



EROSIONAL FEATURES GUIDELINE

Updated: 5/1/2026

Coal Section

Mining Bureau

Air, Energy, and Mining Division

Montana Department of Environmental Quality

TABLE OF CONTENTS

Acronyms	2
1.0 Introduction	2
1.1 Definitions	2
2.0 Required Maintenance	3
3.0 Possible Maintenance	3
4.0 Preventative Measures	4

ACRONYMS

ARM	Administrative Rules of Montana
DEQ	Department of Environmental Quality (Montana)
MCA	Montana Code Annotated

1.0 INTRODUCTION

In the Administrative Rules of Montana (ARM) 17.24.721 (1) through (3) Eradication of Rills and Gullies addresses the formation of rills and gullies and a need to evaluate and determine when correction may be necessary. This rule lacks guidance on how evaluation might be carried out. The following guidelines are offered as a means of addressing erosional features encountered in reclamation and when maintenance work is required or if the feature can be monitored for stability.

Many erosional features that develop in reclaimed fields are results of inadequate planning and/or implementation. Erosion is commonly found in reclamation and generally falls into one of two categories designated with the headings below:

‘Required Maintenance’ are features requiring immediate maintenance.

‘Possible Maintenance’ are features that may eventually require maintenance.

1.1 DEFINITIONS

The following terms define features that occur throughout the native and reclaimed landscapes of eastern Montana. Swales and dry washes can be included as part of normal reclamation. Rills and gullies that form following soil laydown should be evaluated on a case-by-case basis with an eye toward the feature enhancing rather than conflicting with approved post-mine goals.

Swale: A swale is a feature that is generally broad and shallow in cross section where sheet flow can become concentrated. A swale lacks a distinct floodplain or lowest elevation flow path (thalweg).

Rill: A rill is an erosional feature usually less than 12 inches in depth formed on newly reclaimed or cultivated fields. Rilling is an intermediate stage between sheet erosion and gully erosion generally resulting in multiple small features along a slope. Rills can be removed from agricultural fields using normal tillage operations. In certain areas, as vegetation establishes per the approved permanent seed mix, a rill feature becomes less distinct. A vegetated rill may be useful in forming valuable micro-topographic features.

Gully: A gully is an erosional feature caused by concentrated but intermittent flow of water usually during and immediately following large runoff events. Gullies are deep enough to interfere with, and not be obliterated by normal tillage operations. Gullies may contribute to significant redistribution or loss of soil resources and may interfere with the post-mine land use. Gullies are characterized by steep banks and abrupt head cuts. Gullies usually range from 2 to 30 feet in depth with visible instability.

Dry Wash: A dry wash is a steep-sided feature having a relatively flat bottom (usually greater than 3 feet in width) that is in dynamic equilibrium; any headcutting has tapered into the topography, and shrubs and/or trees are usually well established, except in newly constructed dry washes. Readily observed erosion and runoff is usually only due to large precipitation events. A thalweg and a floodplain are generally not discernable. If a dry wash is to be left in place or constructed, it should have functional use such as providing a corridor for wildlife or microsites for specific, and desirable, trees and/or shrubs. It should also exhibit geomorphic characteristics of representative native drainage channels.

2.0 REQUIRED MAINTENANCE

Location is critical in determining necessity for maintenance of rills and gullies. Maintenance will be required where one of the following conditions exist:

- Roads and road embankments have or are becoming impaired to a point where continued safe operations are in question. ARM 17.24.607
- Adverse impacts outside the permit boundary appear imminent or have occurred. ARM 17.24.501(3)(a)
- Post-mine land use was, is, or likely will be adversely affected. ARM 17.24.721(1)(a)
- Soil loss from a soil stockpile is imminent or active in occurrence. ARM 17.24.702(2)
- A gully or other undesirable erosion feature formed due to improper blending of contours. ARM 17.24.501(5)
- Deposition of spoil onto soil, or soil erosion and redeposition onto spoil, is causing soil loss due to excessive and/or widespread gullying. ARM 17.24.702(5)
- Causing or contributing to a violation of a water quality standard. ARM 17.24.721(1)(b)

Many rills and gullies will not fall under the categories listed above, and may still require future maintenance work. The determination of necessity for maintenance work requirements when conditions do not fit a category above will be made on a per case basis. These other case conditions are outlined below under 3.0 Possible Maintenance.

