



PCTA Trail Skills College Curriculum Field Reference



Course 203. Waterbars and Checks

STUDENT SKILL OUTCOMES:

- Understanding of ideal logs and rocks for constructing effective waterbars and checks.
- Safe peeling and transport of logs.
- Safe quarrying and transport of rock, especially safe use of rock bars.
- Understanding of where to locate waterbars and checks.
- Ability to reconstruct “old school” waterbars.
- Developing “Trail Eyes” and ability to “Think like Water.”

KEY TERMS:

Apron: (aka knick, swale, dip) the portion of a drain dip or modern waterbar that is excavated out of the trail tread to divert water off the trail. It consists of a descending ramp and rising back-ramp. The exact shape of the apron, though always broad and gradual, varies according to two different schools of thought. Some make it wider at the **inside edge** of the trail leading to a narrower **outfall ditch** and others make it wider at the **outside edge** without an outfall ditch.

Check: (aka check step, check dam) a log or row of rocks perpendicular to a gullied **fall line** trail, embedded in both banks, to slow the rate of water erosion. If several are constructed on a horse trail, they should be 6', 12, 18', or 24' apart to approximately match the gait of a horse.

Drain Dip: (aka dip, drainage dip, earthen water bar, and rolling grade dip; a close cousin but different from a grade dip, Coweeta dip, knick, swale and bleeder) A broad, gradual excavated trail feature to shed water off the trail at regular intervals to prevent tread erosion by interrupting the normal grade of a section of trail. Soil excavated is mounded and compacted down the trail from the dip. Ideally 15-30' long and 8-12" deep. To withstand horse use, drain dips should only be built in very durable soil with trail grades below 10-12%, ideally in the late fall when the soil is moist and just before winter, allowing snow to compact the dip before use in the spring.

“Old School” Waterbars: still seen many places and in some books, these are constructed so that water is deflected by the “bar” of rock or log. Such structures fail more quickly, as water and horse

hooves directly undermine and erode the bar.

Outfall Ditch: (aka outwash, outlet or outflow ditch), 24" wide excavation to carry water away from the trail at a drain dip or waterbar. Ends when it is 12" below the trail grade or as far as it needs to go to keep water from returning to the trail.

Backramp: (aka Ramp) the descending and ascending facets of a drain dip or waterbar. Always well outsloped to shed water efficiently. Combined, they comprise the drain dip apron.

Waterbar (Log or Rock): (aka rock or log reinforced drain dip). As constructed by the PCTA, this trail drainage structure includes a drain dip reinforced by a peeled log or row of large rocks. The reinforcing log or rocks are buried securely at about a 45 degree angle across the tread and 36" down the trail from the bottom of the dip--thus water leaves the trail well before it reaches the log or rocks. Waterbars are generally required on trail grades in excess of 15%, rather than drain dips. See also, **“Old School Waterbar”**.

KEY CONCEPTS:

- 1) Safety Documents and Concerns:
 - Personal Protective equipment (PPE), Job Hazard Analysis (JHA), Tailgate Safety Session (TSS), Emergency Action Plan (EAP)
- 2) Trail Crew Leave No Trace: Have a positive impact on the land through trail work and be sensitive to off trail and camping impacts.
- 3) Proper/ Improper Tool Care and Use:
 - Fire shovel, McLeod, adze hoe, Rheinhard, Pulaski, pick mattock, rock/ tamping bar, heavy/ light sledge
- 4) Hillside Hydrology/ How Trails Work:
 - Effects of water in diverse soil types
 - Trail design/ tread and drainage structures
- 5) Developing “Trail Eyes”:
 - Suggest hiking in rain to better understand water on trails
 - Notice every drainage, even disappearing ones
- 6) Locating New Waterbar Sites:
 - Locate areas of erosion, fix any existing

