TRAIL SHORTS:

Trail Maintenance Basics For Adopt-A-Trail Volunteers[1]

INTRODUCTION

Trail construction and maintenance is an inexact science with many variables. Much depends on the location of the trail, the soil, the climate, and the types of uses. However, there are certain general guidelines which, if adhered to, will prevent most trail deterioration and minimize maintenance costs.

Trail Problems

Trail users may not be able to articulate what a "perfect" trail looks like, but almost everyone can list the characteristics of a "bad" trail:

1. **Deep Trenching** - The trail is sunken such that users feel like they're walking in the bottom half of a pipe. Water becomes trapped on the trail tread, unable to sheet off the trail. This leads to water channeling/running down the trail and results in even deeper trenching.
2. **Widening** - The trail has widened from a single track to an unsightly wilderness "freeway" of multiple parallel tracks.
3. **Blocking Hazards** – Deadfall from storms and wind fall across the trail causing impassable obstacles or unanticipated impediments that can hurt a trail user.
4. **Vegetative Growth** – Southern Michigan is rife with invasive species of non-native bush (shrubs and small trees) such as Autumn & Russian Olive, Buckthorn, Multiflora Rose and Honeysuckle. These invasives multiply rapidly and encroach on the trail corridors, limiting sightlines and creating “slap and poke” hazards for mountain bikers.
5. **Short Cuts** - Knowing that the shortest distance between two points is a straight line, users create a web of social trail “cuts”. These often end up being steep and erosive, cutting up fall lines to shorten travel on sustainably cut contour trails.

Causes

All of these problems can be tied to one or more of the following five causes:

1. **Water** from rain is the foremost cause of trail problems. The movement of water causes erosion and deep trenches. It also exposes tripping hazards.
2. **Storm Damage** such as wind, snow, ice and bring down deadfall, blocking trail.
3. **People Damage** such as vandalism, trail cutting, trail alteration and dragging of obstacles into the trail.
4. **Poor Initial Trail Design** can rarely be overcome, even by regular maintenance.
5. **Inadequate or Inappropriate Maintenance** can sometimes increase trail problems and create hazards.

DESIGNING FOR TRAIL MAINTENANCE

Ultimately, the most influential component of trail maintenance is the original trail design / alignment. A well-designed trail will be easier to maintain, will deteriorate more slowly and will be more pleasant to use. On the other hand, a poorly-designed trail is difficult to maintain, deteriorates quickly and, once you lose it, there's not much that can be done to restore it. In addition, a poorly designed trail will always be less pleasant to hike or ride.

Elements of a Well-Designed Trail

There are many factors which go into a well-designed trail; here we will only look at the elements required from a maintenance perspective.

1. **Gradient**
   Generally, the linear gradient of a trail should be less than 10%. The term "gradient" refers to the ratio of the rise over the run. In other words, an elevation gain of 2 feet in 20 horizontal feet represents a 10% gradient.

