

PROTECTING THE LAND YOU LOVE

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TRAIL MANAGEMENT GUIDELINES



**Frenchman Bay Conservancy
Trail Management Guidelines**

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SAFETY MESSAGE

The safety of FBC staff and volunteers while engaged in trails work or other strenuous field activities is of paramount concern. Participants must be in good physical condition and pay particular attention to their personal safety and that of their fellow crew members. One member of each field crew should be assigned the responsibility for safety.

Trail Design

From the start, trails should be designed and built to meet specific objectives and have minimal impacts on the land. Hiking trails should meander and be visually pleasing; they should also take advantage of existing trails, terrain and vegetation and be fit for all seasons of the year. Where possible, sensible loops should provide maximum hiking diversity and avoid rabbit warrens of confusion. Following some route and design considerations:

- What is the intended use; i.e. hiking, ATV, snowmobile, fishing access, etc.? This document addresses hiking trails.
- Does public access (such as parking) to the planned trail need to be built?
- How can scenic panoramas, interesting geologic features and extant flora and fauna best be incorporated into the trail design?
- Is the terrain suitable; are the slope and aspect reasonable; can long steep side hills be avoided?
- What is the existing ground cover and vegetation; can it support repetitive hiking use and is it reasonable clear or heavily wooded areas requiring extensive cutting with much wood and brush disposal?
- Will material such as cedar bog bridging or crushed granite have to be purchased, transported and used in construction or maintenance of the trail?
- Are the soils stable and well drained?
- Will the trail be designed for and useable in all types of weather and the four seasons?
- Are there natural, historic or cultural resources that should be left undisturbed?
- If there are critical wildlife or plant areas, how can they best be avoided?
- Can portions of existing roads or trails be used?
- Can longer bridges be avoided?
- Might neighboring land owners be positively or adversely impacted by the trail?
- Is the trail designed for minimum recurring maintenance?

A trail should, if possible, avoid areas of erosion, deep snow drifts, ice or bogs. Generally, trails may cross or go to streams and ponds. However, to avoid erosion and contamination of the water body, they should be appropriately drained and not located closely parallel with the bank or shore.

Trail Alignment

The alignment should follow the contours of the land and generally be curved. Sharp angular turns over 50 degrees and long straight stretches should be avoided. On hillsides, angle across the slope and take advantage of natural drainage.

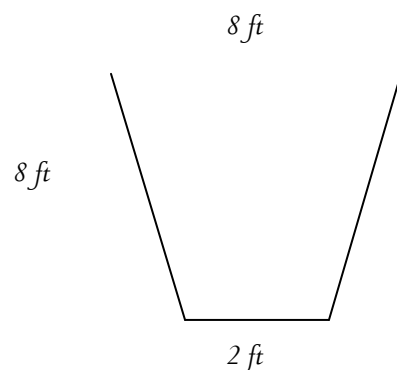
The trail should not appear to be carved out of the hillside. If a switchback is required, try to utilize natural topographic features: Grades should be reduced at approaches to switchbacks, and the turn should be as nearly level as practical.

A clinometer or Abbney level should be used to determine grades. A grade should not be steeper than 10% (10 foot rise in 100 linear feet). A grade of less than 7% is ideal. Generally, steps are recommended for any short stretches where the grade is steeper than 24%. Trails should not be located at zero grades, if possible, because some grade is desirable to provide for proper drainage. A grade should undulate gently. Every effort should be taken to make the scene look natural, with as little impact from trail construction and maintenance as possible.



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A trail tread width should not be less than 18 inches (minimum) for foot trails. It should be cleared of vegetation to a 2-foot width tapering upward 8 feet to a width of 8 feet.



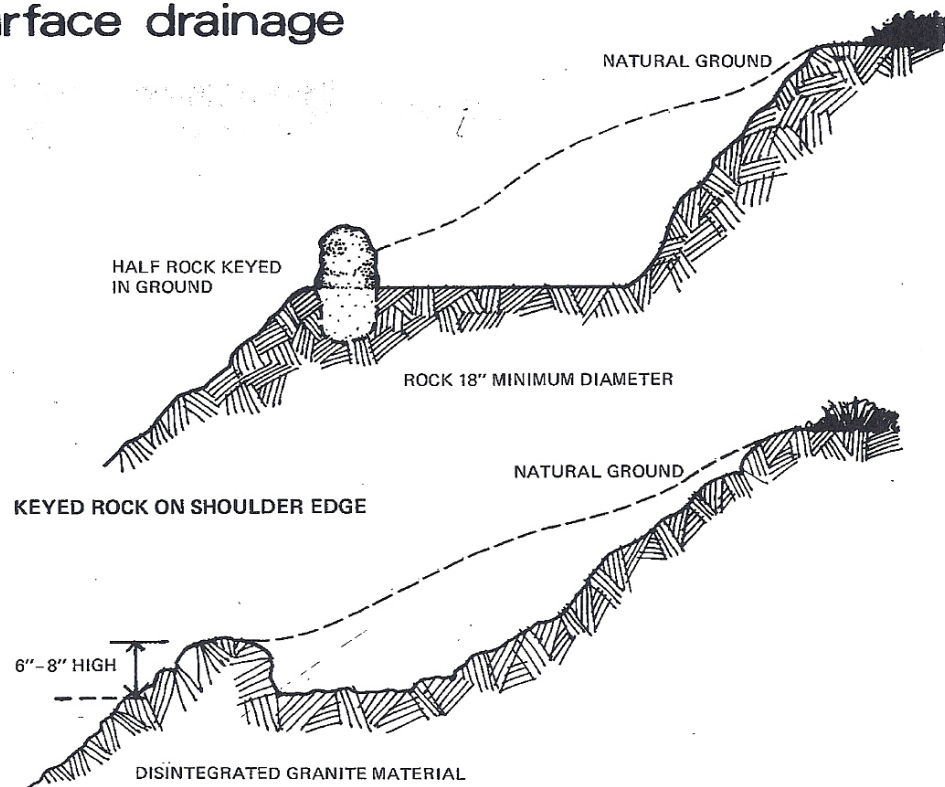
Bushes and trees should be cut flush with the ground, and then exposed stumps covered with soil. Trees and stumps should be removed if the tree roots will interfere with grading. Hazard trees that might fall across the trail should be removed. Snags and decaying wood, however, are important components of natural ecosystems; elsewhere, they should be left to rot. Tree limbs should be cut flush to the tree and then scattered away from the trail. The butt ends of limbs should face away from the trail.

