THE CHATTAHOOCHEE RIVERLANDS

DESIGN GUIDELINES

PART 01

Chattahoochee RiverLands

ACKNOWLEDGEMENTS

We must start this document by acknowledging the River and the resources it has provided people for centuries. The Chattahoochee River is a captivating place that holds deep meaning and provides valuable resources to the Metro Atlanta Region. For millennia, the River shaped the landscape and wove together distinct cultures and ecosystems. It has bound the two through a continuous physical fabric of River and land that today spans hundreds of miles and three states. This Chattahoochee River landscape impresses a sense of awe and reverence that has persisted through generations. Inspired by the beauty of the River and its historical context the Design Team has carefully crafted this first set of Design Guidelines for the Chattahoochee RiverLands.

We acknowledge the Chattahoochee River and the surrounding area as the original homelands of the Cherokee and the Creek people. We acknowledge the painful history of forced removal of these communities from this territory, and we honor and respect the many diverse indigenous peoples still connected to this land on which we gather, live, work, and commune.

The Design Guidelines are a companion document to the Chattahoochee RiverLands Greenway Study published in May of 2020 and are intended to provide standards that can be used by various stakeholders throughout the RiverLands to create a unified and immersive experience for users of all backgrounds and abilities for generations to come. While the Design Guidelines will be informative to anyone interested in the Chattahoochee RiverLands, they are primarily intended for state agencies, local governments, engineering and design firms, and trail organizations who will be charged with designing, building, operating, and maintaining segments of the RiverLands overtime.

This document is only the first step towards developing a comprehensive set of Guidelines. Later phases will require the continued support of individuals and jurisdictions committed to the RiverLands vision.

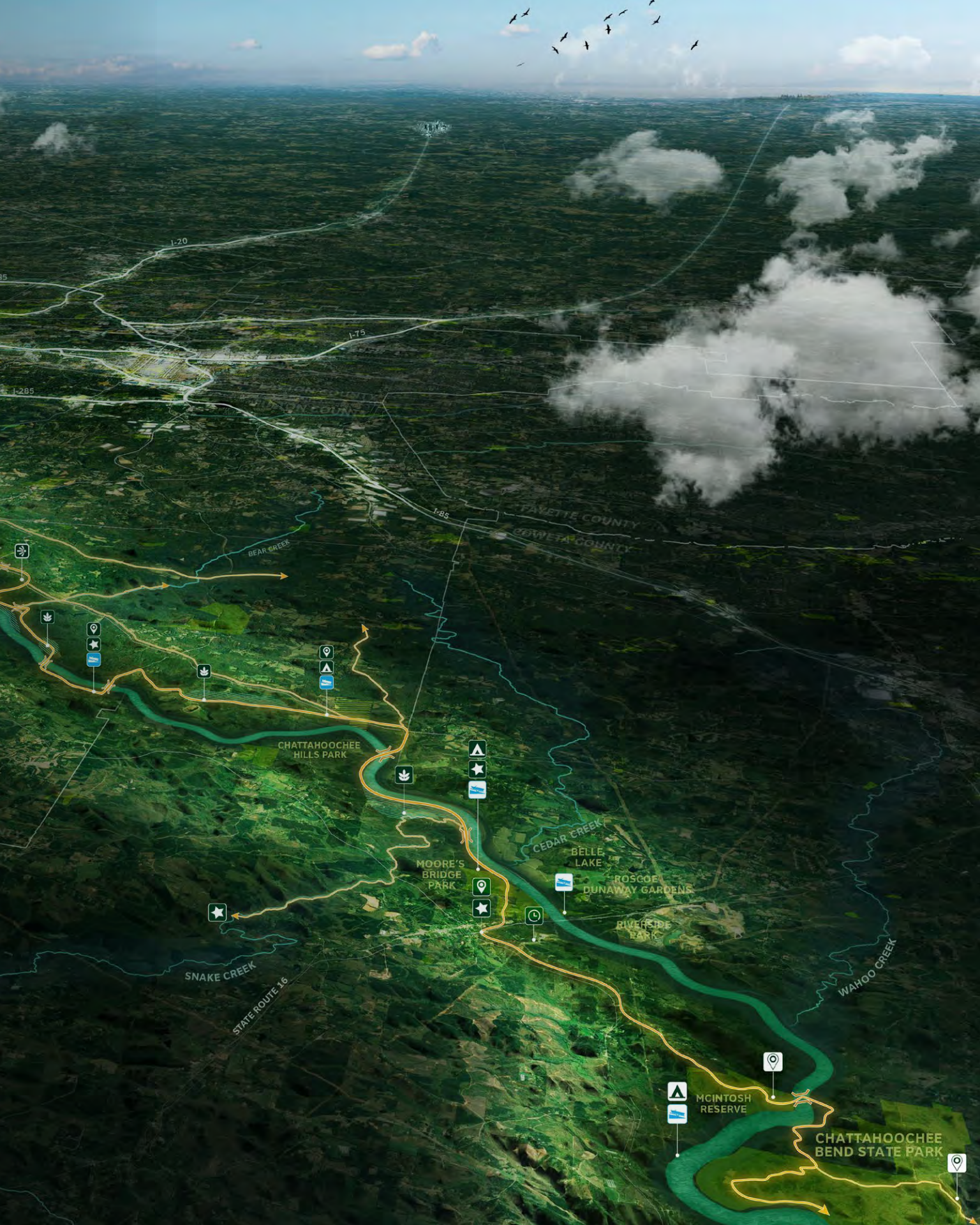

I-20
I-75
I-285
I-85
FAYETTE COUNTY
COWETA COUNTY
BEAR CREEK
CHATTAHOOCHEE HILLS PARK
MOORE'S BRIDGE PARK
CEDAR CREEK
BELLE LAKE
ROSCOE DUNAWAY GARDENS
RIVERSIDE PARK
SNAKE CREEK
STATE ROUTE 16
WAHOO CREEK
MCINTOSH RESERVE
CHATTAHOOCHEE BEND STATE PARK

TABLE OF CONTENTS

*The Chattahoochee RiverLands Design Guidelines was managed by **Trust for Public Land (TPL)**. The project was designed in collaboration with the Chattahoochee Working Group (CWG), a collective of stakeholders, residents, and political officials working within the study area.*

*This document was prepared by the Design Team led by **SCAPE Landscape Architecture DPC** with:*

Gresham Smith
sky design

FINAL DRAFT DOCUMENT SUBMITTED ON MAY 18, 2022

TRUST FOR PUBLIC LAND™

LEARN MORE ABOUT THE PROJECT AT:
WWW.CHATTAHOOCHEERIVERLANDS.COM

Chattahoochee RiverLands

THE RIVERLANDS DESIGN GUIDELINES

The Chattahoochee RiverLands Design Guidelines are a companion document to the Chattahoochee RiverLands Greenway Study and are intended to provide standards that can be used by communities throughout the RiverLands to create a unified and immersive experience for all types of users, for generations to come.

The Chattahoochee River is a shared historic, economic, cultural and ecological resource of extraordinary value for the Metro Atlanta Region and Georgia. The Chattahoochee RiverLands Greenway Study provided an opportunity to reconsider the region's relationship to the River and put forward a collective vision for the future. From Buford Dam to Chattahoochee Bend State Park, the Chattahoochee RiverLands envisions new and equitable investments in parks, trails and water access points along a continuous 100-mile-long corridor.

As the RiverLands project unfolds and evolves over the coming decades, these Design Guidelines will help ensure that the goals set forward in the Greenway Study are achieved and that the RiverLands becomes:

- A Safe Connective Corridor
- A Common Ground for All
- An Ecological Refuge for the Region
- A Living Legacy for Future Generations

The primary objective of the RiverLands Design Guidelines is to create a legible path that follows the River and connects 19 municipalities across seven counties. Through identifiable design elements and materials, that also allow flexibility for implementing agencies, the Guidelines articulate a vision for the RiverLands that will be both distinct and implementable. Future phases of Design Guidelines will further articulate this vision.


Natural Springs Preserve
Tributary River Crossing
Cultural Heritage Site

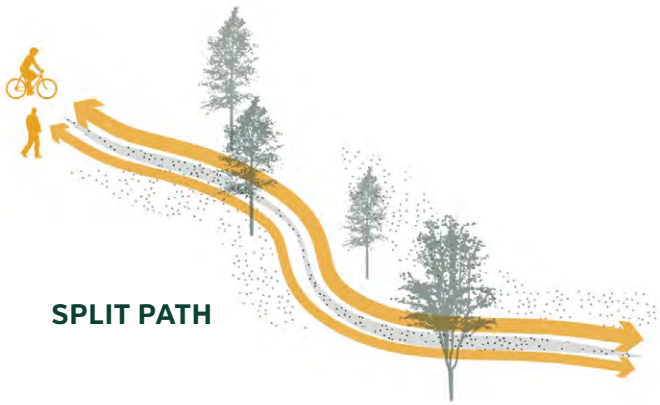

ALONG THE
RIVERLANDS

MAIN STEM GREENWAY

The main stem of the Chattahoochee RiverLands Greenway is more than just a single trail. It is a "common ground for all" formed by a network of existing and proposed trails that stiches together different municipalities while creating a continuous public realm accessible to all. Providing visual consistency along the 100-mile-long corridor through identifiable design elements will assure users that they are along the RiverLands.

The main stem greenway:

- Is consistent, identifiable, and accessible to all;
- Incorporates an elemental palette of materials that draws inspiration from the surrounding landscape;
- Incorporates durable, sustainable, and resilient materials, and minimizes ecological impact wherever possible;
- Is implementable, minimizes long-term maintenance needs, and follows existing regulations.



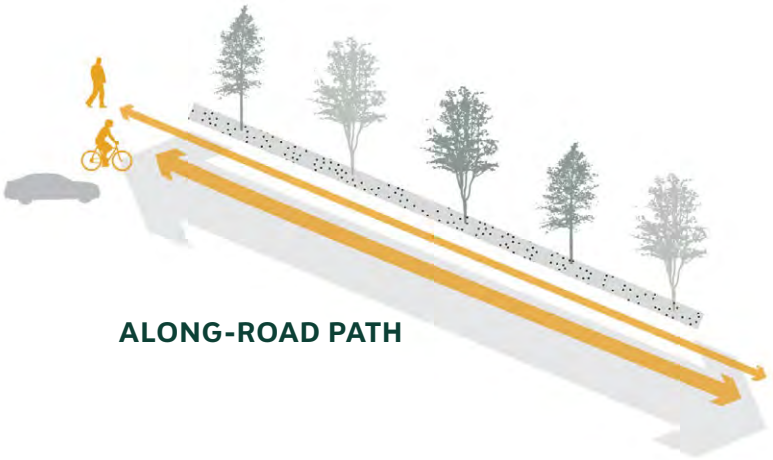
SPLIT PATH

Due to the varied conditions along its length and the array of landscapes it will traverse, the main stem greenway will take many forms: shared-use path, split path, along-road path, boardwalk and, in some cases, a retrofit of existing trails. It will also include pedestrian rambles and connections to tributary trails.

BOARDWALK

Regardless of the landscape or trail typology, and to maintain a recognizable identity, the materials and typical details along the main stem greenway will remain consistent along the entire length of the trail.

SHARED-USE PATH

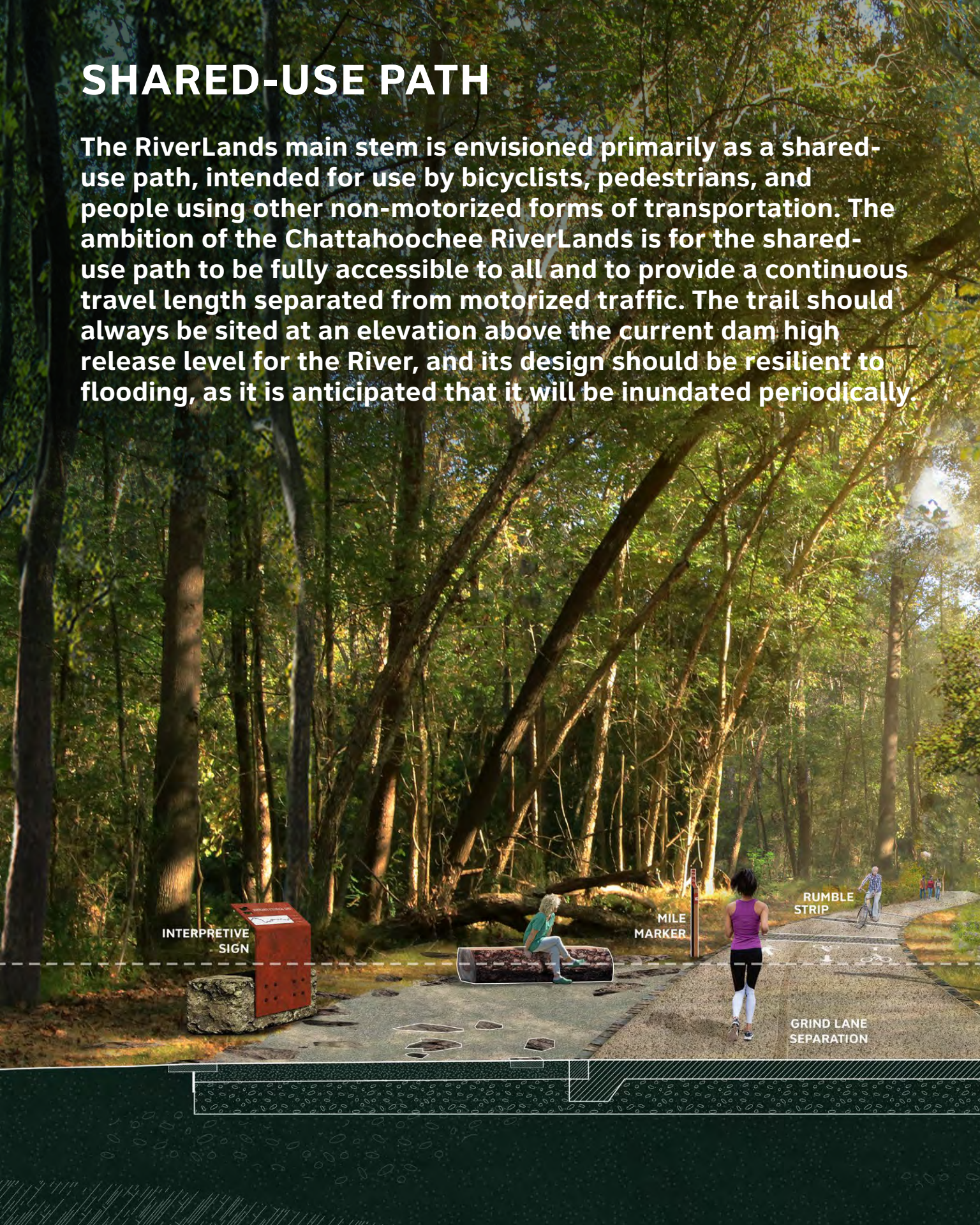


ALONG-ROAD PATH

RETROFIT

SHARED-USE PATH

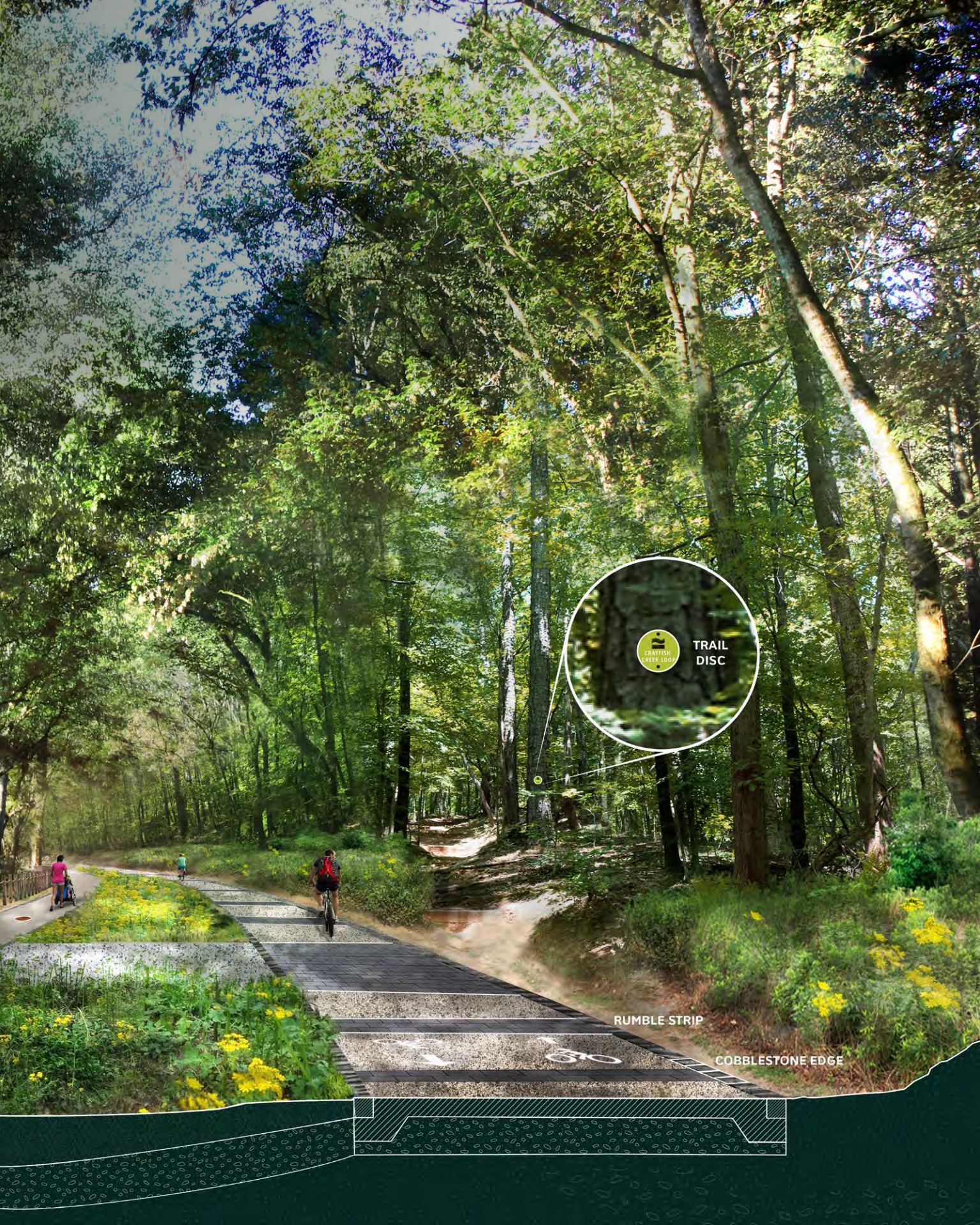
The RiverLands main stem is envisioned primarily as a shared-use path, intended for use by bicyclists, pedestrians, and people using other non-motorized forms of transportation. The ambition of the Chattahoochee RiverLands is for the shared-use path to be fully accessible to all and to provide a continuous travel length separated from motorized traffic. The trail should always be sited at an elevation above the current dam high release level for the River, and its design should be resilient to flooding, as it is anticipated that it will be inundated periodically.




Natural Springs Preserve
Tributary River Crossing
Cultural Heritage Site
BICYCLE DIRECTIONAL
100-YR FLOOD
COBBLESTONE EDGE
BIOSWALE
HIGH RELEASE

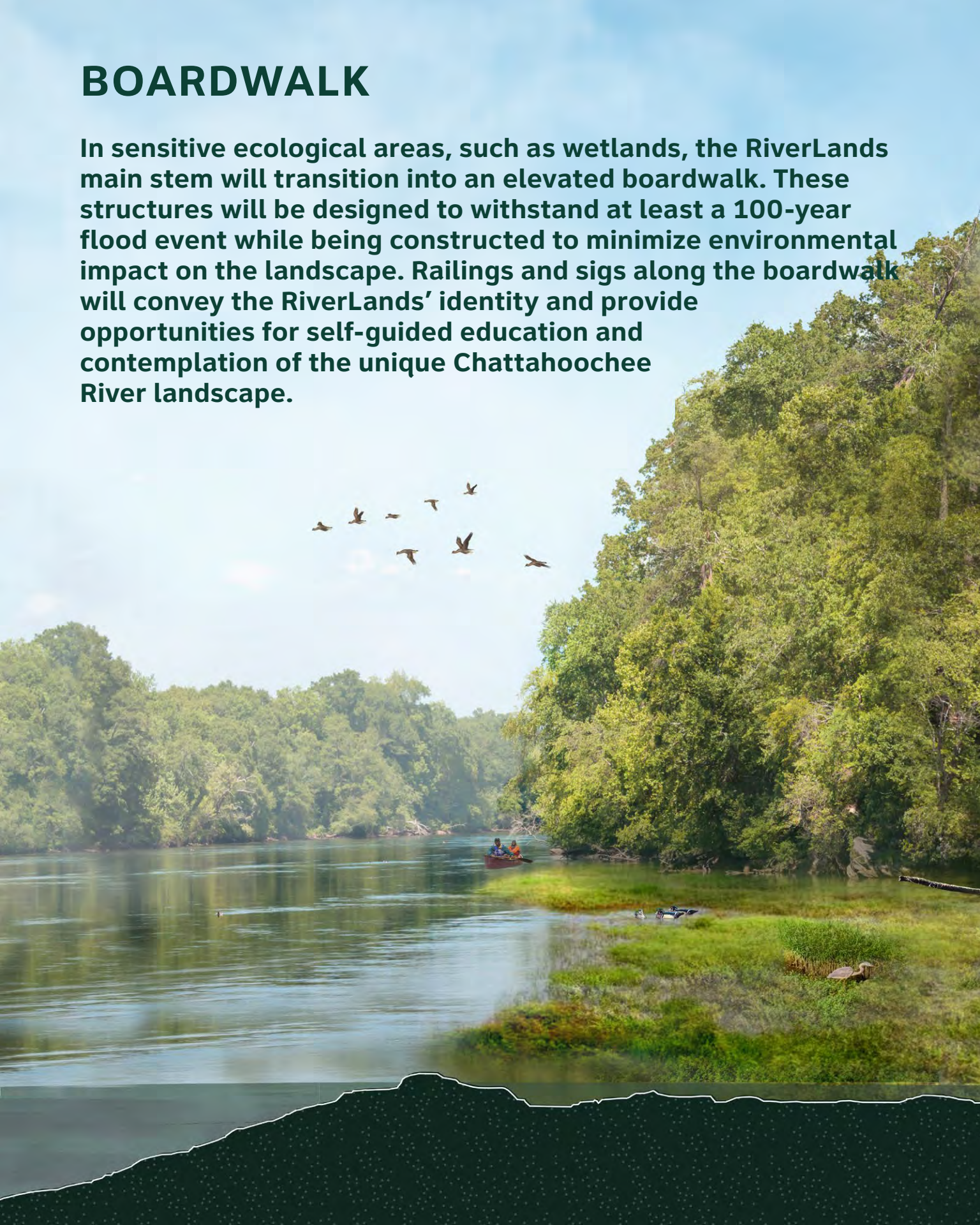
SPLIT PATH

In areas along the RiverLands such as easements, where already disturbed land is available, splitting the trail between cyclists and pedestrians is preferred. Separating bicycle and pedestrian facilities can be more comfortable to a wider range of users while also reducing potential user conflicts, creating a safer, low-stress experience for both recreation and transportation. This strategy could also be used in more densely populated areas where higher traffic volumes might create a less desirable experience.


CRAYFISH CREEK LOOP
TRAIL DISC
RUMBLE STRIP
COBBLESTONE EDGE

BOARDWALK

In sensitive ecological areas, such as wetlands, the RiverLands main stem will transition into an elevated boardwalk. These structures will be designed to withstand at least a 100-year flood event while being constructed to minimize environmental impact on the landscape. Railings and sigs along the boardwalk will convey the RiverLands' identity and provide opportunities for self-guided education and contemplation of the unique Chattahoochee River landscape.




INTERPRETIVE SIGN
TRAIL RULES
ADA DROP RAIL
METAL RAIL WITH WOOD TOP
CONCRETE PLANKS
PAINTED MODAL SEPARATION
HELICAL PILES

ALONG-ROAD PATH

In segments where the RiverLands Greenway runs along existing roads with adequate space, an off-road split path is preferred. Bioswales separating both the path from the road and pedestrians from cyclists will capture stormwater, provide space for tree shade, and prevent user conflicts. Identifiable stone walls could create further protection for non-motorized uses.


STONE WALL
EMBEDDED DISC
MILE MARKER
PERMEABLE PAVERS
WOOD FENCE
BIOSWALE

THE RIVERLANDS ELEMENTS

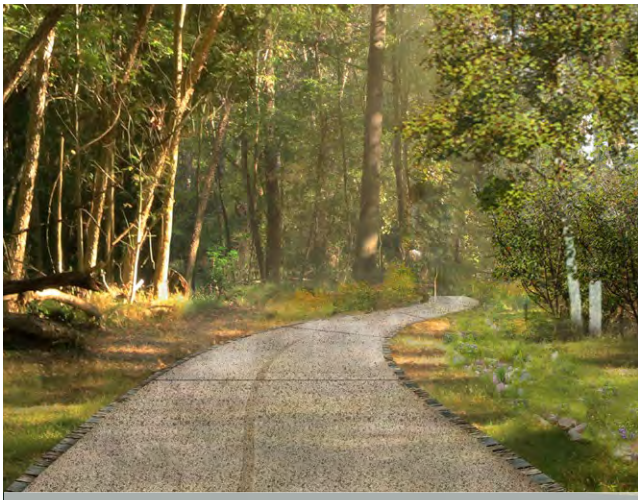
SHARED-USE PATH

The shared-use path running through wooded areas along the River will be the most frequently occurring condition for the main stem. The path will bypass sensitive habitats and avoid habitats that would be negatively impacted throughout the riparian corridor. Forest cover will be protected or restored along the main stem, and programmatic elements and access points will be designed to minimize ecological footprints and to include habitat enhancements. Nooks along the path, with distinctive seating and wayfinding elements, will offer users a moment to pause. Additional signs along the path will provide educational opportunities and assure trail users that they are traveling along the RiverLands.

Maintaining a consistent material language along the RiverLands is of critical importance to creating an identifiable system across the region. The following section provides trail surface material recommendations for the shared-use path.

Chattahoochee
RiverLands

SHARED-USE PATH



Shared-Use Path with Exposed Aggregate Concrete

Exposed Aggregate Concrete Sample

Grind Lane Separation

Painted Lane Separation

Wasau V-Series Permeable Pavers

The width of the shared-use path ranges from 12’ to 18’ in width, with 16’ being the preferred width. This allows for a cyclist to pass a pedestrian going in the same direction, while another user approaches from the opposite direction.

PREFERRED SURFACE MATERIAL

Concrete

The primary material for the shared-use path is exposed aggregate concrete with a sand base color and light grey and brown crushed stone aggregates. The aggregates reflect the native geology of the region and should be matched throughout. Concrete is the preferred trail material because of its availability, low maintenance requirements, and longevity in adverse weather conditions.

LANE SEPARATION RECOMMENDATION

In areas where the shared-use path is 14’-18’ and can accommodate separated uses, the following lane separation recommendations will provide enhanced pedestrian and cyclist safety.

Grind

To separate lanes within the concrete shared-use path, grinding the surface of a 2” wide line is the primary lane separation strategy. This method provides both a visual and tactile warning when users cross lanes.

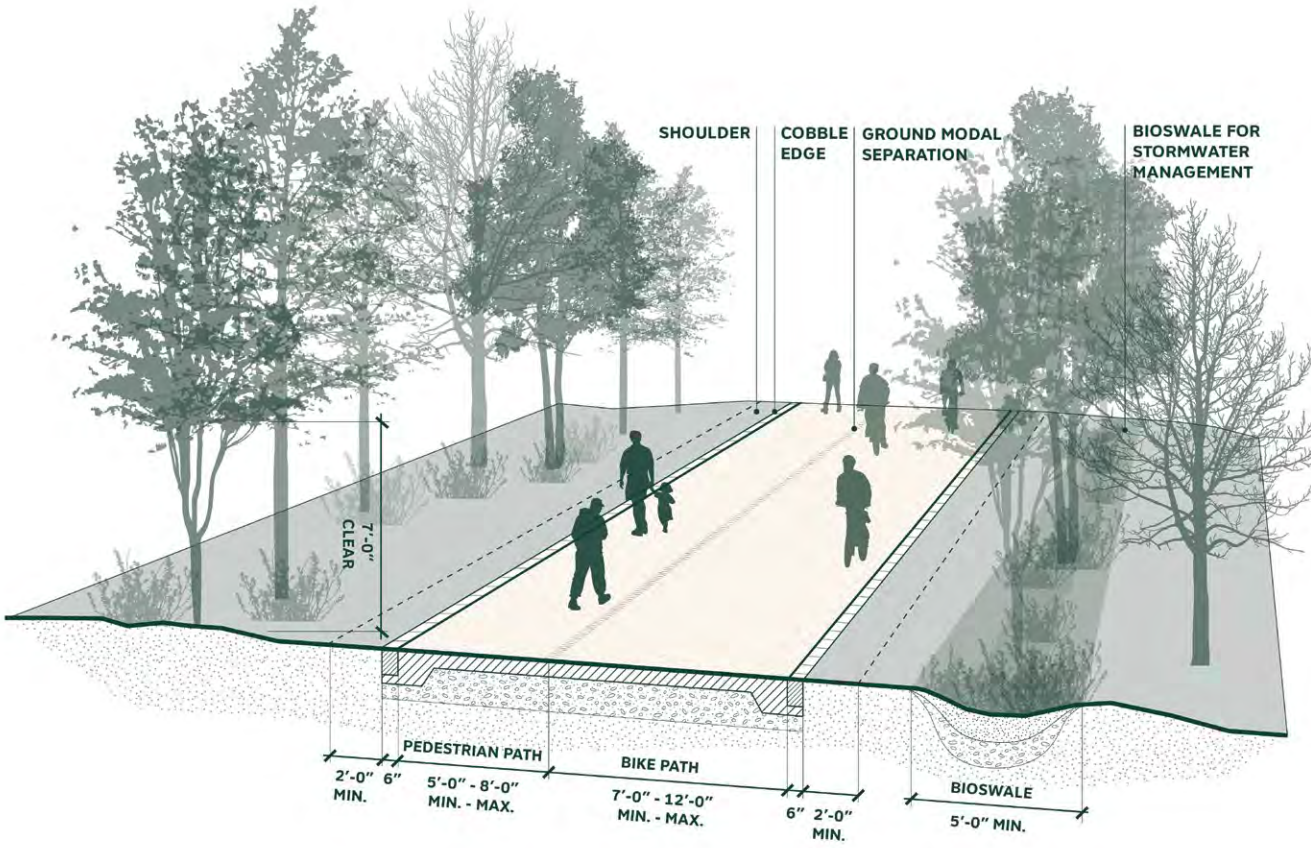
Paint

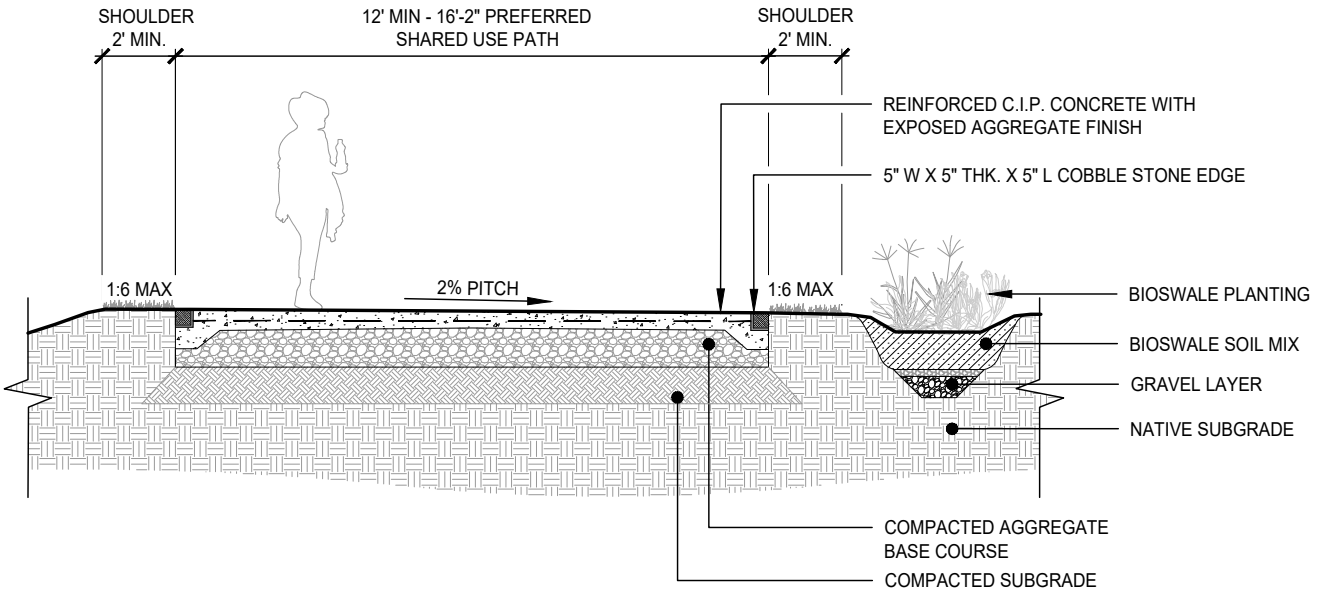
In contexts where grinding the lane separation line is unfeasible or cost prohibitive, white paint may be used to indicate lane separation. Paint will also be used to indicate the type of users and direction for the different users.

OTHER SURFACE MATERIAL CONSIDERATIONS

Pavers

For small segments, Wasau V-Series Permeable Pavers with a similar color and aggregate mix as the poured-in-place concrete may also be used for the surface of the shared-use path. Pavers should only be considered in segments where the porosity of the ground surface or speed reduction for cyclists are primary concerns.



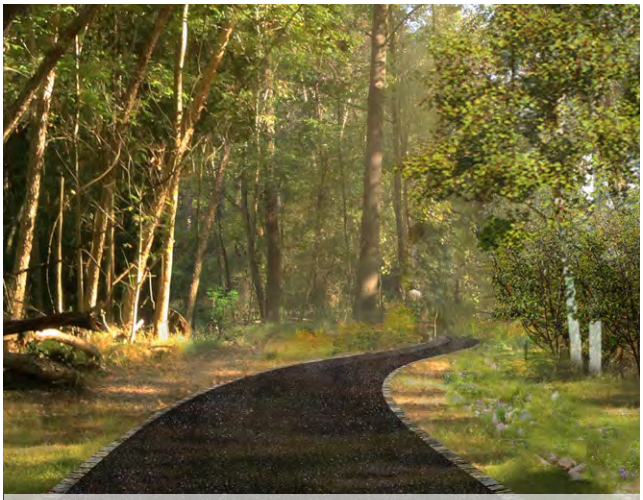


Shared-Use Path Typical Cross Section

Drawing for Illustrative Purposes - Not for Construction

Chattahoochee RiverLands

SHARED-USE PATH (CONTINUED)



Asphalt Shared-Use Path

Asphalt

While asphalt does not match the aesthetic quality of the preferred surface materials, it provides a comfortable surface for cyclists and pedestrians and has a more affordable implementation cost. With proper maintenance, asphalt is free from cracks and bumps, soft on joints for runners and walkers, and adheres to ADA requirements. However, asphalt requires more maintenance than many of the other trail surfaces over time. It is also prone to cracking, particularly in instances where vegetation is abundant.