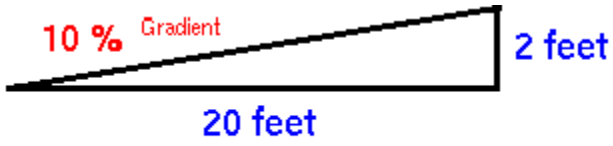


Figure 1

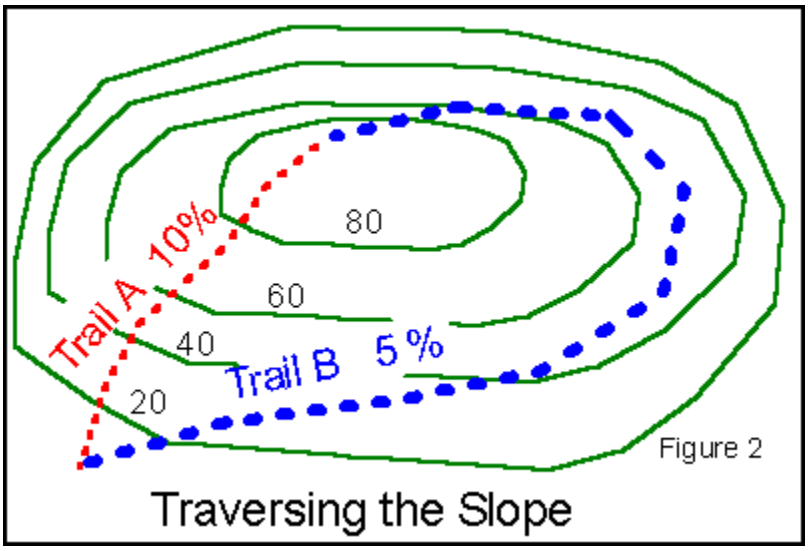
   Ten percent is a good standard, but circumstance may warrant a greater or lesser gradient.

   In highly erosive, sandy soils, a 5% slope may be excessive. Granitic soils are more forgiving and can allow long sections of trail to be constructed at 13 to 15%. It is best to look at existing trail conditions and measure gradients to determine what maximum gradient works best in each unique condition. However, it should be noted that trails less than 10% are far more comfortable to hike and ride. The soils may allow for a trail that exceeds 10%, but the users might not!

2. **Relationship to Existing Contours**
   In map jargon, a contour is a line of points that are at the same elevation. If you walk precisely parallel to a contour, you are walking at a level (0%) grade. If you

walk perpendicular to a contour, you are walking either straight uphill or straight downhill. A well-designed trail is laid out to traverse a hillside, closer to parallel than perpendicular to the contours.

The figure below shows two proposed trail routes to the top of the hill. Although Trail A stays within a gradient of 10%, it is the poorer route because it travels perpendicular to the contours. When a trail runs perpendicular to the contours, water runs down the middle of the trail, causing trenching, even at a 10% gradient. This type of trail cut is also known as "**fall line**" cut. The only way to get water off the trail is for the route to **traverse** the natural slope (Trail B), because then there is always a lower side of the trail. When there is a lower side of the trail, it becomes a simple matter to redirect water across and off the trail (**sheeting**), rather than allowing it to cut a channel down the trail's centerline. Trail cuts that traverse a natural slope are known as "**sustainable**" cuts.



3. **Outslope**
   A well-designed trail should be constructed to have a 3% to 4% cross-slope to get the water off the trail as soon as possible. This explains why it is difficult to construct an effective trail in a flat meadow. You can not merely cut out sod and call it a finished trail. It will always be easiest to construct an outsloped trail if the original trail alignment traverses the natural slope as in Trail B, above.

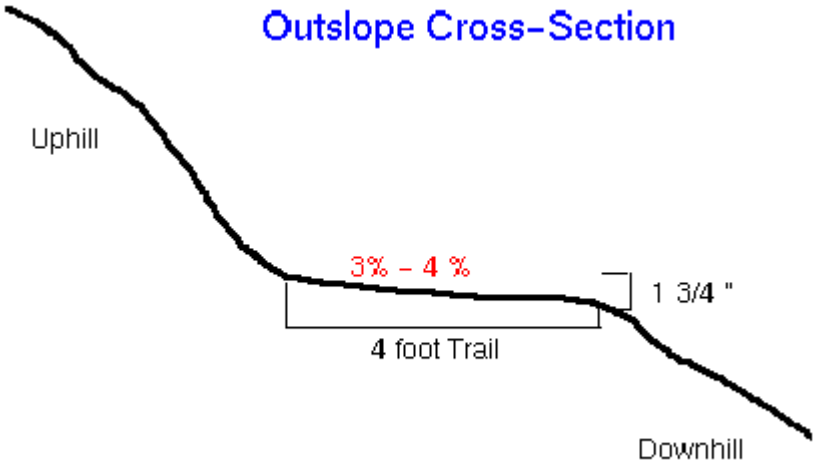


Figure 3

4. **Avoid Switchbacks**
   A "switchback" is any place where the alignment of a trail traverses a slope in one direction and then abruptly "switches back" toward the opposite direction. Switchbacks are often used to run a trail up a steep slope in a constrained location. Although switchbacks are often the only solution to the problems of tight trail corridor changes through steep slopes, they should be avoided where possible. Unless they are perfectly designed and constructed, switchbacks present an irresistible temptation to shortcut the trail and cause erosion over a web of indiscriminately created volunteer routes (**social trails**).