- drainages, reevaluate
 - Berm and slough removal vs. new drainage structure
 - Trail conditions for new waterbar (vs. rolling drain dip)
 - Grade greater than 10%, moist durable soil, avoid top/ bottom of hill
 - Spacing between drainages determined by grade, soil, volume of water
 - Choose log or rock waterbar based on native resources
 - If possible use rock first, more durable
- 7) Constructing New Waterbars
- Materials
 - Log: have certified sawyer fall a green tree 10-12" diameter > measure it out, cut it, peel off bark
 - Rock: safely quarry and transport rocks > box shaped rocks with flat sides are ideal
 - Build a broad gradual apron
 - 15% or greater outslope to help self clean
 - Bury bar completely so top is level with original trail surface
 - Set at 45 degrees at high point of backramp, less/ more angle to match force of water
 - Excavate a 24" wide outfall ditch
 - Extend below tread as far as you need to
- keep water off trail
- Entire structure, including ramp, apron, and backramp, should be at least 20 ft long.
 - Convert "old school" waterbars to newer design
 - Pack soil VERY well
 - Test drainage with tennis ball
- 8) Checks are for retaining tread in less than ideal conditions
- May be appropriate for:
 - Gullied tread, especially if fall line and not drainable
 - Unstable or steep tread
- 9) Materials: rock or log, same instructions as for waterbars
- 10) Setting Checks
- Perpendicular to the tread, level across top
 - Space at least 6' apart to match gait of horse
 - Bury rock or log about half its height
 - Rise not to exceed 6-8"
 - Embed ends into banks
 - Secure rock or log so it does not wiggle
 - Backfill with crushed rock
 - Flank each step with guide rocks or rip rap
- 11) Any fill material needed should be mined carefully
- 12) Report Work Promptly

Figure 1. "Old School" rock water bar. (IMAGE COURTESY OF THE USFS)

