

# Water Resource Protection Plan

WDID# - 1B170595CHUM

180101050601TRC314

APN 217-244-007; 217-251-003; 217-244-004; 217-225-007



*Prepared by:*

**Timberland Resource Consultants**

**165 South Fortuna Blvd**

**Fortuna, CA 95540**

**11/24/2017**

**Revised: 5/01/2018**

180101050601TRC314

**Purpose**

This Water Resource Protection Plan (WRPP) has been prepared on behalf of the discharger, for the Humboldt County property identified as APN 217-244-007; 217-251-003; 217-244-004; 217-225-007, 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. California Regional Water Quality Control Board, North Coast Region, Order R1-2015-0023, conditionally waives the requirement for the property owner to file an ROWD for discharges and associated activities described in Finding-4.

**Scope of Report**

Order No. R1-2015-0023 states that "Tier 2 Dischargers and Tier 3 Dischargers 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. Dischargers must keep this plan on site, and produce it upon request by Regional Water Board staff. Management practices shall be properly designed, 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. Dischargers 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). 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.



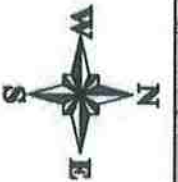
# Water Resource Protection Plan

General Location Map WDID - 1B170595SCHUM

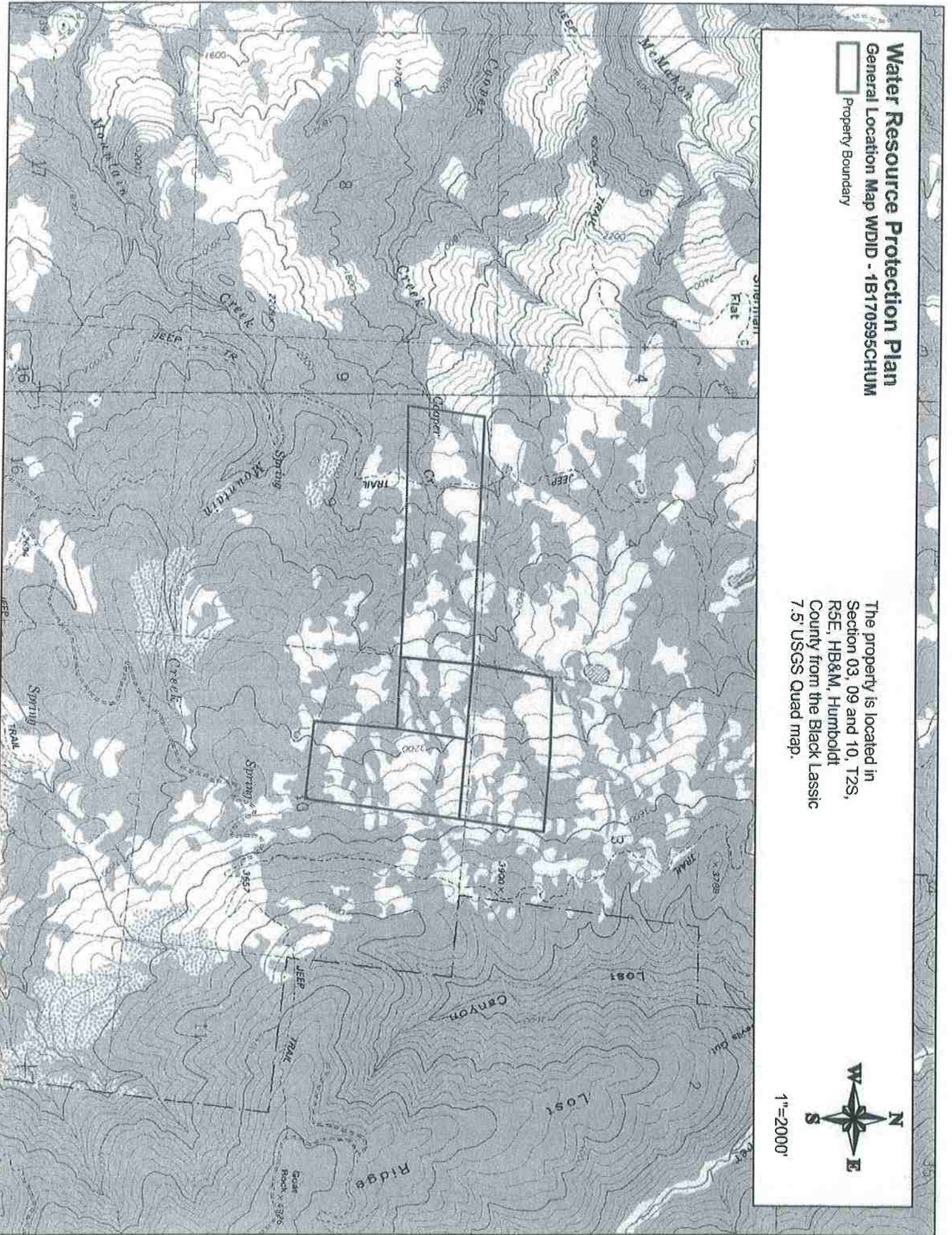


Property Boundary

The property is located in Section 03, 09 and 10, T2S, R5E, HB&M, Humboldt County from the Black Lassic 7.5' USGS Quad map.



1"=2000'





**Property Description**

The property assessed is four parcels totaling approximately 337 acres, located in Sections 03, 09, & 10, T2S, R5E, HB&M, Humboldt County from the Black Lassic 7.5' USGS Quad map. The property is located approximately 2.5 miles Northwest of Blocksburg, California, and is accessed via private roads off of Alderpoint road. Vegetation on the property consists of grasslands, oak woodlands, and Douglas fir timberland. The property has a primarily south facing aspect with an elevation range of approximately 2,200' to 3,200' above sea level. The project area contains un-named watercourses and portions of Cooper Creek, a tributary of The Eel river.

**Project Description**

There are currently five active cultivation areas located on the property, two proposed locations, and one pre-existing legacy cultivation area. The active cultivation areas are described as Cultivations Area A, B, C, D and E throughout this report. Cultivation Areas A, B, C, and D occur on flat areas that have been modified [through grading] in the recent past to accommodate cannabis cultivation. Cultivation Area E is situated on a natural flat area. All cultivation areas have slopes ranging from 0-5% with surrounding slopes ranging from 10-35%. All water has been historically obtained from an on-property, off-stream, pond. Parameters of each cultivation site can be found in the table below:

Table 1: Cultivation Site Parameters.

Cultivation Site	Area <sup>1</sup> (ft <sup>2</sup> )	Adjoining Hillslopes (% Grade)	Distance from a Watercourse (ft)
A	35,690	19	50 [CIII]
B	13,930	15	50 [CII]
C	9,189	10	60 [CII]
D	25,390	10	50 [CII]
E	5,590	26	40[CIII]
Proposed Cultivation Area A	38,860	15	100 [CIII]
Proposed Cultivation B	55,480	20	230 [CII]
Legacy Cultivation Area	89,310	20	110 [CIII]

<sup>1</sup> Area refers to the total land disturbance area. The total cannabis canopy area may vary considerably than the disturbance area. Further details can be found under Item 1 below.

**Monitoring Plan**

Tier 2 Dischargers 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 Dischargers 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 are necessary to 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>). Sites requiring monitoring are indicated as such within the WRPP Mitigation report in the follow pages.

### 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](mailto: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 the Standard Conditions

Assessment of Standard Conditions consisted of field examinations in the winter of 2017/2018. 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 in the Mitigation Report to follow.

### 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



## Assessment of the Standard Conditions (Cont.)

### 1. Site Maintenance, Erosion Control, and Drainage Features

#### Roads

Roads are being classified as "permanent" (used year around), "seasonal" (being used primarily during summer months), and "trail" (being used for occasional access to features on the property).

Permanent roads consist of a well-constructed ranch road network. This road has a rocked surface and was found to be in moderate condition. Overall, the road was shaped well with appropriately located drainage structures, however multiple features require maintenance. Multiple erosion control feature installation sites have been recommended including installation of rolling dips, rocking of watercourse crossing approaches and re-surfacing sections of road. Several site-specific locations have mapped and addressed in the Mitigation Report referenced as Sites 05, 18, 19, 21, 22, 23, 26, 30, 31, 32, 36, 39, 40, and 45.

Seasonal roads are located on every parcel of the property and consists of a well rocked and maintained ranch road. Overall, the seasonal roads are shaped well with appropriately located drainage structures. One location, referenced as Site 14 requires maintenance to an existing rolling dip. The sections of seasonal road on the other parcels of this property are short sections of road with no erosion control or maintenance issues observed. **See General Recommendation #1**

The property contains numerous trails that have been used to access cultivation areas, springs, and water tanks. The majority of these trails are only used occasionally and show minimal signs of vehicle traffic. Trails that are mapped are those trails that have been maintained and are drivable. These trails should be inspected periodically and water bars established as required.

#### Cultivation Areas

Cultivation Area A is located on a graded flat with slopes less than 5% and adjoining natural slopes of 19% or less. Due to close proximity to a Class II watercourse near this cultivation area multiple erosion control recommendations have been made to improve drainage of this area. It has been recommended to install straw waddles around the northern and southern edges of this cultivation area and referenced as Site 51. Cultivation Area A had no signs of surface runoff but was designed in a way that surface flows would be captured by a french drain and drained towards an area away from. Most of the exposed soils within this area were either rocked or mulched.

Cultivation Area B is located on a natural flat area that has been expanded through grading. Graded areas have slopes less than 5% with adjoining natural slopes of 15% or less. The site was relatively well drained and had mulching on the entire area at the time of survey. No erosion control or maintenance sites have been determined for this area.

Cultivation Area C is located on a graded flat with slopes of less than approximately 5% and adjoining natural hillslopes of less than approximately 10%. The graded areas were found to be in good condition. However, a large portion of the cultivation area is within the riparian buffer zone and is planned to be removed prior to 10/15/2018 referenced as a cultivation remediation area on the site map.

### Assessment of the Standard Conditions (Cont.)

Cultivation Area D is located on a hill slope ranging from 5-10% grade. No erosion control or site maintenance recommendations have been made for this area. Due to close proximity to a Class II watercourse a 9,463ft<sup>2</sup> section of cultivation area will have to be removed prior to 10-15-2018. Refer to Site 52 on the site map and Mitigation Report.

Cultivation Area E is located on a natural flat area with outdoor potted plants. A Class III watercourse is adjacent to this cultivation area which has resulted in the recommendation to remove approximately 2,624ft<sup>2</sup> of cultivation area in this location. The discharger was informed and referenced on the site map and Mitigation Report as Site 53.