KEY ELEMENTS OF TRAIL MAINTENANCE

TRAIL TREAD MAINTENANCE

The first step of trail maintenance is to inspect the trail. When erosion problems are evident, the principle questions to ask are, **"Where is the water going and how can I get it off?"**

The following elements represent the primary "tools" to be used in the maintenance of trail tread. They are generally listed in priority order, but each has its own special application and purpose. Clearly, though, the first 3 (Maintaining the Outslope, Install and Maintain Water Bars, and Maintaining Drainage Dips) are far and away the most important.

Maintaining the Outslope

This is the first order of business in trail maintenance. It is the simplest, but most labor-intensive trail maintenance tool.

Normal trail use will build up a berm along the outside (downhill) edge of the trail (Stage 2 of figure 4). If allowed to continue, the berm will grow and prevent water from flowing

off the trail, causing gullying down the centerline of the trail (Stage 3). If this centerline gullying is allowed to continue unchecked, the trail will trench deeper and deeper until it is both unusable and unredeemable (Stage 4).

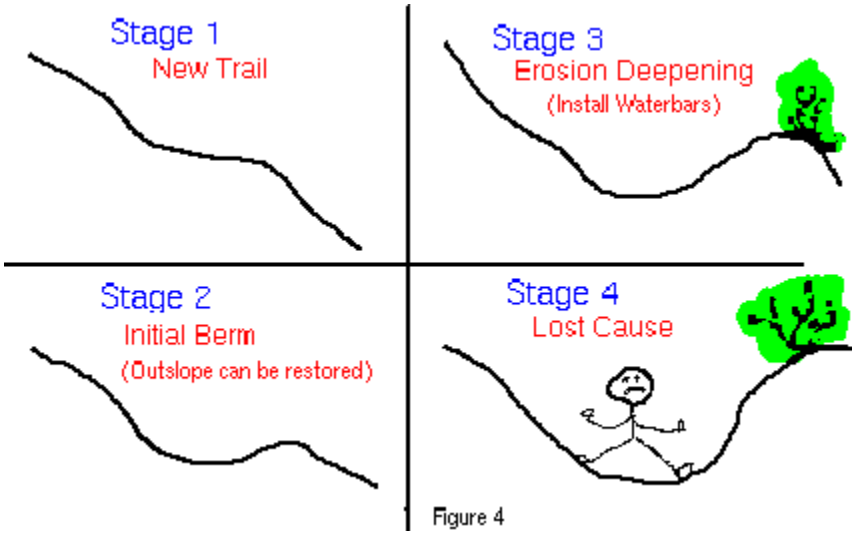


Figure 4

The outslope is maintained at Stage 2 by simply pulling the small 4" - 5" berm back into the trail tread. This unglamorous work must be performed again and again by trail crews, but in many cases, it the outslope is restored on a regular basis, little or no maintenance is needed of any other kind. However, some use patterns (high traffic trails), soil conditions (sandy) and climate conditions (high precipitation) combine to minimize the effectiveness of this maintenance tool; it just has to be done too often to make it worthwhile.

Once a trail has reached Stage 3, the berm is too large and overgrown with vegetation to be removed; the outslope cannot be restored and other maintenance approaches must be employed. When a trail deteriorates to Stage 4, the trail is a lost cause, and the best solution is trail abandonment and relocation/rerouting of the trail corridor. (Note: Trail Adopters are not permitted to relocated/reroute trail – see yellow highlighted and *italicized* note below this section.)