In instances where asphalt is used, the cobble edge treatment specified within these Guidelines can help create a consistent look and feel with other segments of the RiverLands trail.

Asphalt with Metal Edge

Asphalt with Cobble Edge

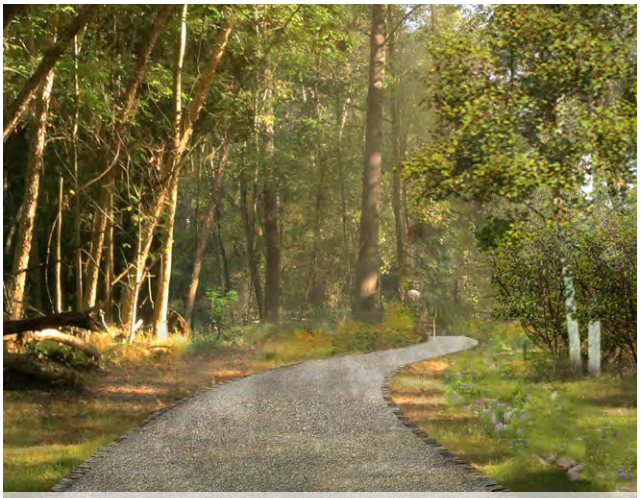
Permeable Rubber Shared-Use Path

Permeable Rubber

As an alternate to concrete, a recycled permeable rubber surface provides stormwater management as well as a comfortable walking and jogging surface. Rubber surfaces are often made from recycled tires and are resistant to staining and erosion. However, they tend to experience wear in high-traffic areas and can break down relatively quickly compared to other material surface alternatives. Like many other porous surfaces, rubber surfaces also require specialized installation and frequent maintenance to ensure that their porosity is maintained over time.

When used along the RiverLands, a sand color similar to the preferred concrete and paver alternatives should be selected. Where feasible, coupling permeable rubber with a cobble or rusted metal edge treatment can help create a consistent aesthetic along all segments of the main stem.

Sand-Colored Permeable Rubber



Gravel Shared-Use Path

ADA-Accessible Gravel

Gravel Sample

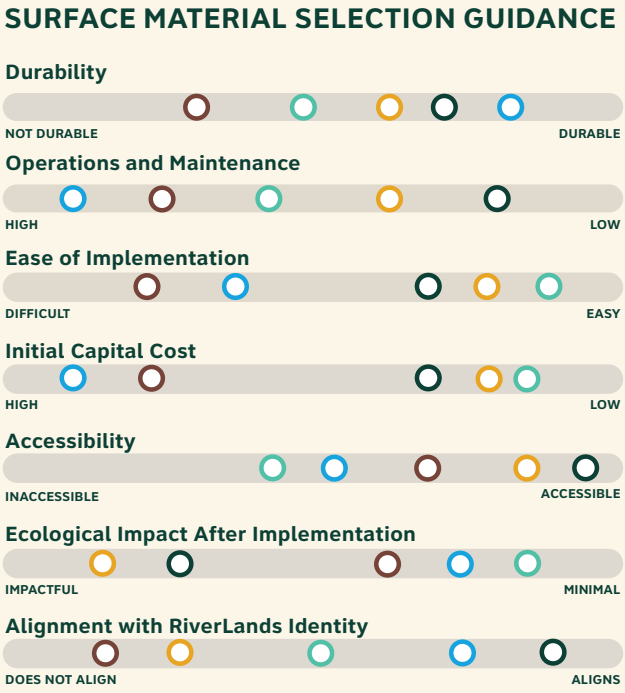
ADA-Accessible Gravel

Where existing guidance and regulations prevent the use of hard surface trail materials, such as within the Chattahoochee River National Recreation Area (CRNRA), ADA-Accessible gravel may be used for the shared-use path. As an alternate material to concrete or pavers, gravel has many advantages: it fits aesthetically into natural surroundings, it minimally disrupts the environment, it is affordable to install, and it has low impact on joints for runners and walking pedestrians. However, gravel is not suitable for many areas within the RiverLands because it can be difficult to maintain and is susceptible to erosion. This can be problematic for multi-use trails as loose gravel can become unstable and pose challenges for both runners and bikers.

If gravel is used for the shared-use path, it is critical that the material qualities including aggregate size and addition of a stabilizer, establish a firm and stable surface in compliance with ADA standards.

For existing shared-use trails that will become part of the main stem, the installation of a cobble or weathered steel metal edge will help both prevent gravel from migrating and creating maintenance challenges and assimilate these segments into the larger RiverLands vision.

SURFACE MATERIAL SELECTION GUIDANCE



Concrete is the preferred surface material for the shared-use path due to its availability and highly customizable look and feel. Of the alternatives, each offers distinct advantages and disadvantages. Gravel is the alternate that most closely aligns with the RiverLands identity because of its aesthetic quality and low ecological impact.

However, gravel is not suitable for large segments as it is poses challenges for multiple uses and can be difficult to maintain in the long-term. Similarly, the specified color, texture, and low ecological impact of permeable rubber aligns well with the RiverLands vision; however, because of its low durability, it should only be used in small segments of the RiverLands.

While asphalt offers the lowest upfront capital cost and is simple to implement, its ecological impact and aesthetic quality do not align closely with the RiverLands vision. Asphalt should only be implemented in segments where absolutely necessary.

SPLIT PATH

Where space allows, the shared-use path should split to avoid obstacles, with at least six-foot paths for pedestrians and at least eight-foot paths for bicyclists. Within the split path condition, there will also be sufficient space to include habitat enhancements and bioswales.

In many instances throughout the RiverLands corridor, the main stem will connect to existing trails or planned tributary trails. A primary design goal at these trail crossings is to make users aware that they are approaching an intersection and allow them to cross from one trail system into another as safely as possible. Trail at trail crossings and other crossing conditions are discussed in more detail starting on page 107.

The following section provides trail surface material recommendations for the split path, as well as green infrastructure guidance most applicable, but not limited, to the split path condition.

Chattahoochee RiverLands

SPLIT PATH (PEDESTRIAN PATH)

Brushed-Finish Concrete Pedestrian Path

Brushed-Finish Texture

Color Recommendation

Bioswale in Split Path

Typical Bioswale Planting

Bioswale After Heavy Rain

The split path condition should be implemented where there is existing space for the trail without disturbing sensitive ecosystems. This condition minimizes user conflict by completely separating pedestrians and cyclists.

DESIGN STRATEGY

Within the split path condition, the travel lane intended for cyclists will be 8’ to 12’ in width and will follow the trail surface material recommendations for the path. The pedestrian travel lane will be 6’ to 10’ wide and will have a distinct trail surface material from the bike lane as discussed below. Both lanes will be cross sloped to drain into a median bioswale.

Trail Materials

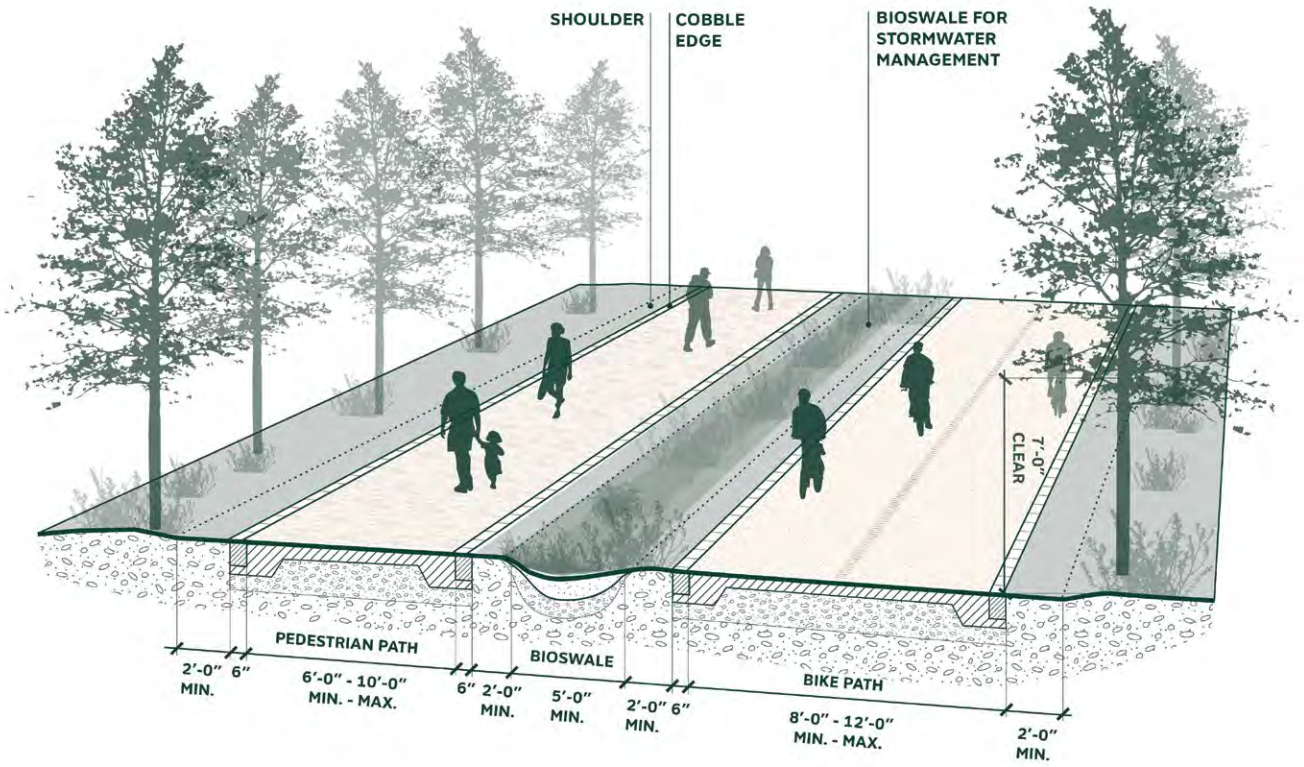
The recommended surface material for the pedestrian lane is poured-in-place concrete matching the color of the exposed aggregate concrete mix specified for the shared-use path. The pedestrian lane will have a brushed finish to provide slip resistance and a textured appearance. Edge treatments for the shared-use path and split path should be the same to provide consistency. Surface material alternates provided for the shared-use path may also be considered for the pedestrian lane but are not recommended.

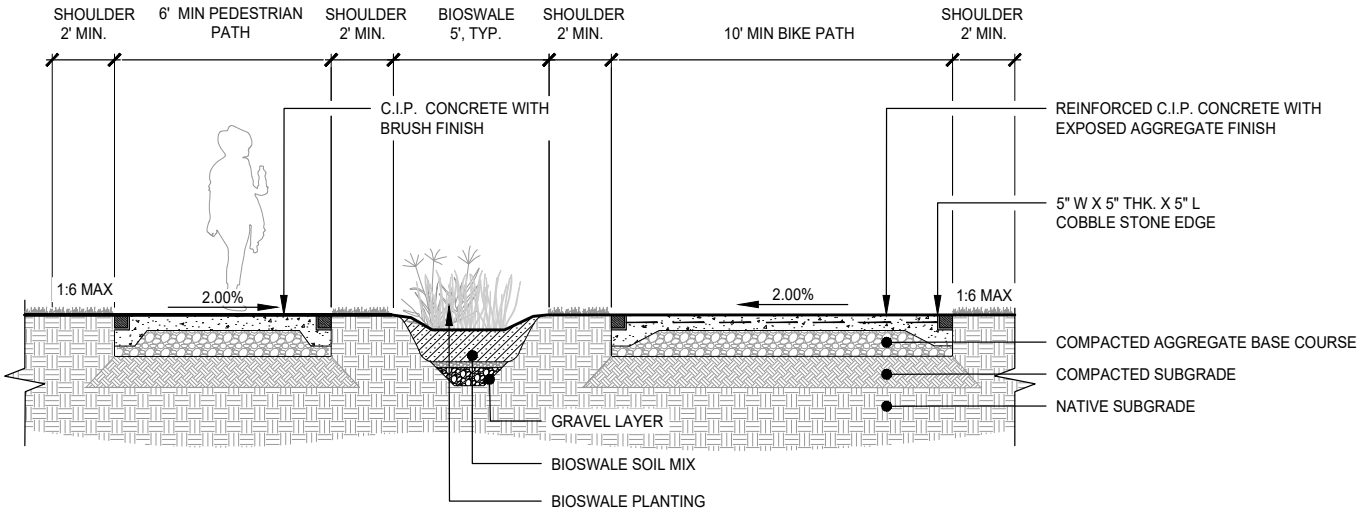
Green Infrastructure

Bioswales planted with native and non-invasive vegetation that can tolerate inundation will be located within the buffers of the shared-use trail on at least one side. In locations where a split path can be accommodated, the median between the pedestrian travel lane and bicycle travel lane will include a 5’ wide bioswale. In urban and industrial areas, urban-adapted non-invasive plant species will be prioritized.

Bioswales will be designed to hold water that will gradually be released back into the landscape. Bioswales are particularly important in flood-prone and erosion-prone areas. By temporarily storing stormwater, bioswales can help prevent flooding and subsidence.

Planting within the bioswales will be native to the region with seasonal pops of color to create special moments along the RiverLands. Perennial plants are recommended to reduce long-term maintenance. In the later phases of the Design Guidelines, the Design Team will make more specific stormwater management and planting recommendations.



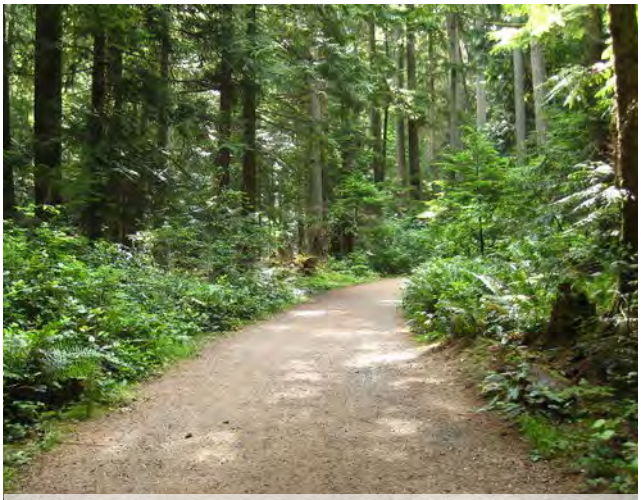


Split Path Typical Cross Section

Drawing for Illustrative Purposes - Not for Construction

Chattahoochee RiverLands

PEDESTRIAN RAMBLES



ADA-Compliant Mulch Pedestrian Trail

Mulch Trail Beside Slope

Wheelchair on ADA Mulch

ADA-Compliant Gravel Pedestrian Trail

Color Sample for ADA-Compliant Gravel

The RiverLands pedestrian rambles are natural surface trails that meander from the main stem to provide a more rustic experience and opportunities for quiet exploration, and to bring people closer to the River's edge or wooded areas.

ADA-Compliant Mulch

Bonded wood carpet and other ADA-compliant mulch products provide a natural-looking trail surface that is accessible to a wider range of users, including those in wheelchairs. Like traditional mulches, ADA-compliant mulches are porous and have a low ecological impact on the landscape. However, because they incorporate a binding agent, ADA-mulch surfaces are more wear-resistant over longer trail segments and require less overall maintenance.

When selecting an ADA-compliant mulch, it is important to select a light tan mulch variation similar to the color of the concrete color sample for the shared-use trail. This will help create continuity between trail segments. ADA-mulch pedestrian rambles do not require an edge treatment.

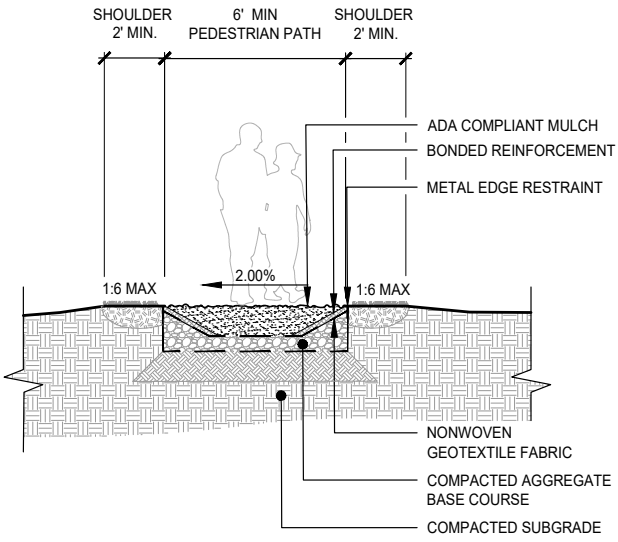
Mulch will be used for pedestrian rambles instead of dirt in areas within the Metropolitan River Protection Act (MRPA) corridor.

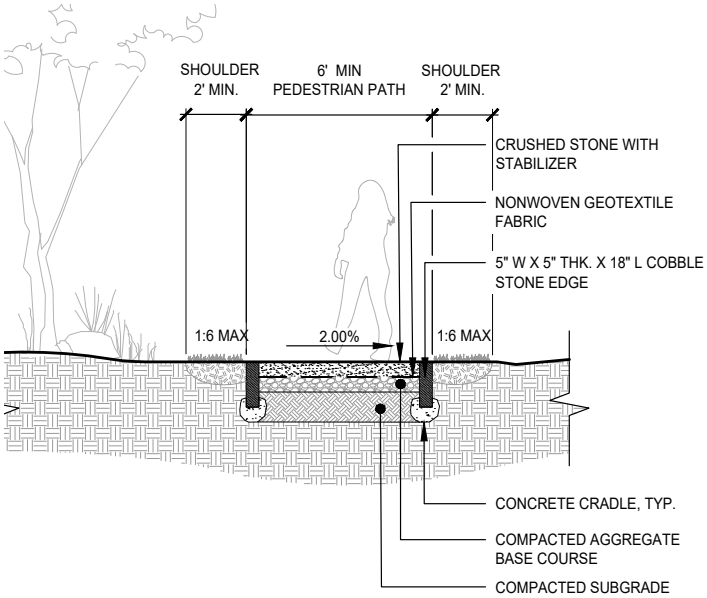
ADA-Compliant Gravel

Similar to the gravel alternate material for the shared-use trail, pedestrian rambles may also use ADA-compliant gravel mixes. Crushed stone mixes, including M10 gravel and Gravel-Lok, must maintain a firm and stable surface to meet accessibility standards. Crushed stone color and tone will match the color of the shared-use trail concrete sample.

Because ADA-compliant gravels are designed to compact over time they may not always be suitable within the MRPA corridor unless impervious surface areas have been allocated for the trail early in the process. They should also be avoided in areas within the floodplain where they may wash away during flood events.

As with the main stem, the installation of a cobblestone or weathered steel edge will help with trail creep and maintenance-related challenges on gravel pedestrian rambles.





Drawings for Illustrative Purposes - Not for Construction

ADA-Compliant Mulch Pedestrian Ramble Technical Section

ADA-Compliant Gravel Pedestrian Ramble Technical Section

SURFACE MATERIAL SELECTION GUIDANCE

Mulch *Gravel*

Durability

NOT DURABLE — DURABLE

Operations and Maintenance

HIGH — LOW

Ease of Implementation

DIFFICULT — EASY

Initial Capital Cost

HIGH — LOW

Accessibility

INACCESSIBLE — *Both* — ACCESSIBLE

Ecological Impact After Implementation

IMPACTFUL — MINIMAL

Alignment with RiverLands Identity

DOES NOT ALIGN — ALIGNS

ADA-compliant mulch and gravel trails have many overlapping advantages and disadvantages. Both materials are durable, accessible, relatively low maintenance, and align aesthetically with the RiverLands identity. The primary distinction between the two materials is their differing ability to be utilized within the floodplain with minimal ecological impact. ADA-compliant gravel is designed to compact over time and will lose some of its porosity in the process. ADA-compliant mulch is more likely to be utilized closer to the river. However, ADA-compliant mulch is also more expensive and less readily available than ADA-compliant gravel products.

Chattahoochee RiverLands

EDGE TREATMENTS

Cobblestone Edge Treatment

Metal Edge Treatment

Raised Cobblestone Edge Treatment

The edge treatment along the main stem will both contain and unify the RiverLands trail. It will provide an identifiable element along the length of the trail that signals to users that they are on the right path.

Cobblestone

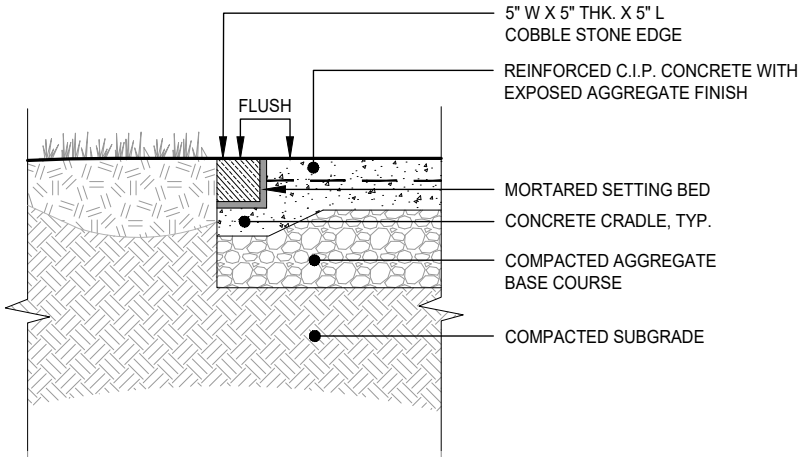
A cobblestone edge is the preferred edge treatment for the RiverLands main stem. Even in segments that are being retrofitted rather than newly constructed, a cobblestone edge that matches colors and textures in the surrounding landscape provides an identifiable way to maintain visual consistency along the Greenway. The cobbles will be set in concrete and will sit flush with the trail as much as possible to allow water to drain over and through them.

Metal Edge

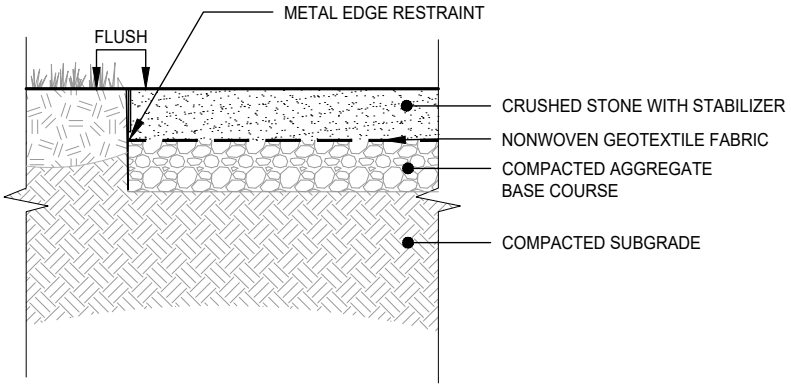
As an alternate to the cobblestone edge treatment, a metal edge may be used. When selecting a metal edge, a rusted metal finish similar in color and texture to weathered steel is the preferred material selection. This metal edging is particularly beneficial when used in conjunction with soft-surface trail materials such as gravel to minimize maintenance and prevent trail creep.

Raised Cobblestone Edge

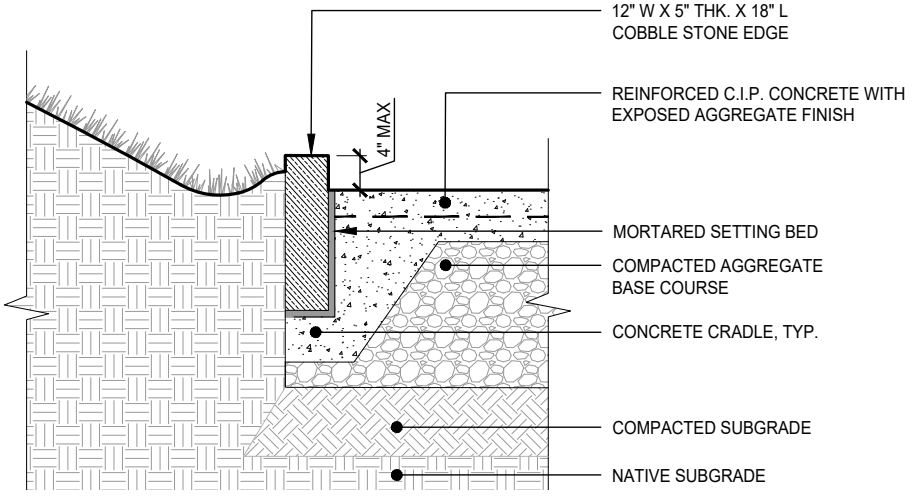
In circumstances where the trail edge must also retain soil uphill from the surface of the trail, a raised cobble edge may be utilized. The raised cobblestone edge should only be implemented where necessary and should be avoided in any areas where it may pose a tripping hazard. This approach is also not recommended for soft surface trails, which are subject to erosion.



Cobblestone Edge Typical Section



Metal Edge Typical Section



Raised Cobble Typical Section

Drawings for Illustrative Purposes - Not for Construction

Chattahoochee RiverLands

NOOK MATERIALS

Inset Rock with Gravel

Open Grid Pavers

Mulch

Nooks are moments along the RiverLands trail which serve as places to stop and rest, take a drink of water, or connect with others. Nooks may take different forms depending on context. The following surface materials are recommended.

Inset Rock and Gravel

The preferred material for nooks along the shared-use trail is gravel with rock insets. The selected rock insets should match the color and tone of the surrounding landscape. They should also be placed as close to flush with the gravel and trail edge treatments as possible to allow for wheelchair access and to prevent tripping. Inset rocks provide consistent and identifiable moments along the RiverLands that allow trail users to distinguish nooks along the entire corridor.

Open Grid Pavers

Open grid pavers are an alternate material than may be used for nooks along the RiverLands. They are primarily intended for areas where erosion is a concern. Open grid pavers provide an identifiable and accessible hard surface to pull off from the trail while allowing surrounding vegetation to grow through. This helps the nooks blend into the landscape. Paver spacing should allow for vegetation to grow but should be small enough to reduce the chance of a tripping hazard. Overgrowth of vegetation through the pavers may pose maintenance challenges, so pavers should only be considered in jurisdictions where there is capacity for additional maintenance.

Mulch

Mulch is more affordable and easily implementable alternate material for nooks along the RiverLands. It is particularly suited for segments of the trail where nooks may fall within the MRPA boundary. ADA-compliant mulch should be selected where possible to provide broader accessibility.

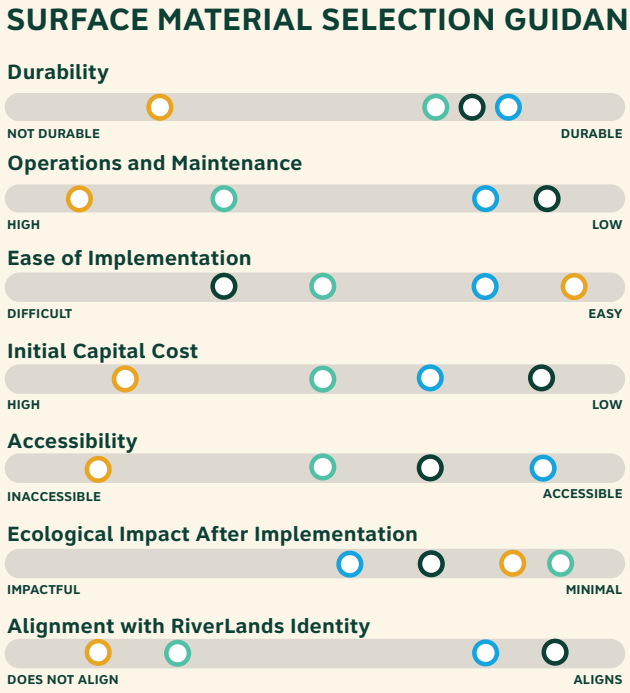
Mulch nooks also present maintenance challenges, particularly in high traffic areas. Where feasible, mulch nooks should have edge restraints or other borders made from natural materials. This will help delineate the edges of the nook and stop material from spreading.

Pavers

Pavers

Pavers may be used as an alternate material for nooks in circumstances in which they are not cost prohibitive. Pavers should match the same color and tone as the pavers indicated for use along the shared-use path. Edge treatments for nooks with pavers should also match the recommendations for the shared-use path. Permeable pavers should be selected where possible to minimize the ecological impact of nooks.

SURFACE MATERIAL SELECTION GUIDANCE



Rock / Gravel *Open Grid Pavers* *Mulch* *Pavers*

Inset rock and gravel nooks are one of the most identifiable features along the RiverLands. Where this treatment is not feasible due to cost or other implementation concerns, it is important to select an alternate material that minimizes ecological impact. While ecologically in alignment with the RiverLands identity, open grid pavers pose too many maintenance challenges to be feasible for large portions of the greenway. Mulch, with the proper edge restraints or borders such as logs, offers a cost-effective and visually non-intrusive alternate to the preferred strategy. Pavers may also be considered in select circumstances, as long as they align with previously identified color, texture, and tone recommendations.

ALONG-ROAD SPLIT PATH

In order to provide continuous access along the entire corridor, the main stem may need to utilize space along an existing roadway. In these areas, pedestrian and cyclist safety is the primary goal and measures should be taken to ensure adequate protection from motorized vehicles. Where possible, the on-road condition should also include bioswales for stormwater management and street trees for shade.

The following section provides recommendations for retrofitting roads to accommodate the RiverLands main stem greenway. Recommendations for walls and fences that can help ensure additional user comfort and safety can be found on page 62.

Chattahoochee RiverLands

ON-ROAD RETROFIT

One-Way Protected Bike Lane

Two-Way Protected Bike Lane

Raised Bike Lane

In order to connect the full 125-mile corridor, the RiverLands trail will, in some instances, transition into an on-road bike lane next to an existing sidewalk.

ON-ROAD STRATEGIES

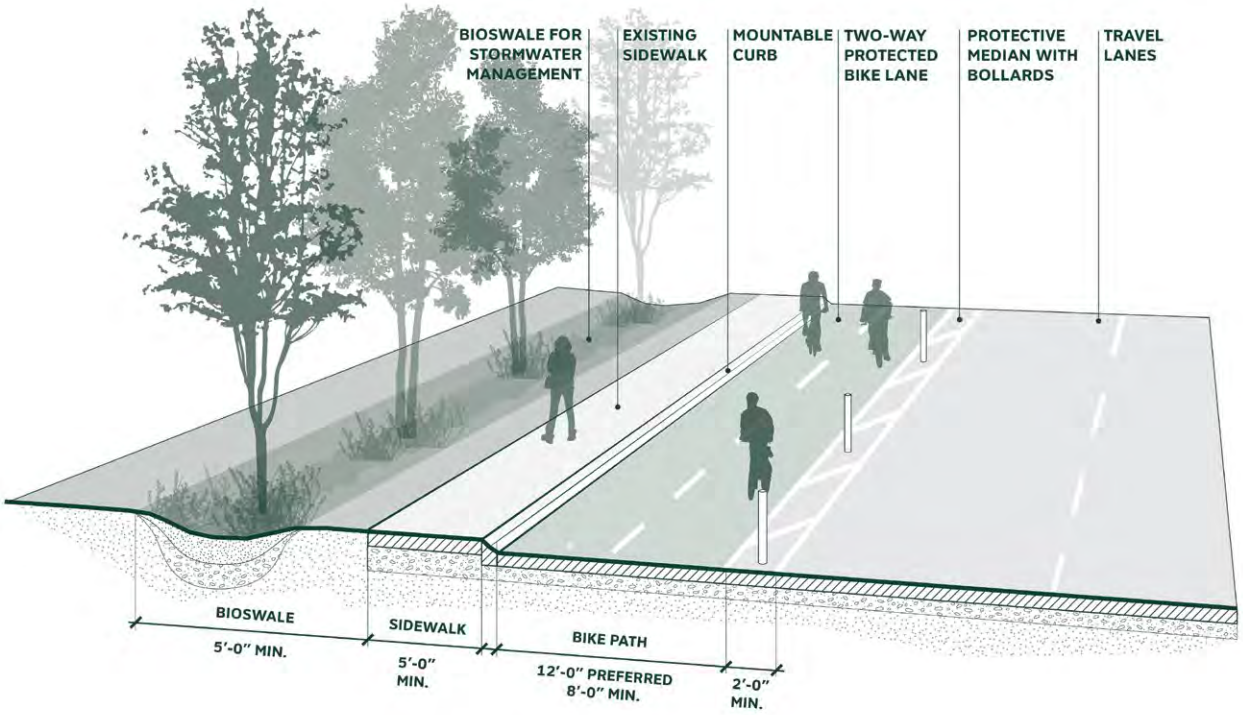
The following strategies represent the preferred conditions for retrofitting existing roads to accommodate the RiverLands main stem. Drawing from the NACTO Urban Bikeway Design Guidelines, the RiverLands trail will transition into an on-road condition as a bike facility that combines the user experience of a separated path, but utilizes the infrastructure of a conventional on-street bike lane. A two-way bike lane is preferred where space allows.

One-Way Protected Bike Lane
At a minimum, the RiverLands on-road condition will be a one-way protected bike lane next to an existing sidewalk. Dedicating and protecting space for cyclists with trail markings and bollards improves the perceived sense of comfort and safety for cyclists. It also provides a visual cue for motorized vehicles and works to prevent user conflicts.

