USDA - Natural Resources Conservation Services &
Resource Conservation District of Santa Cruz County

Rural Road Ram Pilot Application

Effectivity of the Rural Road Ram Smartphone Application

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- Pacific Watershed Associates Inc.
- California Department of Parks and Recreation
- Various private land owners of Santa Cruz County

This report represents undergraduate student work conducted during a summer (eight weeks) in an internship.

EXECUTIVE SUMMARY

The project was part of an internship through the Water Resources Experiential Learning for USDA Careers at California State University at San Bernardino.

The Natural Resources Conservation Service (NRCS) of Capitola, California holds an agreement with the Resource Conservation District of Santa Cruz County (RCDSCC) in Capitola, California to share its resources with one another. As an intern under the USDA grant, I shadowed both teams. Though I assisted with various projects such as Distribution Uniformity tests and Conservation Plans, I mainly focused on a pilot program created to measure road conditions throughout Santa Cruz County. The management of road conditions decreases the human-derived sediment run off into streams.

Road culverts help maintain the roads during rainy seasons. The duty of a road culvert is to offer a safe passage for flowing water during rain events. Culverts can clog, collapse, or deteriorate after prolonged exposure to extreme weather conditions. Bridges, water bars, or rolling dips move water when culverts are not a viable solution. The passageway carries road runoff consisting of water and sediment. The monitoring of these passageways is necessary because increased sediment in watershed may affect water quality and its inhabitants.

The Rural Road Ram Application is a standardized and repeatable field observation and data management tool that can assist landowners and road managers to assess and track road condition and determine the urgency of roadway improvements to reduce the road-derived sediment loads reaching local streams. The application for smartphones measured the amount of road run off sediment from culverts using a pre-downloaded map generating real-time coordinates without internet connection. The data collection process increased in speed and required minimal training.

The application automatically calculated a score from one (poor) to five (desired) based on the characteristics of the existing water pathway, stream crossings, erosional features, and ditch relief culverts. It used measurements such as the road drainage length, culvert size, and degree of streams entering the culvert using a measuring tape and wheel. As an intern, I piloted the program measuring 30 miles of roads with culverts throughout Santa Cruz County.

The application effectively calculated the road sediment run off and provided realtime GPS coordinates of any feature. It had one glitch during the pilot program where it did not generate real time GPS coordinates on Android phone platforms, but it was fixed after the pilot. Further usage of the application increases the ease of use and repeatable results of road condition.

The result of this study positively contributes to the use of technology to compute real time results when in the field without network connection.

1 PROJECT OBJECTIVES

The Rural Road Ram Application was created by the RCDSCC with 2ndNature, an environmental consulting firm, through the 319th grant from the State Water Resources Control Board. The grant required the measurement of 50 miles of roads with culverted stream crossings, cross drains, or erosional features. RCDSCC completed around 20 of the miles prior to the beginning of my internship. I was assigned to complete the remaining miles using the Rural Road Ram Booklet (RRR). Another intern was sent to assist with the project a few weeks after I began. We collected data from trails and roads. Some areas had pre-existing measurements conducted by the Pacific Watershed Associates (PWA). Areas with pre-existing measurements compared data sets to ensure the credibility of collected data. Although the project focused on acquiring mileage, it was also essential to take note of the usability of the application. Our second goal was to provide feedback to 2ndNature to improve its user-friendly characteristic.

2 PROJECT APPROACH

The proper measurement of water pathways required a wheel, measuring tape, smartphone, and past measurements if any. Prior to field work, the smartphone application downloaded a general area map of the survey location using WiFi internet connection. Specific coordinates previously mapped by PWA automatically appeared on the map. Unmapped locations had blank maps. Culverts categories consisted of ditch relief culvert (DRC), rolling dip, water bar, bridge, arch, box culver, ford, armored fill, fill, decommissioned crossing, cutbank, and fill slope (p. 5, RRR).

2.1 CULVERTED STREAM CROSSINGS & OTHER STREAM CROSSINGS

The application asked general questions regarding the culvert after it obtained a name. It asked for the culvert shape, culvert size in inches, the material of the culvert. It asked for the road conditions including surface material of the road, traffic usage, and total road length right and left draining into the culvert. It calculated the dimensions of the water flow with the channel slope, channel width, road depth of culvert, and road width. It accounted for the factors, which may affect the productivity of the culvert using the asking for the existence of diversion potential, debris control, and potholes. It inquired about the inlet culvert, fill slope, outlet culvert, and interior culver conditions. It took account for the outlet downspout and potential piping conditions.

Other stream crossings included the crossing type, road drainage length, material of road surface, traffic usage, and the crossing condition. All stream crossings received a score between one (poor) and five (desired). Please refer to pages 8-11 and 24-26 in the Rural Road Ram booklet for the answer selections.

2.2 CROSS DRAINS

Cross drains measured the same characteristics as the culverted stream crossings with the exception of the channel width, channel slope, and road depth of the culvert. Along with the preexisting questions, it calculated scores with the possibility of the connection to a flowing water source, existing gully, erosion width, and erosion length from the outlet. Please refer to pages 19-23 in the Rural Road Ram booklet for the answer selections.

2.3 Erosional Features

Erosional features along the roadways required a name before accepting features. The application asked for the type of erosional feature, the road drainage left and right of the feature, road surface material, and the traffic usage of the road. It also asked for the erosional length and width of the feature. Please refer to pages 28-29 in the Rural Road Ram booklet for the answer selections.

3 Project Outcomes

The smartphone application used to monitor the sediment run off from rural roads was successful in calculating the run off and providing a real time GPS coordinate of the feature without network connection. The majority of the roads with culverts showed an improvement of conditions from previous PWA measurements. The application proved useful and accessible to general usage after a quick workshop. One major flaw, which was fixed after the pilot program, was the supplication and smartphone compatibility. The application did not show real time GPS coordinates when used on an Android platform with or without network connection. The iOS platform did not have the same problem. After fixing the technological glitch, the application significantly improved during the pilot session.

4 Conclusions

The RCDSCC created the Rural Road Ram smartphone application, which generated real time GPS coordinates and calculated the sediment input of culverts. As an intern, I piloted the application for about 30 miles of roads with culverts and made note of further improvements to increase ease of use. Using tools to measure the length of road walked, opening of culverts, and angle of streams entering the culvert, the application conducted repeatable assessments of road conditions in Santa Cruz County. The application also charted the erosional features near a road to account for sediment run off from areas not related to culverts.

Although the application had a glitch and did not generate real time GPS coordinates on Android platforms, the glitch was fixed after the pilot session. Further usage of the application from various users increases the ease of use and proper calculations of road sediment. The application successfully increased the ease of use for untrained individuals to calculate the sediment run off from roadways.

As an intern, I was allowed to work with the RCDSCC and the NRCS teams. Although the project focused on the Rural Road Ram application, I also shadowed Richard Casale. He exposed me to the duties of a District Conservationist, which included the assessment of erosional farmlands and soil reports. We also attended various field visits where clients would explain the current land situation and we provided them with informational resources. It was essential to build a trusting relationship with each client prior to suggesting conservation plans. In any career with the USDA, it would be essential to build a strong relationship with clients to ensure the best possible outcomes.

5 APPENDIX

Attached to remainder of this paper is the Rural Road Ram booklet created to assist with the usage of the smartphone application and explain terminology.

RURAL ROAD RAPID ASSESSMENT METHODOLOGY

(Rural Road RAM)

RURAL ROAD RAM

USER FIELD PROTOCOLS V3.0
December 2016

2NDNATURE
ecosystem science + design

Rural Road Rapid Assessment Methodology (Rural Road RAM)

User Field Protocols v 3.0
December 2016

Developed by:

2NDNATURE
ecosystem science + design

www.2ndnaturellc.com

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Rural Road RAM technical approach and data management platform will continually be improved and maintained to meet the needs of natural resource managers, funders, regulators and the community within the concise mission defined for the tool. There are many individuals and organizations that have provided technical and usability input and 2NDNATURE will continue to solicit users, encourage feedback and incorporate useful and feasible improvements to Rural Road RAM over time.

A special thank you to a few key collaborative partners, Angie Gruys (Santa Cruz RCD) and Bill Birmingham (Napa RCD), who provided invaluable technical insight and feedback throughout the Rural Road RAM development and improvement process. In addition we thank the Pacific Watershed Associates and CDFG 2010 for providing a transparent approach to quantifying the road related sediment impacts on surface waters from which we could effectively learn and leverage.

All functional improvements identified by users are cataloged in a publicly available Google spreadsheet document to all Rural Road RAM users. This list is reviewed and improvements prioritized biannually by 2NDNATURE staff and Rural Road RAM users. 2NDNATURE will continue to iteratively implement the highest priority improvements and the updates will be automatically provided to all registered users. Check back at www.ruralroadram.com to view the current platform and features or contact 2NDNATURE for a demonstration log in.

The Rural Road RAM Field Observation Protocols assumes the RAM user is familiar with the purpose, user work flow and functions of Rural Road RAM. Prior to conducting field observations the user should review the Rural Road RAM Technical Document and interact with the demonstration log in at www.ruralroadram.com. It is recommended that users interested in conducting RAM field observations attend a training by a supporting organization.

OFFICE PREPARATION

Things to bring into the field include:

- Rural Road RAM Field Protocols
- One of the following:
  - Smartphone/Tablet with Rural Road RAM native application (no cell service required)
  - Smartphone/Tablet with cell service, internet browser, GPS mapping software, and camera OR
  - Field datasheet, map of the road network and roads of interest, map of RAM inventoried sites if any exist, mobile device with GPS mapping software or GPS unit, and camera
- Flashlight
- Camera
- Tape measure (recommend Stanley FatMax 100')
- Field notebook and pen / Clipboard
- Safety Vest

RAM ASSESSMENT APPROACH

To the extent possible begin assessments at the top elevation of the road of interest and progress downhill. This allows efficient documentation of road length drainage estimates as you travel the road, locating and assessing sites along the way.

