

Section 4.0

Design Standards

A core element of the Lake County Trails Master Plan is to provide design criteria for shared-use trails in Lake County. “Shared-use paths” are defined by AASHTO as “facilities on exclusive right-of-way and with minimal cross flow by motor vehicles.” Within this document, the use of the term shared-use trail, multi-use trail, and shared-use path are interchangeable and intended to reflect the type of facility addressed by AASHTO as a shared-use path. Lake County’s shared-use trails are restricted to non-motorized modes of transportation and intended for a variety of user types to share. Typical users include recreational and commuter purposes such as bicycling, in-line skating, pet walking, pedestrians, commuting, and exercising. The most common trail would be an asphalt or concrete surface of 12 to 15 feet in width with travel in both directions. The trail would be expected to connect regionally significant destinations or other trail systems and would provide trailheads, rest stops, wayfinding, and an overall user experience of the surrounding environment.



The trail environment and community “sense of place” are expected to change depending on the specific situation of the various trails within the overall trail network. Therefore, the design standards provided in the following sections are intended to allow flexibility for a range of trail types across a variety of environmental and corridor scenarios.

4.1 Shared-Use Trail Types

Regional Shared-Use Trail

Regional Shared-Use Trails are characterized by their interconnection to regional destinations and other statewide trails. These trails are 12 to 15 feet in width and consist of an asphalt or concrete surface. They are intended to provide long distances of travel for recreational users by connecting major trail systems. While these trails also connect local destinations, such as schools, parks, and downtown areas, to communities, they are considered the backbone of the larger statewide trail system. These trails are designed to attract users from other areas of the state or country and are the “showcase” trails of the Lake County Trails Network. Therefore, these trails require trailheads to provide parking and restroom facilities. The design and construction of these “showcase” trails should be developed to maximize the user experience and provide a positive and memorable impression of Lake County.

Minor Shared-Use Trail

Minor Shared-Use Trails are considered the arterials of the Lake County Trails Network. They are characterized by their interconnection to regional shared-use trails within Lake County but do not necessarily link statewide trails directly to each other. These trails are generally 12 feet in width and consist of an asphalt or concrete surface. While these trails will function as local trails to connect destinations such as schools, parks, downtown areas, and natural areas, to communities and neighborhoods, the primary purpose of these trails is to provide countywide interconnectivity between the local trails and destinations. These trails are generally of sufficient length and quality to attract users from other areas of the county or other areas of the state as a stand-alone destination and, therefore, require trailheads to provide parking and restroom facilities.

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Shared-Use Trail Types Continued

Community Walkways/Local Trails

Community Walkways/Local Trails are considered the collectors and distributors of the Lake County Trails Network. They connect neighborhoods to local destinations and shared-use trails. Although they are identified on the Lake County Trails Master Plan Map, these trails are largely the responsibility of the local municipality or community and will not be included in the prioritization process for the Lake County Trails Master Plan. While community walkways and local trails utilize regional shared-use trails for connectivity, the focus for these trails is their connection between the “front door” of residences and local destinations and places of work.

These walkways are 8 to 10 feet in width and consist of an asphalt or concrete surface. Because many of them will be constructed adjacent to roadway corridors, they will often include transit connectivity.

Urban Bicycle and Pedestrian Corridor

Often, a shared-use path will connect to or through a downtown or core urban area. Within these downtown or core urban areas, specific attention to bicycle and pedestrian elements is required to properly integrate the regional nature of the trail with the urban streetscape. Within these areas, the design of the bicycle facility should encourage slower trail user speeds and give preference to pedestrian movements. These designs should incorporate positive guidance signing to clearly show the route of the trail, enhanced amenities such as bicycle parking

and rest areas, and street-scaping such as lighting, landscaping, and art to provide an attractive and visually integrated project. Particular attention should be given to the interaction between vehicles and the trail. Traffic calming measures should be thoroughly evaluated to determine appropriateness. While this interaction is often at lower speeds, the number of visual distractions vehicles encounter within the urban environment often competes with their awareness of pedestrians and bicycles. Travel surfaces should be designed to accommodate all user types with particular attention given to small-diameter wheels such as in-line skates and strollers. The proper design for these corridors is as much of an art as a science and the subject of numerous reference works. These references are cited in Appendix A. The design standards for these types of facilities are outside the scope of this Master Plan and should be developed for individual projects based on the cited references, engineering judgment, and local preferences.



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4.2 Trail Settings

Each of the trail types may be located within the context of any number of settings or scenarios.

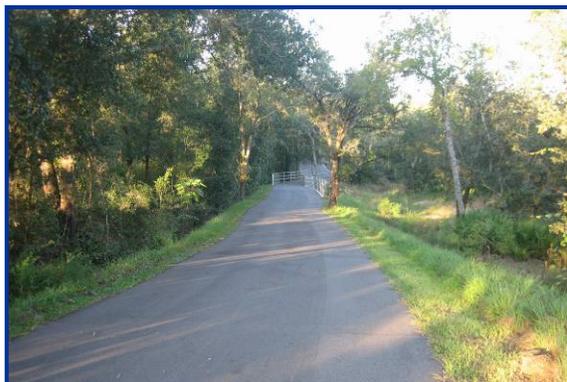
- **Rails-to-Trails** - Trails are constructed on an abandoned railroad bed.



- **Rails-with-Trails** - Trails are constructed adjacent to an active railroad.



- **Trails Through Natural Areas** - These trails are often the most scenic trails and are constructed to blend as much as possible into the natural surroundings and to minimize their impact on the surrounding ecosystems. While the nature of regional trails requires a hardened surface, the design should avoid wetlands and remove only the vegetation absolutely necessary



to provide the clear area for a trail. Curvilinear trails that follow natural contours and lay gently on the land are preferred.

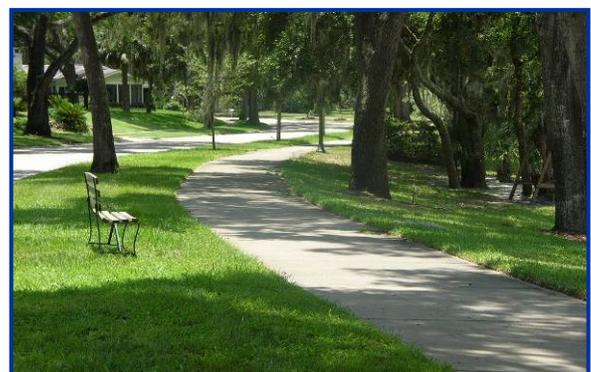
- **Trails Adjacent to Rural Roadways** - This scenario includes the construction of a trail adjacent to and within the right-of-way of a rural roadway. The roadway type can range from a low volume, low speed local roadway to a high volume, high speed limited access highway.



- **Trails Adjacent to Urban Roadways** - This scenario includes the construction of a trail adjacent to and within the right-of-way of an urban roadway. The roadway type can range from a low volume, low speed local roadway to a high volume, low speed multi-lane arterial.



- **Trails Adjacent to Residential Streets** - This scenario includes the construction of a trail adjacent to and within the right-of-way of a residential street.



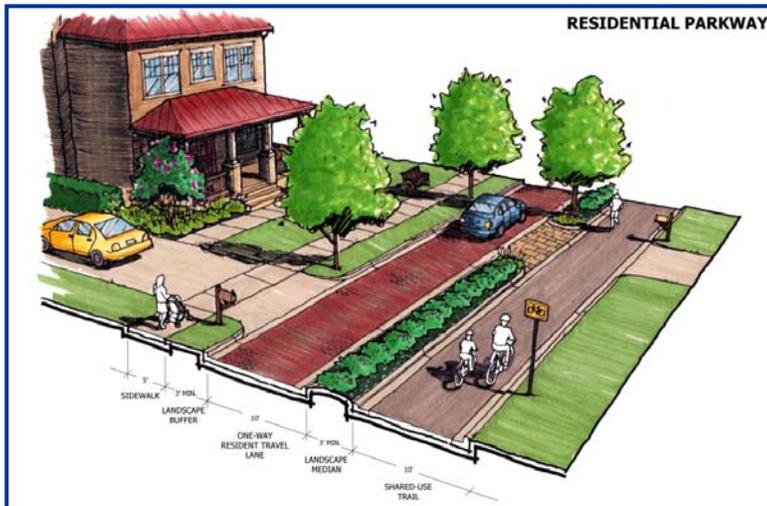
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Trail Settings Continued

- **Bicycle and Pedestrian Boulevards** - Segments of existing residential streets are converted to bicycle and pedestrian facilities by eliminating through traffic. These are best implemented within a community with an extensive street “grid” and require extensive public involvement, traffic calming, and landscaping.



- **Trails within the Urban Core** – Often, a shared-use path will connect to or through a downtown or core urban area. Within these downtown or core urban areas, specific attention to bicycle and pedestrian elements is required to properly integrate the regional nature of the trail with the urban streetscape. Within these areas, the design of the bicycle facility should encourage slower trail user speeds and give preference to pedestrian movements. These designs should incorporate positive guidance signing to clearly show the route of the trail, enhanced amenities such as bicycle parking and rest areas, and street-scaping such as lighting, landscaping, and art to provide an attractive and visually integrated project.



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4.3 References

The design standards within this master plan cover a broad range of design concerns including geometric design, intersections, signing and pavement markings, structures, appurtenances, and aesthetics. The standards included in the Master Plan will ultimately answer the question, “How should these trails be constructed?” The design criteria were determined by consulting several sources, listed below.

- Guide for the Development of Bicycle Facilities, AASHTO.
- Bicycle Facilities Planning and Design Handbook, Florida Department of Transportation.
- Trail Intersection Design Guide, Florida Department of Transportation.
- Florida Pedestrian Facilities Planning and Design Handbook, Florida Department of Transportation.
- Plans Preparation Manual, Florida Department of Transportation.
- Manual on Uniform Traffic Control Devices, Federal Highway Administration.
- Structures Design Manual, Florida Department of Transportation.
- Reference and Resource Guide, Florida Department of Environmental Protection - Office of Greenways and Trails.
- University Course on Bicycle and Pedestrian Transportation, Federal Highway Administration.
- A Policy on Geometric Design of Highways and Streets, AASHTO.
- Rails-with-Trails: Lessons Learned, Federal Highway Administration.
- Bikesafe: Bicycle Countermeasure Selection System, US Department of Transportation.

4.4 Geometric Design Criteria

Lake County has adopted as a guideline the Bicycle Facilities Planning and Design Handbook (BFPDH) by the Florida Department of Transportation (FDOT). All criteria are subject to change and only current criteria will be used during the final design for trails. Table 4-1 summarizes the geometric design criteria for shared-use trails adjacent to major or minor arterial roadways.



