needed nutrients for optimum health and growth, without having any excess water or nutrient percolate beyond the root zone.

The water storage tanks have been sited in secure locations to prevent release into waters of the state.

6. Irrigation Runoff (Compliance: Y☒/ N☐)

Implementing water conservation measures, irrigating at agronomic rates, applying fertilizers at agronomic rates and applying chemicals according to the label specifications, and maintaining stable soil and growth media should serve to minimize the amount of runoff and the concentration of chemicals in that water. In the event that irrigation runoff occurs, measures shall be in place to treat/control/contain the runoff to minimize the pollutant loads in the discharge. Irrigation runoff shall be managed so that any entrained constituents, such as fertilizers, fine sediment and suspended organic particles, and other oxygen consuming materials are not discharged to nearby watercourses. Management practices include, but are not limited to, modifications to irrigation systems that reuse tailwater by constructing off-stream retention basins, and active (pumping) and or passive (gravity) tailwater recapture/redistribution systems. Care shall be taken to ensure that irrigation tailwater is not discharged towards or impounded over unstable features or landslides.

There are no signs of irrigation runoff within the cultivation sites. Irrigating at agronomic rates, combined with the proximity of the cultivation areas from the watercourses, ensures there is little to no chance for any irrigation runoff to reach surface waters.

7. Fertilizers and Soil Amendments (Compliance: Y☒/ N☐)

a. Fertilizers, potting soils, compost, and other soils and soil amendments shall be stored in locations and in a manner in which they cannot enter or be transported into surface waters and such that nutrients or other pollutants cannot be leached into groundwater.

Fertilizers and soil amendments are stored in an agriculture barn near the southern residence or in a storage shed and IBC totes next to the cultivation area. Cultivation soils remain in their respective pots or beds in the immediate cultivation area and are amended for reuse at the beginning of the growing season. There is also a cultivation soil spoil pile located next to the cultivation area. The soil pile is not tarped but has overgrown with grasses and weeds and shows no movement to surface waters or is in a location where it can be transported to surface waters. There were no fertilizers, potting soils, compost, and other soils and soil amendments stored in locations in which they can enter or be transported into surface waters.

In order to remain in compliance with Standard Condition 7, the Discharger shall store all fertilizers (bagged, boxed, and bottled), potting soils, composts, and soil amendments in sheds, covered areas, or placed on pallets and tarped if stored outside. They shall be stored in a manner in which they cannot be transported to surface waters or such that nutrients or other pollutants cannot be leached into groundwater.

b. Fertilizers and soil amendments shall be applied and used per packaging instructions and/or at proper agronomic rates.

The Discharger shall ensure that fertilizers and soil amendments are applied and used per packaging instructions and/or at proper agronomic rates.

c. Cultivation areas shall be maintained so as to prevent nutrients from leaving the site during the growing season and post-harvest.

Cultivation areas are level and soils are contained in pots or planter boxes. No cultivation soils are leaving the site in runoff.

8. <u>Pesticides/Herbicides</u> **(Compliance: Y☒/ N☐)**

At the present time, there are no pesticides or herbicides registered specifically for use directly on cannabis and the use of pesticides on cannabis plants has not been reviewed for safety, human health effects, or environmental impacts. Under California law, the only pesticide products not illegal to use on cannabis are those that contain an active ingredient that is exempt from residue tolerance requirements and either registered and labeled for a broad enough use to include use on cannabis or exempt from registration requirements as a minimum risk pesticide under FIFRA section 25(b) and California Code of Regulations, title 3, section 6147. For the purpose of compliance with conditions of this Order, any uses of pesticide products shall be consistent with product labeling and any products on the site shall be placed, used, and stored in a manner that ensures that they will not enter or be released into surface or ground waters.

At the time of the assessment, there were no pesticides or herbicides stored on the property.

In order to remain in compliance, pesticides, herbicides, and fungicides shall be applied per specifications included in the packaging. The Discharger shall ensure any pesticides or herbicides used are placed, used, and stored in a manner that ensures that they will not enter or be released into surface or ground waters.

9. <u>Petroleum products and other chemicals</u> **(Compliance: Y☐/ N☒)**

a. Petroleum products and other liquid chemicals, including but not limited to diesel, biodiesel, gasoline, and oils shall be stored so as to prevent their spillage, discharge, or seepage into receiving waters. Storage tanks and containers must be of suitable material and construction to be compatible with the substance(s) stored and conditions of storage such as pressure and temperature.

b. Above ground storage tanks and containers shall be provided with a secondary means of containment for the entire capacity of the largest single container and sufficient freeboard to contain precipitation.

c. Discharger's shall ensure that diked areas are sufficiently impervious to contain discharged chemicals.

d. Discharger(s) shall implement spill prevention, control, and countermeasures (SPCC) and have appropriate cleanup materials available onsite.

e. Underground storage tanks 110 gallons and larger shall be registered with the appropriate County Health Department and comply with State and local requirements for leak detection, spill overflow, corrosion protection, and insurance coverage.

There several fuel storage tanks on the property without secondary containment and cover from precipitation. One 1000-gallon tank and two 350-gallon tanks.

In order to be in compliance any fuel tank, portable fuel can, and drum that contains fuel shall be stored indoors within garages or storage sheds, or if stored outdoors be contained within a secondary containment vessels large enough for the entire capacity and be covered from precipitation.

10. Cultivation-related wastes (Compliance: Y☒/ N☐)

Cultivation-related wastes including, but not limited to, empty soil/soil amendment/ fertilizer/pesticide bags and containers, empty plant pots or containers, dead or harvested plant waste, and spent growth medium shall, for as long as they remain on the site, be stored[8] at locations where they will not enter or be blown into surface waters, and in a manner, that ensures that residues and pollutants within those materials do not migrate or leach into surface water or groundwater's.

Cultivation related wastes are being stored a utility trailer or in lidded trashcans in the shed next to the agriculture barn where their contents cannot enter drainages that reach watercourses. The Discharger disposes organic plant waste material by burning it or composting it nearby the cultivation sites.

In order to remain in compliance with Standard Condition 10 above, all cultivation-related waste in the form of empty bags, containers, pots, and dead or harvested plant waste and spent growth medium shall be stored where they will not enter or be blown into surface waters, or removed from the site and disposed of properly. Cultivation-related wastes that contain residues or pollutants shall be stored in a manner that ensures that those materials do not leach into surface water or groundwaters. This can be achieved by following items 137 and 139 in Appendix B of the Order.

[8] Plant waste may also be composted, subject to the same restrictions cited above for cultivation-related waste storage.

11. Refuse and human waste (Compliance: Y☒/ N☐)

a. Disposal of domestic sewage shall meet applicable County health standards, local agency management plans and ordinances, and/or the Regional Water Board's Onsite Wastewater Treatment System (OWTS) policy, and shall not represent a threat to surface water or groundwater.

There is an unpermitted septic system attached to the both of the residences located on the property. The Onsite Wastewater Treatment System (OWTS) serving the residence appears to be functioning properly. No evidence of disposal field failure was detected when inspected. Although the system is not a permitted one, it is likely that this system will fall under Tier 0 (existing systems that are properly functioning and do not meet the conditions of failing systems or otherwise require corrective action – as defined in the RWQCB OWTS Policy and Humboldt County Local Agency Management Plan).

b. Refuse and garbage shall be stored in a location and manner that prevents its discharge to receiving waters and prevents any leachate or contact water from entering or percolating to receiving waters.

The Discharger is storing refuse and garbage in lidded trashcans underneath an awning attached to the shop, in the shop, or in the residence where their contents cannot enter drainages that reach watercourses.

c. Garbage and refuse shall be disposed of at an appropriate waste disposal location.

The Discharger stated they dispose of trash at the Eel River Resource Recovery Transfer Station in Redway, CA.

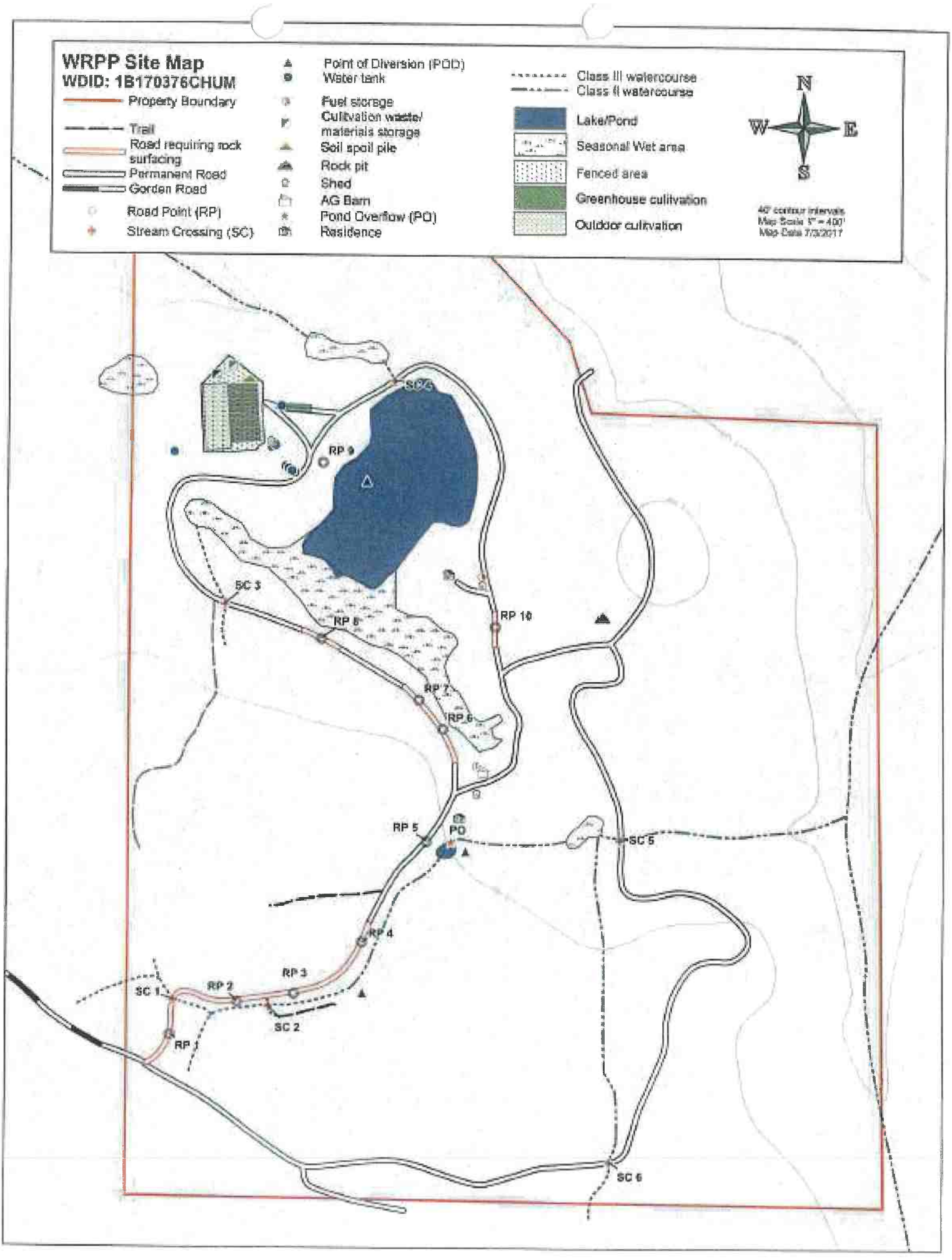
In order to remain in compliance with Standard Condition 11. b. and c. above, refuse and garbage shall be stored in a location and manner that prevents its discharge to receiving waters and prevents any leachate or contact water from entering or percolating to receiving waters. This can be accomplished by storing garbage in covered containers or keeping it tarped during the winter. Garbage and refuse shall be disposed of at an appropriate waste disposal location. See Appendix B. Item 141 of the Order.