**Proposed Cultivation Areas** - There are two proposed cultivation areas located on this property, referenced as Proposed Area A and B on the Site map. Proposed Area A is located on a natural flat area with vegetation consisting of grasses, no erosion issues observed at this area. This proposed cultivation area has riparian buffers of 230ft to a Class II watercourse to the southeast and 230ft to a Class III watercourse to the northwest. Proposed Cultivation Area B is located on a natural flat with vegetation consisting of grasses. No erosion issues were observed at this area. A wet area was observed approximately 110ft to the west which results in a Class III watercourse. A second-Class III watercourse was observed 100ft to the south of this area.

**Legacy Cultivation Area:** The legacy garden is approximately 2 acres of area situated in a mature oak woodland with an approximate slope of 20%. The area has been inactive for more than a decade. No erosion or site maintenance issues were observed at this location. This area is situated between two watercourses with a Class II 120ft to the north and a Class III 110ft to the southwest.

### 2. Stream Crossing Maintenance

There are 24 stream crossings located on the property. Of these 24 crossings, 11 are functioning adequately and are appropriately sized for a 100-year storm event. The other 13 crossings are either not functioning adequately or are not sized for a 100-year storm event and shall require either replacement or removal. Further details can be found in the Mitigation Report to follow. **See General Recommendation #3 & #5**



Assessment of the Standard Conditions (Cont.)

Method for 100-year flood flow (A < 200)												APN 217-251-003; 217-225-007; 217-244-004; 217-244-007		
No.	Crossing	channel length (ft) to top L	channel difference (ft) H	channel centerline elevation (ft) Tc	Runoff coefficient C	Return-Period Precipitation I*	Area (acres) A	100-yr flood flow (cfs) Q100	existing	proposed	dersized?			
											Tc	Yes	No	
1	1				0.35	3.35	6.8851975	8.1	12.0	18.0	yes	1.0		
2	2				0.35	3.35	8.0154355	9.4	12.0	18.0	yes	2.0		
4	3				0.35	3.35	12.703118	14.9	24.0	24.0	no	4.0		
6	4				0.35	3.35	6.8807409	8.1	18.0	18.0	no	6.0		
7	5				0.35	3.35	14.034309	16.5	24.0	24.0	no	7.0		
8	6				0.35	3.35	7.7142102	9.0	24.0	18.0	no	8.0		
9	7				0.35	3.35	6.7623998	7.9	24.0	18.0	no	9.0		
10	8				0.35	3.35	7.4215589	8.7	18.0	18.0	no	10.0		
11	9				0.35	3.35	28.776657	33.7	24.0	36.0	yes	11.0		
16	10				0.35	3.35	12.816219	15.0	24.0	24.0	no	16.0		
17	11				0.35	3.35	12.767367	15.0	18.0	24.0	yes	17.0		
20	12				0.35	3.35	18.498453	21.7	24.0	24.0	no	20.0		
27	13				0.35	3.35	9.4019866	11.0	24.0	24.0	no	27.0		
28	14				0.35	3.35	19.47562	22.8	18.0	30.0	yes	28.0		
33	15				0.35	3.35	20.217496	23.7	24.0	30.0	yes	33.0		
34	16				0.35	3.35	2.8792696	3.4	18.0	18.0	no	34.0		
38	17				0.35	3.35	21.034203	24.7	36.0	30.0	no	38.0		
42	18				0.35	3.35	10.230907	12.0	24.0	24.0	no	42.0		
43	19				0.35	3.35	104.7113	122.8	48.0	60.0	yes	43.0		
44	20				0.35	3.35	11.08814	13.0	18.0	18.0	no	44.0		
46	21				0.35	3.35	124.58666	146.1	30.0	60.0	yes	46.0		
47	22				0.35	3.35	3.1173783	3.7	df	18.0	no	47.0		
48	23				0.35	3.35	2.2939656	2.7	12.0	18.0	yes	48.0		

Equal to Tc or for 10 min, whichever is larger; convert to in/hr for input as "I"

HW/L	CU18	CU24	CU30	CU36	CU42	CU48	CU54	CU60	CU72	CU84	CU96
1.0	5.6	11.6	20	32	47	66	89	115	180	265	375

Magnitude and Frequency Method for 100-year flood flow (A > 100 acres)								100-yr flood flow Q100 (cfs)			
No.	Crossing	Area (acres) A	Basin maximum elevation (ft)*	Crossing elevation (ft)*	Area (mi²) A	Avg. Annual Precipitation (In/yr) P	Elevation (ft/1000) H	North Coast <sup>(1)</sup> (NC)	Sierra <sup>(2)</sup> (S)	North-east <sup>(3)</sup> (NE)	Central Coast <sup>(4)</sup> (CC)
1	50	483	3900	2400	0.755	62	3.15	395.8	519.7	105.9	337.3

\*To estimate discharges for bridges, use elevations along watercourse at 85 percent and 10 percent of watercourse length from crossing to drainage divide, respectively, instead of using maximum and crossing elevations. See below for M&F equations



## Assessment of the Standard Conditions (Cont.)

### 3. Riparian and Wetland Protection and Management

Assessment of the property concluded that portions of Cultivation Area A, B, C, D, and E are located within 100-feet of a Class II watercourse and or 50' of a Class III watercourse.

Cultivation Area A has approximately 1,700ft<sup>2</sup> of cultivation area that is located within 100 feet of a Class II watercourse. During the field assessment this area was flagged and it was determined that drainage of the area would not have a significant impact to water quality. It has been recommended to install straw waddles around the northern and southern edges of this cultivation area.

Cultivation Area B has approximately 4,354ft<sup>2</sup> of cultivation area that is located within 100 feet of a Class II watercourse. During the field assessment this area was flagged and it was determined that drainage of the area would not have a significant impact to water quality. No grading has occurred at this location. The entire area was mulched with straw and no cultivation related materials were evident at the time of survey. The cultivation remediation area was flagged during the field assessment and the discharger was informed of close proximity to watercourses. Should cultivation take place in 2018 the discharge should confirm all areas are outside of the areas that were flagged during the field visit. The portion of area within the remediation area will not be used in 2018.

Cultivation Area C has approximately 5,364ft<sup>2</sup> of cultivation area that is located within the riparian buffer of 100ft of two Class II watercourses. During the field assessment this area was flagged and it was determined that drainage of the area would not have a significant impact to water quality. The cultivation remediation area was flagged during the field assessment and the discharger was informed of close proximity to watercourses. The portion of area within the remediation area will not be used in 2018.

Cultivation Area D has approximately 4,354ft<sup>2</sup> of cultivation area that is located within 100 feet of a Class II watercourse. During the field assessment the discharger relayed that this cultivation area will be removed in 2018. The cultivation remediation area was flagged during the field assessment and the discharger was informed of close proximity to watercourses. When cultivation related materials are removed it is being recommended to treat the site per the specifications of the attached erosion control BMP's.

Cultivation Area E has approximately 2,623ft<sup>2</sup> of cultivation area that is located within 50 feet of a Class III watercourse. During the field assessment this area was flagged and it was determined that drainage of the area would not have a significant impact to water quality. The cultivation remediation area was flagged during the field assessment and the discharger was informed of the close proximity to a watercourse. The portion of area within the remediation area will not be used in 2018.

The legacy cultivation area is located between two watercourses. This area is situated between a Class II 120ft to the north and a Class III 110ft to the southwest. During the removal of cultivation related waste, it should be noted that spent soil shall be disposed of in a one location outside the preferred riparian buffer of 200ft. All pots shall be removed and disposed of at a waste disposal facility or collected in an area that will not be mobilized into a watercourse.

**Assessment of the Standard Conditions (Cont.)**

Due to all current cultivation areas being within close proximity to watercourses two proposed cultivation areas were investigated in the field. These two locations would consolidate all of the pre-existing areas within the riparian buffer and a portion of the legacy garden. The proposed cultivation areas have adequate riparian buffers and are located on slopes ranging from 0-10% with surrounding slopes ranging from 15-20%. It is being recommended to begin utilizing these location post approvals of County and State permitting and removal of cultivation related materials at all of the areas defined and referenced as cultivation remediation areas.

**4. Spoils Management**

Currently, no spoils are not stored or placed in or where they can enter any surface water. Any/all spoils are adequately contained or stabilized to prevent sediment delivery to surface waters. Any/all spoils generated through development or maintenance of roads, driveways, earthen fill pads, or other cleared or filled areas have not been side cast in any location where they can enter or be transported to surface waters. Any/all future spoils generated as a result of any future construction projects that are to be stored on the property shall be done so in accordance with the BMP's.

**5. Water Storage and Use**

All the agricultural irrigation water on the property is derived from an on-property, off stream pond estimated to hold approximately 2 million gallons. This pond is referenced as Pond A on the site map. The pond meets and exceeds the required water demands for agricultural use. Domestic water is sourced from a spring point of diversion. At this time the discharge has 13,100 gallons of water tank storage, one off stream pond and one on stream pond. The discharger utilizes drip systems in every cultivation area. **See General Recommendation #2**

The diversion intake infrastructure at Point of Diversion consists of a cement cistern buried in a disconnected surface seep. This water is utilized for domestic uses. Collected water is gravity fed to a 2500-gallon transfer tank via a 1-inch polyline located approximately 70-feet downslope. Waterlines are then run to a water storage tank area located upslope of Cultivation Area A.

Combined water storage	
Pond 1 (off stream)	1,199,050 gals
Pond 2 (on-stream)	5,776,948 gals
Water Storage Tanks	21,000 gals
<b>Total Combined Water Storage</b>	<b>6,996,998 gals</b>

**Point of Diversion 2017 Water Use Estimates**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
0	0	0	3,000	3,000	3,000	3,000	3,000	3,000	0	0	0	18,000



**Assessment of the Standard Conditions (Cont.)****Pond A 2017 Water Use Estimates**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
0	0	0	79,800	82,260	119,700	248,000	248,000	119,700	0	0	0	897,460

**6. Irrigation Runoff**

During multiple visits to the property, no irrigation runoff, or evidence of such runoff, was observed at any of the five cultivation sites.