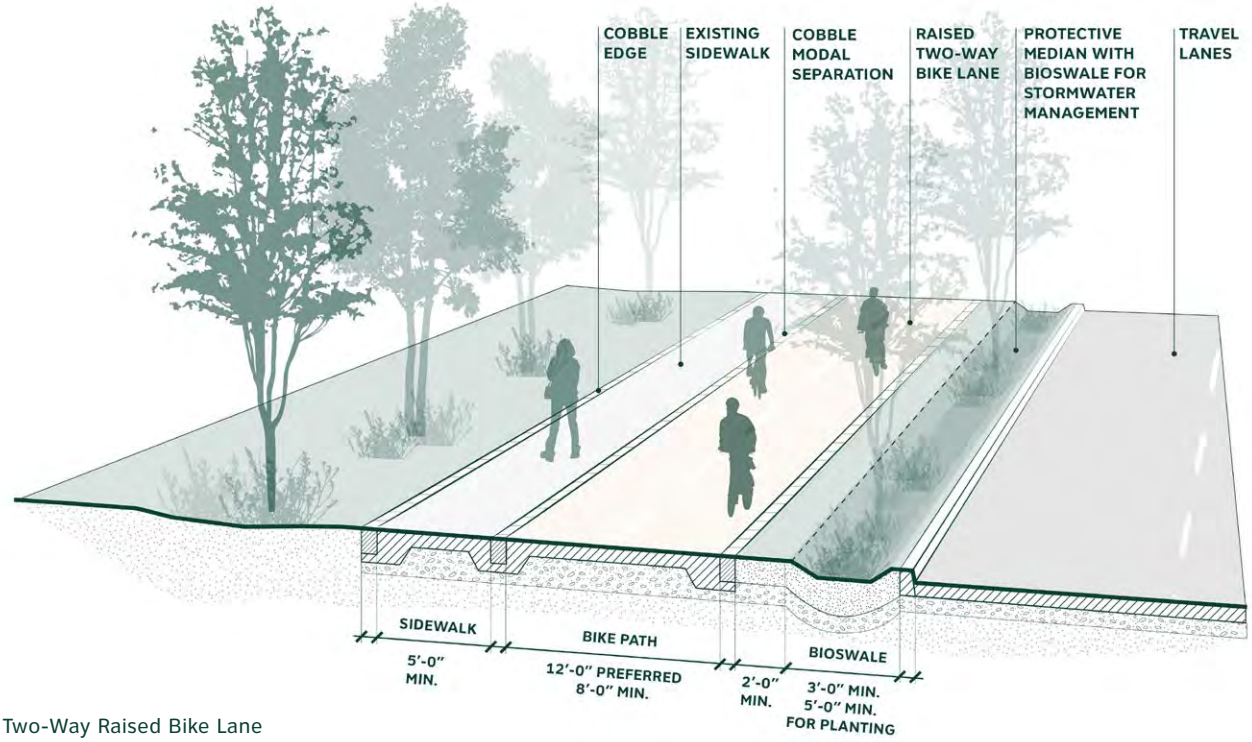
Two-Way Protected Bike Lane
Where space allows and the level of service is anticipated to be high, a protected bike lane that can accommodate travel in two directions is preferred. Two-way bike lanes can not only accommodate more cyclists, but also help eliminate the fear of collision with both motorized vehicles and other cyclists.

Raised Bike Lane
To further ensure separation between motorized and non-motorized users, vertically separating the RiverLands bike lane and sidewalk from the road is recommended where space allows. This raised zone can be used for additional furnishing and flush curbs that allow cyclists to pass each other.

In each of these strategies the on-road bike lane should be painted a shade of green within the RiverLands color palette.



Two-Way Protected Bike Lane

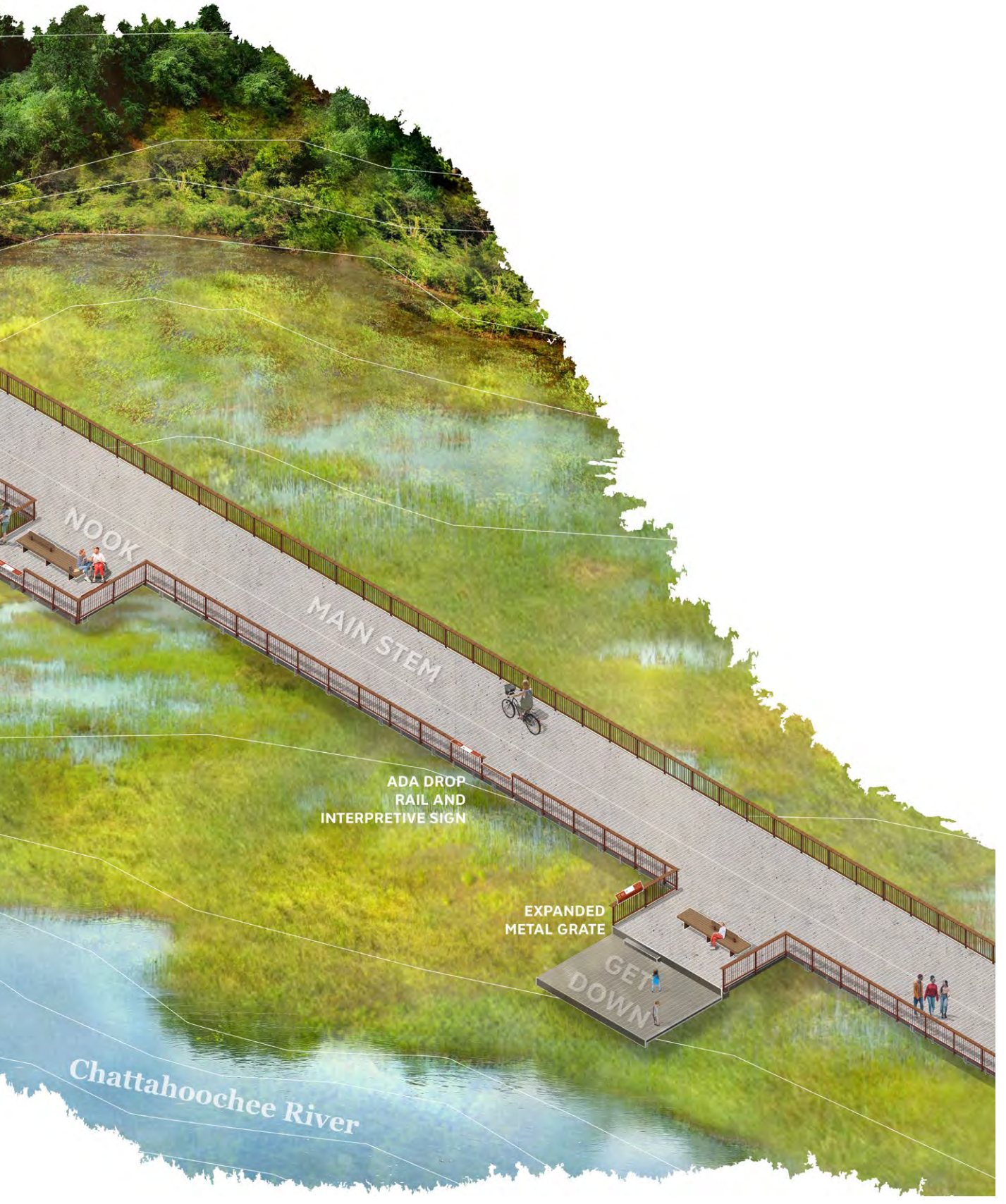


Two-Way Raised Bike Lane

BOARDWALK

In sensitive ecological areas, particularly those with wetlands, the main stem greenway should become a boardwalk to limit impacts, and to provide opportunities to see and hear the species that reside there. These raised boardwalks, which will include railings, benches and wayfinding elements should be designed to withstand occasional flooding.

The following section provides structural recommendations, surface material recommendations, and railing design guidance for boardwalks within the RiverLands. Special consideration has been given to resilient, durable materials with a low environmental impact which can withstand the stress of wet environments and sustain periodic flooding.



Chattahoochee RiverLands

BOARDWALK

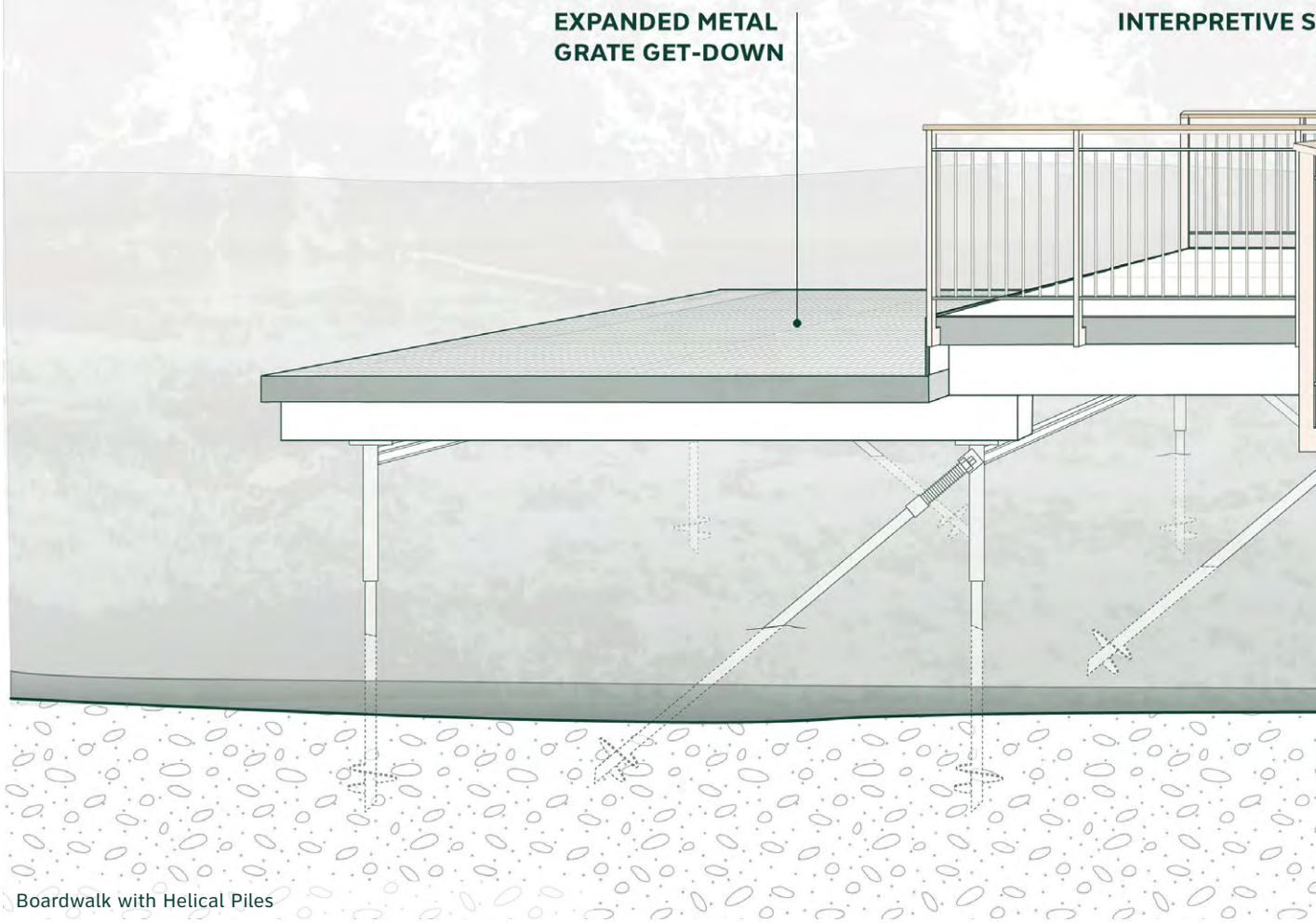
Along the RiverLands, boardwalks will facilitate movement over wetlands and in areas where reoccurring ponding water is likely. This also includes constructed wetlands or areas with stormwater management improvements.

STRUCTURAL RECOMMENDATION

Boardwalks within the RiverLands should be constructed on helical piles, which can be installed with portable installation equipment and lighter machinery, to access sensitive areas that require minimal disturbance. This includes areas with sensitive or soft soils and difficult terrain. Given the clay geology of the region and the presence of sensitive aquatic ecosystems, a boardwalk construction technique that minimizes disturbance to the natural environment is critical.

Once installed, the helical piling system also provides increased resistance for boardwalks that are exposed to both seasonal and storm-related flooding. The pilings themselves are resistant to corrosion and have a high lift-up capacity to elevate the boardwalk path above current flood levels. They can also be adapted over time to respond to future flood levels.

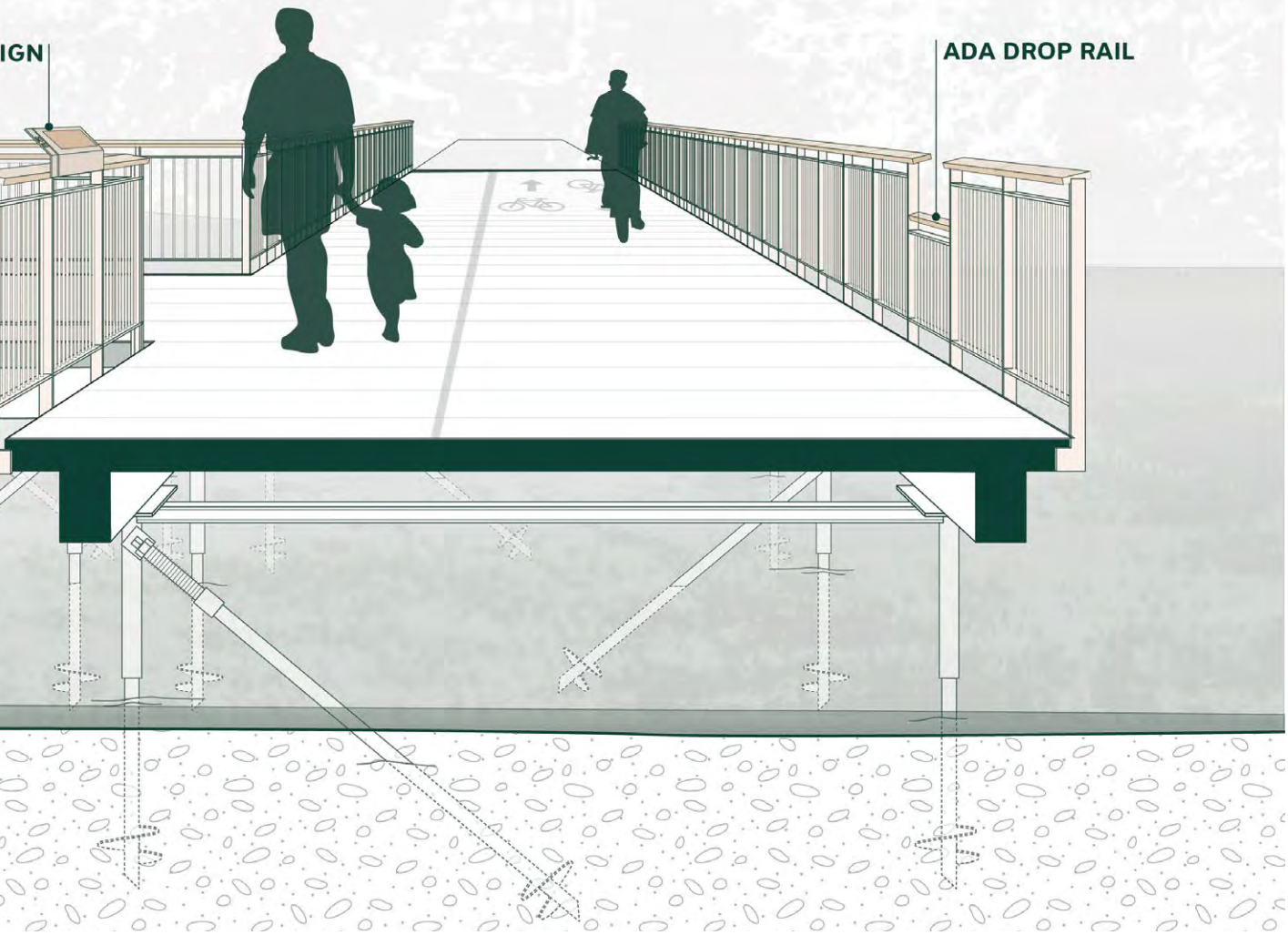
Site furnishings on this boardwalk system should be selected with weight in mind. Recommended site furnishings and signs that contain stone elements, found in later sections of this document and intended for grounded trails, may overload the bearing capacity



Boardwalk with Helical Piles

of the boardwalk and cause warping. Instead, seats and signs composed of lighter materials such as wood and metals should be used on boardwalks.

The helical pile boardwalk system is currently being used in other segments of the Chattahoochee RiverLands, including the Roswell Riverwalk Boardwalk. The uniform aesthetic connection to these precedent projects will help ensure consistency over the length of the RiverLands.

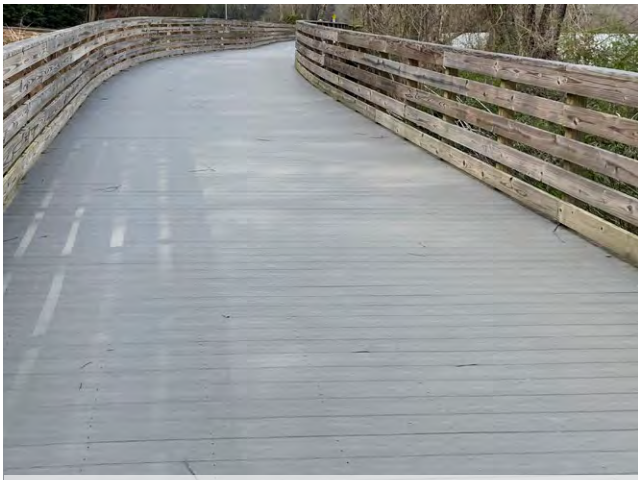


BOARDWALK SURFACE MATERIALS

Concrete Boardwalk Planks

Pre-Cast Concrete Planks

Concrete planks are the recommended surface material for boardwalks throughout the RiverLands. While they have a higher implementation cost compared to other boardwalk surface materials, their long-term durability and low maintenance costs would largely off-set the initial cost. Concrete planks also have the highest-rated slip resistance. When selecting a color, concrete planks will match the hue of the RiverLands main stem greenway with tan undertones.



Trex Decking

Recycled Composite Decking Material

For boardwalks where concrete planks are cost prohibitive, recycled composite decking materials, such as Trex, are good alternates with low environmental impact. Composite decking is also extremely durable and long-lasting. It is unlikely to warp, rot, or stain over time. However, unlike concrete planks, recycled composite decking can become slippery over time. When selecting Trex decking or other composite material alternatives for a boardwalk within the RiverLands, the material should match the RiverLands main stem greenway to the extent possible or remain consistent with other existing composite material segments, such as the Roswell Riverwalk Boardwalk.

Wood

Wood

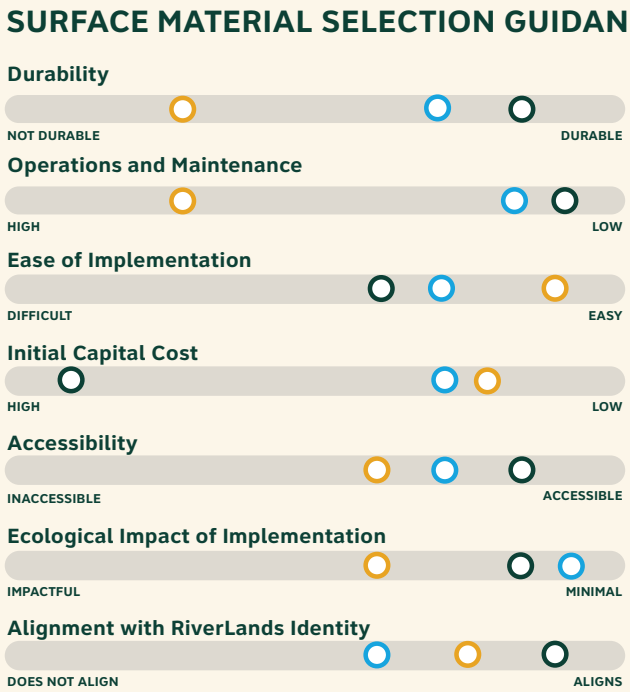
Wood planks are the most cost-effective boardwalk surface material. In areas where cost constraints, or low availability precludes the use of concrete planks or recycled composite decking, wood is a suitable alternative. However, wood should be used sparingly in areas prone to inundation and seasonal flooding as it prone to swelling, rotting, and warping. These changes can lead to ADA compliance issues and maintenance challenges in the long-term. Like recycled composite decking, it can also become slippery over time.

Expanded Metal Get-Down

Expanded Metal Grate

Expanded metal grating is the preferred material for get-downs in wetland areas throughout the RiverLands. Expanded metal grates are light, readily available, and have minimal ecological impact in sensitive areas. Their permeability allows water to easily pass through during flood events and they can be easily replaced if they begin to deteriorate. Ultimately, expanded metal grating allows people to get close t o the water and to see and experience aquatic ecosystems near and within the Chattahoochee River without causing harm to wildlife. When selecting a color for the metal grating, weathered steel that matches the metal finish of other RiverLands metal design elements is preferred.

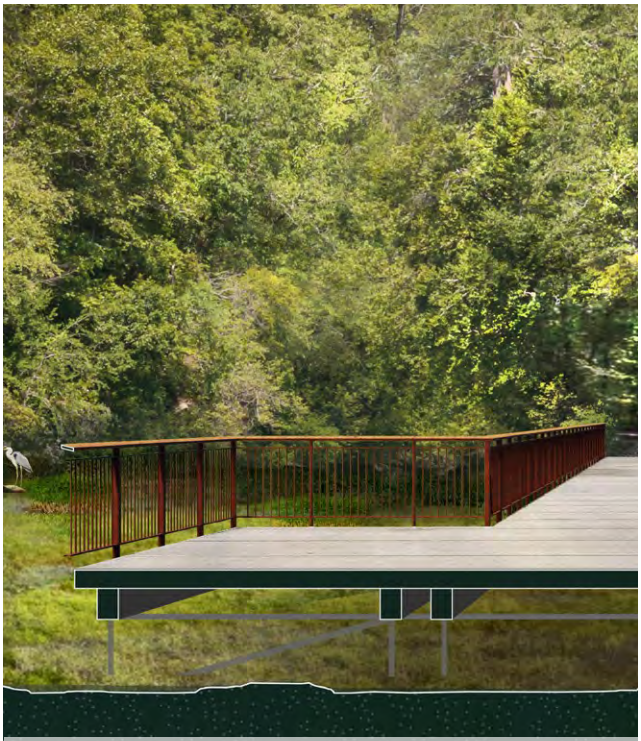
SURFACE MATERIAL SELECTION GUIDANCE



Concrete Planks *Recycled Composite* *Wood*

Considering durability, maintenance, ecological impact and alignment with RiverLands identity, concrete planks are the preferred material for boardwalk surfaces. Where concrete planks are cost prohibitive, Trex or other composite material surfaces are the preferred alternative over wood. Wood may be used as an alternative in circumstances where maintaining a natural aesthetic and experience is the priority. Additionally, wood may be used in places where concrete and recycled composite planks are both cost prohibitive or where there is adequate operations and maintenance capacity to replace wooden planks as they wear.

RAILINGS

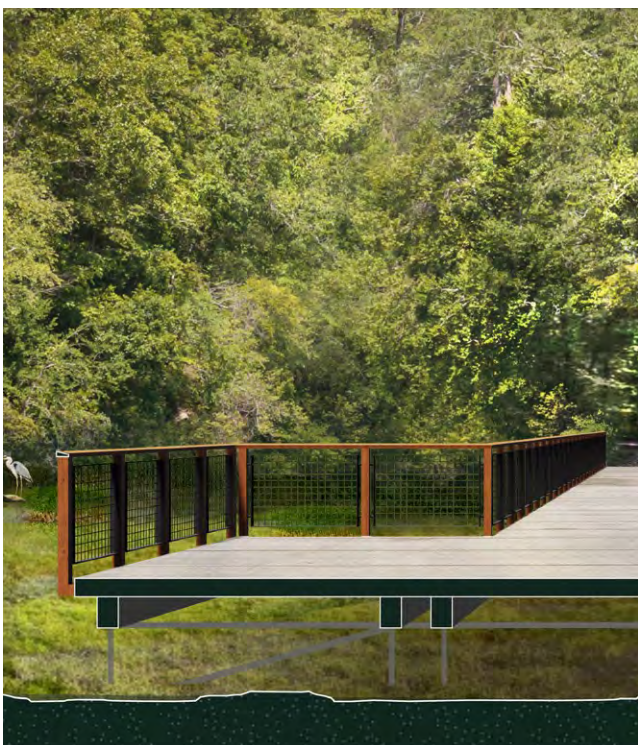


Metal with Wood Top Rail

Railings along elevated pathways and boardwalks provide an opportunity to express the elemental, yet refined, material identity that defines the RiverLands trail.

Metal with Wood Top Rail

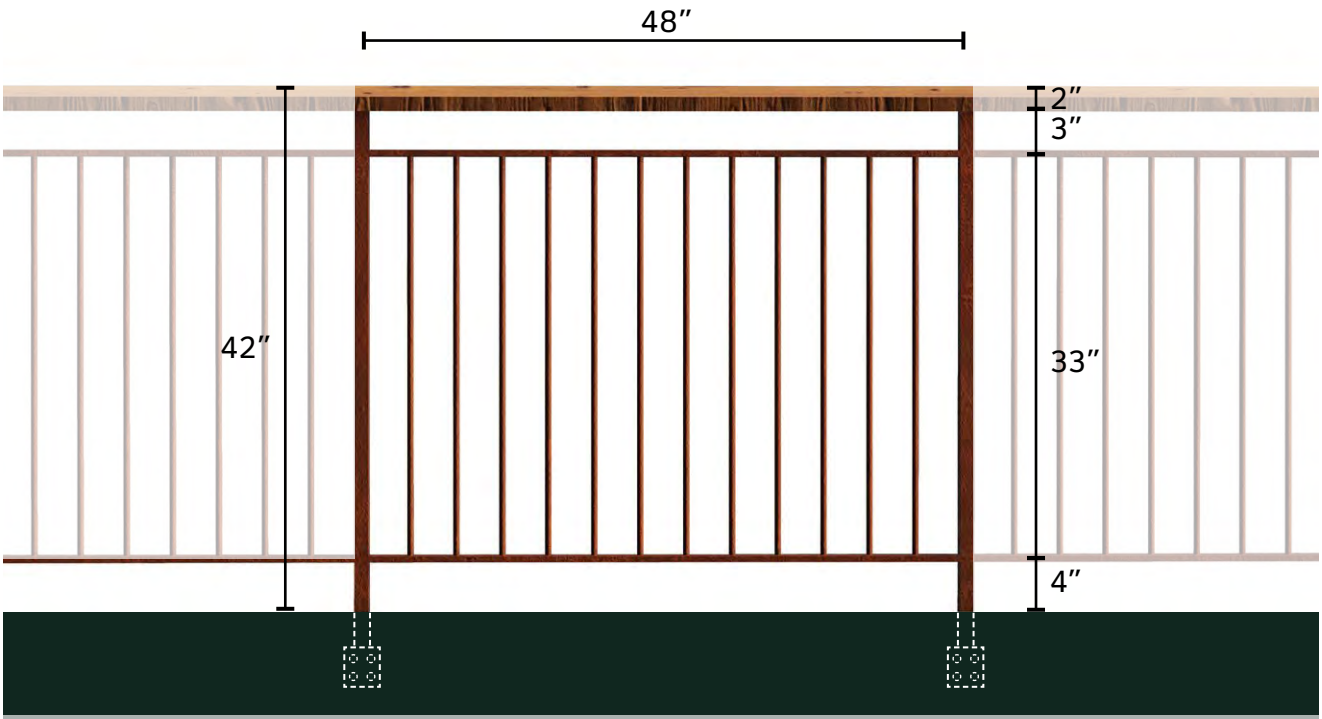
The preferred railings along elevated portions of the RiverLands are custom metal designed to have a weathered steel base, vertical metal slats, and a canted wood top rail. While the base of the railings will be metal, the wooden top rail will prevent the railings from becoming hot to the touch during the summer. The canting of the top rail will allow water to shed after rain and keep the wood from holding water, which can lead to rotting. Vertical metal slats will prevent people from climbing the railing and are less susceptible to snapping or deteriorating than metal cables. Enough space should be provided between the ground surface and the bottom of the rail for litter and debris to easily filter through during flood events.



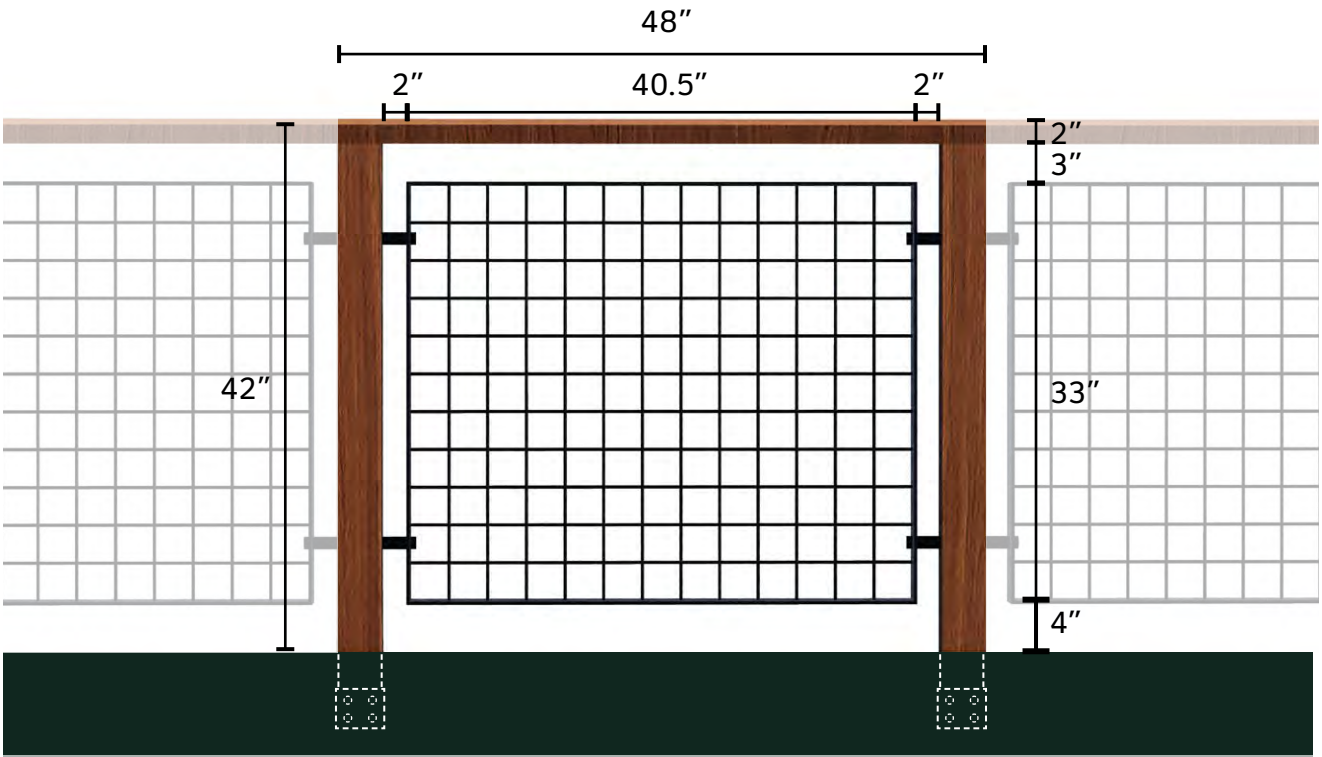
Wood with Metal Mesh

Wood with Metal Mesh

In circumstances where the metal custom metal railing is cost prohibitive or a more natural material palette is desired, a wooden railing with a canted top rail and metal mesh panels is recommended. The metal mesh panels are visually non-intrusive and prevent climbing and play a minimal role in the overall design of the railing than the wood posts. Again, enough space should be provided between the ground surface and the bottom of the metal mesh to allow for litter and debris to easily pass through in flooded conditions.



Metal with Wood Top Rail Elevation

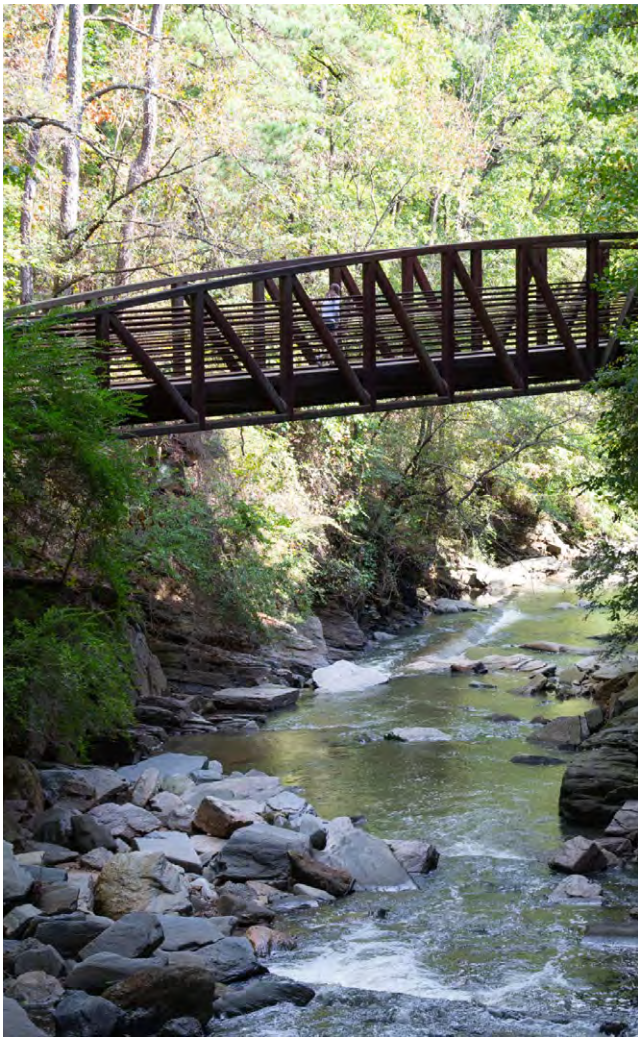


Wood with Metal Mesh Elevation

SITE FURNISHINGS

MATERIALITY

Material choices define and enhance the character of the RiverLands and should align with broader project goals of sustainability, durability, and creating a cohesive visual identity. Throughout the RiverLands, four materials are used to maintain aesthetic consistency and ensure longevity. Wood and stone elements are inspired by the riparian forests and rocky shoals of the Chattahoochee River, while concrete and metal – primarily weathered steel – reflect the character within the more industrial and urban segments of the RiverLands corridor. When combined in seating, fence, wall, and wayfinding elements, they establish a clear and cohesive visual identity that signals to visitors that they are on the RiverLands. In order to ensure that these guidelines will be widely implementable, recommended site furnishings of varying costs are provided, including custom, opportunistic and off-the-shelf options.



Chattahoochee RiverLands

RIVERLANDS CONNECTION TO EXISTING TRAIL SEGMENTS

The RiverLands preferred alignment will connect 26 existing parks, including some of the park units that comprise the Chattahoochee River National Recreation Area (CRNRA). Trails and path systems within these parks have been designed to meet existing codes, regulations, and guidelines that pre-date the RiverLands. However, site furnishings, such as benches, walls, and fences, as well as signs and wayfinding can help unite new segments of the RiverLands trail with these existing trails. While the surface material of the trail may change between trail segments, furnishing elements have been designed to maintain continuity along the corridor. Even if two adjacent trail segments select different site furnishings from the palette of options shown in this section, when combined with consistent signs, the RiverLands main stem should still appear contiguous. Opportunities for implementing these unifying furniture elements are explored on the following pages.

