

2007-08 Dirt and Gravel Roads Assessment Guide

(modified version which removed references to the old GIS system)

I. INTRODUCTION

1. Assessment purpose: The purpose of an unpaved road assessment is to identify and evaluate sections of unpaved road that contribute to stream pollution. These pollution sites, called worksites, are the basis of the Dirt and Gravel Road Maintenance Program. Paved and “tar and chip” roads are not eligible for funding and should not be assessed.
2. Worksites: Each continuous length of road that affects water quality should be defined as a potential worksite. Remember that while runoff may only be a problem at one point source (culvert, bridge, etc.), the entire length of road contributing drainage to that point should be considered a worksite. Some roads will contain several worksites, and some roads will contain no worksites. Remember that a worksite should only be made at a location where a water body is affected by sediment from the road area. Even springs and intermittent streams should be included since any material entering these channels will eventually be transported to larger streams.
 - A. If the entire length of a road is not near a stream or contributes no pollution at all, no worksites should be made regardless of the road conditions.
 - B. Conversely, if a road runs adjacent to and pollutes a stream along its entire length, it can be made into one long worksite or several smaller worksites.

II. ASSESSMENT PROCEDURE

1. Preparation:
 - A. Personnel: One person can complete the road assessment, although it will take some practice. The process will move along more efficiently if one person handles the assessment while another person drives, and helps in making observations. Consider working in teams at first to facilitate discussion before conducting solo assessments. When working alone, please pull to the side of the road before attempting to read maps or complete an assessment.
 - B. Maps: The entire assessment can be done with printed the maps from the original GIS system. You may find it easier, however, to use navigate with printed maps. If you are not using electronic maps in the field, be sure to have printed maps that have existing worksites identified and labeled.
 - C. Time: Based on previous time studies, a rule of thumb is to allot for about twelve minutes of time for each mile of dirt road to be inspected. This figure is for an experienced assessor, much more time will be required when starting out. This figure will also vary greatly depending on location, personnel, road conditions, and the number of worksites found. Each work site identified requires more time for detailed observation and data entry.
2. Conducting the Assessment:
 - A. Finding a Worksite:
 - i) Find a road that is highlighted as unpaved on the GIS map. Initially, it may be easier to have a printed copy of the county map with unpaved roads highlighted. With some practice, however, the person operating ArcView will be able to follow along on the GIS map and instruct the driver where to go as they are driving.
 - ii) When a highlighted unpaved road is found, note the odometer reading or reset the trip odometer at the beginning of the road. This will allow you to find your location later by measuring

distance on the GIS map. Now start driving along the road. Drive slowly enough so that you can see all road and drainage features. Inspect any outlets or ditches that look like their discharge may reach the stream.

- iii) While driving, it is important to take good notes. When you are at the top of a hill, you have no way of knowing where the road ditches will eventually empty out. In this case, note the mileage or location at the top of the hill. If you find a culvert and turnout further down the hill that outlets road drainage without affecting a stream, the section of road above you can be disregarded. Now note the mileage or location of the culvert and turnout. Why?...because if the ditches below the culvert lead down to the stream, then that culvert and turnout should be the upper limit of the worksite. Keeping track of this information on scratch paper as you drive means you don't have to go back up the hill to find the beginning of the site once you get to the bottom of the hill and want to make a site.
- iv) Once you find a place where road runoff may be contributing to stream pollution, you should get out of the vehicle in order to better assess the site and determine if it is to become a potential work site. As you identify more sites, you may become comfortable enough with the assessment procedure to create and evaluate sites without leaving the vehicle.
 - 1) If the site contributes to stream pollution at all, it should be evaluated as a worksite and assessed thoroughly.
 - 2) The entire section of unpaved road where road drainage contributes to stream pollution should become a worksite. In some cases, you may want to make several small worksites instead of one large worksite.
 - 3) Consider making multiple worksites if there is a substantial change in the site assessment conditions. For example, consider a long road that comes down off a hill and into a flat near a stream. The road segment on the hill would have a different pollution potential and therefore assessment evaluation than the road in the valley bottom. These two segments can be identified and evaluated separately instead of creating one large worksite where site conditions must be averaged. Also, whenever ownership of a road changes, at a township line for example, separate worksite should be made since different entities would apply for each section.