**7. Fertilizers and Soil Amendments**

Fertilizers, potting soils, compost, and other soils and soil amendments are stored in structures on the property in a manner in which they will not enter or be transported into surface waters and so that nutrients or other pollutants will not be leached into groundwater. Fertilizers and soil amendments are applied and used per the manufacturers guidelines. Cultivation areas are currently maintained so as to prevent nutrients from leaving the site during the growing season and post-harvest. **See General Recommendation #4**

**8. Pesticides and Herbicides**

The use of pesticide products is consistent with product labeling and all products on the property are currently used and stored in closed structures to ensure that they do not enter or are released into surface or ground waters. Storage structures are located on a separate property. The Discharger shall ensure that all pesticide and herbicide products on the property are currently used, and stored in closed structures, to ensure that they do not enter or are released into surface or ground waters. We recommend development of temporary storage structures at each cultivation area for storage of in-use pesticides and herbicides.

**9. Petroleum Products and Other Chemicals**

Currently, no fuel storage or petroleum products are present on the property. Should the discharger at any point in the future obtain fuel storage or petroleum products, any/all future 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 shall be of suitable material and construction to be compatible with the substance(s) stored and conditions of storage such as pressure and temperature. 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 cover shall be provided to prevent any/all precipitation from entering said secondary containment vessel. Dischargers shall ensure that diked areas are sufficiently impervious to contain discharged chemicals. Discharger(s) shall implement spill prevention, control, and countermeasures (SPCC) and have appropriate cleanup materials available onsite if the volume of a fuel container is greater than 1,300 gallons. 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.

## Assessment of the Standard Conditions (Cont.)

### 10. Cultivation-Related Wastes

No 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, are stored at locations where they can enter or be blown into surface waters, or in a manner that could result in residues and pollutants within such materials to migrate or leach into surface water or groundwaters. The legacy garden has a collection of pots and spent soil that shall be removed after the proposed cultivation areas have been approved. The collection of cultivation waste at the legacy garden poses no immediate threat to water quality and due to being a shade tree cultivation area the discharger needs the proof of pre-existing cultivation in order to acquire proposed cultivation.

### 11. Refuse and Human Waste

Garbage and refuse is removed from the property as it is produced and hauled away to a landfill transfer station. Human waste is managed by an unpermitted septic system on site. It is the discharger's responsibility to ensure compliance of such action with the Humboldt County Department of Environmental Health and Human Services. This septic system should be inspected and approved to be functioning adequately by a licensed professional.

### 12. Remediation/Clean-up/Restoration

Currently, four of the Standard Conditions are not being met; 1. Site Maintenance, Erosion Control, and Drainage Features, 2. Stream Crossing Maintenance, 3. Riparian and Wetland Protection and Management and 11. Refuse and Human Waste. Sites will be treated in accordance with regulations, following approval of any and/or all necessary permits, and done in accordance with the BMP's attached to this WRPP and listed in Appendix B of the Order as needed.

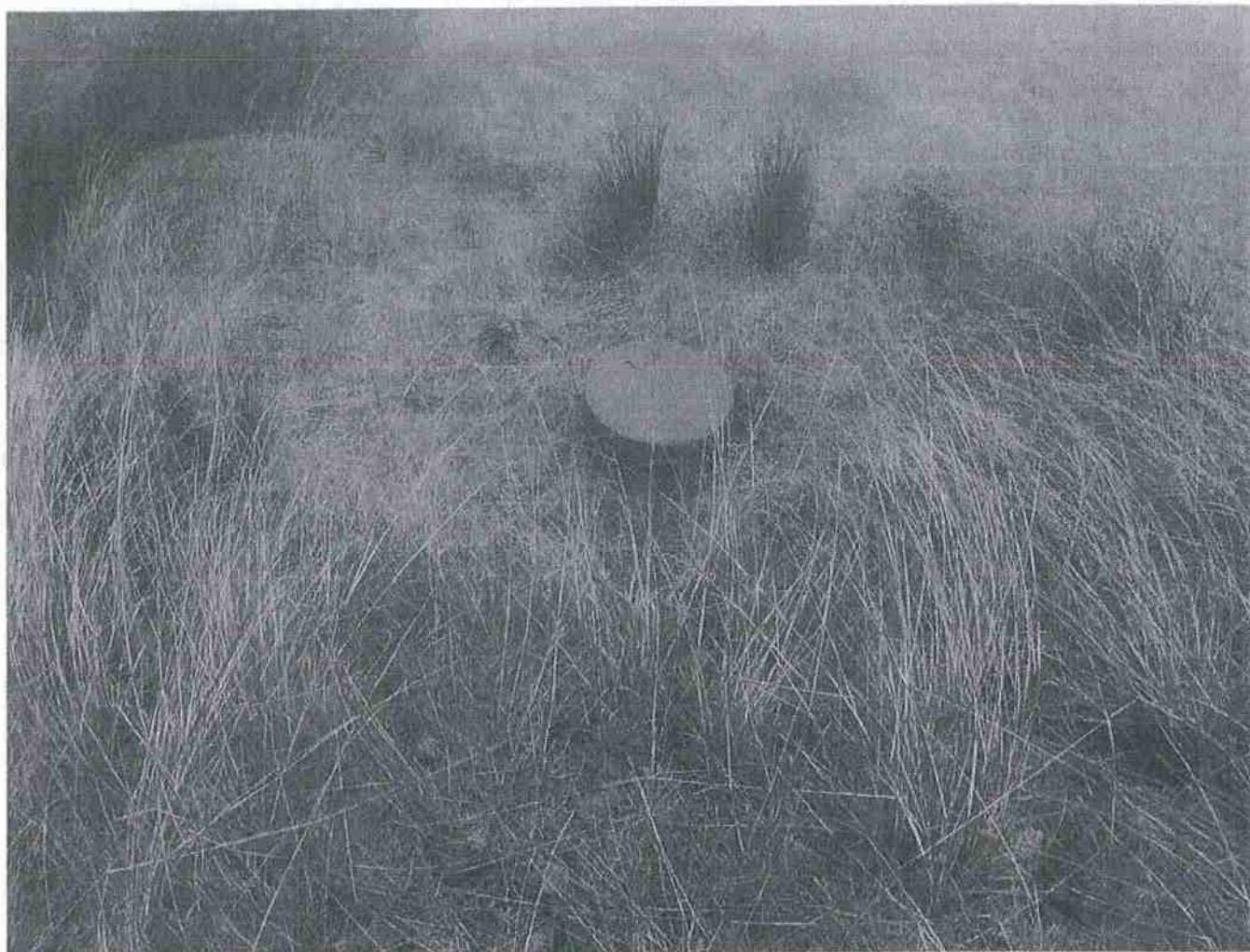
Site specific recommendations are labeled as "sites" on the Site Map and described in detail in the Mitigation Report following this section. Additionally, several general recommendations have been made, as described in the report above, along with several other broad recommendations are described below. Lastly, several interim measures have been developed to prevent impacts in advance of certain site-specific treatments. See the interim Measures section below.



**General Recommendations**

1. The seasonal road network shall be graded, at an appropriate time of the year, in order to re-establish the rolling dips and push-outs to achieve proper drainage. It is advised that the discharger have a qualified professional provide guidance to the operator to ensure that grading activities meet the objective of this requirement. The treatment priority for this requirement shall be no later than 10/15/2019.
2. Water use shall be designed and metered such that water used for the irrigation of cannabis will be recorded. Water use for the irrigation of cannabis is to be recorded monthly for annual reporting.
3. All culverts should be inspected regularly during the winter months to check for plugging, blockage, or other issues.
4. Fertilizer, soil amendments, and pesticide use it to be recorded in such a manner that cumulative annual totals are recorded for annual reporting.
5. A Lake and Streambed Alteration Agreement with the California Department of Fish and Wildlife, shall be required to continue use of the surface water diversions and prior to any in-stream work. Any additional guidelines, treatments, or restrictions set forth under the finalized Lake and Stream Agreement shall be followed.
6. Existing or newly installed road surface drainage structures such as water bars, rolling dips, ditch relief culvers, and intentionally in/out-sloped segments of road shall be maintained to ensure continued function of capturing and draining surface runoff.
7. Road surfaces should be maintained via grading, as needed, to prevent road surface runoff from being trapped in and eroding wheel tracks.

## Photographs



**Site 47:** Spring point of diversion, Utilized for domestic use only. Shallow cement cistern collects a spring in this location.





**Legacy cultivation area:** Approximately 2-acre area with approximately 200-300, 3-gallon pots situated throughout. This area has not been used in more than a decade.

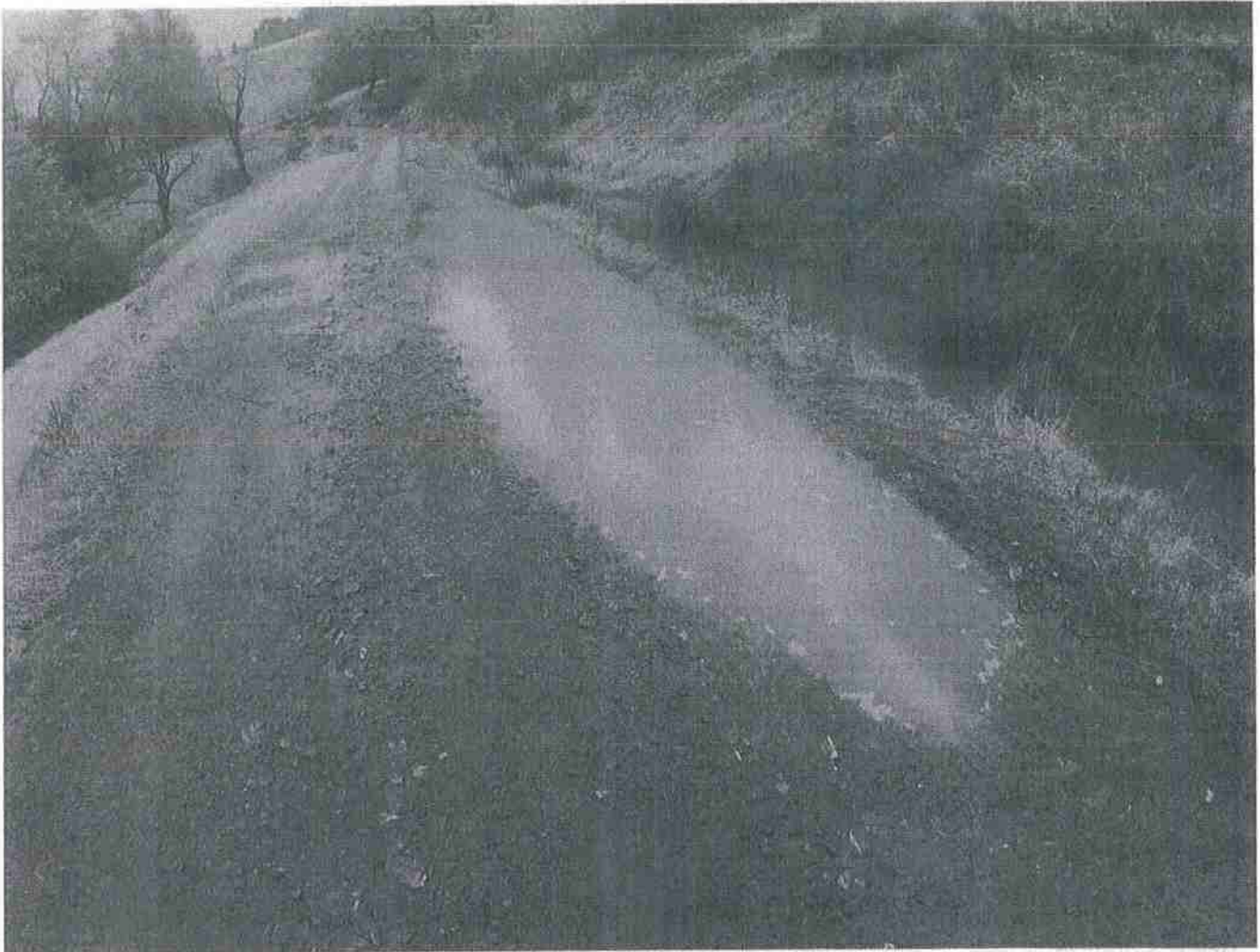


**Pond A:** Off stream pond that is used for agricultural irrigation water.





**Pond B:** On stream pond. Used for aesthetics and fire prevention.



**Site 01:** Ponding water on road, it is being recommended to build up the road surface to contain surface water from a bank seep.