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**Table 4-1
Shared-Use Trail Geometric Design Criteria
Major and Minor Arterial Roadways**

Design Element	Rural	Urban	Source
Design speed	20 mph	20 mph	FDOT BFPDH Section 5.8
Paved Width			
Desirable	15 ft	12 ft	FDOT BFPDH Section 5.5
Minimum	10 ft	10 ft	AASHTO Figure 17
Minimum Radius	75 ft	30 ft	FDOT BFPDH Table 1
Horizontal Clearance to Obstacles			
Desirable	4 ft	4 ft	FDOT PPM Section 8.8
Minimum	3 ft	3 ft	AASHTO Figure 17
Minimum (with drop off)	6 ft	6 ft	FDOT BFPDH Section 5.6
Minimum Separation from Roadway <i>(distance to edge of shoulder)</i>	Outside Clear Zone		
Desirable		5 ft	FDOT PPM Section 8.6.10
Minimum	5 ft	5 ft	
Vertical Clearance			
Desirable	10 ft	10 ft	FDOT BFPDH Section 5.7
Minimum	8 ft	8 ft	
Shoulder Width (Grassed)	2 ft	2 ft	FDOT BFPDH Section 5.6
Horizontal Curve Radius			
Desirable	100 ft	100 ft	AASHTO Table 1
Minimum (with proper signing)	36 ft	36 ft	
Profile Grade			
Desirable	< 5%	< 5%	FDOT BFPDH Section 5.10
Maximum (with restricted lengths)	11%	11%	
Maximum change in grade (without vertical curve)	4%	7%	FDOT PPM Table 2.6.2
Minimum base clearance above design high water elevation	1 ft.	1 ft.	
Pavement cross slope	0.02	0.02	FDOT BFPDH Section 5.9

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4.5 Typical Sections

Figures 4-1 through 4-9 show graphical depictions of the various shared-use trail types and include critical geometric dimensions. Appendix B shows engineering typical sections for use in the design of construction plans. The engineering typical sections also provide pavement designs.

Figure 4-1 - Rails-to-Trails

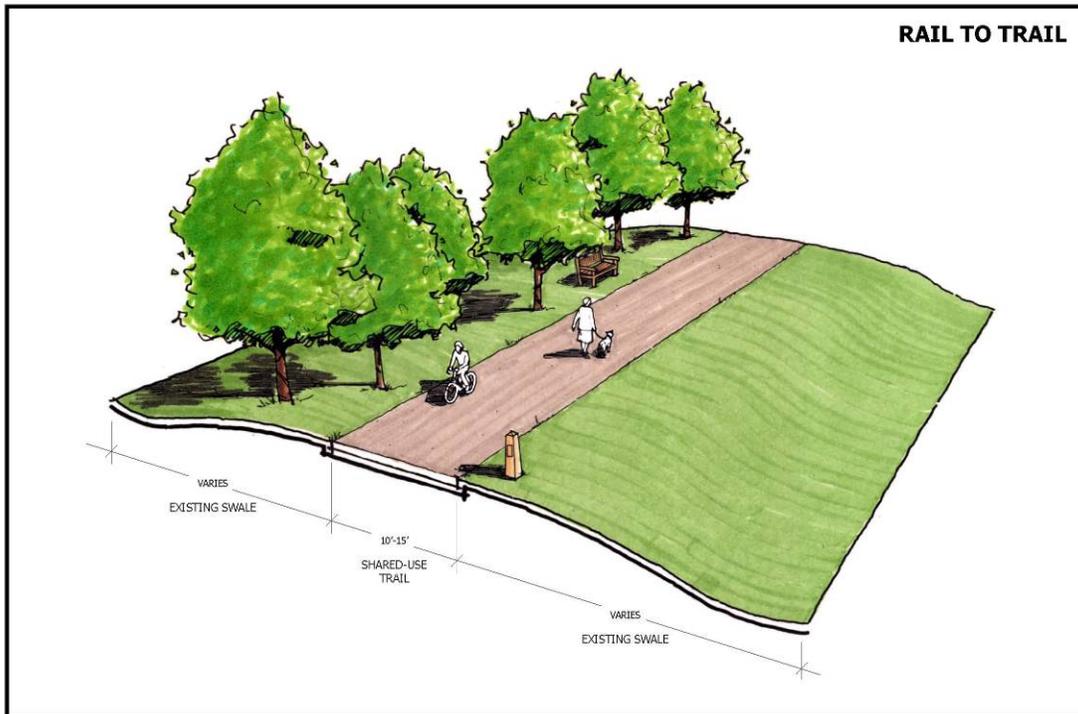
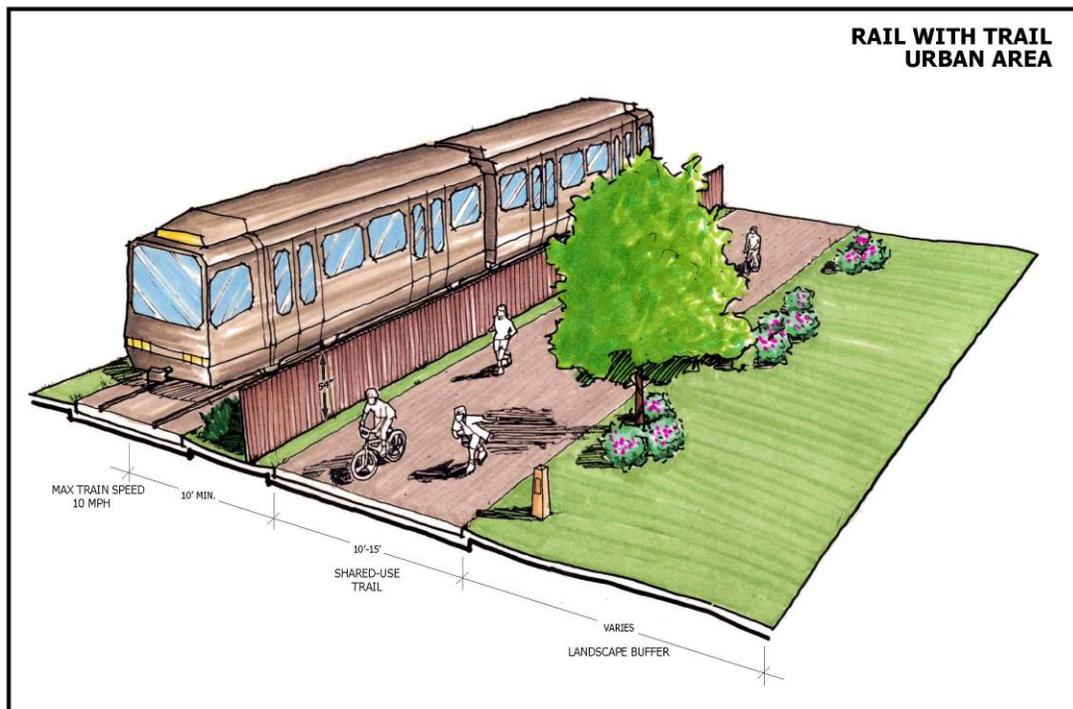


Figure 4-2 - Rails-with-Trails (Urban – Low Speed)



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Figure 4-3 – Rails-with-Trails (Rural – High Speed)

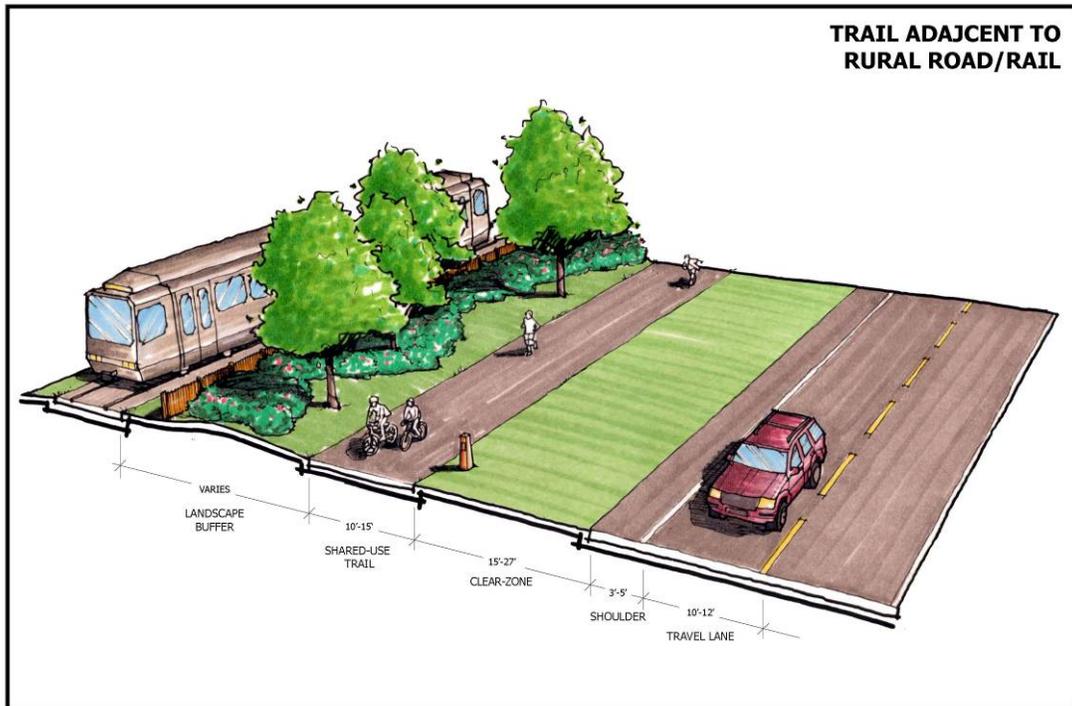


Figure 4-4 - Trails Through Natural Areas



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Figure 4-5 - Trails Adjacent to Rural Roadway

