Maintenance, Operations, and Design

In general, people desire safe, reliable, and quality user experiences whether traveling or recreating. The traveling public expects governments and public works departments to construct, maintain and operate roads, highways, bridges, and sidewalks in safe, functional, and efficient conditions. People who play softball, soccer, frisbee, and other sporting activities expect ball fields and park facilities to be maintained in not only a useful condition, but in a state that provides a fulfilling and satisfactory outdoor experience. An enjoyable visit to the park or a trail reinforces and promotes use and fosters a sense of pride for one's community. Conversely, a park or public facility that is improperly maintained discourages use. Trail users have similar expectations.

Trail managers are responsible to a large extent for providing safe facilities with limited controls and conditions that minimize risk, while promoting positive user experiences. Managers establish these conditions initially through good trail design and infrastructure, but must maintain the facilities with routine and long-term trail maintenance, education and outreach, user involvement, and regulations and enforcement. Needless to say, maintaining trails comes at a cost. Future expansion of the proposed Thurston Regional Trail Network will require local agencies to forecast and manage maintenance and operations budgets to keep pace with the expanding network. This section of the plan discusses some of these tasks and their costs. This section also includes an overview of trail operations and basic design features that enhance trails and contribute to positive user experiences.

Maintenance

Who Maintains the Trails?

At present there are nine agencies that maintain and operate shared-use and recreational trails that are open to the public in the Thurston Region. It is not always clear to trail users who owns and/or operates and maintains a particular trail. The easiest way for a trail user to know who to contact should the need arise would be to read a sign posted at a trailhead or trail access point. Unfortunately, not all trails presently have signs with this information and it is

Removing debris off the trail surface is necessary for safe and enjoyable trail use. The I-5 Bicycle Trail at Boulevard Road. Photo by Paul Brewster.

not always clear from those trails with signs who to contact to for sweeping, clearing brush, or removing fallen trees.

The following table includes a list of point of contacts for maintaining the existing trails.

Existing Trail	Managing Agency and Contact Information
Chehalis Western Trail: Woodard Bay to Martin Way	Washington State Department of Natural Resources, Central Region: 360.748.2383 or 1.800.527.2387
Chehalis Western Trail: 12th Avenue to State Route 507	Thurston County Parks and Recreation Department: 360.786.5595
Arc of Statehood Trail **Heritage Park Trail** **Heritage Park Hillside Trail** **Capitol Lake Interpretive Center Trail** **Deschutes Parkway** (All around Capitol Lake Vicinity)	Washington State Department of General Administration: 360.725.0000
East Bay Promenade (Trail): The Port of Olympia, Marine Drive vicinity.	The Port of Olympia: 360.528.8000
Evergreen Parkway Bicycle Paths: The Evergreen State College Campus	The Evergreen State College: 360.867.6349
Old Evergreen Parkway Trail: South of the Evergreen State College Campus to 2nd Ave	Thurston County Roads and Transportation Services Department: 360.786.5495
I-5 Bicycle Trail: Eastside and Wheeler to the Chehalis Western Trail (Olympia City Limits)	Inter-local Agreement General Operations and Maintenance, sweeping, debris removal, pavement repairs: City of Olympia Public Works: 360.753.8588 Landscaping and Fencing: Washington State Department of Transportation: 360.357.2607
I-5 Bicycle Trail: Chehalis Western Trail to College Street (Lacey City Limits)	Inter-local Agreement General Operations and Maintenance, sweeping, debris removal, pavement repairs: City of Lacey Public Works: 360.491.5600 Landscaping and Fencing: Washington State Department of Transportation: 360.357.2607
McLane School Forest Trail	McLane School Forest and Trails Committee: no point of contact information available Thurston County Parks and Recreation is evaluating an inter-local agreement to assume maintenance and operations
Woodland Trail – Lacey City Limits	City of Lacey Parks and Recreation Department: 360.491.0857
Woodland Trail – Olympia City Limits	City of Olympia Parks, Arts, and Recreation Department: 360.753.8380
Yelm Prairie Line Trail	City of Yelm Public Works: 360.458.8406
Yelm- Tenino Trail	Thurston County Parks and Recreation Department: 360.786.5595