Once a site is located, the site type needs to be identified as the type will dictate the user work flow through the site and the observations made.

This quick field guide includes:

- Obtaining the necessary field data to inventory a site.
- Conducting a RAM field assessment to determine site condition at the time of observation.

There are 3 ways to enter field observations into the Rural Road RAM website (www.ruralroadram.com):

- Enter the field observation data directly into the Rural Road RAM mobile application using a smartphone or tablet where cell service is not available. The Mobile App Quick Start Guide is available under "Downloads".
- Enter the field observation data directly into the Rural Road RAM website using a smartphone or tablet where cell service is available.
- Print a hard copy of the field datasheet and complete it in the field. Return to your office and enter the data into the Rural Road RAM website. Field datasheets are provided for each road site type.

FIELD PERSONNEL SAFETY

Safety is a primary concern for all personnel performing RAM observations. All field personnel should work in pairs and maintain a high level of safety consciousness at all times. Users should not take any chances with their own safety, or that of the public, in order to save time.

Vehicle Safety Reccommendations

- Park vehicle on road shoulder as far away from the travel lane as possible
- When limited shoulder width prohibits pulling the vehicle completely off the roadway, park in a location where the shoulder is wider and walk to the site
- Never park vehicle in the road or in a manner that will obstruct drive lanes

User Safety Reccommendations at Site Inspections

- Always be alert and on guard with traffic
    - Wear a safety vest for visibility
- Maintain vigilance when accessing road site for inspections. Several hazards or obstacles may exist approaching a road site, including:
    - poisonous plants
    - animials or insects
    - uneven ground and or dense vegetation
    - fast moving water
    - slippery uneven surface
- Properly secure field equipment when approaching road site to free hands while walking or climbing
- Use best professional judgment in accessing sites. Never risk your safety in order to inspect a road site

IDENTIFY SITE AND TYPE

What is a road site?

A location where road derived or caused erosion is potentially generated and/or routed from the road to the nearest stream. The sites of highest priority are those that likely deliver sediment to a stream channel during the subsequent runoff event. There are 3 road site types that can inventoried and assessed in Rural Road RAM (Table 1).

Table 1. *Rural Road RAM site types.*

Site Type	Definition
Stream Crossing	A stream crossing is road site where fill has been imported to allow passage over an annual or perennial stream. Structural features such as culverts, bridges, or other features are used to allow drainage to occur, typically beneath the road surface. Stream crossings themselves are susceptible to clogging, damage and other types of failure over time, which can result in large episodic pulses of sediment delivered directly into the stream. Annual chronic sediment generation from the associated road surface and roadside ditch will drain to these sites. These chronic sediment loads can be reduced by properly placing cross drains to hydrologically disconnect excessive lengths of road draining to a stream crossing. Rural Road RAM users make observations to determine the chronic and episodic erosion scores of an inventoried stream crossing.
Cross drain	A cross drain is a feature placed across a road length to reduce the area of road surface draining to specific location. Cross drains are designed to capture and remove surface water from the traveled way or other road surfaces or hydrologically disconnect road-derived drainage to reduce the risk of unpaved road surface and road side ditch erosion. Typical cross drain types are water bars, rolling dips, and ditch relief culverts (DRCs). These types vary in cost, optimal application and lifespan, but all require proper construction and some level of regular inspection and maintenance. RAM condition assessments evaluate the chronic and episodic erosion scores of an inventoried cross drain. Episodic erosion associated with a cross drain will most likely be due to gully development or enlargement at the outlet of the cross drain.
Erosional Feature	An erosional feature is used to document the presence of cutbanks and fillslopes that may be an additional source of episodic sediment should erosion be exacerbated during a subsequent runoff event. The relative magnitude and expected connection to the local stream or drainage are rapidly assessed, along with the chronic sediment loads draining to the site. Should the road surface be the erosional feature, the user should inventory it as a fillslope and add in the notes section that it is actually the surface of the road.

The types of RAM observations and data are determined by the site type and structure. Table 2 lists the structures by Rural Road RAM site type, and photo examples are provided in Figure 1. The two most common site types that have the potential to generate and/or transport sediment from rural roads are culverted stream crossings and cross drains. These two site types are the general focus for rural road improvement programs to implement projects and protect downslope water quality. The 'other' stream crossing structures are included in Rural Road RAM in the instance they are identified in the field and/or a culverted stream crossing is improved by constructing a bridge or decommissioning the crossing. Erosional features are identified in the field where cutbanks or fillslopes are endangering the road or threatening water quality. The Rural Road RAM datasheets follow the color groupings below. The data collection inputs required by the user are unique to the site type and structure.

Table 2. Rural Road RAM site and associated structure types with descriptions. Types are color coded to correspond to the Rural Road RAM field datasheet (Appendix A).

Site Type	Structure	Description
Culverted Stream Crossing	Culvert (round, oval)	Circular, square or oval structures that are placed in the steam channel and have fill material compacted around them.
Cross Drain	Ditch Relief Culvert (DRC)	Circular structure placed under a road to capture and remove surface water from the inboard ditch, cutbank, and insloped road surface. These cross drains often have fill material compacted around them.
	Rolling Dip	Rolling dips are smooth, angled depressions constructed in the roadbed oblique to road alignment, typically with a cross slope 3-5% greater than road grade. Rolling dips are typically used to capture and remove water from the road surface, but can also drain the inboard ditch and cutbank.
	Water Bar	Water bars are shallow, abrupt, excavated troughs constructed at an oblique angle across the road to drain the road surface and cutbank. Water bars are typically used on roads not traveled during saturated conditions.
	Other	Other structures constructed to drain road surface and cutbank may include road shaping such as inslope or outslope, or cross drains along decommissioned roads.
Stream Crossings - Other	Bridge	A bottomless structure that has abutments built on both of the stream banks or uses the natural stream banks as abutments.
	Arch	A bottomless structure that has abutments built down by the active stream channel. The difference from a bridge is that it is usually a continuous arch from the active channel up to its apex.
	Box Culvert	Box structure placed in the stream channel with abutments on both of the stream banks. Unlike circular or oval culverts, compacted fill material is not used.
	Ford	A wet stream crossing designed so that vehicles travel across the stream bed. No material is placed in the channel to accommodate the crossing. Vehicles travel directly on the stream bed.
	Fill	A wet stream crossing designed so the stream flow travels across the road prism and native fill material has been pushed into the channel to provide vehicle access. This definition may also apply to stream crossings where drainage structures have failed or washed out to the point that it is no longer functioning.
	Armored Fill	A wet stream crossing designed so the stream flow travels across the road prism, but the road fill is armored with rock, concrete or other hardened (debris, wood, etc.) non-native materials to prevent erosion of the fill material by the stream flows.
	Decomm-issioned crossing	Stream crossings whose drainage structure and fill materials have been excavated (pulled) from the channel, allowing the stream to flow through the area as it had before the road was constructed. These stream crossings may need to be evaluated to determine if adverse 'adjustments' are occurring at the site and further treatment would be needed to reduce sediment delivery.
Erosional Feature	Cutbank	The upslope side of a hillslope that was excavated to construct the road. The steepness of the cutbank is typically greater than the natural hillslope, resulting in increased erosional rates. The majority of the sediment from a cutbank will most likely accumulate on the road surface, but a portion could be delivered to nearby streams via road surface runoff.
	Fillslope	The downslope side of a hillslope where material has been placed to construct the road. These slopes are typically not engineered nor have been properly compacted during construction and therefore can result in increased erosional rates through gullying or shallow fill failures. Erosion from a fillslope may undercut the road surface and sediment may be transported to nearby streams.

Stream Crossing Types

Photos taken from Weaver et al. (2014). H*andbook for Forest, Ranch, & Rural Roads* or provided by Napa RCD.

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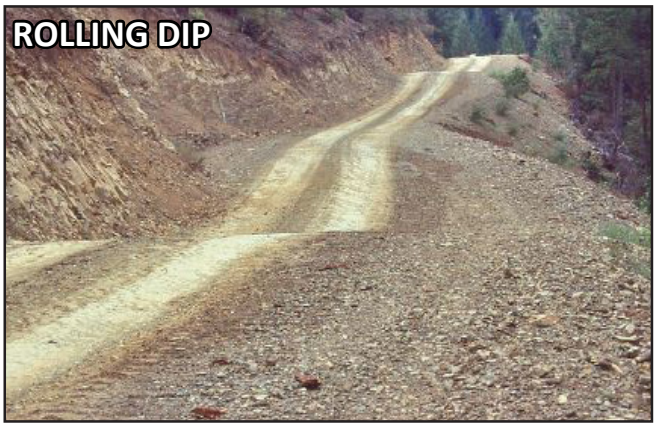
STREAM CROSSING STRUCTURES

FIGURE 1A

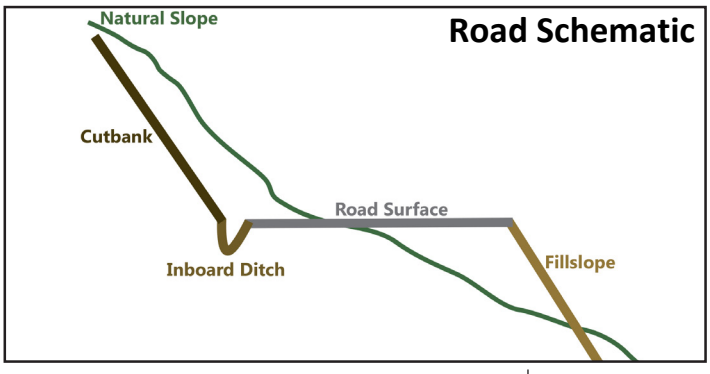
Cross Drain Types



Note: Rolling dips are generally shallower and less abrupt than water bars, allowing traffic to continue at prevailing speeds.

Erosional Feature Types

Photos taken from Weaver et al. (2014). H*andbook for Forest, Ranch, & Rural Roads* or provided by Napa RCD.



