Figures

Photos

Chapter 7. Equestrian Trail Design

Equestrian trails are primarily designated for use by equestrians (horseback riders). They are designed to meet the requirements of horses and their riders, protect resources, and achieve sustainability. They are not multi-use or accessible trails. Pedestrians may use them but they are not the primary user for whom the trail is designed to accommodate. The planning, layout, and design discussed in Chapter 3, *Planning and Environmental Compliance*, and Chapter 5, *Principles of Trail Layout and Design,* apply to these trails. However, there are additional design criteria related to equestrian trails.

Photo 7.1- Equestrian Users

7.1. Horse Behavior

The trail designer needs a basic understanding of horse behavior. A design that incorporates and accommodates the needs of horses will result in trails that have less impact on resources, provide a safe and enjoyable experience for the horse and rider, and are more sustainable.

Horses have developed their physical and behavioral characteristics through 60 million years of evolution. Even though they are large and powerful, they have been prey to large carnivores throughout their existence and have developed instincts to ensure their survival. Humans domesticated horses and have enjoyed their use and company for thousands of years. However, the animal's basic instincts have not changed from when it was wild, which is why a horse can often be skittish. It is cautious when approached by other animals (including humans) and jumps or takes flight when startled or threatened.

Horses are herd animals and their behavior is largely influenced by a social herd structure. Thus, a horse will perceive itself as part of a herd, even if the herd consists of just the horse and rider. In every herd there is a leader and followers. As a herd animal, horses are very sensitive to their environment and the behavior of the animals (including humans) around them. They find comfort and safety in a herd, and enjoy and require strong leadership and companionship. Keep in mind when designing trails that herd dynamics are in effect on trail rides. For example, if a horse sees another horse become startled and bolt, it too may bolt. When a dominant horse is crowded on the trail, it may kick at the next horse in line to force it to respect the dominant horse's space. When confined in small enclosures, horses will establish dominance over each other. This pecking order behavior leads to horses inflicting injuries on each other or preventing some horses from having access to food and water.

7.2. Physical Characteristics

7.2.1. Vision

Horses have large and wide set eyes. In combination with a narrow face, these characteristics allow them to have a 350-degree field of vision and they can see everything around them except for directly behind their head and in front of their feet. Only 65 degrees of this field of vision is binocular (with two eyes), and the remaining 285 degrees is monocular (with one eye). As a result, horses detect movement in almost any direction, but their depth perception is poor, particularly where their vision is monocular. Horses' eyes are also elongated, which inhibits their ability to quickly focus on objects both near and far. Their vision is generally poorer than humans'; they can only see about 60% as well and as far. Because of their visual limitations, horses have difficulty determining if an approaching backpacker is a human or a predator. They have excellent night vision, but their eyes have difficulty adjusting to abruptly changing light and dark conditions.

7.2.2. Sense of Hearing and Smell

A horse's senses of hearing and smell far exceed that of humans. They often hear or smell an approaching animal long before their rider. These sensory capabilities can result in horses becoming startled without their riders knowing the cause. Horses have a good memory and remember trail routes taken in the past. This memory, when combined with their sense of smell, allows them to retrace a travel route with little difficulty.

7.2.3. Hooves

Hooves provide horses with excellent traction in a variety of conditions. In addition, horses are capable of feeling vibrations through their hooves. The underside triangular portion of the hoof ("frog") is fleshy and susceptible to injury from sharp stones or abrasive surfaces. This area can become bruised or injured with repeated exposure to these types of surfaces. Horseshoes provide additional strength and support to the hoof in rugged terrain or during prolonged riding periods. However,

horseshoes also reduce traction in rocky or icy terrain. Developed surfaces such as wood, asphalt, and concrete are slippery, regardless of whether the horse is shod.

7.3. User Protocols

Standard protocol is that pedestrians using equestrian trails must yield the right-of-way. All equestrian trails should have signs that explain right-of-way protocols. When approaching a horse, hikers should make themselves as visible as possible, not approach too rapidly, and speak in a low and friendly voice to ensure recognition. Hikers should select a wide spot in the trail or an area with a gentle side slope and step off to the downhill side of the trail. Most equestrians prefer to have the uphill side of the trail during an encounter in case the horse bolts. When the horse approaches, hikers should not make any sudden movements and should maintain their conversation. The hiker should not step back on the trail until the horse is a full body length down the trail. Stepping behind a horse too soon can result in the horse attempting to kick the hiker and cause serious injury.

7.4. Design Requirements

7.4.1. Trail Length and Circulation

Although many equestrians ride their horses for long distances in remote settings, most horses and equestrians are not trained or in condition for this type of riding. The majority of equestrians in the United States live in or around urban areas. Horses are stabled or pastured near the owner's home for riding on weekends. To accommodate equestrian users, Class I trail designs should provide trails of varying lengths. Generally, 3 to 8 miles provide the distance desired by most equestrians. Longer trail riding opportunities are provided only if the landbase is large enough to support them. Interconnected loop trails provide equestrians a variety of route options to meet their needs. (See Figure 7.1.)