The existing ground surface should not be unnecessarily disturbed to obtain a trail base, especially on flat areas. On level ground, the trail base should be formed by building up rather than cutting down. All duff should, however, be removed before making cuts or fills for the tread.

Construction of hillside trails usually requires grading a shelf for the trail, but if the existing surface is flat and provides a suitable tread, it should be left undisturbed. Hillside excavation may not be necessary on slopes less than 10 percent. The usual procedure is to scratch a continuous line between slope stakes, using a shovel or Pulaski. Excavation should begin along this line; and the working surface should be kept level or slightly in-slope until the final grade is reached.

Fills on slopes greater than 20 percent are hard to maintain. In areas with heavy spring runoff, berms at the outside edges of the trails are not recommended.

berm-surface drainage



Trail bridges

Foot bridges under 30 feet could be built of suitable native material if it is available. In most cases, however, cedar bog walk materials will serve to bridge or bypass currently known streams and perennially wet areas.

Re-vegetation

Adequate re-vegetation should be planned for cut-and-fill slopes, borrow pits and eroded areas. Plants native to the local area should be used and care must be taken not to import non-native plant species to FBC preserves. Non-native plants are an issue—their treatment and eradication in many cases are yet to be determined. Native seed mixes, methods and volume of application and initial care should be in accord with proven practices.

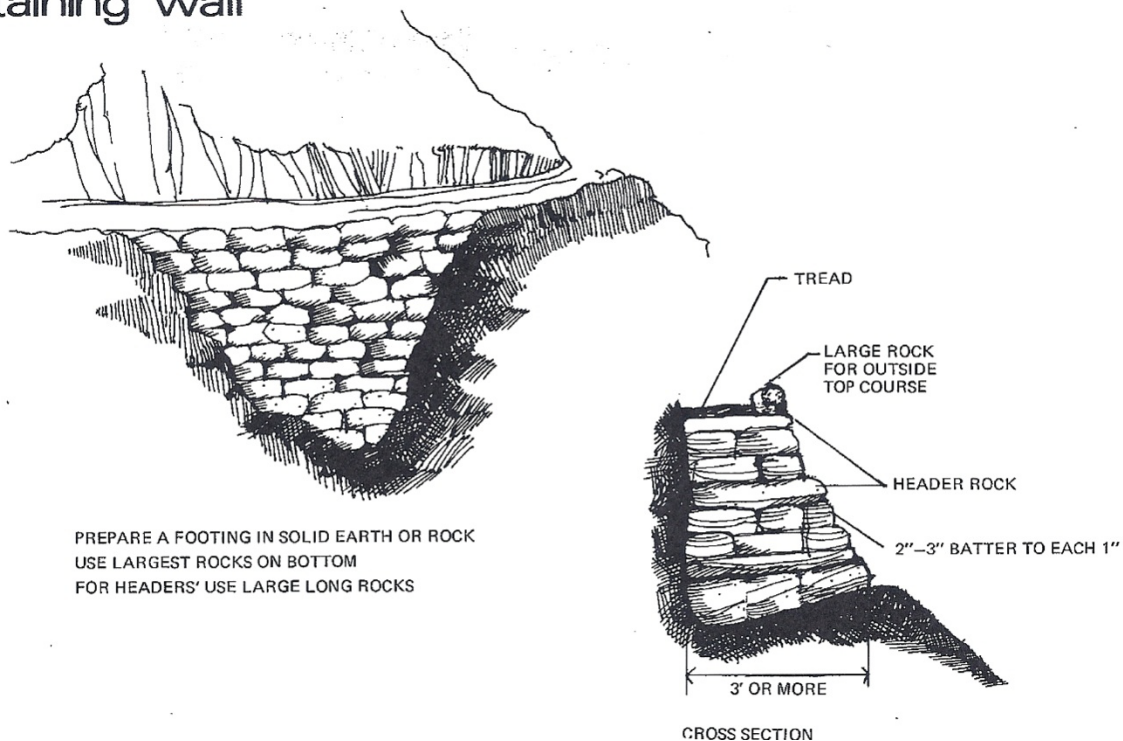
Trail tread materials

Native materials should be used if good rock and gravel is available. Decomposed granite is locally abundant and available for purchase. The cost in terms of labor and getting it to many of FBC's more remote sites may, however, be prohibitive. Hauling in tread material is costly; it should only be used for extreme needs, such as on heavily used trails. Gravel or decomposed granite should be loaded by hand and hauled by wheelbarrow. In some places small, mechanized equipment such as a "Bobcat" might be used.

Retaining wall (cribbing)

Sound durable rocks having a good bearing surface are the preferred structural material. Native logs or other untreated timber should be used only if rock is not readily available and only when side slopes do not exceed 50 percent. Joints in the wall should always be staggered at least 6 inches or more.