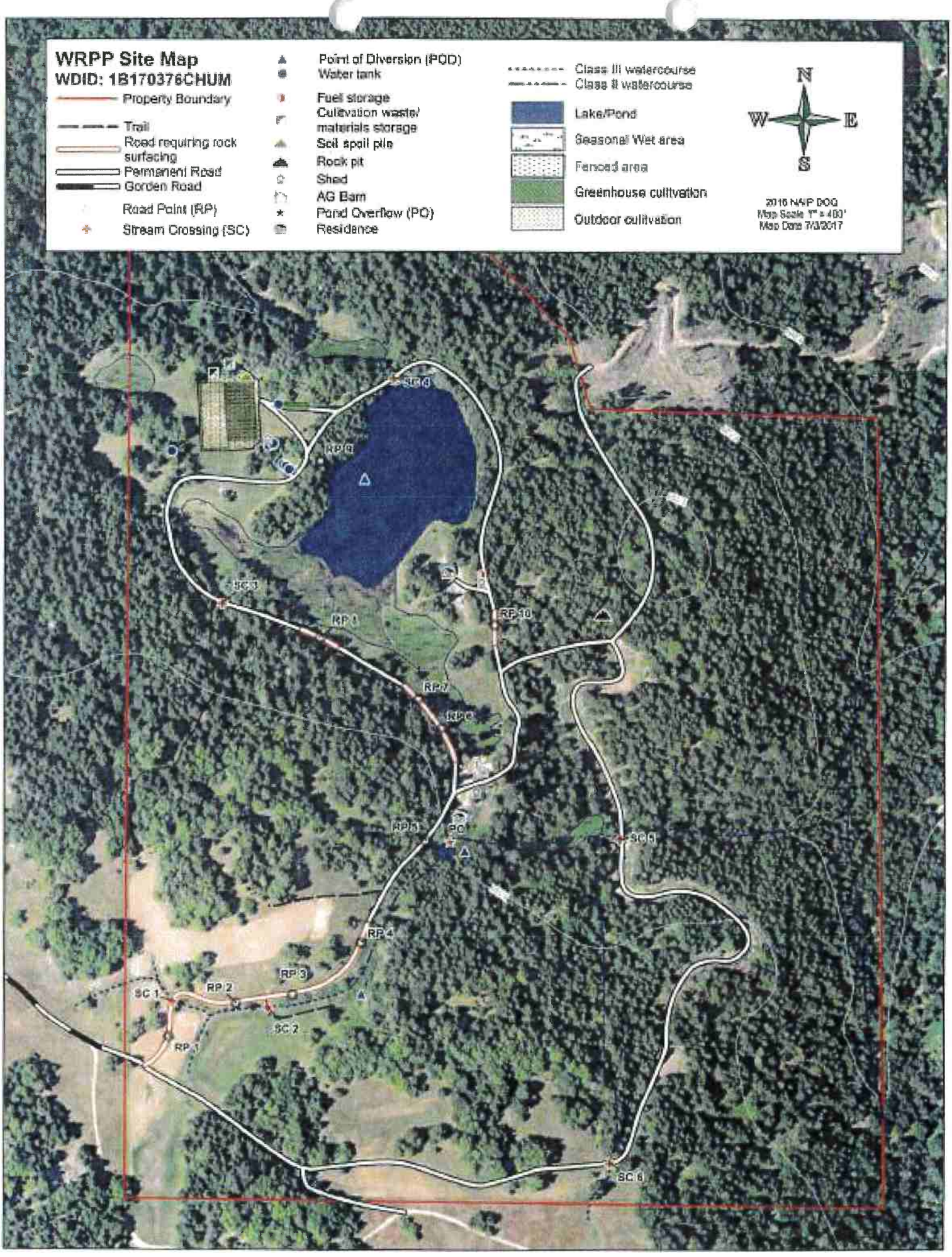
12. Remediation/Cleanup/Restoration Remediation/cleanup/restoration activities may include, but are not limited to, removal of fill from watercourses, stream restoration, riparian vegetation planting and maintenance, soil stabilization, erosion control, upgrading stream crossings, road outsloping and rolling dip installation where safe and suitable, installing ditch relief culverts and overside drains, removing berms, stabilizing unstable areas, reshaping cutbanks, and rocking native-surfaced roads. Restoration and cleanup conditions and provisions generally apply to Tier 3 sites, however owners/operators of Tier 1 or 2 sites may identify or propose water resource improvement or enhancement projects such as stream restoration or riparian planting with native vegetation and, for such projects, these conditions apply similarly. Appendix B accompanying this Order includes environmental protection and mitigation measures that apply to cleanup activities such as: temporal limitations on construction; limitations on earthmoving and construction equipment; guidelines for removal of plants and revegetation; conditions for erosion control, limitations on work in streams, riparian and wetland areas; and other measures.

Mitigation measures are listed below in the Mitigation Report and also noted above in the document.

General recommendations

- ☐ Obtain secondary containment for the fuel tanks once in-use. The fuel tank and secondary containment shall be covered from precipitation to prevent the secondary containment from filling with rainwater.
- ☐ Fertilizer, soil amendments, and pesticide use it to be recorded in such a manner that cumulative annual totals are recorded for annual reporting.
- ☐ Water use shall be designed and metered such that water used for the irrigation of cannabis will be recorded separately from domestic use. Water use for the irrigation of cannabis is to be recorded monthly for annual reporting.
- ☐ Frequent use of un-surfaced roads should be avoided, particularly when road surfaces are soft/saturated.
- ☐ All culverts should be inspected regularly during the winter months to check for plugging, blockage, or other issues.
- ☐ Existing or newly installed road surface drainage structures such as water bars, rolling dips, ditch relief culverts, and intentionally in/out-sloped segments of road shall be maintained to ensure continued function of capturing and draining surface runoff.
- ☐ Utilize spill trays when fueling portable generators or water pumps to prevent the potential for leeching, seepage or spillage.


WRPP Site Map
WDID: 1B170376CHUM
Property Boundary
Trail
Road requiring rock surfacing
Permanent Road
Gorden Road
Road Point (RP)
Stream Crossing (SC)
Point of Diversion (POD)
Water tank
Fuel storage
Cultivation waste/ materials storage
Soil spoil pile
Rock pit
Shed
AG Barn
Pond Overflow (PO)
Residence
Class III watercourse
Class II watercourse
Lake/Pond
Seasonal Wet area
Fenced area
Greenhouse cultivation
Outdoor cultivation
N
W
E
S
40' contour intervals
Map Scale 1" = 400'
Map Date 7/3/2017
SC 4
RP 9
SC 3
RP 8
RP 10
RP 7
RP 6
RP 5
PO
SC 5
RP 4
RP 3
RP 2
SC 1
SC 2
RP 1
SC 6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Map Date 7/3/2017
SC 4
RP 9
SC 3
RP 1
RP 10
RP 7
RP 6
RP 5
PO
SC 5
RP 4
RP 3
SC 1
RP 2
SC 2
RP 1
SC 6

Mitigation Report (Identified Sites Requiring Remediation)

Unique Point(s)	Map Point Description	Associated Standard Condition	Temporary BMP	Permanent BMP	Priority for Action	Time Schedule for completion of Permanent BMP	Completion Date
Main access road from gate to Cultivation Site	Road lacking grading.	A.1.	N/A	Grade the main access road from the entrance of the property to the cultivation site.	3	10/15/2018 or 2019 weather permitting	
RP 1	Winter traffic and poor road surfacing has resulted in the formation of ruts and pot holes that deliver sediment to the riparian buffer of a Class III watercourse.	A.1. a.	N/A	Install a rocked rolling dip per attached specifications. Install staked wattles at the outflow of the rocked rolling dip. Resurface and rock the road.	3	10/15/2018 or 2019 weather permitting	
RP 2	Road runoff is bypassing a failing rolling dip, resulting in erosion past the rolling dip and sediment discharge to a Class III watercourse.	A.1. a.	N/A	Install a rocked rolling dip per attached specifications and rock the surface of the road. Place rock and install wattles at the outflow of the rocked rolling dip.	3	10/15/2018 or 2019 weather permitting	
RP 3	Road runoff is bypassing a failing rolling dip, resulting in erosion of the surface of the road past the rolling dip and sediment discharge to a Class III watercourse.	A.1.a	N/A	Install a rocked rolling dip per attached specifications and rock the surface of the road to Road Point 2. Install a shallow inside ditch leading up to Road Point 2 and inslope the road into the inside ditch. Place rock and install wattles at the outflow of the rocked rolling dip.	3	10/15/2018 or 2019 weather permitting	
RP 4	The surface of the road, the existing rolling dip, and inside ditch is discharging sediment into a Class II watercourse. At the outlet of the rolling dip, a perched fill has formed from the collection of sediment in road surface runoff.	A.1.a	N/A	Remove the perched fill from the edge of the roads fill prism, install a rocked rolling dip per attached specifications and rock the surface of the road to Road Point 3. Place rock and install wattles at the outflow of the rocked rolling dip and the ditch relief culvert. Install an 18" ditch relief culvert per attached specifications and clear the existing connected inside ditch of road fill material. Further extend the inside ditch and inslope the road into the inside ditch to Road Point 3. Rock line the inside ditch for 100' before the ditch relief culvert.	3	10/15/2018 or 2019 weather permitting	
RP 5	Storm waters are not being drained off the surface of the road.	A.1. a.	N/A	Install a rolling dip per attached specifications.	3	10/15/2018 or 2019 weather permitting	

RP 6 7 & 8	Winter traffic and poor road surfacing has resulted in the formation of ruts and sediment delivery to a wet area.	A.1.a.	N/A	Install a rocked rolling dip per attached specifications. Resurface and rock the approaches approximately shown on the attached site maps. Surface rock shall be applied approximately no less than 50' on either approach into the rocked rolling dip.	3	10/15/2019 or 2019 weather permitting	
RP 9	Recent work on the access trail to the point of diversion's water works has resulting in disturbed soils on a slope into the lake.	A.1.a	N/A	Seed and mulch the disturbed ground and install staked wattles.	2	2017	9/2017
RP 10	Winter traffic and poor road surfacing has resulted in the formation of potholes and sediment delivery to a wet area.	A.1. a.	N/A	Install a rocked rolling dip per attached specifications. Resurface and rock the approaches approximately shown on the attached site maps. Surface rock shall be applied approximately no less than 50' on either approach into the rocked rolling dip. Fill in the pothole above the rocked rolling dip that is resulting in erosion of the surface of the road leading into the rocked rolling dip.	3	10/15/2019 or 2019 weather permitting	
SC 1	Class III watercourse consisting of an 18-inch diameter steel culvert, twenty feet in length. This culvert is slightly undersized for the 100-year storm, too short, and filled with sediment because it was installed with a lower gradient than the natural stream channel.	A.2.	N/A	Install a 24-inch diameter culvert with a minimum 30-foot length set slightly steeper in grade per the attached specifications.	3	10/15/2019	9/2017
SC 2	Class III watercourse crossing consisting of a 12-inch diameter plastic culvert on a seasonal access road.	A.2.	N/A	This crossing is significantly undersized and shall be upgraded to a minimum 30-inch diameter culvert installed per the attached specifications.	4	Shortest time possible, but no later than the expiration of this Order (five years).	9/2017
SC 3	Class III watercourse crossing consisting of a 10-inch diameter steel culvert. This culvert is plugged at the outlet, undersized, and too short.	A.2.	N/A	Replace the culvert with an 18-inch diameter culvert per the attached specifications.	4	Shortest time possible, but no later than the expiration of this Order (five years).	9/2017

SC-4	Class III watercourse crossing/lake overflow consisting of a 24-inch diameter steel culvert. The culvert is lacking an energy dissipater at the outflow.	A.2.	N/A	Install an energy dissipater at the outflow of the culvert.	3	2019	9/2017
PD	The pond's outlet is showing signs of minor erosion.	A.2.	N/A	Install large cobbles and small boulders along the pond's outlet.	3	10/15/2018	
Point of Diversion, Water Storage	Water Storage and Use	A.5.	N/A	-- If the Discharger continues to divert and store surface waters for longer than 30 days, the Discharger shall apply for a Small Irrigation Use Registration, once made available by the California State Water Resources Control Board.	4	(Optional; well being installed)	
Fuel Storage	There several fuel storage tanks on the property without secondary containment and cover from precipitation. One 1000-gallon tank and two 350-gallon tanks.	A. 9.	N/A	Any fuel tank, portable fuel can, and drum that contains fuel shall be stored indoors within garages or storage sheds, or if stored outdoors be contained within a secondary containment vessels large enough for the entire capacity and be covered from precipitation.	3	Once in use	

Treat Priority: Treatment Priority (1) indicates a very high priority with treatment being planned to occur immediately, (2) indicates a high priority site with treatment to occur prior to the start of the winter period (Oct. 15), (3) indicates a moderate priority with treatment being planned to occur within one year, or prior to the winter period (Oct. 15) of the 2nd season of operations, and (4) indicates a low priority with treatment being planned to occur in the shortest time possible, but no later than the expiration of this Order (five years).