Install and Maintain Water Bars (Not applicable at Flow Design Trails)

Water bars divert water off a trail at controlled points along the trail. They can be incorporated in the original construction of a trail, or they can be installed later as a maintenance measure. Done well, a series of water bars can effectively eliminate erosion and stabilize a trail for years. Done poorly, water bars can accentuate trail erosion and become dangerous tripping hazards. Water bars are typically utilized to make “old school” fall line cut trail more sustainable. They are typically not needed, nor utilized on “new school” sustainable trails falling grade contours.

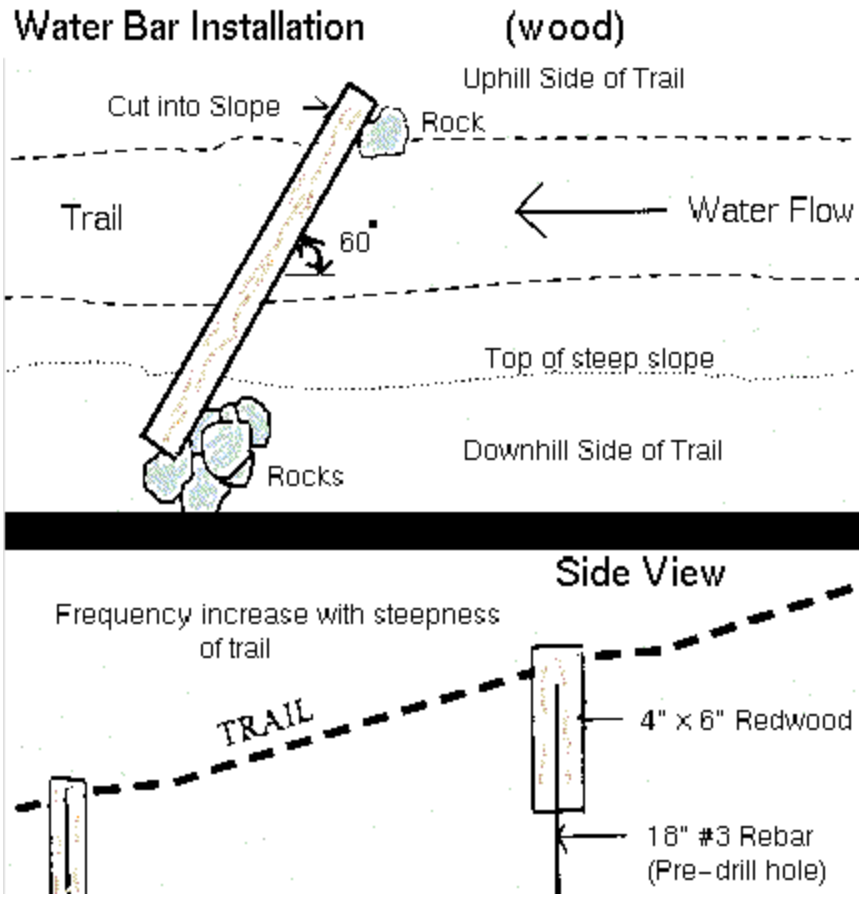
Some permanent water bars are made from native deadfall trees or rock obtained on-site. When on-site deadfall or rock of a suitable size is not available, water bars can be made from certain nontreated, approved finished lumber. While you will see them at utilized at places on the trail, current “best practices” in trail maintenance eschew Peeler logs or

other landscaping products because their appearance is foreign to a natural environment. Some trail maintainers and land managers do not mind using commercial landscaping product made of black rubber that diverts water, but is flexible enough to allow cyclists to easily cross. They may also utilize GeoWeb black plastic erosion prevention (honeycomb) matting or even chunks of concrete to armor fall line trail against erosion. However, this too, may be inappropriate for a natural environment.