Routine Maintenance

A regular maintenance program is important to maximize the safety of those who use trails. Poorly maintained trails can pose significant safety hazards to both bicyclists and pedestrians. Trail managers must program their maintenance activities to address the seasonal conditions. The autumn months in the Pacific Northwest bring rain and cold temperatures. Big Leaf Maples, Red Alders, Cottonwoods and other deciduous trees drop their leaves in large masses on the trail surface. Dry leaves are easier to sweep or blow away, but wet leaves left to decompose become mushy hazards that are difficult to remove. If not addressed, cyclists are subject to an increased risk for losing steering control and may suffer personal injuries from crashing or inflict injuries on other trail users.

Routine scheduled maintenance throughout the year not only ensures trail safety, but can increase a trail's longevity. The Rails-To-Trails Conservancy (RTC) published a useful guide to trail maintenance titled, *Rail-Trail Maintenance and Operation: Ensuring the Future of Your Trail – A Survey of 100 Rail-Trails*. It includes useful checklists for scheduling routine maintenance. Some activities like cleaning restrooms and emptying trash cans require frequent service. Other tasks may require weekly, monthly, or annual inspections.

Trails for the 21st Century (RTC, 2001) suggests the following sample maintenance activity list:

- Replace missing and damaged regulatory and directional signs.
- Repaint worn pavement markings.
- Trim trees, shrubs, and grass to maintain sight distances.
- Patch holes, fill cracks, and feather edges.
- Clean drainage systems; modify to eliminate ponding.
- Sweep to remove leaves, mud, gravel, and other debris.
- Mow trail shoulders.
- Pick up trash; empty trash cans.
- Clean out ditches, culverts, and other drainage structures
- Maintain furniture and other support facilities.
- Clean rest rooms and drinking fountains; repair as needed.
- Remove graffiti from rest rooms, retaining walls, rocks, and other surfaces.
- Prune dense understory growth to promote user safety.
- Inspect structures for deterioration.
- Remove fallen trees.
- Clean and replace lights (in tunnels and at road crossings).
- Weed control

Thurston County staff recommends documenting when trail maintenance activities occur. Logging these activities provides useful records for scheduling future maintenance and estimating costs. Referencing a checklist while doing routine maintenance can help staff focus on issues that regularly need attention. Resolving the issue on the spot can save a maintenance crew an unnecessary trip back in the future.

Cost Estimates

Thurston County Parks and Recreation Department's 2006 maintenance and operations expenditures included many of the kinds of tasks identified in the RTC's list above. County staff summarized their routine maintenance expenditures including labor, materials, and equipment, and calculated that it costs their department an average of $3,900 per trail mile per year. The 29 miles of the Chehalis Western Trail and the Yelm-Tenino Trail that the County maintains, consists of varied urban, suburban, and rural environments that are characteristic of other existing and proposed trail corridors identified in this plan. Using the County's 2006 routine maintenance expenditure estimates, annual maintenance costs for the entire proposed 145 mile Regional Trail Network could cost local agencies a combined $565,500 per year.

Pavement Preservation

Trails are constructed using similar techniques and materials as local roads. Although trail surfaces don't carry the loads and intensity of use that roads experience, over time trails are subject to the same effects of degradation from ultraviolet light exposure, freeze-thaw cycles and water damage, and encroaching vegetation. The Rails to Trails Conservancy conducted a national survey of multiple trail management agencies and it found that asphalt trails are resurfaced every seven to 15 years. Transportation Departments can chip seal roads as a relatively low cost preservation technique to increase the pavement's life cycle, but chip sealing trails is not a recommended preservation method for trails. It creates a very rough surface that reduces the variety of trail uses afforded to smoother trail surfaces. Trail resurfacing and rehabilitation needs may not become necessary for the first seven to ten years of an asphalt trail's lifecycle. Furthermore, trail rehabilitation needs vary based on a segment's initial construction quality and the surrounding environmental conditions it is exposed to. Some segments may only require a one inch resurfacing layer of asphalt, whereas some sections may require a complete rebuild.