Attached Photo's

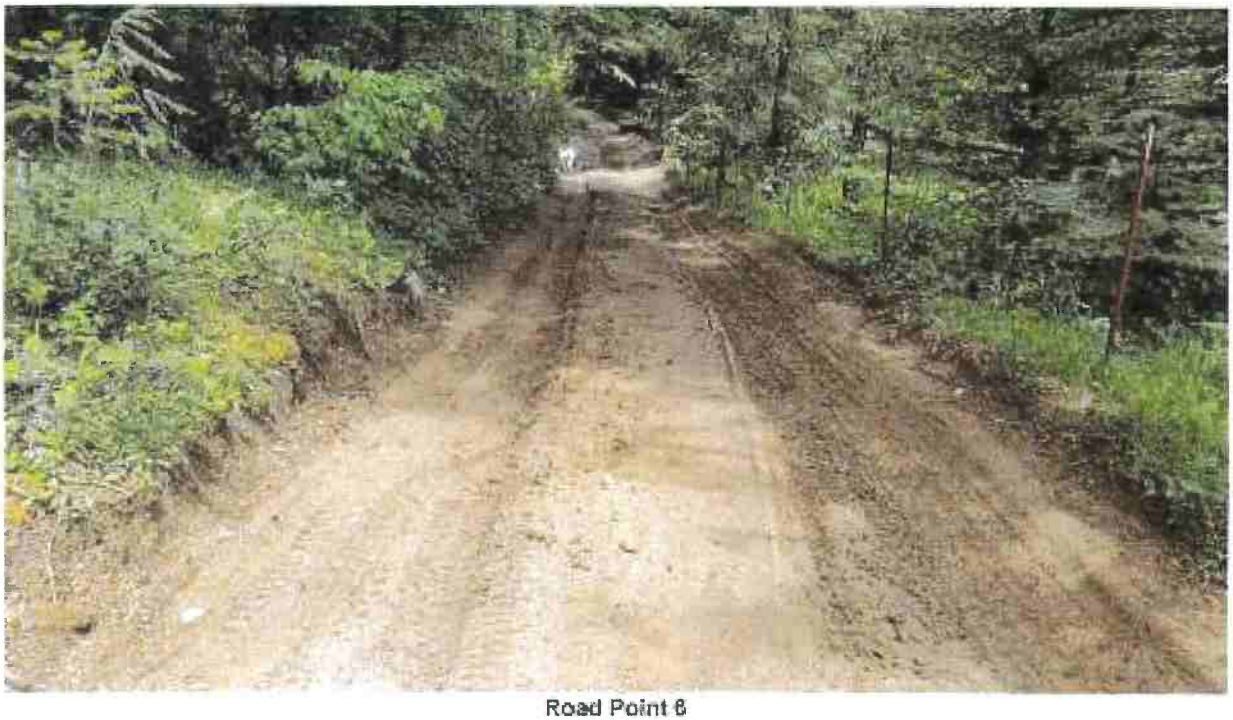
Road Point 1: Winter traffic and poor road surfacing has resulted in the formation of ruts and pot holes that deliver sediment to the riparian buffer of a Class III watercourse. Install a rocked rolling dip per attached specifications. Install staked wattles at the outflow of the rocked rolling dip. Resurface and rock the road.

Road Point 2: Road runoff is bypassing a failing rolling dip, resulting in erosion past the rolling dip and sediment discharge to a Class III watercourse. Install a rocked rolling dip per attached specifications and rock the surface of the road. Place rock and install wattles at the outflow of the rocked rolling dip.

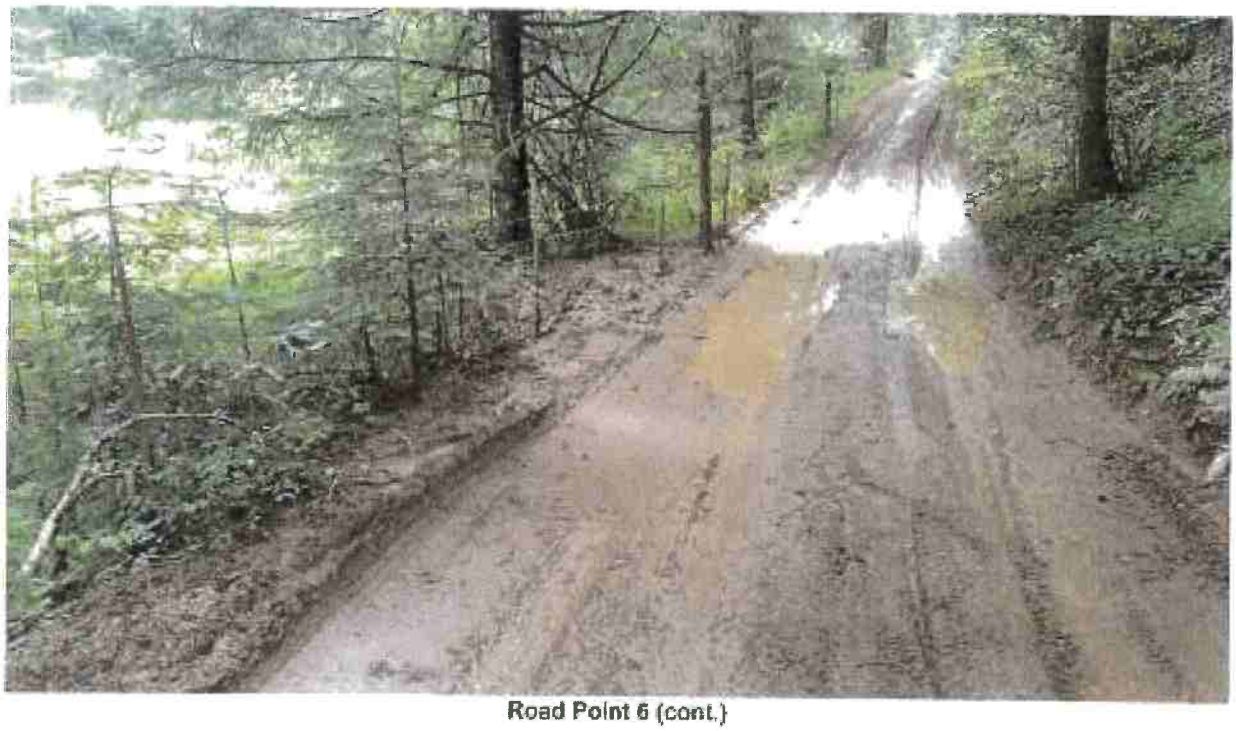
Road Point 3: Road runoff is bypassing a failing rolling dip, resulting in erosion of the surface of the road past the rolling dip and sediment discharge to a Class III watercourse. Install a rocked rolling dip per attached specifications and rock the surface of the road to Road Point 2. Install a shallow inside ditch leading up to Road Point 2 and inslope the road into the inside ditch. Place rock and install wattles at the outflow of the rocked rolling dip.

Road Point 4/Ditch Relief Culvert: The surface of the road, the existing rolling dip, and inside ditch is discharging sediment into a Class II watercourse. At the outlet of the rolling dip, a perched fill has formed from the collection of sediment in road surface runoff. Remove the perched fill from the edge of the roads fill prism. Install a rocked rolling dip per attached specifications and rock the surface of the road to Road Point 3. Place rock and install wattles at the outflow of the rocked rolling dip and the ditch relief culvert. Install an 18" ditch relief culvert per attached specifications and clear the existing connected inside ditch of road fill material. Further extend the inside ditch and inslope the road into the inside ditch to Road Point 3. Rock line the inside ditch for 100' before the ditch relief culvert.

Road Point 5: Storm waters are not being drained off the surface of the road. Install a rolling dip per attached specifications.



Road Point 6



Road Point 6 (cont.)

Road Point 7

Road Point 8

Road Point 6, 7 & 8: Winter traffic and poor road surfacing has resulted in the formation of ruts and sediment delivery to a wet area. Install a rocked rolling dip per attached specifications. Resurface and rock the approaches approximately shown on the attached site maps. Surface rock shall be applied approximately no less than 50' on either approach into the rocked rolling dip.

Road Point 9: Recent work on the access trail to the point of diversion's water works has resulting in disturbed soils on a slope into the lake. Seed and mulch the disturbed ground and install staked wattles.

Road Point 10

Road Point 10 (cont.)

Road Point 10 (cont.): Winter traffic and poor road surfacing has resulted in the formation of potholes and sediment delivery to a wet area. Install a rocked rolling dip per attached specifications. Resurface and rock the approaches approximately shown on the attached site maps. Surface rock shall be applied approximately no less than 50' on either approach into the rocked rolling dip. Fill in the pothole above the rocked rolling dip that is resulting in erosion of the surface of the road leading into the rocked rolling dip.

Stream Crossing 1: Class III watercourse consisting of an 18-inch diameter steel culvert, twenty feet in length. This culvert is slightly undersized for the 100-year storm, too short, and filled with sediment because it was installed with a lower gradient than the natural stream channel. Install a 24-inch diameter culvert with a minimum 30-foot length set slightly steeper in grade per the attached specifications.

Stream Crossing 2: Class III watercourse crossing consisting of a 12-inch diameter plastic culvert on a seasonal access road. This crossing is significantly undersized and shall be upgraded to a minimum 30-inch diameter culvert installed per the attached specifications.

Stream Crossing 3: Class III watercourse crossing consisting of a 10-inch diameter steel culvert. This culvert is plugged at the outlet, undersized, and too short. Replace the culvert with an 18-inch diameter culvert per the attached specifications.

Stream Crossing 4/Lake Overflow: Class III watercourse crossing/lake overflow consisting of a 24-inch diameter steel culvert. The culvert is lacking an energy dissipater at the outflow. Install an energy dissipater at the outflow of the culvert.

Pond Overflow

Pond Overflow (cont.): The pond's outlet is showing signs of minor erosion. Install large cobbles and small boulders along the pond's outlet.

STATEMENT OF CONTINGENT AND LIMITING CONDITIONS CONCERNING THE PREPARATION AND USE OF WATER RESOURCE PROTECTION PLAN

Prepared by Timberland Resource Consultants

1. This Water Resource Protection Plan has been prepared for the property within APN 317-023-010 in Humboldt County, at the request of the Client.

2. Timberland Resource Consultants does not assume any liability for the use or misuse of the information in this Water Resource Protection Plan.

3. The information is based upon conditions apparent to Timberland Resource Consultants at the time the inspection was conducted, and as disclosed to Timberland Resource Consultants by the landowner and/or Discharger. Changes due to land use activities or environmental factors occurring after this inspection, have not been considered in this Water Resource Protection Plan.

4. Maps, photos, and any other graphical information presented in this report are for illustrative purposes. Their scales are approximate, and they are not to be used for locating and establishing boundary lines.

5. The conditions presented in this Water Resource Protection Plan may differ from those made by others or from changes on the property occurring after the inspection was conducted. Timberland Resource Consultants does not guarantee this work against such differences.

6. Timberland Resource Consultants did not conduct an investigation on a legal survey of the property.

7. Persons using this Water Resource Protection Plan are advised to contact Timberland Resource Consultants prior to such use.

8. Timberland Resource Consultants will not discuss this report or reproduce it for anyone other than the Client named in this report without authorization from the Client.

_____

Nick Robinson
Timberland Resource Consultants

Attachments

Better Management Practices & Maps

BMP: General BMPs

- If operations require moving of equipment across a flowing stream, such operations shall be conducted without causing a prolonged visible increase in stream turbidity. For repeated crossings, the operator shall install a bridge, culvert, or rock-lined crossing.

- During construction in flowing water, which can transport sediment downstream, the flow shall be diverted around the work area by pipe, pumping, temporary diversion channel or other suitable means. When any dam or artificial obstruction is being constructed, maintained, or placed in operation, sufficient water shall at all times be allowed to pass downstream to maintain fish life below the dam. Equipment may be operated in the channel of flowing live streams only as necessary to construct the described construction.

- Disturbance or removal of vegetation shall not exceed the minimum necessary to complete operations. The disturbed portion of any stream channel shall be restored to as near their original condition as possible. Restoration shall include the mulching of stripped or exposed dirt areas at crossing sites prior to the end of the work period.