Chattahoochee RiverLands

CUSTOM SEATING

Boulder Bench

Boulder Bench with Wood Top

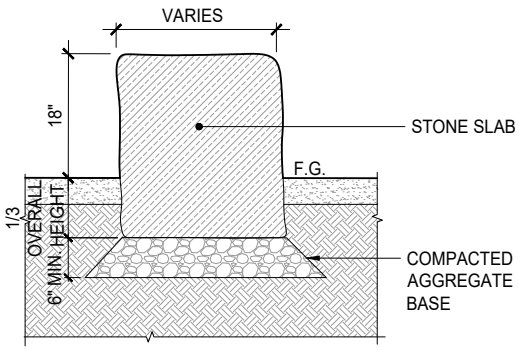
Concrete Bench with Wood Top

Custom seating options can define and enhance the character of the RiverLands while ensuring user comfort along the trail. Seating provides users moments to rest, socialize, and immerse themselves in the natural environment. The options shown can be further customized to respond to site or programmatic opportunities and are accomodating to people of all albilities.

Boulder
Boulder seats are appropriate in more naturalized portions of the RiverLands where rock formations or shoals are prevalent in the surrounding landscape. They can easily blend with their context to create an immersive experience in nature while still providing an opportunity for rest. Boulders sourced from local quarries should match the color of any existing stone on site if possible. Boulders will be particularly suitable in areas subject to flooding as they are one of the most resilient seating options.

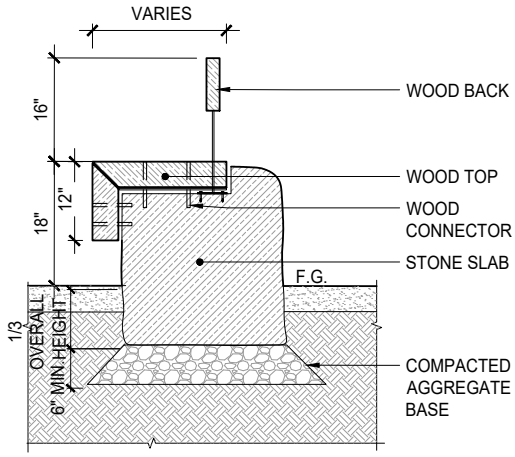
Boulder with Wood Top
This option provides a slightly more comfortable seating surface and polished look. This could work particularly well in transitional zones between more urbanized and natural areas or where a more natural look is desired. The same considerations for locally sourced stone discussed in the boulder seating section applies. Wood should be chosen with consideration for rot, durability, and sustainability.

Concrete with Wood Top
A bench with a concrete base would work well in the more urban or industrial stretches of the RiverLands and may function as a more economical variation of the boulder seating if necessary. Concrete should be mixed with considerations for embodied carbon and use fly ash and recycled aggregates when possible. Concrete will be pigmented with warm tones similar to the recommended trail material. Wood will be chosen with consideration for rot, durability, and sustainability. This option is designed to be modular to maximize flexibility and respond to site and programmatic needs. Benches can be backed or unbacked, be combined to form seating islands if unbacked, or seating that faces two ways with or without a back. They can be arranged in longer, linear arrays or in L-shaped formations to create conversation hubs. Arm rests can be added or removed as necessary to enable modular arrangements and enhance user comfort.

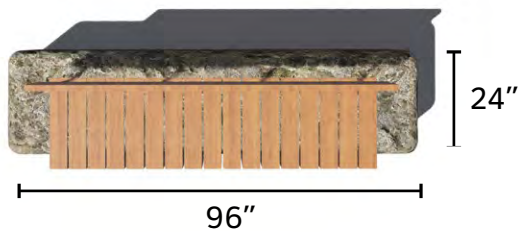


Boulder Bench Typical Section

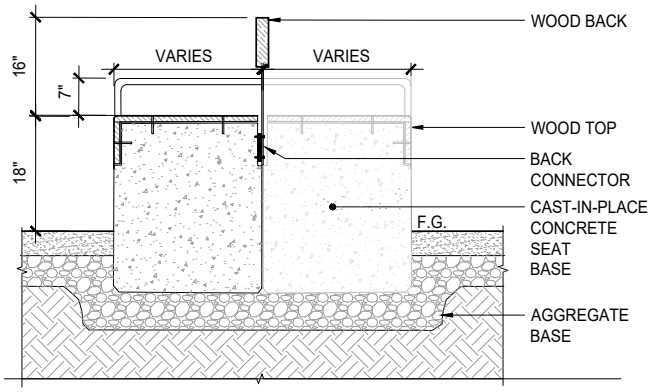
Boulder Bench Typical Plan



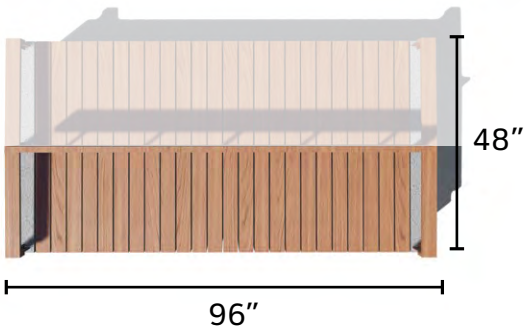
Boulder Bench with Wood Top Typical Section



Boulder Bench with Wood Top Typical Plan



Concrete Bench with Wood Top Typical Section



Concrete Bench with Wood Top Typical Plan

OPPORTUNISTIC SEATING

Saw-Cut Log Bench

Saw-Cut Log with Back Bench

Log Stool

When possible, working with materials found on site can provide a context specific, sustainable, and possibly, lower-cost option for seating. Trees cleared for the trail or removed as invasive species would be suitable candidates for opportunistic seating outside of the floodplain. Trees should not be removed for the sole purpose of creating seating.

Saw-Cut Log

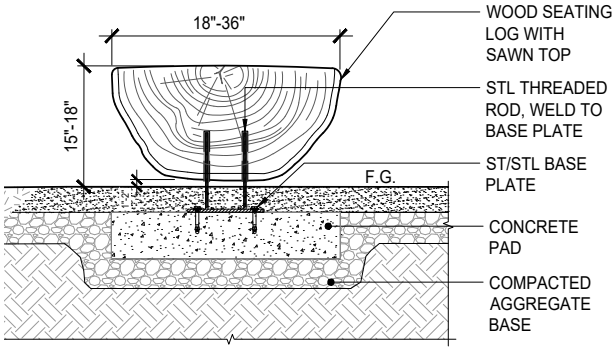
This simple bench requires a log 18”- 36” in diameter and should be cut with a flat planar surface for seating for a 15”-18” high bench. A steel beam fastens the log to a below-grade concrete pad, maximizing its resilience against disturbances such as floods. The wood can be treated to increase resistance to rot.

Saw-Cut Log with Back

Similar to the saw-cut bench, this option introduces a back for user comfort. This option requires larger diameter trees than the backless variation. Special consideration should be paid to the angle of the cut to mitigate ponding of water on the bench. Like the backless version, it is fastened to a below-grade concrete pad with a steel beam.

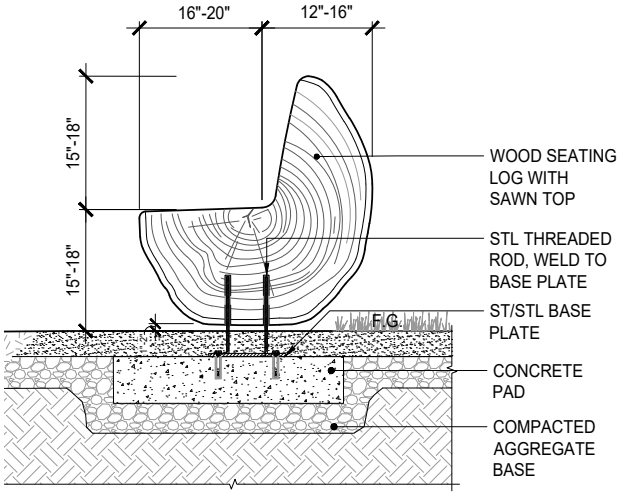
Log Stool

Stools can be created to provide more social or playful seating arrangements. These are well-suited to outdoor classrooms and can be used in conjunction with other types of seating. The varying height means they can be made from trees that do not have the clear length and consistent diameter required for log benches. They are also adaptable and accomodating to people of varying heights. Log stools can be treated to increase their resistance to rot.

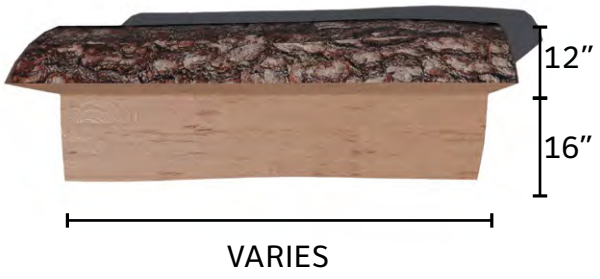


Saw-Cut Log Bench Typical Section

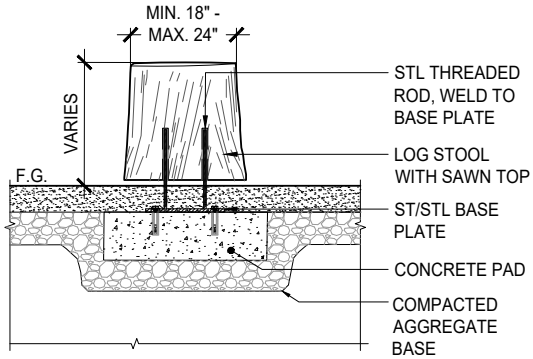
Saw-Cut Log Bench Typical Plan



Saw-Cut Log with Back Bench Typical Section



Saw-Cut Log with Back Bench Typical Plan



Log Stool Typical Section

Log Stool Typical Plan

Drawings for Illustrative Purposes - Not for Construction

Chattahoochee RiverLands

OFF-THE-SHELF SEATING

Solid Wood Bench with Back

Bench with Metal and Large Wood Planks

Bench with Metal and Wood Slats

These options provide more economical and easily replaceable seating for the RiverLands. They are appropriate for more urban settings or applications where more lightweight seating elements are needed, such as on boardwalks.

Solid Wood with Back

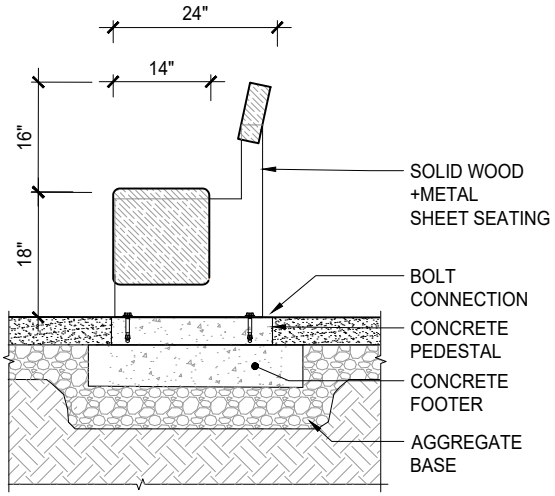
The Colossus Giant Timber Bench from Columbia Cascade is the preferred off-the-shelf seating option of the RiverLands. It can vary in length to respond to site needs. The color of its powder coated elements should approximate the color of weathered steel as much as possible. To maximize durability and resilience to flooding, it should be bolted to a concrete pad and pedestal with an aggregate base.

Metal and Large Wood Planks

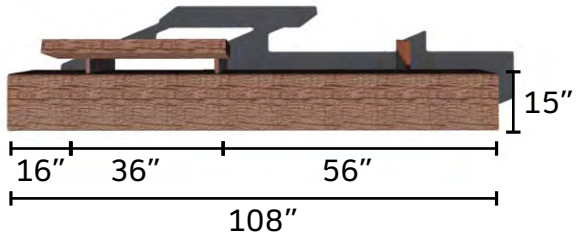
The Solid 12 Bench by Streetlife is a two-way bench option for high-traffic areas and larger spaces. Steel elements will be corten, with FSC-Certified wood. The Quattro Back can be added for extra comfort and support. The backrest should not be rounded. Several benches can be linked for larger, linear areas that may require more seating. This bench is well-suitable for trail gateways, expanded crossings, or larger nooks. It's bidirectionality could work well in boardwalk nooks to face both the path and the view

Metal and Wood Slats

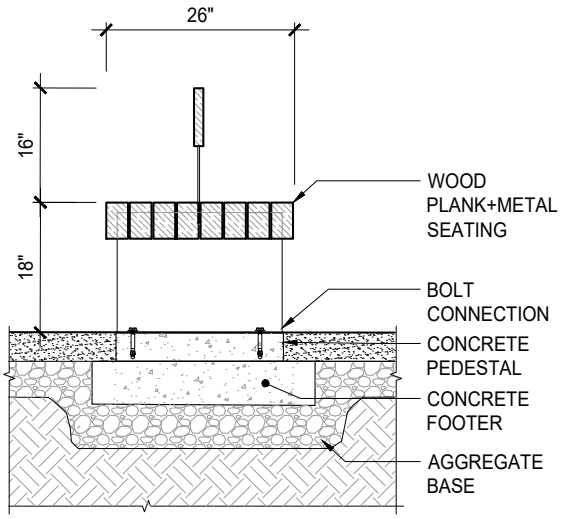
The Generation 50 Bench by Landscape Forms is a subtler and more economical option. It would be better suited for more urban or industrial areas along the trail. The aluminum supports and armrests will be powder coated to approximate the color of weathered steel. Nutmeg is the recommended finish to achieve this look. The wood elements will be domestically sourced thermally modified Ash. Standard armrest will be used, not looped, and center arms are discouraged. Benches should be bolted to concrete foundations for resilience and durability.



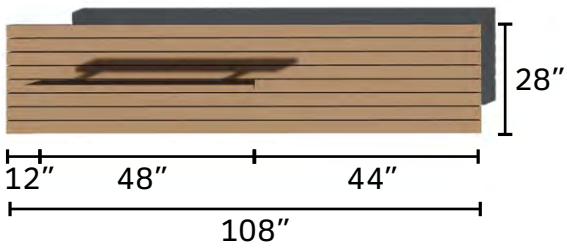
Solid Wood Bench with Back Typical Section



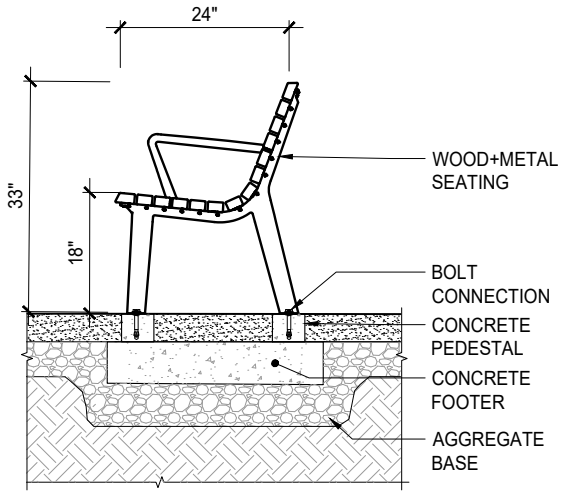
Solid Wood Bench with Back Typical Plan



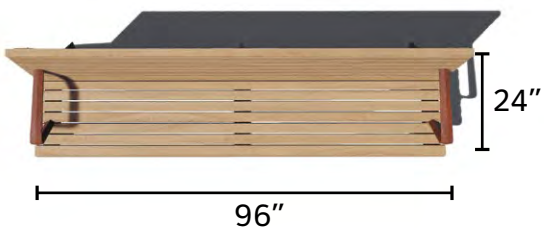
Bench with Metal and Large Wood Planks Typical Section



Bench with Metal and Large Wood Planks Typical Plan



Bench with Metal and Wood Slats Typical Section

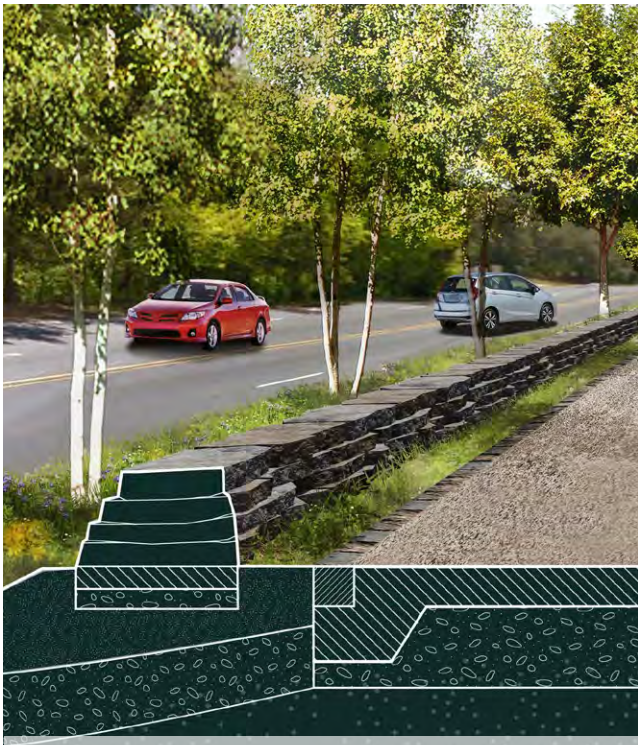


Bench with Metal and Wood Slats Typical Plan

Drawings for Illustrative Purposes - Not for Construction

Chattahoochee RiverLands

WALLS



Protective Stacked Stone Wall

Walls may be deployed in specific locations throughout the RiverLands. Protective walls will safeguard non-motorized vehicles in on-road segments on the trail. Retaining walls will hold back soil where necessary to prevent erosion.

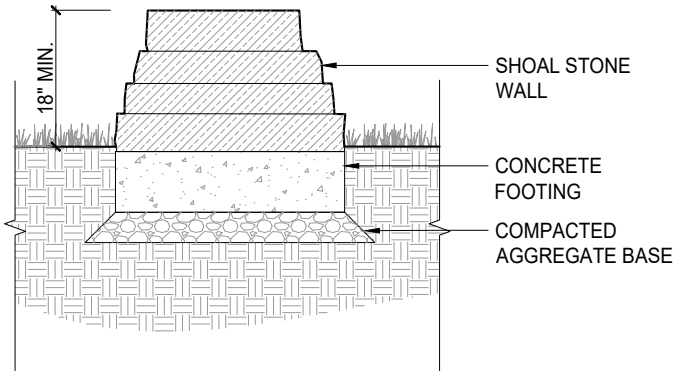
Stacked Stone

Where feasible, stacked stone walls are preferred. They are primarily suitable for protective walls and, depending on the load of soil, can also be suitable for some retaining walls. Stone walls along the RiverLands should be constructed with stacked slabs of thin stone that are similar in color and tone to the shoals along the Chattahoochee River.

Concrete Retaining Wall with Textured Formwork

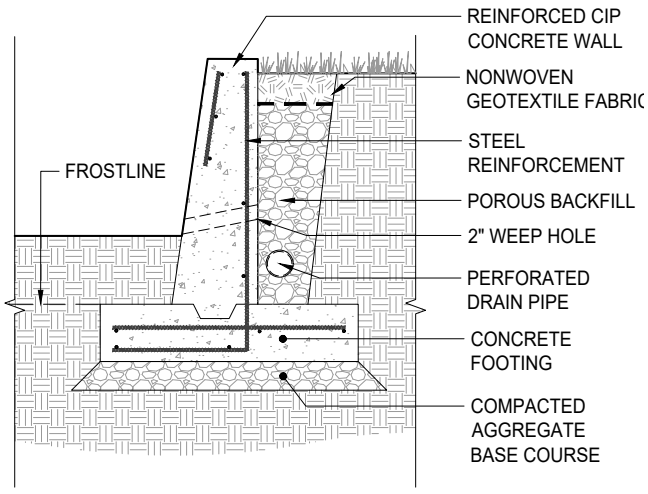
Concrete

In locations where retaining walls are necessary to prevent erosion, concrete walks with subtle formwork are preferred. The formwork on these concrete walls will be inspired by natural textures within the RiverLands landscape, while not drawing any additional attention to the wall.

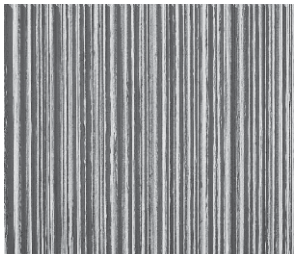


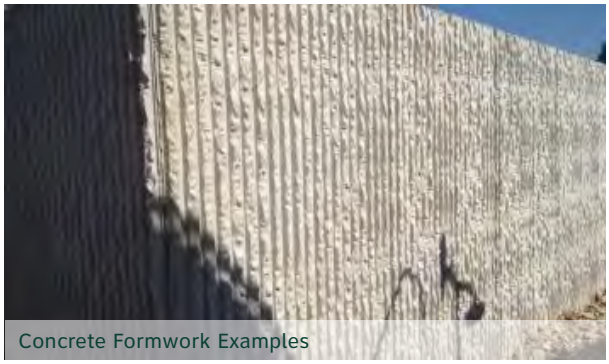
Stacked Stone Wall Typical Section

Stacked Stone Wall Elevation



Concrete Retaining Wall Typical Section





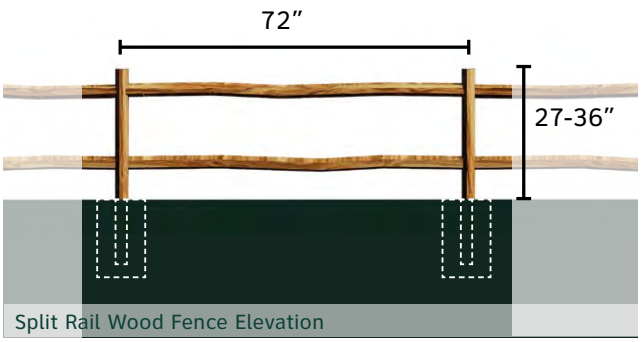
Concrete Formwork Examples

Drawings for Illustrative Purposes - Not for Construction

Chattahoochee RiverLands

FENCES

Split Rail Wood Fence



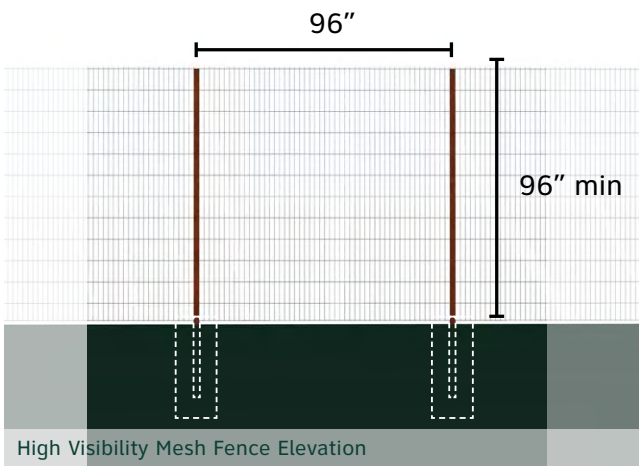
Split Rail Wood Fence Elevation

The RiverLands main stem cuts through a wide range of land uses, including public, private, and industrial landscapes. Where fences are needed to separate adjoining parcels or provide additional privacy or security, the following options should be considered.

Split Rail Wood Fence

The preferred fence along the RiverLands is a split rail wood fence. The design of these fences is inspired by both the hardwood forests and the agricultural countryside that constitute a significant portion of the RiverLands. While these fences might prevent crossing into private land, their primary purpose is to visually signify separation.

High Visibility Mesh Fence

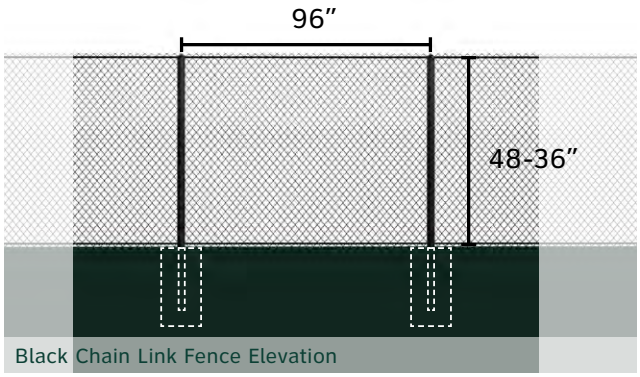


High Visibility Mesh Fence Elevation

High Visibility Mesh

In locations when additional security is necessary, high visibility mesh fences with oxidized mesh links are recommended. Oxidized mesh is visually non-intrusive, disappears into the landscape and is uncomfortable to hold, making scaling difficult. The mesh should be strung together between weathered steel posts which are durable, low maintenance, and align with the RiverLands overall look and feel.

Black Chain Link Fence

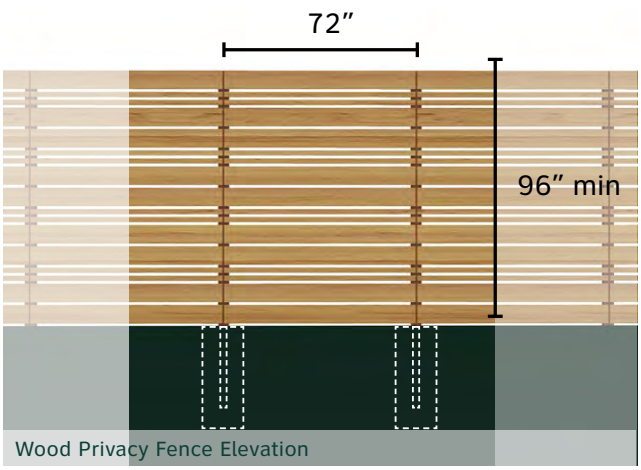


Black Chain Link Fence Elevation

Black Chain Link

In circumstances or locations where lower-cost separation methods are necessary, black vinyl chain link may be used. Black should always be used for the chain link option rather than metal or other finishes.

Wood Privacy Fence



Wood Privacy Fence Elevation

Wood Privacy Fence

In locations where both visual privacy and physical security are concerns for adjacent property owners, a wooden privacy fence may be used. The design of the wooden privacy fences should follow an alternating pattern, as shown to the left, of two wide wooden slats (1x6) followed by two thin wooden slats (1x2), with one wide slat at the top.

Drawings for Illustrative Purposes - Not for Construction

Chattahoochee RiverLands

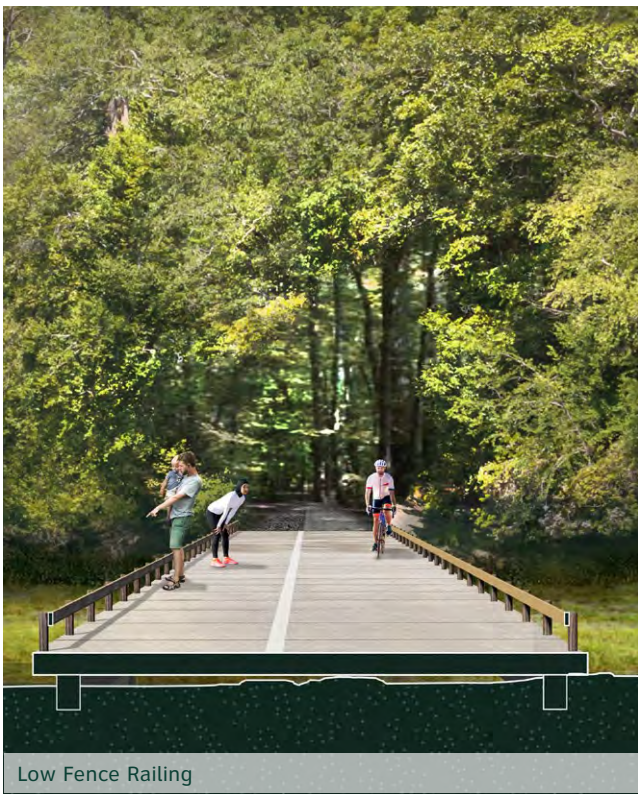
BRAILLE TRAIL

Guide Rope Railing

A core goal of the Chattahoochee RiverLands vision is to connect communities and destinations along the River in ways that are accessible to people of all backgrounds, ages, and abilities. To provide further support to those who are visually impaired, the following railings should be considered where possible.

Guide Rope

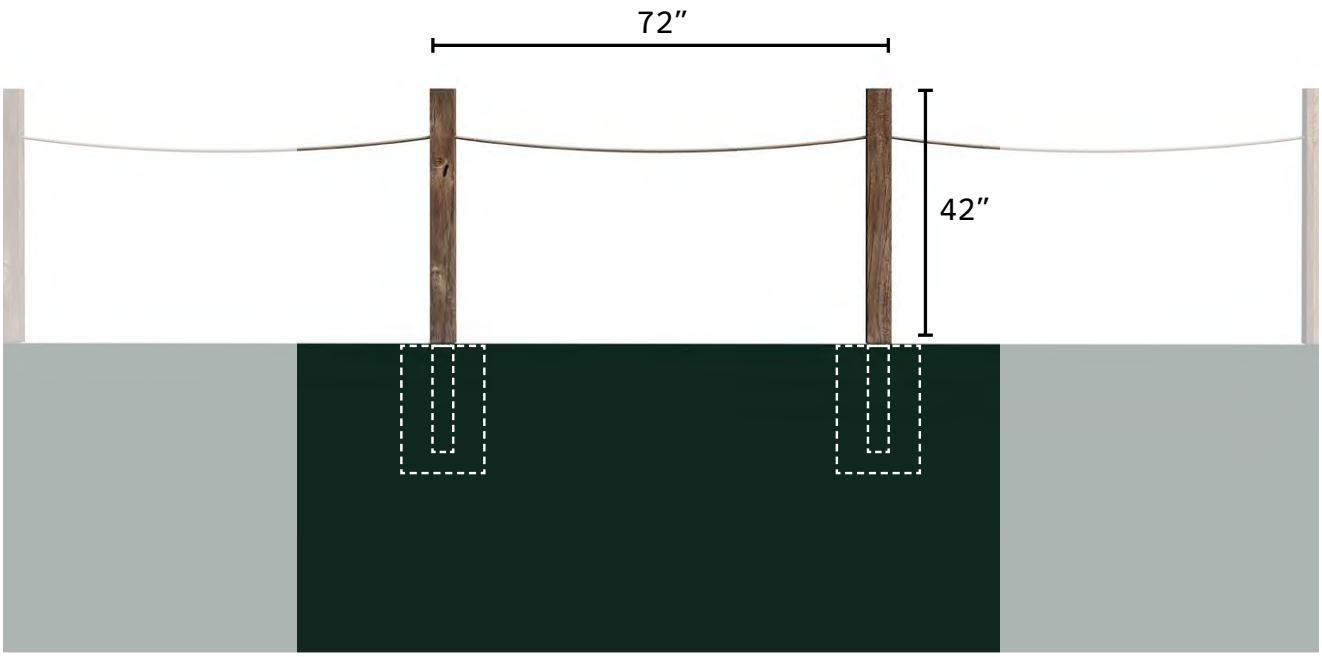
Braille trails typically include a guide rope for people living with visual impairments to hold and follow along the path. These guide ropes are strung together between wooden posts along the length of the trail. They are a relatively inexpensive and low maintenance addition to the main stem greenway that increase the accessibility of the RiverLands. Guide ropes should be avoided in areas where operations and maintenance equipment access, such as lawn mowers, is needed.



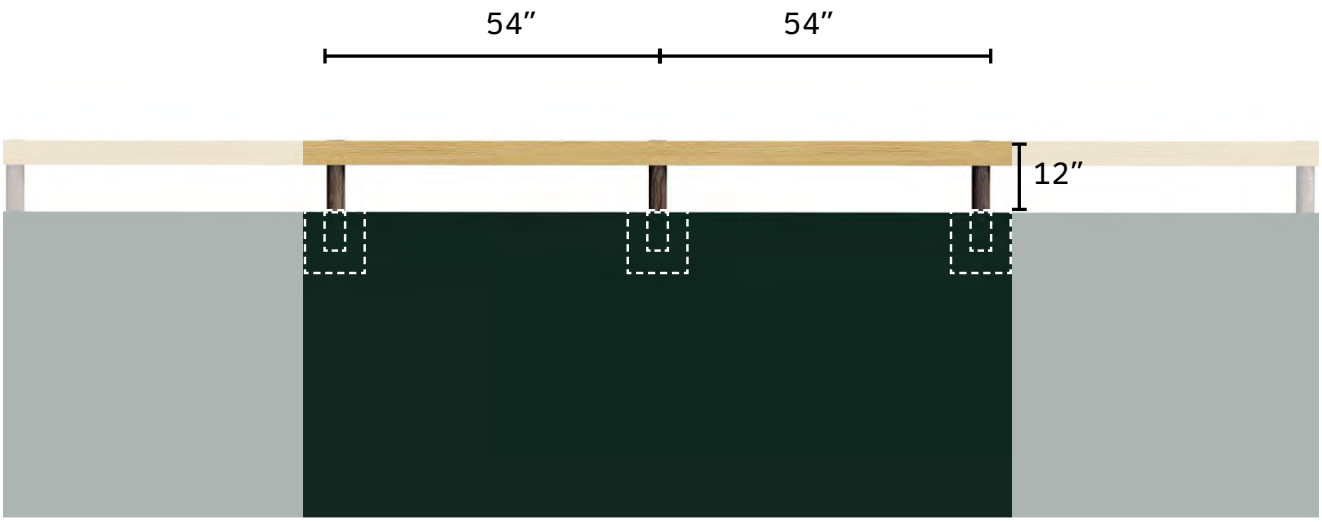
Low Fence Railing

Low Fence

A low fence maybe utilized along segments of the main stem greenway where there is potential for people to wander off the path. A low fence can help people living with visual impairments or people in wheelchairs redirect their motion and keep them from venturing into the surrounding area. In order to align with material palette of other RiverLands furnishings where possible, this low fence should be made from wood and metal.



Guide Rope Railing Elevation



Low Railing Elevation

Drawings for Illustrative Purposes - Not for Construction

Chattahoochee RiverLands

SIGNS AND WAYFINDING

SIGNAGE APPROACH

The signs developed in these Guidelines is intended to enhance users' experience of the RiverLands. The signs are intended to fuse with the riparian landscape both aesthetically and functionally, to add legibility to the greenway, to increase accessibility, and create a unifying identity for the RiverLands.