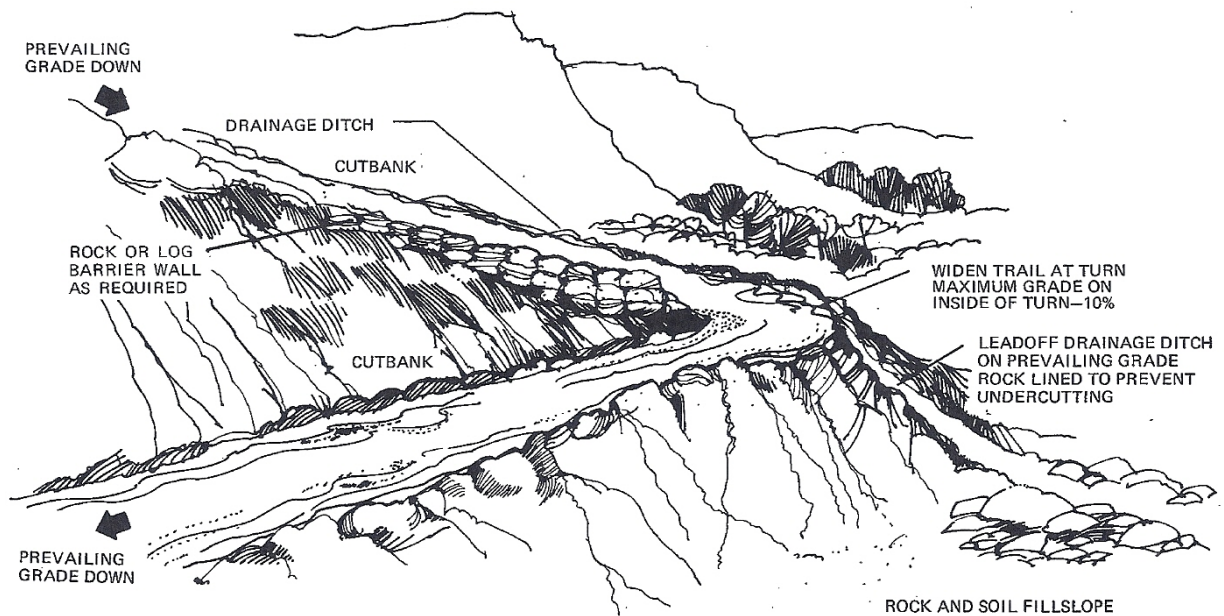
retaining wall



Switchback construction

When switchbacks are necessary, the turns should be constructed as flat as possible. On side slopes of less than 20 percent, the switchback should be treated as any other section of the trail by following a long radius curve.

switchback

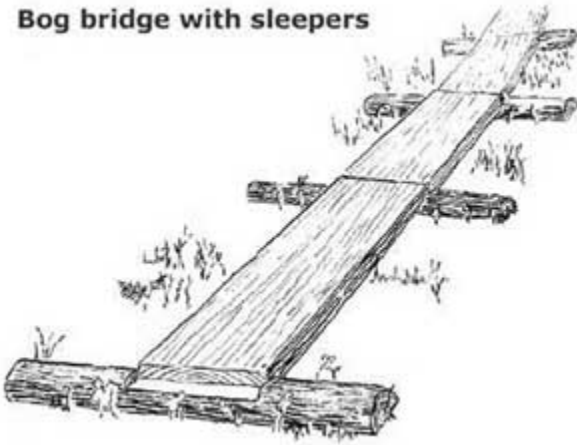


Other Trail Construction Types

Bog walks

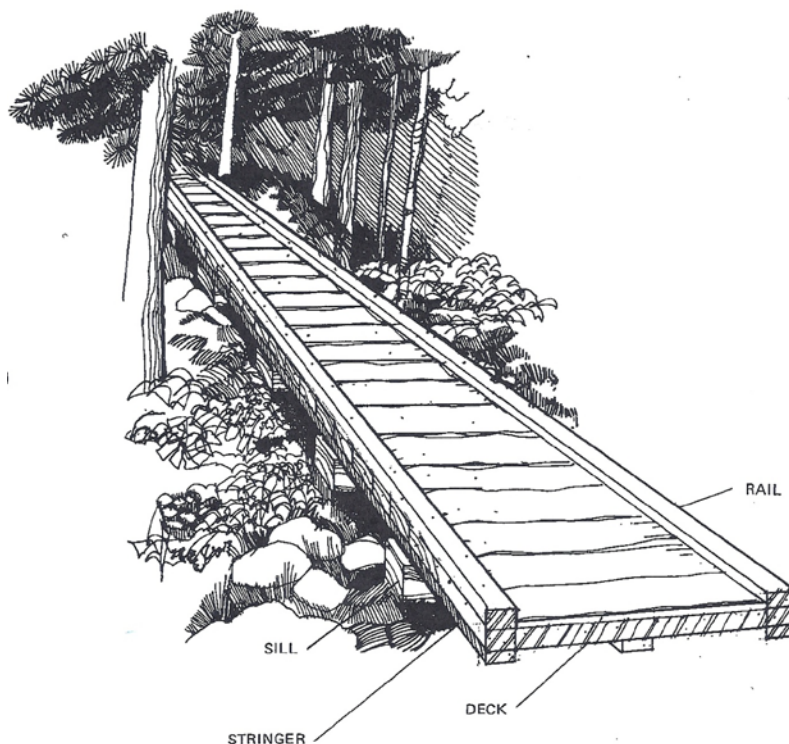
It is anticipated that bog walks will be the primary means of providing hiking trail access across wet areas. The most important consideration should be to get the water level below the trail base and carry the water under and away from the walkway at frequent intervals.

Bog bridge with sleepers



Puncheon

Puncheon is essentially a 4-foot wide boardwalk using cedar or treated planks fastened to adzed log or squared timber stringers. The decking should be securely screwed or spiked to the stringers.