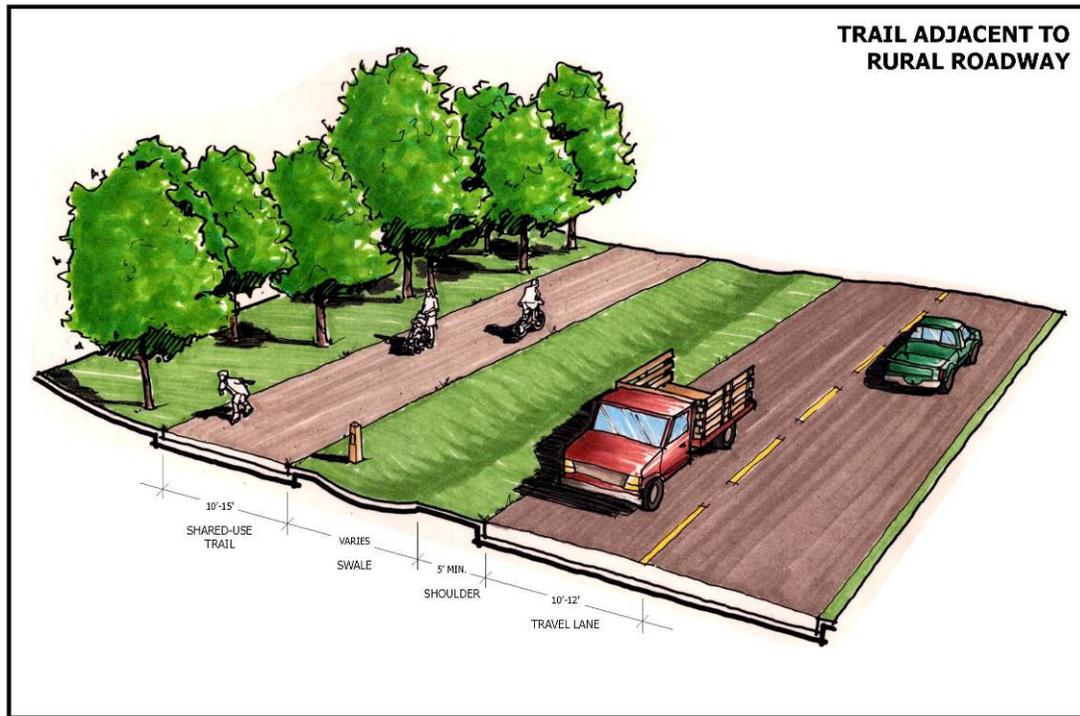
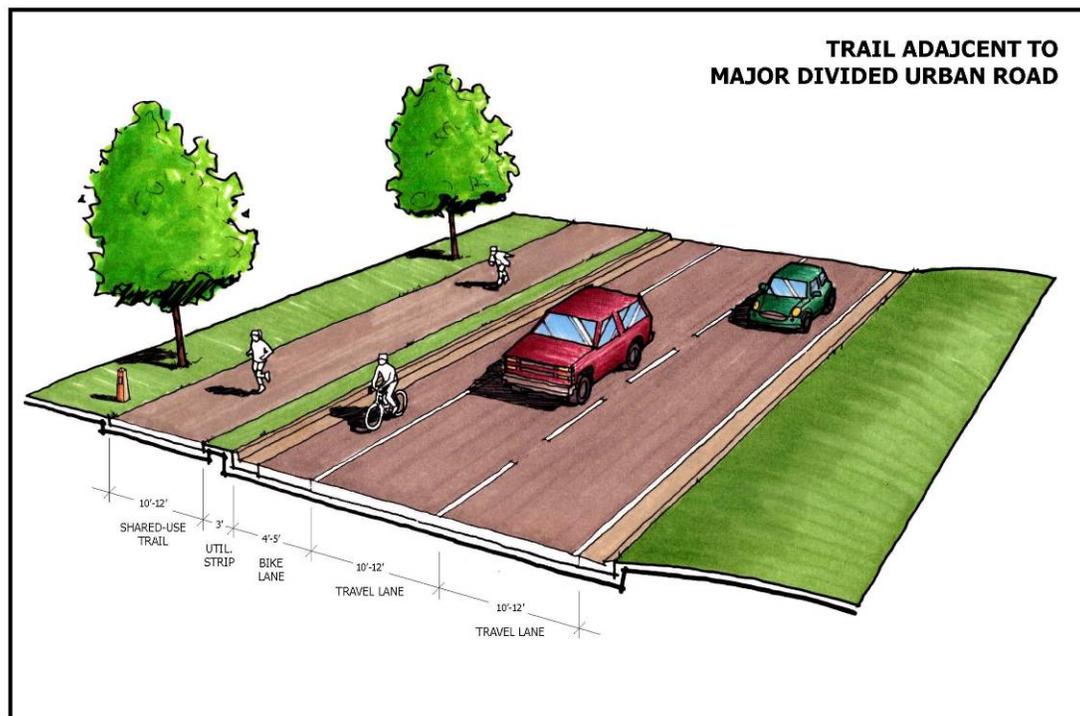


Figure 4-6 - Trails Adjacent to Urban Roadway



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Figure 4-7 - Trails Adjacent to Residential Street

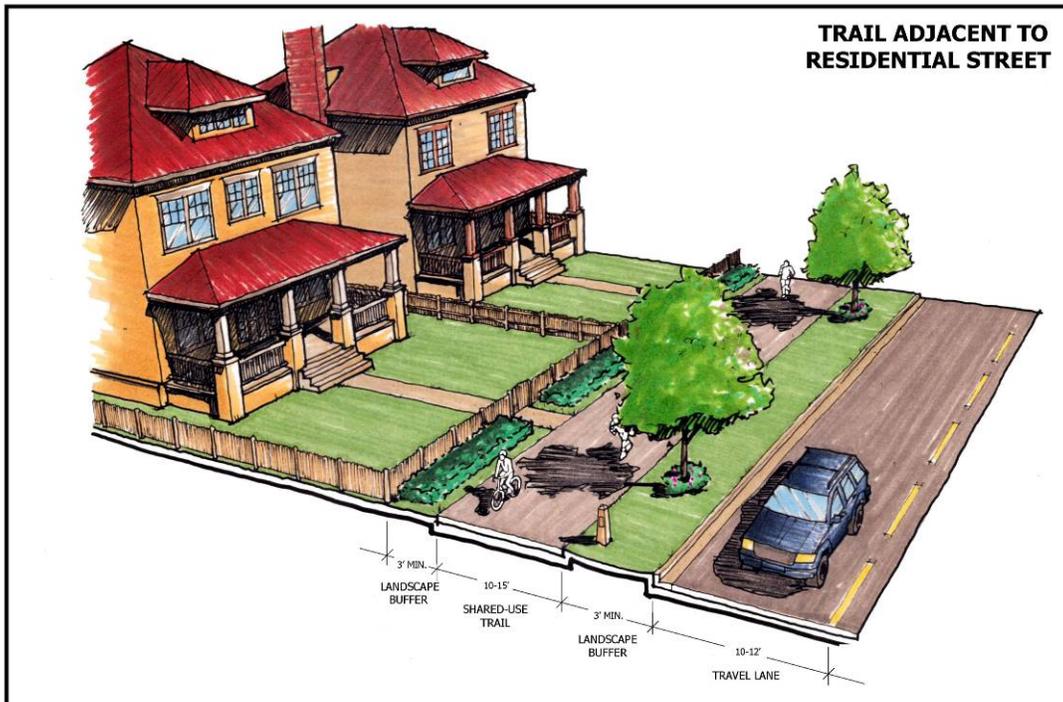
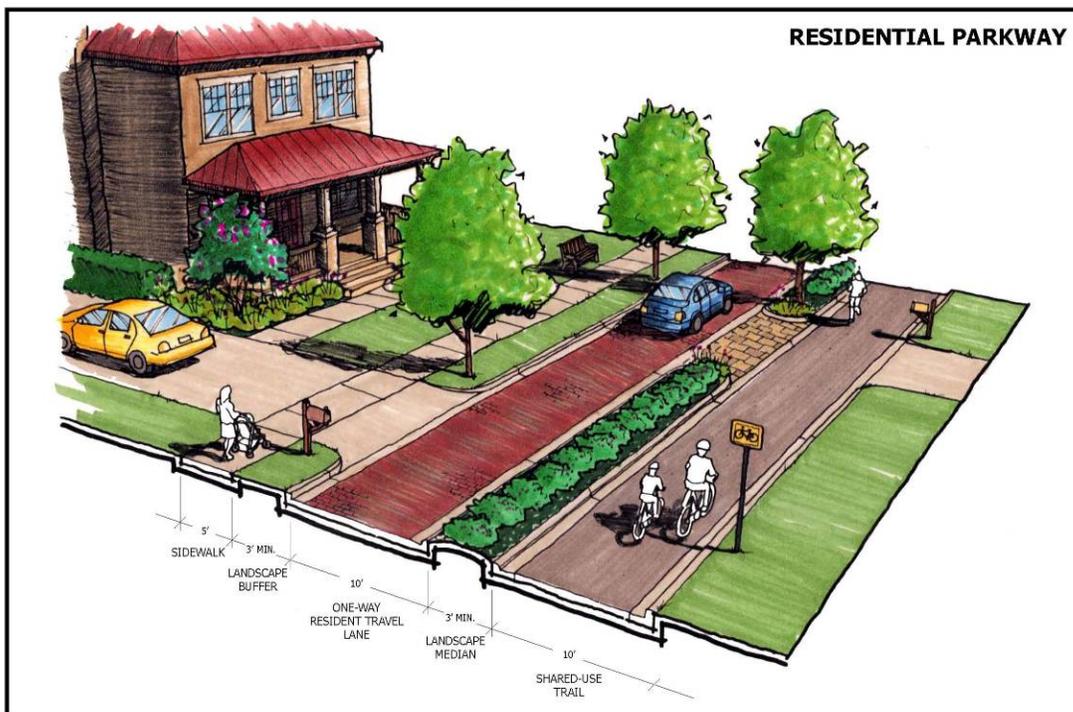
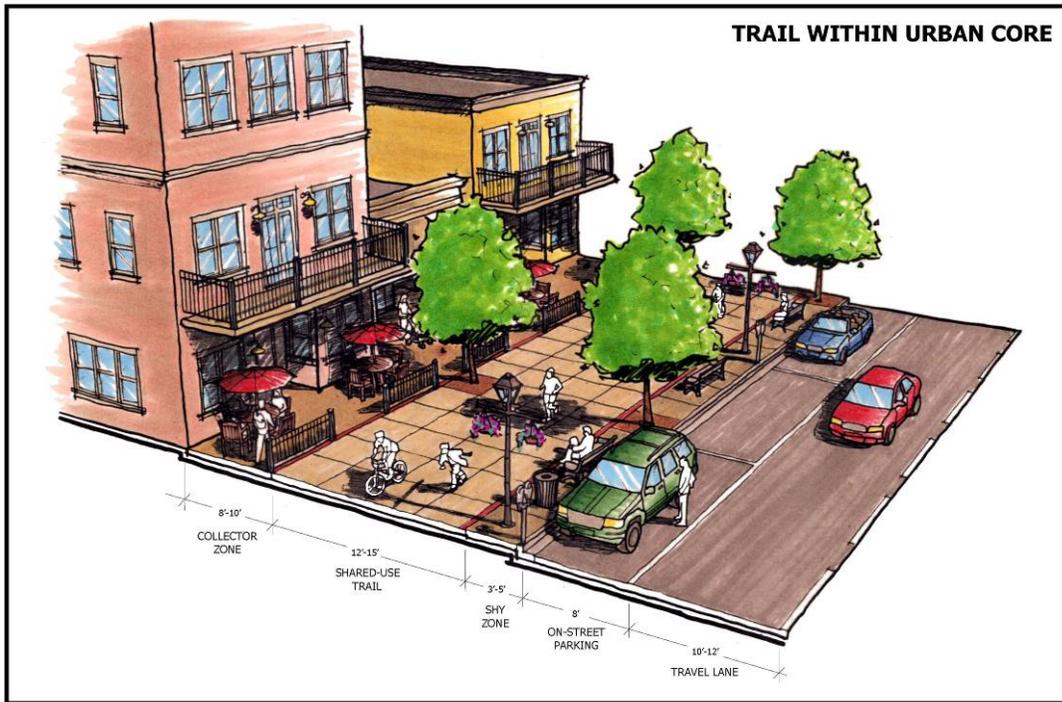


Figure 4-8 - Bicycle and Pedestrian Boulevards



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Figure 4-9 - Trails within the Urban Core



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4.6 Intersection Concepts and Signal Analysis

Intersections involving trails and roadways represent areas of potential conflict and require proper signing and pavement markings to warn trail users of the upcoming intersection and to inform motor vehicles of the pedestrian movement. The FDOT Trail Intersection Design Guide, together with the Manual on Uniform Traffic Control Devices (MUTCD) by FHWA and the FDOT Florida Bicycle Facilities Planning and Design Handbook provides guidance for the development of trail intersections. Three main categories describe trail intersections: Mid-Block, Parallel, and Complex. Complex intersections require application of the criteria to a specific intersection that does not match a standardized case. The Master Plan includes standard intersection details to provide a guide for designers when implementing the trail projects. These standard details are shown in the Trail Intersection Details contained in Appendix C and described below.

4.6.1 Case I – Mid-Block Crossing

These crossings occur where the trail crosses an existing roadway outside the influence of another intersection. Design features include a landscaped trail median, concrete trail approach, handrails, and signing and pavement markings on both the roadway and the multi-use trail.