Cost Estimates

Thurston County has already replaced sections of trail because of age or structural problems related to vegetation encroachment. Given the current condition of the County's trails, County staff estimated it will need to replace

one mile of trail every five to ten years. In 2007, a two inch layer of asphalt for a ten foot wide section of trail (assuming existing base layer is in good condition) costs approximately $14.41 per linear foot or $76,085 per mile of trail. Resurfacing one mile of trail with two inches of asphalt every seven years would cost approximately $10,869 per year.

The County's long-term pavement preservation budget is likely to change for a variety of reasons including increasing costs of asphalt, expansion of the trail network, or natural disasters. Resurfacing all 29 miles of County owned Trails at 2007 prices could exceed $2 million. Fortunately this is not necessary, but it highlights the need for a shared strategy to finance the long-term maintenance of the Regional trail Network.

Long-Term Maintenance Strategy

As trail managers add miles to their trail systems, considerations for increased routine maintenance expenditures and long-term pavement management and replacement costs will need to be factored into budgets and capital facilities plans. Considering that maintenance costs for the full-build out of the proposed Thurston Regional Trail Network might cost over one half million dollars (2006 dollars) a year and that trail resurfacing costs may be upwards of $76,085 per mile, creative strategies and partnerships to finance the future trail network should be explored by the Thurston Region.

Combining Resources

Intra-agency interdepartmental sharing of maintenance tasks could save money for trail managing agencies. Public Works Departments often operate specialized equipment for road maintenance that can also service trails. Sharing maintenance tools and equipment between departments to service more miles can reduce the overall per unit cost of maintaining paved surfaces. Inter-local agreements between the cities and the County to create a trail management district could possibly further reduce overhead and expenditures by dedicating trail maintenance equipment, materials, staff, and administration to maintain the entire trail network. The Conditions and Recommendations section of this plan identifies this as Follow-Up Measure Number Two (pg. 3-10) to further explore this issue.

Community Participation

Volunteer organizations desire to be a part of a solution and can organize work parties or may adopt segments of trail for routine maintenance. Certain maintenance activities such as sweeping or blowing leaves and trimming vegetation could be performed by community groups. The Woodland Trail Greenway Association (WTGA) has volunteered thousands of hours to cleaning, weeding, and landscaping large segments of Woodland Trail. The

WTGA has also pledged their support to the development of Tumwater's Deschutes Valley Trail. The WTGA could serve as a model for other potential trail stewards in the Thurston Region. Their commitment is clear in their mission statement:

Volunteers assist in landscaping the Woodland Trail at a volunteer work party. Photo by Jack Horton.

The mission of the Woodland Trail Greenway Association is to advocate for and partner in the development of a publicly-owned multiuse trail and greenway from Pioneer Park to McAlister Springs, linking the cities of Lacey, Olympia and Tumwater in Washington State.

We further advocate the development of other non-motorized connections, recognizing that it will be part of an interconnected system of trails, sidewalks, bike lanes, low volume streets, and transit in Thurston County, WA.

Equestrian organizations could seek opportunities and be invited to participate in the ongoing maintenance of the equestrian side paths along the Chehalis Western Trail and Yelm-Tenino Trail corridors. User groups are likely to volunteer labor if it can help maintain facilities that serve their activities and trip purposes. Thurston County also organizes volunteer work parties and raises funds through its "Friends of the Trails" Program, which assists in the maintenance of its trail system. Boy Scouts, Girl Scouts, and other fraternities and sororities can also be invited to fulfill community support requirements though trail volunteer efforts.