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1.1 Culverted STREAM Crossing RAM Field Observation Quick Guide

If using hard copy datasheets (Appendix A), fill out top of sheet network, date, personnel and sheet #.
If using website, fill out date and personnel under GENERAL INFORMATION.

CULVERTED STREAM CROSSINGS				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
GENERAL INFORMATION - Arrive at Culverted Stream Crossing				
Site ID		*n/a*	Name of site where observations are made	Label datasheet with site ID, the same ID that will be used in data entry.
Culvert type	At culvert	*categorical*	Shape of culvert: round, oval or box	**Culvert:** circular culvert **Oval Culvert**
ROAD DRAINAGE - Inspect road drainage to stream crossing				
Road direction ID	ID each road length draining to site	*categorical*	Unique name of each road surface that will drain/route runoff to the site during a storm.	See Figure 2 for guidance on how to complete road drainage observations. Stand on the road at the culverted stream crossing site facing the outlet. Identify each road surface draining to the site (either the inlet or outlet), indicated by location road right (**R1**) or road left (**L1**). There is no limit to the number of road lengths draining to the culverted stream crossing in the database. Complete the road length, surface type and traffic density for each road direction ID. *Note: the database automatically assigns road direction IDs based on direction (right or left) and sequential numbering.*
Road length	Road surfaces draining to site	ft	Distance to the first functional cross drain for each road draining to the site	For each road identified and assigned a road direction ID, document the length of road to the first functional cross drain for each road (R1, L1, R2, etc.). Estimates should be to the closest 50ft. A functioning cross drain is adequately capturing and removing surface water from the travel way. The surface water is not bypassing the cross drain and continuing down. See Figure 2 for guidance.

CULVERTED STREAM CROSSINGS				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
Surface	Road surfaces draining to site	*categorical*	Surface type of each road ID draining to the site	See Figure 2 for guidance. ***P:*** *Paved:* Road surface of respective ID is paved with either asphalt or concrete. If road surface integrity/condition is degraded with high density of pot holes or asphalt loss, user should select "rocked". Paved road surfaces require additional user information indicating presence of a active cutbank and inboard ditches. **Large active cutbanks** - are defined as cutbanks 50 ft or longer, that are composed of coarse material, unvegetated, and appear to contribute sediment downstream. **Active inboard ditches –** are 50ft or more of an unarmored, unvegetated ditch that appear to contribute sediment downstream. User answers yes or no to indicate if either feature is present at the designated road length. ***R****: Rocked:* Majority of road surface of respective ID is rocked or hardened with rocks or pavers. If < 50% of the surface area of the respective ID length is rocked, user should select "native". ***N****: Native:* Majority of road surface of respective ID is native dirt or other material that is not resistant to pulverization by traffic and subsequent erosion.
Traffic	Road surfaces draining to site	*categorical*	Relative traffic density of each road ID draining to the site	See Figure 2 for guidance. ***H:*** *Heavy Year Round:* > 20 car passes per day every day. ***M****: Moderate Year Round:* 5-20 car passes per day every day. ***S****: Seasonal:* Road is not travelled year-round, but there may be daily traffic during drier months. Less than "Moderate Year Round" and more than "Occasional" traffic. **O**: *Occasional:* Very low, infrequent traffic use, including bikes and cars. Not a daily access road any time of year and has minimal to no use during winter wet road conditions.
Road Prism Dimensions – perform measurements to estimate sediment volume at crossing				
Channel slope	Upstream of inlet	°	Average of the natural channel grade	Locate a land surface directly adjacent to the stream that represents the general hillslope. Use inclinometer (available as free mobile app) to measure slope. If inaccessible, estimate average land slope to best of your ability to the nearest 5 degrees. See Figure 3.
Channel width	Upstream of inlet	ft	Average natural channel width	The average channel width is determined by measuring the channel bottom width, the top of bank width and dividing by 2 (W1+W2/2). In smaller stream channels there may be only one width observable. If inaccessible, estimate average channel width to best of your ability to the nearest 0.5 ft. See Figure 3.

CULVERTED STREAM CROSSINGS				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
Road depth	Inlet of culvert	ft	Vertical distance from base of culvert to top of road surface	Use a tape measure and estimate the thickness of the road prism to the nearest 0.5 ft. See Figure 3.
Road width	Road surface above culvert	ft	Width of road sediment prism	Estimate prism sediment width by measuring road width from inlet road shoulder at the outlet road shoulder. When culvert is placed at a skew anlge, make road width measurements at the same skew angle as the pipe. Make measurements to nearest 5 ft, by pacing or using tape measure. See Figure 3.
Culvert Dimensions – record culvert information				
Culvert Shape	Inlet of culvert	*categorical*	Indicate the culvert shape	Specify if the culvert is round or oval. At crossings with multiple barrels, user may input unique information for up to 4 barrells.
Culvert size	Inlet of culvert	in	Indicate the size of the culvert and record the # of barrels (if applicable)	Round: Measure the culvert diameter and record. Oval: Measure and record the span and rise. At crossings with multiple barrels, measure and record information for each barrel (up to 4 can be recorded per crossing)
Material	Inlet of culvert	*categorical*	Construction material of the culvert	If the culvert is made of different materials at inlet and outlet, record the inlet material. **Plastic; Steel; Aluminum; Concrete**

CULVERTED STREAM CROSSINGS				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
Inlet Observations – assess inlet condition				
Diversion potential	At culvert, inspect drainage path from roads and channel	*Yes No*	Visual evidence flows could be diverted past culvert inlet if clogging or other failure occur	**Yes**: If the stream crossing floods or fails at the inlet, water would flow down the road or inboard ditch beyond the stream crossing inlet, causing erosion down the road. Typically sites with only 1 road length draining to them would be YES. **No**: If the stream crossing floods or fails at the inlet, water would flow straight across the road, along the path of the culvert placement and spill back into the same stream channel. Stream crossings located at the local topographic low point, with both a road right and road left draining to them, would be NO.
			Is stream currently diverted?	**Yes**: There is evidence that diversion is currently occurring or has occurred in the past. Diversion would continue to occur unless changes were made to the site. **No**: No evidence of current or past diversion.
Debris control	Inlet of culvert	*categorical*	Presence of *t post* or other structure in flow path upstream of inlet	***None:*** No debris control structure present ***1 stake:*** Single t-post within 3-5 ft of inlet in flow path ***2 stakes:*** Two t-posts within 3-5 ft of inlet in flow path ***Screen:*** Screen, trash rack or other debris capturing device in flow path
Potholes	Road Surface	*Yes No*	Potholes exist on the road surface above road prism	***Yes:*** Potholes exist on the *road surface* ***No:*** Road surface does not have any potholes

CULVERTED STREAM CROSSINGS				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
Inlet culvert condition	Inlet of culvert *Inspect interior of culvert*	*categorical*	Visual estimate of the condition of the inlet of the culvert *Note interior condition and inspect again at outlet before finalizing estimates*	*See Figure 4 for visual examples of multiple choice options.* ***Good****:* None of the below issues observed. Defined as: no visible holes in culvert; if crushed or clogged, capacity loss is < 20%; and no evidence of pipe separation. *Crushed.* Visual estimate of the reduction in the capacity/size of the opening. Indicate the most severe option that applies. ***CRSH 20-50%:*** *Crushed 20-50%:* The surface area of available space for water to enter/exit has been reduced by 20-50% from the original area of the opening. ***CRSH >50%:*** *Crushed >50%:* The surface area of available space for water to enter/exit has been reduced by >50% from the original area of the opening. *Clogged.* Visual estimate of the reduction in the capacity/size of the opening due to debris or sediment accumulation. Indicate the most severe option that applies. ***CLG 20-50%****: Clogged 20-50%:* The surface area of available space for water to enter/exit has been reduced by 20-50% from the original area of the opening. ***CLG 50%:*** *Clogged >50%:* The surface area of available space for water to enter/exit has been reduced by >50% from the original area of the opening. ***Holes 20-50%:*** Evidence of some holes within the culvert material are visible. **Hole >50%:** If the bottom is rusted out or any evidence of substantial holes imparing the barrel. ***Pipe sep:*** *Pipe Separation:* (Interior Only) Visual evidence that the pipe has separated somewhere between the inlet and outlet. Inspection of interior, sink holes atop pipe alignment or evidence of piping at the outlet may all indicate that the pipe has failed internally.
Fillslope condition	Inlet of culvert	*categorical*	Visual estimate of the relative amount of active erosion on the inlet fillslope surface	*See Figure 5 for how to locate inlet/outlet fillslope in the field and visual examples of multiple choice options.* ***PRO/ARM:*** *Protected/Armored:* Fillslope rocked, concrete or other type of surface protection that will minimize erosion of the surface. ***< 10% active:*** Minimal to no active erosion (bare exposed soil) visible. ***10-25% active:*** Some bare soil and active erosion visible but less than 25% of the fillslope surface area. ***>25% active:*** Bare soil and active erosion visible on more than 25% of the fillslope surface.

CULVERTED STREAM CROSSINGS				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
OUTLET OBSERVATIONS – assess outlet and interior condition				
Outlet culvert condition	Outlet of culvert	*categorical*	Visual estimate of the condition of the outlet of the culvert	See culvert condition at inlet above.
Interior culvert condition	Interior of culvert	*categorical*	Visual estimate of the condition of the interior of the culvert	See culvert condition at inlet above. Inspect the interior to the extent possible at outlet and consider interior as observed at both inlet and outlet. If the outlet is inaccessible to view, or there is a downspout extension and the interior cannot be evaluated, select 'good' for condition.
Outlet Down-spout	Outlet of culvert	*Yes No*	Visual observation if there is a downspout at the outlet	***Yes:*** Downspout is attached to the outlet ***No:*** No downspout at outlet
		Yes No	Is downspout accessible for maintenance	***Yes:*** There is a hole, or door on downspout that permits access to clean out debris at the downspout. ***No:*** No access to clean or maintain downspout from clogging
Fillslope condition	Outlet of culvert	*categorical*	Visual estimate of the relative amount of active erosion on the outlet fillslope surface	See fillslope condition at inlet above.
Piping	Outlet of culvert	*Yes No*	Visual evidence that water intended to be routed through culvert is traveling through other subsurface pathways	Inspect soil around and beneath culvert for any evidence of water flow not within the culvert itself directed toward the outlet of the culvert. Inspections can be done at both the inlet and the outlet to determine if water is flowing under road, but not within the culvert.