4.6.2 Case II – Side-Street Crossing

This crossing type is characterized by a trail parallel to a main roadway crossing a side street with traffic greater than 2,000 Average Annual Daily Traffic (AADT). Design features include a landscaped trail median, concrete trail approach, handrails, and signing and pavement markings on both the roadway

and the multi-use trail. In some situations, a Case II Side-Street Crossing may be appropriate when the AADT for the side street is less than 2,000. These situations would involve crossings where increased visibility for the trail might be desirable or in situations where it would be important to clearly distinguish the trail from a road and reduce the potential for vehicular traffic entering the trail.



4.6.3 Case III - Driveway Crossing

This crossing type is characterized by a parallel trail facility crossing a side street or driveway with traffic less than 2,000 AADT. Design features include signing and pavement markings.



4.6.4 Signal Analysis

The FDOT Trail Intersection Design Guide recommends considering signalization when cross-street traffic exceeds 10,000 AADT for a two-lane roadway. When the cross street is four or more lanes in width and speeds are greater than 40 mph, the FDOT BFPDH suggests considering a signal for all traffic volumes. During the study and design phase,

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Signal Analysis Continued

each trail should be evaluated for signalized trail crossings. Those trail crossings that require signalization will require approval by the agency with jurisdiction over the roadway and be justified with a Signal Warrant Study. Trails that cross roadways at an existing signalized intersection should be reviewed for appropriate pedestrian phasing during the design phase for the individual trails.

The implementation and design of a pedestrian signal requires adherence to the MUTCD and the appropriate codes and design standards for the relevant jurisdiction. These jurisdictions might include a city, the FDOT, or Lake County.

4.6.5 Pedestrian Refuges

Pedestrian refuges should be considered for unsignalized trail intersections that require trail users to cross four or more travel lanes (two in each direction of vehicular flow) or signalized intersections that require pedestrians to cross six or more travel lanes (three in each direction). If adequate time is provided to pedestrians during the signal phase, pedestrian refuges are unnecessary. Pedestrian refuges should be a minimum of 12 feet in length and the same width of the trail on either side of the intersection. Each project should evaluate pedestrian refuges based on the site specific requirements, MUTCD, A Policy on Geometric Design of Highways and Streets (AASHTO), and engineering judgment.



4.6.6 Assigning Right-of-Way

The Standard Trail Intersection Details provided in Appendix C assume the right-of-way has not been assigned to the trail users. The assignment of right-of-way is a design decision that requires engineering judgment and site specific information. Generally, right-of-way is assigned to the movement that has a

heavier volume of traffic, higher speed traffic, and superior classification of highway. Because of these criteria, a trail is not normally assigned right-of-way. However, it must be recognized that trail users have very low delay tolerance, a strong desire to conserve momentum, and sometimes little knowledge of traffic rules (e.g., children). These factors warrant the assignment of right-of-way to a trail in some situations. While this involves engineering judgment, the incorrect assignment of right-of-way to vehicular traffic on extremely low volume roads or large driveways may lead to confusion and even unsafe practices. Trail users should never be assigned right-of-way when the cross street vehicular speeds exceed 30 mph or the cross-street AADT exceeds 10,000. The FDOT Trail Intersection Design Guide provides basic guidance to assist trail designers to properly assign right-of-way.

4.7 Trail Signs

In addition to the guidance provided by the MUTCD and the intersection signing and pavement marking details found in Appendix C, trail networks require warning signs, informational signs such as wayfinding kiosks, trail location identifiers, trail rules, and emergency services information.



4.7.1 Warning Signs

Warning signs are typically diamond shaped, metal signs with black lettering and a yellow background. They advise users when caution is needed. These signs should be placed to provide adequate response time. While warning signs are located predominately at trail intersections, there are other situations where warning signs should be installed.

- Install W1-1, W1-2, W1-3, W1-4, or W1-5 signs when the horizontal curvature does not meet the minimum radius of 95 feet.
- Install W5-2 or W5-4a signs when the width of the trail is reduced to less than 12 feet.
- Install W7-5 signs when the slope of the trail exceeds six percent.
- Install other warning signs as necessary to warn trail users of unusual or unexpected situations on the trail.

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4.8.1 Location

The effectiveness of a grade separated crossing depends on the perceived ease of use by the trail user. Trail users tend to compare the time and effort of using the overpass against the perceived benefits of safety. According to the FDOT Florida Pedestrian Facilities Planning and Design Handbook (FPPDH), studies have shown grade separated crossings should be on the normal path of trail users or else pedestrians and bicyclists will tend to cross at locations they believe to be more direct. Studies have shown that overpasses constructed in line with long, straight multi-use trail approaches will be used by virtually all trail users.

Trail overpasses should also be carefully located within an urban area so as to not conflict with driveway access, frontage visibility, or sight distance for side streets.

Trail Overpass Warrants

Because of the high cost associated with overpasses, the FPPDH provides criteria that can be used to determine the locations of pedestrian overpasses. This study recommends the use of these overpass warrants for determining the phasing of the construction of the trail overpasses in relationship to their corresponding projects. The criteria recommended for this project to determine when the trail overpasses should be funded are as follows:

- Hourly trail volume greater than 300 movements in the four highest continuous hour periods if the vehicular speed exceeds 40 mph in an urban area.
- Vehicular volume of the cross street should exceed 10,000 in the same four-hour period as used for the trail user volume or have greater than 35,000 AADT.



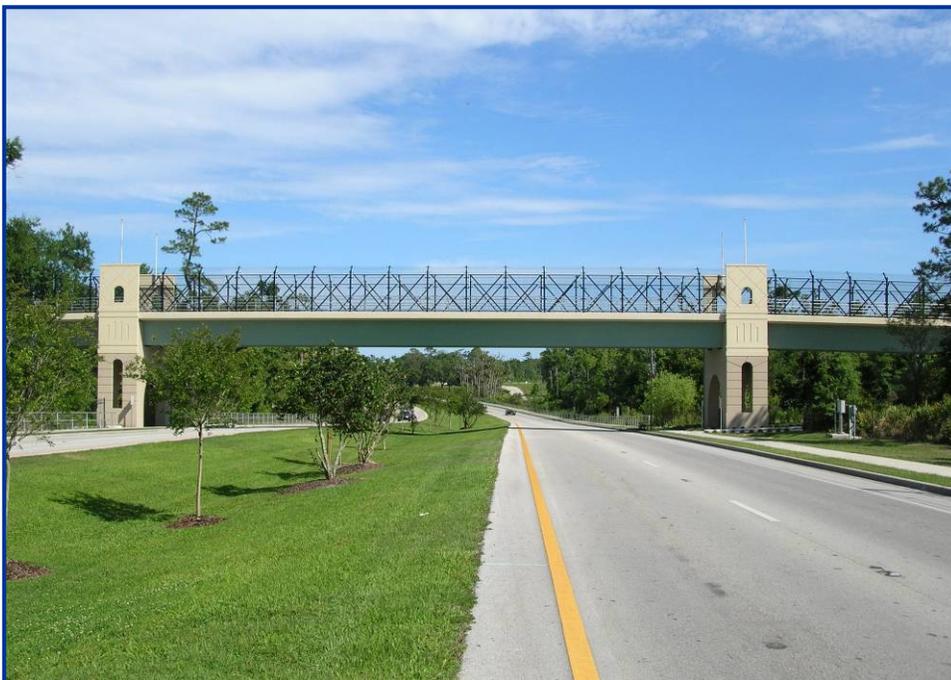
4.7.2 Guide Signs and Wayfinding

Guide signs and wayfinding are discussed more fully in Section 4.10.1 of this report. Emergency Signing is more fully discussed in Section 4.12 of this report.

4.8 Trail Overpasses/Underpasses

Trail overpasses and underpasses provide for trail users and motor vehicles to cross at different levels. These grade separated facilities greatly reduce conflicts between the trail users and cross traffic.

These types of facilities are expensive and may not be utilized by trail users if constructed in an improper location.



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4.8.2 Potential Overpass/Underpass Locations

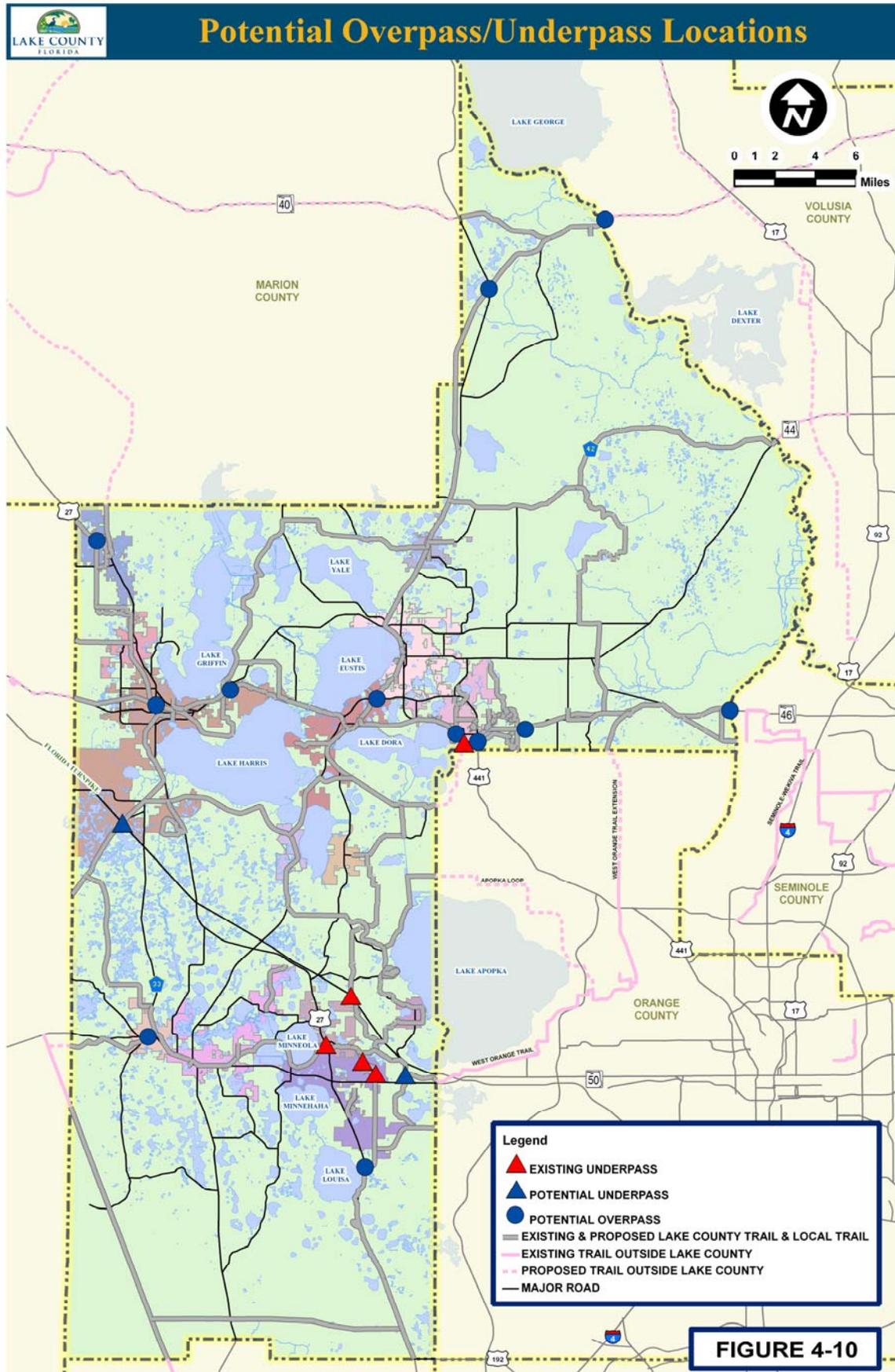
The Lake County Trails Master Plan provides locations that should be evaluated for trail overpasses. In some situations, the trail overpass will meet warrants and funding will be available to construct the trail overpass with the initial trail project. However, in most situations, a safe and suitable at-grade crossing will be available until the trail meets warrants or funding is available. Table 4-2 summarizes the locations of potential trail overpasses. These locations are also denoted on Figure 4-10 on the following page.