**Site 50:** Double barrel Class II watercourse crossing, consisting of a 48" metal culvert and a 48".  
See mitigation report for details.



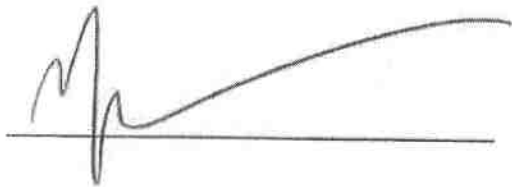
**Site 50** – Alternate view, this watercourse crossing is not functioning adequately due to the culverts being inadequately sized and too short. Additionally, the inlet of the metal culvert is crushed and obstructed. See mitigation report for further details.



## 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 217-244-007; 217-251-003; 217-244-004; 217-225-007 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. 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.

A handwritten signature in black ink, appearing to read 'Nick Robinson', written over a horizontal line.

Nick Robinson  
Timberland Resource Consultants

# Water Resource Protection Plan

Site Map - WDID 1B170595CHUM

-  Property Boundary
-  Pond
-  Cultivation Area
-  Historic Garden
-  Proposed Area
-  Structure
-  Residence
-  Tank
-  Site

- Watercourse**
-  Class II
-  Class III
- Road**
-  Permanent
-  Seasonal
-  Trail



1"=750'





# Water Resource Protection Plan

## Site Map - W DID 1B170595CHUM

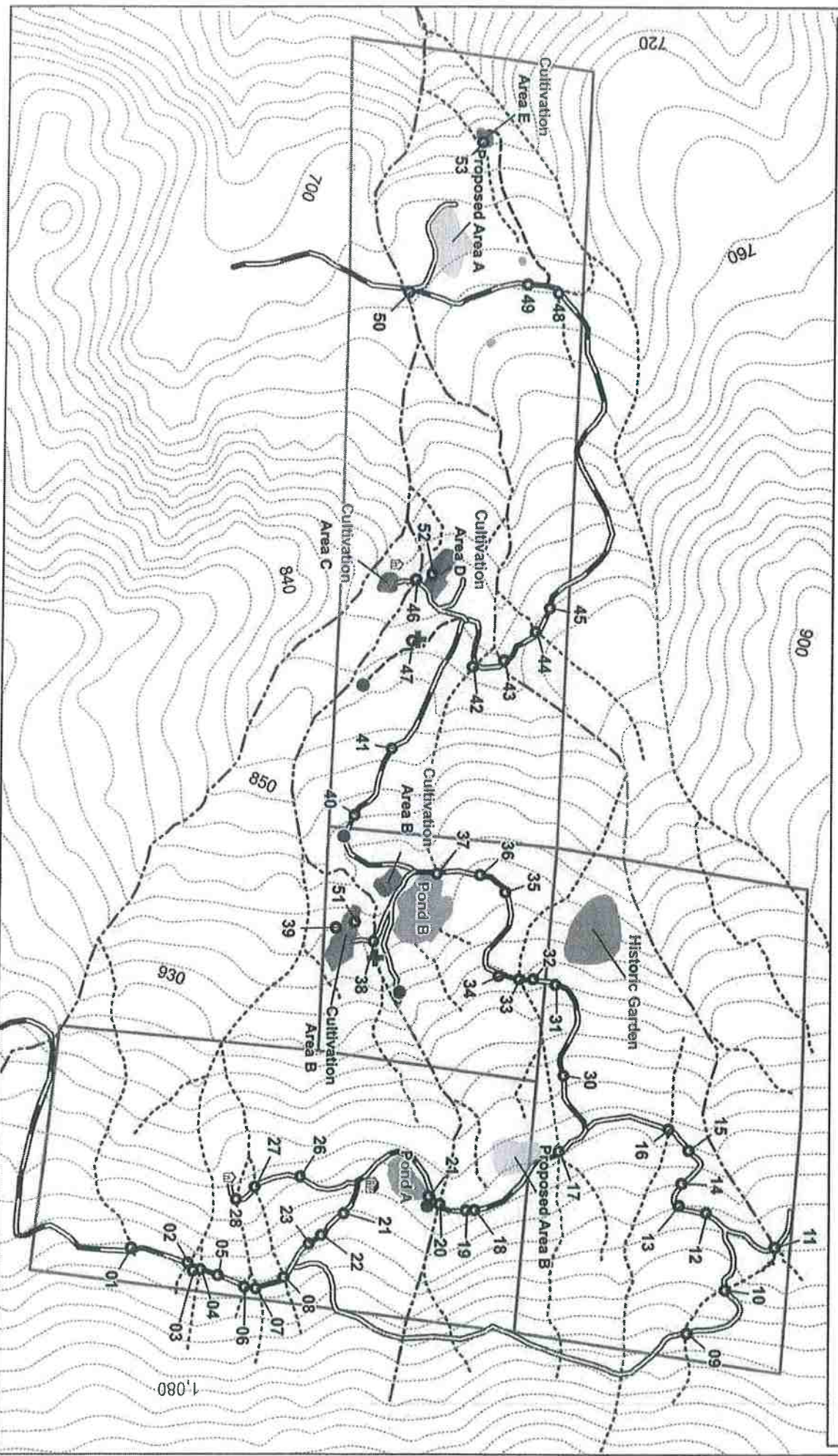
-  Property Boundary
-  Structure
-  Residence
-  Tank
-  Site

- Watercourse**
-  Class II
-  Class III
- Road**
-  Permanent
-  Seasonal
-  Trail

-  Proposed Area
-  Historic Garden
-  Cultivation Area
-  Pond



1"=750'





# WRPP - Mitigation Report

WDID# - 1B170595CHUM

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
1	-123.601592 40.306187	Permanent	X	X	X	A.2.	Prior to 10/15/19 pending the approval of any required permits	
Current Condition: Class III watercourse crossing consisting of a 12" metal culvert. Culvert is too short with surface rust observed at the time of inspection. Culvert was deemed to be undersized for 100 year storm events.						Prescribed Action: Install an 18" culvert in this location per the specifications of the attached BMP's.		
2	-123.601345 40.30706	Permanent	X	X	X	A.2.	Interim measures immediately; Mitigation measures prior to 10/15/19 pending the approval of any required permits	
Current Condition: Class III watercourse crossing consisting of a 12" metal culvert. Culvert inlet was buried and surface rust was observed at the time of inspection. Culvert was deemed to be undersized for 100 year storm events.						Interim measure: The inlet of the culvert shall be cleared of obstructions and perched sediment. Prescribed Action: Install an 18" culvert in this location per the specifications of the attached BMP's.		
3	-123.601153 40.307135	Permanent	X	X	-	A.1.	Prior to 10/15/19 pending the approval of any required permits	
Current Condition: Bank seep resulting in ponding water adjacent to the road surface. Ponding water was contained however during storm events it is likely that water is able to cross the road surface.						Prescribed Action: Install rock on the section of road adjacent to the ponding water. Road shall be built up and crowned to contain the bank seep to the inside ditch.		
4	-123.601173 40.307248	Permanent	X	X	X	A.2.	Interim measures immediately; Mitigation measures prior to 10/15/19 pending the approval of any required permits	
Current Condition: Class III watercourse crossing consisting of a 24" metal culvert. The condition of this culvert was rusted through, not to grade, with a buried inlet. This culvert is sized appropriately for a 100 year storm event.						Interim measure: The inlet of the culvert shall be cleared of obstructions and perched sediment. Prescribed Action: Install a 24" culvert per the specifications of the attached		
5	-123.601066 40.307515	Permanent	X	X	-	A.1.	Prior to 10/15/19 pending the approval of any required permits	
Current Condition: Inadequately drained section of road. At the time of survey ponding water was observed on the road surface.						Interim measure: Install a type 1 rocked rolling dip at this location per the specifications of the attached BMP's.		
6	-123.600839 40.307924	Permanent	X	X	-	A.2.	Prior to 10/15/18	
Current Condition: Class III watercourse crossing consisting of an 18" metal culvert. This culvert was not functioning adequately due to a buried inlet. This culvert is sized adequately for a 100 year storm event.						Prescribed Action: Clear the inlet of any obstructions and perched sediments.		