3.0 POSSIBLE MAINTENANCE

To determine maintenance necessity for erosional features not listed above as 'Required Maintenance,' the following examples should be considered:

- In approved soil substitution fields, rills and gullies commonly develop. These features are acceptable provided they do not fit into a 'Required Maintenance' situation.
- A dry wash inappropriately located or constructed resulting in accelerated erosion conflicting with approved post-mine land uses.
- Erosion and sediment deposition is occurring and will likely accelerate in the constructed channel(s). Assess the drainage channel for possible degeneration into gullies that could interfere with post-mine land uses.
- Deposition of spoil onto soil, or soil onto spoil, due to excessive and/or widespread wind or water transport. Maintenance would be required if the coverage by deposited spoil, or soil, is severe enough to inhibit establishment and/or growth of vegetation, or interference of post-mine land uses and standards.

Severity will be judged on the following criteria:

- Extent of soil loss, contamination, degradation, or deterioration
 - Soil is unacceptably degraded, contaminated or deteriorated if it's ability to establish and/or support vegetation is adversely affected, or it cannot support post-mine land uses/ standards.
- Loss of seed or the seedbed through overland flow.
- Soil is considered permanently lost if it cannot be retrieved (e.g., the soil material is deposited in a sediment pond, a mine pit, outside the disturbance boundary, or degraded with another material).

An entire field may need to be considered when evaluating maintenance needs. For example, the number and density of the rills and/or gullies, as well as the depth to which individual features have eroded, can affect the decision to perform maintenance on a reclamation field.

Before planning maintenance, consider if enough time has been allowed for natural geomorphic processes to reach a state of relative equilibrium. Relative equilibrium will be consistent with the post-mining topography and approved post-mine land use. This should be done with respect to comparable and more mature native or reclaimed sites.

Many shallow erosional features fill with sediment and/or stabilize to an acceptable state supported by vegetation given sufficient time. Once a permanent vegetative cover has become established, often requiring multiple growing seasons following initial seeding, the level of erosion can be expected to significantly decline.

Field inspectors will determine maintenance necessity by balancing this guideline's concepts with the location and severity of an erosional feature. Evaluation will be done with an understanding that a limited amount of erosion is expected and acceptable during the evolution of constructed landscapes.

4.0 PREVENTATIVE MEASURES

The following measures can aid in reducing the formation of rills and gullies requiring maintenance.

- Properly planning the reclamation sequence when blending successive reclamation. This should include all surrounding reclamation and rough regrade during the contouring phases of reclamation. Proper blending of one field to another is a critical factor in preventing the development of rills and gullies.
- The location and type (soil substitution, special shrub plantings, etc.,) of alternate or enhanced reclamation is a critical factor in evaluating if a gully can remain or requires maintenance, leading to proper consideration for placement of alternate and enhanced reclamation far in advance of soil laydown and seeding.
- A planned feature must complement the vegetation and land use goals.
- Swales can be constructed to create topographic diversity (e.g. undulation and slope break) in the landscape and can reduce the area contributing to sheet flow. They should be spaced out along a slope (e.g. approximately 300 to 500 feet apart) and direct flow askew the

- slope's fall line. The degree of skew will be dependent of slope gradient, from a slope break line/ridge. A break line can occur in the slope below the main ridge.
- Implementation should occur during the rough regrade phase of reclamation when swales should inhibit formation of high density rilling and/or gullies and minimize depth.
 - Reclamation activities (rough regrading, soiling, revegetation, etc.,) are best performed in a continuous basin zone extending from a slope's drainage channel to its drainage basin divide. This aids in proper topographic blending and encourages the creation of micro-topographic features such as swales.
 - Where trees or shrubs are planted on steep slopes, care must be taken to prevent furrows from exacerbating erosion by concentrating runoff. Furrows should parallel contours of the land to help minimize the concentration of overland flow and dissipate downslope flow energy. Where deep ripping furrows (using 36-inch rippers) are implemented, measures to reduce their trenching effect are encouraged. Where tree and shrub plantings follow deep ripping, they are best planted by hand.