**Table 4-2
Potential Overpass/Underpass Locations**

Trail Name	Location	Jurisdiction
Tav-Lee Trail	East of CR 44	Leesburg
Leesburg-Wildwood Trail	@US 27	Leesburg
South Lake Trail to Citrus Ridge Trail	@ SR 50	Clermont
South Lake Trail to Citrus Ridge Trail	@ US 27	Clermont
South Lake Trail	@ SR 50 in Mascotte	Mascotte
North Lake Trail	@ US 441	Tavares/Eustis
Gardenia Trail	@ US 441	Lady Lake
Lake-Wekiva Trail*	@ US 441	Mount Dora
Tremain Street Greenway*	@ Lake-Wekiva Trail	Mount Dora
Lake-Wekiva Trail	@ Realigned SR 46 Just East of Round Lake Road in Sorrento	Lake County
Lake-Wekiva Trail	Wekiva River	Lake County
North Lake Trail	@ SR 19	Lake County
Black Bear Scenic Trail	St. Johns River	Lake County

* Utilizes the existing FCR railroad trestle.

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4.8.3 Trail Overpass Superstructure Types

Trail overpass superstructure types will be determined during the Project Development and Environment Phase for each trail project. While the structure type for each of the trail overpasses will be determined individually, three main structure types should be explored for each location.

- A pre-fabricated steel truss bridge, as manufactured by companies such as Steadfast Bridges, would provide an economical and rustic appearing structure. Concrete abutments at the bridge ends would be used to support the superstructure.
- A single steel box girder bridge would provide a high degree of aesthetics with a modern, streamlined look. However, their relatively large structure depth (six-foot minimum to meet maintenance requirements) would increase the length of the approach ramps. Concrete abutments at the bridge ends would be used to support the superstructure.



- Conventional beam/slab bridges composed of concrete AASHTO beams are economical but have limited aesthetic value. Like the box girders, they have a relatively large structure depth. This structure type would provide a low cost, low maintenance option to the steel truss or box girder. Concrete abutments at the bridge ends would be used to support the superstructure.

Regardless of the bridge type utilized, screened covers, such as chain link, will be required to enclose or partially enclose the structures in order to reduce the likelihood of objects being dropped or thrown onto the roadway below. Colored vinyl mesh can be used to enhance the appearance of the screen and facades can be added to provide improved aesthetics.

Two structural options should be evaluated for the approach ramps.

- Ramps supported on fill contained by proprietary retaining walls would permit various aesthetic treatments such as rustications, color tinting, and trail logos on the face of the walls. If desired, lower sections of the ramps could be constructed on fill with sloped embankments instead of a retaining wall in order to reduce costs.
- Ramps composed of slabs integral with single column piers/piles could be utilized to provide a more open look. A majority of the structural components for this type of ramp could be precast in order to expedite construction and reduce costs.

Pedestrian handrails meeting ADA requirements would be mounted on curbs or parapets. Horizontal clearance across a bridge should provide the width of the trail plus a minimum of two feet on each side.

4.8.4 Trail Underpass Types

Trail underpass types will be determined during the Project Development and Environment Phase for each trail project. While the structure type for each of the trail underpasses will be determined individually, three main structure types should be explored for each location.

- A pre-fabricated structural plate box culvert such as the Contech Structural Plate MULTI-PLATE®, provides an economical solution and can be made more aesthetically pleasing with the use of a wide variety of end treatments



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Trail Underpass Types Continued

- A precast box culvert such as CONSPAN Bridge Systems® or BEBO® Arch System



- A cast-in-place concrete box culvert

Regardless of the underpass type utilized, the underpass requires a minimum height of 8 feet in height and a width of 20 feet. The minimum height allows maintenance vehicles access and the minimum width allows for separating pedestrian and bicycle users through the length of the tunnel.

4.9 Trailheads and Trailstops

4.9.1 Trailheads

Three trailhead types are defined for the purpose of the Lake County Trails Master Plan: Minor, Major, and Municipal. Prototypical concept designs are shown in Figures 4-11 through 4-13.

- Municipal trailheads are trailheads developed and maintained by a municipality that include the minimum facility requirements provided for a minor county trailhead. The designation of these trailheads must be requested by the municipality with jurisdiction over the park in order to be added to the Lake County Trails Master Plan Map as a trailhead. These facilities are not official Lake County Parks and Trails facilities but serve the overall trail network.
- Minor trailheads will include restroom facilities, a minimum of 15 parking spaces including handicap parking, an informational kiosk including a map of the overall trail network, drinking water, benches, and bicycle racks.

- Major trailheads are intended to be “showcase” facilities. They should be located in areas of high use and attract users from around the state. These trailheads will require, at a minimum, restroom facilities, 30 parking spaces including handicap parking, an informational kiosk with a map of the overall trail network, drinking water, bicycle racks, a playground, and picnic facilities. These trailheads will likely serve as both a launching point for a trail excursion and as recreation and education destinations during a long trail ride. Opportunities for concessions, such as bike rentals, should be considered for these sites as well as the opportunity for educational enhancements. The educational enhancements might include bicycle safety, environmental stewardship, or historical interpretation and might also promote the Lake County Trails Network. Overall, they should be developed to showcase the best of Lake County’s Trails.

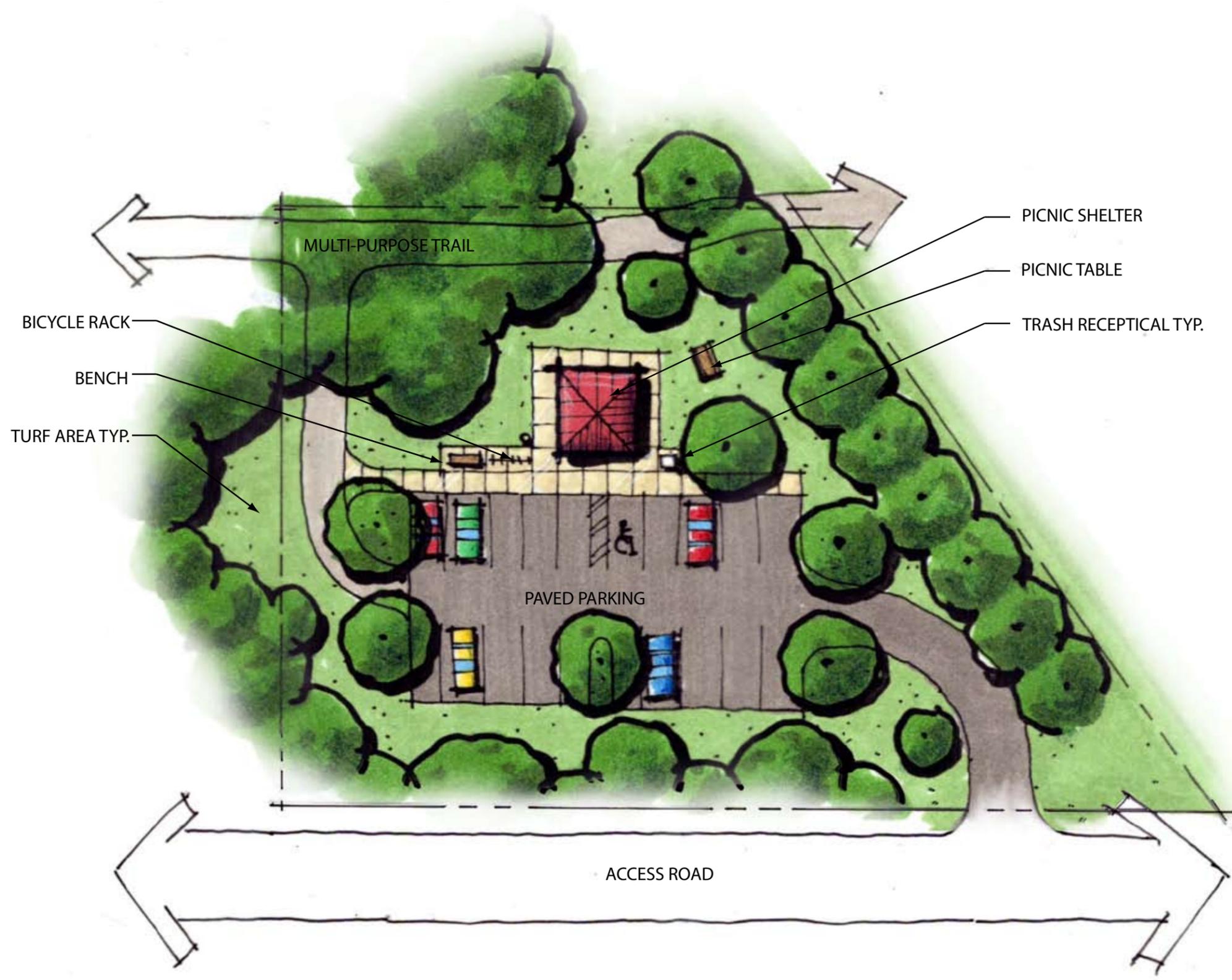
The Lake County Trails Master Plan identified 15 existing and future trailheads, including three major trailheads and 12 minor trailheads. Table 4-3 summarizes the existing and future trailheads and Figure 4-14 depicts the location of the existing and future trailheads. Additional information regarding trailheads can be found in Section 7.0 of this report.

4.9.2 Trailstops and Rest Areas

Any long shared-use path or trail network needs areas for users to rest. These should be at intermediate points, scenic lookouts, or near amenities such as restaurants, stores, picnic areas, and other recreational areas.

Rest stops should be constructed such that trail users can pull off the trail and not block traffic. A rest stop should have, at a minimum, a bench, a shade structure, and a trash receptacle. In addition, water fountains and bathroom facilities should be included at one or more stops along the trail.

Other amenities and safety features that should be considered include interpretive signs, information kiosks, emergency call boxes, emergency weather instructions, animal watering facilities, and hitching posts for horses, if applicable.



PROTOTYPICAL MINOR TRAILHEAD 1

0 5 10 30
SCALE: 1"=30'-0"

18 JAN. 2008



- PICNIC TABLE TYP.
- BICYCLE RACK TYP.
- RESTROOMS
- WATER FOUNTAIN/AIR STATION
- INTERPRETIVE SIGNAGE TYP.

- GRILL
- PICNIC SHELTER
- TURF AREA TYP.
- ENTRY SIGNAGE

PROTOTYPICAL MINOR TRAILHEAD 2



GLATTING-JACKSON KERCHER ANGLIN, INC.