- Structures and associated materials not designed to withstand high seasonal flow shall be removed to areas above the high-water mark before such flows occur.

- No debris, soil, silt, sand, bark, slash, sawdust, rubbish, cement or concrete washing, oil or petroleum products, or other organic or earthen material from any logging, construction, or associated activity of whatever nature shall be allowed to enter into or be placed where it may be washed by rainfall or runoff into waters of the State. When operations are completed, any excess materials or debris shall be removed from the work area. No rubbish shall be deposited within 150 feet of the high-water mark of any stream.

BMP: General Erosion Control

- Timing for soil stabilization measures within the 100 feet of a watercourse or lake: For areas disturbed from May 1 through October 15, treatment shall be completed prior to the start of any rain that causes overland flow across or along the disturbed surface. For areas disturbed from October 16 through April 30, treatment shall be completed prior to any day for which a chance of rain of 30 percent or greater is forecast by the National Weather Service or within 10 days, whichever is earlier.

- Within 100 feet of a watercourse or lake, the traveled surface of logging roads shall be treated to prevent waterborne transport of sediment and concentration of runoff that results from operations. Treatment may consist of, but not limited to, rocking, out sloping, rolling dips, cross drains, water bars, slope stabilization measures, or other practices appropriate to site-specific conditions.

- The treatment for other disturbed areas within 100 feet of a watercourse or lake, including: (A) areas exceeding 100 contiguous square feet where operations have exposed bare soil, (B) approaches to road watercourse crossings out to 100 feet or the nearest drainage facility, whichever is farthest, (C) road cut banks and fills, and (D) any other area of disturbed soil that threatens to discharge sediment into waters in amounts deleterious to the quality and beneficial uses of water, shall be grass seeded and mulched with straw or fine slash. Grass seed shall be applied at a rate exceeding 100 pounds per acre. Straw mulch shall be applied in amounts sufficient to provide at least 2- 4-inch depth of straw with minimum 90% coverage. Slash may be substituted for straw mulch provided the depth, texture, and ground contact are equivalent to at least 2 – 4 inches of straw mulch. Any treated area that has been subject to reuse or has less than 90% surface cover shall be treated again prior to the end of operations.

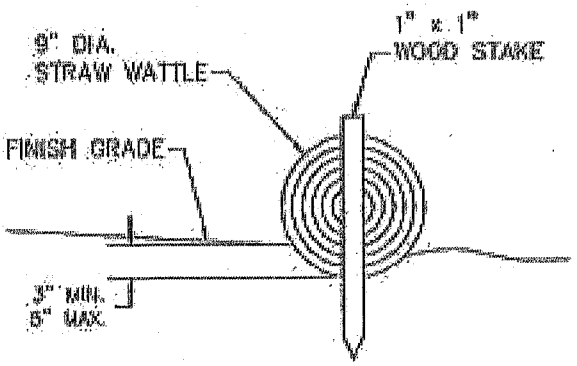
- Within 100 feet of a watercourse or lake, where the undisturbed natural ground cover cannot effectively protect beneficial uses of water from operations, the ground shall be treated with slope stabilization measures described in #3 above per timing described in #1 above.

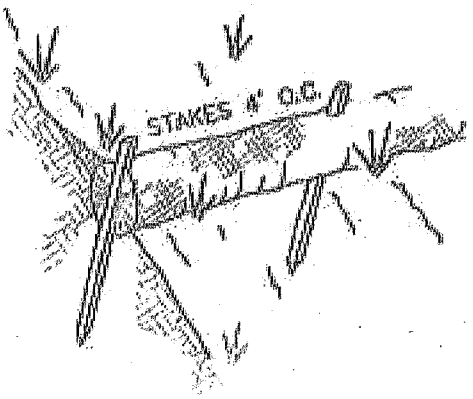
- Side cast or fill material extending more than 20 feet in slope distance from the outside edge of a landing which has access to a watercourse or lake shall be treated with slope stabilization measures described in #3 above. Timing shall occur per #1 above unless outside 100 feet of a watercourse or lake, in which completion date is October 15.

- All roads shall have drainage and/or drainage collection and storage facilities installed as soon as practical following operations and prior to either (1) the start of any rain which causes overland flow across or along the disturbed surface within 100 feet of a watercourse or lake protection, or (2) any day with a National Weather Service forecast of a chance of rain of 30 percent or more, a flash flood warning, or a flash flood watch.

BMP: General Erosion Control (Cont.)

- Erosion control and sediment detention devices and materials shall be incorporated into the cleanup/restoration work design and installed prior to the end of project work and before the beginning of the rainy season. Any continuing, approved project work conducted after October 15 shall have erosion control works completed up-to-date and daily.
- Erosion control materials shall be, at minimum, stored on-site at all times during approved project work between May 1 and October 15.
- Approved project work within the 5-year flood plain shall not begin until all temporary erosion controls (straw bales or silt fences that are effectively keyed-in) are installed downslope of cleanup/restoration activities.
- Non-invasive, non-persistent grass species (e.g., barley grass) may be used for their temporary erosion control benefits to stabilize disturbed slopes and prevent exposure of disturbed soils to rainfall.
- Upon work completion, all exposed soil present in and around the cleanup/restoration sites shall be stabilized within 7 days.
- Soils exposed by cleanup/restoration operations shall be seeded and mulched to prevent sediment runoff and transport.
- Straw Wattles (if used) shall be installed with 18 or 24-inch wood stakes at four feet on center. The ends of adjacent straw wattles shall be abutted to each other snugly or overlapped by six inches. Wattles shall be installed so that the wattle is in firm contact with the ground surface.





BMP: General Erosion Control Techniques

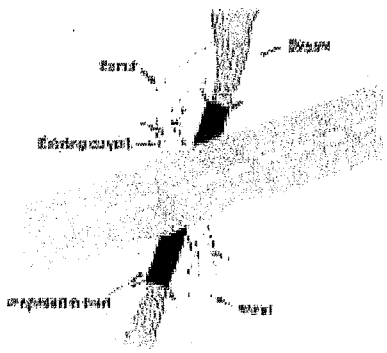
TABLE 34. Guidelines for erosion and sediment control application

Timing of application	Technique	Portion of road and construction area treated
Erosion control during construction	Hydromulching, hydroseeding	Road fill slopes, cut slopes, bare soil areas
	Dry seeding	Road fill slopes, cut slopes, bare soil areas
	Wood chip, straw, Excelsior or cacified mulch	Road fill slopes, cut slopes, bare soil areas
	Straw wattles	Road fill slopes and cut slopes
	Gravel surfacing	Road, landing and turnout surfaces
	Dust palliative	Road surfaces
	Minimize disturbance (soil and vegetation)	All areas peripheral to construction
Sediment control during construction	Sediment basin	Roadside ditches, turnouts and small stream crossings
	Sediment traps (e.g., silt fences, straw bales barriers, woody debris barriers)	Road fill slopes, cutbanks, bare soil areas and ditches
	Straw bale dams	Ditches and small streams
	Sumps and water pumps	Stream channels and stream crossings
	Streamflow diversions (e.g., temporary culverts, flex pipe, etc.)	Stream channels and stream crossings
	Surface diversion and dispersion devices (pipes, ditches, etc.)	All disturbed bare soil areas
Permanent erosion control	Road shaping	Road and landing surfaces
	Gravel surfacing	Road, landing and turnout surfaces
	Bituminous or asphalt surfacing	Road surface
	Rolling dips	Road surface
	Ditch relief culverts	Roadbed and road fill
	Downspouts and berm drains	Road fill slopes
	Waterbars	Road and landing surfaces
	Berms	Road surface and roadside areas
	Ditches	Road and landing surfaces
	Riprap	Road fill slopes, stream crossing fills, cutbanks, stream and lake banks
	Soil bioengineering	Road fill slopes, cut slopes, stream crossings, streambanks
	Tree planting	Road fill slopes, cutbanks, bare soil areas, stream crossings, streambanks

HANDBOOK FOR FOREST, RANCH AND RURAL ROADS

BMP: Permanent Culvert Crossing

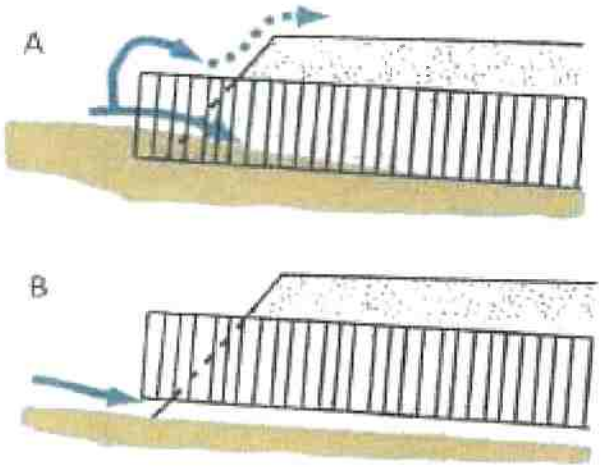
- New culvert installations shall be sized to accommodate flows associated with a 100-year storm event.
  - If the new culvert is replacing a poorly installed old culvert, the crossing may need to be abandoned to the following standard:
    - When fills are removed they shall be excavated to form a channel that is as close as feasible to natural watercourse grade and orientation, and that is wider than the natural channel.
    - Excavated banks shall be laid back to a 2:1 (50%) or natural slope.
- New culverts shall be placed at stream gradient, or have downspouts, or have energy dissipaters at outfall.
  - Align culverts with the natural stream channel orientation to ensure proper function, prevent bank erosion, and minimize debris plugging. See Figure 97 below.
  - Place culverts at the base of the fill and at the grade of the original streambed or install a downspout past the base of the fill. Downspouts should only be installed if there are no other options.
  - Culverts should be set slightly below the original stream grade so that the water drops several inches as it enters the pipe.
  - Culvert beds should be composed of rock-free soil or gravel, evenly distributed under the length of the pipe.
  - Compact the base and sidewall material before placing the pipe in its bed.
  - Lay the pipe on a well-compacted base. Poor basal compaction will cause settling or deflection in the pipe and can result in separation at a coupling or rupture in the pipe wall.
  - Backfill material should be free of rocks, limbs, or other debris that could dent or puncture the pipe or allow water to seep around the pipe.
  - Cover one end of the culvert pipe, then the other end. Once the ends are secure, cover the center.
  - Tamp and compact backfill material throughout the entire process, using water as necessary for compaction.
  - Backfill compacting will be done in 0.5 – 1.0-foot lifts until 1/3 of the diameter of the culvert has been covered.
  - Push layers of fill over the crossing to achieve the final design road grade, road fill above the culvert should be no less than one-third to one-half the culvert diameter at any point on the drivable surface.
- Critical dips shall be installed on culvert crossings to eliminate diversion potential. Refer to Figure 84 below.
- Road approaches to crossings shall be treated out to the first drainage structure (i.e. waterbar, rolling dip, or hydrologic divide) to prevent transport of sediment.
- Road surfaces and ditches shall be disconnected from streams and stream crossings to the greatest extent feasible. Ditches and road surfaces that cannot be feasible disconnected from streams or stream crossings shall be treated to reduce sediment transport to streams.
- If downspouts are used, they shall be secured to the culvert outlet and shall be secure on fill slopes.
- Culverts shall be long enough so that road fill does not extend or slough past the culvert ends.
- Inlet of culverts, and associate fill, shall be protected with appropriate measures that extend at least as high as the top of the culvert.
- Outlet of culverts shall be armored with rock if road fill sloughing into channel can occur.
- Armor inlets and outlets with rock, or mulch and seed with grass as needed (not all stream crossings need to be armored).
- Where debris loads could endanger the crossing, a debris catchment structure shall be constructed upstream of the culvert inlet.
- Bank and channel armoring may occur, when appropriate, to provide channel and bank stabilization.