# WRPP - Mitigation Report

WDID# - 1B170595CHUM

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
7	-123.600811 40.308098	Permanent	X	X	-	A.2.	Prior to 10/15/18	
<p>Current Condition: Class III watercourse crossing consisting of a 24" plastic culvert. This culvert is functioning adequately and is sized appropriately for a 100 year storm event. Road fill was perched above watercourse at the time of survey. This culvert drains a bank seep and inside ditch.</p>						<p>Prescribed Action: Remove road fill that is perched around the inlet of this culvert. Road fill can either be laid back to a 2:1 slope, seeded and mulched or relocated to a location away from any watercourses.</p>		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
8	-123.601033 40.308518	Permanent	X	X	X	A.2.	Prior to 10/15/20 pending the approval of any required permits	
<p>Current Condition: Class III watercourse crossing consisting of a 24" metal culvert. The condition of that culvert is not functioning adequately due to be rusted through with a shotgun outlet. This culvert is sized appropriately for a 100 year storm event.</p>						<p>Prescribed Action: Install a 24" metal culvert in this location to the specifications of the attached BMP's</p>		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
9	-123.598993 40.314622	Permanent	X	X	X	A.2.	Interim measures immediately; Mitigation measures prior to 10/15/20 pending the approval of any required permits	
<p>Current Condition: Class III watercourse crossing consisting of a 24" metal culvert. This culvert is not functioning adequately due to the inlet being crushed allowing water to divert down an inside ditch. This culvert is sized appropriately for a 100 year storm event.</p>						<p>Interim Measure: Open up the crushed inlet. Lay back perched sediment materials from inlet of culvert. Clear the inlet of any obstructions. Prevent watercourse channel from diverting down the inside ditch by clogging the ditch with a soil berm Prescribed Action: Monitor result of interim action, if the watercourse crossing is still not functioning adequately install a 24" metal culvert at this location to the specifications of the attached BMP's.</p>		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
10	-123.600855 40.315197	Permanent	X	X	X	A.2.	Prior to 10/15/19 pending the approval of any required permits	
<p>Current Condition: Class II watercourse crossing consisting of an 18" metal culvert. The condition of this culvert was not functioning adequately due to being rusted through and not to grade. Water was observed to be running under the culvert. This culvert is sized appropriately for a 100 year storm event.</p>						<p>Prescribed Action: Install an 18" culvert at this location per the specifications of the attached BMP's.</p>		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
11	-123.6017 40.315932	Permanent	X	X	X	A.2.	Prior to 10/15/20 pending the approval of any required permits	
<p>Current Condition: Class II watercourse crossing consisting of a 24" smooth wall plastic culvert. This culvert is functioning adequately however a sediment wedge was observed near the inlet. The hydrological study determined this culvert to be undersized for a 100 year storm event.</p>						<p>Prescribed Action: Install a 36" culvert in this location per the specifications of the attached BMP's.</p>		



# WRPP - Mitigation Report

WDID# - 1B170595CHUM

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
12	-123.602368 40.314892	Permanent	-	X	-	A.1.		
Current Condition: Existing rolling dip is functioning adequately.						Prescribed Action: None.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
13	-123.602503 40.314483	Permanent	-	X	-	A.1.		
Current Condition: Existing rolling dip is functioning adequately.						Prescribed Action: None.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
14	-123.60294 40.31452	Permanent	-	X	-	A.1.	Prior to 10/15/18	
Current Condition: Existing rolling dip is not functioning adequately due to being beaten down from road use.						Prescribed Action: Re-establish a type 1 rocked rolling dip in this location per the specifications of the attached BMP's.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
15	-123.603588 40.314615	Permanent	-	X	-	A.1.		
Current Condition: Existing rolling dip functioning adequately.						Prescribed Action: None.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
16	-123.604004 40.314311	Permanent	X	X	-	A.2.	Prior to 10/15/19	
Current Condition: Class III watercourse crossing consisting of a 24" metal culvert. This culvert is lacking a critical dip, is not to grade, and has a shotgun outlet. This culvert is not functioning adequately however is sized appropriately for a 100 year storm event.						Prescribed Action: Install erosion control boulders at the outlet of this culvert. Establish a critical dip for this watercourse crossing.		





Timberland  
Resource  
Consultants

## WRPP - Mitigation Report

WDID# - 1B170595CHUM

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
17	-123.603553 40.312647	Permanent	X	X	X	A.2.	Prior to 10/15/20 pending the approval of any required permits	
Current Condition: Class III watercourse crossing consisting of an 18" metal culvert. This culvert is rusted through and undersized for a 100 year storm event.						Prescribed Action: Install a 24" metal culvert in this location per the specifications of the attached BMP's.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
18	-123.602383 40.311388	Permanent	X	X	-	A.1.	Prior to 10/15/18	
Current Condition: Existing rolling dip that is draining the bank seep. This drainage feature is not functioning adequately due to being saturated by draining a bank seep and becoming beaten down.						Prescribed Action: Re-establish this rolling dip and apply more substantial rock to this feature. 2-3" minus rock is recommended.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
19	-123.602378 40.311265	Permanent	X	X		A.1.	Prior to 10/15/18 pending the approval of any required permits	
Current Condition: This site references the approaches of the watercourse crossing at Site 20. The approaches need to be rocked.						Prescribed Action: Rock the road approximately 25' in either direction of the watercourse crossing. 3" minus rock is recommended.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
20	-123.602493 40.310863	Permanent	X	X	-	A.2.	Prior to 10/15/19 pending the approval of any required permits	
Current Condition: Class II watercourse crossing consisting of a 24" plastic culvert. This watercourse crossing is lacking a critical dip and erosion was observed at the outlet of this culvert. This culvert is sized appropriately and functioning adequately.						Prescribed Action: Install erosion control boulders at the outlet of this culvert. Additionally a critical dip shall be established.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
21	-123.602297 40.30942	Seasonal	X	X	-	A.1.	Prior to 10/15/19 pending the approval of any required permits	
Current Condition: Existing rolling dip that is not functioning adequately.						Prescribed Action: Re-establish a type 1 rolling dip in this location per the specifications of the attached BMP's.		



# WRPP - Mitigation Report

WDID# - 1B170595CHUM

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
21	-123.602645 40.310698	Permanent	-	X	-	A.5.		
Current Condition: Pond overflow consisting of an 18" plastic culvert.						Prescribed Action: None.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
22	-123.60187 40.309083	Permanent	X	X	-	A.1.	Prior to 10/15/19 pending the approval of any required permits	
Current Condition: Existing rolling dip has become beaten down due to road use.						Prescribed Action: Re-establish a type 1 rolling dip in this location per the specifications of the attached BMP's.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
23	-123.60187 40.309083	Permanent	X	X	-	A.1.	Prior to 10/15/19 pending the approval of any required permits	
Current Condition: Existing rolling dip has become beaten down due to road use.						Prescribed Action: Re-establish a type 1 rolling dip in this location per the specifications of the attached BMP's.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
26	-123.602708 40.308057	Seasonal	-	X	-	A.1.		
Current Condition: Existing inside ditch, functioning adequately at the time of inspection.						Prescribed Action: None.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
27	-123.602508 40.307762	Permanent	-	X	-	A.2.		
Current Condition: Class III watercourse crossing consisting of a 24" plastic culvert. Functioning adequately and sized appropriately for a 100 year storm event.						Prescribed Action: None.		





Timberland  
Resource  
Consultants

# WRPP - Mitigation Report

WDID# - 1B170595CHUM

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
28	-123.606048 40.312702	Permanent	X	X	-	A.2.	Prior to 10/15/20 pending the approval of any required permits	
Current Condition: Class III watercourse crossing consisting of an 18" culvert. A rust line was observed at the time of inspection but the culvert appeared to be functioning adequately. This culvert is undersized for a 100 year storm event.						Prescribed Action: Install a 30" culvert at this location per the specifications of the attached BMP's.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
30	-123.606835 40.312553	Permanent	X	X	-	A.1.	Prior to 10/15/18	
Current Condition: Inadequately drained section of road.						Prescribed Action: Install a type 1 rolling dip in this location per the specifications of the attached BMP's.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
31	-123.606942 40.312213	Permanent	-	X	-	A.1.	-	
Current Condition: Existing rolling dip functioning adequately.						Prescribed Action: None.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
32	-123.60697 40.312065	Permanent	X	X	-	A.1.	Prior to 10/15/19 pending the approval of any required permits	
Current Condition: Existing rolling dip has become beaten down due to use.						Prescribed Action: Re-establish type 1 rolling dip at this location per the specifications of the attached BMP's.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
33	-123.606995 40.311692	Permanent	-	X	-	A.2.	-	
Current Condition: Class III watercourse crossing consisting of a 24" plastic culvert. This watercourse crossing is functioning adequately and is sized appropriately for a 100 year storm event.						Prescribed Action: None.		



# WRPP - Mitigation Report

WDID# - 1B170595CHUM

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
34	-123.608657 40.31177	Permanent	-	X	-	A.1.	-	
Current Condition: Ditch relief culvert consisting of an 18" plastic culvert. This culvert is functioning adequately.					Prescribed Action: None.			
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
35	-123.608992 40.311387	-	-	X	-	A.1.	-	
Current Condition: Existing rolling dip is functioning adequately.					Prescribed Action: None.			
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
36	-123.609012 40.310732	-	X	X	-	A.1.	Prior to 10/15/18	
Current Condition: Existing rolling dip has become beaten down due to road use.					Prescribed Action: Re-establish type 1 rolling dip at this location per the specifications of the attached BMP's.			
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
37	-123.607667 40.309793	Permanent	X	X	-	A.1.	-	
Current Condition: Pond overflow consisting of a 24" plastic culvert. Functioning adequately.					Prescribed Action: None.			
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
38	-123.607933 40.30922	Seasonal	-	X	-	A.2.	-	
Current Condition: Class II watercourse crossing consisting of a 36" plastic culvert. Functioning adequately and sized appropriately for a 100 year storm event.					Prescribed Action: None.			





# WRPP - Mitigation Report

WDID# - 1B170595CHUM

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
39	-123.61016 40.309475	Permanent	X	X	-	A.1.	Annually prior to 10/15	
Current Condition: Erosion control has been established in this location. Erosion control consists of straw mulching installed on exposed soils within the cultivation area.						Prescribed Action: Maintain this configuration.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
40	-123.611472 40.310023	Permanent	X	X	-	A.1.	Prior to 10/15/19	
Current Condition: Existing rolling dip has become beaten down due to road use.						Prescribed Action: Re-establish type 1 rolling dip at this location per the specifications of the attached BMP's.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
41	-123.613103 40.311223	Permanent	X	X	-	A.1.	Prior to 10/15/19	
Current Condition: Existing rolling dip is functioning adequately.						Prescribed Action: Re-establish type 1 rolling dip at this location per the specifications of the attached BMP's.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
42	-123.613228 40.311697	Permanent	-	X	-	A.2.	-	
Current Condition: Class III watercourse crossing consisting of a 24" plastic culvert. This culvert is functioning adequately and is sized appropriately for a 100 year storm event.						Prescribed Action: None.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
43	-123.613798 40.312165	Permanent	X	X	-	A.2.	Prior to 10/15/20 pending the approval of any required permits	
Current Condition: Class II watercourse crossing consisting of a 48" metal culvert. Functioning adequately however was determined to be undersized for a 100 year storm event.						Prescribed Action: Install a 60" culvert in this location per the specifications of the attached BMP's.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
44	-123.61427 40.312373	Permanent	X	X	-	A.2.	Prior to 10/15/20 pending the approval of any required permits	
Current Condition: Class III watercourse crossing consisting of an 18" metal culvert. This culvert is not functioning adequately due to being rusted through. This culvert was determined to be undersized for a 100 year storm event.						Prescribed Action: Install an 18" culvert in this location per the specifications of the attached BMP's.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
45	-123.614808 40.31034	Permanent	X	X	-	A.1.	Prior to 10/15/19	
Current Condition: Inadequately drained section of road.						Prescribed Action: Install a type 1 rolling dip in this location per the specifications of the attached BMP's.		