DESIGN LANGUAGE

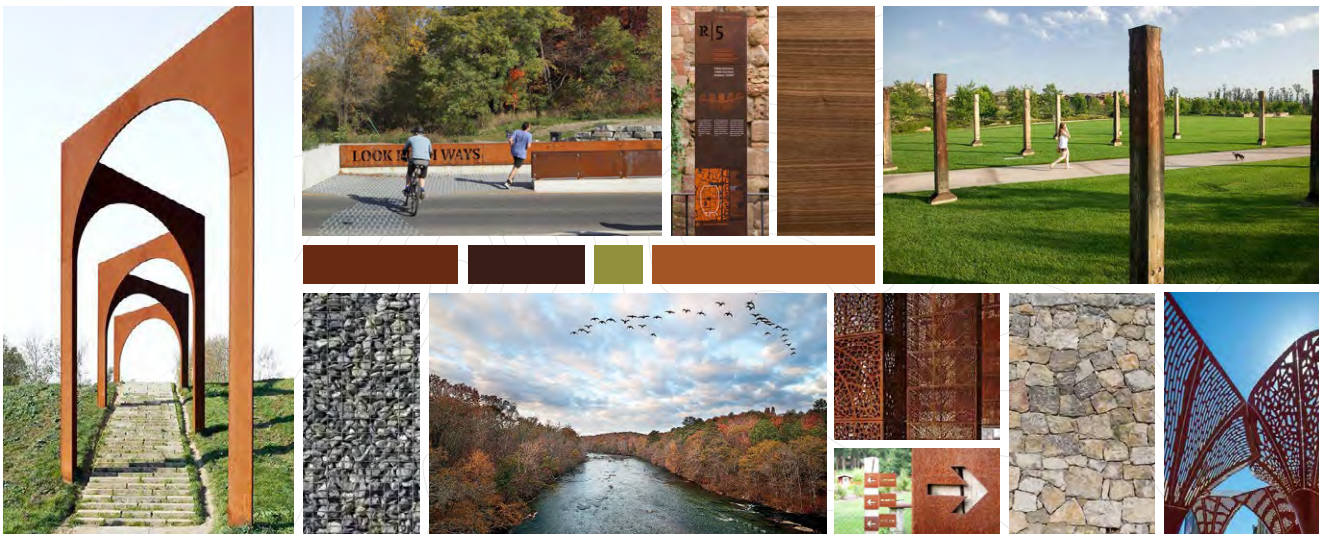
The design language for the signs and wayfinding outlined in these Guidelines was developed through regular collaborative meetings with the Chattahoochee Working Group. These meetings were essential in establishing clear criteria for future implementation. Concerns included ensuring navigability and accessibility along the RiverLands, honoring the natural environment, and establishing a consistent aesthetic vision and identity across the length of the project.

Listed below are descriptive words that were used to shape the design language:

Aesthetic Descriptors:
- Rustic
- Natural
- Warm
- Raw
- Weathered
- Timeless

Physical Descriptors:
- Embedded
- Wrapped
- Bent
- Cut
- Sliced

The RiverLands User Journey Influenced Part 01 Sign Type Selection



Inspiration Images that Informed the Design Language

POST, PANEL, PODIUM

The design team approached the signs and wayfinding system by tackling each of the three primary sign components separately: post, panel, and podium. The team saw the interactions between these elements as opportunities to create a distinct identity across a range of sign types. This led to the language of embedding and wrapping signs.

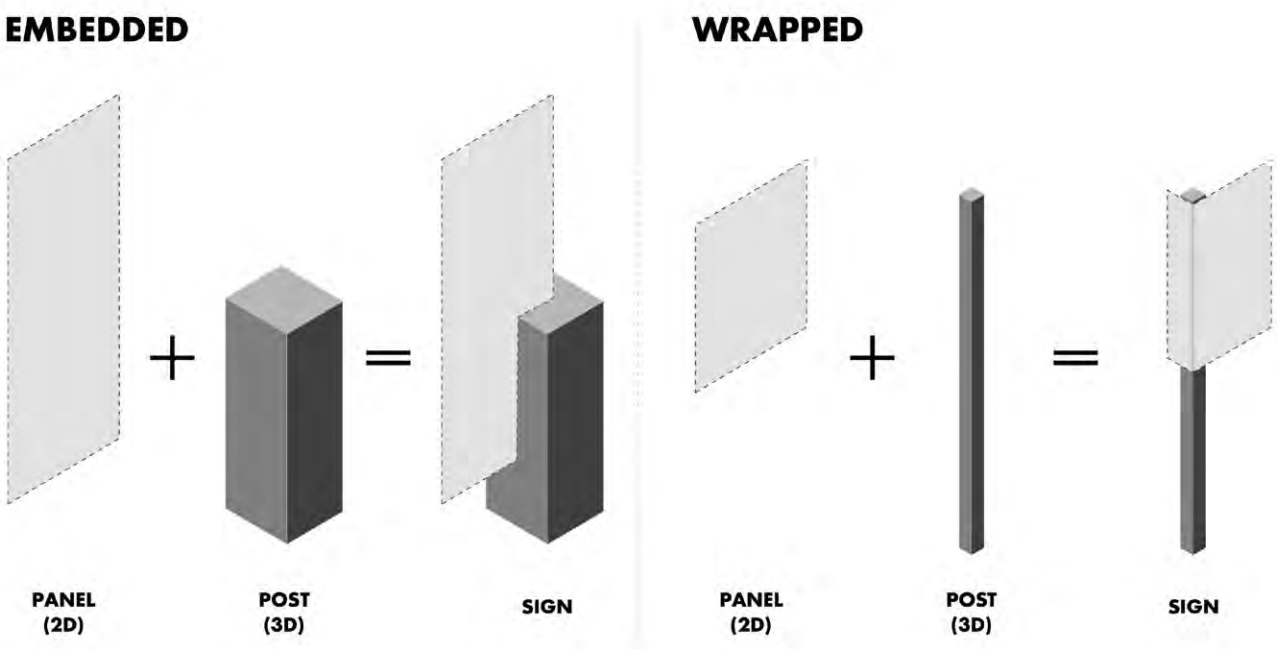
This concept was further refined to create three families of variants that involved the act of wrapping and embedding sign panels as shown below. This unites the diverse sign types needed in the RiverLands and allows design intent to be maintained through budgetary, implementation, or material constraints. These families will be further explained in below

POST, PANEL, PODIUM INTERACTIONS

Embedded: Panels & Podiums
- Chattahoochee RiverLands ID
- RiverLands Pedestrian Directional

Wrapped: Panels & Posts
- RiverLands Trailhead Marker
- RiverLands Rules Sign
- RiverLands Bicycle Directional
- RiverLands Mile Marker

Both: Unique Condition Signs
- RiverLands Interpretive Sign



Early Explorations of the Design Language: Embedded and Wrapped Sign Panels on Posts and Podiums

COST CONSIDERATIONS

Considering the scale and complexity of the Chattahoochee RiverLands, cost of fabrication and ease of implementation were crucial design considerations for the seven sign types in these Guidelines. To create a cohesive system that multiple jurisdictions could implement, the wayfinding system was developed as three families: High-Cost ($$$), Mid-Cost ($$), and Low-Cost ($). Signs can be mixed and matched across families according to budgetary constraints and jurisdictional priorities while maintaining a cohesive RiverLands identity.

High-Cost
This family includes the RiverLands preferred sign types. Signs in this family are most identifiable and most durable.

Mid-Cost
This mid-range option offers a combination of standard and specialty elements.

Low-Cost
This pared back family of signs uses the lowest cost materials and construction.

MATERIAL ALTERNATIVES

Materials considerably affect the overall cost and construction of the signs. The material palette for the Chattahoochee RiverLands signs and wayfinding system is composed of metal, stone, and wood. Each material group contains options that balance different budgetary or implementation concerns.

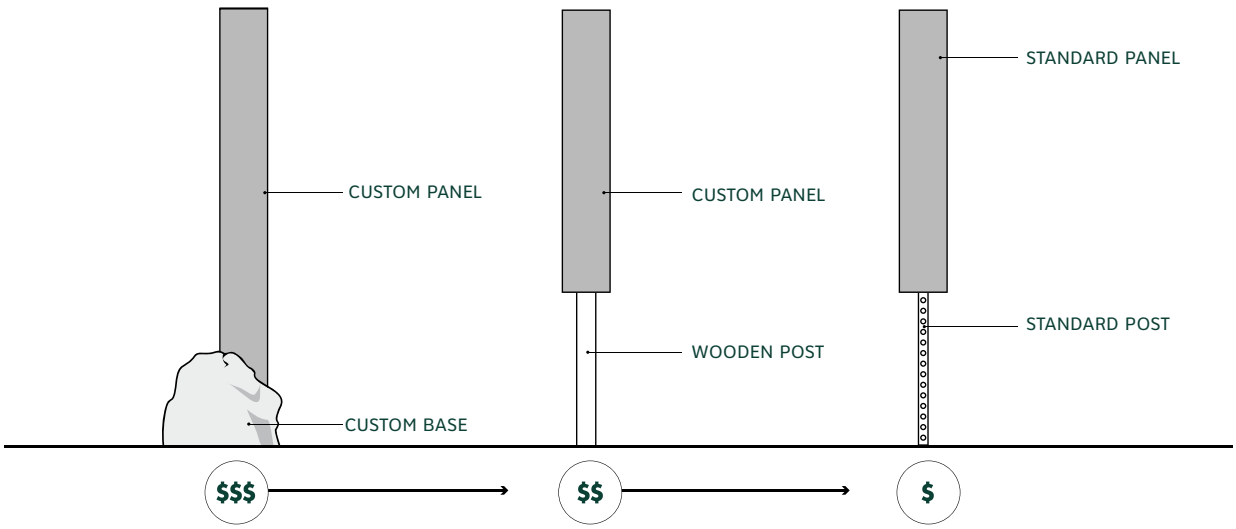
Metal Panels: Weathering Steel & Aluminum
The signs and wayfinding system will use paint on aluminum panels to mimic the look and feel of weathering steel.

Stone Podiums: Quarried & Manufactured
Stone podiums will be locally sourced and cut from quarries to match any natural rock outcroppings found on site and will be processed by sign fabrication companies.

Wood Posts: Natural & Manufactured
Posts will be made of wood that has been treated for rot resistance and stained. Other options include aluminum posts that have been powder coated to mimic the look of wood or painted brown to match the color of wood.

COST HIGH, MID, & LOW	METAL WEATHERING STEEL EFFECT	STONE QUARRIED & MANUFACTURED	WOOD NATURAL & MANUFACTURED
$$$ HIGH-COST	HIGH-END WEATHERING STEEL EFFECT PAINT ON ALUMINUM	STONE FROM LOCAL QUARRY	TREATED & STAINED NATURAL WOOD
$$ MID-COST	LOW-END WEATHERING STEEL EFFECT PAINT ON ALUMINUM	CONCRETE	WOOD GRAIN POWDER COATING
$ LOW-COST	ALUMINUM PAINTED DEEP RED	REMOVED	ALUMINUM PAINTED DARK BROWN

Material Alternatives Palette



Cost Spectrum Principles

RIVERLANDS SPECIFICATIONS

The Chattahoochee RiverLands branding was initially developed by the Chattahoochee Working Group and was refind by the Greenway Study (2020). This branding was used to inform the overall signs and wayfinding system in the Design Guidelines.

BRANDING

The Chattahoochee RiverLands brand is welcoming and accessible. The signs and wayfinding system will build upon the RiverLands branding to create an environment that is inviting to diverse users, ensures accessibility and navigability, and encourages discovery and stewardship.

Brand Design Elements

The Chattahoochee RiverLands brand consists of the logo, a color palette, icons, and fonts. These branded design elements will be applied throughout the wayfinding system to create a consistent design language that trail users will be able to easily identify. Integrated branded elements are crucial to create a sense of place for visitors. These elements will be described further in the following sections.

Implementing Municipality Identities

The Chattahoochee RiverLands wayfinding system will connect 19 municipalities. To unite participating municipalities, these Guidelines include a branded add-on disc that will be present on Trail ID and Trail Rules signs. Displaying the participating municipality branding will provide another layer of wayfinding information for trail users. Branded Add-On Discs will be discussed further on page 96.

PROJECT SPECIFICATIONS

In order to produce the RiverLands Signs, implementing agencies must use the project specifications provided in these Guidelines. Individual sign type spreads will further explain materials, icons, logos, and arrows used.

Chattahoochee RiverLands Logo Mark

Examples of Participating Jurisdiction Logos on Branded Add-On Discs

PAINT PALETTE

	P1	Sherwin Williams *SW7103 Whitetail*
	P2	Sherwin Williams *SW6787 Fountain*
	P3	Sherwin Williams *SW6760 Rivulet*
	P4	Sherwin Williams *SW6334 Flower Pot*
	P5	Sherwin Williams *SW6328 Fireweed*
$$	P6	TIGER Drylac Powder Coating *044/60035 Lava*

Exterior Sign Paint and protective top coat.
Top Coat must be Clear Coat Satin Finish.

REFLECTIVE VINYL

	V1	3M Engineering, Grade 3270 Series 3270 White - SIGN91326
	V2	3M Engineering, Grade 3930 Series Custom Ink to Match P4

Must be MUTCD compliant. (Pg.37)
3M approved clear UV/Graffitti Vinyl over laminates.
Vinyl seam must not interfere with sign messages.

MATERIAL PALETTE

$$$	M1	Local Quarried Stone
$$	M2	Cast Concrete
$$$	M3	PURE + FREEDOM *Sera (Reveals paintedP4)*
$$$	M4	Cedar Wood Post Stained to Match P6
$$	M5	Reynobond Design Line *Embala Brown*

COMPONENT PALETTE

	C1	Transpo - Breakaway Model AS3 - 4 1/2"
	C2	1/2" X 6" Galvanized Coarse Thread Hex Bolts; to Use with 1 1/2" Washers, Painted P5

RIVERLANDS LOGOS

Chattahoochee RiverLands

RIVERLANDS ICONS

Icons must be MUTCD & NPS compliant. Further Explanation on Page 37 of guideli

RIVERLANDS ARROWS

For all Directionals and Wayfinding; Arrows are GDOT/MUTCD compliant.

TYPEFACE 1 - ClearviewHwy 2-W

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z 0 1 2 3 4 5 6 7 8 9

NOTE: All Headers, Titles, Destinations & Trail names are all UPPERCASE
NOTE: All Wayfinding & Body Text is Sentence Case
NOTE: Specified Type Face is proprietary, and will need to be licensed for commercial use.

SIGN TYPES

The Chattahoochee RiverLands signs and wayfinding system addresses the distinct needs of the RiverLands to create a clear and cohesive user experience.

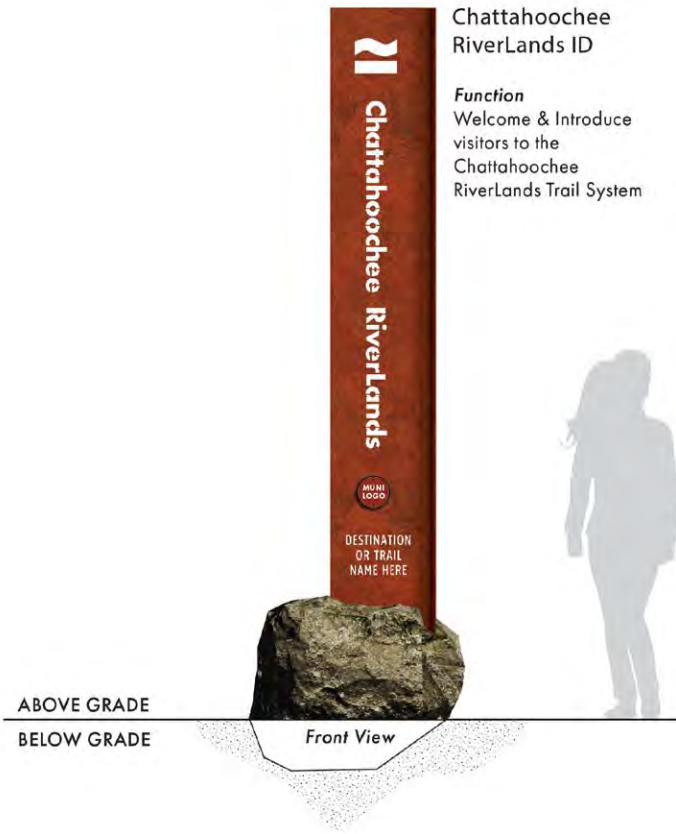
These signs are intended to support the complete user experience from trail entry to intended destination. Part 01 sign types are required and widely utilized signs that will help define the overall user experience while within the Chattahoochee RiverLands.

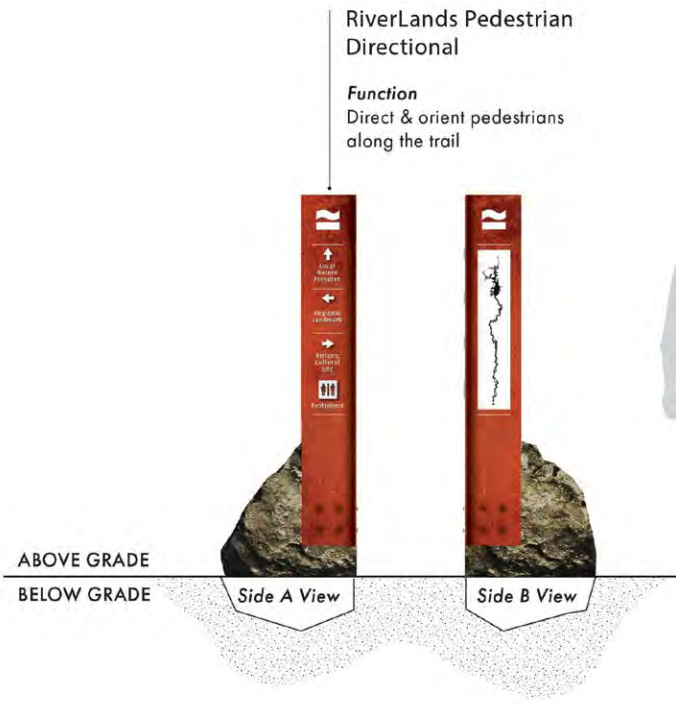
Developed Sign Types (Part 01)

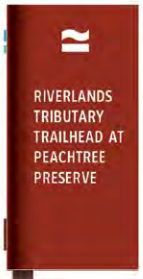
- Chattahoochee RiverLands ID
- RiverLands Trailhead Marker
- Chattahoochee RiverLands Rules Sign
- RiverLands Bicycle Directional
- RiverLands Pedestrian Directional
- RiverLands Mile Marker
- RiverLands Interpretive Signs

Signs to be Developed in the Future

- Parking ID
- Parking Directional
- Bike ID
- Donor & Recognition Sign
- Branded Bollard
- Vinyl Banners
- Regulatory Signs
- Public Art Opportunities







RiverLands Tributary Trail Marker

Function
Inform Bicyclists and Pedestrians when they have entered the trail

RiverLands Rules Sign

Function
Inform visitors of the rules of conduct on the trail

Post Mounted

Wall Mounted

RiverLands Bicycle Directional

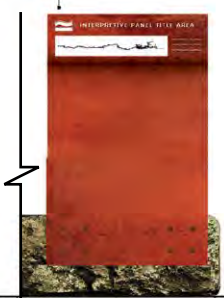
Function
Direct & orient Bicycle riders along the trail.

RiverLands Mile Marker

Function
Inform Trail Users of their location on the trail

RiverLands Interpretive Sign, Free-Standing

Function
Inform visitor of historical or natural significance on the trail



RiverLands Interpretive Sign, Railing Mount

Function
Inform visitor of historical or natural significance on the trail

Chattahoochee RiverLands

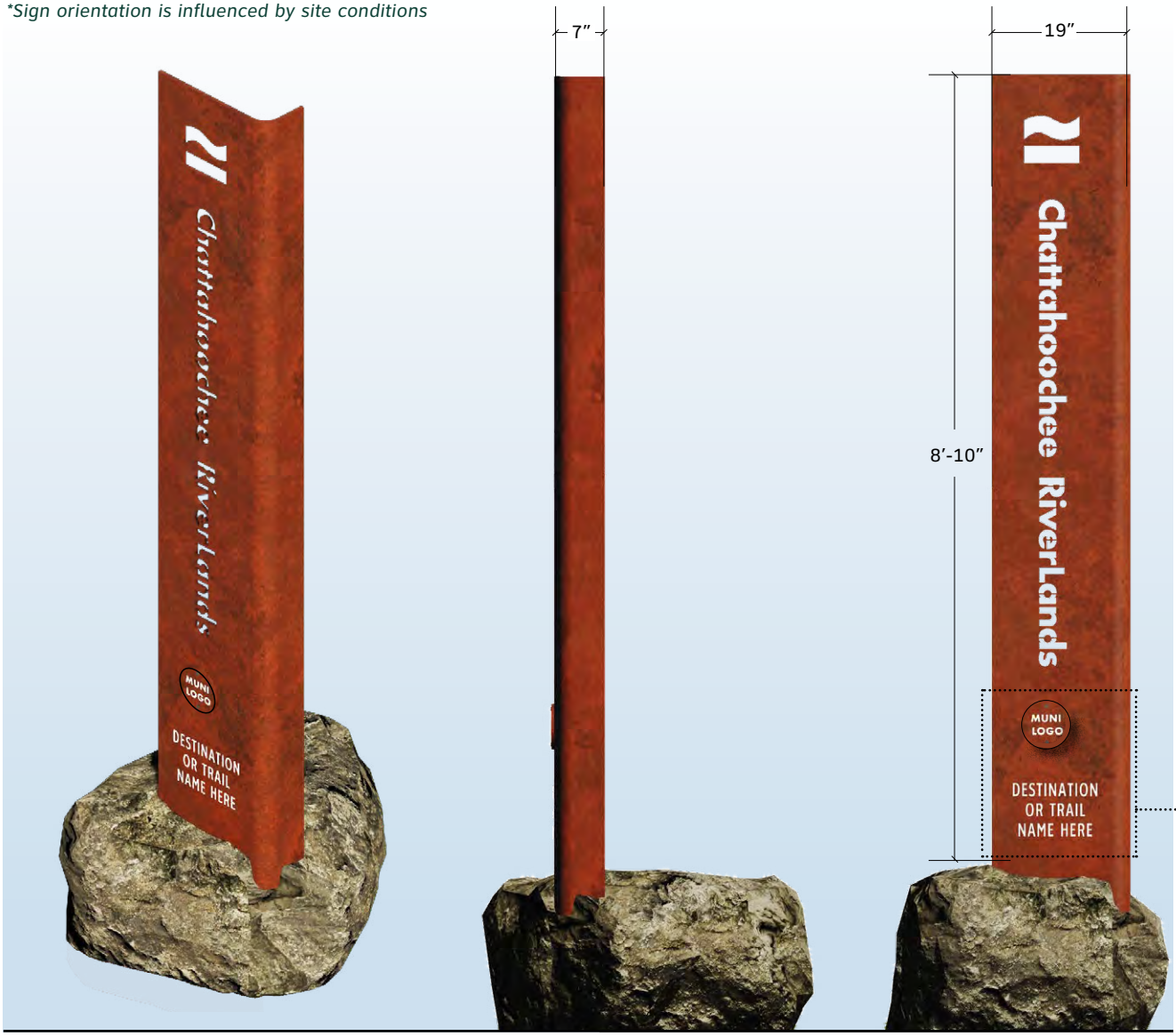
CHATTAHOOCHEE RIVERLANDS ID

Chattahoochee RiverLands identification signs are the first on-site design element that trail users will encounter and must have high visibility. These signs will act as beacons to indicate that a user has entered the RiverLands. Chattahoochee RiverLands ID's have a monumental appearance and should be located at primary trailheads, parks and destinations with high foot traffic.

Construction Guidelines

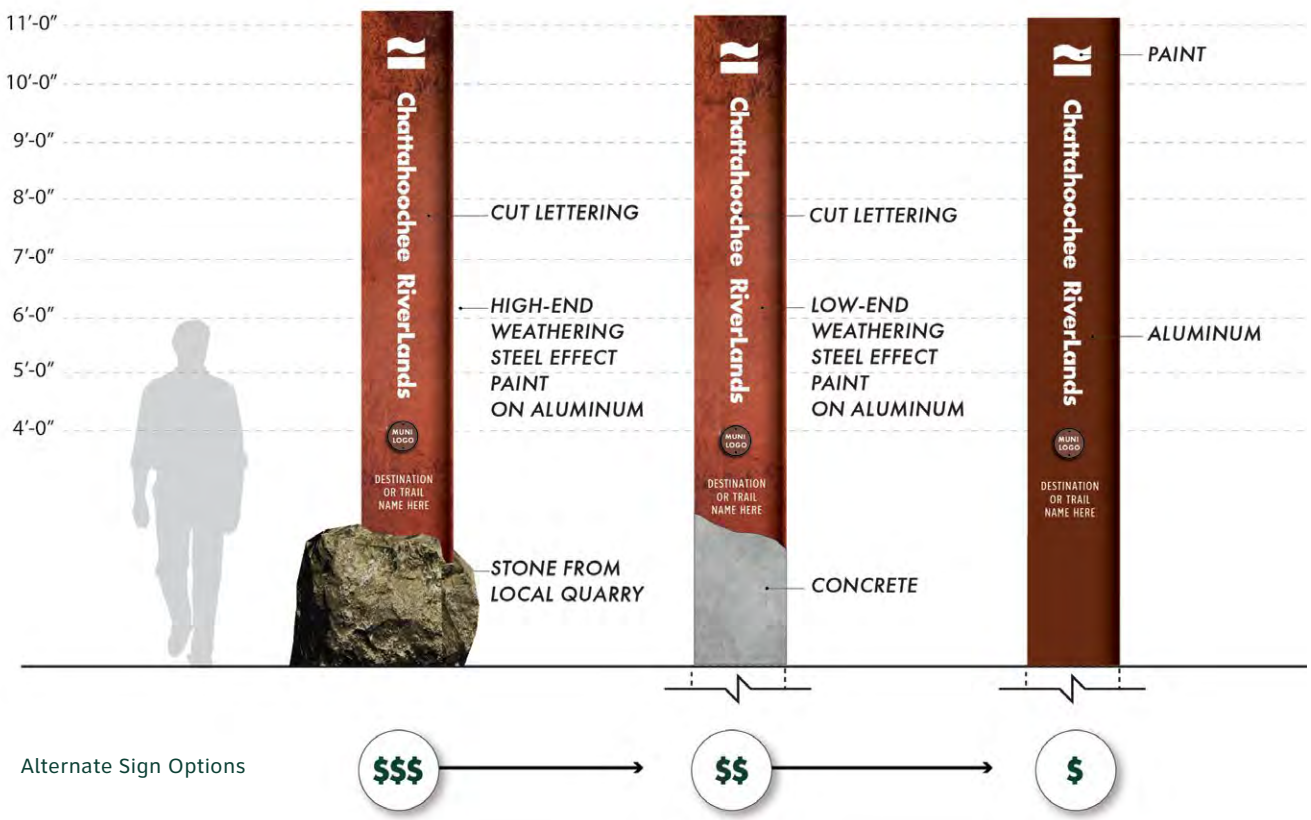
Stone from local quarries will be minimally finished to preserve the individual character of each boulder. Stone podiums will be buried in the ground to provide stability and resilience to flood events. Natural stone will be water jet cut on one side to mount a panel as appropriate. Sign panels will be secured using hidden mounts. The logo and 'Chattahoochee RiverLands' name should be cut out of sign panel.

**Sign orientation is influenced by site conditions*

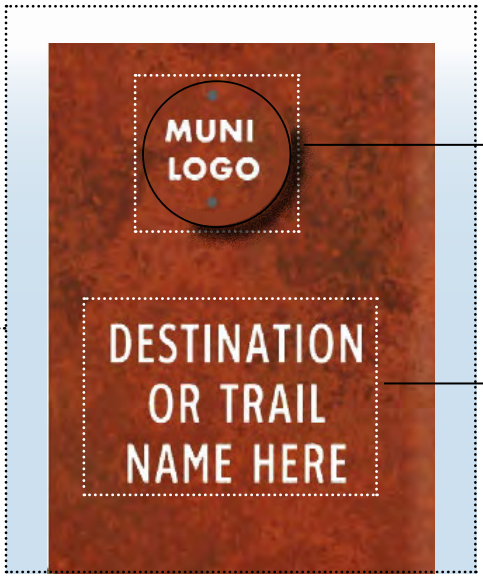


Axonometric | Side Elevation | Front Elevation

Recommended Chattahoochee RiverLands ID Sign - Drawings for Illustrative Purposes - Not for Construction



Alternate Sign Options

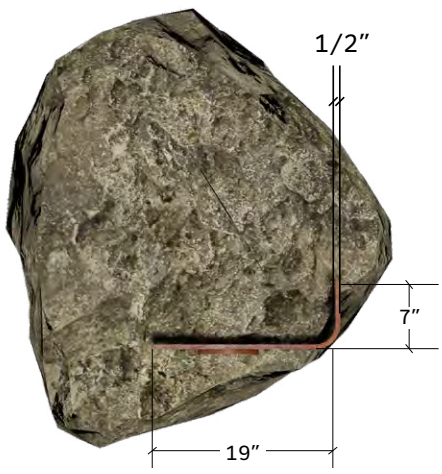


Replaceable Sign Content

PARTICIPATING JURISDICTION LOGO
Participating jurisdictions place their logo on a branded disc that will be attached here to the Chattahoochee RiverLands ID signs.

TRAILHEAD / DESTINATION
This is where Trailhead Names or popular destinations with primary trail entry points will exist on the Chattahoochee RiverLands ID signs. Message may not exceed 3 lines.

Message Example:
Sugar Hill Trail



Plan View

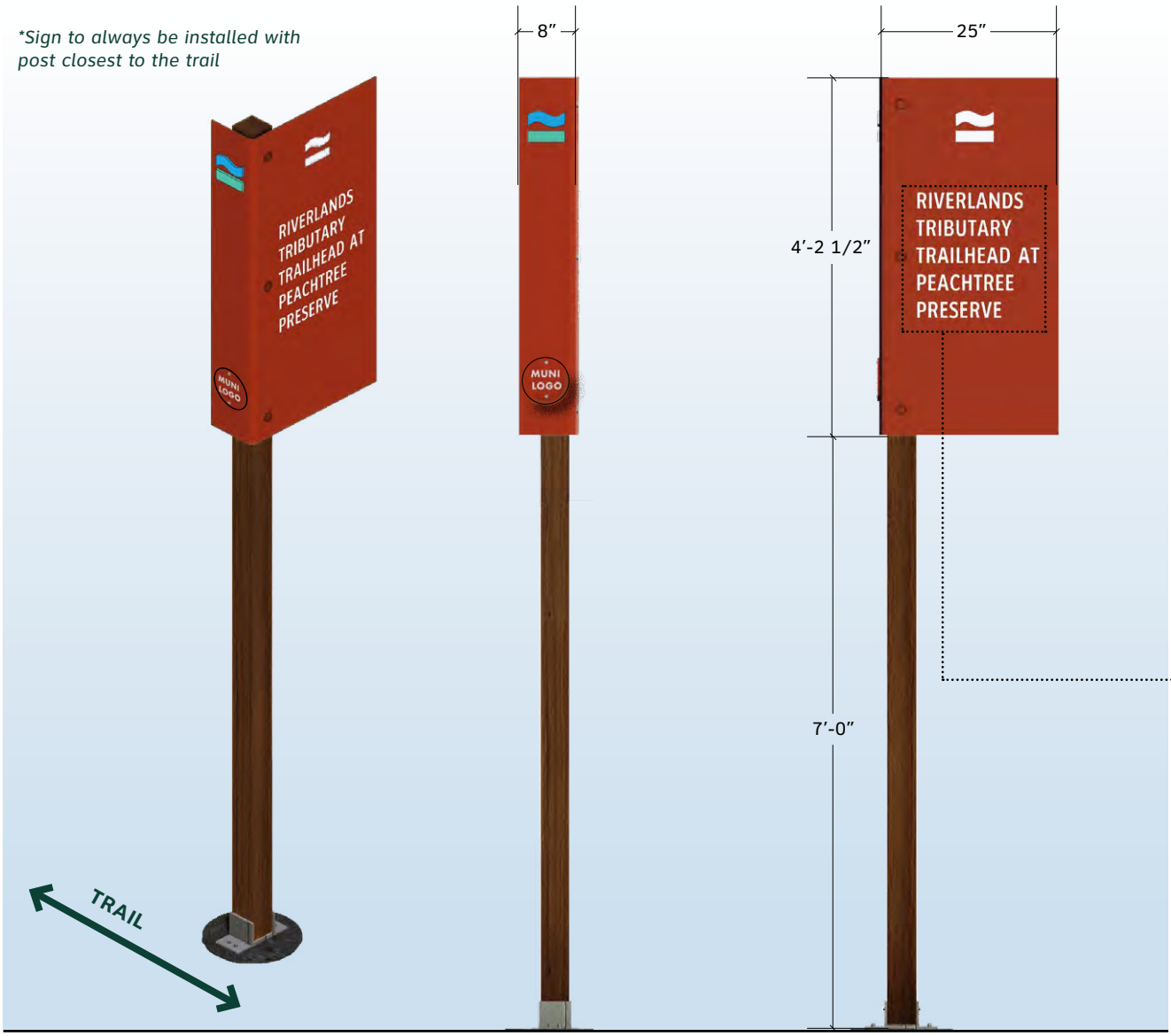
Chattahoochee RiverLands

RIVERLANDS TRIBUTARY TRAIL MARKER

Tributary Trail Marker signs must have clear visibility to all trail users to indicate that they have entered The Chattahoochee RiverLands Trail system at one of the 44 tributary trails identified in the Greenway Study (2020). These signs follow MUTCD guidelines so they may be placed on trails that have entrances along vehicular roadways. These signs include breakaway bases, MUTCD icons and fonts, and reflective vinyl.

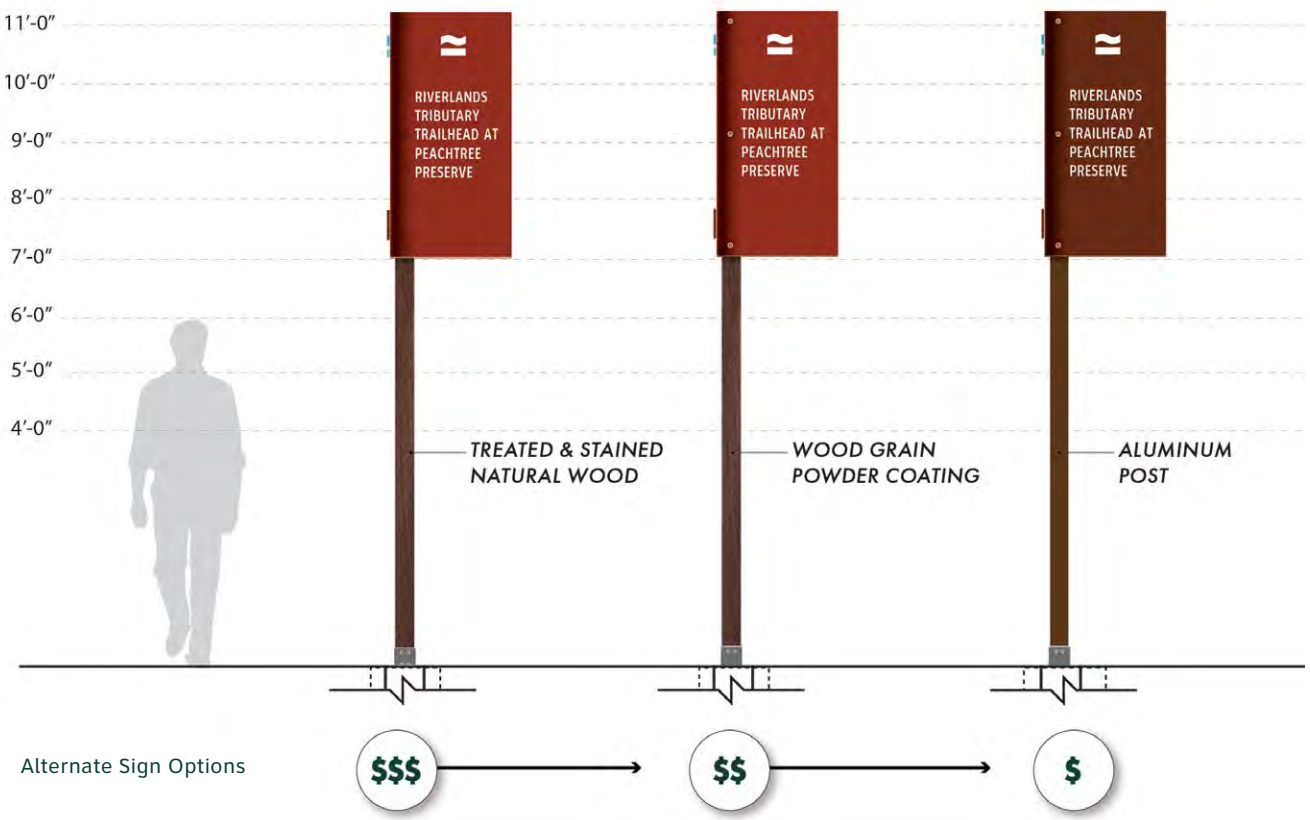
Construction Guidelines

A concrete base will be poured on or off-site depending on site conditions and will be connected to the post by a breakaway mount. The sign panel will wrap around the upper portion of post and will be mounted via coarse threaded bolts. All exposed hardware should be painted to match the sign panel. The dimensional logo will be mounted flush to the sign panel, mechanically fastened with tamper-proof hardware.