Loop trails are preferable for all user groups. Retracing a path is not as stimulating as traversing over new ground. With equestrians, loop trails are important because a horse can become "barn sour" when retracing a path. When a horse knows it is heading back to camp or a trailhead, it sometimes gets anxious. Knowing that food, water, the company of other horses, and the relief of not carrying a rider is close at hand can cause a horse to pick up its pace and become difficult to handle. This behavior is reduced when riding a loop trail.

A good way to accommodate all users when there is competition for trails is to establish multi-use trails as the main arteries of the system and have designated use trails branching off the main arteries. These trails can connect to other similarly designated loops or loop back to the multi-use artery. (See Figure 7.1.)

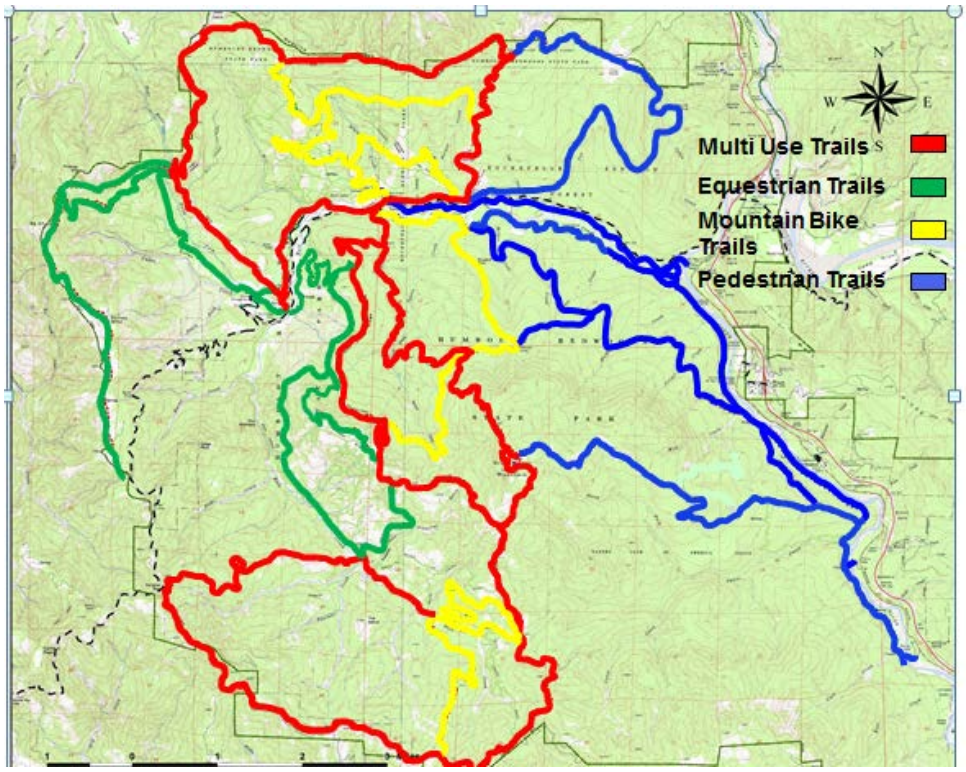

Figure 7.1 - Shared and Separate Trails with Loops

7.4.2. Water

Horses require between 12 and 20 gallons of water per day, depending on the weather, amount of exercise, physical size, and the amount of food consumed. Class I equestrian trails longer than 7 miles require watering stations. Water troughs should be properly located and of appropriate design. Horses should not be allowed to drink from streams, ponds, or springs due to the impact associated with their ingress and egress, or from urinating and defecating in sensitive areas. Some of the important criteria for horse trough location and design are:

- They should be spaced approximately 5 to 7 miles apart.
- They should be located near a year-round fresh water source.
- They must be located on durable and stable ground outside the influence of a water course and adjacent to the trail.
- The trough should be installed on a dry stone rock tray and the approach area hardened with aggregate/soil mix.
- The trough is designed with an inlet for fresh water and an overflow outlet to maintain a constant supply of fresh water in the trough.
- The outlet water is piped back to the watercourse.
- An escape screen is installed in the trough to allow rodents to climb out of the trough if they fall in.

7.4.3. Tread Width

Class I and 2 equestrian trails should have a minimum tread width of 36 and 24 inches, respectively. Although the trail is designed primarily for equestrians, pedestrians will be encountered frequently on these trails. In locations where the hillslopes are steep and hikers have difficulty stepping off the trail, passing spaces should be provided. Passing areas should be a minimum of 60 inches wide and 60 inches long.