# WRPP - Mitigation Report

WDID# - 1B170595CHUM

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
46		-	X	X	-	A.2.	Prior to 10/15/20 pending the approval of any required permits	
Current Condition: Class II watercourse crossing consisting of a 30" metal culvert. This watercourse crossing is functioning adequately however, was determined to be undersized for a 100 year storm event.						Prescribed Action: install a 60" culvert in this location per the specifications of the attached BMP's.		
47	-123.62047 40.312423	-	X	X	-	A.5.		
Current Condition: Point of diversion. Domestic use only. Hydrologically disconnected spring captured by a cement cistern gravity fed through a 1" poly line to a stock tank/trough.						Prescribed Action: None.		
48	-123.620638 40.311952	Permanent	X	X	X	A.2.	Interim measures immediately; Mitigation measures prior to 10/15/20 pending the approval of any required permits	
Current Condition: Class III watercourse crossing consisting of a 12" metal culvert. This culvert is not functioning adequately due to having a crushed inlet and being undersized.						Interim Measure: Open the crushed inlet of this culvert and remove any obstructions or perched sediments from the inlet. Prescribed Action: Install an 18" culvert in this location per the specifications of the attached BMP's.		
49	-123.620638 40.311952	Permanent	X	X	-	A.1.		
Current Condition: Ditch relief culvert consisting of an 18" plastic culvert. This culvert is functioning adequately.						None.		
50	-123.620463 40.31015	Permanent	X	X	X	A.2.	Prior to 10/15/20 pending the approval of any required permits	
Current Condition: Class II watercourse crossing consisting of a double barreled culvert configuration with two 48" culverts. One culvert is a 48" metal culvert with an obstructed and bent inlet and eroding outlet. This metal culvert is undersized, too short, set high in the road fill, and with an obstructed inlet. The second culvert is a cement culvert that was passing the majority of the flows due to obstructions at the first culvert. This cement culvert also had an eroding outlet due to being undersized, too short, and set high in the road fill. Neither of these culverts are functioning adequately or sized appropriately.						Prescribed Action: Due to a wide channel there are multiple proposed actions to resolve this inadequately sized watercourse crossing. The section of road that the crossing utilizes is approximately 40ft in length. Three options for installation of a new watercourse crossing structure were discussed with the discharger. Option #1 includes having a bridge designed by a licensed engineer and installed. This bridge shall span the distance of the two culverts. Option #2 remove the current configuration and install a rock ford crossing per the specifications of the attached BMP's. Option #3 consists of a double barrel culvert installation consisting of two 8ft culverts per the specifications of the attached BMP's. These culverts must extend beyond the road fill.		
51	-123.620463 40.31015	Permanent	X	X	-	A.2.	Prior to 10/15/20 pending the approval of any required permits	
Current Condition: Cultivation area is within close proximity to A class III watercourse at its southern edge and a Class II watercourse at its northern edge.						Prescribed Action: Install approximately 100ft of straw waddle at the northern edge of the cultivation area and approximately 100ft of straw waddle at the southern edge of the cultivation area.		





Timberland  
Resource  
Consultants

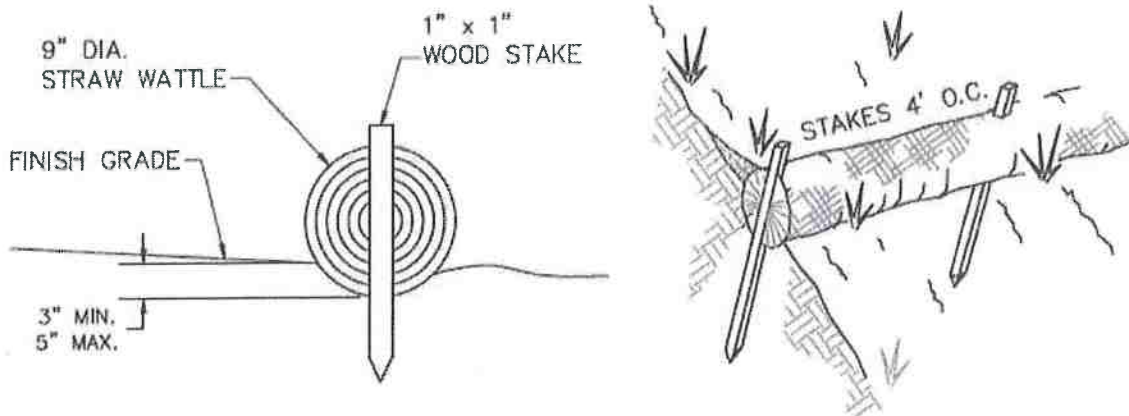
## WRPP - Mitigation Report

WDID# - 1B170595CHUM

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
52	-123.620463 40.31015	Permanent	X	X	-	A.2.	Prior to 10/15/20 pending the approval of <u>any required permits</u>	
Current Condition: Cultivation area is within close proximity to a Class III watercourse on the north and southern edges of the area.						Prescribed Action: Remove all cultivation related materials from the area that is defined on the Site map as ,Cultivation Remediation Area. Post removal of cultivation related materials it is being recommended to treat the "cultivation remediation area" per the specifications of the attached BMP's.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
53	-123.620463 40.31015	Permanent	X	X	-	A.2.	Prior to 10/15/20 pending the approval of <u>any required permits</u>	
Current Condition: Cultivation area is within close proximity to A class III watercourse runs adjacent to the south eastern edge.						Prescribed Action: Remove all cultivation related materials from the area that is defined on the Site map as ,Cultivation Remediation Area. Post removal of cultivation related materials it is being recommended to treat the "cultivation remediation area" per the specifications of the attached BMP's.		

## BMP: Erosion Control

- 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.



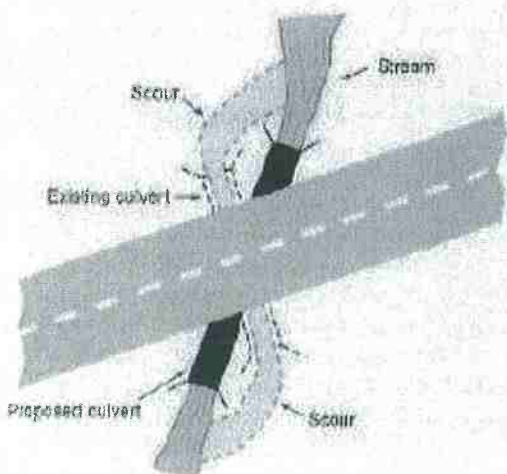
## BMP: Crossing Abandonment

- When fills are removed they shall be excavated to form a channel that is as close as feasible to natural watercourse grade, orientation, and a width 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.
- Road approaches leading to the crossing to be abandoned shall be hydrologically disconnected.
- The abandonment of a watercourse crossing shall not prevent equipment access to existing watercourse crossings not also being abandoned.



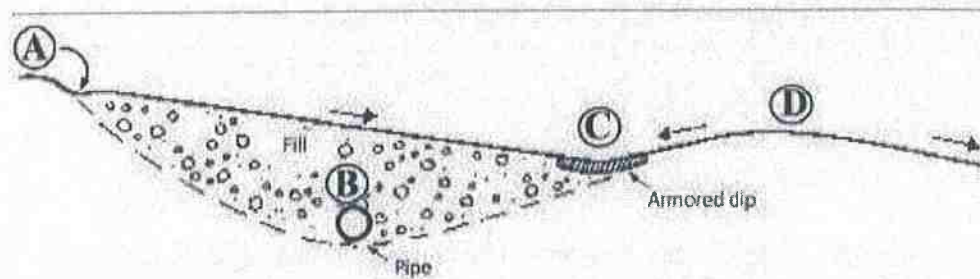
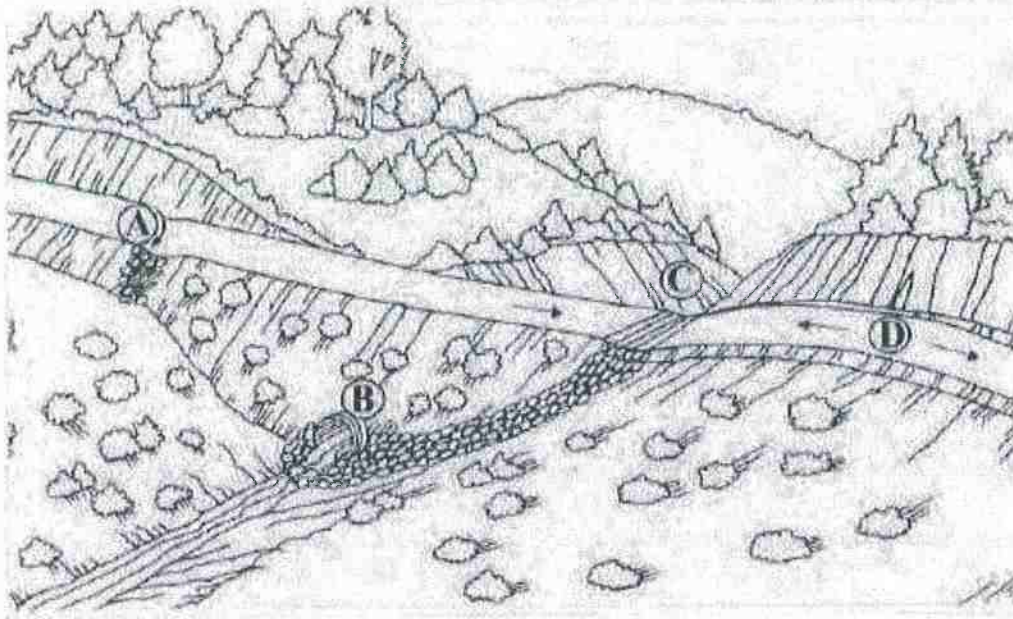
## BMP: Permanent Culvert Crossing

- 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.



**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 in a relatively straight horizontal alignment so streamflow does not have to turn to enter the inlet or discharge into a bank as it exits. This figure shows a redesigned culvert installation that replaces the bending alignment that previously existed. Channel turns at the inlet increase plugging potential because wood going through the turn 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.)