Quick Guide - Road Drainage Observations

PURPOSE - Quantify and describe all lengths of roads draining to a site (stream crossing, cross drain, or erosional feature).

TIP: To the extent possible begin assessments at the top elevation of the road of interest and progress downhill. This allows efficient documentation of road length drainage estimates as the user travels down the road, locating and assessing sites.

1. Determine number of roads draining to site.

- For stream crossings at topographic lows, there are at least 2 roads. For cross drains & erosional features, there is typically 1 road.
- Additional roads may result from road spurs, intersections, driveways etc.

2. Determine road direction (R or L) by looking downstream (or downslope) from the site towards the fillslope. Number site based on direction and consecutive numbering (R1 -right 1, L1 - left 1, etc).

- There is no limit to the number of road lengths draining to the road site. Note - when recording multiple road lenghts on the mobile app - road number is not listed

3. For each draining road, estimate the length of the road segment draining to the observed site to the nearest 50ft.

- Road length includes topographic road length high to the road site (end road length at site).
- Road lengths that are <50ft, enter the measured length to nearest 10ft.
- Functional cross drains are defined as road features that capture and remove surface water from travel way. Features may include waterbars, rolling dips, and natural drainage breaks.
- Account for crowned road lengths that demonstrate half runoff to road feature and other to sheetflow, by half total road length
- ***TIP: Distances can be estimated using paces. Calibrate your pace so 1 pace = 3 feet by practicing with a measuring tape. Count paces between sites and estimate road length by multiplying paces by 3 to estimate feet.***

4. Record road surface for each road draining to the identified road site.

- Surface types have been grouped in categories, paved (P), rocked (R), and native (N). If road surface is an even mixture of two types, select the worse condition.

  P: Paved: Road surface of respective ID is paved with either asphalt or concrete. If road surface integrity/condition is degraded with high density of pot holes or asphalt loss, user should select “rocked”.

  Cutbank - on paved roads only, the user must indicate if there is a large active cutbank on the road length contributing to the road site. Unvegetated cutbanks, with coarse or fine material that can slough for 50 ft or more is considerered large active cutbank.

  Inboard Ditch - on paved roads only, the user must identify active inboard ditch presensce. Active inboard ditches consist of 50 feet ot more of a ditch that is unvegetated or protected, and shows evidence of moving sedmiment.

  R: Rocked: Majority of road surface of respective ID is rocked or hardened with rocks or pavers. If < 50% of the surface area of the respective ID length is rocked, user should select “native”.

  N: Native: Majority of road surface of respective ID is native dirt or other material that is not resistant to pulverization by traffic and subsequent erosion.

4. Determine traffic density for each road draining to the identified road site. These may need to be estimated in the field and verified with residents at a later time.

- Traffic density is grouped into categories (heavy, moderate, seasonal, and occasional); select traffic type based on best professional judgment.

  H: Heavy Year Round: > 20 car passes per day every day.

  M: Moderate Year Round: 5-20 car passes per day every day.

  S: Seasonal: Road is not travelled year round, but there may be daily traffic during drier months.

  O: Occasional: Very low, infrequent traffic use, including bikes and cars. Not a daily access road any time of year and has minimal to no use during winter wet road conditions.

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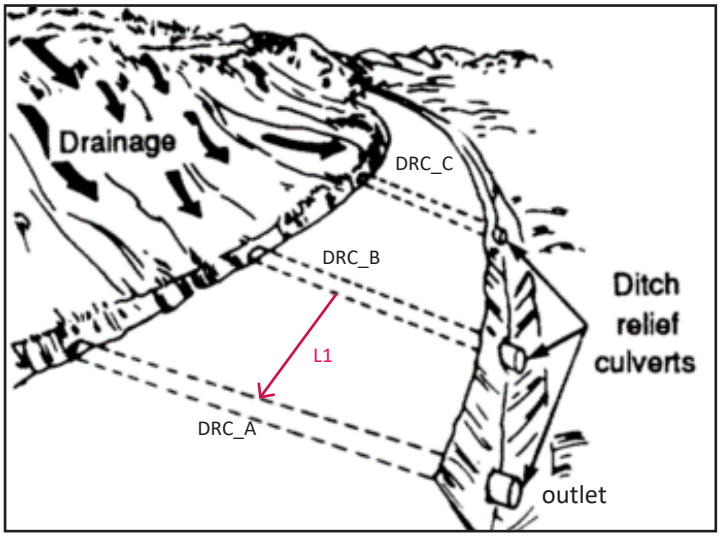
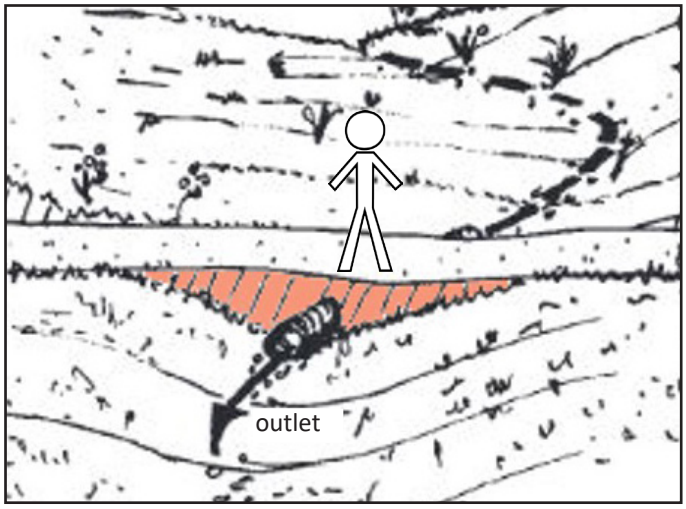
Quick Guide - Road Drainage Observations



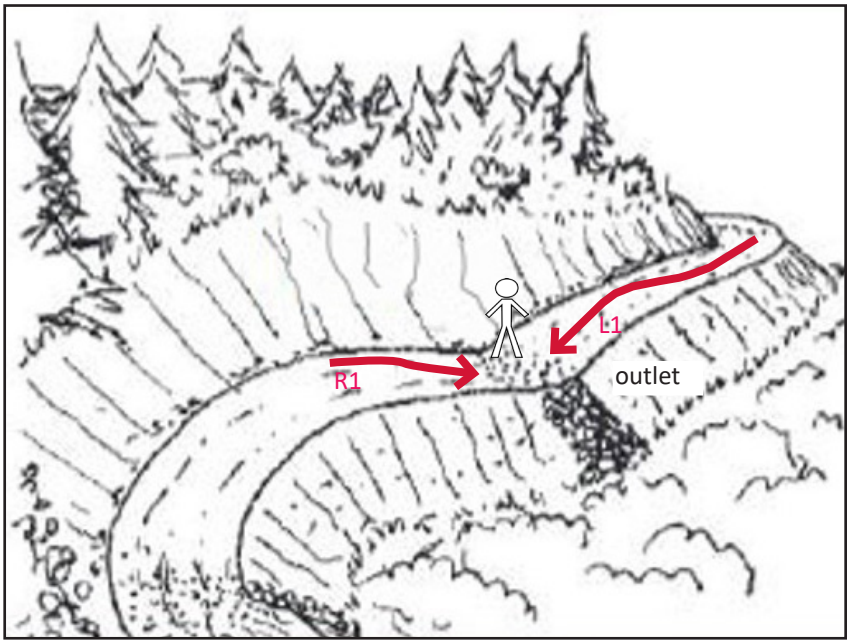
Measure road lengths between functional cross drains

Schematic demonstrates ditch relief culverts capturing surface water and removing it from the drive lane. Road length measurments include all road lengths draining to road feature between functional cross drains. In this example 1 road length (left 1) drains between DRC_A and DRC_B



Determine Road Direction

Stand on road and face outlet direction. Determine left and right roads when oriented in this position for stream crossings and crossdrains. Similarly, at erosional features, orient direction by facing the fillslope to determine road left and right.



Road Drainage Example

Stand at road feature and face outlet.

Designate the topographic high from road left and right. In this example there are 2 road lengths draining to feature. Users will identify sites that may have only 1 road length, and others may have >2 road lengths.

Pace and estimate in feet all road lengths draining to road site.