7.4.4. Trail Layout and Tread Construction

The general layout and design of equestrian trails should follow those identified in Chapter 5, *Principles of Trail Layout and Design*. In addition, equestrian trail layout should avoid low gradient hillslopes (less than 20%) and flat ground. When flat ground cannot be avoided, elevate the trail tread by constructing a turnpike or causeway. (See Chapter 14, *Drainage Structures.*) On hillslopes, equestrian trails should always have a full bench for greater durability and sustainability. Horses tend to walk on the outside edge of trails that are constructed on hillslopes, which may be related to their limited binocular vision and prey instincts. Staying on the outside edge of the trail provides them with a better view of the uphill side of the trail, where potential predators would likely approach. Their tendency to walk on this portion of the trail makes full bench construction imperative. General trail tread construction practices should follow those identified in Chapter 11, *Principles of Trail Construction*.

If native soil is not suitable for long-term sustainability, the trail tread can be strengthened by adding crushed rock aggregate. (See Chapter 11, *Trail Construction, Tread Hardening.*) Apply crushed rock to the trail bed by mixing native soil into the top layer of aggregate to help bind the aggregate together, soften its appearance, and reduce the impact to the underside of the horse's hooves (frog). Hardened and smooth trail surfaces, such as concrete, soil cement, asphalt, and non-permeable soil stabilizers, should not be applied to equestrian trails. These surfaces are slippery and cause horses to lose traction and fall. They also can injure the frog.

7.4.5. Grade Uniformity

A sudden increase in linear grade is to be avoided when laying out and constructing equestrian trails. When linear trail grades are relatively constant, horses have a steady gait. When a grade suddenly increases, such as going from a 5% to 15% grade in 10 linear feet, horses will adjust their stride to compensate. Horses will push off harder with their hind legs when going uphill, transferring weight to the hind legs and applying more force to the hooves. When going downhill, the horse will sit back on its hind legs and brake its descent with its hooves, transferring weight to the hind legs and applying more force to the hooves. These actions result in the hooves penetrating into the trail tread and displacing soil. Over a period of time, these sections of trail can become entrenched and develop drainage problems.

7.4.6. Trail Structures

Due to the blind spot directly in front of the horse's feet, low trail structures such as steps and waterbars should be avoided on equestrian trails. Horses have a difficult time recognizing these structures and will trip over them or walk around them. Waterbars (with a few exceptions) are generally not an effective drainage solution and should be avoided as explained in Chapter 14, *Drainage Structures*. Steps on an equestrian trail are also problematic and should be avoided. If an existing trail has steps, the trail should be rerouted to eliminate the steps, if possible. If a reroute is not possible, the steps should be constructed per the equestrian step design in Chapter 17, *Trail Steps*.

7.4.7. Switchbacks and Climbing Turns

Switchbacks and climbing turns should be designed and constructed as discussed in Chapter 12, *Topographical Turn, Switchback, and Climbing Turn Construction***.** When designing a switchback or climbing turn, it is important that the radius of the turn is wide enough to accommodate horses. If the turning radius is too narrow horses are forced to cut across the inside corner of the turn. The linear grades coming into and out of the turn should be equal. If they are not, horses will erode the trail tread in a fashion similar to those previously discussed for abrupt grade changes. A minimum turning radius of 10 feet is required for equestrian trails. If the trail is used by pack stock, the radius should increase to 15 feet. The grade of the upper and lower legs of the turn should not exceed 14%, unless the parent material is durable enough to support a steeper grade.

7.4.8. Watercourse Crossings

For equestrian trails, wet crossings ("fords") are preferred over bridges. The process for locating and selecting crossing sites is discussed in Chapter 5, *Principles of Trail Layout and Design,* and Chapter 14, *Drainage Structures*. All wet crossings, even those across swales, need to be armored to protect soil and stream gravel, reduce erosion and sediment delivery, and provide a sustainable crossing. (See Chapter 14, *Drainage Structures*.)

When approaching a drain swale or armored stream crossing, horses have a tendency to walk below or downstream of the developed crossing site. This behavior results in volunteer trails developing below the intended crossing site. Volunteer trails are unsightly and highly erodible, which causes sediment to be transferred into the watercourse. When constructing these crossing structures, the ground below the approach to the crossing needs to be blocked by installing rock or log barriers parallel to the watercourse and above the high water elevation. (See Figure 7.2.) Given a horse's aversion to low lying structures, these barriers will force the horse to use the intended crossings.

Some horses become nervous walking across a bridge. This reaction is related to their depth perception, sensitivity to vibrations through their hooves, and reduced

traction on unnatural surfaces. Horses are also more confined while crossing a bridge and their options for flight are severely limited. However, crossing limitations and environmental concerns will often necessitate a bridge. Bridges on equestrian trails should be designed to accommodate the size, weight, and traction needs of horses. (See Chapter 16, *Trail Bridges.*) The bridge should be wide enough and the railings high enough that the horse and equestrian feel unconfined and protected from the edge of the bridge.