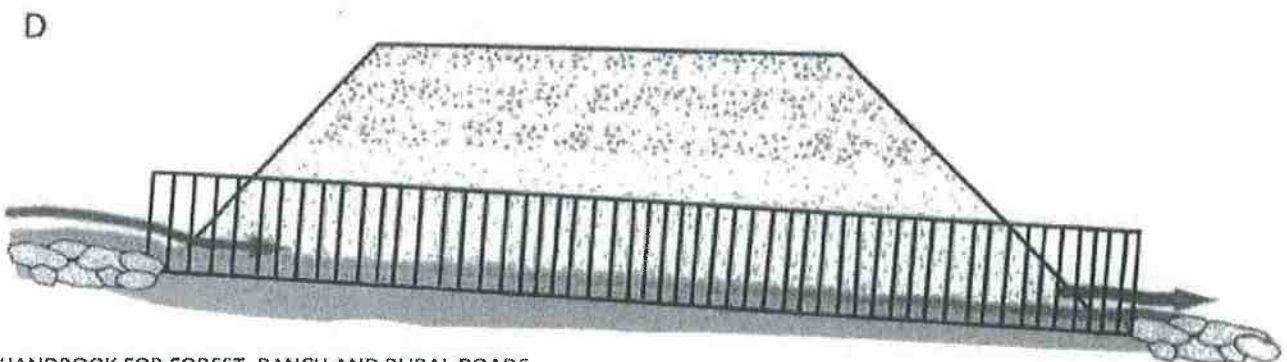
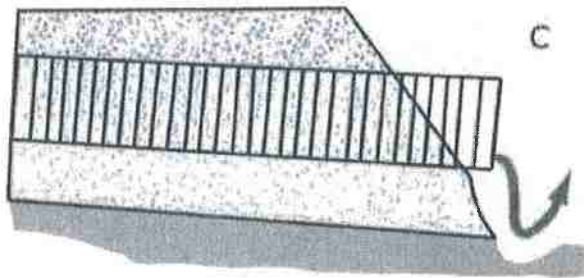
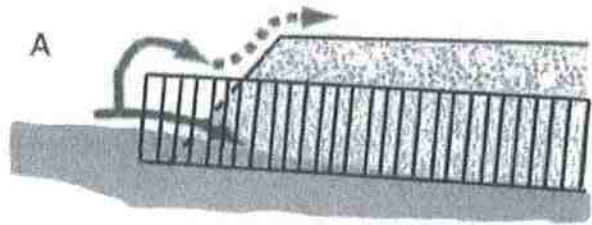


**FIGURE 94.** Critical dips or dipped crossing fills should be centered near a stream crossing's down-road hinge line, not over the centerline of the crossing where overtopping could cause washout or severe erosion of the fill. If the stream crossing culvert (B) plugs, water will pond behind the fill 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 streamflow from diverting down the ditch line. For extra protection in this sketch, riprap armor has been placed at the critical dip outfall and extending downslope to the stream channel. This is only required or suggested 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).

HANDBOOK FOR FOREST, RANCH AND RURAL ROADS



**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).

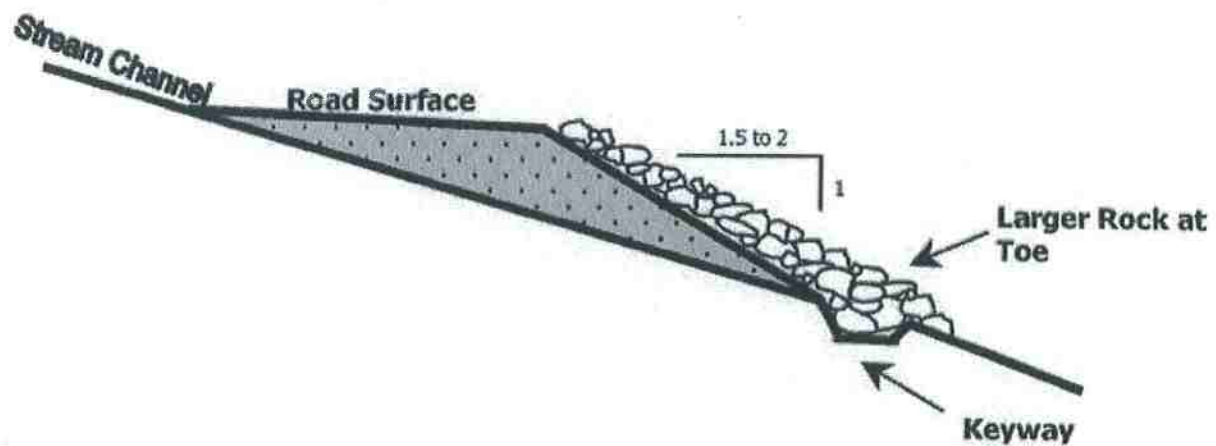
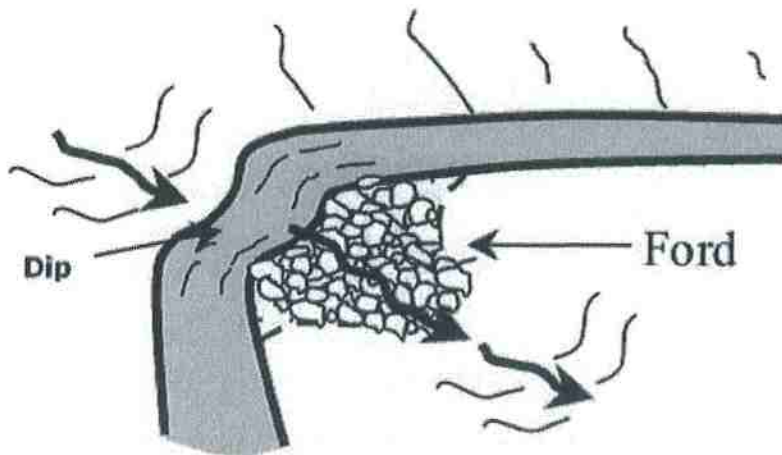
### BMP: Rocked Ford

- 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 armor 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.



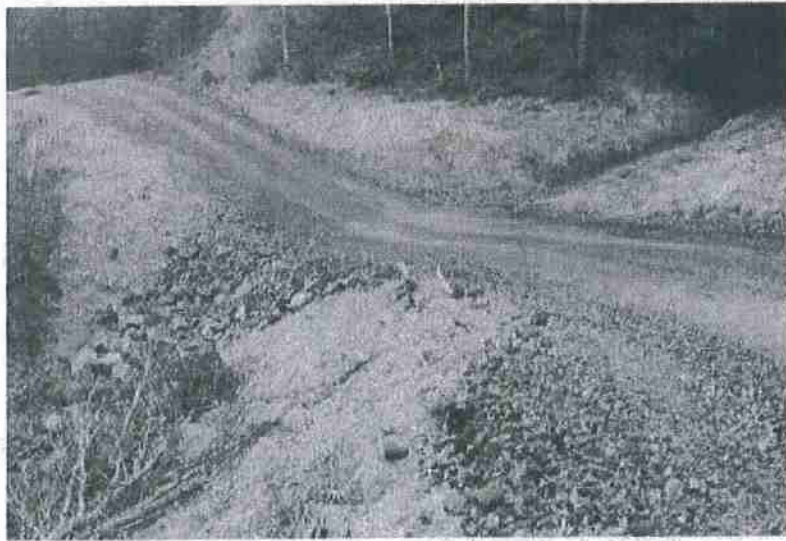
**BMP: Rocked Ford (Cont.)**

**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 rock armored 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 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 downcutting. Armored fills cannot be used on fish bearing streams.*

HANDBOOK FOR FOREST, RANCH AND RURAL ROADS



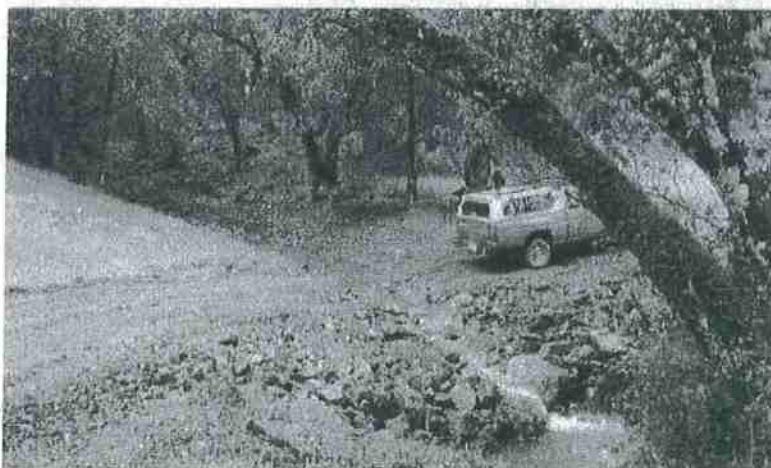
## BMP: Armored Ford [Fill] (Cont.)



**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 roadbed, 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 compacted or surfaced with road rock.



**FIGURE 121F.** The same armored fill 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 reduced to the minimum amount needed to maintain a relatively smooth driving surface on this low volume road.

### 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.
- The rolling dips outlet may be armored to resist downcutting and erosion.
- Do not discharge rolling dips into swales that show signs of instability or active landsliding.
- 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

- Rocked 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 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.
- Do not discharge rolling dips into swales that show signs of instability or active landsliding.
- If the rolling dip is designed to divert both road surface and ditch runoff, block the down-road ditch with compacted fill.
- The rolling dip must be drivable and not significantly inhibit traffic and road use.