Trail Design

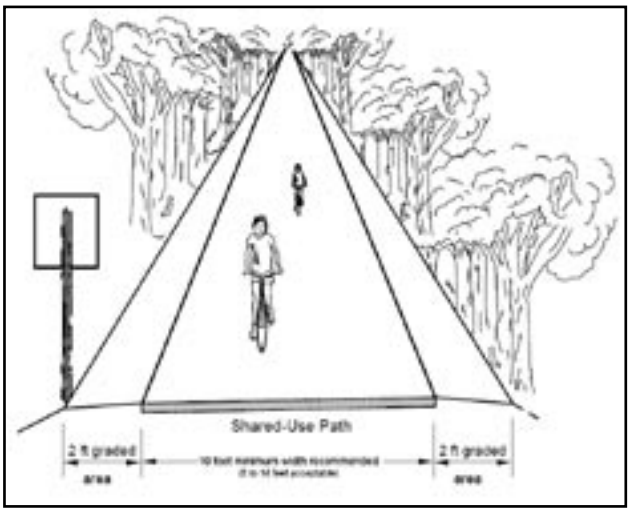
This Plan does not cover trail design in great detail. Transportation engineers and officials have access to published peer-reviewed design specifications for shared-use trails and their standards are well known. The Conditions and Recommendations section of this Plan offers a list of references that support the industry standards and can aid trail managers in planning, designing and engineering their trails. A basic overview of trail design standards is provided in this section for general audiences that may reference this plan.

Shared-Use Trail Profile

Shared-use trails are typically a minimum of 10 feet wide with two foot graded gravel shoulders on each side of the trail (AASHTO, 1999). Under certain conditions it may be advantageous or necessary to increase a trail's

width to 12 to 14 feet because of anticipated higher volumes of trail users (WSDOT, 2006). Trails may also be reduced to eight feet wide where right-of-way (ROW) constraints or lower expected volumes of trail users do not require greater widths. The trail surface is typically paved with asphalt, but may also be paved with concrete, or consist of compacted crushed-rock (figure 1). Some paved and unpaved recreation trails are built with the same design standards, but the trail is intended to be used for slower speed trail activities. Where sufficient ROW and the proper topographical conditions exist, trail designers may include an additional three to four foot wide compacted gravel foot path that is separate from the paved trail. This footpath is intended serve runners, pedestrians, or equestrians in designated areas, that prefer a softer path.

Figure 1: Shared-Use Path



Source: Bicycle Facilities, Chapter 1020. 2006. Washington State Department of Transportation Design Manual (with slight modification).

Trailheads and Access Points

Access points are opportunities to link trails to the surrounding communities. They compose critical links between on-street facilities and the trail. There are basically two types of access points: trailheads and trail access points. Trail access facilities and accompanying amenities also require adherence to Americans with Disabilities Act 1990 (See Appendix B) standards and guidelines.

Trailheads

Trailheads are major trail access points and often include vehicle parking, restrooms, an informational kiosk, information signs, picnic areas, shelters, drinking water fountains, bicycle racks, and garbage cans. Trailheads are typically sited near more populated parts of communities or existing parks and open spaces.

Trail Access Points

These points can be designated or undesignated points of entry. They offer limited facilities like signs, a kiosk, or benches. The greater the frequency of access points, the more options for connecting users to their destinations. Trail access points also grant trail managers and fire crews more direct access to specific points along the corridor, reducing interruptions for trail users.

Horse back riders secure their horses on hitching rails before taking a lunch break. These rails were constructed as part of an Eagle Scout Project near Mud Mountain Dam on the White River. Photo courtesy of Patti Seldal.

Bicycle racks and water fountains are useful amenities for the trail user taking a break from their ride. Photo by Paul Brewster.