Corduroy

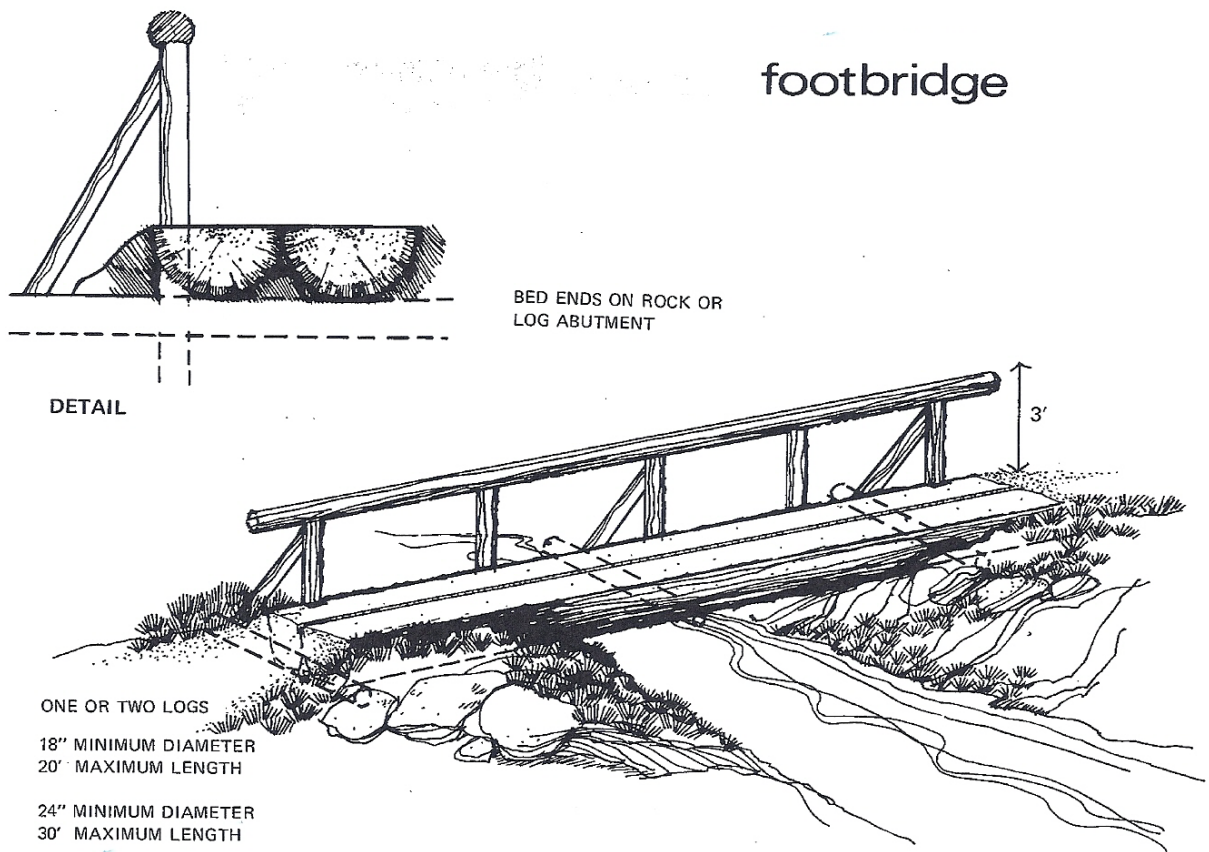
Corduroy is logs or timbers laid over wet areas to afford safe and relatively dry passage. This technique is normally short-lived, considered a temporary measure and discouraged unless needed for a pressing temporary need to prevent trail widening or the development of new unwanted trails.

Bridges

Because of their expense in terms of materials and labor; and, that fact that they often are damaged or destroyed by ice and/or high water, bridges over 30 feet in length should be built only where there are no other alternatives.

If needed, they must be of high quality construction, with the appropriate width and handrail(s), and sited to maximize their expected useful life. Safety of the users is the prime consideration in any bridge design.

Only bridges built with an adequate opening to accommodate each year's floodwaters will survive. Occasionally, cribs can be avoided if a high bank, large rock, or ledge happens to be in the correct location. Most sites requires two cribs, one on each side of the stream.



Trail blazes

Cairns should be used in alpine areas where vegetation is low to the ground. They should be built as broad as they are tall, using large rocks, and placed at short regular intervals from 100 to 300 feet apart.

A standard FBC 4-inch by 5-inch diamond made of metal can be attached to trees or posts using aluminum nails and driven in about 1 inch may be used. Or, and in most instances, a Nelson blue painted blaze will clearly mark the route. (The blaze mark should be approximately the same size as a dollar bill.)



Drainage methods

Surface water will flow along a trail and erode the trail surface if allowed to accumulate above a certain critical combination for soil type, slope, and velocity. Precautionary measures to prevent silting, erosion, or gulying of areas must be taken if the trail is to survive.

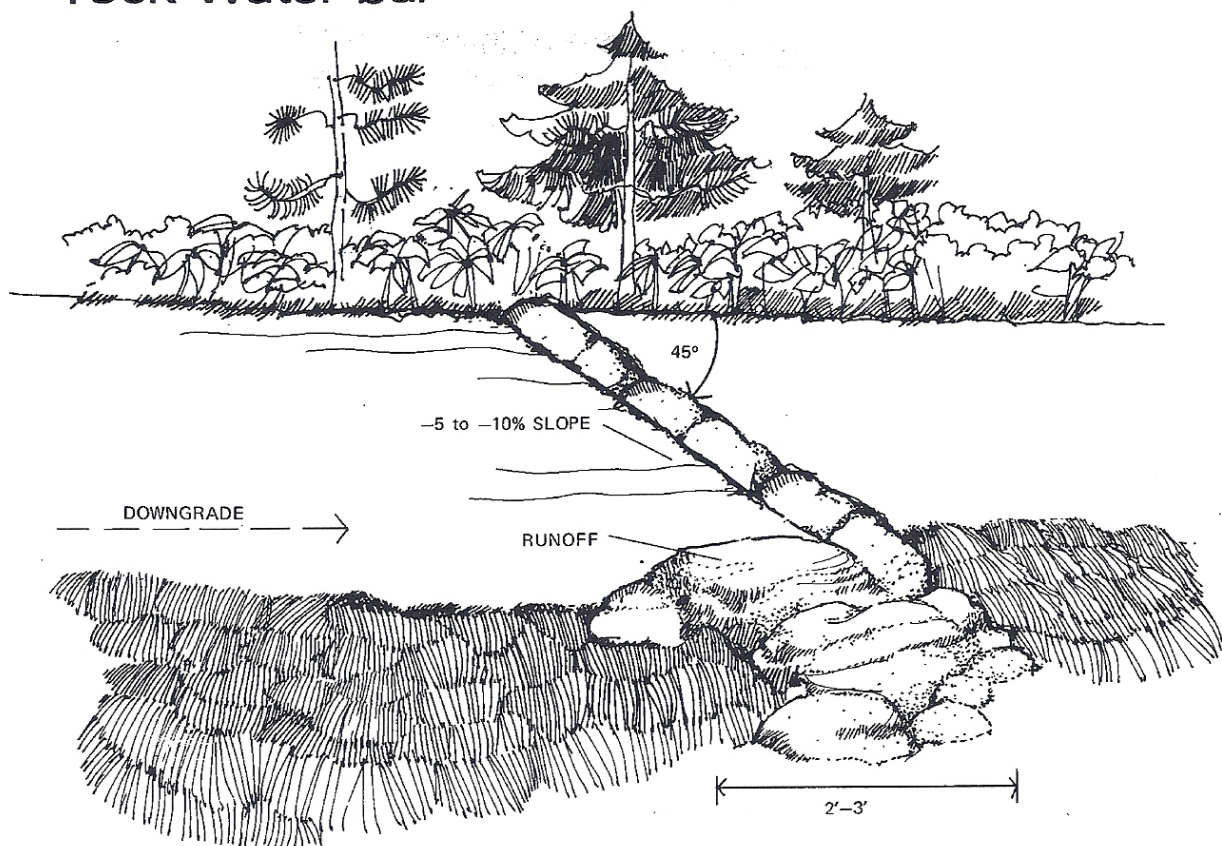
Surface water can be diverted by out-sloping, grade dips, water bars, culverts, ditches, and by varying the trail grade when it is constructed. Approximately $\frac{1}{2}$ to 1 inch per 18 inches of slope across the trail tread is normally sufficient for water to run off the trail side, but this should be based on specific soil types.