18 JAN. 2008

0 5 10 30
SCALE: 1"=30'-0"

DESIGN STANDARDS

FIGURE 4-12



PROTOTYPICAL MAJOR TRAILHEAD



GLATTING-JACKSON KERCHER ANGLIN, INC.

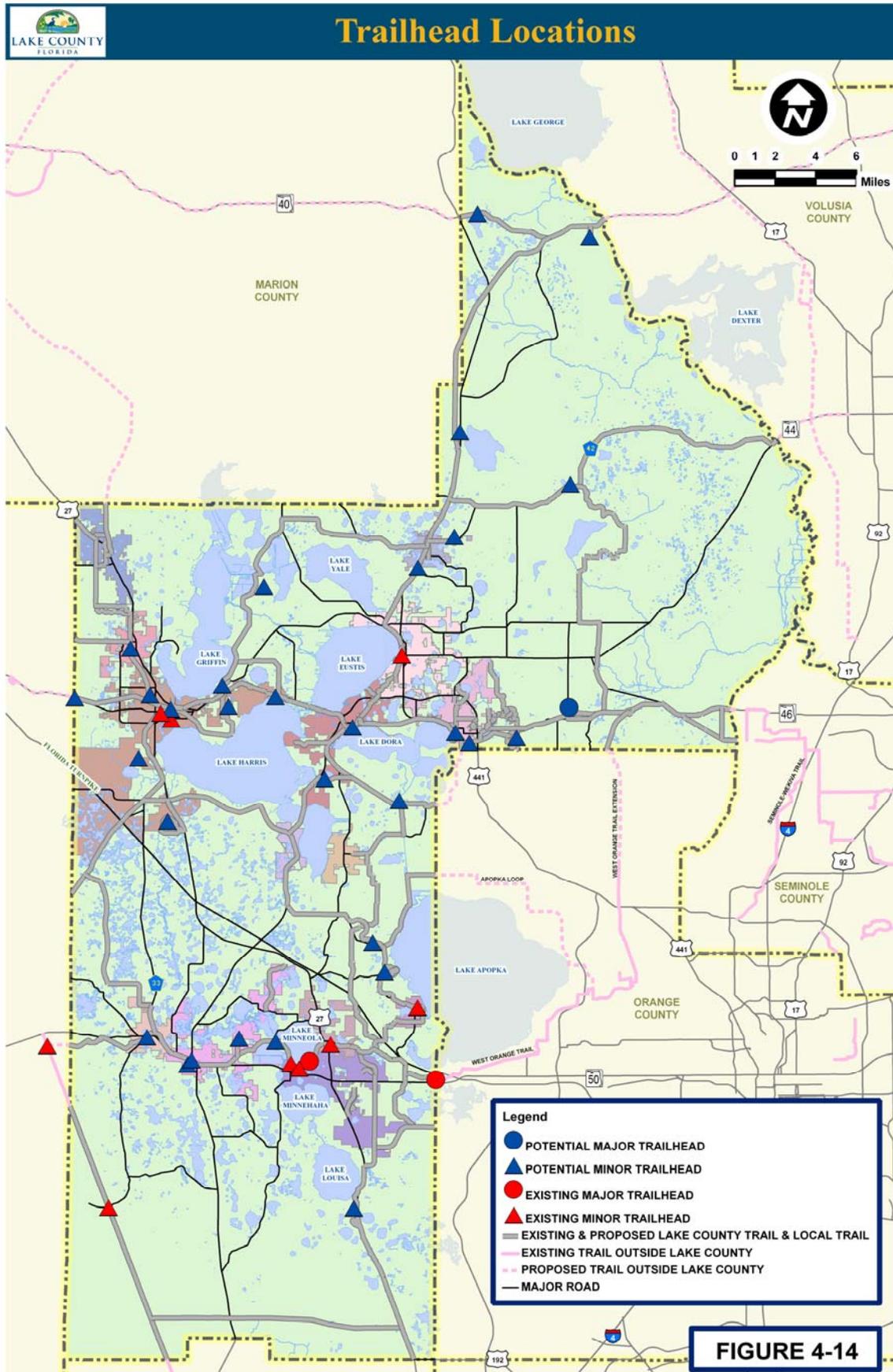
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**Table 4-3
Trailhead Locations**

Trail Name	Trailhead Type	Status
Astor Lions Park Trailhead	Minor	Potential
Clay Island Trailhead	Minor	Potential
Clermont Waterfront Park	Major	Existing
Downtown Clermont Trailhead	Minor	Existing
East Lake Park Trailhead	Major	Potential
Emerelda Marsh Preserve Trailhead	Minor	Potential
Farran Park Trailhead	Minor	Existing
Ferndale Preserve Trailhead	Minor	Potential
Gardenia Park Trailhead	Minor	Potential
Groveland Trailhead	Minor	Potential
Inland Groves Park Trailhead	Minor	Potential
Killarney Station Trailhead	Major	Existing
Lake David Trailhead	Minor	Potential
Lake Denham Park Trailhead	Minor	Potential
Lake Idamere Park Trailhead	Minor	Potential
Lake Jem Park Trailhead	Minor	Potential
Lake Louisa Trailhead	Minor	Potential
Lake-Sumter Line Trailhead	Minor	Potential
Mabel Trailhead	Minor	Existing
Mascotte Trailhead	Minor	Potential
Minneola Trailhead Park	Minor	Existing
Montverde Trailhead	Minor	Existing
Mote Morris Trailhead	Minor	Existing
North Lake Park Trailhead	Minor	Potential
ONF Visitor Center Trailhead	Minor	Potential
Paisley Woods Trailhead	Minor	Potential
Pear Park Trailhead	Minor	Potential
Rossiter Street Trailhead	Minor	Potential
Sabal Bluff Trailhead	Minor	Potential
Sleepy Hollow Trailhead	Minor	Potential
South Lake High Trailhead	Minor	Potential
Susan Street Complex Trailhead	Minor	Potential
Tavares Trailhead	Minor	Potential
Tav-Lee Trailhead	Minor	Potential
Train Depot Trailhead	Minor	Potential
Tremain Street Trailhead	Minor	Potential
Umatilla Park Trailhead	Minor	Potential
Van Fleet Trailhead	Minor	Existing
Venetian Garden Trailhead	Minor	Existing
West Lake Minneola Trailhead	Minor	Existing
Wildcat Lake Trailhead	Minor	Potential
Wolf Branch Sink Preserve Trailhead	Minor	Potential

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4.10 Aesthetic Design Standards

While the design of a trail begins with fundamental safety and operational considerations for each of the various types of trails, the design must also include standards for aesthetic elements. A trail user should expect to enjoy the rich and broad cultural and natural heritage of Lake County as they travel over the rolling hills and around the numerous lakes that were once the location of historic railroads. Aesthetic elements help to enhance the trail user experience with the surrounding environment. It is the desire of Lake County to promote the incorporation of each community's unique sense of place. However, for regional trails that traverse several communities, trails outside an established community, or for communities that would like to incorporate a standard design, a set of design standards were developed to provide a common feel for Lake County's trails.

4.10.1 Wayfinding

Wayfinding is defined as the “consistent use and organization of definite sensory cues from the external environment.” Simply put, the goal of wayfinding is to provide a cohesive layering of visual cues to direct the movement of vehicles, bicycles, and pedestrians through a defined area. Within the context of the Lake County Trails Master Plan, wayfinding represents the integration of each community's character within the signing, architectural design, and landscaping of the various trails and trail intersections as they move throughout Lake County.

While each trail and the accompanying design standards will reflect the character of the surrounding community through font types, colors, and the “branding” of the individual trail, each trail system should develop many of the basic wayfinding features. These include a corridor logo and a unified set of architectural design features such as directional signs, a range of gateway features, and interpretive signing. The Lake County Trail Signing Palette concepts are shown in Figure 4-15.

Auto

Wayfinding signs direct motorists to trailhead parking facilities and often provide visual cues at trail crossings that help build awareness of the trail as a community feature.

Trail

Wayfinding signs direct trail users at road crossings, trail intersections, and decision points. Signs can incorporate the trail logo, directional arrows, and distances to key destinations along the trail.

Some more well developed trails post trail service signs that can be purchased by local businesses to indicate business names, type of service (e.g., restaurant, ice cream, etc.), and direction and distance from trail.

4.10.2 Railings, Fences, and Barriers

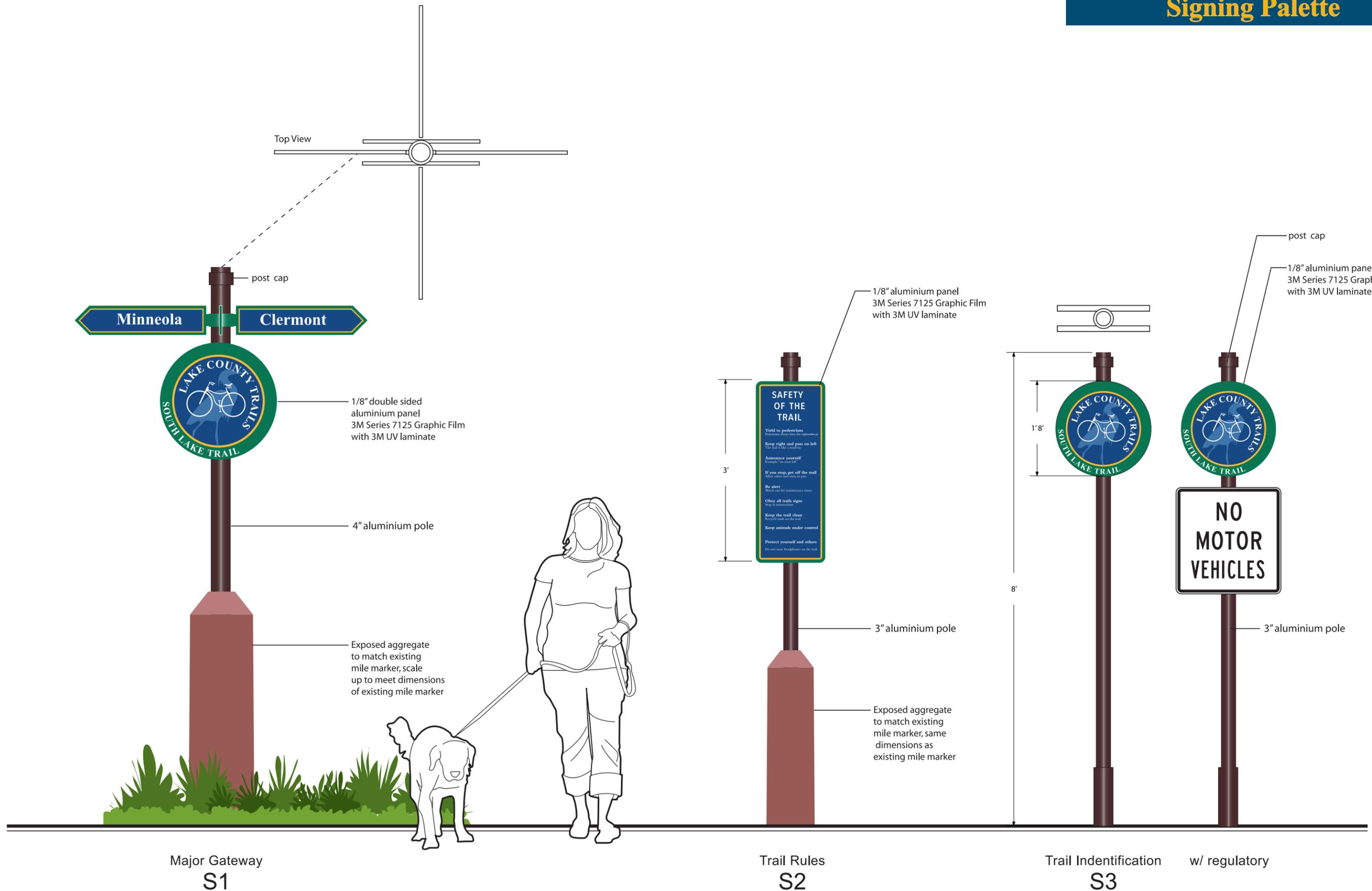
The incorporation of positive separation through the use of railings, fences, barriers, and privacy walls is utilized adjacent to trails for a number of different privacy or safety considerations. When these are used adjacent to a trail, AASHTO recommends railings, fences, and barriers be a minimum of 3.5 feet (1.1 m) high. Also, smooth rub rails should be attached to the barriers at handlebar height of 3.5 feet if the barrier is constructed within the clear zone of the trail.