Access Control

When it is necessary to restrict unauthorized vehicles from entering a trail, bollards are the preferred access control device. A bollard is a single post that measure at least three feet tall. One bollard placed in the center of a 10 foot wide trail set back 10 feet away from the intersection generally provides sufficient navigable space for trail users. Wider trails may require additional bollards, but three are better than two to avoid channeling a trail user into the center of a trail that could lead to potential head-on collisions with other trail users. A minimum of five feet of space between bollards is recommended. Bollards are designed to be removable to grant service vehicles access to the trail. Gates and other types of barriers can cause nighttime hazards and can potentially limit access to the trail for people in wheel chairs or other personal mobility devices.

Road and Railroad Crossing

Transportation engineers are the best judges for determining what types of crossing are suitable for intersecting with roads and railroads. Traffic volumes dictate whether a trail will cross at grade or go over or under an existing roadway. Trails should cross railroads at right angles to tracks. The crossing surface should also be level with the tops of the tracks to avoid the possibility of bicyclists losing steering control from stuck tires in the rail flangeway.

Equestrian Design Considerations

Some shared-use trail corridors are wide enough to accommodate horseback riding. In the Thurston Region, horseback riding on shared-use trails is presently limited to trail segments in unincorporated Thurston County. Trail managers should be aware of the unique requirements of riders and their horses when designing trails in corridors where equestrian use is or will be permitted. In addition, equestrian groups should develop partnerships with Thurston County to find opportunities to share in the design, construction, and maintenance of equestrian facilities.

The most important factor to consider when accommodating equestrians is to separate equestrian use from other trail uses to avoid conflicts between users. This can be achieved by creating a separate equestrian path that is adjacent to the paved trail, but preferably divided by natural vegetation. Horses and their riders prefer natural surfaces over hard paved or loose trail surfaces for stability and hoof protection. Stabilized dirt is the ideal substrate. A 5-foot-wide tread with a 10-foot vertical clearance provides suitable conditions for trail riding (RTC, 2001) (Figure 2). Stumps, branches, and other debris should be cleared from the trail to prevent injuries to horses and their riders.

Equestrians also require special support facilities at trail heads and along the trail. Horseback riding is a very social activity, and like walkers and hikers, they enjoy group outings. Trails that permit equestrian use should include

designated equestrian trailheads. Equestrian trailheads should offer sufficient space for parking trucks and horse trailers, as well as allow additional space for staging multiple riders preparing for a group ride. Mounting blocks or stumps should be located at trailheads, bridge crossings, and along appropriate utility and recreation stops within the trail corridor to assist riders who experience challenges with mounting and dismounting from their horses. A large even diameter log secured in place can serve this function. Hitching posts and water troughs are also needed at rest stops and picnic areas to serve the equine trail user.

Figure 2: Equestrian Trail Clearance Requirements

Source: Developed by TRPC. Adapted from Rail to Trail Conservancy TrailLink 2005 Conference Proceedings.

In the Pacific Northwest, untended natural trails will quickly be taken over by vegetation. Equestrian trails will require frequent maintenance. Frequent use of these natural trails by equestrians can hamper the growth of vegetation, but they will require annual maintenance to keep them accessible and functional. Equestrians are the best stewards of their trail systems and the creation and the existence of these trails will rely heavily on the participation of the equestrian community. Equestrians should be encouraged to pack a pruner and a folding bow saw to maintain clear paths for their enjoyment. Equestrian users should take care to properly trim vegetation and dispose of organic material in a manner that conforms to Thurston County's maintenance procedures.

Equestrians must be sensitive to their horses' bodily functions. Horse droppings left to compost on a shared-use trail will cause conflicts with cyclists and hikers, even if the presence of horse droppings are an infrequent event. At the same time, other trail users should be sensitive to the nature and behavior of horses. Equestrian groups are encouraged to work with Thurston County to develop educational signs that offer tips and techniques for all trail users to share the trail with horses and their riders.