Water bars

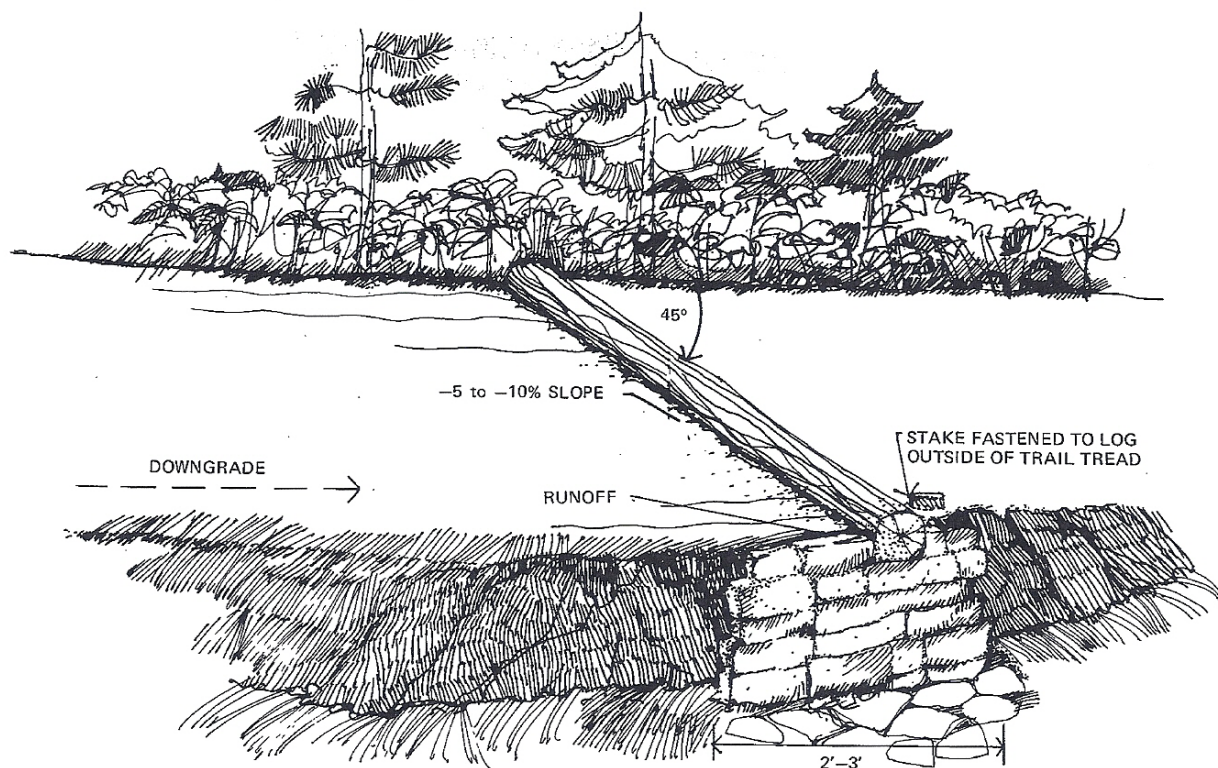
Effective water bars minimize the speed, volume, and distance travelled by water down a trail. The greater the slope and the more water channeled by a trail, the greater the need for water bars. Placement should begin near the top of the slope to catch water before it gains momentum.

For a rock or log water bar, a trench must be dug across the trail at a 30- to 45-degree angle. Bars placed at less than 30 degrees may slow water too much, causing the bar to clog with silt and debris. Bars placed at 30 to 45 degrees tend to clean themselves as water flows freely off the trail. Bars placed at more than 45 degrees produce scour erosion along the bar face. The trench should be free of rocks and roots. With routine maintenance, rock water bars will last forever.