A common design on equestrian bridges is to install running boards on top of the decking to protect it and simplify maintenance. The running boards are installed parallel to the direction of travel so that the wood grain also runs parallel. Unfortunately, this design often causes horses to slip on the boards as their shod hooves slide across the wood grain. This situation can be mitigated by installing decking boards (thick enough to provide a reasonable life expectancy) perpendicular to the direction of travel. These methods may increase construction and maintenance costs, but they improve equestrian safety. The approaches to all watercourse crossing structures should be constructed at trail grade. (See Chapter 16, *Trail Bridges.)*

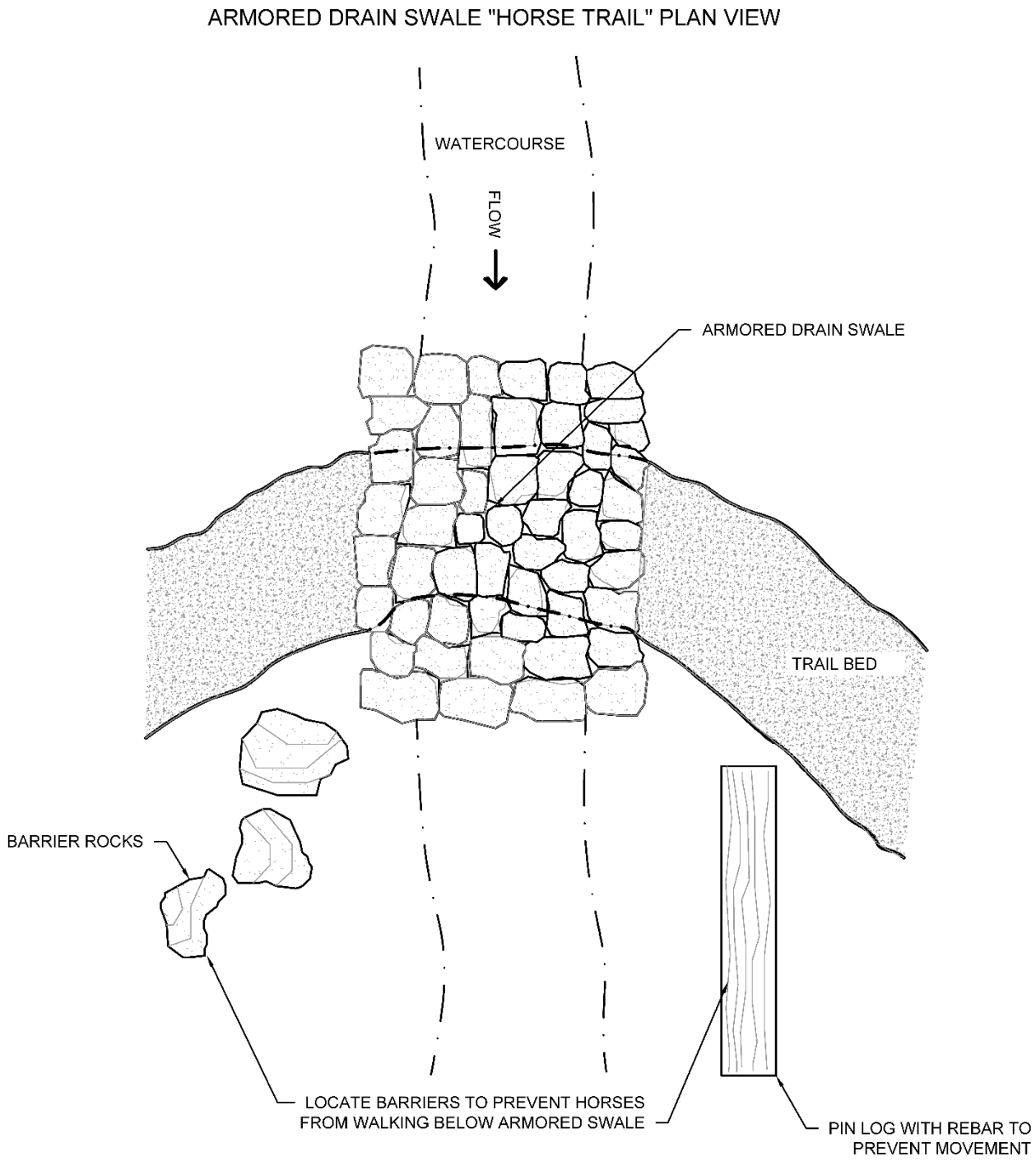

Figure 7.2 - Armored Drain Swale Horse Trail

ARMORED DRAIN SWALE HORSE TRAIL

CALIFORNIA STATE PARKS

NOT TO SCALE