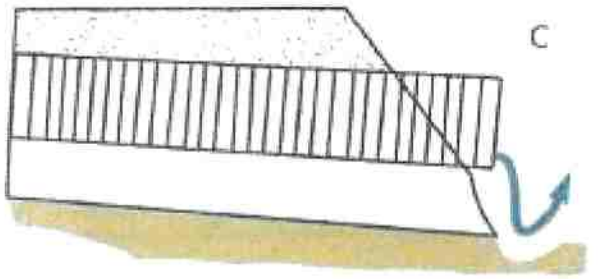


HANDBOOK FOR FOREST, PARK, AND RURAL ROADS

FIGURE 97. *Culvert alignment should be in relation to the stream and not the road. It is important that the stream enters and leaves the culvert on a relatively straight horizontal alignment or streambank does not have to turn to enter the inlet or discharge into a bank as it does. This figure shows a recommended culvert installation that replaces the existing alignment that previously existed. Channel turns at the inlet increase plugging potential because wood going through the inlet will not align with the inlet. Similarly, channel turns at the inlet and outlet are often accompanied by scour against the channel banks (Wisconsin Transportation Information Center, 2004).*

BMP: Permanent Culvert Crossing (Cont.)





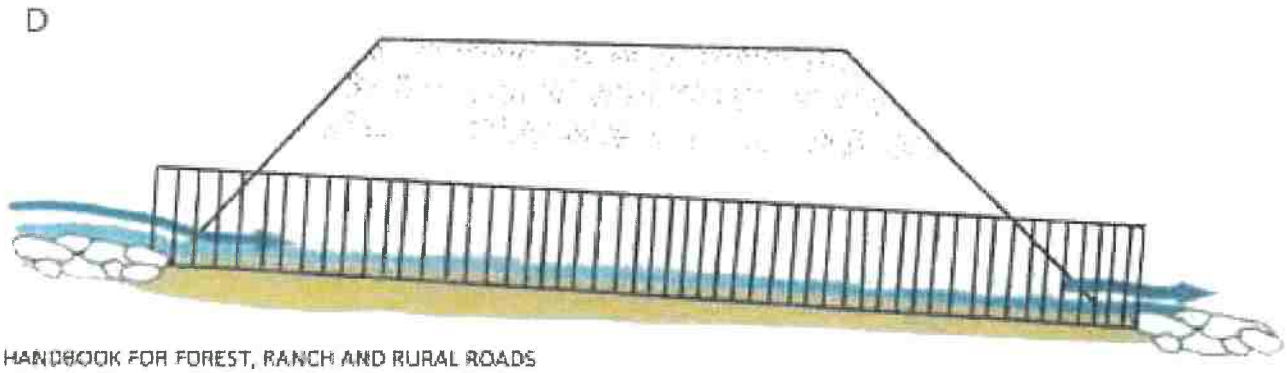
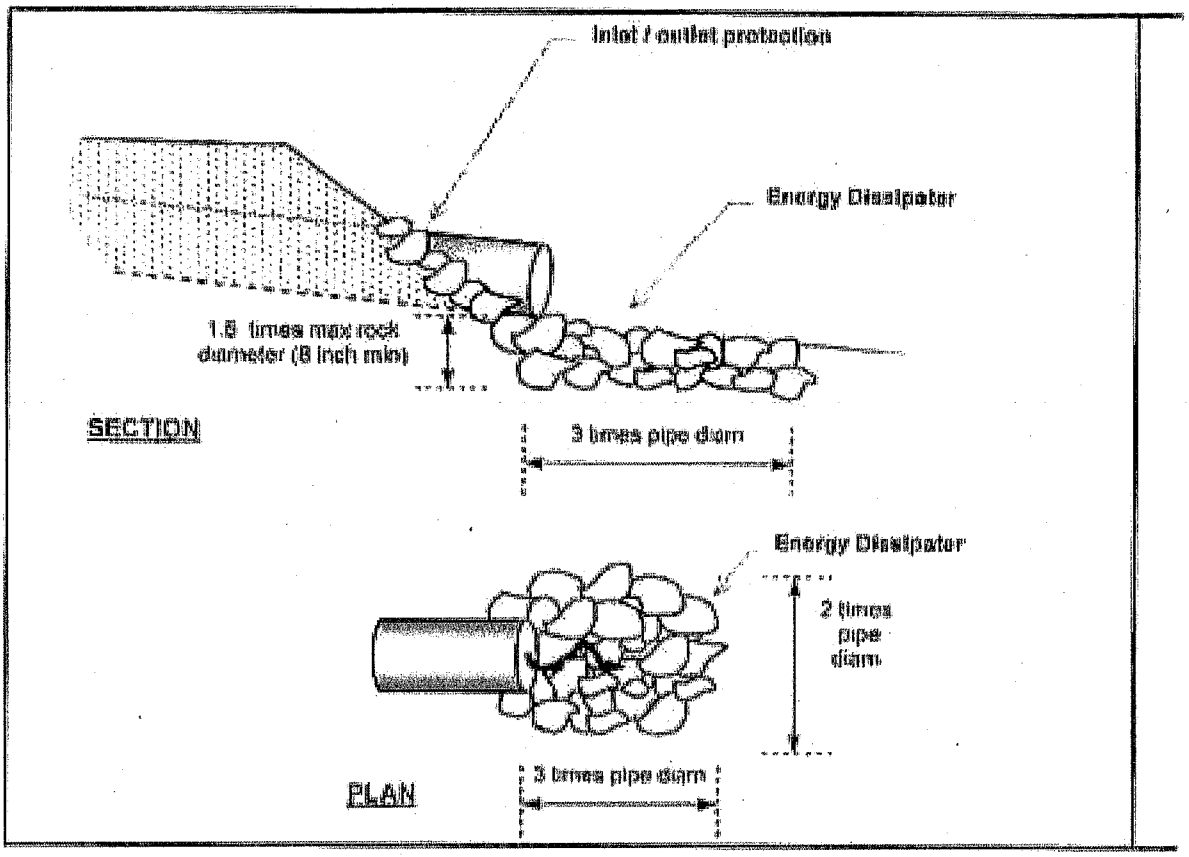
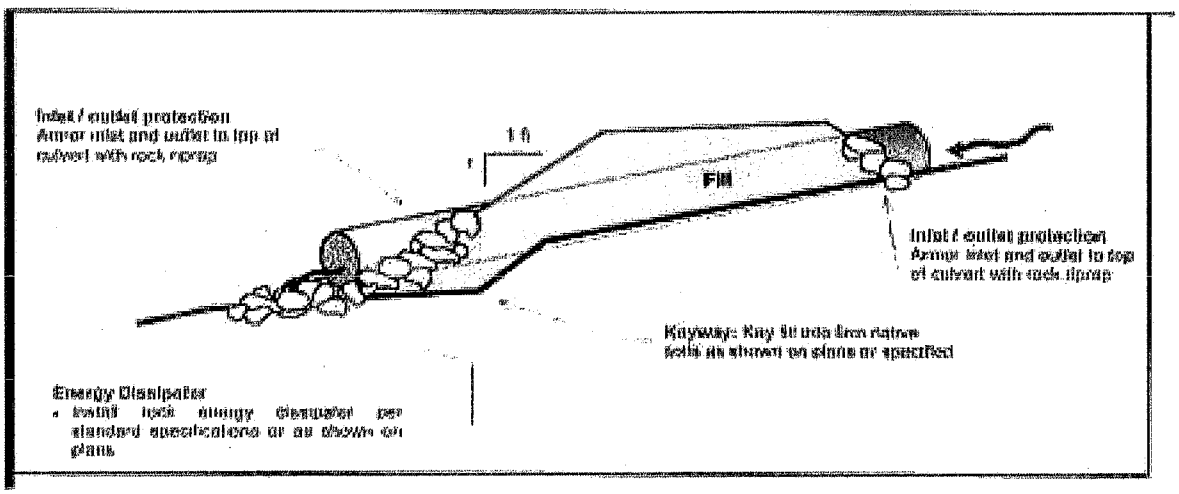


FIGURE 155. *Proper culvert installation involves correct culvert orientation, setting the pipe slightly below the bed of the original stream, and backfilling and compacting the fill as it is placed over the culvert. Installing the inlet too low in the stream (A) can lead to culvert plugging, yet if set too high (B) flow can undercut the inlet. If the culvert is placed too high in the fill (C), flow at the outfall will erode the fill. Placed correctly (D), the culvert is set slightly below the original stream grade and protected with armor at the inlet and outlet. Culverts installed in fish-bearing stream channels must be inset into the streambed sufficiently (>25% embedded) to have a natural gravel bottom throughout the culvert (Modified from MDSL, 1991).*

HANDBOOK FOR FOREST, RANCH AND RURAL ROADS

BMP: Culvert Rock Armoring Specifications





Riprap installed to protect the inlet and outlet of a stream crossing culvert from erosion or for energy dissipation should be keyed i the natural channel bed and banks to an approximate depth of about 1.5x the maximum rock thickness. Riprap should be placed at le up to the top of the culvert at both the inlet and outlet to protect them from splash erosion and to trap any sediment eroded from t newly constructed fill slope above.

BMP: Permanent Culvert Crossing (Cont.)

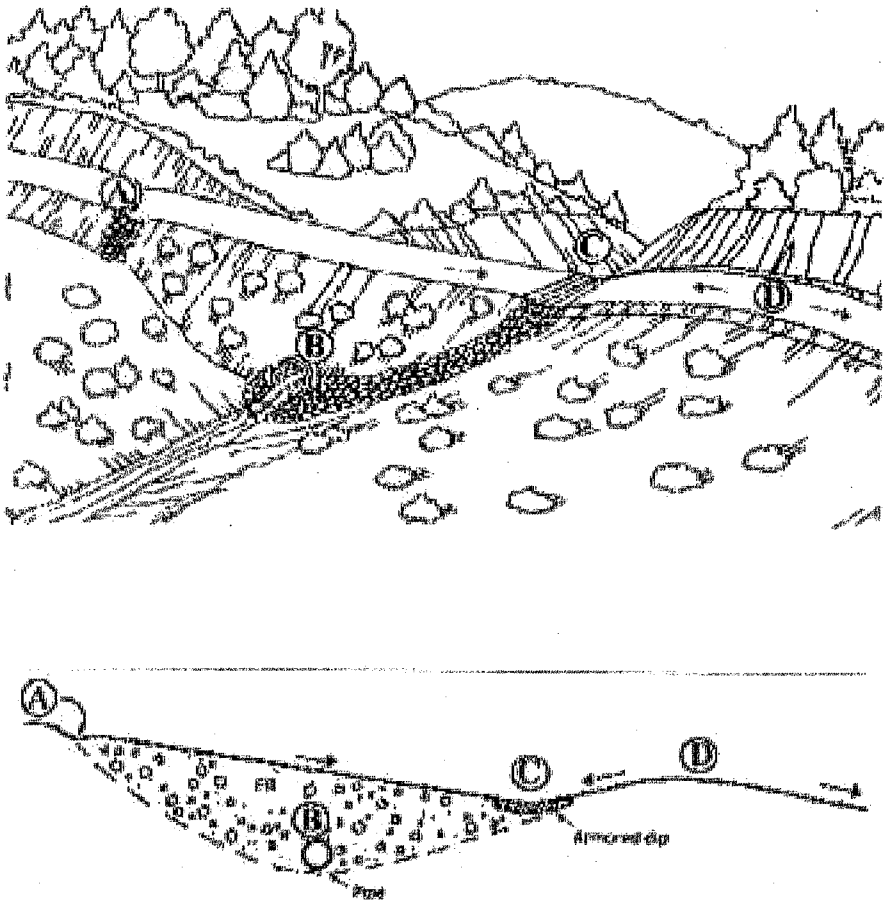
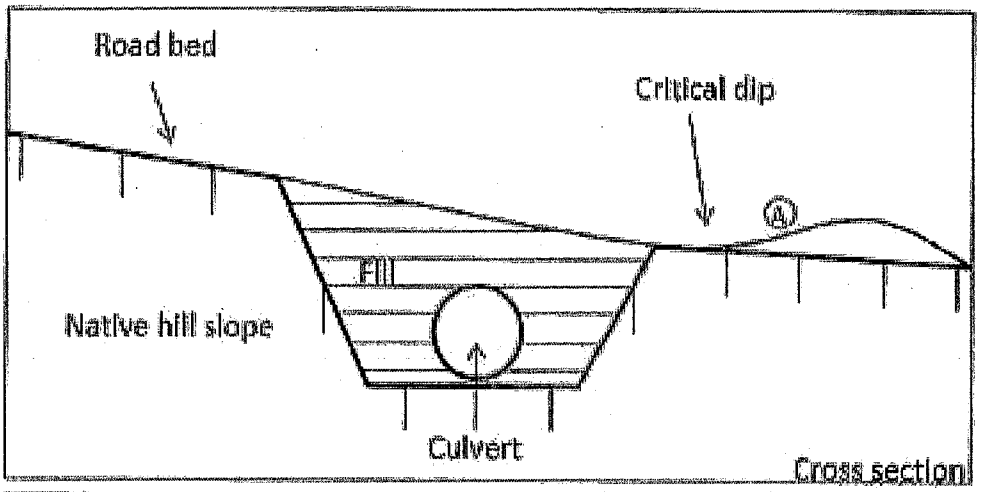
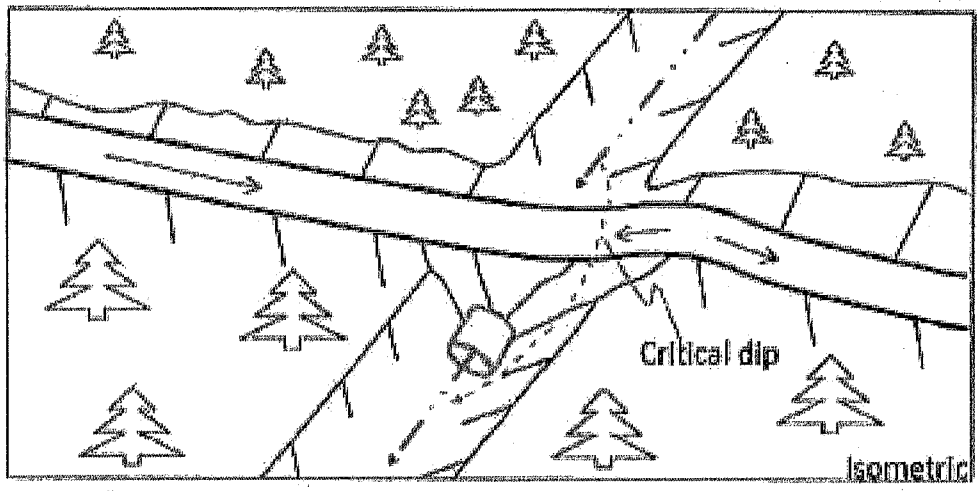