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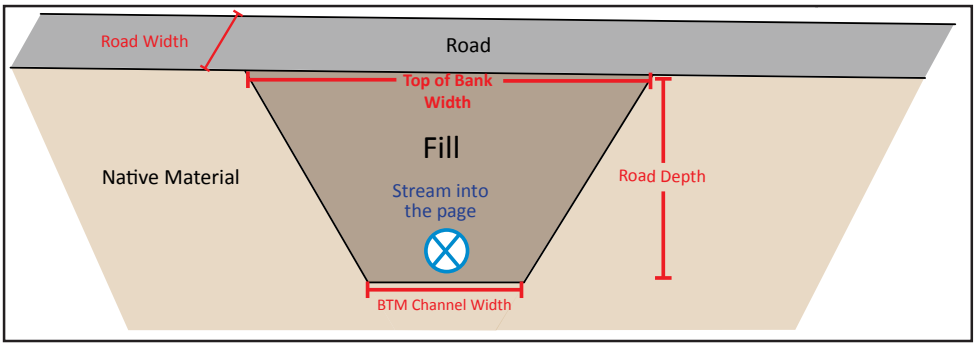
Quick Guide - Road Dimension Observations

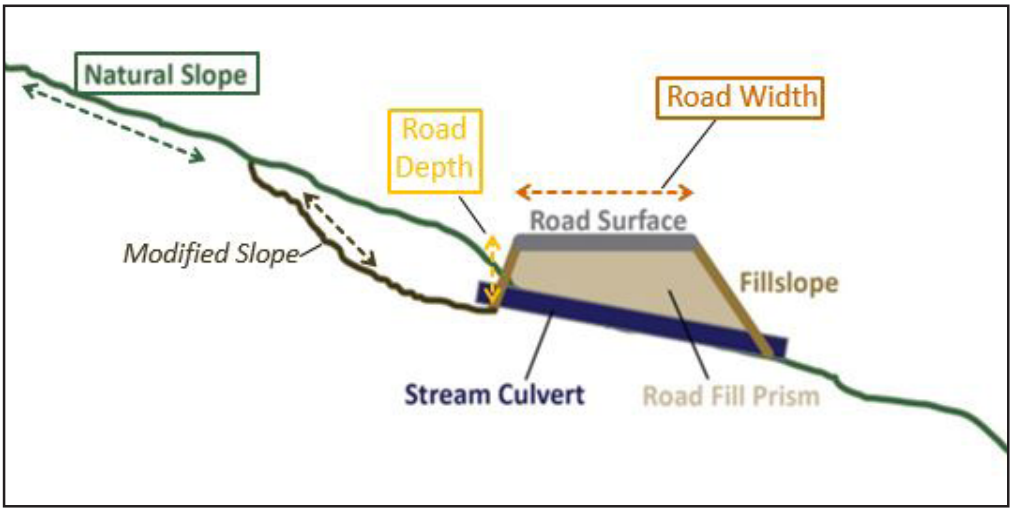
PURPOSE - Quantify the volume of material used to create the road fill prism at a culverted stream crossing.

Road Fill Prism

Native material (tan) is excavated to place culvert (blue) and non-native fill material (dark brown) is placed around culvert to create flat surface to construct road (grey).



TIP: To construct a culverted stream crossing, the native channel is typically excavated to place the culvert and then material is placed around the culvert to fill in the space and create a relatively flat surface for the road. See diagram below.



1. Determine channel slope. Walk upstream of the stream crossing. Locate surface directly adjacent to the stream that represents the surface slope to estimate channel slope to the nearest 5 degrees.

- ***TIP: Download the free inclinometer application 'tiltmeter' for iOs or 'clinometer' for android. Place smartphone on a representative surface to accurately measure slope.***

2. Estimate channel width. Face stream crossing while standing in channel upstream of site. Measure bottom channel width (W1) and top of bank width (W2) (see diagram above) and determine average width by (W1+W2)/2.

- If channel is inaccessible, estimate average channel width to best of your ability to the nearest 0.5ft. Field personnel safety is of utmost importance, so take care on steep, slippery slopes and avoid harmful vegetation (poison oak, stinging nettle, etc.).

3. Estimate road depth. Face stream crossing while standing in channel upstream of site. Measure the vertical distance from the base of culvert to top of road surface (see diagram) to the nearest 0.5ft.

- If channel is inaccessible, estimate road depth to best of your ability to the nearest 0.5ft. Field personnel safety is of utmost importance, so take care on steep, slippery slopes and avoid harmful vegetation (poison oak, stinging nettle, etc.).

4. Estimate road width. Walk to road surface at the site. Measure road width (see diagram) from shoulder inlet to shoulder outlet using a tape measure or paces to the nearest 5ft.

- If the road width varies greatly across the site, measure the shortest and longest distance and calculate the average.

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Quick Guide - Culvert Condition Observations

PURPOSE - Evaluate the ability of the culvert at stream crossings or cross drains to transport water efficiently.

1. Observations are made at the inlet and the outlet to determine the culvert condition at the inlet, outlet and in the interior. Walk into channel directly above and below site and face culvert.

- If channel is inaccessible, estimate fill slope condition from the road surface or adjacent hillslope. Field personnel safety is of utmost importance, so take care on steep, slippery slopes and avoid harmful vegetation (poison oak, stinging nettle, etc.).
- ***TIP: Use a flashlight tool from your smartphone to inspect the interior of the culvert. Using a flashlight is a quick way to identify if any holes or pipe separation exist within the interior.***

2. Make visual estimates of the culvert condition based on categories provided. You may select as many options as apply.

- If you are unsure on the category, select the more severe of the options.

Good: None of the below issues observed: no visible holes in culvert; if crushed or clogged, capacity loss is < 20%; and pipe is intact.

Pipe sep: Pipe Separation: (Interior Only) Visual evidence that the pipe has separated somewhere between the inlet and outlet. Inspection of interior, sink holes atop pipe alignment or evidence of piping at the outlet may all indicate that the pipe has failed internally.

Holes. Visual estimate of holes on the surface area.

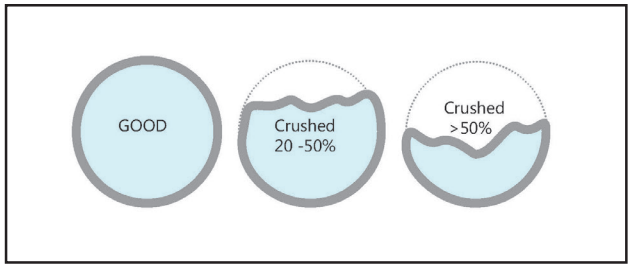
Holes 20-50%: Holes are visible over 20-50% of the culvert's surface area.

Holes >50%: Crushed >50%: Holes exist over >50 % of the culvert's surface area- example a rusted out bottom.

Crushed. Visual estimate of the reduction in the capacity/size of the opening relative to the original area of the opening.

CRSH 20-50%: Crushed 20-50%: The available surface area for water to enter/exit has been reduced by 20-50% .

CRSH >50%: Crushed >50%: The available surface area for water to enter/exit has been reduced by >50%.



Examples of crushed culverts

Clogged. Visual estimate of the reduction in the capacity/size of the opening relative to the original area of the opening due to debris or sediment accumulation.

CLG 20-50%: Clogged 20-50%: The surface area of available space for water to enter/exit has been reduced by 20-50% .

CLG 50%: Clogged >50%: The surface area of available space for water to enter/exit has been reduced by >50%.

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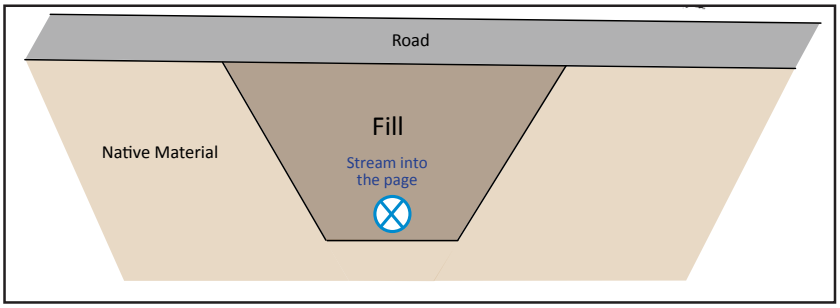
Quick Guide - Fillslope Condition Observations

PURPOSE - Evaluate the condition of the fillslope at the inlet and outlet of a culverted stream crossing to determine if flow is being properly routed through the site.

Road Fill

Native material (tan) is excavated to place culvert (blue) and non-native fill material (dark brown) is placed around culvert to create flat surface to construct road (grey).



TIP: To construct a culverted stream crossing, the native channel is typically excavated to place the culvert and then material is placed around the culvert to fill in the space and create a relatively flat surface for the road. See diagram above.

TIP: When making fillslope visual estimates at the culvert it is helpful to visualize the road fill as a 2 dimensional surface as shown in the diagram above.

1. Observations are made at both the inlet and outlet. Walk into channel directly above and below site and face culvert.
   - If channel is inaccessible, estimate fillslope condition from the road surface or adjacent hillslope. Field personnel safety is of utmost importance, so take care on steep, slippery slopes and avoid harmful vegetation (poison oak, stinging nettle, etc.).
2. Make visual estimates on the active erosion of the fillslope based on categories provided.
   - If you are unsure on the category, select the more severe of the options.
   - ***TIPS: Active erosion vs. previous erosion scars can be difficult to discern in the field. Inlet fillslope erosion typically occurs near the culvert, as a result of flow in the channel being redirected away from the culvert and hitting directly into the fillslope. Outlet fillslope often erodes as a result of sheet flow over the road surface, and can be seen on the fill surface above the culvert.***

     Pro/Arm: Protected or armored: fillslope is rocked, hardened or well-vegetated to protect surface and minimize erosion to fillslope surface.

     <10% active: minimal to no active erosion or bare soil visible.

     10-25% active: some bare soil and active erosion visible but less than 25% of the fillslope surface area

     >25% active: bare soil and active erosion visible on more than 25% of the fill slope surface area

Fillslope erosion at the outlet due to sheet flow over the road surface

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1.2 Cross Drain RAM Field Observation Quick Guide

If using hard copy datasheets, fill out top of sheet network, date, personnel and sheet #.
If using website, fill out date and personnel under GENERAL INFORMATION.
All observations are conducted for ditch relief culverts. Shaded observation fields are not completed for water bars, rolling dips or other cross drains.

CROSS DRAINS				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
GENERAL INFORMATION & ROAD DRAINAGE - Arrive at Cross Drain.				
Site ID		*n/a*	Name of site where observations are made	Label datasheet with site ID, the same ID that will be used in data entry.
Cross drain type		*categorical*	Type of cross drain	**Ditch Relief Culvert:** For DRC cross drains, more information and data collection is required. Populate ALL fields for DRC cross drain observations. **Water Bar:** DO NOT populate fields shaded in green. **Rolling Dip:** DO NOT populate fields shaded in green. **Other:** DO NOT populate fields shaded in green.
Road direction ID	ID each road length draining to site	*categorical*	Assign each road surface that will drain/route runoff to the site during storm	See Figure 2 for guidance on how to complete road drainage observations. Stand on the road at the cross drain look toward outlet or in the direction water is conveyed to outlet. Identify each road surface draining to the site, indicated by location road right (**R1**) or road left (**L1**). There is no limit to the number of road lengths draining to the cross drain in the database. Complete the road length, surface type and traffic density for each road direction ID. *Note: the database automatically assigns road direction IDs based on direction (right or left) and sequential numbering.*
Road length	Road surfaces draining to site	ft	Distance to the first functional cross drain for each road draining to the site	For each road identified and assigned a road direction ID, document the length of road to the first functional cross drain for each road (R1, L1, R2, etc.). Estimates should be to the closest 50ft. A functioning cross drain is adequately capturing and removing surface water from the travel way. The surface water is not bypassing the cross drain and continuing down the road to the site. If a ditch relief culvert, the inlet is not clogged. See Figure 2 for guidance.