Reference Pictures

The pictures in this section are intended to be examples of conditions that exist in the field. Worksite assessment evaluations are in shades of grey, not black and white. This means that there is no clear cut line between two adjacent rankings. There is no definite line between a poor bank, and an unstable bank. The ultimate decision lies with the person conducting the survey. The purpose of this section is to help to obtain a relatively uniform inventory assessment across the Counties involved in this program by showing an example for each rating.

Some of these pictures are of areas that would not be considered a worksite because they are not near a stream. Remember that even if you have an unstable bank and eroding ditches, the ultimate factor in determining if a worksite should be made is whether or not sediment from the road area reaches the stream. If all of the runoff from a road empties into a forest, and does not reach a stream before infiltrating or dropping its sediment load, the road is not a worksite. Only after you have determined there is stream pollution and created a worksite should you complete the site evaluation described in this document.

**Does sediment reach the stream?
If so, then it should be a worksite!**

Road Sediment in Stream: an overall estimate of sediment delivery to stream

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NONE

If there is no evidence of road material reaching the stream, you should reconsider why you made a worksite there!

Slight

A small amount of road sediment finds its way into the stream. Minimal direct inputs of sediment from parallel ditches. Ditches outlet before stream. Some flow may reach stream through vegetated buffer in high flows. Some minor area may drain to stream at crossings. The roads pictured below turn their ditches out before the stream, but some runoff may reach the stream with minimal filtration.

**MODERATE**

Inadequate buffer exits or some road sediment has a direct route to the stream. The culverts pictured below have direct routes to the stream (located directly across the road), but the amount of drainage entering the stream is small because of the topography, short ditch runs, and adequate road surface.



Unless it is raining, you will usually have to look for indirect evidence of stream pollution. Remember that many streams will carry away most sediment brought to them by the road. This category can be used to assess the overall sediment delivery to the stream. Look for unnatural road material or sediment deltas in the stream.

Road Sediment in Stream: an overall estimate of sediment delivery to stream

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SEVERE

Obvious and direct stream pollution from road. A large portion of the road area drains into the stream. Sediment deltas and road material may be visible in stream. Stream encroachments, where the stream is cutting into the road bank, and fords are also in this category.



These two pictures above illustrate the common practice of draining long ditch runs directly into the stream at crossings. Both crossings pictured here drain all four ditches directly into the stream. The sediment delivery is very high due to the poor road composition, direct discharge, and long ditch runs.



This site illustrates a stream encroachment where the stream is beginning to undercut the base of the road. Fords also fall into the category of stream encroachment.



You don't always need running water! The small canyon pictured here is actually a culvert outlet! The culvert collect ~ 1,500 feet of road ditch drainage. This is a case where the road ditch is the headwaters of the stream.

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Wet Site Conditions: general water table conditions of the road area**DRY**

Site is unaffected by groundwater, seeps, or springs

**Saturated Ditches**

Road ditch shows signs of frequent saturation. Some standing water may be present. Look for hydrophilic plants in and around the road ditch.

**Roadside Springs**

Roadside springs and seeps often appear in the uphill cut bank. They can destabilize the road base and create additional drainage and pollution problems. The spring pictured here is obvious, since the area around the seep has vegetated before the rest of the road bank.

**Flow in Ditches**

When ditches become too saturated with groundwater, or collect roadside springs and seeps, they will contain flowing water even in dry periods. This creates many concerns including increased erosion, sediment transport, and road base saturation. Often in these cases, the road ditch becomes the headwaters of a stream!

**Saturated Base**

Water, water, everywhere... Look for symptoms such as: wet areas wetland roadside plants, potholes, standing water, mottled soils, and fine particles pumping up through the road. The road pictured to the right has roadside springs, flow in the ditches for several hundred feet, and a saturated road base.