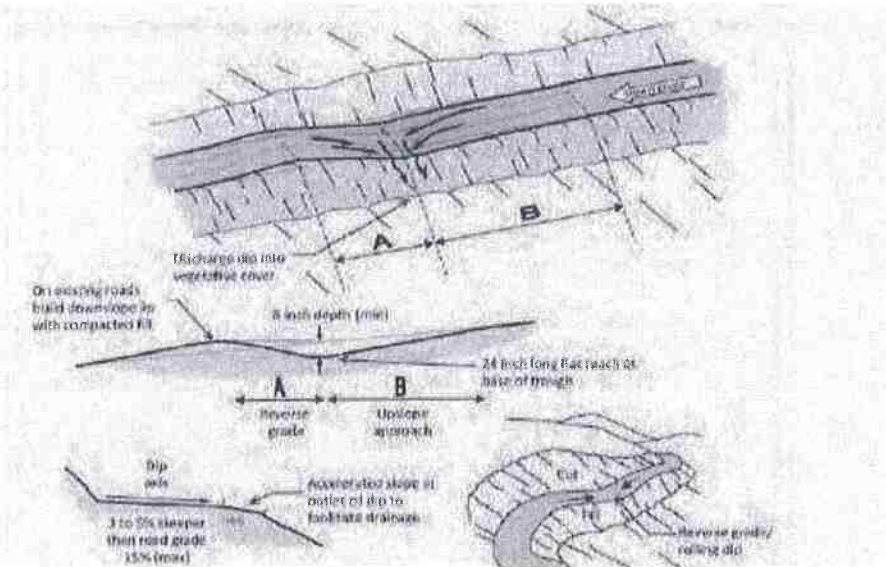


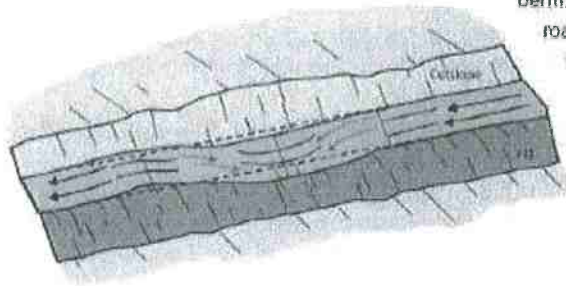
FIGURE 34. A classic Type I rolling dip, where the excavated up-road approach (B) to the rolling dip is several percent steeper than the approaching road and extends for 60 to 80 feet to the dip axis. The lower side of the structure reverses grade (A) over approximately 15 feet or more, and then falls 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 5% greater than the up-road grade (B) so it will drain properly. The dip axis should be out-sloped sufficiently to be self-cleaning, without triggering excessive downcutting or sediment deposition in the dip axis (Modified from: Best, 2013).

HANDBOOK FOR FOREST, RANCH AND RURAL ROADS



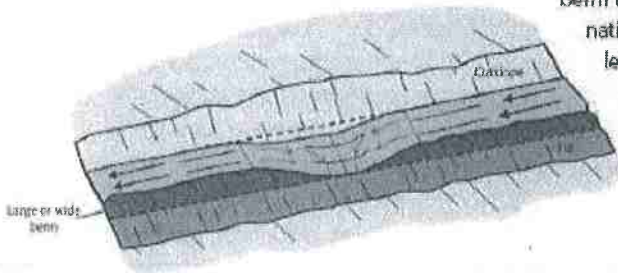
## BMP: Rolling Dip and Rocked Rolling Dip (Cont.)

Type 1 Rolling Dip  
(Standard)



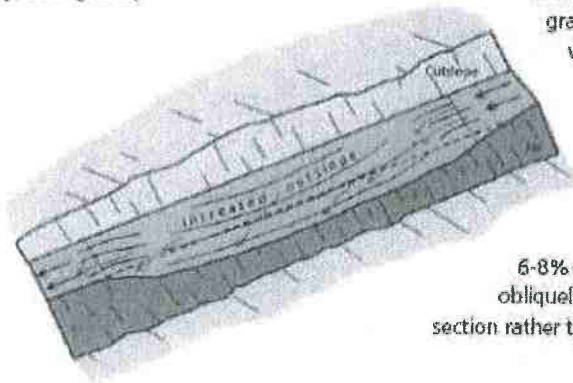
Type 1 rolling dips are used where road grades are less than about 12-14% and road runoff is not confined by a large through cut or berm. The axis of the dip should be perpendicular to the road alignment and sloped at 3-4% across the road tread. Steep roads will have longer and more abrupt dip dimensions 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 thick berm road reaches)



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

Type 3 Rolling Dip  
(Steep road grade)



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

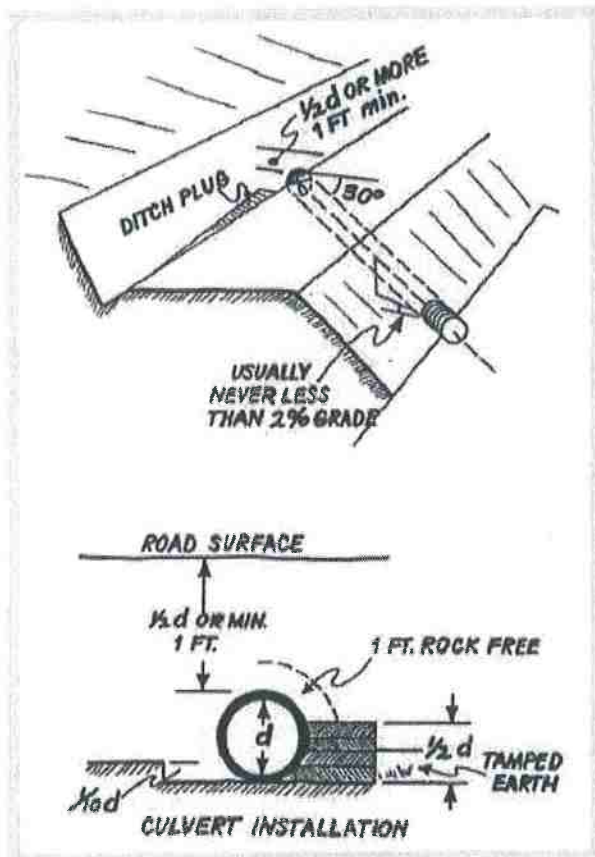
Instead of relying on the dip's grade reversal to turn runoff off the roadbed, the road is built with an exaggerated outslope of 6-8% across the dip axis. Road runoff is deflected obliquely across the dip axis and is shed off the outsloped section rather than continuing down the steep road grade.

FIGURE 36. Rolling dip types

HANDEDOK FOR FOREST, RANCH AND RURAL ROADS

### 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.



HANDBOOK FOR FOREST, RANCH AND RURAL ROADS

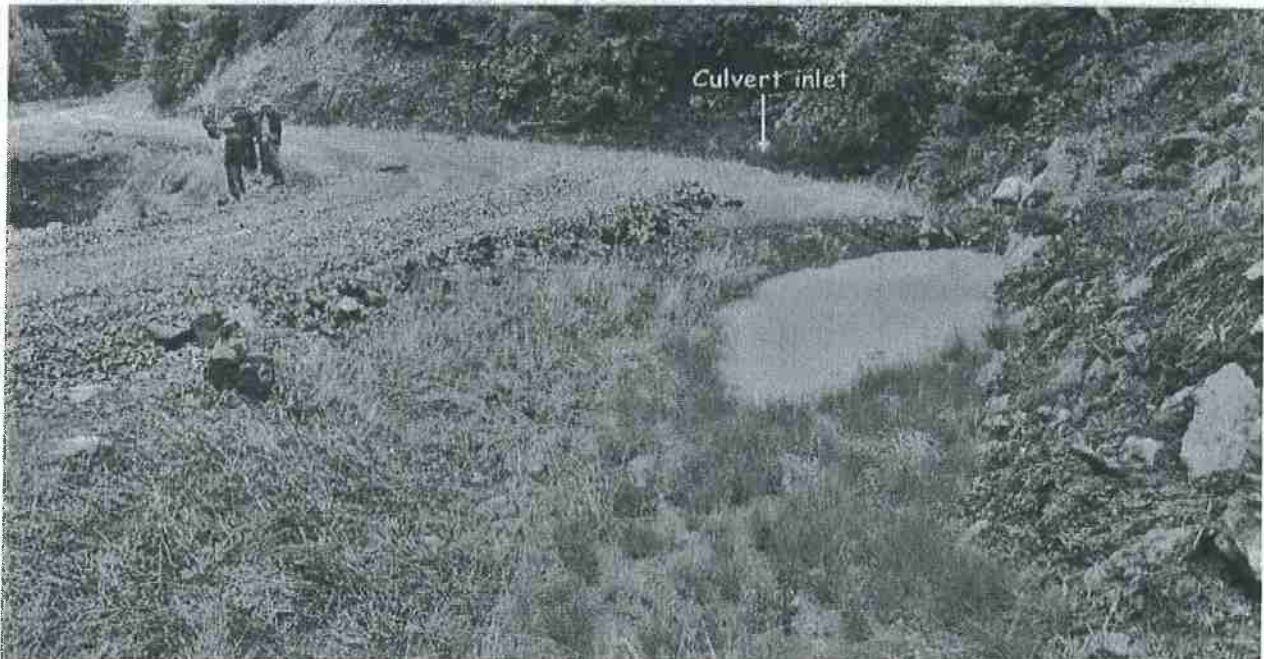
FIGURE 48. The elements of a properly installed ditch relief culvert. The culvert is angled at about 30 degrees to the road alignment to help capture flow and prevent culvert plugging or erosion of the inlet area. It is set at the base of the fill (ideally) or with a grade slightly steeper than the grade 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 39.**

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 this photo, a waterbar and ditch relief culvert are used to drain all road surface and ditch runoff from the insloped road prism.

HANDBOOK FOR FOREST, RANCH AND RURAL ROADS



**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.

HANDBOOK FOR FOREST, RANCH AND RURAL ROADS

### **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 filled with smaller gravels and rocks.

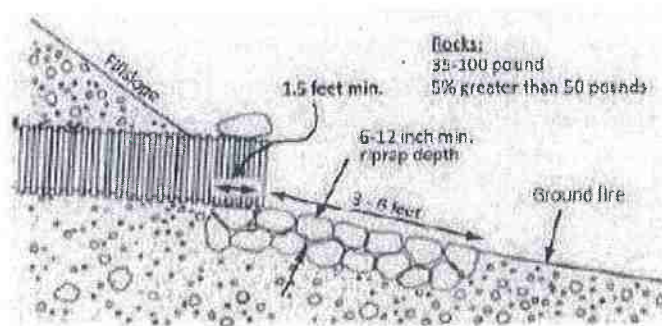


FIGURE 107A. Riprap armor at culvert outlet (Modified from: Keller et al., 2011).

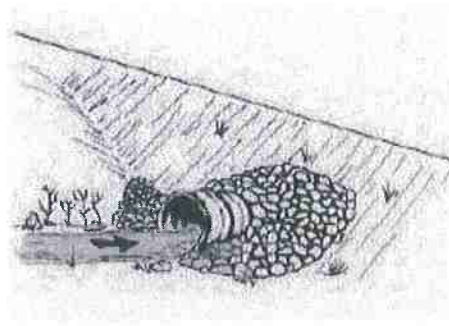


FIGURE 107B. Riprap armor at culvert inlet (Keller and Shear, 2003).

HANDBOOK FOR FOREST, RANCH AND RURAL ROADS