CROSS DRAINS				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
Surface	Road surfaces draining to SITE	*categorical*	Surface type of each road ID draining to the site	*See Figure 2 for guidance.* ***P:*** *Paved:* Road surface of respective ID is paved with either asphalt or concrete. If road surface integrity/condition is degraded with high density of pot holes or asphalt loss, user should select "rocked". Paved road surfaces require additional user information indicating presence of a active cutbank and inboard ditches. **Large active cutbanks** - are defined as cutbanks 50 ft or longer, that are composed of coarse material, unvegetated, and appear to contribute sediment downstream. **Active inboard ditches –** are 50ft or more of an unarmored, unvegetated ditch that appear to contribute sediment downstream. User answers yes or no to indicate if either feature is present at the designated road length. ***R****: Rocked:* Majority of road surface of respective ID is rocked or hardened with rocks or pavers. If < 50% of the surface area of the respective ID length is rocked, user should select "native". ***N****: Native:* Majority of road surface of respective ID is native dirt or other material that is not resistant to pulverization by traffic and subsequent erosion.
Traffic	Road surfaces draining to site	*categorical*	Relative traffic density of each road ID draining to the site	See Figure 2 for guidance. ***H:*** *Heavy Year Round:* > 20 car passes per day every day. ***M****: Moderate Year Round:* 5-20 car passes per day every day. ***S****: Seasonal:* Road is not travelled year-round, but there may be daily traffic during drier months. Less than "Moderate Year Round" and more than "Occasional" traffic. **O**: *Occasional:* Very low, infrequent traffic use, including bikes and cars. Not a daily access road any time of year and has minimal to no use during winter wet road conditions.
Culvert Dimensions – record culvert information				
Culvert Shape	Inlet of culvert	*categorical*	Indicate the culvert shape	Specify if the culvert is round or oval. At DRCs with multiple barrels, user may input unique information for up to 4 barrells.

CROSS DRAINS				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
Culvert size	Inlet of culvert	in	Indicate the size of the culvert	Round: Measure the culvert diameter and record. Oval: Measure and record the span and rise. At crossings with multiple barrels, measure and record information for each barrel (up to 4 can be recorded per crossing)
Material	Inlet of culvert	*categorical*	Indicate the construction material of the culvert	If the culvert is made of different materials at inlet and outlet, record the inlet material. **Plastic; Steel; Aluminum; Concrete**
Inlet Observations – assess inlet condition				
Potholes	Road Surface	*Yes* *No*	Potholes exist on the road surface above road prism	***Yes:*** Potholes exist on the *road surface* ***No:*** Road surface does not have any potholes
Inlet culvert condition	Inlet of culvert *Inspect interior of culvert*	*categorical*	Visual estimate of the condition of the inlet of the culvert *Note interior condition and inspect again at outlet before finalizing estimates*	*See Figure 4 for visual examples of multiple choice options.* ***Good****:* None of the below issues observed. Defined as: no visible holes in culvert; if crushed or clogged, capacity loss is < 20%; and no evidence of pipe separation. *Crushed.* Visual estimate of the reduction in the capacity/size of the opening. Indicate the most severe option that applies. ***CRSH 20-50%:*** *Crushed 20-50%:* The surface area of available space for water to enter/exit has been reduced by 20-50% from the original area of the opening. ***CRSH >50%:*** *Crushed >50%:* The surface area of available space for water to enter/exit has been reduced by >50% from the original area of the opening. *Clogged.* Visual estimate of the reduction in the capacity/size of the opening due to debris or sediment accumulation. Indicate the most severe option that applies. ***CLG 20-50%****: Clogged 20-50%:* The surface area of available space for water to enter/exit has been reduced by 20-50% from the original area of the opening. ***CLG 50%:*** *Clogged >50%:* The surface area of available space for water to enter/exit has been reduced by >50% from the original area of the opening. ***Holes 20-50%:*** Evidence of some holes within the culvert material are visible. **Hole >50%:** If the bottom is rusted out or any evidence of substantial holes imparing the barrel. ***Pipe sep:*** *Pipe Separation:* (Interior Only) Visual evidence that the pipe has separated somewhere between the inlet and outlet. Inspection of interior, sink holes atop pipe

CROSS DRAINS				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
				alignment or evidence of piping at the outlet may all indicate that the pipe has failed internally.
OUTLET OBSERVATIONS				
Outlet culvert condition	Outlet of culvert	*categorical*	Visual estimate of the condition of the outlet of the culvert	See culvert condition at inlet above.
Inlet culvert condition	Interior of culvert	*categorical*	Visual estimate of the condition of the interior of the culvert	See culvert condition at inlet above. Inspect the interior to the extent possible at outlet and consider interior as observed at both inlet and outlet.
Outlet Down-spout	Outlet of culvert	*Yes No*	Visual observation if there is a downspout at the outlet	***Yes:*** Downspout is attached to the outlet ***No:*** No downspout at outlet
		Yes No	Is downspout accessible for maintenance	***Yes:*** There is a hole, or door on downspout that permits access to clean out debris at the downspout. ***No:*** No access to clean or maintain downspout from clogging
Piping	Outlet of culvert	*Yes No*	Visual evidence that water intended to be routed through culvert is traveling through other subsurface pathways	Inspect soil around and beneath culvert for any evidence of water flow not within the culvert itself directed toward the outlet of the culvert. Inspections can be done at both the inlet and the outlet to determine if water is flowing under road, but not within the culvert.

CROSS DRAINS				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
Hydro connect?	Flows discharged from cross drain	*Yes No*	Hydrologically connected? Visual evidence that some fraction of the water that exits the cross drain will reach the closest stream or drainage channel	The outlets of a cross drain may not be hydrologically connected over the range of flows exiting the cross drain. This can be determined by inspecting the path water would be expected to take and identify if there is any visible channel, gully, flow path or other evidence that the water discharged from the outlet of the cross drain ever reaches the nearest surface water stream. Evidence of active erosion, bare soil or channel formation indicates **YES** the site is hydrologically connected. No visible evidence of a flow path indicates the site is not hydrologically connected.
Gully presence	Outlet of cross drain	*Yes No*	Visual evidence that active erosion is present where the cross drain volumes discharge.	The volumes discharged from a cross drain may cause the formation of a gully. **YES** suggests the presence of visible exposed soil that may continue to erode and transport sediment downslope during subsequent runoff events. Often it can be difficult to determine active versus past erosion in the field. If you are unsure, select yes.
Active erosion width	Outlet of cross drain	*categorical*	Maximum width of gully	**If a gully is present** at outlet, user estimates the maximum width and length of the actively erodible surface using 4 discrete categories for each. Typically direct measurement is unsafe so users should estimate to the best of their ability from a safe location away from the unstable surface. If the user is unsure of the width/length select the larger value of the options.
Active erosion length	Outlet of cross drain	*categorical*	Maximum length of gully	

1.3 Other Stream Crossings RAM Field Observation Quick Guide

If using hard copy datasheets, fill out top of sheet network, date, personnel and sheet #.
If using website, fill out date and personnel under GENERAL INFORMATION.

OTHER STREAM CROSSINGS (NON CULVERTED)				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
Arrive at Stream Crossing. (GENERAL INFORMATION)				
Site ID			Name of site where observations are made	Label datasheet with site ID.
Crossing Type	Entire crossing	*catgorical*	Structure type	The following crossing types require additional information. **Bridge or Arch or Box Culvert**: Estimate the width and height of the area where the water flows through to the nearest 5 ft. Enter width and height information in the fields labeled “Width” and “Length” under structure observations. **Armored fill**: For armored fill crossing types select the type of fill material used to armor the crossing, gravel, cobble or debris. **Ford** **Fill** **Decom Crossing:** Decomissioned crossing
ROAD DRAINAGE				
Road direction ID	ID each road length draining to site	*categorical*	Unique name of each road surface that will drain/route runoff to the site during a storm.	See Figure 2 for guidance on how to complete road drainage observations. Stand on the road at the erosional feature and face the fillslope. Identify each road surface draining to the site, indicated by location road right (**R1**) or road left (**L1**). There is no limit to the number of road lengths draining to the stream crossing in the database. Complete the road length, surface type and traffic density for each road direction ID. *Note: the database automatically assigns road direction IDs based on direction (right or left) and sequential numbering.*

OTHER STREAM CROSSINGS (NON CULVERTED)				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
Road length	Road surfaces draining to site	ft	Distance to the first functional cross drain for each road draining to the site	For each road identified and assigned a road direction ID, document the length of road to the first functional cross drain for each road (R1, L1, R2, etc.). Estimates should be to the closest 50ft. A functioning cross drain is adequately capturing and removing surface water from the travel way. The surface water is not bypassing the cross drain and continuing down the road to the stream crossing. If a ditch relief culvert, the inlet is not clogged. See Figure 2 for guidance.
Surface	Road surfaces draining to site	*categorical*	Surface type of each road ID draining to the site	See Figure 2 for guidance. ***P:*** *Paved:* Road surface of respective ID is paved with either asphalt or concrete. If road surface integrity/condition is degraded with high density of pot holes or asphalt loss, user should select "rocked". Paved road surfaces require additional user information indicating presence of a active cutbank and inboard ditches. **Large active cutbanks** - are defined as cutbanks 50 ft or longer, that are composed of coarse material, unvegetated, and appear to contribute sediment downstream. **Active inboard ditches –** are 50ft or more of an unarmored, unvegetated ditch that appear to contribute sediment downstream. User answers yes or no to indicate if either feature is present at the designated road length. ***R****: Rocked:* Majority of road surface of respective ID is rocked or hardened with rocks or pavers. If < 50% of the surface area of the respective ID length is rocked, user should select "native". ***N****: Native:* Majority of road surface of respective ID is native dirt or other material that is not resistant to pulverization by traffic and subsequent erosion.
Traffic	Road surfaces draining to site	*categorical*	Relative traffic density of each road ID draining to the site	See Figure 2 for guidance. ***H:*** *Heavy Year Round:* > 20 car passes per day every day. ***M****: Moderate Year Round:* 5-20 car passes per day every day. ***S****: Seasonal:* Road is not travelled year-round, but there may be daily traffic during drier months. Less than "Moderate Year Round" and more than "Occasional" traffic. **O**: *Occasional:* Very low, infrequent traffic use, including bikes and cars. Not a daily access road any time of year and has minimal to no use during winter wet road conditions.