Signs for Multi-Use Trails

Trails are transportation facilities and Federal Highways Administration's (FHWA) Manual on Uniform Traffic Control Devices (MUTCD) outlines the shape, size, and color of traffic control signs for trails. Signs orient users to surrounding spaces and destinations, conditions, and potential hazards or safety concerns. Signs offer trail users predictability and confidence to use trails as transportation corridors. Signs can also provoke curiosity and promote exploration. The following types of signs are important to increase trail safety and promote trail system efficiency: informational, regulatory, warning, educational, and mile marker.

Informational

These signs give trail details such as length, major geographical features and destinations, and acceptable uses. They can include maps and point of contact information for the trail managing authority or emergency service providers. These signs can also provide trail users with information such as the location of transit stops, restrooms and public telephones. Wayfinding signs to connect to other trails, parks, schools, hospitals, libraries, and police stations are included in this category. Informational signs can also suggest what equipment or items are recommended for using the trail such as food and water, cell phone, layers of clothing, helmets, flashlights or bicycle lights, maps, and spare tires or patch kits.

Regulatory

Regulatory signs dictate a trail's operational requirements, primarily serving to control traffic. They also designate which segments of trail are permitted for equestrian uses. These signes inform users of travel speeds; include stop and yield signs; and can prioritize trail user ROW.

Warning

Warning signs point out existing or potential hazards on or around the trail. They warn users of upcoming intersections or approaching traffic, bridges, tunnels, significant grade changes or natural hazards. They can also warn bicyclists to be considerate of horseback riders and reduce speeds or dismount so as not to frighten horses.

This sign on the Chehalis Western Trail is informational, educational, and provides useful point-of-contact information to the user. Photo by Stacey Brewster.

Educational

Educational signs offer opportunities for interpretation along a trail corridor. These signs can highlight a community's history or explain unique environmental features. Trails can provide a sense of place and these signs offer opportunities to narrate and explain its special qualities.

Milepost Markers

Mile markers and signposts indicate a known distance on the trail based on an established starting point that usually begins at a major trail head or trail junction. These makers orient users to their location on a trail. They are preferably set a minimum of every one-quarter mile. Mileposts are instrumental to direct emergency response crews to the site of an accident or emergency.

Landscaping

Trail users' experiences are influenced by the scenery of a trail corridor. Flora and fauna can create an ambiance that provokes a sense of place and can encourage users to return for future uses. Landscaping increases the scenic value of a trail and can also be designed to prolong the life of a trail. Taller trees can cast shade on a trail surface and potentially prolong the life of the asphalt by reducing ultraviolet light exposure. Well chosen plant species can flourish and inhibit the spread of unwanted vegetation. It is important to select plant species whose roots will not damage the trail.

Trails through undeveloped rural areas may have the landscaping built right in. The best landscaping is the native flora for a specific geographical area. Native vegetation is low maintenance because it has adapted with the area's climate and soil conditions. Native vegetation also provides suitable foraging and breeding habitat for native fauna and migrating birds.

Urbanized trail corridors may require extensive vegetation restoration efforts. A landscaping plan should consider user safety and security, both genuine as well as perceived. Forward and rear sight distances are important at road crossings, bridges, and tunnels. The surrounding vegetation should not box users in, but rather have natural openings to give trails users an escape route should they feel threatened. Local agencies would benefit from consulting a landscape architect with trail design experience when developing a landscaping plan.

Operations

Trail Uses – Utility, Recreation and Physical Activity

Shared-use trails are designed for multiple users and uses. The shared-use trail derives its name from the myriad of shared forms of activities that are enabled by a trail's wide smooth surface. Trails are linear and lengthy which lends them to support a variety of mobile activities. Parks managers refer to these activities as recreation, and transportation officials call them trips. For the sake of categorization and definition, trail use can be broadly categorized into two types of trips, utility and recreation. Utility trips are practical and include traveling to work, going to school, and running errands like going to the grocery store or the bank.