There are many opinions about the proper installation of water bars. Three trail handbooks will promote three different approaches. Well, here is one more. The elements of a properly installed water bar are:

1. **Set the water bar at a 60 degree angle** across the trail. A water bar set perpendicular (90 degrees) across the trail will not divert the water off. A water bar set 30 degrees across the trail can be awkward to hike or ride over.
2. **Extend the water bar such that water is carried completely off the trail** to a steep side slope. Otherwise, the water flow will bypass the water bar and erosion will occur.
3. **Provide rock at the downslope end** of the water bar to dissipate the energy of the flowing water, thereby minimizing erosion.
4. **The top of the water bar should be nearly flush with the trail tread** to minimize tripping hazards. On first consideration, it may not make sense to make the top of the bar flush with the tread because there would be nothing to "catch" and divert the water. However, we are not concerned about diverting **all** water flowing down a trail, only that amount of water than causes erosion. With the bar flush, its effectiveness only kicks in when there is enough water to erode away a lip on the uphill side of the water bar, which then allows the bar to divert the water flow.
5. **The boulders used for rock water bars must be huge**, otherwise, they will be kicked out of place by a horse. The rocks should overlap like shingles on a roof to prevent water from flowing between rocks and eroding away the integrity of the water bar. In addition, long boulders with one flat side work best to prevent tripping hazards.

Water bars need regular maintenance. The excess soil and debris that build up at the downslope end of the water bar needs to be periodically graded out to assure that water flows off the trail. This is a key responsibility of trail segment adopters. **Without regular unplugging, a water bar is useless**.



Maintaining Drainage Dips

A drainage dip, or, “grade reversal” is built into the original trail alignment and is a change in gradient (a "dip" in the trail) that dissipates and diverts water flow (it's like a built-in water bar). Like a water bar, it only remains an effective means of erosion prevention as long as regular maintenance keeps it unencumbered from debris so that water can “sheet” off the trail.

****DOUBLE UNDERLINE/TRIPLE STAR NOTE TO TRAIL ADOPTERS****
ON HOW TO HANDLE MAINTENANCE OF SECTIONS OF FALL LINE TRAIL

YOU ARE NEITHER PERMITTED, NOR EXPECTED TO RELOCATE OR REROUTE PARTS OF THE TRAIL THAT YOU HAVE ADOPTED. WHILE YOUR TRAIL SECTION WILL UNDOUBTEDLY HAVE SECTIONS OF “OLD SCHOOL”, NONSUSTAINABLE FALL LINE CUT TRAIL, DECISIONS TO REROUTE OR RELOCATE TRAIL MUST BE RUN BY DEPARTMENT OF NATURAL RESOURCES LAND MANAGERS AND PLANNING. IF YOU HAVE SECTIONS OF FALL LINE TRAIL THAT MUST BE MAINTAINED IN YOUR ADOPTED SEGMENT, YOU SHOULD TAKE THE FOLLOWING APPROACH STEPS:

1. *DEBERM ANY OUTSLOPE THAT HAS NOT YET REACHED STAGE 3 (old school trails like the Potawatomi)*
2. *CLEAN OUT SAND RUNOFF AND DEBRIS FROM LOW-LYING DRAINAGE BASINS THAT HAVE BEEN CONSTRUCTED INTO TRAIL DESIGN (new school trails like DTE Energy Foundation Trail).*
3. *MAINTAIN EXISTING WATER BARS SO THAT THE REMAIN CLEAR OF DEBRIS AND FUNCTIONAL (old school trails like Potawatomi Trail)*
4. *IF THE TRAIL SECTION IS BECOMING A "LOST CAUSE", RECOMMEND TO THE DNR AND TRAIL COORDINATOR THAT IT BE ASSESSED FOR RELOCATION AND REROUTING.*
5. *DO NOT REMOVE OR INSTALL WATER BARS, GEOWEB, LANDSCAPE MATTING, GEOTEXTILE WITHOUT THE PERMISSION OF THE DNR AND TRAIL COORDINATOR (these materials are only present on old school trails like the Potawatomi)*