OTHER STREAM CROSSINGS (NON CULVERTED)				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
CROSSING CONDITION - Inspect the channel bed and banks upstream, downstream and within the stream crossing				
Xing Condition	Entire stream crossing	*categorical*	Qualitative determination of stream crossing condition	User assigns a 1-5 condition score to the stream crossing based on the qualitative descriptions in Table 3 and best professional judgment.

***Table 3**. Qualitative condition scores for other stream crossings (non culverted).*

SCORE	CONDITION	DESCRIPTION
1	POOR	Visual and convincing evidence of elevated active erosional surfaces (> 50%) either upstream, downstream or within the stream crossing itself. Significant concern that elevated flow conditions will continue to exacerbate erosional severity and contribute episodic sediment pulses directly into stream. The stability of the stream crossing during elevated flow conditions appears threatened due to constriction and/or misdirection of the flow within the stream crossing.
2	DEGRADED	Visual and convincing evidence of substantial (> 30%) active erosional surfaces either upstream, downstream or within stream crossing itself. Reasonable concern that elevated flow conditions will continue to exacerbate erosional severity and contribute episodic sediment pulses directly into stream. The stability of the stream crossing during elevated flow conditions may be threatened due to constriction and/or misdirection of the flow within the stream crossing.
3	FAIR	Visual and convincing evidence of some (<30%) active erosional surfaces either upstream, downstream or within stream crossing itself. Some concern that elevated flow conditions could continue to exacerbate severity and distribution of erosion observed.
4	ACCEPTABLE	Trace amounts of active erosion either upstream or downstream of the stream crossing, or within the stream crossing itself. It is questionable whether the site is actively eroding. The stream crossing appears relatively stable and elevated flows appear to be able to pass the stream crossing unimpeded.
5	DESIRED	No visual evidence of active erosion upstream or downstream of the stream crossing. The stream crossing appears stable and elevated flows appear to be able to pass the stream crossing unimpeded.

1.4 Erosional Feature RAM Field Observation Quick Guide

If using hard copy datasheets, fill out top of sheet network, date, personnel and sheet #. If using website, fill out date and personnel under GENERAL INFORMATION.

EROSIONAL FEATURE				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
Arrive at Erosional Feature. (GENERAL INFORMATION & DOWNSLOPE OBSERVATIONS)				
Site ID			Name of site where observations are made	Label datasheet with site ID.
Erosional feature type		*categorical*	Type of erosional feature	**Cutbank:** Upslope of the road **Fillslope:** Downslope of the road
Road direction ID	ID each road length draining to site	*categorical*	Unique name of each road surface that will drain/route runoff to the site during a storm.	See Figure 2 for guidance on how to complete road drainage observations. Stand on the road at the erosional feature facing the fillslope (downhill) direction. Identify each road surface draining to the site, indicated by location road right (**R1**) or road left (**L1**). There is no limit to the number of road lengths draining to the stream crossing in the database. Complete the road length, surface type and traffic density for each road direction ID. *Note: the database automatically assigns road direction IDs based on direction (right or left) and sequential numbering.*
Road length	Road surfaces draining to site	ft	Distance to the first functional cross drain for each road draining to the site	For each road identified and assigned a road direction ID, document the length of road to the first functional cross drain for each road (R1, L1, R2, etc.). Estimates should be to the closest 50ft. A functioning cross drain is adequately capturing and removing surface water from the travel way. The surface water is not bypassing the cross drain and continuing down the road to the stream crossing. If a ditch relief culvert, the inlet is not clogged. See Figure 2 for guidance.

EROSIONAL FEATURE				
OBS	**LOCATION OF OBS**	**UNIT**	**DESCRIPTION**	**PROTOCOL**
Surface	Road surfaces draining to site	*categorical*	Surface type of each road ID draining to the site	*See Figure 2 for guidance.* ***P:*** *Paved:* Road surface of respective ID is paved with either asphalt or concrete. If road surface integrity/condition is degraded with high density of pot holes or asphalt loss, user should select "rocked". Paved road surfaces require additional user information indicating presence of a active cutbank and inboard ditches. **Large active cutbanks** - are defined as cutbanks 50 ft or longer, that are composed of coarse material, unvegetated, and appear to contribute sediment downstream. **Active inboard ditches –** are 50ft or more of an unarmored, unvegetated ditch that appear to contribute sediment downstream. User answers yes or no to indicate if either feature is present at the designated road length. ***R****: Rocked:* Majority of road surface of respective ID is rocked or hardened with rocks or pavers. If < 50% of the surface area of the respective ID length is rocked, user should select "native". ***N****: Native:* Majority of road surface of respective ID is native dirt or other material that is not resistant to pulverization by traffic and subsequent erosion.
Traffic	Road surfaces draining to site	*categorical*	Relative traffic density of each road ID draining to the site	*See Figure 2 for guidance.* ***H:*** *Heavy Year Round:* > 20 car passes per day every day. ***M****: Moderate Year Round:* 5-20 car passes per day every day. ***S****: Seasonal:* Less than "Moderate Year Round" and more than "Occasional" traffic. **O**: *Occasional:* Infrequent traffic use, including bikes and cars. Not a daily access road any time of year and has minimal to no use during winter wet road conditions.
Active erosion width	Surface of erosional feature	*categorical*	Estimated maximum width of active erosion scar	Estimate the maximum width and length of the actively erodible surface using 4 discrete categories for each. Typically direct measurement is unsafe so users should estimate to the best of their ability from a safe location away from the unstable surface. If the user is unsure of the width/length select the larger value of the options.
Active erosion length	Outlet of cross drain	*categorical*	Maximum length of active erosion scar	

APPENDIX A: RURAL ROAD RAM FIELD DATASHEETS

RURAL ROAD RAM FIELD DATA SHEET

CULVERTED STREAM CROSSINGS

Road Network: **Personnel:** **Date:**

GENERAL	Road Drainage					Road Prism		Culvert Dimensions				Inlet Observations					Outlet Observations				
Site ID	**Road Direction ID**	**Road Length (ft)**	**Surface** *P = Paved R = Rocked N = Native*	**Paved Rds** *CB=cutbank ID =inboard ditch*	**Traffic** *H =Heavy M=Moderate S=Seasonal O=Occasional*	**Road Prism Dimensions** *(degrees / feet)*		**Shape** *Rd= Round Ov = Oval*	**Culvert Size** *Diam (in) Span (in)*	**Culvert Size** *Diam (in) Rise (in)*	**Material** *Pl =plastic St =Steel Al =Aluminum Co =Concrete*	**Diversion Potential**	**Debris Control**	**Inlet Culvert Condition**	**Potholes**	**Fillslope condition**	**Outlet Culvert Condition**	**Interior Culvert Condition**	**Outlet Down-spout**	**Fillslope condition**	**Piping**
	R1		P R N	CB ID	H M S O	Chan Slope		Rd Ov			Pl St Al Co	**Potential** Y N	None 1 stake 2 stakes Screen	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Yes	PRO/ARM < 10 % active 10-25% active > 25% active	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50% Pipe sep.	Present? Y N	PRO/ARM < 10 % active 10-25% active > 25% active	Yes
	L1		P R N	CB ID	H M S O	Chan Width		Rd Ov			Pl St Al Co										
	R2		P R N	CB ID	H M S O	Rd Depth		Rd Ov			Pl St Al Co	**Curr Evid** Y N			No				Access? Y N		NO
	L2		P R N	CB ID	H M S O	Rd Width		Rd Ov			Pl St Al Co										
	R1		P R N	CB ID	H M S O	Chan Slope		Rd Ov			Pl St Al Co	**Potential** Y N	None 1 stake 2 stakes Screen	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Yes	PRO/ARM < 10 % active 10-25% active > 25% active	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50% Pipe sep.	Present? Y N	PRO/ARM < 10 % active 10-25% active > 25% active	Yes
	L1		P R N	CB ID	H M S O	Chan Width		Rd Ov			Pl St Al Co										
	R2		P R N	CB ID	H M S O	Rd Depth		Rd Ov			Pl St Al Co	**Curr Evid** Y N			No				Access? Y N		NO
	L2		P R N	CB ID	H M S O	Rd Width		Rd Ov			Pl St Al Co										
	R1		P R N	CB ID	H M S O	Chan Slope		Rd Ov			Pl St Al Co	**Potential** Y N	None 1 stake 2 stakes Screen	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Yes	PRO/ARM < 10 % active 10-25% active > 25% active	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50% Pipe sep.	Present? Y N	PRO/ARM < 10 % active 10-25% active > 25% active	Yes
	L1		P R N	CB ID	H M S O	Chan Width		Rd Ov			Pl St Al Co										
	R2		P R N	CB ID	H M S O	Rd Depth		Rd Ov			Pl St Al Co	**Curr Evid** Y N			No				Access? Y N		NO
	L2		P R N	CB ID	H M S O	Rd Width		Rd Ov			Pl St Al Co										
	R1		P R N	CB ID	H M S O	Chan Slope		Rd Ov			Pl St Al Co	**Potential** Y N	None 1 stake 2 stakes Screen	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Yes	PRO/ARM < 10 % active 10-25% active > 25% active	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50% Pipe sep.	Present? Y N	PRO/ARM < 10 % active 10-25% active > 25% active	Yes
	L1		P R N	CB ID	H M S O	Chan Width		Rd Ov			Pl St Al Co										
	R2		P R N	CB ID	H M S O	Rd Depth		Rd Ov			Pl St Al Co	**Curr Evid** Y N			No				Access? Y N		NO
	L2		P R N	CB ID	H M S O	Rd Width		Rd Ov			Pl St Al Co										
	R1		P R N	CB ID	H M S O	Chan Slope		Rd Ov			Pl St Al Co	**Potential** Y N	None 1 stake 2 stakes Screen	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Yes	PRO/ARM < 10 % active 10-25% active > 25% active	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50% Pipe sep.	Present? Y N	PRO/ARM < 10 % active 10-25% active > 25% active	Yes
	L1		P R N	CB ID	H M S O	Chan Width		Rd Ov			Pl St Al Co										
	R2		P R N	CB ID	H M S O	Rd Depth		Rd Ov			Pl St Al Co	**Curr Evid** Y N			No				Access? Y N		NO
	L2		P R N	CB ID	H M S O	Rd Width		Rd Ov			Pl St Al Co										
	R1		P R N	CB ID	H M S O	Chan Slope		Rd Ov			Pl St Al Co	**Potential** Y N	None 1 stake 2 stakes Screen	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Yes	PRO/ARM < 10 % active 10-25% active > 25% active	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50% Pipe sep.	Present? Y N	PRO/ARM < 10 % active 10-25% active > 25% active	Yes
	L1		P R N	CB ID	H M S O	Chan Width		Rd Ov			Pl St Al Co										
	R2		P R N	CB ID	H M S O	Rd Depth		Rd Ov			Pl St Al Co	**Curr Evid** Y N			No				Access? Y N		NO
	L2		P R N	CB ID	H M S O	Rd Width		Rd Ov			Pl St Al Co										
	R1		P R N	CB ID	H M S O	Chan Slope		Rd Ov			Pl St Al Co	**Potential** Y N	None 1 stake 2 stakes Screen	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Yes	PRO/ARM < 10 % active 10-25% active > 25% active	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50% Pipe sep.	Present? Y N	PRO/ARM < 10 % active 10-25% active > 25% active	Yes
	L1		P R N	CB ID	H M S O	Chan Width		Rd Ov			Pl St Al Co										
	R2		P R N	CB ID	H M S O	Rd Depth		Rd Ov			Pl St Al Co	**Curr Evid** Y N			No				Access? Y N		NO
	L2		P R N	CB ID	H M S O	Rd Width		Rd Ov			Pl St Al Co										