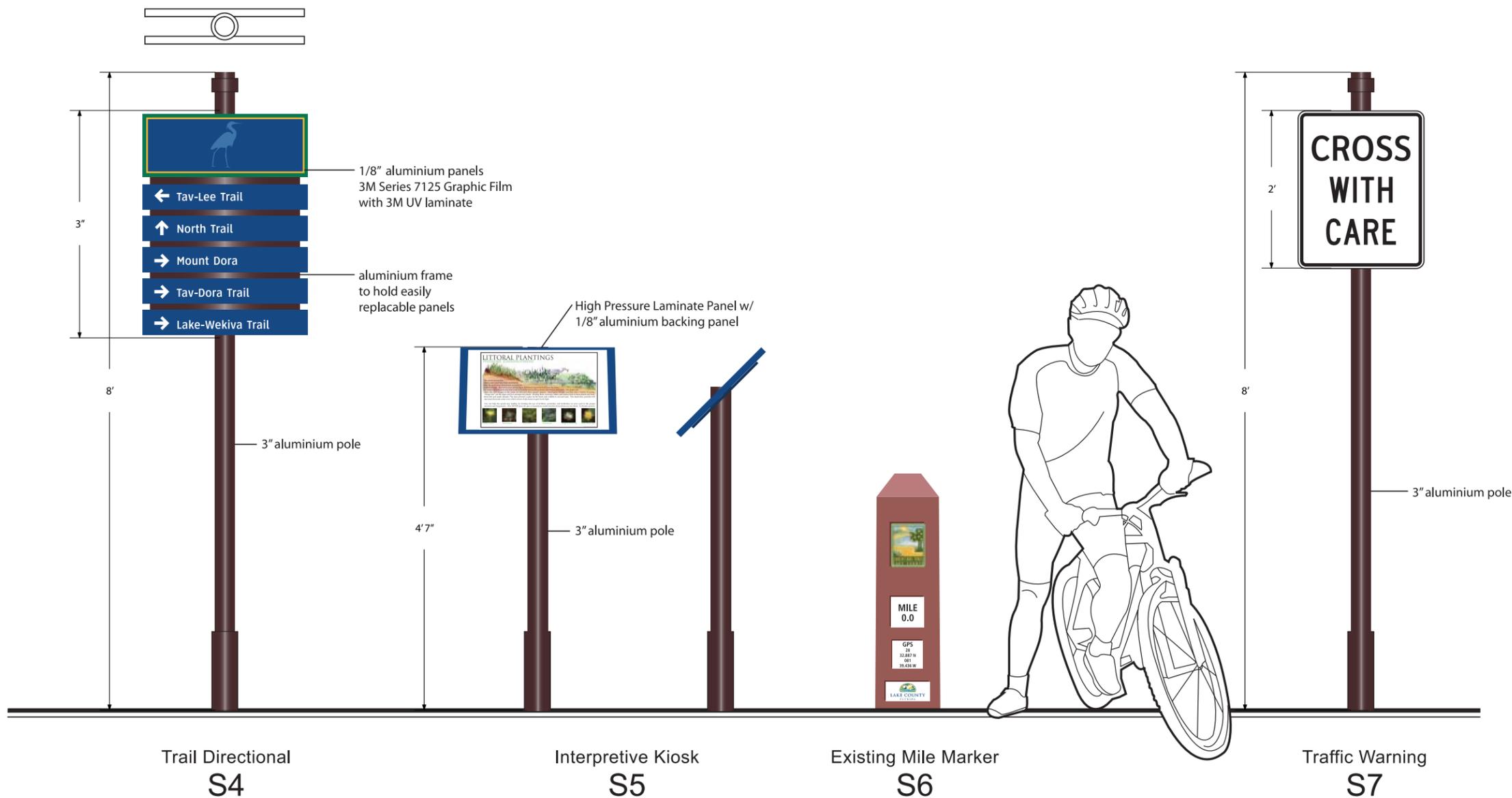
The design of these railings, fences, and barriers should incorporate the overall feel of the surrounding community and the architectural design standards should be approved by each individual community. At a minimum, the design of these types of barriers should be reviewed for safety and architectural design as part of the land development review process for the appropriate jurisdiction.

4.10.3 Plant Material

The choice of plant material should be designed for each trail individually. However, the incorporation of native Florida plants should be favored. If non-native plants are chosen for incorporation into the trail design, “Florida friendly” plants should be used. These plants are characterized by high drought and heat tolerance and are not considered invasive exotics. Plantings that require intensive irrigation and fertilization should be discouraged.

Trail landscaping will be done on a location by location basis to best match the ecosystem/area the trail is passing through. Landscaping will prohibit the use of any plants identified by the Florida Exotic Pest Plant Council (FLEPPC) as an invasive plant, listed as category one or two. Visit www.fleppc.org for a list of invasive plants identified by the FLEPPC.





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4.11 Equestrian Considerations

The accommodation of equestrian use on a shared-use trail requires properly planned, designed, and maintained trails. In determining appropriateness of accommodating equestrian use, each trail should first evaluate equestrian demand. Within Lake County, there are certain geographic regions that have identifiable equestrian communities and equestrian destinations. In these areas, the regional trails should consider equestrian use on shared-use trails. These areas are discussed in Section 5.1.2 of this report.

Linear trails that do not provide destinations, loop routes, or connectivity between equestrian trail systems do not tend to attract equestrian users and do not normally provide adequate demand for incorporation of equestrian accommodations.

In addition to the standard design guidelines for shared-use trails, when equestrian accommodations are incorporated into a trail, additional consideration must be given to the signage, vertical and horizontal clearances, surface type, structural features such as tunnels and overpasses, interaction between trail users, trailheads, and parking areas.

Trail Length

Trail length for equestrian accommodation is recommended to be a minimum of five miles.

Trail Design

Equestrian use may be accommodated on a 5' wide shoulder of a paved shared-use trail or on a separated equestrian path. If possible, a separate path provides the greatest level of service for equestrian use. Regional shared-use trails that expect heavy volumes of bicycles or are in an urban setting are not appropriate for utilization of an unseparated equestrian trail. Equestrian trails adjacent to or part of a shared-use trail require a minimum width of 8 feet of clear area and 4 feet of tread width. A minimum of 10 feet in vertical clearance is required. The maximum sustained grade is 10 percent but may be increased to 20 percent grade for lengths of less than 50 yards. The surface of an equestrian trail should be compacted earth. Limerock or sharp gravel are not appropriate surface types. The design requirements for equestrian accommodations are shown with the Rail-to-Trail typical section in Appendix B, and in Figure 4-16.

Signage

Each trail should be clearly posted as open to equestrian use. At access points to the trail, signs should be posted to educate and guide trail users to equestrian etiquette and provide equestrian users positive guidance to equestrian appropriate destinations and trail features such as watering stations and rest areas. Signs should also provide warnings of unusual or unexpected conditions in the trail, trail intersections, and potential conflicts with other trail users.

Parking

The parking needs for an equestrian equipped trail should include a minimum of four parking spots for trailers. These parking spots are recommended to be 80 feet in length (50 feet minimum) and 30 feet wide. These parking areas should include animal watering facilities, hitching posts, and manure disposal sites.

Trail Maintenance

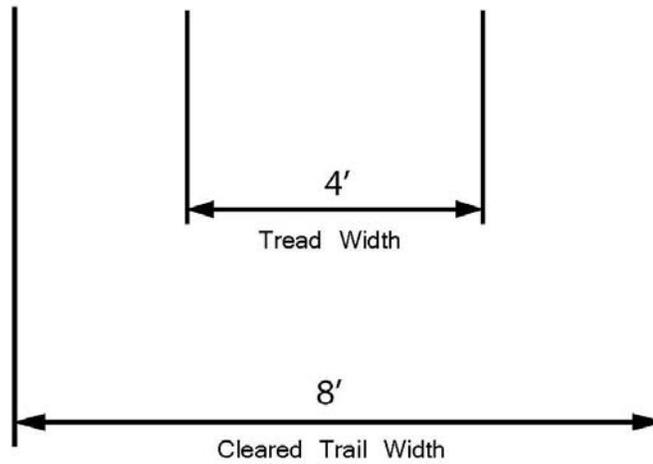
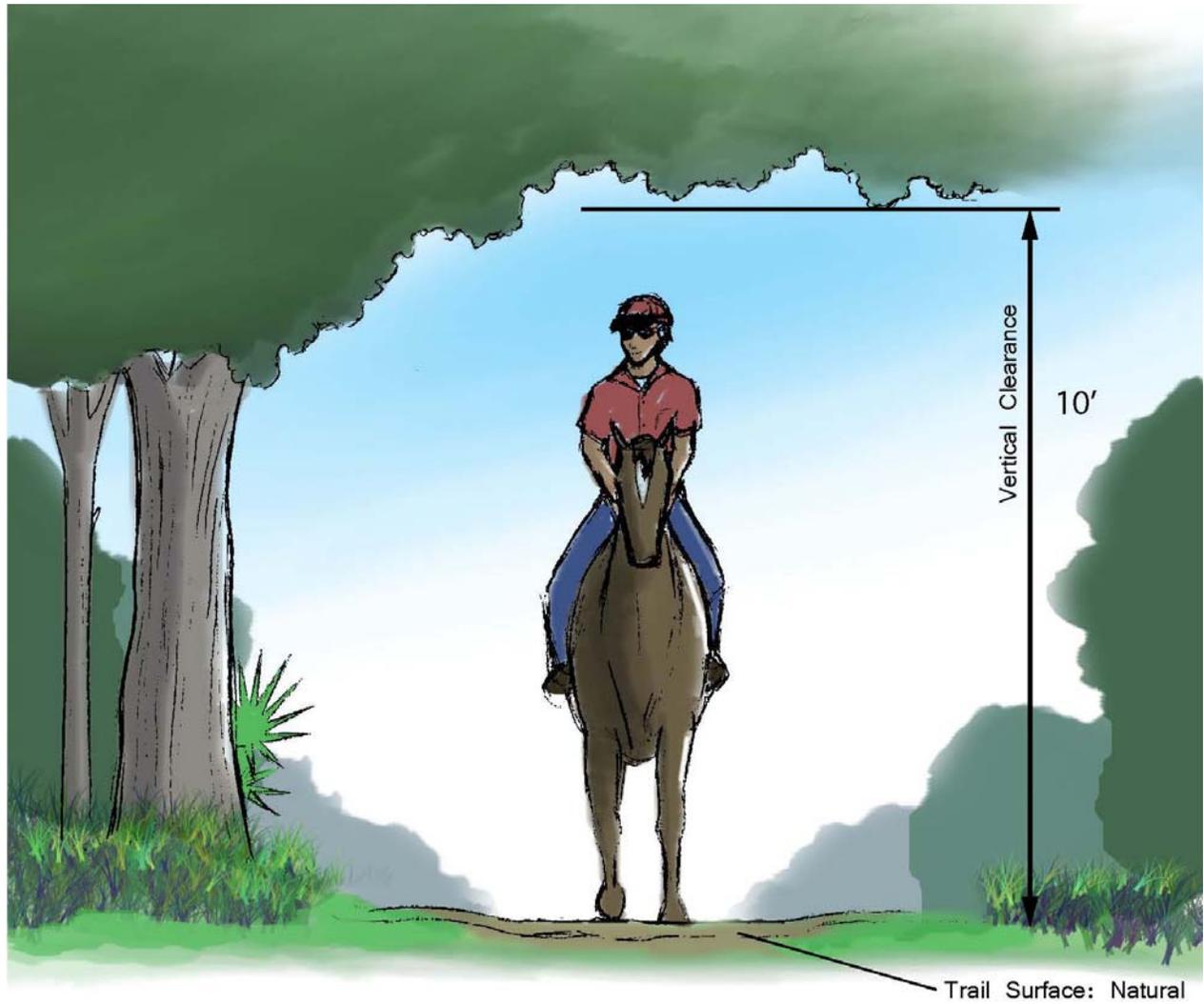
Trail maintenance for the paved surface of a shared-use trail will require increased frequency to clean the trail surface of manure. The surface of the equestrian path will require a unique maintenance schedule to address issues associated with hardened earth trails, vegetation maintenance, and good working order for the equestrian amenities, especially the watering stations.