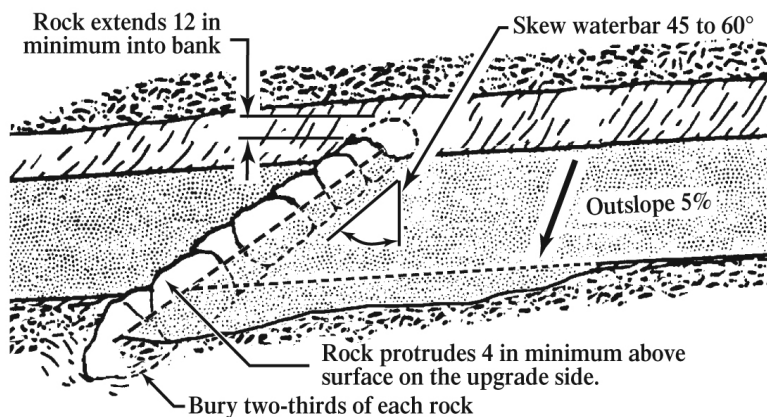


Figure 2. Diagram of modern waterbar construction

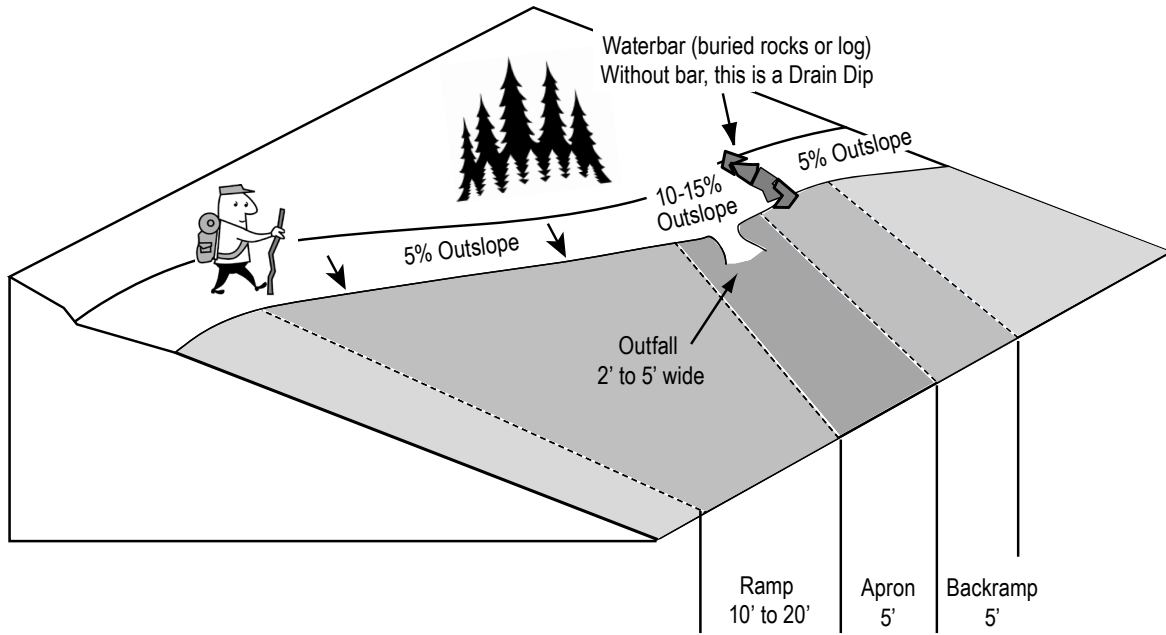
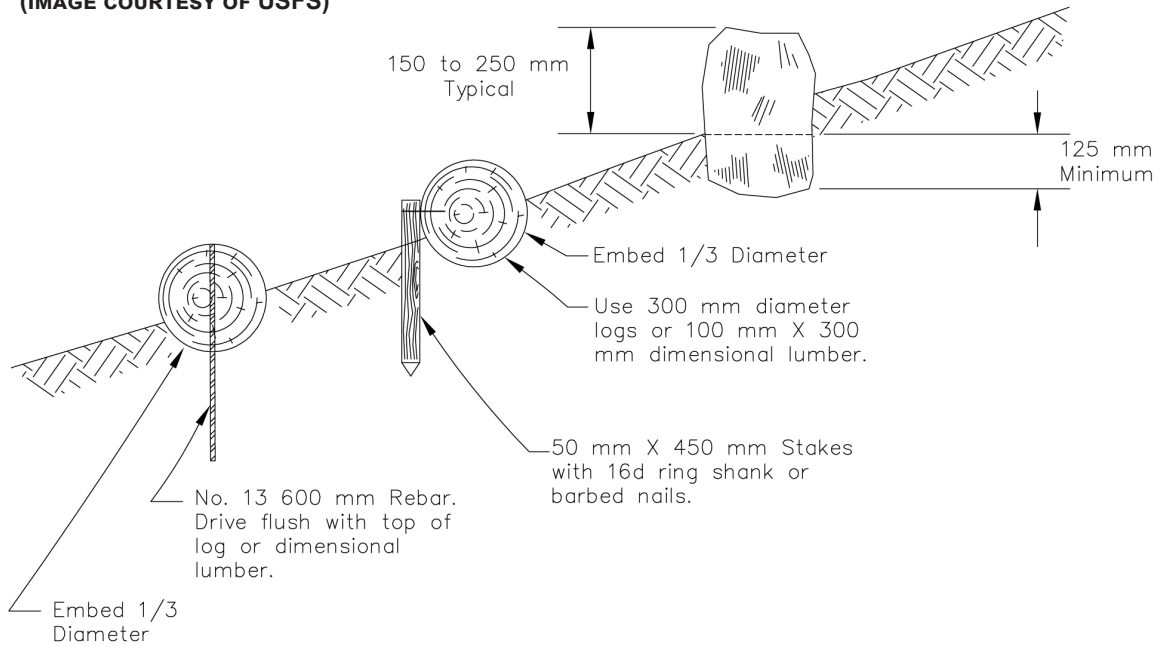


Figure 3. Check Dams.
(IMAGE COURTESY OF USFS)



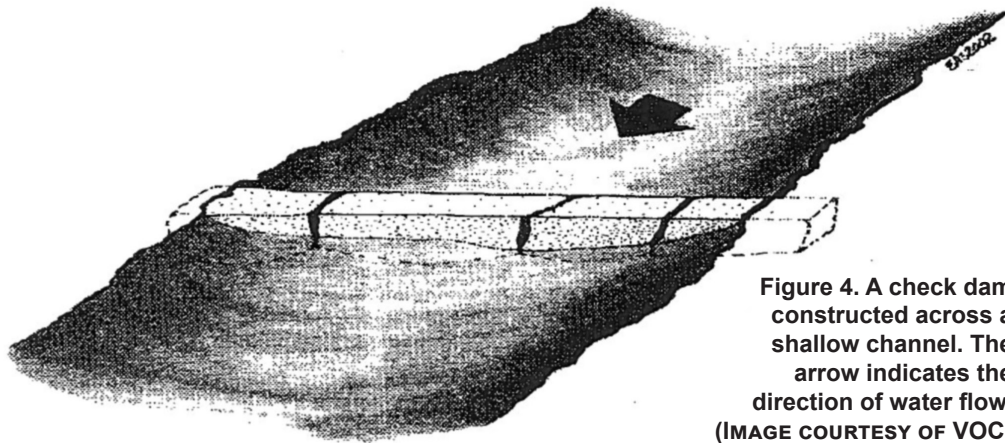


Figure 4. A check dam constructed across a shallow channel. The arrow indicates the direction of water flow. (IMAGE COURTESY OF VOC)

Figure 5. Seven Steps to Modern Water Bar Construction. (IMAGE COURTESY OF VOC)