rock water bar



log water bar



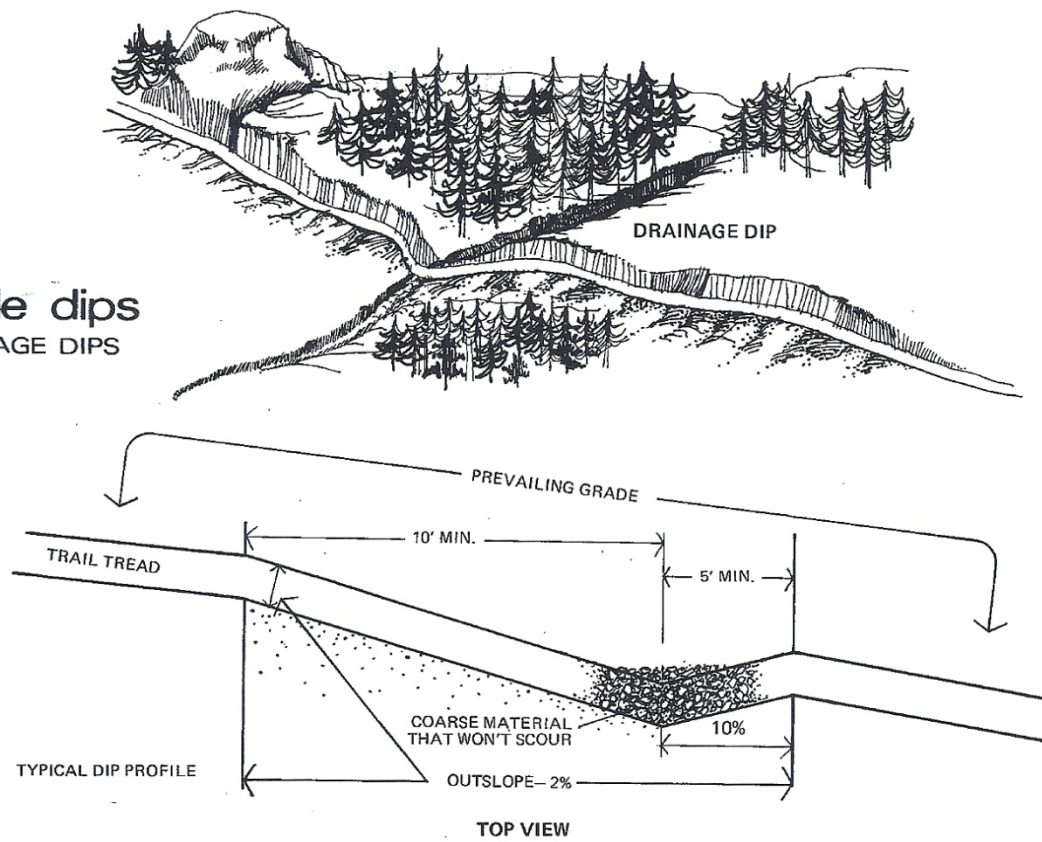
A wood-log water bar should be placed in a trench, with over half its diameter below the tread. The log should be solidly placed, if possible, wedging it between rocks and ledge. If using stakes, the sides of the log should be notched before the installation to accept each stake driven. Peel all logs and use the most durable species available, most often cedar.

Grade dips and Culverts

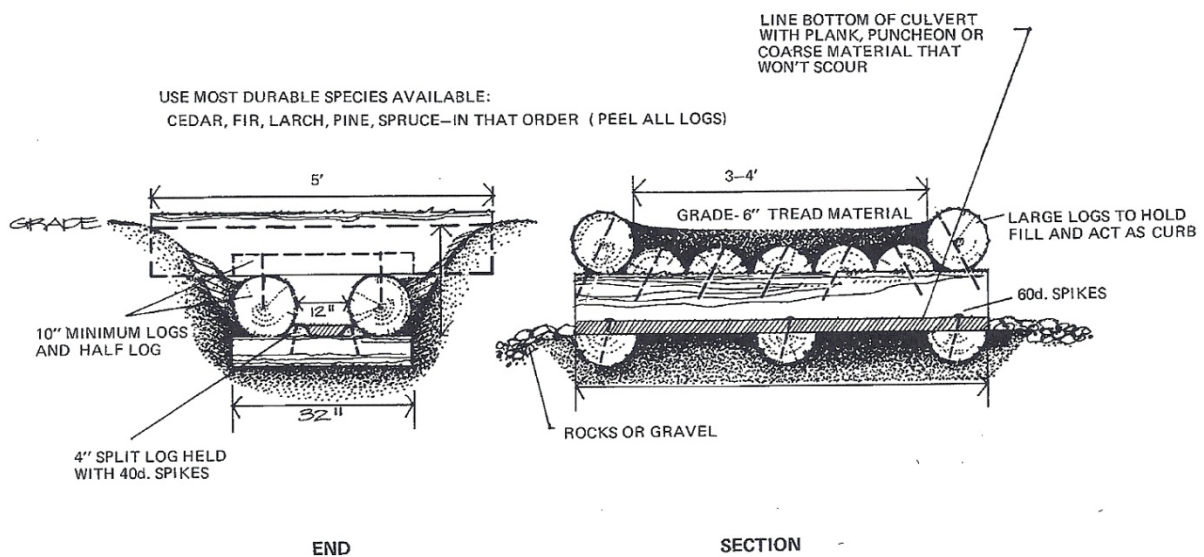
These are hardened dips in the trail designed to carry water across and away from the tread. They perform a similar function as stone or wood culverts. Diagrams next two pages.