Trail Tunnels and Overpasses

Trail tunnels and overpasses will require site specific designs to accommodate equestrian use. Trail underpasses will require a minimum of 10 feet of vertical clearance and 10 feet of horizontal clearance. Most overpasses associated with shared-use trails will require equestrian users to dismount in order to safely cross. Mounting blocks should be provided at both approaches to an overpass. Each project should include equestrian specific design for grade separated crossings. Presently, there are no tunnels or overpasses located on equestrian appropriate trails within the Lake County Trails Network.

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Figure 4-16
Equestrian Trail Design Requirements



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4.12 Trail User Security and Safety Considerations

4.12.1 9-1-1 Systems

Florida has one of the nation's best greenway and trail systems with nearly 4000 miles on over 100 major trails. Many of these trails, such as the West Orange Trail which connects into the South Lake Trail, see over one million users a year. With users in the millions, one of the greatest challenges for trail providers such as Lake County is ensuring and promoting the safety of trail users.

In the event of a trail-related emergency, the first way people seek help is through those around them and/or a local 9-1-1 service. Because trail users are often calling from a cellular phone, locating a caller using 9-1-1 on a trail is more complicated than calling from a home or office phone. In 2000, there were 150 million calls made to 9-1-1 centers across the country. Of those 150 million, 30 percent (nearly 45 million) of those calls came from wireless phones. Currently, there are three main types of wireless 9-1-1 services: Phase 0 (Basic 9-1-1), Phase I (Enhanced 9-1-1 or E 9-1-1), and Phase II (Enhanced 9-1-1 or E 9-1-1).

Phase 0 is the most primitive of all of the 9-1-1 systems. The Federal Communication Commission's (FCC) rules state that the wireless providers are required to transmit your call to one of the 6,174 Public Safety Answering Points (PSAPs) across the nation, regardless of whether or not one is subscribed to that particular wireless service. In Phase 0, the receiver of the call at the PSAP has no information about the caller other than what is provided verbally to them by the caller. The vast majority of the PSAPs in the United States have upgraded from Phase 0 to Phase I.

To be classified as Phase I, the FCC states that wireless providers must be able to provide the PSAP with a phone number associated with the originator of the 9-1-1 call, as well as the cell site or tower that is transmitting that call. While having this information is very helpful to the emergency responder, it only guarantees that your location can be determined in relation to the cell tower receiving your call, which could be miles away. A benefit of Phase I is that the emergency responder at the PSAP now has the ability to call you back, even if you aren't able to give them your number.

Phase II is the most advanced of all the 9-1-1 systems. Phase II requires all wireless providers to begin providing the PSAPs with more detailed locations of their callers, specifically, their latitude and longitude. To meet the FCC's standards for this service, the location must be accurate within 50 to 300 meters. To ensure these conditions are met, wireless providers are also required to ensure that 95 percent of their subscribers have Phase II E9-1-1 capable handsets. Currently, all but 12 of the counties in Florida are capable of full Phase II 9-1-1 service. Of those 12, all are in the process of upgrading to Phase II. Currently, Lake County has full Phase II service.

Making an emergency 9-1-1 call from a cell phone purchased after 2003 is one of the easiest ways to convey your location to an emergency responder. However, there are many variables such as poor reception, a dead battery, or a phone broken as a result of an accident, which might prohibit your phone from working properly. If the user's phone is not useful in connecting with an emergency responder or if the user doesn't have a cell phone, then



they should look for the nearest emergency landline phone located along the trail. Many trails, such as the urban Cady Way Trail in Orlando, now provide emergency phones spaced along the trail. These phones are clearly labeled and connect the caller directly to an emergency responder, in a best case scenario, with their location.

The success of the emergency responder depends almost entirely on them being able to locate the caller based on either wireless information or verbal information provided to them by the caller at the time of the emergency. If a caller is forced to provide only a verbal description of their location, it is up to trail designers to make sure that they are able to do this as quickly and effectively as possible.

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9-1-1 Systems Continued

The majority of major trails have dedicated mile markers spaced every mile or half mile. On Lake County's trail marker, there is both the mileage along the trail and the exact Global Positioning System (GPS) coordinates of the marker itself. GPS coordinates are the most accurate way to locate a person along the trail. Even if the caller doesn't know what the coordinates mean, they can be provided to the responder at the PSAP so they can input them into their GPS system to derive a location.



GPS branding could be used as an option in addition to the mile markers alone. There are many amenities along trails that are not located near a mile marker. A few very common examples of these amenities include shelters and restrooms, benches, and water stations. If every amenity on the trail had its own GPS coordinates displayed on it, at any given time a trail user may be closer to an item with GPS coordinates than if they were displayed on mile markers alone.



When trail users continually familiarize themselves with their location on the trail during use, their chances of being able to convey that same location to someone who is not present is much greater. Users should take note of small towns they pass through or roads they cross. Commonly recognized features help to generate a general location. One should also make every effort to take notice of the passing mile markers in order to keep track of their distance from their starting point, as well as their current location. The more detailed one is in the description, the easier it is for a responder to narrow down the location.

Regardless of best planning practices, unforeseen events are as possible on the trail as in daily life. To

best handle these situations, it is recommended that Lake County continue including GPS coordinates on all of their trail mile markers. The County should also consider expanding this type of GPS branding to more amenities including benches, trash receptacles, water stations, and shelters. It is also recommended that there be an emergency phone located at every trailhead in the county, in areas with known criminal activity, and segments with a high volume of night traffic. These phones should be ADA accessible and clearly marked.

4.12.2 Crime Prevention Through Environmental Design

Crime Prevention Through Environmental Design (CPTED) is the process of preventing crime through the proper design and maintenance of the physical environment. The underpinning principles of CPTED are rooted in the belief that environmental factors affect the perceptions of all trail users and proper design not only reduces the incidence of crime but also changes the perceptions of the possibility of criminal activity, which makes citizens feel safer and criminals feel more vulnerable.

The integration of CPTED principles into trail design should seek to address the following overlapping CPTED principles.

- Natural Surveillance – Keeping the environment maintained so that people can be easily seen by other users, staff, and anyone passing the trail on an adjacent street. This also involves keeping the surrounding foliage trimmed away from the trail surface and incorporating lighting where night use is anticipated.
- Natural Access Control – The use of visual cues to indicate proper use of the facility. In trail design, this involves the proper design of road crossings so that motorized vehicles do not want to use the trail. While this can be accomplished through hardening methods, such as bollards, the incorporation of pedestrian features, gateway signing, and median and buffer landscaping will reinforce the perception that the corridor is not appropriate for motorized vehicles.
- Territoriality – Territorial reinforcement is used to distinguish public and private spaces. The methods include a wide range of visual cues and community involvement to show that someone

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Crime Prevention Through Environmental Design Continued

owns and cares about the trail. This may be accomplished by fostering stakeholder interaction, vigilance, and control over the trail; increasing trail use; presence of park or trail rangers; and creating a hierarchy of spaces by delineating private space from public space through real or symbolic boundaries. The use of public art is a common strategy to increase positive territoriality.

- Image/Maintenance – Ensuring the trails are clean, free from litter, mowed, and graffiti-free will foster the perception that the trail is safe and discourage criminal activity.

In summary, CPTED is not a checklist but takes the idea that a clean, inviting, and well maintained public space that is obviously a valued asset to the community will initiate a reinforcing cycle of use. Trail users feel safe and are encouraged to visit the facility, which in turn discourages illegitimate use of the facility, which in turn encourages greater legitimate use. The result is a positive environment for trail users to comfortably enjoy the Lake County Trails Network.

4.13 Other Engineering Issues

4.13.1 Contamination

A concern for many Rails-to-Trails or Rails-with-Trails projects is contamination. Based on the nature of existing railroad corridors, it is likely that additional railroad related contamination, including the presence of arsenic and other wood preservative constituents, will be present. While most of the railroad ties are removed from the historic railroad grades in Lake County, any remaining railroad ties may either be incorporated into a project or disposed of at a nearby landfill.

Further contamination might be present in the surrounding surface soil as a result of pesticide applications or leaching from the railroad ties. Treatment of this type of contamination consists of specific design specifications for handling the soil and sodding or paving over the contaminated areas.

Other trail types would require project specific evaluation for contamination. Most trail projects simply disturb the upper six to twelve inches of soil and are generally not considered a high risk. If any drainage, retaining wall, or other structures with excavations of over one foot are necessary, a

contamination screening using a comprehensive database search should be performed during the study or design of the trail if adjacent to urban or developed land to search for recorded contamination sites. Additionally, field reconnaissance should be conducted during design to identify any unrecorded potentially contaminated sites.

4.13.2 Permitting

Lake County is located in the St. Johns River Water Management District (SJRWMD) and Southwest Florida Water Management District (SWFWMD). Trail projects within Lake County would not require a permit per Rule 40C-42.0225, Number 6 (SJRWMD) and Rule 40D-4.051, Number 13 (SWFWMD). A Letter of Permit Exemption to SJRWMD and SWFWMD will be required for each trail. New construction for trailheads would require a separate permit. Any potential impacts to the 100-year floodplain will be compensated for as mandated by federal, state, or local agencies.