FIGURE 94. *Critical dips or dipped crossing fills should be centered over a stream crossing down-road from culverts, not over the centerline of the crossing where overtopping could cause washout or severe erosion of the fill. If the stream crossing culvert (B) plugs, water will pond behind the fill until reaching the critical dip or low point in the crossing (C) and flowing back down into the natural stream channel. The down-road ditch must be plugged to prevent diversion from diverting down the ditch line. For extra protection in this sketch, dipsy armor has been placed at the critical dip outfall and armoring downslope to the stream channel. This is usually installed on stream crossings where the culvert is highly likely to plug and the crossing fill overtopped. The dip at the hinge line is usually sufficient to limit erosional damage during an overtopping event. Road surface and ditch runoff is disconnected from the stream crossing by installing a rolling dip and ditch relief culvert just up-road from the crossing (A) (Keller and Sherar, 2003).*

Typical Critical Dip Design for Stream Crossings with Diversion Potential





Critical Dip Construction:

1. Critical dip will be constructed on the lower side of crossing.
2. Critical dip will extend from the cutbank to the outside edge of the road surface. Be sure to fill inboard ditch, if present.
3. Critical dip will have a reverse grade (A) from cutbank to outside edge of road to ensure flow will not divert outside of crossing.
4. The rise in the reverse grade will be carried for about 10 to 20 feet and then return to original slope.
5. The transition from axis of bottom, through rising grade, to falling grade, will be in the road distance of at least 15 to 30 feet.
6. Critical dips are usually built perpendicular to the road surface to ensure that flow is directed back into the stream channel.

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BMP: Inlet and Outlet Armoring

- Inlets of culverts and associate fills shall be protected with rock armoring that extends at least as high as the top of the culvert.
- Outlets of culverts shall be provided a rocked energy dissipater at the outfall of the culvert.
- Outlets of culverts and associate fills shall be protected with rock armoring that extends at least as high as the top of the culvert if road fill sloughing into channel can occur.
- Prior to inlet and outlet rocking, the inlet and outlets shall be prepared. Preparation will include removal of vegetation and stored materials from the inlet and outlet.
- Inlets may require construction of an inlet basin.
- Slopes at the outlet should be shaped to a 2:1 or natural slope prior to placing rock armor.
- Rock used at culvert inlets and outlets should be a matrix of various sized rocks and rip-rap that range from a 3" dia. to a 2' dia.
- The largest rocks should be places at the base of the culvert or fill. Incrementally smaller rocks shall be placed over the larger rocks at the armoring extend up the slope. Voids and spaces shall be back filed with smaller gravels and rocks.

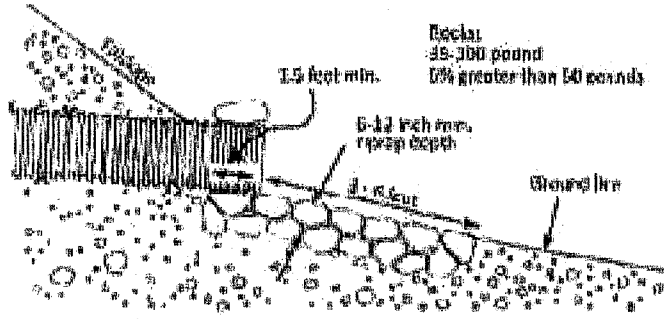

FIGURE 107A. *Riprap armor at culvert outlet (Modified from Keller et al., 2011).*

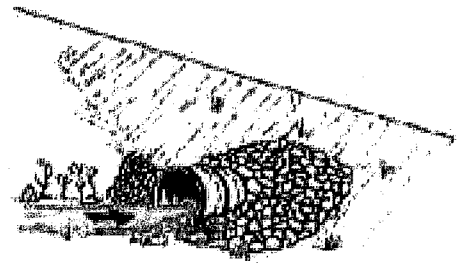

FIGURE 107B. *Riprap armor at culvert inlet (Keller and Sherar, 2003).*

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BMP: Stream Bank Armoring (Riprap)

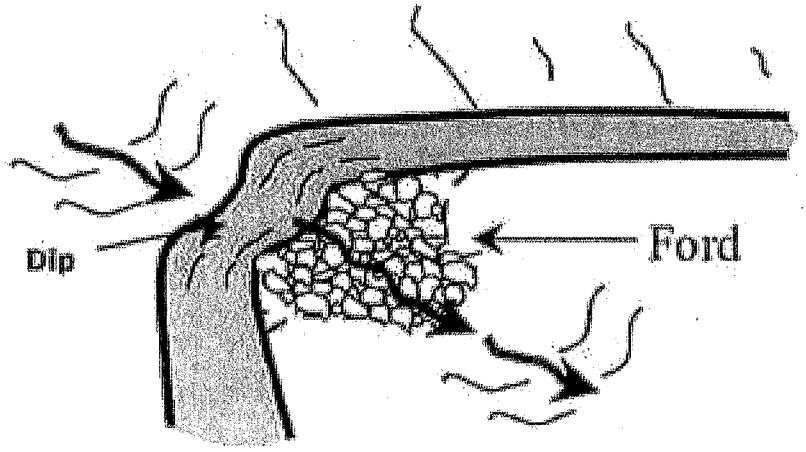
- Riprap should be installed on top of geotextile fabric or a clean mixture of coarse gravel and sand.
- The riprap should be keyed into the streambed and extend below the maximum expected scour depth with an adequately sized key base width at a thickness of a minimum of 2x the median (D50) rock diameter with the largest stone sizes placed at the base of the riprap structure.
- The armor should be set into the streambank so it does not significantly protrude into, or constrict, the natural channel, or otherwise reduce channel capacity.
- The riprap should extend along the length of unstable or over steepened bank and up the bank sufficiently to encompass the existing bank instability and/or design flood elevations.

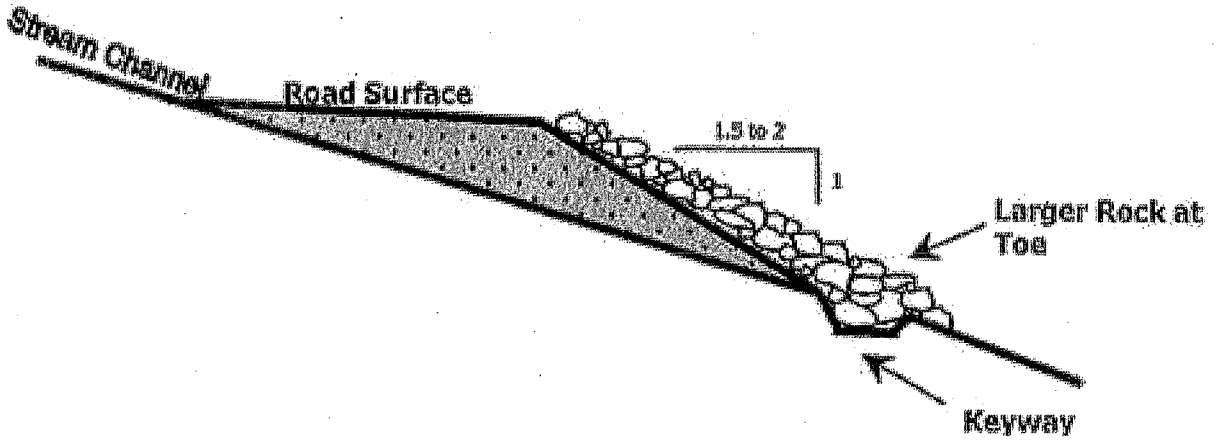
BMP: Rocked Ford

- Rocked fords are drainage structures designed to carry watercourses across roads with little to no erosion of the road surface or fill.
- Fords constructed in-channel shall be of appropriately sized material that shall withstand erosion or displacement by expected velocities and placed in a broad, U-shaped channel to create a drivable crossing.
  - The road shall dip into and out of the rocked ford to minimize diversion potential. Construct a broad rolling dip across the roadbed, centered at the crossing, which is large enough to contain the expected 100-yr flood discharge while preventing flood flow from diverting down the road or around the rock armor.
- The road surface at the ford shall be constructed with clean rock. The rock shall be applied to a minimum depth of 6 inches.
  - A range of interlocking rock armor sizes should be selected and sized so that peak flows will not pluck or transport the armor off the roadbed or the sloping fill face of the armored fill.
- The ford's outlet shall be rock armored to resist downcutting and erosion.
  - *Excavate the keyway and armored area* - Excavate a two to three-foot-deep "bed" into the dipped road surface and adjacent fillslope (to place the rock in) that extends from approximately the middle of the road, across the outer half of the road, and down the outboard road fill to where the base of the fill meets the natural channel. At the base of the fill, excavate a keyway trench extending across the channel bed.
  - *Armor the basal keyway* - Put aside the largest rock armoring to create the buttresses. Use the largest rock armor to fill the basal trench and create a buttress at the base of the fill. This should have a "U" shape to it and it will define the outlet where flow leaves the armored fill and enters the natural channel.
  - *Armor the fill* - Backfill the fill face with the remaining rock armor making sure the final armor is unsorted and well placed, the armor is two coarse-rock layers in thickness, and the armored area on the fill face also has a "U" shape that will accommodate the largest expected flow.
  - *Armor the top of the fill* - Install a second trenched buttress for large rock at the break-in-slope between the outboard road edge and the top of the fill face.
- Road approaches to rocked fords shall be rock surfaced out to the first drainage structure (i.e. waterbar, rolling dip, or hydrologic divide) to prevent transport of sediment using rock.
- Bank and channel armoring may occur when appropriate to provide channel and bank stabilization.
- Road approach rock and rock ford armoring shall be reapplied following use as needed to maintain a permanent crossing.

BMP: Rocked Ford (Cont.)

FORD: A large dip is graded into the road at the axis of the stream channel. The outside fill face is dished out to form a spillway with large rock. On large watercourses, rock is keyed several feet into firm native soils. The road surface is rocked with 6" of minus rock .