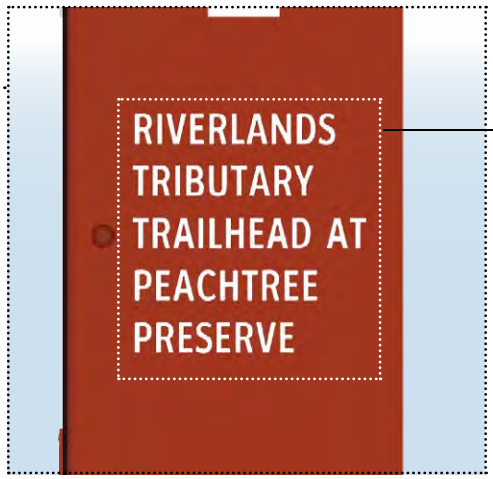


Axonometric | Side Elevation | Front Elevation

Recommended Trailhead Marker Sign - Drawings for Illustrative Purposes - Not for Construction



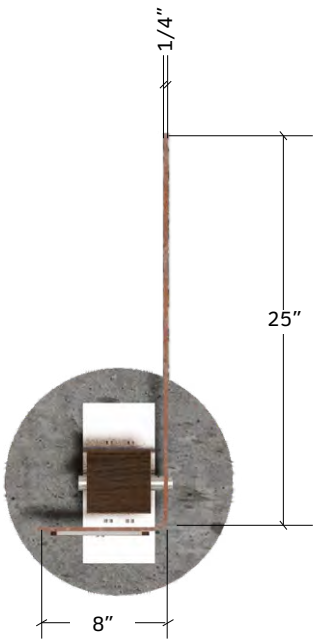
Alternate Sign Options



Replaceable Sign Content

TRIBUTARY TRAIL NAME
This is where Trailhead Names will exist on the Trailhead Marker Signs.

Message Example:
Sugar Hill Trail



Plan View

Chattahoochee RiverLands

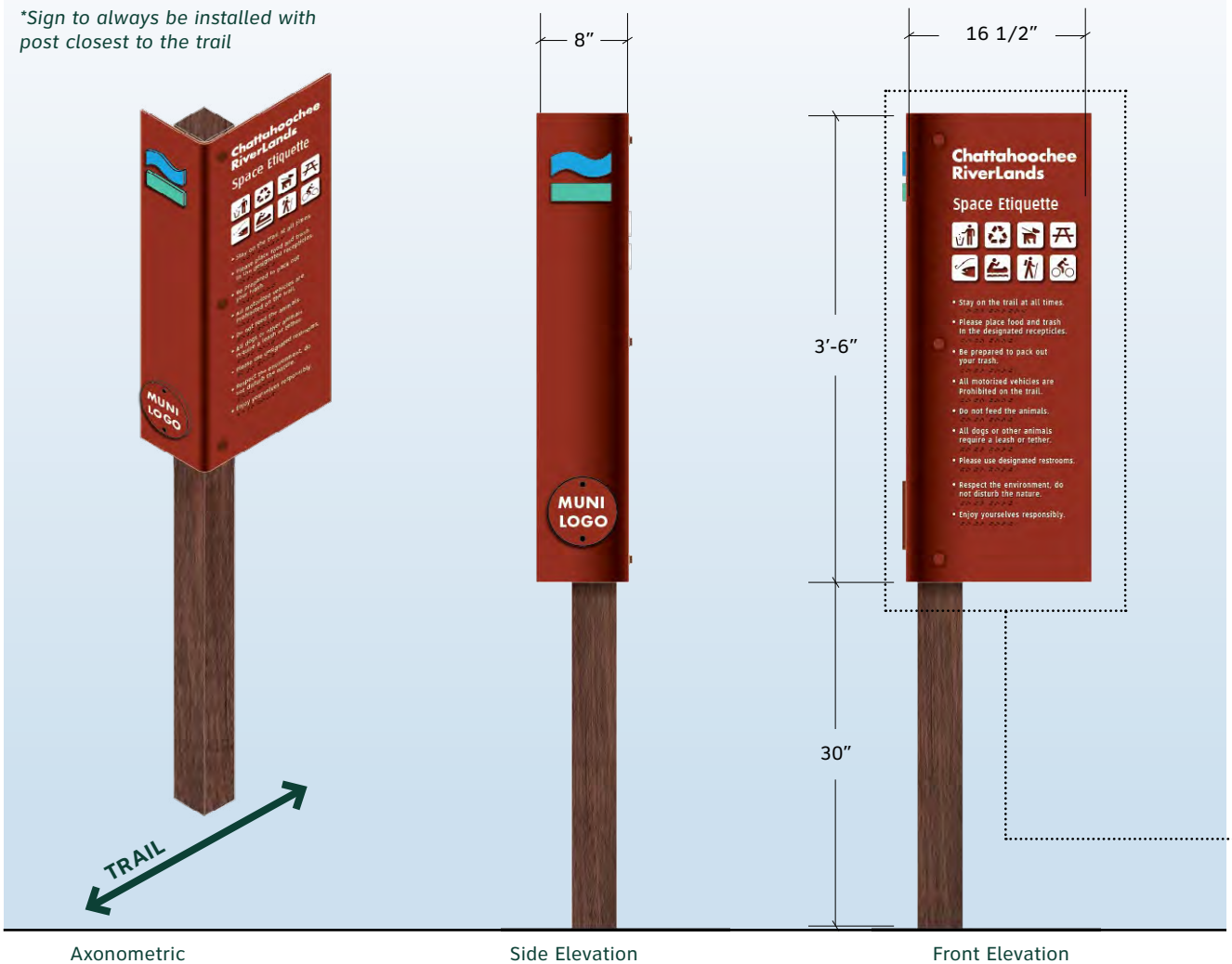
RIVERLANDS RULES SIGN

Chattahoochee RiverLands Rules signs inform users of the codes of conduct, etiquette, and safety warnings along the trails. These signs will be placed at trail, park, and amenity entrances. These signs may be post mounted or mounted to walls, gates, or fences depending on site conditions. **Of the sign types listed, the content of rule signs is the most variable from one location to the next.** Signs include text, icons, and a modular space for accessibility information. Sign content may vary depending on trail, park, and amenity needs. Sign content is at the discretion of implementing agencies.

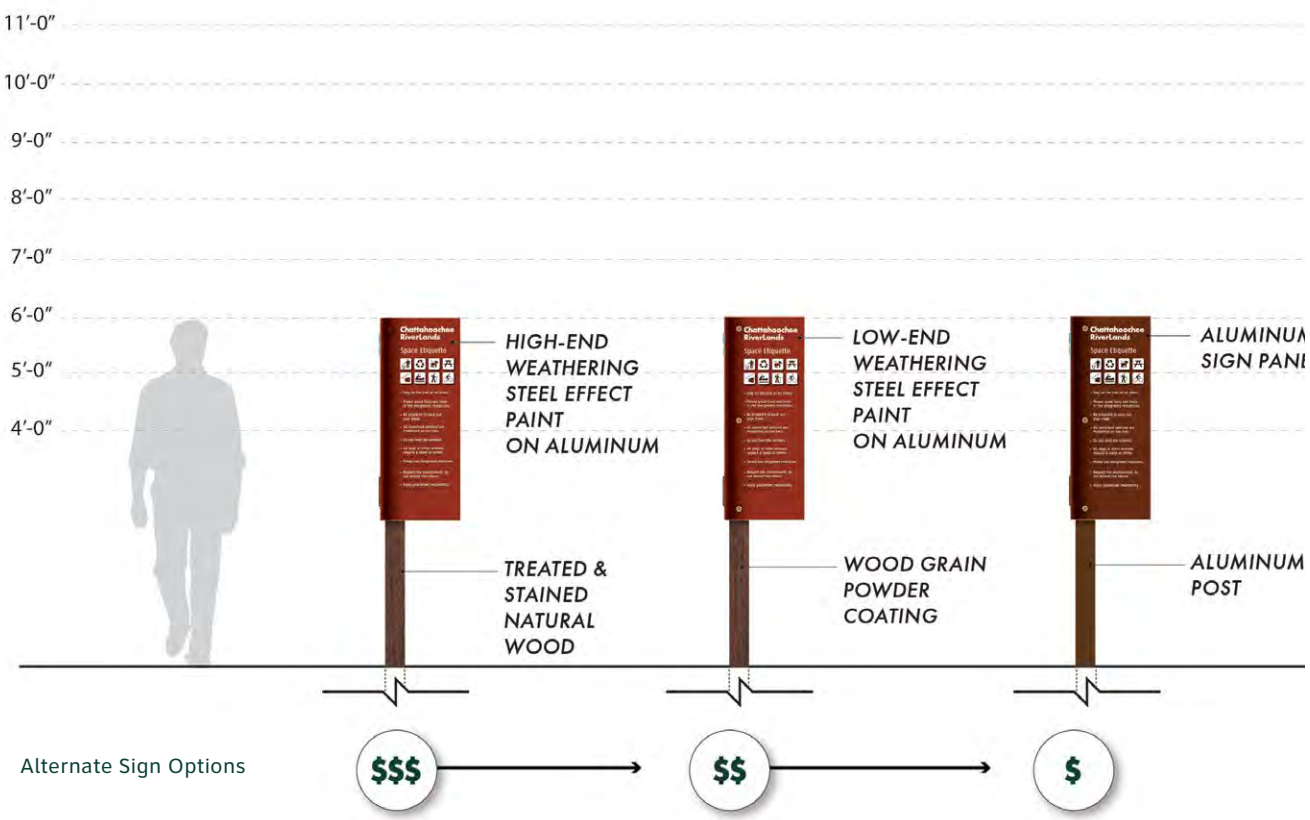
Construction Guidelines

The post will be appropriately treated and mounted directly into ground. The sign panel will wrap around the upper portion of post and will be mounted via coarse threaded bolts. All exposed hardware should be painted to match the sign panel. The dimensional logo should be mounted flush to the sign panel, mechanically fastened with tamper-proof hardware.

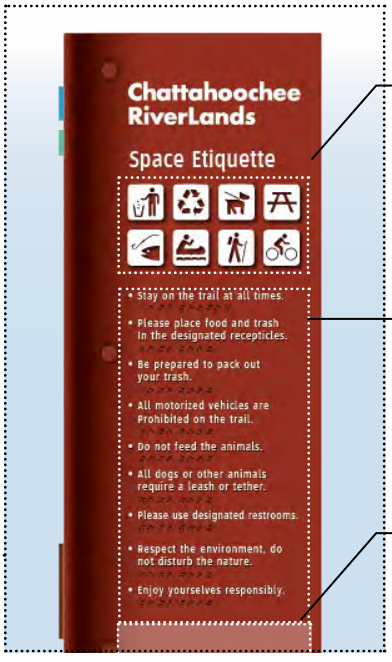
**Sign to always be installed with post closest to the trail*



Recommended Rules Sign - Drawings for Illustrative Purposes - Not for Construction



Alternate Sign Options

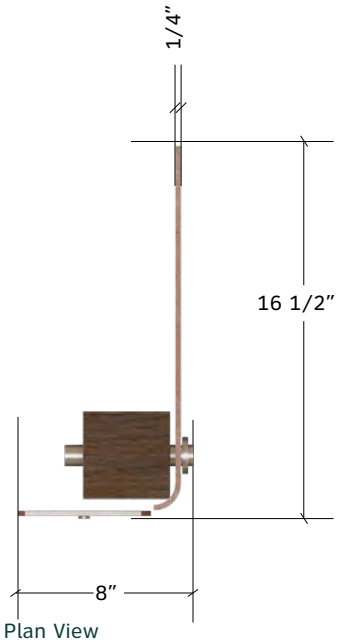


Replaceable Sign Content

ICONS
MUTCD Approved Icons will be located here.

RULES
Rules will be listed here. Message must include Braille Grade II Translation.

ACCESSIBILITY MODULE
There is room here for accessibility information, if needed. Please refer to page 103 for more information.



Plan View

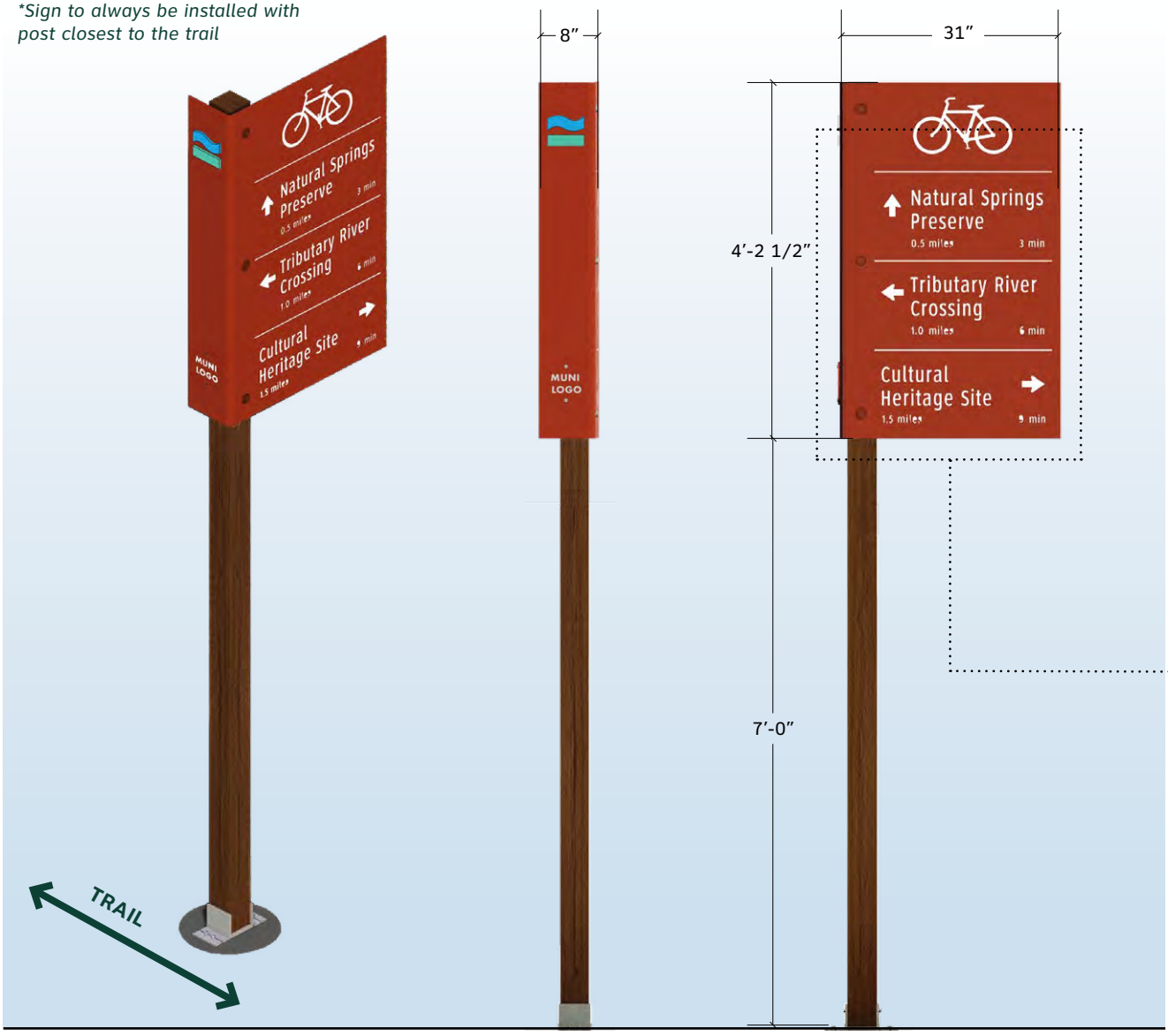
RIVERLANDS BICYCLE DIRECTIONAL

Bicycle directional signs inform bicyclists that they are following a bike route to destinations along the Chattahoochee RiverLands. These signs must have visible to cyclists and follow MUTCD guidelines. They may be located on trails near vehicular roadways and they include breakaway bases.

Construction Guidelines

A concrete base will be poured on or off-site depending on site conditions and will be connected to the post by a breakaway mount. The sign panel will wrap around the upper portion of post and will be mounted via coarse threaded bolts. All exposed hardware should be painted to match the sign panel. The dimensional logo should be mounted flush to the sign panel, mechanically fastened with tamper-proof hardware.

**Sign to always be installed with post closest to the trail*



Axonometric | Side Elevation | Front Elevation

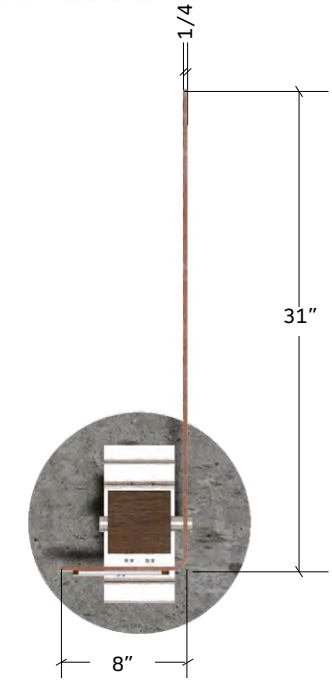
Recommended Bicycle Directional Sign - Drawings for Illustrative Purposes - Not for Construction

Alternate Sign Options

Replaceable Sign Content

DESTINATION MESSAGE
Destinations are listed here along with the distance and minutes from the sign location. Destinations are further explained on page 100.

MUTCD ARROW
Arrow directions will be further explained on page 104.



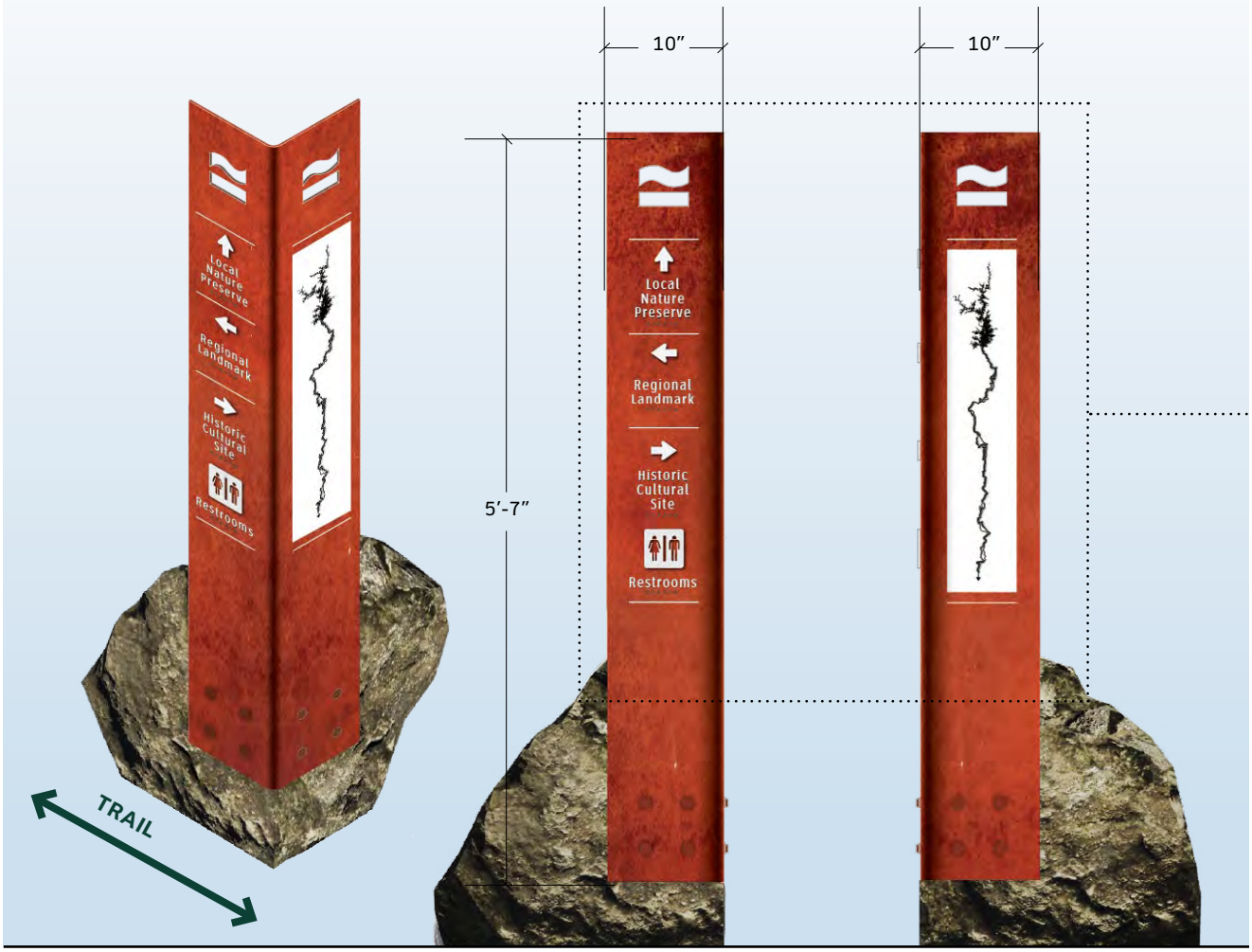
Plan View

RIVERLANDS PEDESTRIAN DIRECTIONAL

Pedestrian directional signs direct pedestrians to destinations along the Chattahoochee RiverLands. These signs must be visible to all trail users and follow ADA guidelines. These signs include a modular space to provide users with a trail map or interpretive information. The trail map must follow the Chattahoochee RiverLands brand guidelines.

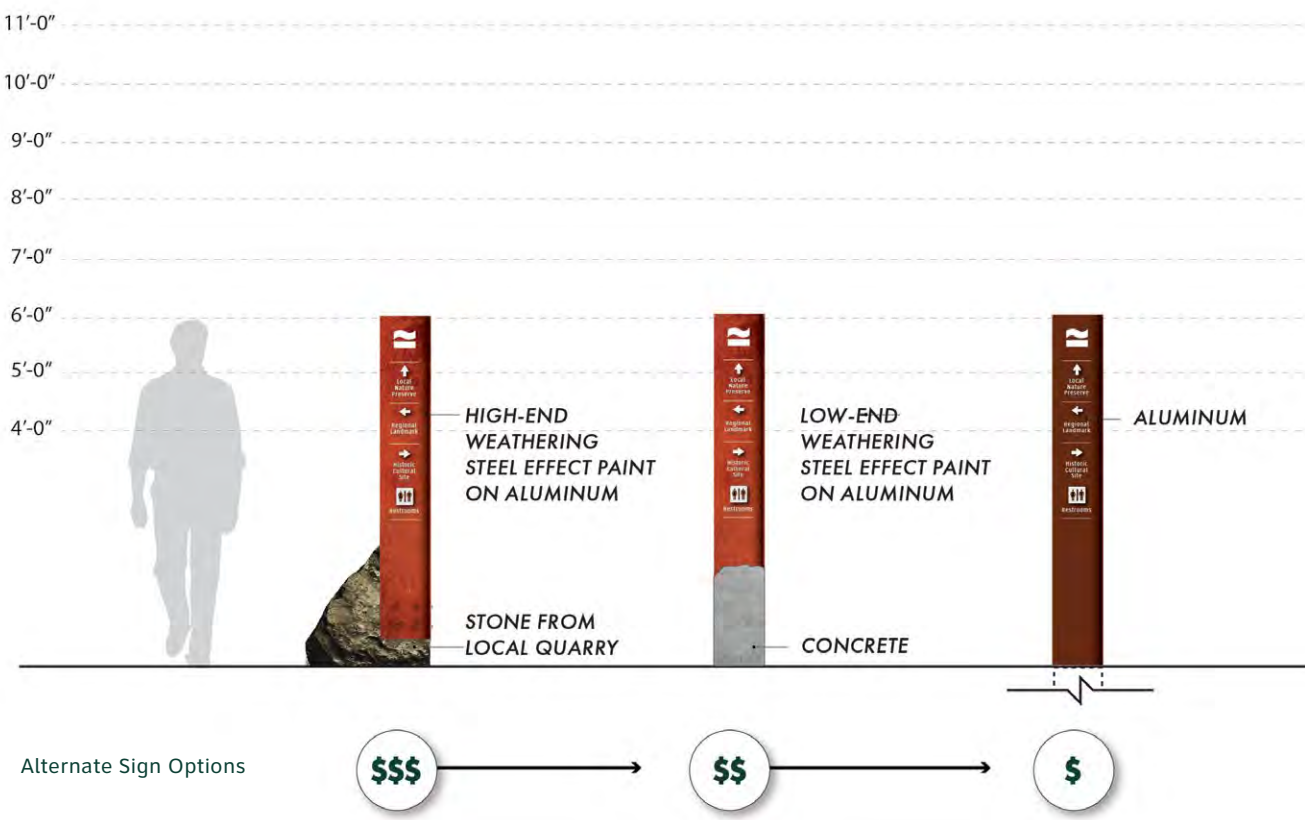
Construction Guidelines

Stone from local quarries will be minimally finished to preserve the individual character of each boulder. Stone podiums will be buried into the ground to provide stability and resilience to flood events. Natural stone should be water jet cut on one side to mount a panel as appropriate. Sign panels should be mounted using coarse threaded bolts. All exposed hardware will be painted to match the sign panel. The upper logo should be cut out of the sign panel. Dimensional arrows and icons will be mounted flush to the sign panel and mechanically fastened with tamper-proof hardware from the back.



Axonometric | Front Elevation | Side Elevation

Recommended Pedestrian Directional Sign - Drawings for Illustrative Purposes - Not for Construction

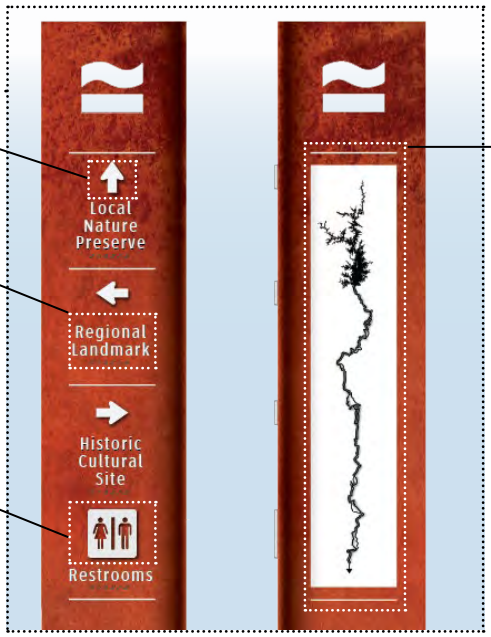


Alternate Sign Options

MUTCD ARROW
Arrows are further explained on page 104.

DESTINATION MESSAGE
Signed destinations are listed here. Abbreviations may be used. Further explanation on page 100. Message must be raised and include Braille Grade II Translation.

RESTROOM ICON
An Icon may be used to replace Destination titles. Message must include Braille Grade II Translation.

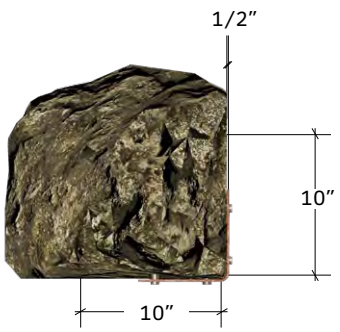


MODULAR SPACE
Implementing agencies may place a map, interpretive image, or text here.

Replaceable Sign Content

SIDE A

SIDE B



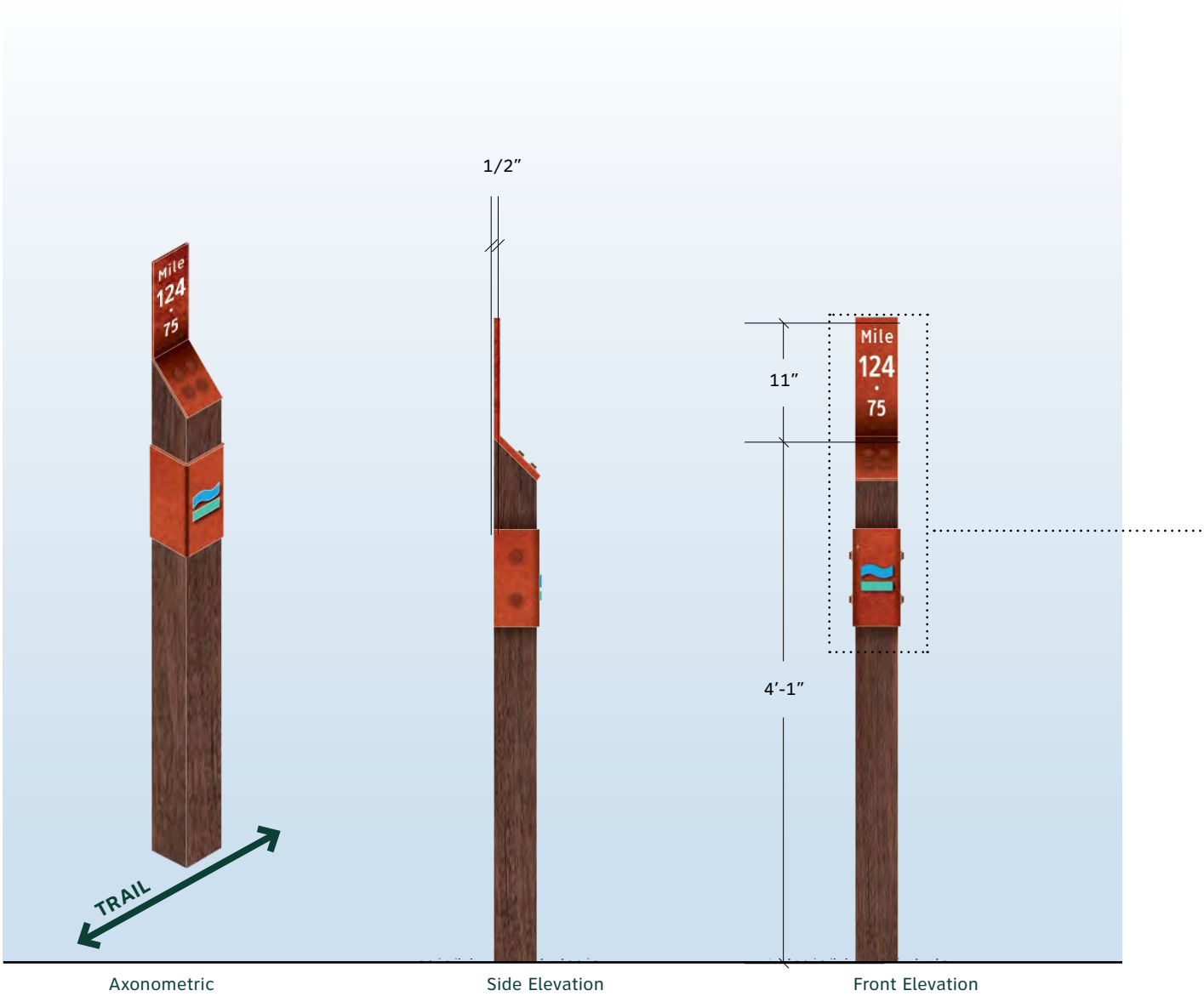
Plan View

RIVERLANDS MILE MARKER

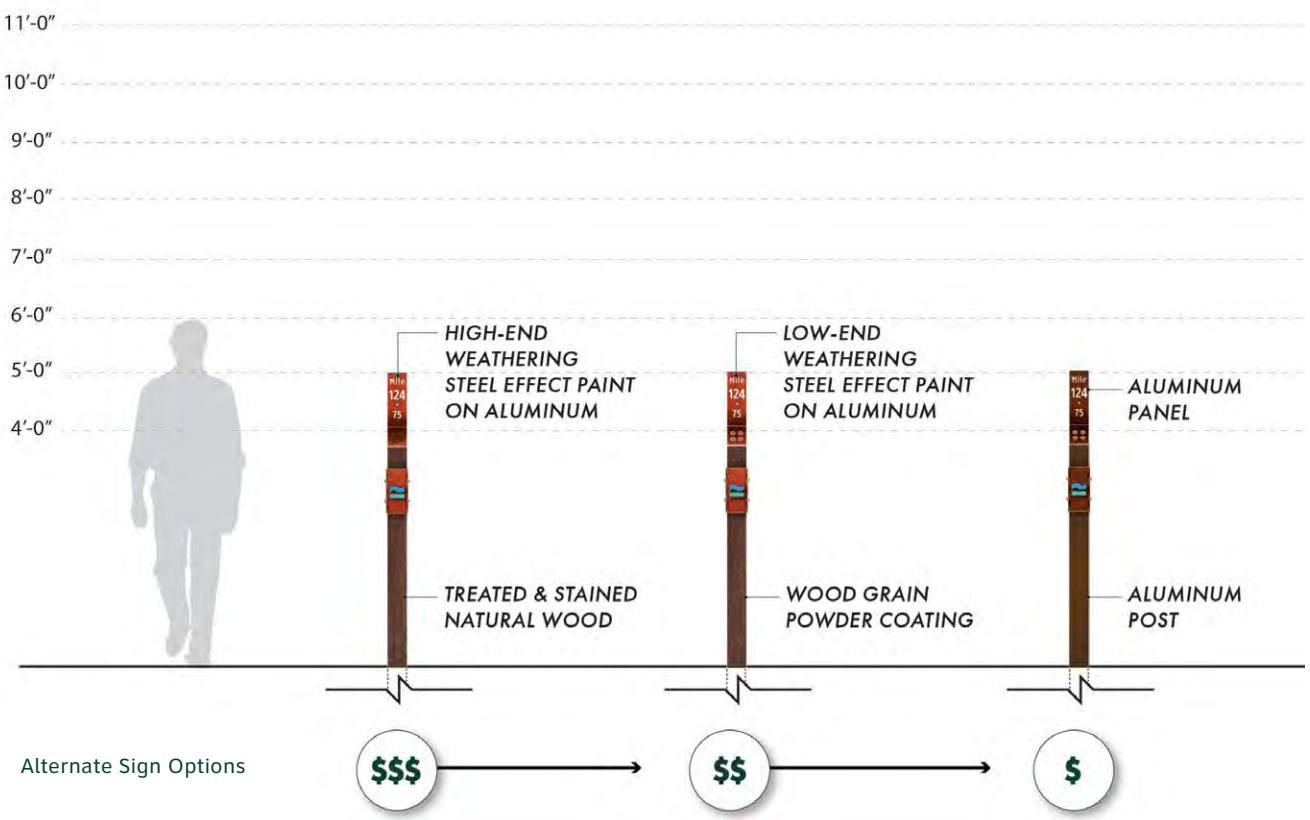
Mile Marker signs inform trail users of their location along the Chattahoochee RiverLands. These signs must be visible to all trail users and follow ADA guidelines. These signs will be located in 0.25-mile increments in higher traffic areas and 0.5-mile increments in lower traffic areas, or at the implementing agencies' discretion.