“Wet site conditions” refers to the amount of groundwater, springs, and seeps affecting the worksite. Evaluations will be dependent on recent weather conditions. It is virtually impossible to determine wet site conditions during rain events. This is a topic where having a local official's site knowledge would be beneficial.

Road Surface Material: approximate makeup of road surface**HARD GRAVEL**

Predominantly placed limestone or sandstone aggregate. Not necessarily DSA, but most likely a purchased and placed aggregate product. Road has a relatively uniform look to it with little to no native soil present and minimal loose aggregate on the surface.

Three year old DSA is pictured to the right.

**MIXED STONE**

The mixed stone rating is to be used when there are several different types of stone on the road with no type being dominant. These materials will vary greatly in their hardness and resistance to erosion, so they receive a medium rating. The picture to the right illustrates an old limestone placement that has mixed with the subbase over time.

**SOFT STONE / DUST**

A mixture of soft sandstones, shales, bankrun gravel, and soapstones. The surface is predominantly rock with some native material incorporated.

**STONE / DIRT / DUST**

A mixture of past stone placements with native earthen material. Over time, aggregate will erode away and native material will work up to the surface. Expect to see varying degrees of naturally occurring and placed stone in predominantly dirt roads. Dust potential can be seen by observing a lot of loose fine material on the road surface.

**SEVERE DUST**

Little to no evidence of stone on the road surface. Most of these roads are simply shaped from native earthen materials. Dust and sediment generation from the road surface can be expected to be extremely high.



The makeup of the road surface is an important factor in determining the amount of sediment generated from the road area. Studies have shown that sediment generation rates can be 12-25 times higher for native surface roads compared to roads surfaced with quality aggregate.

Road Slope: measure of average steepness or grade of worksite**<10%**

Relatively flat. Rises less than 1 foot for every 10 feet of road length. Roads with slopes like the one pictured here do not allow water to build enough speed to cause major erosion problems on the road or in the ditches. Roughly equates to a <5 degree slope.

**10% - 30%**

Steep slope. Rises 1 – 3 feet for every 10 feet of road length. Roads such as this one with a slightly steeper slope have a greater potential to generate sediment. Steeper roads require more culverts and turnouts to prevent water from building up enough speed to cause major erosion problems. Roughly equates to a 5-15 degree slope.

**>30%**

Extremely Steep slope. Rises more than 3 feet for every 10 feet of road length. While slopes in excess of 30% are rare, they can generate large quantities of sediment and are some of the most difficult sites to address. Roughly equates to a >15 degree slope.



“Road slope” refers to the grade of the road in terms of “rise over run”. Steeper roads will amplify any other problems that are identified on the road and make potential solutions more difficult to implement.

Road Shape: quality of crown or cross-slope for proper surface drainage**GOOD**

Good surface drainage will shed water perpendicular to the roadway. A crown, which sheds water to each side like a roof, is most common. Side slopes, where the entire road is sloped in one direction, will also work. The road pictured here has good crown.

**FAIR**

A relatively flat road that may even have some evidence of water flow in wheel tracks. The road pictured here is relatively flat, and water is beginning to flow down the road instead of to the side.

**POOR**

No side-slope and visible evidence of water flow down and across road. Poor road shape leads to erosion in wheel tracks, standing water, potholes, and wash boarding. Concentrated water flow on the road surface leads to excessive erosion. The road pictured here carries water in the wheel tracks instead of shedding it to the side. In dry conditions, look for channels cut by past flows.



Road shape refers to the cross-sectional profile of the road. Side-slope on a road is vital to insuring water runs perpendicular to the road instead of down the road surface. Crown or cross-slope is a road's first line of defense against erosion. It is very important on steep slopes, since water is more likely to flow down the road.