BMP: Armored Ford/Fill

- Armored fords are watercourse crossing fills comprised primarily of rock and designed to carry watercourses across roads without erosion or displacement of installed fill material.
- Armored fords shall have a U-shaped channel to create a drivable crossing.
    - The road shall dip into and out of the armored ford to minimize diversion potential. Construct a broad rolling dip across the roadbed, centered at the crossing, which is large enough to contain the expected 100-yr flood discharge while preventing flood flow from diverting down the road or around the rock armor.
- The road surface at the armored ford shall consist of rock small enough to be easily passable by vehicle, but large enough to not be transported during high flow storm events.
- The ford's inlet shall be rocked if a threat of head cutting exists.
    - *Excavate the keyway* - Excavate a one to three-foot-deep "bed" into the inboard edge of the road.
    - *Armor the basal keyway* – place various sized rock in the constructed keyway to prevent head cutting. Use the largest rock armor to fill the keyway trench and create a buttress along the inboard edge of the road. This should have a "U" shape to it and it will define the inlet where flow leaves the natural channel and enters the road.
- The ford's outlet shall be rock armored to resist downcutting and erosion.
    - *Excavate the keyway and armored area* - Excavate a two to three-foot-deep "bed" into the dipped road surface and adjacent fillslope (to place the rock in) that extends from approximately the middle of the road, across the outer half of the road, and down the outboard road fill to where the base of the fill meets the natural channel. At the base of the fill, excavate a keyway trench extending across the channel bed.
    - *Armor the basal keyway* - Put aside the largest rock armoring to create the buttresses. Use the largest rock armor to fill the basal trench and create a buttress at the base of the fill. This should have a "U" shape to it and it will define the outlet where flow leaves the armored fill and enters the natural channel.
    - *Armor the fill* - Backfill the fill face with the remaining rock armor making sure the final armor is unsorted and well placed, the armor is two coarse-rock layers in thickness, and the armored area on the fill face also has a "U" shape that will accommodate the largest expected flow.
    - *Armor the top of the fill* - Install a second trenched buttress for large rock at the break-in-slope between the outboard road edge and the top of the fill face.
- Road approaches to armored fords shall be surface rocked out to the first drainage structure (i.e. waterbar, rolling dip, or hydrologic divide) to prevent transport of sediment using rock.
- Bank and channel armoring may occur when appropriate to provide channel and bank stabilization.
- Armored ford armoring shall be reapplied following use as needed to maintain a permanent crossing.

FIGURE 120. *This armored fill crossing of a steep, ephemeral stream was constructed to provide a low maintenance crossing. The crossing has been deeply dipped to reduce the volume of road fill and to eliminate the potential for stream diversion. The fill slope has been heavily armored through the axis of the crossing to contain flood flows and prevent down cutting. Armored fills cannot be used as flow bearing surfaces.*

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BMP: Armored Ford [Fill] (Cont.)

FIGURE 121D. Well graded rock armor is then backfilled into the structure and spread across the breadth of the U-shaped stream crossing, and about one-third the way up the reached, so that streamflow will only flow over or come in contact with resistant armor material. The armor must be spread and compacted across the design width of the expected flood flow channel width so peak flows will not flank the armored structure

FIGURE 121E. Two weeks after this armored fill was constructed, a storm flow event occurred and the structure maintained its function and integrity. The road approaches had not yet been completed or surfaced with road rock.

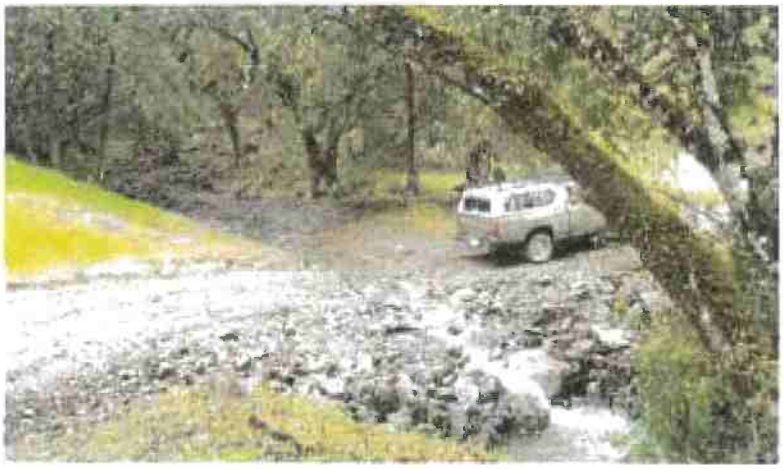

FIGURE 121F. The same armored ford as it appeared after the first winter flood flows. No maintenance was required to reopen the road. It is also clear that no stream diversion is possible at this stream crossing site, and the volume of fill within the crossing has been sculpted to the minimum amount needed to maintain a relatively smooth driving surface on this low volume road

BMP: Permanent Crossing Decommissioning Specifications

- When fills are removed they shall be excavated to form a channel that is as close as feasible to natural watercourse grade and orientation, and that is wider than the natural channel.
- Excavated banks shall be laid back to a 2:1 (50%) or natural slope.
- Temporary crossings shall be removed by November 15.
    - Any temporary culvert crossing left in after October 15 or installed between October 15 and May 1, shall be sized to accommodate the estimated 100-year flow.
- Bank and channel armoring may occur when appropriate to provide channel and bank stabilization.

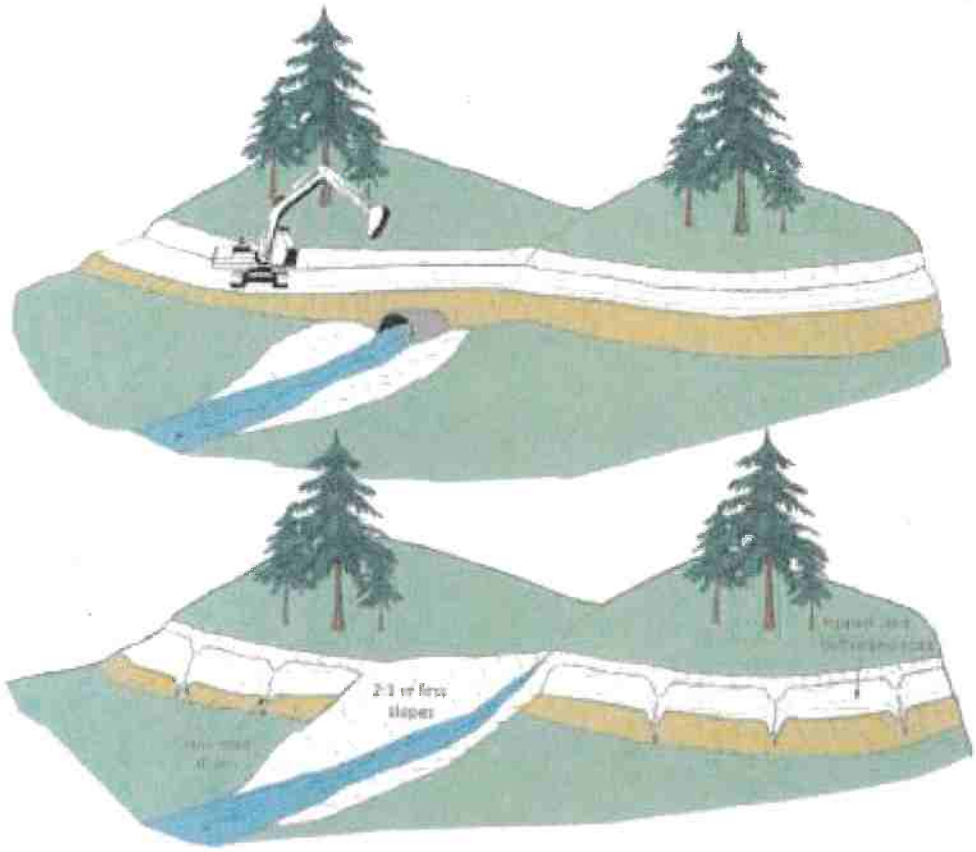

FIGURE 263. *On roads that are to be closed (decommissioned), all stream crossing culverts and fills should be removed. Stream crossing excavations are best performed using an excavator. The original channel should be excavated and exhumed down to the former streambed, with a channel width equal or greater than the natural channel above and below the crossing. Sideslopes should be laid back to a stable angle, typically a 2:1 (50%) gradient, or less. Spoil can be endhauled off-site or stored on the road bench adjacent the crossing, provided it is placed and stabilized where it will not erode or fall and enter the stream.*

BMP: Permanent Crossing Decommissioning Specifications (Cont.)

- Excavating and removing all fill materials placed in the stream channel when the crossing was originally built.
- Fill material should be excavated to recreate the original channel grade (slope) and orientation.
- The excavated channel bed should be as wide, or slightly wider than, the original watercourse channel.
    - This can be better determined by observing the channel width of the watercourse up slope of crossing to be removed at a point in which the crossing or any other disturbance has not affected the natural channel slope and width.
- If the channel sideslopes were disturbed, they should be graded (excavated) back to a stable angle (generally less than 50%,(2:1)) to prevent slumping and soil movement.
- The bare soils should then be mulched, seeded, and planted to minimize erosion until vegetation can protect the surface.
- The approaching, hydrologically connected road segments should be cross-road drained to prevent road runoff from discharging across the freshly-excavated channel sideslopes.

BMP: Waterbar Construction

FIGURE 40. *Waterbars are constructed on unsurfaced forest and ranch roads that will have little or no traffic during the wet season. The waterbar should be extended to the cutbank to intercept all ditch flow (1) 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 constructed to be self-cleaning, typically with a 30° skew to the road alignment 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 vegetation. Rock (shown in the figure) should not be necessary if waterbars are spaced close enough to prevent serious erosion. (5) The cross ditch depth (6) and width (7) must allow vehicle cross-over without destroying the function of the drain. Several alternate types of waterbars are possible, including one that drains only the road surface (not the ditch), and one that drains the road surface into the inside ditch (BCMF, 1991).*

BMP: Rolling Dip

- Rolling dips are drainage structures designed to capture and discharge surface water collected on road surfaces and in inside ditches at a specific location.
- The road shall dip into and out of the rolling dip to eliminate the possibility of water flowing along the road surface or in an inside ditch to bypass the dip structure.
- The rolling dip shall be constructed with clean native materials.
- Do not discharge rolling dips into swales that show signs of instability or active land sliding.
- If the rolling dip is designed to divert both road surface and ditch runoff, block the down-road ditch with compacted fill.

BMP: Rocked Rolling Dip

- The rocked rolling dips inlet and outlet shall be armored to resist downcutting and erosion.
- The entire length of the rocked rolling dip shall be rock armored to a minimum of 5-feet from the centerline of the dip.
- If a keyway is necessary, the rocked rolling dip keyway shall be constructed at the base of the dip and shall be of sufficient size, depth, and length to support materials used in the rocked rolling dip construction back up to the road crossing interface.

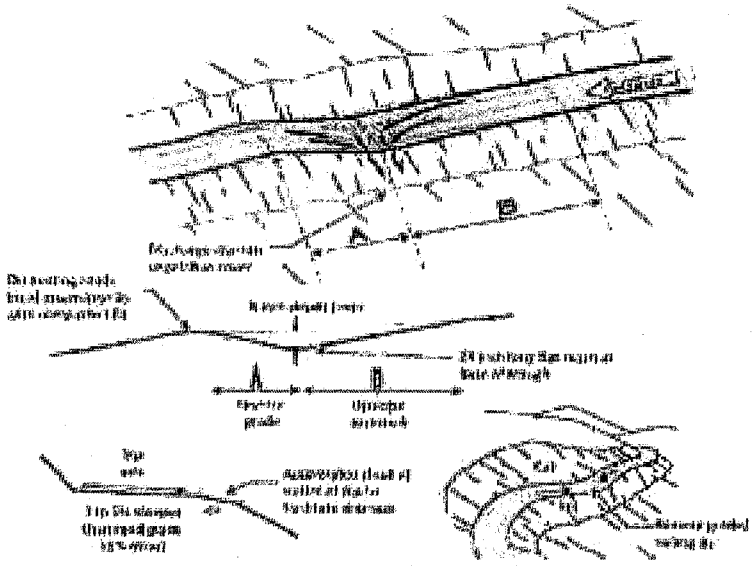

FIGURE 34. *A classic Type I rolling dip, where the excavated up-road approach (B) to the rolling dip is several percent steeper than the approaching road surface for 50 to 80 feet to the dip axis. The lower side of the structure receives grade (A) over approximately 10 feet or more, and then falls down to rejoin the original road grade. The dip 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. The outward cross-slope of the dip axis should be 3% to 6% greater than the up-road grade (B) so it will drain properly. The dip axis should be outsloped sufficiently to be self-cleaning, without triggering excessive downcutting or sediment deposition in the dip axis (Modified from: Keller, 2013).*

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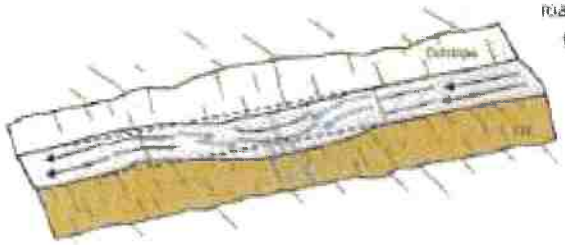
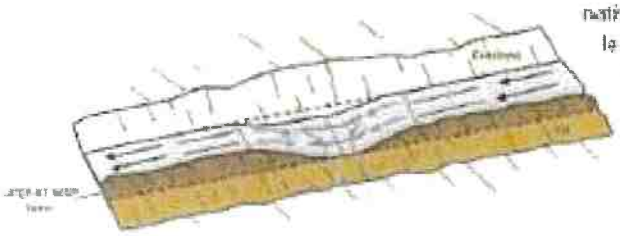
BMP: Rolling Dip and Rocked Rolling Dip (Cont.)