Construction Guidelines

The post will be appropriately treated and mounted directly into ground. The logo wrap will be mounted via coarse threaded bolts, connecting both sides through the center of the post. The top of the post will be mitered at 45˚ on the sign panel mounting surface. The sign panel will be mounted to the post via coarse threaded bolts. All exposed hardware will be painted to match the sign panel. The dimensional logo will be mounted flush to the sign panel, and be mechanically fastened with tamper-proof hardware



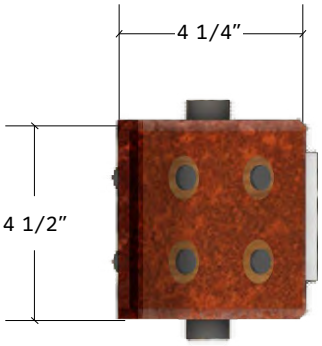
Recommended Mile Marker Sign - Drawings for Illustrative Purposes - Not for Construction



Alternate Sign Options

MILES
This is where the miles will be listed on the sign. Grade II braille below mile number.

Replaceable Sign Content



Plan View

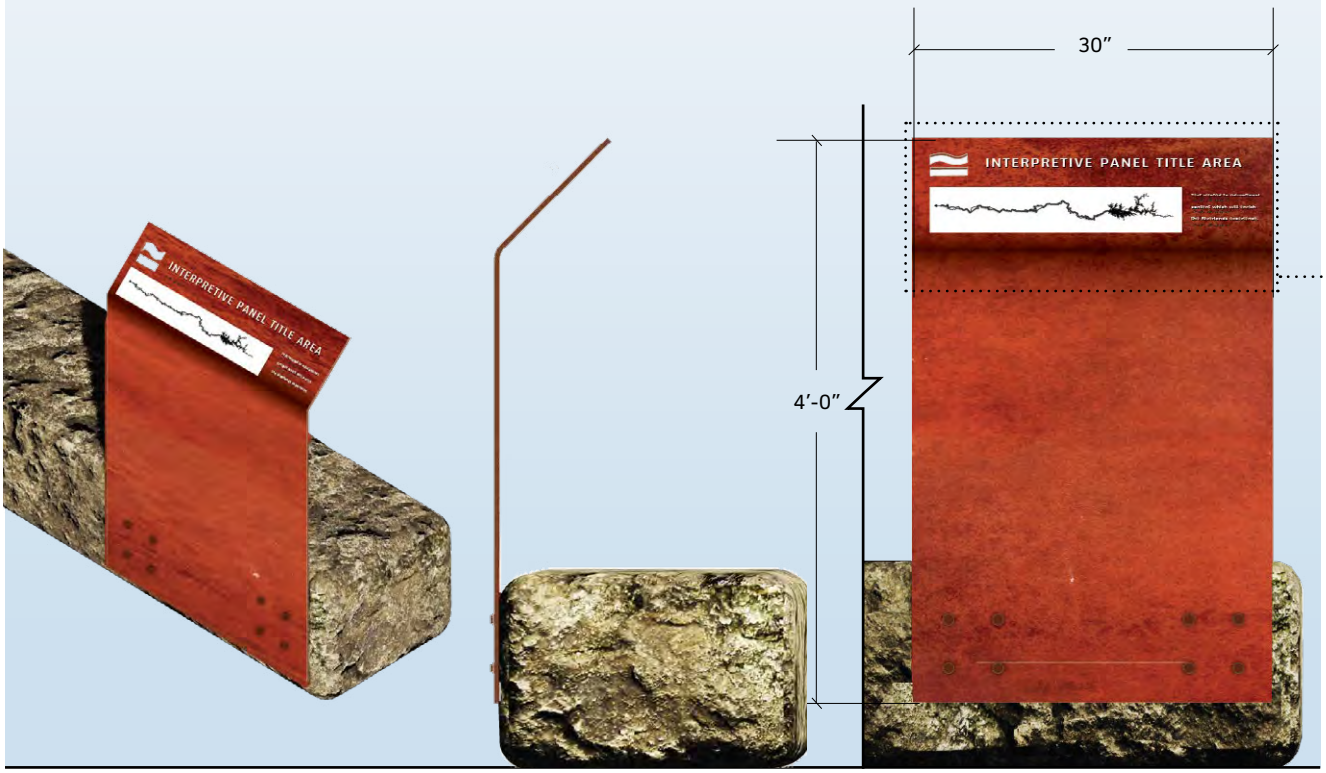
Chattahoochee RiverLands

RIVERLANDS INTERPRETIVE SIGNS

This is the freestanding design option for the Interpretive Signs along the Chattahoochee RiverLands. These signs will be placed in locations of significance or nooks depending on sign content and needs. This sign must follow ADA regulations and be accommodating for all trail users.

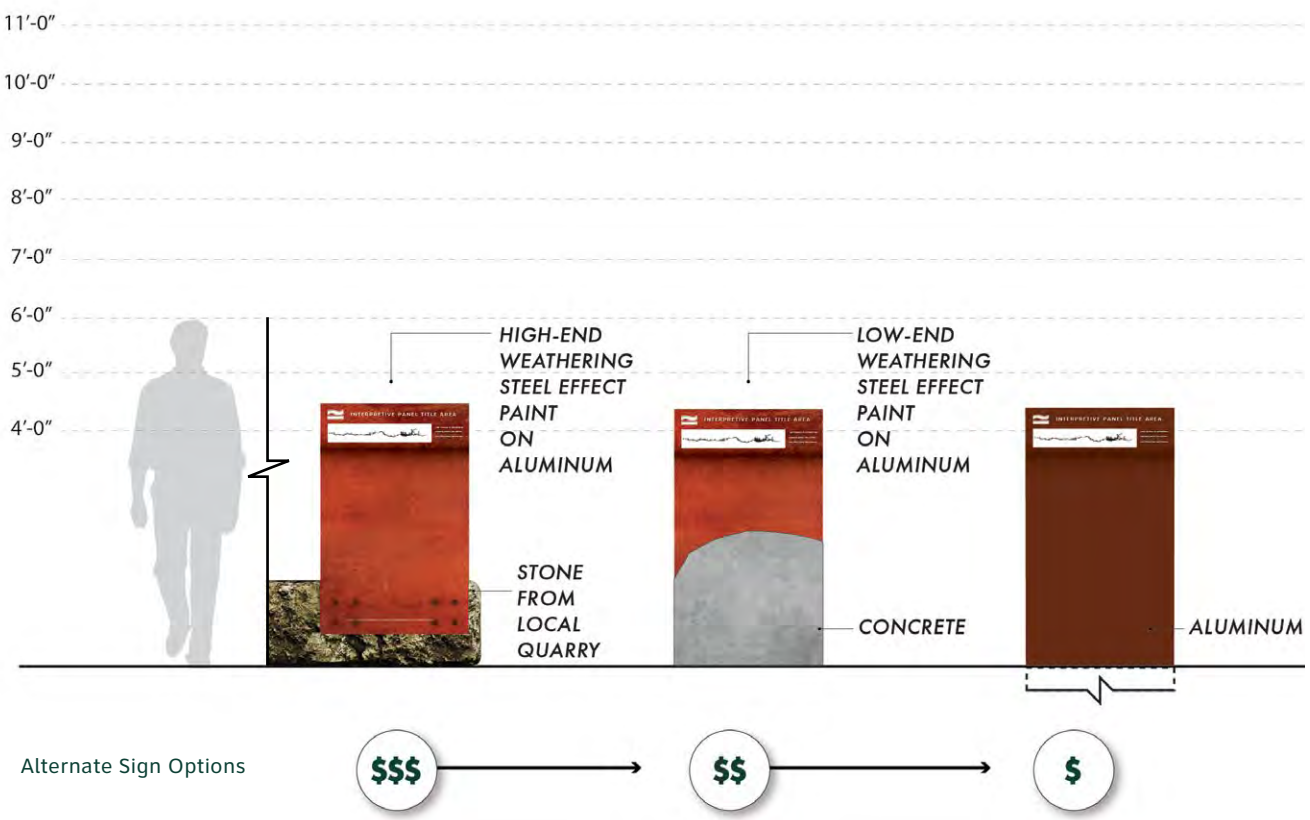
Construction Guidelines

Stone from local quarries will be minimally finished to preserve the individual character of each boulder. Stone podiums will be buried into the ground to provide stability and resilience to flood events. Natural stone will be water jet cut on one side to mount a panel as appropriate. Sign panels will be mounted via coarse threaded bolts. All exposed hardware will be painted to match the sign panel. The logo will be cut out of the sign panel.



Axonometric | Side Elevation | Front Elevation

Recommended Interpretive Sign - Drawings for Illustrative Purposes - Not for Construction



Alternate Sign Options

TITLE
This is where Trailhead Names will exist on the Trail Marker Signs. Message may not exceed 1 line.

Message Example: Information

TEXT, IMAGE, OR GRAPHIC
This space is meant for interpretive text that describes significant elements of the RiverLands. Message must include Braille Grade II Translation.

More Information about Interpretive Content on Pg. 90

Replaceable Sign Content

Plan View

INTERPRETIVE SIGNS CONTINUED

APPLIED INTERPRETIVE SIGNS

Applied interpretive signs are intended to embed a spirit of discovery along the Chattahoochee RiverLands. These signs are not mandatory on the trail but should be seen as an enriching addition to the trail users' journey. Integrating this information into hardscape surfaces and railings can inspire greater engagement with the River and create an exciting environment that enhances the RiverLands identity.

Railing Application: Interpretive Panel
This application will be attached to the canted tops of the boardwalk railings.

Hardscape Application: Embedded Interpretive Disc
Hardscape interpretive applications are shortform messages embedded in concrete along pedestrian sides of the trail.

INTERPRETIVE CONTENT

The Chattahoochee RiverLands provides a rich environment for ecological education and can operate as an "outdoor classroom." Topics that interest trail users of all backgrounds should be considered for interpretive signs. Messaging will be succinct and accessible to all age groups. Below are two significant sign categories that can enrich users' experience.

Natural Content
Signs focusing on natural content highlight and celebrate the rich biodiversity supported by the Chattahoochee River. Topics of interest include ecological restoration, rare or endangered species or ecosystems, or explanations of the natural and human processes that shape the River.

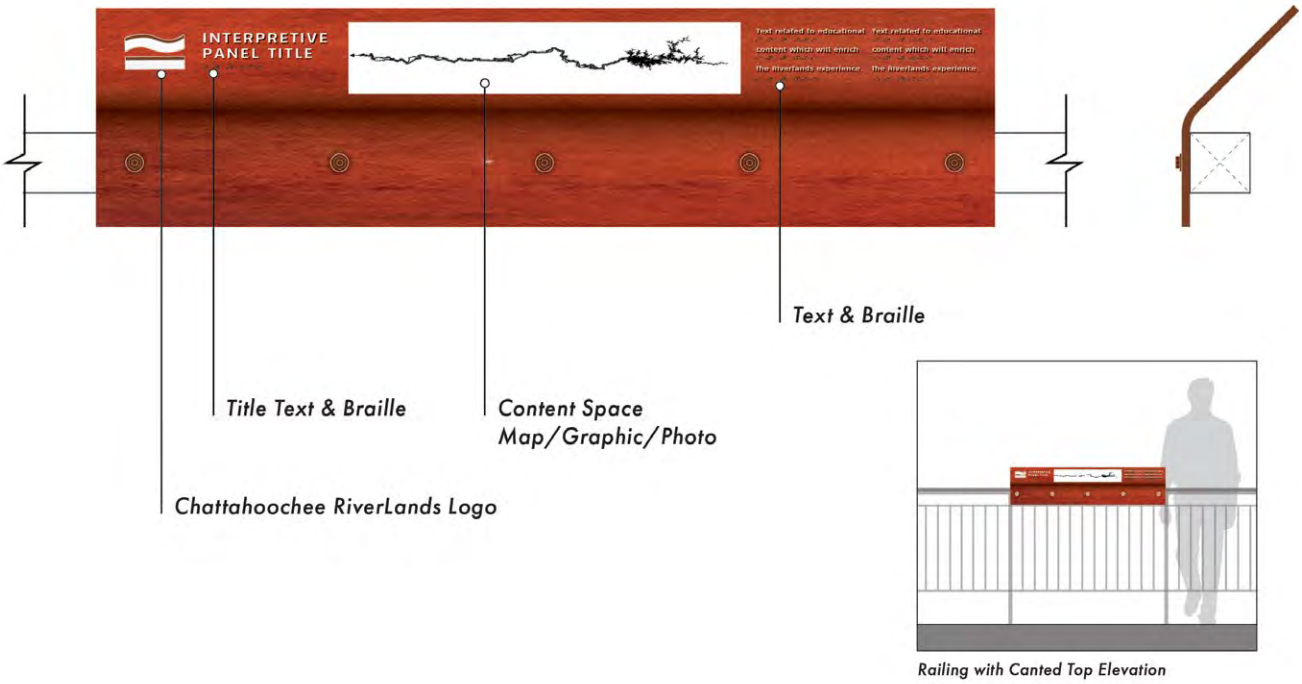
Historic Content
The Chattahoochee RiverLands has a rich cultural heritage that remains relevant today. Bringing this history to light through educational signs along the trail will provide trail users the opportunity to learn and reflect while exploring.

INTERPRETIVE CONTENT IDEAS

NATURAL	HISTORIC
Ecological Restoration	Regional Planning
Land Conservation	Paleo-Indian Period
Habitat Fragmentation	Fishing Weirs
Chattahoochee Crawfish	Rock Shelters
Flood Regulation	Brick Company
Water Filtration	Spanish Explorers
Aquatic Species	Creek Confederacy
Terrestrial Species	1802 State of GA Border
Drinking Water	Treaty of Indian Springs
Sedimentation	Trail of Tears
Shoal Bass Stocking	1836 Railroads
Preventing Pollution	Marietta Paper Mill
Watersheds	1864 "Atlanta Campaign"
Vegetation on the Trail	1889 Cotton Expo
Aquatic Health	1904 Morgan Falls Dam
Tributary Conditions	1906 Race Riots
Floodplains	Dixie Highway
Climate sciences	Holic Policies
Biogeochemistry	Buford Dam Construction
Limnology Discussions	The "River Rats"
Urbanization Impacts	Rambling Raft Races
Alternative Energy	MRPA
Endangered Species	Moore's Bridge Park
Noise & Light Pollution	McIntosh Reserve
Environmental Justice	Old Campbellton
Avian Movement	Recreation Activities
Fish Populations	Activism on the River

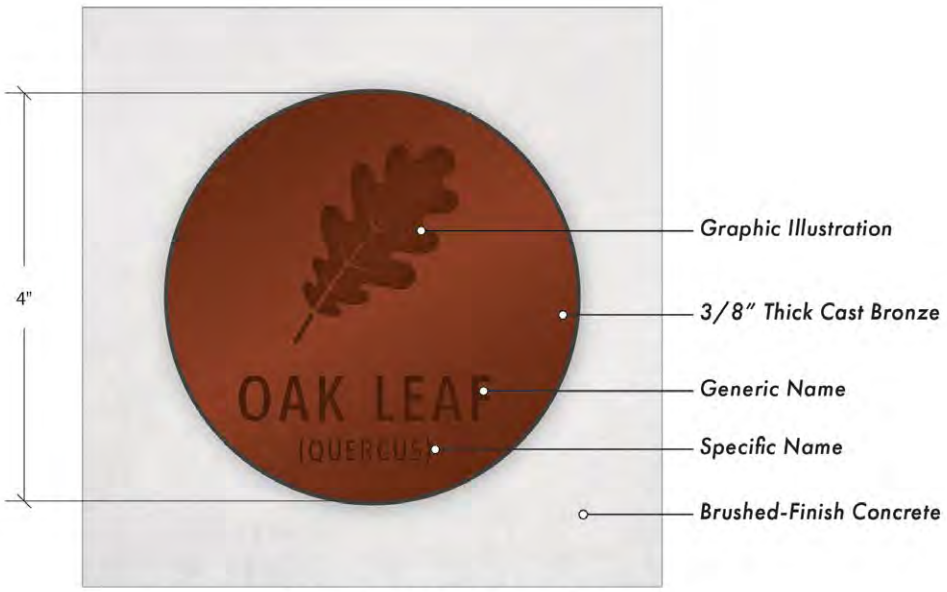
The intention of the list above is to only provide ideas and topics for interpretive content. Implementing agencies may source ideas for content that is not on this list. Further exploration is required.

Implementing agencies must intentionally place interpretive content that relates to sign location.



Railing with Canted Top Elevation

Interpretive Panel Railing Application



Interpretive Disc: Pin mounted with epoxy adhesive flush and set in brushed-finish concrete
Text & Graphic Illustration: Raised 1/32" off of disc face.

Embedded Interpretive Disc Hardscape Application

Terrestrial Species on the Chattahoochee RiverLands

Botanic
- Trout Lilies
- Redbuds
- Serviceberry
- Azaleas

Animals & Fish
- Southern Leopard Frog
- Blue Herron
- River Otter
- Crawfish

Insects
- Blue-Winged Olive Mayfly
- Caddis Flies
- Nymphs
- Leeches

*Further exploration by implementing agencies is necessary

Short-Form Content

Chattahoochee RiverLands

COST SPECTRUM & SIGN SUMMARY

The Chattahoochee RiverLands wayfinding system allows all implementing agencies to customize a trail sign palette based on site conditions, project ambitions, and budget.

COST SPECTRUM RECOMMENDATIONS

Chattahoochee RiverLands ID
Given the prominence and primary location of this sign type, the high-cost option is recommended..

RiverLands Trailhead Marker
Trailhead Markers are located at secondary and tertiary trail entrances. The mid-cost and low-cost options would be appropriate in these instances.

RiverLands Rules Sign
Chattahoochee RiverLands Rules have two installation options depending on site conditions. While mounted panels will be more affordable than all cost alternatives, many site conditions will require a freestanding sign. Implementing agencies may choose the low-cost option with minimal change to overall look and feel.

RiverLands Bicycle Directional
The overall cost of bicycle directional signs will be heavily influenced by the number of destinations that require signs along a length of trail and the materials used. Implementing agencies should use their discretion when selecting alternatives that meet their needs.

RiverLands Pedestrian Directional
Pedestrian directional signs will be viewed close-up by trail users and located in nooks with high traffic. The high-cost option is recommended for this sign type.

RiverLands Mile Markers
Due to the high number of mile marker signs needed along the trails, implementing agencies may use mid-cost and low-cost signs to reduce overall costs. However, as mile markers are a sign type allowed as a retrofit option along existing trails, the more distinctive high-cost option may be appropriate to establish RiverLands identity.

RiverLands Interpretive Sign
Interpretive signs will be viewed close-up by trail users and located in special site conditions with high traffic or significant ecological, cultural, or historic features. The high-cost option is recommended for this sign type.

CHATTAHOOCHEE RIVERLANDS ID

RIVERLANDS TRAILHEAD MARKER

RIVERLANDS RULES SIGN

RIVERLANDS BICYCLE DIRECTIONAL

RIVERLANDS PEDESTRIAN DIRECTIONAL

RIVERLANDS MILE MARKER

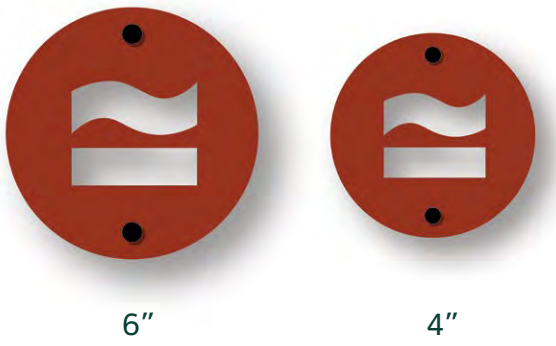
RIVERLANDS INTERPRETIVE SIGN

Chattahoochee RiverLands

RETROFITTING THE RIVERLANDS

This section provides guidance on how to update existing signs to include the Chattahoochee RiverLands branding. Outlined below are three strategies to update signs. These include a branded add-on disc, a vinyl Chattahoochee RiverLands logo, and paint applications.

Due to the expansive nature of the Chattahoochee RiverLands, it is impossible to categorize all existing signs and their placement. Two generic sign examples have been provided to demonstrate retrofitting applications. Ultimately, application of sign retrofitting is up to the implementing agencies' discretion.



6" Disc for Large Signs and 4" Disc for Small Signs

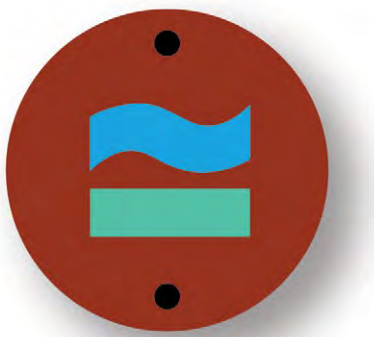
BRANDED ADD-ON DISC

These discs may be applied to signs and applicable surfaces on the trails to indicate to trail users that they are on either the primary, secondary, or tertiary trail routes.

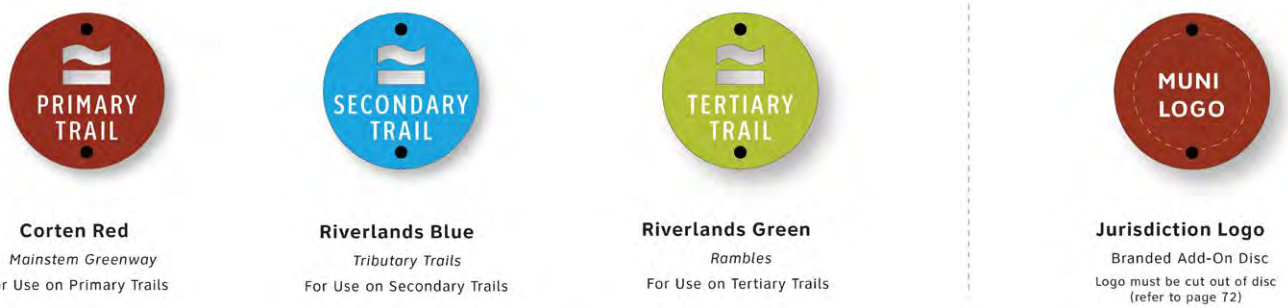
RiverLands Red Disc: Primary Trails
Primary trails are known as the main stem greenway.

RiverLands Blue: Secondary Trails
Secondary trails are known as the tributary trails.

RiverLands Green: Tertiary Trails
Tertiary trails are known as rambles.



Full Color Disc Option for when Cut-Outs Inhibit Readability.



Disc Colors to Designate Trail Hierarchy | Jurisdiction Logo Disc

ADDITIONAL RETROFITTING OPTIONS

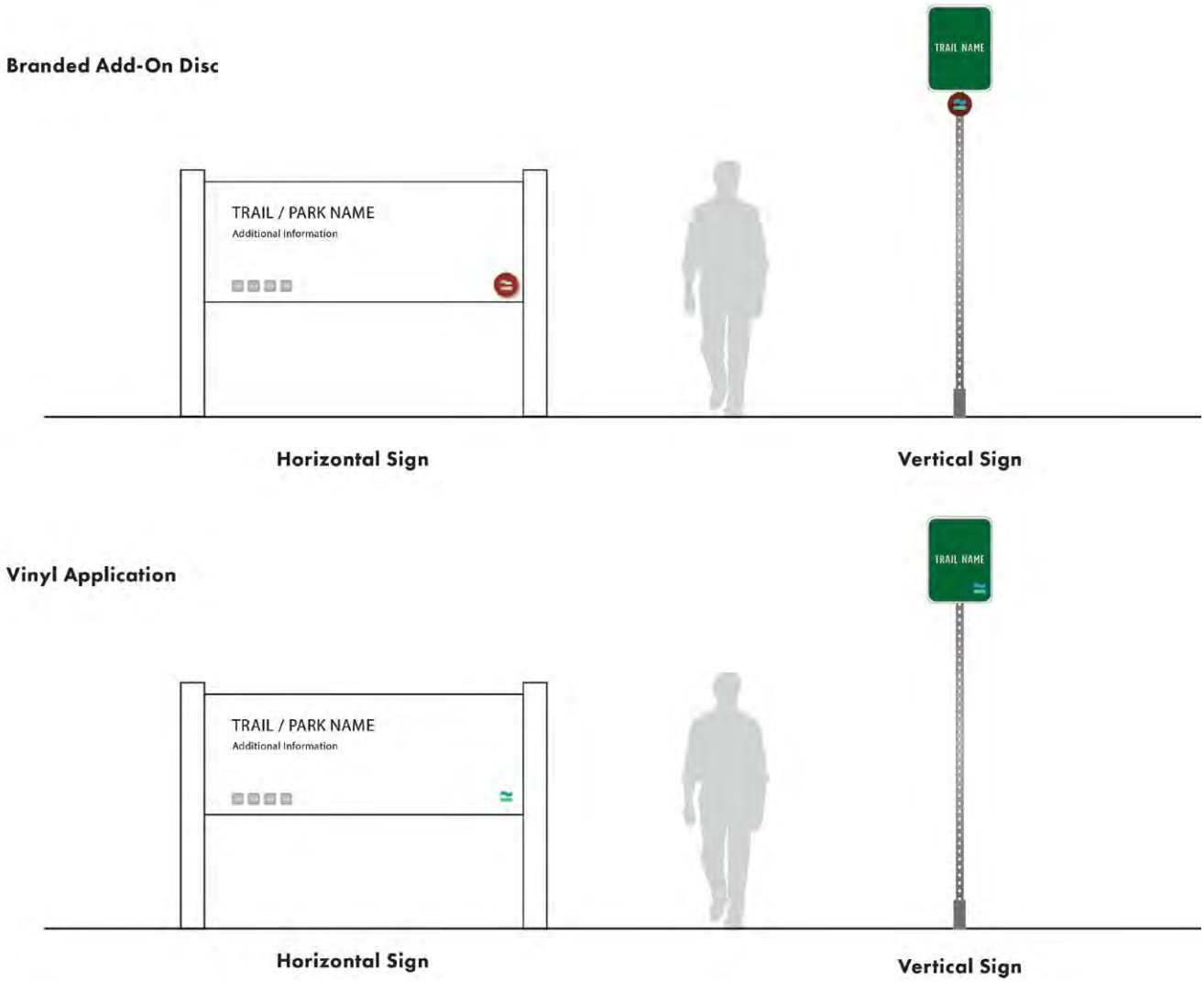
On signs where a branded add-on disc is not appropriate, implementing agencies may apply vinyl stickers or paint the Chattahoochee RiverLands logo on desired surfaces. To maintain consistency, implementing agencies must always place vinyl and paint applications at the bottom right corner of sign panels.

Vinyl Application

Thick vinyl stickers of the Chattahoochee RiverLands Logo may be easily applied to the bottom right corners of sign panels along the Chattahoochee RiverLands. These stickers are durable but may need reapplication in three to five years. Implementing agencies must maintain the look of the vinyl sticker to prolong the life of this application.

Paint Application

Paint is another easily applied option. Paint may be used on sign panels and hard surface material. Implementing agencies may create stencils of the Chattahoochee RiverLands logo to apply the logo on desired surfaces. Paint applications must not exceed 6" in height or be smaller than 4" in height. Implementing agencies must determine which paint product will result in the desired outcome based on the paint surface.



Branded Add-On Disc and Vinyl Application Examples

SIGN PLACEMENT STRATEGY

When implementing agencies are placing signs along the RiverLands, it is important to consider MUTCD (Manual on Uniform Traffic Control Devices) and ADA (Americans with Disabilities Act) Regulations. MUTCD and ADA laws are put in place to protect the public and must be followed to create a safe environment. MUTCD Regulations are for signs that are meant to be read by bicyclists and ADA Regulations are for signs that are meant to be read by all non-vehicular trail users. Implementation of signs will require a wayfinding professional who is familiar with GDOT, MUTCD, and ADA to observe trail and road conditions, and plot sign locations.

SIGN PLACEMENT CONSIDERATIONS

The Chattahoochee RiverLands wayfinding system's goal is to direct and orient trail users along the trail. Placing signs in strategic locations will provide a positive experience to trail users. Wayfinding professionals involved in implementation must also consider destination locations and common decision points along the trail.

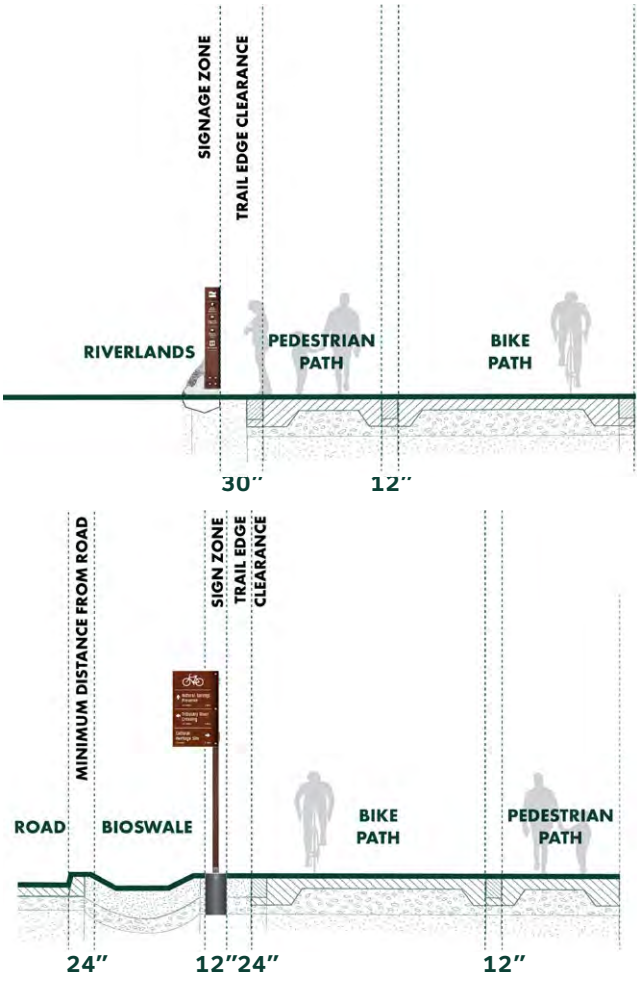
Placement Requirements for Directional Signs
Directional signs must be strategically placed to reduce sign clutter while meeting the needs of both bicyclists and pedestrians. When placing directional signs, destination locations will determine the sign location and messaging. **The sign location of bicycle and pedestrian directional signs on trails must be no farther than 1.5 miles from the destination.**

MUTCD DISTANCE REGULATIONS

Distance From Trail
The nearest edge of any potential obstruction including signs should be a minimum of two feet from the edge of the trail.

Distance from Regulatory Signs
Regulatory signs hold a higher priority over wayfinding signs. Trail signs must be no less than seventy-five feet away from regulatory signs.

Distance from Road
The nearest edge of any potential obstruction, including signs, should be a minimum of two feet from the edge of a road. Signs must also be placed a hundred feet away from turn lanes and road entrances.from turn lanes and road entrances.



Sign Distance from Trail and Road.
Implementation of signs will require further observation of trail and road conditions before placement.

ADA DISTANCE REGULATIONS

Distance From Trail
Signs must be placed a minimum of two feet from the trail.

Clearance Space
Pedestrian directional and interpretive signs must be centered at the back of a 30" by 48" minimum clear ground space. This ensures adequate clearance for people who use wheelchairs or other mobility devices. The clear space may not overlap with the trail width but may overlap with a resting space.

SIGN TYPE	REGULATIONS	FUNCTION	PLACEMENT
Chattahoochee RiverLands ID	———	Welcome & Introduce Visitors to the Chattahoochee RiverLands Trail System	Chattahoochee RiverLands ID signs are located at the most popular & primary entry points. *Quantity: 1 per primary trail entrance*
Trail Head Marker	**MUTCD** **Manual on Uniform Traffic Control Devices**	Inform Bicyclists & Pedestrians when they have entered the trail	Trail Head Markers are located at secondary and tertiary entry points of the Chattahoochee RiverLands. *Quantity: 1 per secondary & tertiary trail entrance* PLACED ON BICYCLE PATH
Chattahoochee RiverLands Rules	**ADA** **Americans with Disabilities Act**	Inform visitors of the trail rules, amenities, & accessibility information	Chattahoochee RiverLands Rules signs should be located at trail entry points, park entries, and amenity entries. *Quantity: 1 per trail, park, or amenity entrance* PLACED ON PEDESTRIAN PATH WHERE APPLICABLE
Bicycle Directional	**MUTCD** **Manual on Uniform Traffic Control Devices**	Direct and orient bicyclists while traveling along the trail	Bicycle Directional signs may be strategically placed 0.5, 1.0, and 1.5 miles from the Destinations indicated on the signs. They must also be located at decision points along the trail. *Quantity: Depends on destinations & site conditions* PLACED ON BICYCLE PATH
Pedestrian Directional	**ADA** **Americans with Disabilities Act**	Direct and orient pedestrians while walking along the trail	Pedestrian Directional signs are strategically placed at decision points along to trail to direct visitors to destinations. They may also be located at nooks. *Quantity: Depends on destinations & site conditions* PLACED ON PEDESTRIAN PATH WHERE APPLICABLE
Mile Marker	**ADA** **Americans with Disabilities Act**	Inform trail users of their location	Trail Markers should be located every 0.25, 0.5, 0.75 & 1.0 Mile increments. *Quantity: 1- 4 per mile* PLACED ON PEDESTRIAN PATH WHERE APPLICABLE
Interpretive Signs	**ADA** **Americans with Disabilities Act**	Inform trail users of historical or natural significance on the trail	Interpretive Signs may be located at Nooks, Boardwalks, or locations of natural and historic significance. *Quantity: Depends on destinations & site conditions* PLACED ON PEDESTRIAN PATH WHERE APPLICABLE

Sign Placement Matrix
Implementing agencies may use this matrix to inform their signage needs.