Slope to Stream: Slope of down-slope bank between road and stream**Less than 30%**

Relatively gentle grade between road and stream. This equates to less than 3 feet of fall for every 10 feet of horizontal distance away from the road. You would have little trouble walking to the stream and back. Roughly equates to a <15 degree slope.

**30% to 60%**

A relatively steep grade between the road and stream. This equates to 3-6 feet of fall for every 10 feet of horizontal distance away from the road. Walking to the stream and back is still possible, but increasingly difficult. Roughly equates to a 15-30 degree slope.

**More than 60%**

A very steep grade between the road and stream. This equates to over 6 feet of fall for every 10 feet of horizontal distance away from the road. Walking to the stream and back is dangerous to impossible. Roughly equates to a >30 degree slope.



“Slope to stream” refers to the grade of the downhill bank between the road and the stream. Steeper grades will greatly increase the distance that runoff and sediment will flow away from the road. Lower grades will be more resistant to erosion and allow a better chance for runoff to infiltrate into the ground before reaching the stream.

Distance to Stream: worksite distance from stream in feet**Over 100 Feet**

Road stays at least 100 feet away from stream. There are no well-defined channels or tributaries to carry runoff and sediment to the stream. The picture to the right illustrates how far road sediment can travel away for the road corridor. Notice the distance from the road sediment to the truck in the distance that marks the road.

**50 to 100 Feet**

Road stays at least 50 feet away from stream.

**Less than 50 Feet / Crossing**

Road is within 50 feet of stream, or road crosses stream. These sites present the highest potential for direct discharge of sediment into the stream. The picture to the right shows a dry stream channel. Remember that any sediment that make it to an intermittent channel will eventually make it to a perennial channel. In many cases, road drainage will effectively become the headwaters of the stream!



Unfortunately, many of our roads were built over old foot paths that existed along our streams. A worksite's proximity to a stream is a good indication of potential sediment pollution. Remember that intermittent streams are still streams. If you threw a shovel-full of dirt in the channel, it would be gone in the next rain event.

Outlets to Stream: extent to which ditch outlets lead to nearby streams**NONE**

In most cases, if there are no outlets to the stream, you should not be scoring the site because it should not be a worksite. An example of a worksite where you may answer “none” would be if the drainage enters directly from a bridge, not from the ditch outlets. Use this rating where concentrated drainage does not directly enter the stream. The road pictured to the right has no ditch outlets to the stream. A small amount of road area (~100') around the crossing does enter the stream and justify creation of a worksite.

**NEAR STREAM**

In this case, the turnout or culverts empties out near, but not directly into the stream. There should be some chance for filtration and infiltration, but some of the runoff may still affect the stream. In the picture to the right, the pipe being replaced discharges about 40 feet from the water's edge.

**DIRECTLY INTO STREAM**

These are the obvious worst case offenders. These are ditch outlets (culverts and turnouts) that either empty directly into a stream, or have clearly defined channels cut to the stream. The picture to the right illustrates a ditch that empties directly to the stream at a bridge. A delta of fine road material is clearly visible.



The volume of water coming to the outlet plays an important role in determining how stable the outlet will be. Pay close attention to outlets that have obvious channels cut away from the road that lead directly into the stream. These are symptoms of excessive flow from that outlet.

Outlet / Bleeder Stability: stability of outlet carrying water away from road**STABLE**

No erosion at culvert or turnout outlet. Preferably, outlets should be at natural ground elevation to promote infiltration and have minimal flow to reduce erosion. Some factors making outlets more stable:

- low water flow volumes
- thick, well rooted vegetation
- well-drained soils
- low gradients
- wide and shallow outlets
- no evidence of erosion from base of outlet
- shallow crosspipes that outlet at ground level

**MODERATE**

Some erosion is evident below the turnout or culvert outlet. Likely causes of erosion are poor soils, lack of vegetation, excessive water flow, and deep or narrow outlets. The bleeder outlet pictured here shows some minor signs of erosion and deposition.