RURAL ROAD RAM FIELD DATA SHEET

CROSS DRAINS

Road Network: **Date:**

GENERAL		Road Drainage					Culvert Dimensions				Inlet Observations		Outlet Observations						
Site ID	**Cross Drain Type**	**Road Direction ID**	**Road Length (ft)**	**Surface** *P = Paved R = Rocked N = Native*	**Paved Rds** *CB=cutbank ID =inboard ditch*	**Traffic** *H =Heavy M=Moderate S=Seasonal O=Occasional*	**Shape** *Rd= Round Ov = Oval*	**Culvert Size** *Diam Span (in)*	**Culvert Size** *Diam Rise (in)*	**Material** *Pl =plastic St =Steel Al =Aluminum Co =Concrete*	**Inlet Culvert Condition**	**Potholes**	**Outlet Culvert Condition**	**Interior Culvert Condition**	**Outlet Down-spout**	**Piping**	**Connected**	**Active Erosion Max Width**	**Active Erosion Max Length**
	DRC* Waterbar Rolling Dip Other	R1		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Yes	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50% Pipe sep.	Present?	Yes	Hydro Con?	< 2 ft 2-10 ft 10-30 ft > 30 ft	< 20 ft 20-40 ft 40-100 ft > 100 ft
		L1		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co					Y N		Y N		
		R2		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co		No			Access?	NO	Active Gully?		
		L2		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co					Y N		Y N		
	DRC* Waterbar Rolling Dip Other	R1		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Yes	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50% Pipe sep.	Present?	Yes	Hydro Con?	< 2 ft 2-10 ft 10-30 ft > 30 ft	< 20 ft 20-40 ft 40-100 ft > 100 ft
		L1		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co					Y N		Y N		
		R2		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co		No			Access?	NO	Active Gully?		
		L2		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co					Y N		Y N		
	DRC* Waterbar Rolling Dip Other	R1		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Yes	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50% Pipe sep.	Present?	Yes	Hydro Con?	< 2 ft 2-10 ft 10-30 ft > 30 ft	< 20 ft 20-40 ft 40-100 ft > 100 ft
		L1		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co					Y N		Y N		
		R2		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co		No			Access?	NO	Active Gully?		
		L2		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co					Y N		Y N		
	DRC* Waterbar Rolling Dip Other	R1		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Yes	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50% Pipe sep.	Present?	Yes	Hydro Con?	< 2 ft 2-10 ft 10-30 ft > 30 ft	< 20 ft 20-40 ft 40-100 ft > 100 ft
		L1		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co					Y N		Y N		
		R2		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co		No			Access?	NO	Active Gully?		
		L2		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co					Y N		Y N		
	DRC* Waterbar Rolling Dip Other	R1		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Yes	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50% Pipe sep.	Present?	Yes	Hydro Con?	< 2 ft 2-10 ft 10-30 ft > 30 ft	< 20 ft 20-40 ft 40-100 ft > 100 ft
		L1		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co					Y N		Y N		
		R2		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co		No			Access?	NO	Active Gully?		
		L2		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co					Y N		Y N		
	DRC* Waterbar Rolling Dip Other	R1		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Yes	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50%	Good CRSH 20-50% CRSH > 50% CLG 20-50% CLG > 50% Holes 20-50% Holes >50% Pipe sep.	Present?	Yes	Hydro Con?	< 2 ft 2-10 ft 10-30 ft > 30 ft	< 20 ft 20-40 ft 40-100 ft > 100 ft
		L1		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co					Y N		Y N		
		R2		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co		No			Access?	NO	Active Gully?		
		L2		P R N	CB ID	H M S O	Rd Ov			Pl St Al Co					Y N		Y N		

*Populate **ALL** fields for DRC crossing. **DO NOT** populate green fields for Waterbar, Rolling Dips or 'Other' types.

RURAL ROAD RAM FIELD DATA SHEET

STREAM CROSSINGS and EROSIONAL FEATURES

Road Network: **Date:** **Personnel:** **Sheet #**

Stream Crossings

GENERAL		ROAD DRAINAGE OBSERVATIONS						STRUCTURE OBSERVATIONS				Site notes
Site ID	**Crossing Type**	**Diversion Potential**	**Road Direction ID**	**Road Length (ft)**	**Surface** *P = Paved R = Rocked N = Native*	**Paved Rds** *CB=cutbank ID =inboard ditch*	**Traffic** *H =Heavy M=Moderate S=Seasonal O=Occasional*	**Width (ft)** *(Bridge/Arch only)*	**Height (ft)** (Bridge/Arch only)	**Material** *(Armored Fill only)*	**Crossing Condition** *(Qualitative Assessment)*	**Notes**
	Bridge Arch Box Ford Fill Armored Fill Decom Xing	**Potential** Y N	R1		P R N	CB ID	H M S O			Gravel Cobble Debris	1 2 3 4 5	
			L1		P R N	CB ID	H M S O					
		Curr Evid Y N	R2		P R N	CB ID	H M S O					
			L2		P R N	CB ID	H M S O					
	Bridge Arch Box Ford Fill Armored Fill Decom Xing	**Potential** Y N	R1		P R N	CB ID	H M S O			Gravel Cobble Debris	1 2 3 4 5	
			L1		P R N	CB ID	H M S O					
		Curr Evid Y N	R2		P R N	CB ID	H M S O					
			L2		P R N	CB ID	H M S O					
	Bridge Arch Box Ford Fill Armored Fill Decom Xing	**Potential** Y N	R1		P R N	CB ID	H M S O			Gravel Cobble Debris	1 2 3 4 5	
			L1		P R N	CB ID	H M S O					
		Curr Evid Y N	R2		P R N	CB ID	H M S O					
			L2		P R N	CB ID	H M S O					

Erosional Features

Site ID	**Crossing Type**	**Diversion Potential**	**Road Dir**	**Road Length (ft)**	**Surface**	**Paved Rds**	**Traffic**	**Active Erosion Max Width (ft)**	**Active Erosion Max Length (ft)**	**Notes**
	Erosional Feature Cutbank Fillslope	**Potential** Y N	R1		P R N	CB ID	H M S O	<2 ft 2-10 10-30 >30 ft	<20 ft 20-40 40-100 > 100 ft	
			L1		P R N	CB ID	H M S O			
		Curr Evid Y N	R2		P R N	CB ID	H M S O			
			L2		P R N	CB ID	H M S O			
	Erosional Feature Cutbank Fillslope	**Potential** Y N	R1		P R N	CB ID	H M S O	<2 ft 2-10 10-30 >30 ft	<20 ft 20-40 40-100 > 100 ft	
			L1		P R N	CB ID	H M S O			
		Curr Evid Y N	R2		P R N	CB ID	H M S O			
			L2		P R N	CB ID	H M S O			
	Erosional Feature Cutbank Fillslope	**Potential** Y N	R1		P R N	CB ID	H M S O	<2 ft 2-10 10-30 >30 ft	<20 ft 20-40 40-100 > 100 ft	
			L1		P R N	CB ID	H M S O			
		Curr Evid Y N	R2		P R N	CB ID	H M S O			
			L2		P R N	CB ID	H M S O			