grade dips

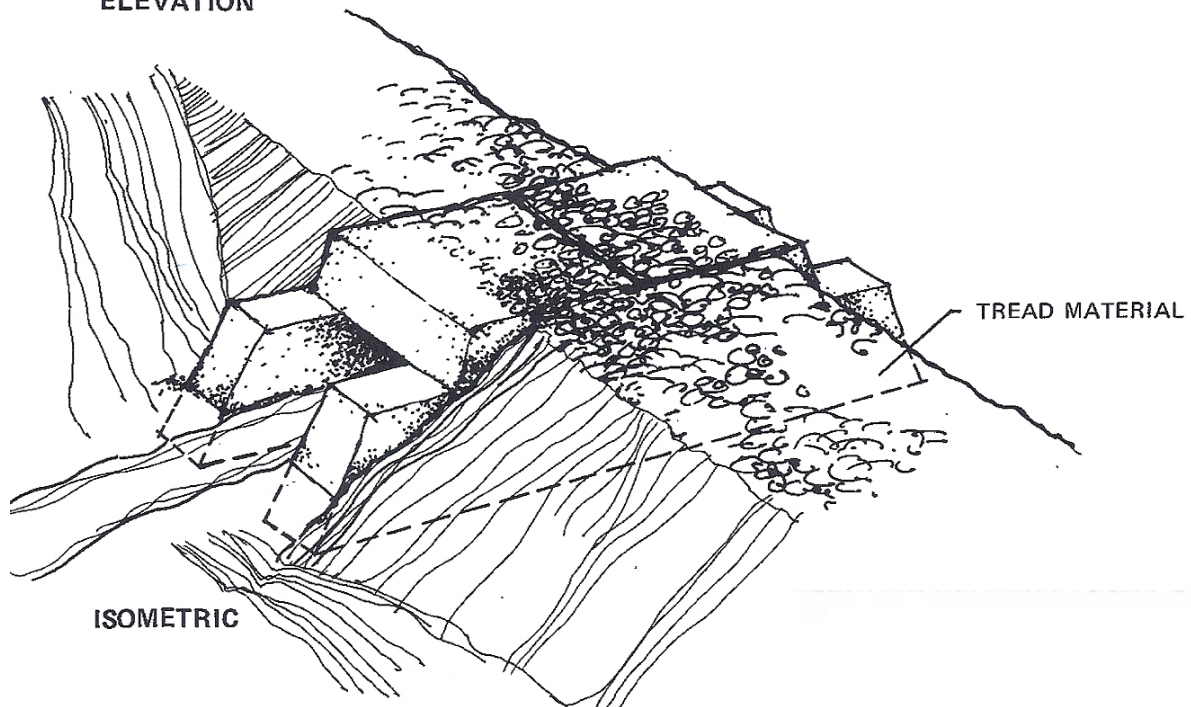
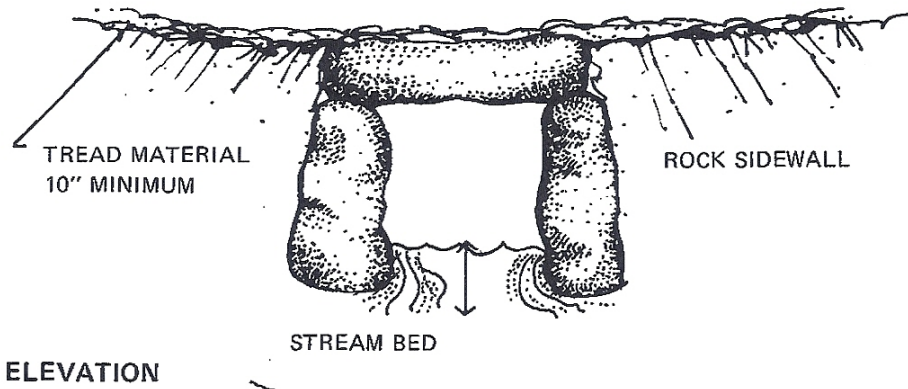
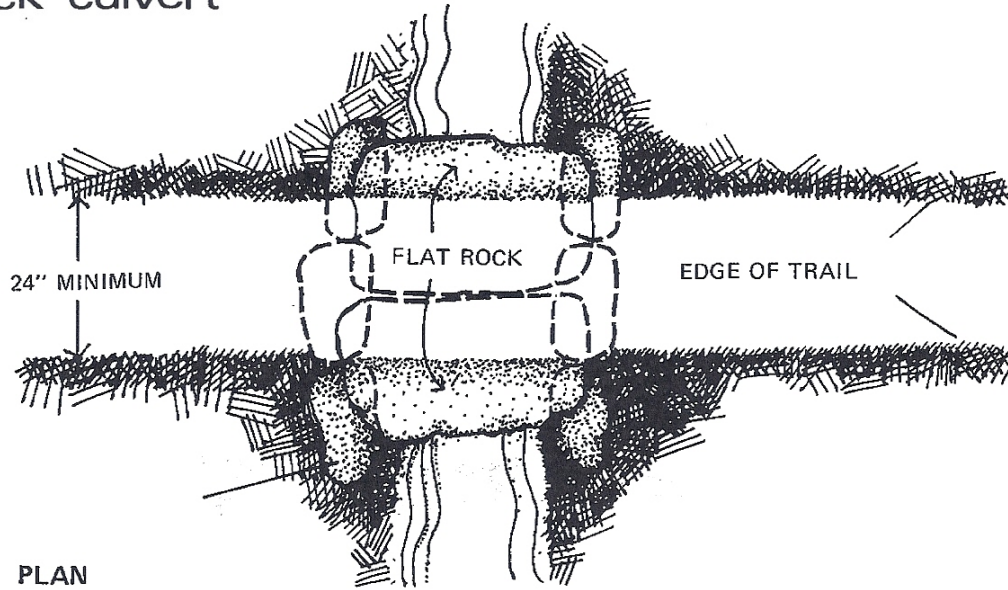
DRAINAGE DIPS



log culvert



rock culvert



Signs

FBC trail signs generally fall into four categories:

1. Preserve signs at the trailhead or parking lot
2. Signs for use activities that are permitted, limited or prohibited
3. Directional signs along the trail
4. Signs recognizing LMF funding

FBC Preserve Signs

FBC preserve signs were standardized in 2010.

Layout:

- Preserve name
- FBC logo with name
- Trails Open to the Public



The typeface is Old Baskerville. The letters are routed and painted Pantone 308U. The sign is 1½” pine of appropriate dimension for the site. The finish is four coats of automotive clear coat. For quality and consistency, all new preserves signs are manufactured to FBC specifications by DaVinci Signs in Hermon, Maine. Ande Binan is the primary contact.

The signs are mounted on pressurized 4x4 posts routed for fit as seen at Tidal Falls and set in a concrete footing. The posts are stained with Cabot’s Oak Brown.

Message signs

Signs with messages about activities that are permitted, limited or prohibited are manufactured on standard metal road sign templates with vinyl lettering. The FBC logo with our name in Pantone 308U should appear on an off white background. Sierra Signs in Hancock can manufacture these for FBC.

Directional trail signs

These signs are currently installed on Baker Hill and Long Ledges Preserves. The number of interlocking trails in this area has caused some hiker confusion over the years. The FBC system links numbered trail signs with corresponding numbers on the trail map. In addition, there are signs with trail names and arrows indicating the direction of the trail and the direction back to the parking lots.

These rustic signs were designed and crafted by Rick Beckjord, the grantor of the Baker Hill Preserve. The signs are crafted from 1" pine with route letters painted blue. These signs are finished with spar varnish. After Rick's death, the remainder of the needed signs will be crafted at Signworks in Farmington, Maine, in the style that Rick designed. Mike Monahan is the primary contact.



Smaller trail directionals

These are 3¼" metal diagonal triangles mounted as necessary.