The 2000 U.S. Census data reveals that 35,842 people in Thurston County age five and older have some type of disability. *Source: The Profile, TRPC*

Trails are essentially non-motorized arterials and their use is limited to human-powered forms of travel. Exceptions are made for people with physical disabilities that rely on electric wheel chairs or other electric personal assistive mobility devices (EPAMD, Appendix C). Well designed trails accommodate

all skill levels. Trails should not favor a specific use or user group. The following are some of the types of trail uses that are supported in the Thurston Region:

- Walking alone, with family or friends, with a dog or other pet
- Jogging
- Running
- Skating
- Stroller pushing
- Bicycling
- Cross country skiing
- Bird watching and nature viewing
- Horseback riding (in designated areas)
- Wheel chair and electric personal assistive mobility device uses

See Appendix C for more information on mopeds, electric personal assistive mobility devices, electric-assist bicycles, and motorized scooters.

Hours of Operations

Rules of use and hours of operation are posted at the kiosk at the Chehalis Western Trail Chambers Lake Trailhead. Photo by Paul Brewster.

Trail managers may schedule hours of operation to control trail use, however daytime-only hours limit their transportation value. Winter days are short in the Pacific Northwest and bicycle commutes often occur in the dark. The Department of Natural Resources' and Thurston County's trails' hours are posted as open from Dawn to Dusk. The City of Olympia plans to allow night time trail uses, but will lock restroom facilities after dark. Conflicting hours of operation for linked trails can confuse users and give normally law abiding trail users (with lawful intentions) the sense that they are engaged in unlawful activities. Neighboring trail managers that share corridors or trail junctions could develop after dark conditional transportation uses for bicycle commuters or other valid after-hour uses.

Events

Trail promotion can increase community awareness of trails and increase their use and community stewardship. Grand opening celebrations, trail corridor tours, organized work parties, and special events can increase a trail corridor's visibility among community members. Trail events can also recruit volunteers. Thurston County has successfully hosted two Annual Trail Day events to increase awareness of the Chehalis Western Trail and Yelm-Tenino Trails. At these events, information booths,

raffle prize drawings, and family activities are designed to foster trail awareness and stewardship. The events also solicit membership for Thurston County's "Friends of the Trails" program which provides community support and assistance for the preservation, improvement, and continued development of Thurston County's Trail System.

Trail User Security and Safety

National statistics indicate that development of abandoned railroad corridors to multi-use trails actually create safer environments for properties adjacent to trail corridors (Rails to Trails Conservancy, 1998). The development of a trail increases lawful activities and decreases unlawful behavior along these corridors. The more trail users that perform lawful activities like bicycling, walking, jogging, or nature watching, along any given segment of trail – whether urban, suburban, or rural — the greater the deterrent to criminal behavior.

Crime Prevention through Environmental Design

Crime Prevention through Environmental Design (CPTED) is the concept of designing infrastructure or spaces that eliminates or reduces criminal behavior while simultaneously encouraging people to maintain awareness of other people's safety and security. CPTED principles apply to the built environment, but can also be applied to trailheads and trails that are located in more populated urban and suburban environments, particularly around retail and commercial areas, schools and neighborhoods.

CPTED design strategies are guidelines that trail managers can apply to reduce the fear and incidence of crime and improve the quality of the public's trail use experiences. CPTED design principles are interdisciplinary, and require the planning and design efforts of transportation and parks planners, engineers, architects and landscape architects, and law enforcement officials. The National Crime Prevention Council lists four general CPTED principles that focus on creating perceptions of spaces that influence offender decisions and deter criminal activity and promote secure environments (National Crime Prevention Council, 2007):

1. **Natural Surveillance** - This design concept creates an environment that makes one feel they can be easily observed or monitored. This is promoted by features that maximize visibility of people, parking areas and restroom entrances: doors and windows that look out on to streets and parking areas; increased line of sight visibility for trail segments, sidewalks and streets; highly visible transit stops; and adequate night time lighting.
2. **Territorial Reinforcement** - This physical design concept serves to

create or extend a field of influence for any given person or group of people in a particular setting. Users then develop a sense of spatial control while potential offenders, perceiving this control, are discouraged. This is promoted by features that define property lines and distinguish private spaces from public spaces using landscape plantings, pavement designs, gateway treatments, and shoulder level open type fences.