PRUNING & TRIMMING

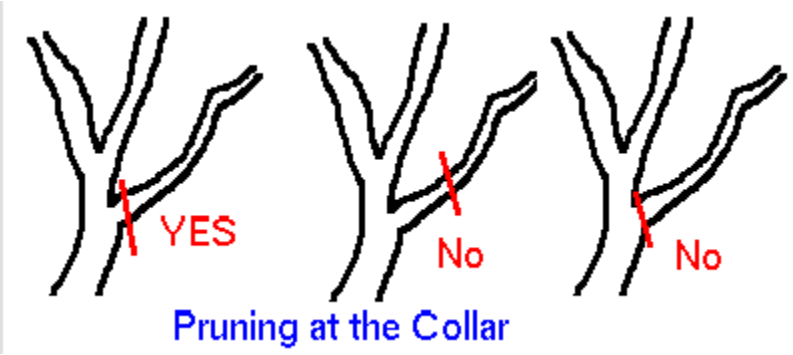
Pruning vegetation is an essential and regular part of trail maintenance, especially in brushy chaparral areas. Multi-use trails should have 10' vertical and 8' horizontal clearance (though there will be exceptions for the sake of protecting certain native hardwood trees and other protected flora).

Too often, trail pruning is accomplished in the most expeditious manner possible -- a branch intrudes within the walking/riding space of the trail and is quickly lopped-off so that it doesn't intrude and the debris is indiscriminately tossed aside. However, our goal in trail maintenance is to **maintain a trail as safely and as natural in appearance as possible**. A quick pruning job deals only with the function of trail maintenance, not the aesthetics. Improper pruning can also create dangerous vegetative hazards such as pointed "pungee sticks" that can seriously impale a trail user.

There are 10 elements of acceptable pruning. Each of these elements makes pruning a more tedious maintenance task, but results with a trail that is compatible with the natural environment.

1. **Do not randomly toss debris!** Branches that are randomly discarded usually end up hanging in adjacent shrubs or trees or lying in the middle of the trail. These dead branches are both unsightly and create a hazard for trail users.
2. **Place debris out of view.** This element requires the extra effort of dragging branches well off the trail and out of the sight of trail users.
3. **Place the butt (cut) end away from the trail.** This will help disguise the debris.
4. **Each cut branch should be touching the ground to promote decomposition.** This means that brush piles are not appropriate.
5. **Pruning should be done sensitively so that the trail appears natural** and not as if a chain saw just blasted through. Trail users should not be aware that **any** maintenance work has recently been done.

6. **Prune to the collar of any branch stem** for the health of the shrub and a more natural looking result. At the base of any branch there is a wide section that contains a plant's natural healing agents. Any pruning performed away from this collar will expose the plant to a greater risk of infection. A cut at the collar will naturally heal. For large branches over 2" in diameter, cut from the bottom, then cut down from the top. This prevents tearing of the bark, reducing infection.
7. **Only use loppers or pruning shears to prune.** Do not use machetes as they can leave sharp pungee points and also are dangerous to be swinging about in a narrow trail corridor.
8. **Never, ever use a chainsaw without permission from the land manager. Weedwhips and trimming devices such as the Stihl Kombi Unit may be used.**
9. **Manual (hand) saws should be used on deadfall only, not live trees, shrubs and flora.**
10. **Non-native invasive trees and shrubs can be removed at the base or, if possible, pulled up by the root ball when soil is soft.** Typical non-native invasives seen along trails in Southern Michigan include Autumn & Russian Olive, Buckthorn, Multiflora Rose and Honeysuckle. Get to know, identify and hate these species. A good pictorial non-native invasive species guide can be found online at http://www.invasive.org/eastern/



CUTTING GRASS

While many portions of trail run through hardwood forest, sections also pass through areas of grass, weeds and fields. In these sections, grass and weed growth can become an issue, obscuring the trail and trail corridor sightlines. In these areas, trail adopters should maintain excessive growth by trimming it carefully with either a hand **scythe**, or, a gas or electric powered monofilament line weed whip or Kombi unit. If a weed whip is going to be used, the trail adopter should always check in with the land manager or trail coordinator first to discuss use parameters. If growth is so significant that even use of a weed whip is marginally effective, the trail adopter should contact the land manager to request the land manager (not the adopter) have someone mow the area with a commercial walk-behind mower.