Type 1 Rolling Dip
(Standard)



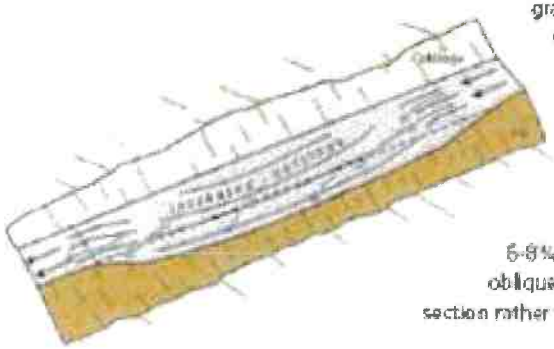
Type 1 rolling dips are used where road grades are less than about 12-14% and road runoff is not confined by a large through cut or berm. The axis of the dip should be perpendicular to the road alignment and sloped at 3-4% across the road tread. Steep roads will have longer and more abrupt dip dimensions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

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



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

Type 3 Rolling Dip
(Steep road grade)



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

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

FIGURE 30. *Rolling dip types*

HANDBOOK FOR FOREST, RANCH AND RURAL ROADS

BMP: Rolling Dip with Leadout ditch (Cont.)

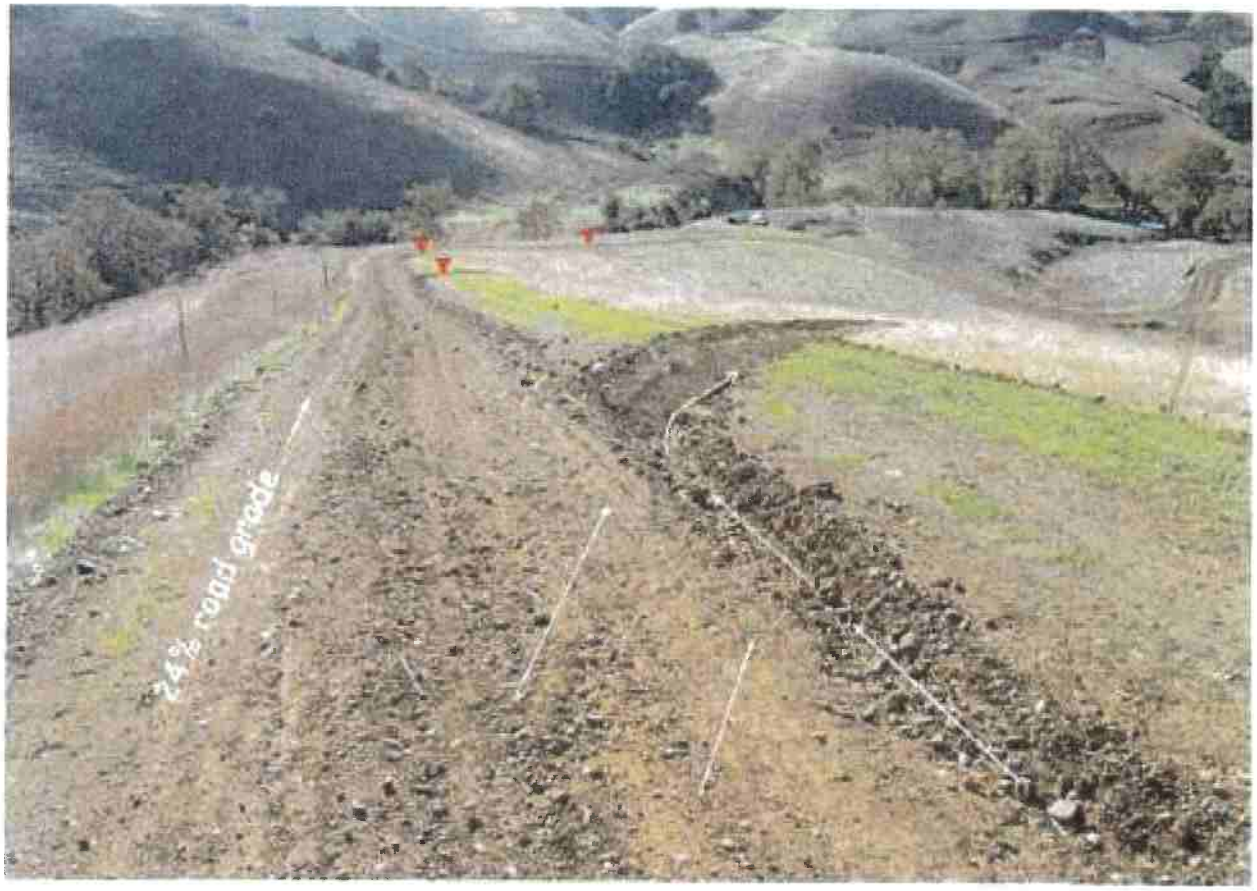


FIGURE 55. *Steep roads that go straight up or down a hillside are very difficult to drain. This steep, fall line road developed a through cut cross section that was drained using lead out ditches to direct runoff off the road and onto the adjacent, vegetated hillside. The road was "outsloped" to drain runoff to the right side, and the lead out ditch was built slightly steeper than the road grade, to be self cleaning. Four lead out ditches have been constructed at 100-foot intervals to the bottom of the hillside.*

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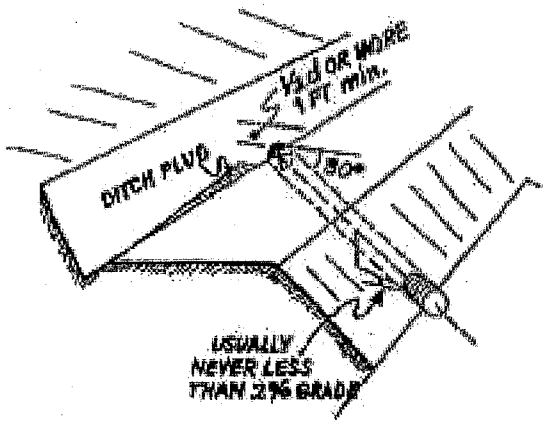
BMP: Ditch Relief Culvert

- Install ditch relief culverts at an oblique (typically 30 degree) angle to the road so that ditch flow dis not forced to make a sharp angle turn to enter the pipe. On low gradient roads (<5%), where ditch flow is slow, ditch relief culverts can be installed at right angles to the road.
- Install ditch relief culverts (DRC) to outlet at, and drain to, the base of the fill.
- If it cannot be installed at the base of the fill, install the DRC with a grade steeper than the inboard ditch draining to the culvert inlet, and install a downspout on the outlet to carry the culverted flow to the base of the fillslope.
- Downspouts longer than 20 feet should be secured to the hillslope for stability.
- Ditch relief culverts should not carry excessive flow such that downcutting of the ditchline or gullying below the outlet occur.
- Do not discharge flows from ditch relief culverts onto unstable fill or active landslides.
- If the ditch is on an insloped or crowned road, consider using outsloping to drain the road surface. The ditch and the ditch relief culvert would then convey only spring flow from the cutbanks and hillslope runoff, and not turbid runoff from the road surface.



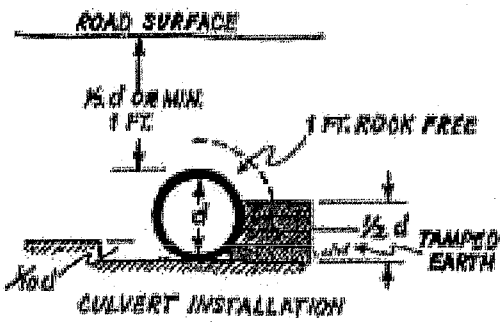


FIGURE 48. *The elements of a properly installed ditch relief culvert. The culvert is angled at about 30 degrees to the road alignment to help capture flow and prevent culvert plugging or erosion of the inlet area. It is set at the base of the fill (ideally) or with a grade slightly steeper than the grade of the contributing ditch (but never with a grade less than 2 percent) (USDA-SCS, 1983). At a minimum, the grade of the ditch relief culvert should be sufficient to prevent sediment accumulation at the inlet or deposition within the culvert itself (it should be self-cleaning) (USDA-SCS, 1983).*

BMP: Ditch Relief Culvert (Cont.)

FIGURE 30.
Waterbars are often used to drain surface runoff from seasonal, unsurfaced roads. Because they are easily broken down by vehicles, waterbars are only used on unsurfaced roads where there is little or no wet weather traffic. In the photo, a waterbar and ditch relief culvert are used to drain all road surface and ditch runoff from the outsloped road prism.

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FIGURE 238. *Traffic and surface runoff from graveled roads often produces surface erosion, turbid runoff and fine sediment transport that can be delivered to streams. Where ditches can't be eliminated, sediment traps and roadside settling basins can be installed to capture and remove most of the eroded sediment. This settling basin has been constructed along the inside ditch just before a stream crossing culvert inlet (see arrow). Eroded sediment from the road and ditch are deposited in the basin before flow is released to the stream. Fine sediments have filled about 1/3 of this basin and vegetation is now growing. Sediment basins require periodic maintenance to maintain their storage capacity.*

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BMP: Storage Bladders

- Location for storage bladder must be sited and planned as to minimize the potential for impacts due to rolling and/or failure. Storage bladders should be stored on flat slopes where stability will not be affected.
- If bladders are stored on slopes the potential for rolling must be assessed and if necessary containment or anchors installed. Options to mitigate the potential for rolling may include a fence, dirt berm, or a tethered anchor.
- Secondary containment is recommended in the form of a dirt berm, containment pit or impermeable material with skeletal support. Dirt berms shall be sculpted to a maximum 1:2 slope ratio. The containment should be capable of holding the contents of the bladder. At the least, secondary containment should be designed to slow the initial force of a failure.
- Bladders should be monitored consistently throughout their use to prevent failure. Inspections for structural weaknesses and other risks that may cause failure should occur a minimum of once per month.

This is an example of a containment pit which will assist in mitigating the impacts if this storage bladder failed.

BMP: Cultivation Site Restoration

- Remove all cultivation and associated materials from designated cultivation site.
  - This includes plant mass, root balls, potting containers, cultivation medium and any materials associated with the preparation, cultivation, and harvest of commercial cannabis.
  - Cultivation medium removed from the site shall be stored/disposed of in compliance with Order conditions related to spoils management.
- All disturbed and/or unstable slopes shall be stabilized and returned to pre-project conditions.
  - Slopes shall be contoured as close as feasible to natural grade and aspect.
  - Temporary erosion control shall be applied to prevent sediment run-off.
- Soil exposed as a result of project work, soil above rock riprap, and interstitial spaces between rocks shall be revegetated with native species by live planting, seed casting, or hydroseeding prior to the rainy season of the year work is completed.
  - Native plants characteristic of the local habitat shall be used for revegetation when implementing and maintaining cleanup/restoration work in riparian and other sensitive areas.
  - Native forbes and grammiinoids shall be planted to replace sediment stabilization, sediment filtration and nutrient filtration
  - Native trees and shrubs shall be planted to replace bank stabilization, inputs of large woody debris and temperature control within riparian areas.
  - Restoration of the quality/health of the riparian stand shall promote: 1) shade and microclimate controls; 2) delivery of wood to channels, 3) slope stability and erosion control, 4) ground cover, and 5) removal of excess nutrients.