3. **Natural Access Control** - This design concept aims to decrease criminal behavior by denying access to potential targets by giving potential offenders a perception of risk. This perception is gained by designing trail segments, sidewalks, building entrances and neighborhood gateways to clearly indicate public routes and discouraging access to private areas with structural elements. Entries and exits should be obvious. Spaces that are well maintained give the impression they are frequently used by law abiding citizens.
4. **Target Hardening** - This concept attempts to give the impression that facilities are industrial strength or heavy and steadfast. The impression of durability deters the crime because it requires too much energy or specialized equipment. Doors should have deadbolts and interior door hinges that prohibit entry. Trail amenities such as benches, bicycle racks, water fountains, restrooms, garbage containers, and signs should be durable and secure.

Conflicts, Factors, and Controls

Trail system managers that recognize the causes for conflicts, and implement measures and programs to control factors that create conflicts, are more successful with promoting positive trail use experiences for its users. The Federal Highways Administration (FHWA) and the National Recreational Trails Advisory Committee completed a study, "Conflicts on Multiple-Use Trails: Syntheses of the Literature and State of the Practice." Most user conflicts were caused by:

- Collisions and nears misses among users
- Reckless behavior
- Poor user preparation or judgment
- Unsafe conditions not related to trail use (obstacles, weather, etc.)
- Poor trail design, construction, maintenance or management issues

The study identified factors that trail managers can use to control or influence to maintain user safety:

- User Speed (speed differential between users is more problematic than the actual speed)
- Mass of user and vehicle
- Sight Distances

- Trail width
- Trail crossings
- Trail surface
- Congestion (for example, number of users per mile)
- Users overtaking one another without warning
- User expectations and preparedness (for example, walkers who understand they may encounter bicyclists and can react more effectively)
- Emergency procedures
- On-site management presence

The study surveyed trail managers for effective techniques to reduce conflict. Trail managers reported the following approaches:

- Signage
- Education
- Meeting with user groups
- Expanding facilities
- Police or ranger patrols
- Enforcement of regulations
- Brochure articles in newsletters or local newspapers
- Imposing speed limits
- Volunteer trail patrols
- Partial closings
- Bicycle bell give-a-ways

Emergency Response and Enforcement

Trail managers should have plans in place for trail emergencies. Fire and police departments need to effectively access trails to respond to emergencies quickly. Between December 2005 and September 2006, Thurston County Department of Communications (CAPCOM) serviced 48 calls for the Chehalis Western Trail or properties adjacent to the trail and four calls for the Yelm-Tenino Trail. Only one advanced life support call (reason not reported) and three basic life support calls were documented.

Thurston County Parks and Recreation has ensured that all municipal police and fire departments have access to the County's trails. Equally important, trail users must be able to reference signs and milepost markers to orient them to their whereabouts. This not only allows them to report their location to emergency crews, but it also gives trail users a sense of security knowing where they are in relation to the surrounding environment.
Trails are separate from the road network and present challenges because they have limited access for service and emergency vehicles. Police, firefighters,

and paramedics should be aware of any unique obstacles or situations that could make trail access difficult. Emergency responders not only need access to the trails, but must understand how to navigate to the section of trail to provide assistance where it is requested. Emergency crews and their support staff should have access to maps or geocoded displays that have digital waypoints of the trail's milepost markers to assist them in navigating to their objectives.

Randomly scheduled bicycle mounted police patrols can serve to both provide trail users a sense of safety and foster good relations between the public and community police officers. The frequency of patrols should be determined by local police commanders based on each trail's unique security challenges and the availability of police officers to staff the patrols.