Maintenance Guidelines

Trail log

A trail log should be prepared for each preserve trail section. It is normally prepared only once in the life of a trail and is meant to be a reference document for future maintenance and planning purposes. Following is a checklist of features that might be included in such a document:

Type of terrain	rock section	underdrain
ground cover	drainage ditch	steps
% of side slope	stone barrier	fence sign
trail tread width	barricade	cairn
grade	turnout	gate
surfacing and depth	intersection	vista
switchback	bridge	stile
climbing turn	drainage dip	special features
retaining wall	water bar	
puncheon section	culvert	

Annual Maintenance

The annual plan should define, schedule and provide estimated costs for required maintenance activities for the fiscal year. Again, the following are simply checklists for annual maintenance planning:

Trail maintenance-vegetation checklist

Brush clearing areas
Hazard tree removal
Litter cleanup
Slope revegetation
Backslope grooming
Vista maintenance

Tread maintenance checklist

Grading tread
 slough and slide removal
 grubbing rocks, roots, stumps
Spot surfacing
Surface replacement (similar material)
Surface repair and removing loose rocks

Drainage maintenance checklist

No factor in trail maintenance is more important than proper drainage. Proper drainage prevents erosion.

Cleaning and repairing structures

- culverts
- underdrains
- water bars
- grade dips
- drainage ditches

Replacement of existing drainage structures

- culverts
- underdrains

Installing additional drainage structures

- water bars
- culverts
- rock drains
- water bars
- grade dips
- drainage ditches

Structure maintenance checklist

- bridge repair
- cribbing and retaining wall repair
- barrier and guardrail repair
- fence, gate, stile repair
- shelter/kiosk repair

Sign maintenance checklist

- sign repair and rehabilitation
- sign replacement
- blaze and trailblaze repair and replacement
- cairn repair
- barricade rocks replacement

Trail maintenance-vegetation guidelines

Leave no stubs

Trees and brush outside the tread should be cut as close to the ground as possible, leaving no sharp-pointed stumps or stems

Any fallen tree lying on or over a trail should be removed, or, if a large tree, that portion lying across the trail. When cutting a log, the cuts should be made at a sufficient angle to permit the cut section to be rolled free with minimum effort. Generally, the uphill cut should be made first to permit the lower section to hold the upper portion from sliding onto the trail and possibly injuring the workers whose footing is unstable for the upper cut.

Travel way clearance for hikers should be 4 feet wide by 8 feet high:



GLOSSARY

ABUTMENT	The foundation of either extreme end of a bridge that supports the superstructure (sills, stringer, trusses, or decks).
BACKSLOPE	The cut bank formed by the excavation extending upward from the tread
BASE	The primary excavated bed of a trail upon which the tread or finished surface lies.
BERM	The ridge of dirt or rocks placed on the outside of the trail base.
BRIDGE	Any structure spanning and permitting passage over a river, stream, chasm, canyon, or road.
CAIRN	A constructed mound of rock located adjacent to a trail. Used in open alpine areas or mountain areas where the tread is indistinct.
CLINOMETER	Instrument used for measuring angles of elevation or inclination.
CORDUROY PUNCHEON	A log structure laid on the ground for the purpose of crossing swampy areas. Usually consists of stringers, decking, and often a soil or loose gravel tread on top of decking.
DECK or FLOORING	That part of a bridge structure that provides direct support for trail traffic.
DRAINAGE, CROSS	Running water in swamps, springs, creeks, drainages, or draws that the trail must cross.
DRAINAGE, SURFACE	Rain or snow runoff from the surface of the tread.
DUFF	Organic matter or a deep mat of tree needles or leaves in various stages of decomposition on the ground of a forest.
FORD	A natural stream crossing improved sufficiently for use by saddle or pack animals and trail users.
GRADE DIP	A reverse in the grade of the trail accompanied by an angling outslope that will divert water off the trail.
GRADE, MAXIMUM	The steepest grade permitted on any part of a trail.
GRUBBING	To dig, to clear of roots, to uproot shallow roots near or on the ground surface; also grubbing of tree stumps.

HEADER	A long, uniform, stone laid with its end towards the face of a retaining wall or crib used intermittently to structurally tie in the other rocks laid in the wall.
MEASURING WHEEL, or CYCLOMETER	An instrument that measures circular arcs. A device that records the revolutions of a wheel and hence the distance travelled by a wheel on a trail or land surface.
OUTSLOPING	A method of base grading that leaves the outside edge of the trail lower than the inside.
PUNCHEON	See Corduroy.
RUN PLANK	Usually wood planks laid lengthwise (along the axis) on top of bridge decking used as the tread surface.
SIDESLOPE	The natural slope of the ground measured at right angles to the centerline of the trail, or the adjacent slope which is created after excavating a sloping ground surface for a trailway, often termed a cut-and-fill slope, left and right of the trail base and tread.
SILL	A crosswise member at the top of an abutment or pier that supports the stringers, beams, or trusses.
SKEW	Deviation from a straight line; slant.
SPECIFICATIONS	The standard of workmanship and type of materials for all component parts of a trail base, trail tread, clearing, grade, bridge, culvert, puncheon.
STAKES, GRADE and SLOPE	Stakes set by the trail locator to establish the elevation and cross section of the completed tread.
STAKES, LINE	Stakes set by the trail locator to establish the centerline of the trail.
STATION	One hundred feet measured along the centerline of the trail.
STILE	A step or set of steps for passing over a fence or wall.
STRINGER	The lengthwise member of a structure that supports the bridge deck.
SWITCHBACK	A sharp short radius curve in a trail that is used on hillsides to reverse the direction of travel and to gain elevation.

TRAILHEAD

The start or end of a trail often accompanied by various public facilities, such as a parking area, toilets, water, direction and information signs, and a trail use register. A picnic or campground may also be a part of the trailhead facility.

TREAD

The surface portion of a trail excluding backslope, ditch, and shoulder. The tread surfaces could include native material or gravel surface crushed to size. Another tread surface could be soil cement, which is a combination of local trailbed soil mixed with a cement to form a hardened soil cement trail tread.

WATER BAR

A device for turning water off the trail, usually made of logs, stones, soil cement, or by contouring the native material within the trail prism. An enlarged modification of a dip installed at an angle across the trail base, with approximately a 30-degree skew.