REMOVING DEADFALL

From time-to-time, weather or the natural life cycle will result in breakage of trees and tree limbs, causing them to fall onto or across the trail corridor. This "**deadfall** or **downfall**" can range in size from small limbs and twigs to large trees of significant diameter. Such deadfall presents a potential hazard to all trail users and should be removed. Deadfall can be dangerous and very complex with which to deal. If deadfall consists of large hardwoods that are intertwined, one needs to approach any removal with caution, as pieces may shift during removal -- hitting, pinning or pinching the user. Trail adopters should only remove deadfall if it is noncomplex and can be readily cut with a nonmotorized hand saw. **NEVER USE A MOTORIZED SAW SUCH AS A CHAINSAW, SAWZALL, ETC. TO REMOVE DEADFALL UNLESS EXPRESSLY GIVEN PERMISSION TO DO SO BY THE LAND MANAGER!** If deadfall necessitates the use of a motorized saw, contact the land manager to discuss an appropriate approach to removal.

BLOCKING SOCIAL CUTS AND SPURS

As discussed above, social cuts and spur trails will occasionally develop creating a deviation or "option trail" from the intended, authorized trail corridor. Such trails may develop due to trail users trying to skirt a trail obstacle or poorly maintained section of trail. They can also develop to follow a "path of least resistance" or in order to get to a "**control point**" along the trail quicker or more easily than using the existing trail corridor. A control point is a place that influences where users want the trail to go, such as a scenic overlook, structure or other point of interest.

Social cuts and spur trails can have a negative effect on a trail system, creating trail widening, environmental damage and degradation of trail aesthetics. For these reasons, they should be blocked off and reclaimed. In order to block a social cut or spur, it is best to drag native deadfall trees, tree limbs or rocks onto the spur trail tread. Any blocking should be comprehensive (i.e. cover the entirety of the tread of the trail spur, not just the beginning or end) and should be done in as subtle and natural of a way as possible. In addition, any trail blocking should be entirely visible and evident as a user approaches a social cut or spur (i.e. no sudden surprises or hazard obstacles, please). Finally, a trail adopter should never, ever cut down any live trees or flora in order to block a social trail cut or spur.

WHAT IS MY ROLE AS A TRAIL SEGMENT ADOPTER?

FOUR STEPS TO ADOPTION SUCCESS

1. Maintain your adopted segment in accordance with the guidelines in this document. How often you need to do work on your segment will vary depending on seasonal conditions, weather patterns, use patterns, etc. Quantity of work is not important, quality is. Do not let your section become ill-maintained.
2. Maintain periodic communication and dialogue with both the land manager, trail coordinator, and other trail segment adopters.
3. Keep track of the number of hours you work on the trail and report them quarterly to both the land manager and trail coordinator.
4. If you cannot effectively maintain your segment for any reason, please notify both the land manager and trail coordinator so that there are no gaps in trail maintenance quality.

PERMISSION BEFORE FORGIVENESS

This document is designed to give a volunteer trail adopter or maintenance worker the tools and information necessary to do basic, routine maintenance on Southern Michigan primitive, nonmotorized trail systems. If situations arise were a volunteer is unsure of a "best practices" approach to a maintenance situation, the volunteer should contact either the Land Manager, or, the Chapter Trail Maintenance Coordinator for the trail BEFORE proceeding any further. Improper trail maintenance practices can be both dangerous and potentially damaging to natural resources. So, the most important mantra for any trail worker is: WHEN IN DOUBT, GIVE THE LAND MANAGER A SHOUT.

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