**UNSTABLE**

Outlets are contributing sediment to road runoff. Excessive flow is the major cause of outlet scour, and prevents establishment of vegetation. Outlets from deep culverts are also unstable because they require constant maintenance and disturbance to keep flowing. The unstable outlet to the right is caused by excessive water flow, and a deep culvert that necessitates frequent cleaning of the deep outlet trench.



Outlets and bleeders carry water away from the road. They include culvert discharges, turnouts, swales, and any other place where water leaves the road area. They are one of the most important, yet frequently overlooked parts of erosion prevention. Water flow volumes are the major determining factor in outlet stability.

Road Ditch Stability: stability of parallel road ditches**STABLE**

The ditch is either non-existent or shows no evidence of scour or erosion from flowing water.

**FAIR**

There is some evidence of flow in the ditch with movement of some fine particles. There is no evidence of downcutting or movement of larger particles over 1". The road pictured to the right has relatively stable ditches, but the long ditch run without an outlets means that large rain events could cause flow volumes and velocities that lead to ditch erosion.

**POOR**

Fairly obvious evidence exists of flow in the ditch. Look for debris racks, movement of larger particles, and the beginning of downcutting.

**UNSTABLE**

Some down cutting is occurring in the ditch. The ditch is obviously a source of additional sediment to road runoff. Larger particles (>2") are being moved in the ditch.



Instabilities in the road ditch are usually symptoms of excessive water flow. Factors such as off right-of-way water sources, steeper roads, poor material, and lack of outlets will all increase ditch erosion.

Road Bank Stability: stability of bank on up-slope side of road**STABLE**

Low to moderate slope with good vegetative or rock cover (i.e. <30% slope with 60%+ cover). The uphill road bank is well vegetated and at a stable angle. Little to no soil loss can be expected from the bank. Be sure to account for the time of year when assessing vegetative cover. Bedrock outcrops in the bank are also considered to be stable.

**FAIR**

Some erosion potential. Moderate slope with moderate cover (i.e. 10% - 60% slope with about 50% cover). These banks will have sporadic vegetative cover, but some soil loss can be expected. The bank pictured to the right is fairly steep, with a fair amount of vegetation, but some exposed soil.

**POOR**

Bank is eroding. Low to moderate slope with little cover. (i.e. 20% - 60% slope with less than 40% cover). Vegetation is sparse with potential for substantial soil loss. The bank pictured here has some vegetated sections combined with some bare sections.

**UNSTABLE**

Obvious bank erosion and soil loss. Moderate to steep slope with little vegetative cover (i.e. >30% slope with <30% cover). In many situations, unstable vertical banks are caused by the continual cutting of the toe or bottom of the slope during ditch maintenance activities. The bank pictured here is extremely unstable because the toe of the slope is continually cut away during maintenance activities.



Vegetative cover and slope are the most important factors in determining bank stability. Vegetative cover is important because it reduces erosion from raindrop impacts, and helps to hold the bank together with its root structure. Remember that for sites with varying conditions, you will need to rate the average bank stability.

Average Canopy Cover: relative amount of shading on roadway**MODERATE**

Moderate canopy cover is preferred for most roads. Moderate canopy cover can be thought of as about half of the road being shaded during a typical summer day. If the leaves are not out, approximately 10% shading would be optimal.

**MINIMAL**

The road has little to no shade, even if all leaves are out. These roads will often have excessive dust problems in dry weather. The canopy cover or degree and consistency of shade affects: direct impacts of precipitation, rate and pattern of drying, rate and pattern of thawing, ability of vegetation to stabilize banks, aesthetics and maintenance costs.

**HEAVY**

Some sections of road are totally shaded by trees or nearby hills. This causes evaporation of any water in the road area to occur very slowly. Proper drainage is very important on roads that are heavily shaded.



Canopy cover affects the amount of moisture retained by the road. A moderate or ~50% summertime shading is preferred (equates to ~10% shading when leaves are not out). A lack of cover dries the road to create excessive dust. A heavy canopy causes the road to retain water and be more susceptible to rutting.