DESTINATION HIERARCHY

To determine how many directional signs are needed, implementing agencies must understand and strategize where they are directing RiverLands users and how they want those users to move across the landscape.

DESTINATIONS GUIDANCE

When deciding which destinations to include on directional signs, implementing agencies should prioritize destinations that will orient and guide trail users in the most efficient way. Below, destinations have been categorized into tiers of importance starting at Tier 1 for major destinations and Tier 4 for local destinations.

Tier 1 Destinations - Connecting Municipalities
- Counties
- Cities
- Major communities

Tier 2 Destinations - Districts & Neighborhoods
- Districts
- Neighborhoods with significant identities
- State Parks

Tier 3 Destinations - Landmarks & Trail Amenities
- Transit stations
- Major tourist venues
- Regional parks

Tier 4 Destinations - Local Destinations
- Parks
- High schools
- Shopping centers
- Healthcare facilities

Destination Abbreviations

Using universal shortened terms for destinations can free up space on signs and create more appealing graphic layouts. For example, if one of the destinations is called “Cultural Center,” implementing agencies may shorten the destination to “Culture CTR.” Implementing agencies must be consistent in their use of abbreviations to avoid confusion while traveling on the trail.

MESSAGE	ABBREVIATION
Avenue	AVE, AV
Bicycle	BIKE
Boulevard	BLVD*
Center	CTR
Court	CT*
Crossing	X-ING
Drive	DR*
East	E
Hospital	HOSP
Information	INFO
International	INTL
Junction	JCT
Mile(s)	MI
Miles Per Hour	MPH
Minimum	MIN
Minute(s)	MIN
National	NATL
North	N
Parkway	PKWY*
Pedestrian	PED
Place	PL*
Road	RD*
South	S
Street	ST*
Temporary	TEMP
Trail	TR
Turnpike	TPK*
West	W
Please refer to Section 1A.15 of the current MUTCD Guidebook for more information.	
*This abbreviation shall not be used for any Application other than the name of a roadway.	

BICYCLE DIRECTIONAL SIGNS ONLY

TIER 1 • MUNICIPALITIES & TRAILS

Municipalities and Trails act as an overarching destination that guides trail users to their intended destination.
These destinations are at the highest hierarchy on signs because they provide large scale geographic orientation for trail users. All existing municipalities and connecting trails must be signed in order to direct bicycle users in an efficient way.

EXAMPLES: *Johns Creek, The Belt line*

TIER 2 • DISTRICTS & NEIGHBORHOODS

Districts and Neighborhoods provide finer level orientation detail for trail users.
Districts that have been established by local ordinances or are widely known are helpful orientation indicators for trail users. Neighborhoods with local significance may also be included.

EXAMPLES: *Atlanta University City*

BICYCLE & PEDESTRIAN DIRECTIONAL SIGNS

TIER 3 • LANDMARKS & TRAIL AMENITIES

Landmarks & Trail Amenities generate a high amount of travel for all trail users.
Highlighting Landmarks and Amenities will establish the Chattahoochee River Lands as a connecting corridor and will provide trail users with the opportunity to discover what the Chattahoochee RiverLands has to offer.

EXAMPLES: *MARTA, Morgan Falls Overlook Park, Fulton County Charlie Brown Airport, Six Flags, Bowen Homes Site, Moore's Bridge Park, Kayaking, Hooch Boat Ramp*

TIER 4 • LOCAL DESTINATIONS

Local Destinations are the lowest priority destinations.
These destinations may be included on signs in low density areas on the trail and when Tiers 1-3 are not available in that location.

EXAMPLES: *Atlanta Heights Charter School, The Rest Academy, Publix*

ACCESSIBILITY GUIDANCE

The aspiration of accessibility for all was essential to the development of the Chattahoochee RiverLands wayfinding system. The signs included in these guidelines meet all minimum MUTCD and ADA requirements and strive to provide even greater accessibility across the RiverLands. Implementing agencies must follow the considerations outlined below.

CONSIDERATIONS

1. High Contrast Messaging
For signs to have appropriate readability, there must be a 70% contrast between the background and messages.

2. Raised Copy and Braille
Pedestrian signs, including interpretive signs, along the RiverLands must have raised tactile copy and accompanying Grade 2 braille translation. Raised copy must be a minimum of 1/32" raised and must be an uppercase, sans serif font. The font used on signs in Phase 1 is conventional and appropriate for ADA standards. Grade 2 braille translation must be 1/4" raised.

3. Height and Clearance Considerations
Pedestrian signs must be centered to the back of a 30" by 48" minimum clear ground space to ensure adequate clearance for people who use wheelchairs.

Tactile characters on signs shall be located a minimum of 48" above the ground surface, measured from the baseline of the lowest tactile character, and a maximum of 60" above the finish floor or ground surface, measured from the baseline of the highest tactile character

4. Text Size
Signs intended for bike users must have text that is at minimum 2" in height. Pedestrian signs may have text that ranges from 5/8" to 2" in height.

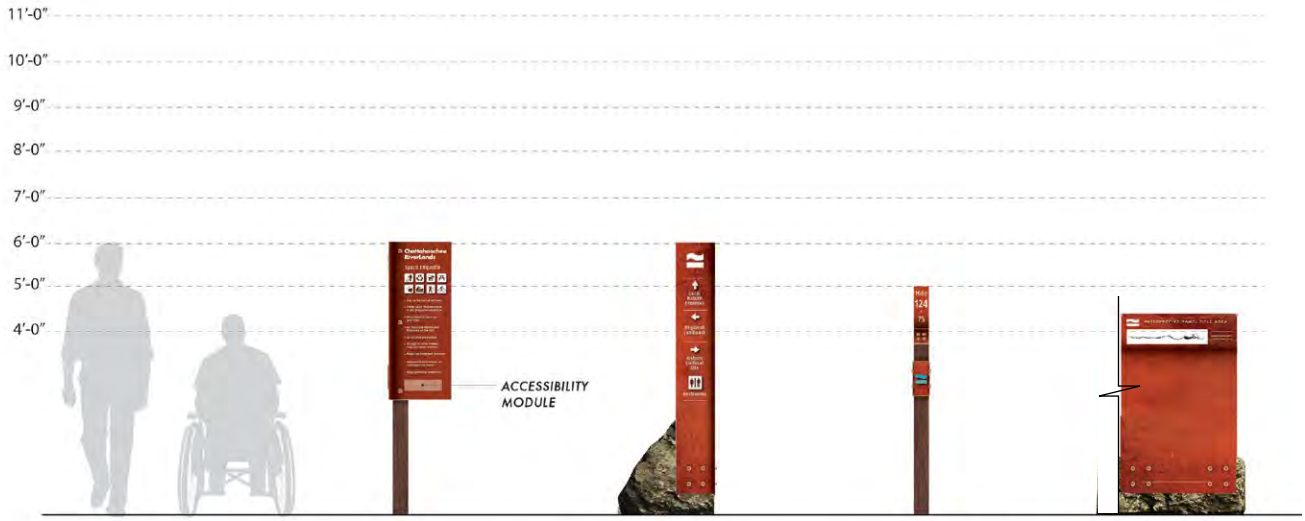
5. Icons for Universal Readability
Using icons that are approved by the MUTCD and the NPS ensures that universal readability is maintained along the trails. Universal icons should be explored and implemented in future design phases.

Text and Braille Height
Braille must be Grade 2 translation.

CHATTAHOOCHEE RIVERLANDS RULES - MODULE
An accessibility module was added to the Chattahoochee RiverLands Rules Signs at trail entries so that trail users can make their own decisions about which trail is appropriate for the amount of time they have available, the people in their group, and the type of hike they are interested in pursuing.
MODULE INFORMATION TOPICS:
Trail Name
Length of the trail
Type of surface on the trail
Typical and minimum trail tread width
Typical and maximum trail grade
Typical and maximum trail cross slope
Height of any major obstacles, such as boulders, in the trail tread
A statement that posted information reflects the condition of the trail when it was constructed or assessed, including the construction or assessment date

Information for Accessibility Module

PEDESTRIAN SIGNS



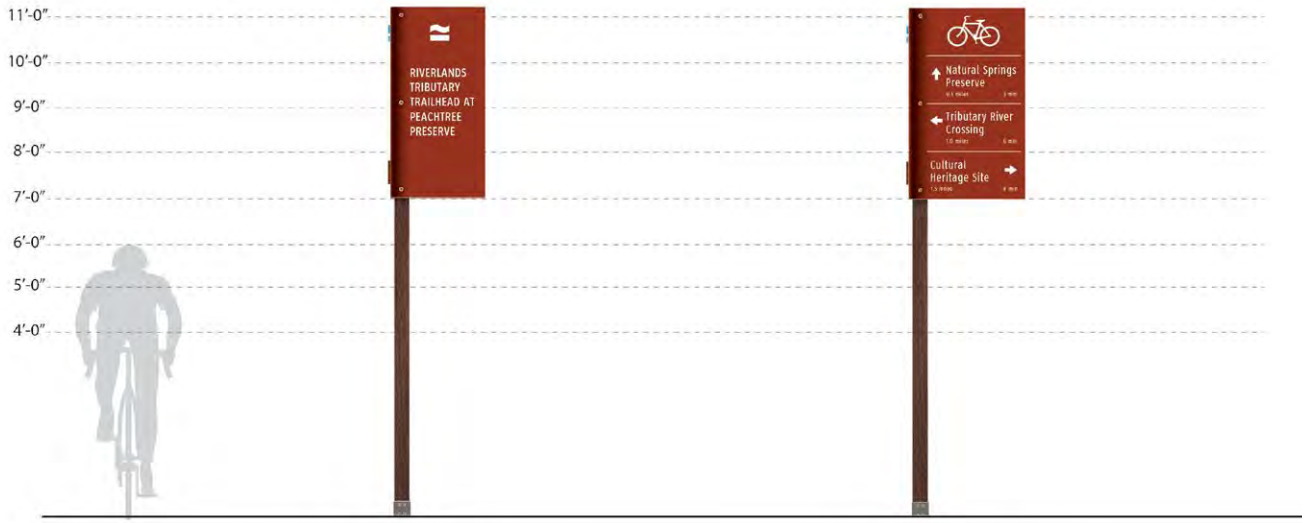
RIVERLANDS RULES SIGN

RIVERLANDS PEDESTRIAN DIRECTIONAL

RIVERLANDS MILE MARKER

RIVERLANDS INTERPRETIVE SIGN

BICYCLE SIGNS



RIVERLANDS TRAILHEAD MARKER

RIVERLANDS BICYCLE DIRECTIONAL

Chattahoochee RiverLands

MUTCD RECOMMENDATIONS

Other than sign placement, the Manual on Uniform Traffic Control Devices (MUTCD) has regulations that are incorporated in the Chattahoochee RiverLands and wayfinding system. While planning destinations on directional signs and throughout future design phases, implementing agencies will need to consider MUTCD regulations to provide trail users with a safe environment.

LIST OF REGULATIONS

1. Bicycle Symbol
A bicycle symbol indicates to trail users that they are on a bike route. On Bicycle directional signs, a bicycle symbol will be placed next to each destination or at the top of the sign identifying a group of destinations.

2. Sign Face
MUTCD signs must use retroreflectorization.

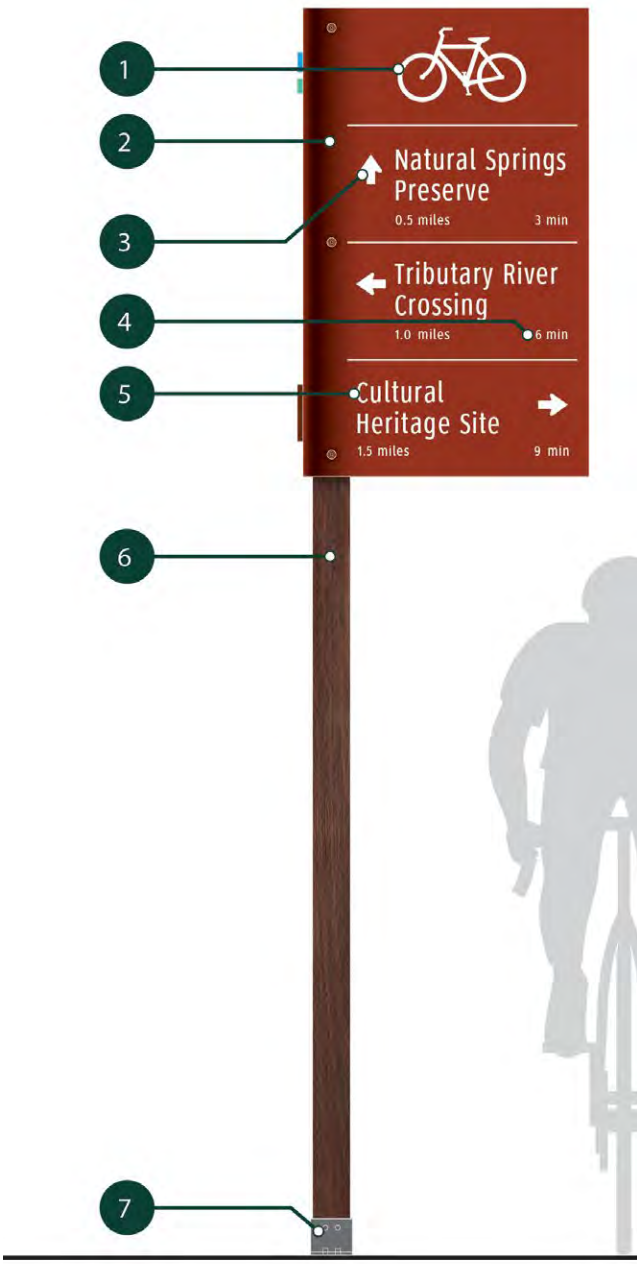
3. Arrow Direction
An arrow pointing to the right, if used, shall be at the extreme right side of the sign. An arrow pointing left or up, if used, shall be at the extreme left side of the sign. Only MUTCD approved arrows may be used on bicycle directional signs. Arrow directions are always ordered up, right, then left.

4. Distance Numerals
The distance numerals will be placed to the right of the destination names. When adding travel time to signs, a “no-sweat” pace of 10 mph or six minutes per mile should be used.

5. Typefaces & Text Height
Messages must be 2.5” in height. Only MUTCD approved typefaces may be used on directional signs. These guidelines use ClearviewHwy 2-W.

6. Height of Sign Panel
Lowest sign panel edge must be seven feet above finish grade.

7. Breakaway Base
MUTCD signs must have a breakaway base.



(R1-1) Stop Sign

(W11-15) Pedestrian and Bicycle Sign

(W11-15P) Trail Crossing (X-ING) Sign

(W16-7P) Crossweb Arrow

(W16-9P) Ahead Sign

(R1-5B) Stop Here For Pedestrians Sign

(R4-7, R4-8) Keep Right and Keep Left Sign

(R10-15) Turning Vehicles Yield to Pedestrians Sign

(R10-3) Pedestrian Signal Information Sign

(W10-2, W10-3) Adapted Railroad Grade Crossing Warning Sign

(R1-2) Yield

REGULATORY SIGNS

The MUTCD, published by the Federal Highway Administration (FHWA), is a compilation of national standards for traffic control devices on all public streets, bikeways, and private roads created to help people navigate roadways and bikeways safely. The following briefly summarizes signs typically used as part of a shared-use trail system.

(R1-1) Stop
Stop signs indicate that drivers must come to a stop and yield to pedestrians and approaching vehicles before proceeding. They should be used in locations where a minor road or trail intersects with a main road or trail, unsignalized intersections, or locations with high speeds, restricted views, or as determined by crash records.

(W11-15) Pedestrian and Bicycle
The W11-15 sign is a vehicular traffic warning sign and may be used to alert road users to locations where unexpected entries into the roadway by bicyclists and pedestrians may occur.

(W11-15P) Trail Crossing (X-ING)
TRAIL X-ING is a supplemental plaque that may be mounted below the W11-15 sign. The sign may be used where both bicyclists and pedestrians will be crossing the roadway.

(W16-7P) Crosswalk Arrow
The downward pointing arrow is a supplemental plaque that may be mounted below the W11-15 and W11-15P signs to point to where pedestrians and bicyclists might be crossing the roadway. Left and right options are to be utilized depending on the crossing orientation.

(W16-9P) Ahead
The AHEAD plaque may be used to supplement W11-15 and W11-15P signs to provide advance warning of pedestrian and bicyclist crossings. When used with a warning sign, the W16-9P sign shall have the same legend, border, and background color as the warning sign with which it is displayed.

(R1-5B) Stop Here For Pedestrians
R1-5B signs are to be utilized if stop lines are used in advance of a marked crosswalk that crosses an uncontrolled multi-lane approach.

(R4-7, R4-8) Keep Right and Keep Left
R4-7 or R4-8 signs should be placed where it is necessary for traffic to pass only to the right- or left-hand side of a roadway feature or obstruction, such as a raised pedestrian refuge island.

(R10-15) Turning Vehicles Yield to Pedestrians
R10-15 signs are to be utilized to remind drivers making a turn to yield to pedestrians.

(R10-3) Pedestrian Signal Information
The R10-3 series of signs may be used to improve pedestrian experience at signalized intersections by highlighting the pedestrian signal types and information.

(W10-2, W10-3) Adapted Railroad Grade Crossing Warning
Some states (Colorado and Virginia) have adapted forms of the parallel railroad grade crossing signs (W10-2 and W10-3) to warn road users making turns that they will encounter a shared-use trail crossing soon after making the turn.

(R1-2) Yield
Yield signs assign right-of-way to traffic on certain approaches to an intersection. Vehicles controlled by a yield sign need to slow down to a speed that is reasonable for the existing conditions or stop when necessary to avoid interfering with conflicting traffic.


TRAIL CROSSINGS

CROSSING CONDITIONS

The design and treatment of trail intersections, especially where trails meet roadways, is an important component of the overall RiverLands network. Roadway crossings, and particularly intersections, can be challenging to navigate and are some of the places trail users are most vulnerable to injury. The vulnerability of all non-motorized and motorized users must to be considered when designing where these groups interact. This includes bicyclists, pedestrians, scooter users, those in walkers or wheelchairs and more. This section provides guidance on the design of various types of crossings and intersections with suggestions rooted in existing regulations and best practices.

UNCONTROLLED CROSSINGS

When a trail crosses a road more than 400' from an existing traffic signal, mid-block or unsignalized crossings can provide a dedicated crossing without requiring trail users to travel out of their way. Crosswalk markings are the bare minimum required to establish a legal crossing. These should be paired with signs, speed tables or raised crosswalks, and/or raised medians or pedestrian refuge islands, depending on conditions. High-visibility crosswalk markings and signs alone or a speed table with crosswalk markings are alternatives for right-of-way constrained contexts. Designing crossings at uncontrolled locations requires consideration of vehicular traffic, line of sight, trail traffic/use patterns, vehicle speed, road type (width and lanes), and user right-of-way.

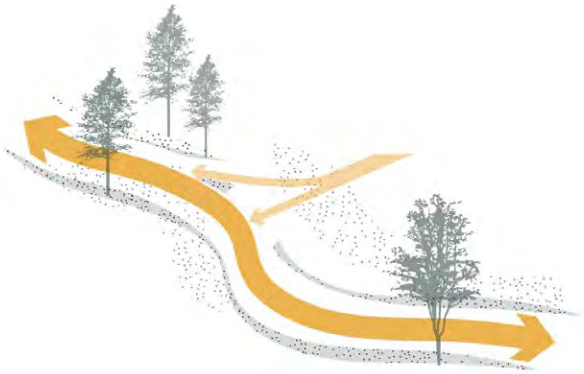
TRAIL AT TRAIL CROSSINGS

Where two trails of any type meet, the primary focus should to make users aware that they are approaching an intersection and to alert them that they may encounter people using different modes of transportation coming from different directions. A combination of design strategies, pavement or trail markings, and signs can help maximize safety, efficiency, and comfort in these scenarios. Factors such as the volume of cyclists, pedestrians, and other users, along with sight distance, surrounding context, the configuration of intersecting trails, and topography should all be considered.

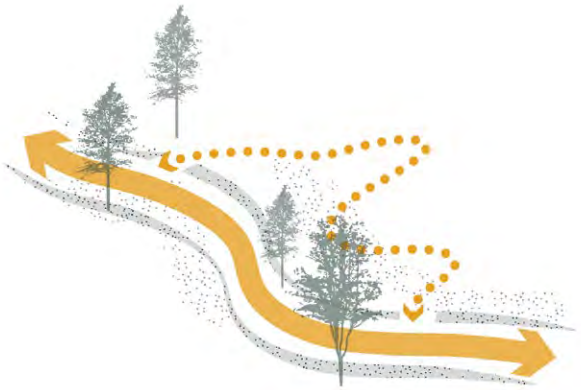
SIGNALIZED CROSSINGS

Signalized crossings provide the most protection for bicyclists and pedestrians, increasing safety and comfort. Signals come in the form of rectangular rapid flashing beacons (RRFBs), pedestrian hybrid beacons (PHBs), and full traffic signals. Each signal should be accompanied by high-visibility crosswalk markings, stop bars or yield markings as appropriate, and signs.

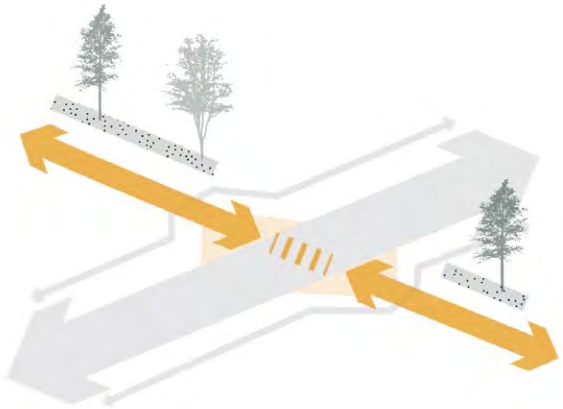
Best practices, standards, and guidance exist on the use of signals to facilitate crossing along shared-use paths; however, engineering judgment and the specific context of the location should be considered for each crossing. Factors such as speed, daily traffic volumes, bicycle, and pedestrian volumes, the number of lanes, and setting are important considerations.



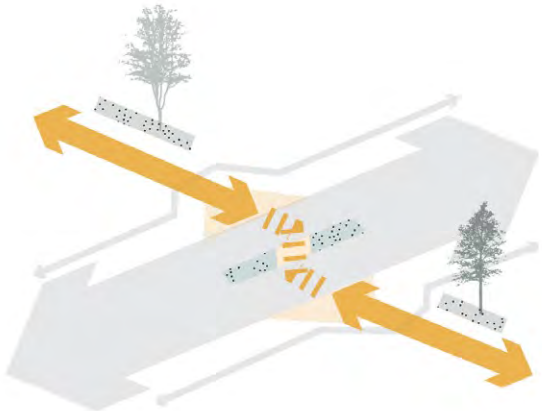
TRAIL AT EXISTING OR TRIBUTARY TRAIL



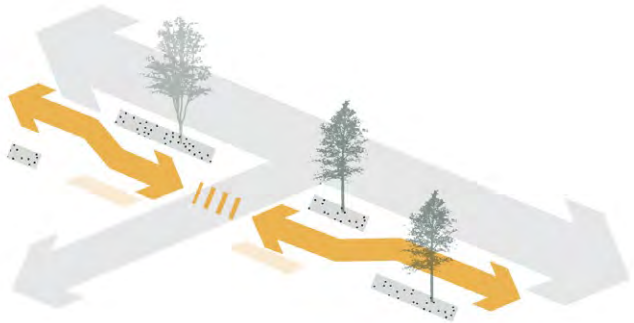
TRAIL AT PEDESTRIAN RAMBLE



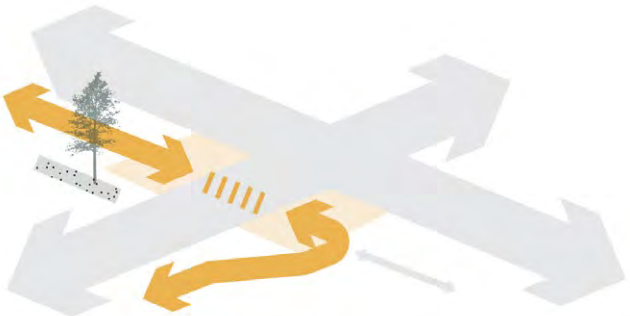
TRAIL AT MINOR ROAD MIDBLOCK



TRAIL AT MIDBLOCK WITH RAISED ISLAND



TRAIL AT MINOR ROAD SIDE STREET



TRAIL AT SIGNALIZED INTERSECTION

TRAIL AT EXISTING OR TRIBUTARY TRAIL

Throughout the Chattahoochee RiverLands, there are places where the main stem meets existing trails or potential future tributary trails. The RiverLands main stem is comprised of a shared-use path with two bi-directional spaces, one for pedestrians and the other for cyclists and other wheeled vehicles. Most of the existing trails, and potentially some of the tributary Trails, are not separated by mode of travel. At these places where the two types of trails come together, it will be important not only to provide branded and directional signs, but also to make intuitive connections that help pedestrians, bicyclists, and others safely and comfortably navigate the transition.

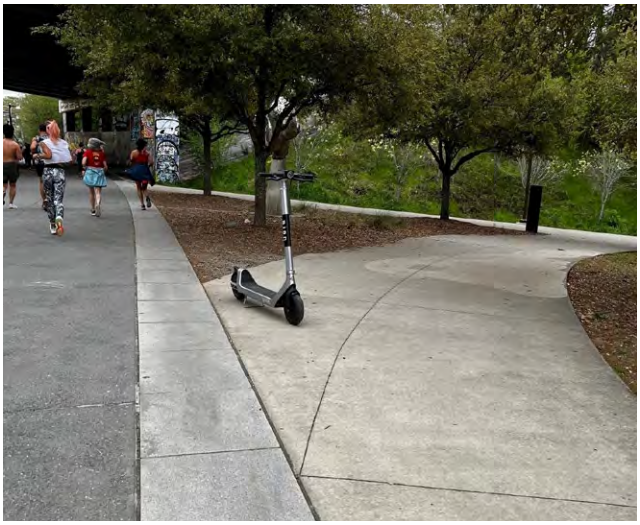
Where two trails intersect, the primary focus should be to make users aware that they are approaching an intersection and to alert them that they may encounter people using different modes of transportation coming from different directions. This can be achieved through a combination of engineering, design, and signage.

TYPICAL DESIGN APPLICATION

- Strive for unobstructed sight lines
- Where space permits, use curves to slow bicycle traffic on the approach to a connecting trail
- Allow sufficient room for trail users traveling in different directions to enter the existing or tributary trail separately from one another to reduce conflicts
- Include directional signs at all intersections.
- Provide a mixing zone in advance of the crossing to allow adequate space for users to congregate safely. A distance of 25’ is preferred. Separate entrances for pedestrians and bicyclists should be provided to minimize conflicts.
- Apply rumble strips in a gradual spacing pattern on the approach to the trail crossing. For spacing, refer to the Trail at Pedestrian Ramble detail enlargement.

DESIGN STRATEGY

- Consider using textured surfaces or pavers in the space where two trails meet to reiterate this is a mixing zone. Where space permits, provide separate entrances for pedestrians and cyclists to reduce potential conflicts.
- Communicate that trail users along the “entering” trail must yield to through traffic along the primary trail.

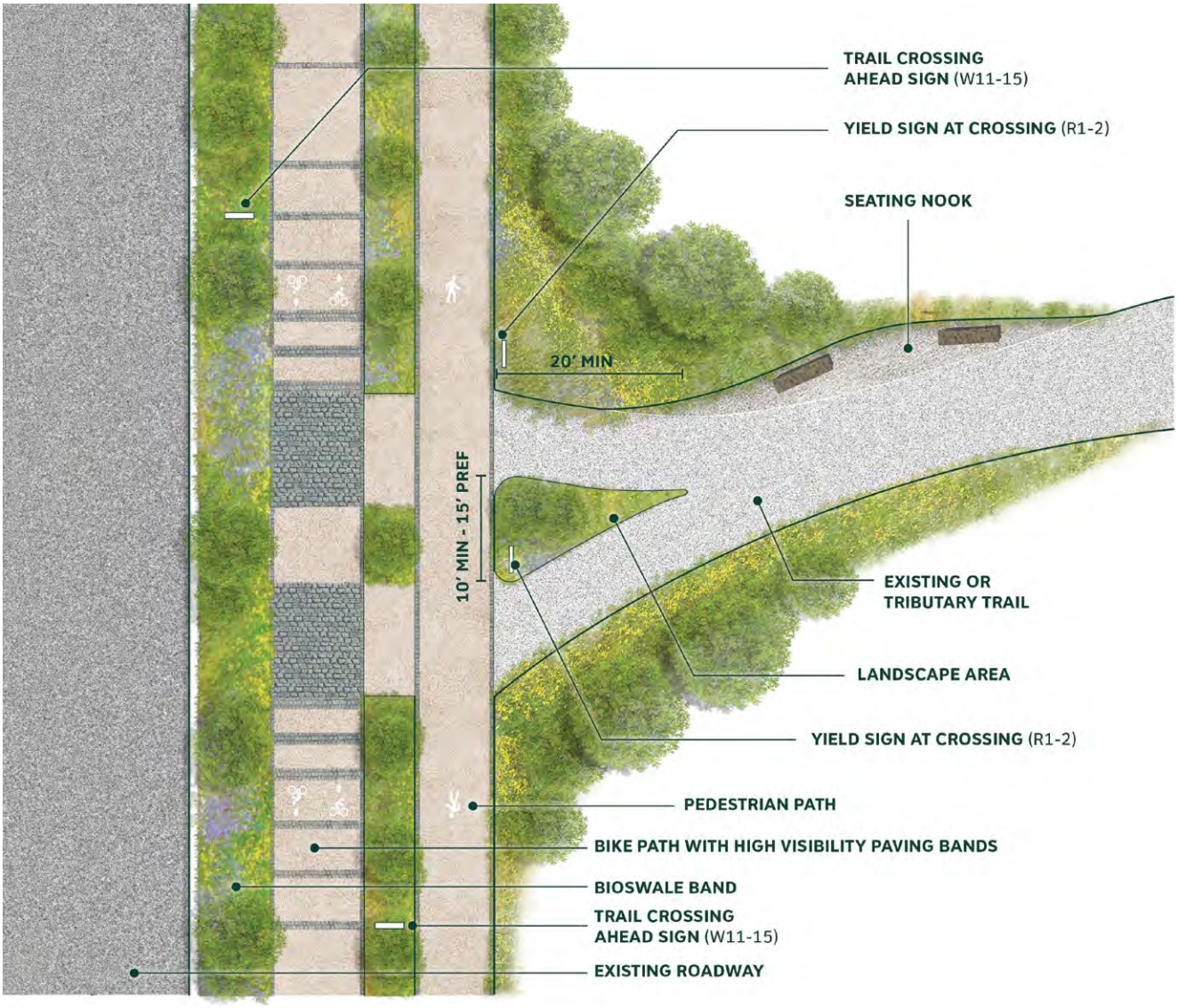


Atlanta Beltline at Freedom Park Trail Connection

OTHER CONSIDERATIONS

In some cases, the main stem and existing trail will not meet at intersections or angles but will be adjoining segments in the same alignment. Close collaboration with local agencies and jurisdictions will be essential in designing a seamless transition. Agencies should consider roadway geometry and the MUTCD when integrating multiple countermeasures.

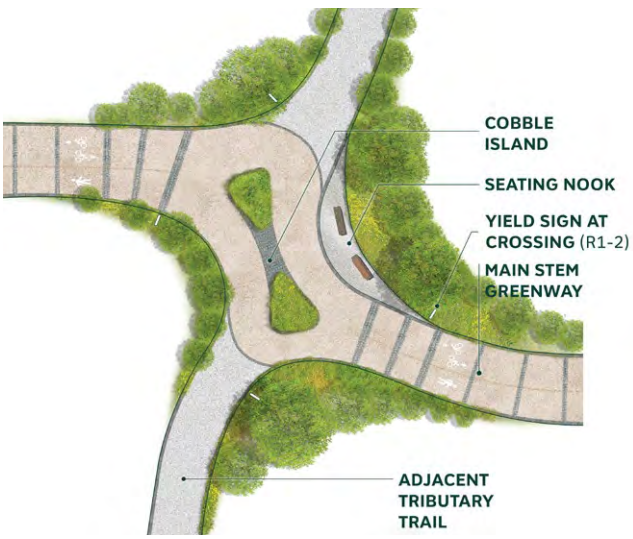
- Consider off-setting the trail intersection and creating two three-way intersections rather than one four-way intersection to reduce conflicts.



Trail at Existing or Tributary Trail

OTHER CONSIDERATIONS
TRAFFIC CIRCLE

A traffic circle design may be a viable alternate option in situations where high volumes of a mix of users (cyclists, pedestrians, skaters, and others) are anticipated at a 4-legged (or more) intersection. Traffic circle style intersections can help slow user speeds, provide adequate sight distance to oncoming traffic, and clarify expected operations. Introducing a new pavement material, paver, or surfacing is another useful notification and speed reduction technique. Consider using low-growing and minimally spreading vegetation to maintain clear sight lines. Material such as boulders or public, art can also be used to discourage people from cutting across the center island.



Trail at Existing or Tributary Trail: Traffic Circle

TRAIL AT PEDESTRIAN RAMBLE

Unpaved or compacted earth accessory trails are often located in the remote and natural areas along the RiverLands corridor. These trails, designed for use by pedestrians, can vary in width, and condition, and can often appear abruptly out of wooded areas. Providing clear sight distance and signs are important to draw attention to unexpected crossings.

TYPICAL DESIGN APPLICATION

- Strive for unobstructed sight lines
- Design trails to intersect at 90-degree angles where possible because of the speed differentials between potential users.
- Divide the multi-use trail a minimum of 20 feet before the crossing to separate trail uses between bicycle and pedestrian.
- Separate the trail with a landscaped median if existing conditions allowing. The landscape median should be a minimum of 10’ to provide adequate planting area.
- Continue main shared-use path paving across the crossing median connection for visual continuity. The preferred edge treatment is a continuous granite paver edge, flush with shared-use path bicycle and pedestrian trails.
- Provide a flush transition between differing surfaces.
- Incorporate rest areas for user comfort. Furnishings such as benches and bike racks should be installed and educational, and directional signs should be developed.
- Provide signs to remind bicyclists to yield to pedestrians.
- Apply rumble strips in a gradual spacing pattern on the approach to the trail crossing. For spacing, refer to the Trail at Pedestrian Ramble detail enlargement.

DESIGN STRATEGY

- Crossings should be designed to accommodate all shared-use path user groups.
- Natural unpaved or compacted earth accessory trails should be considered pedestrian only.
- Slope should not exceed 30% for natural surface trails to limit the recurring maintenance needed. Avoid grades greater than 4% when connecting with unpaved, earthen, or aggregate trails.

Atlanta Beltline at Eastside Trail Connection

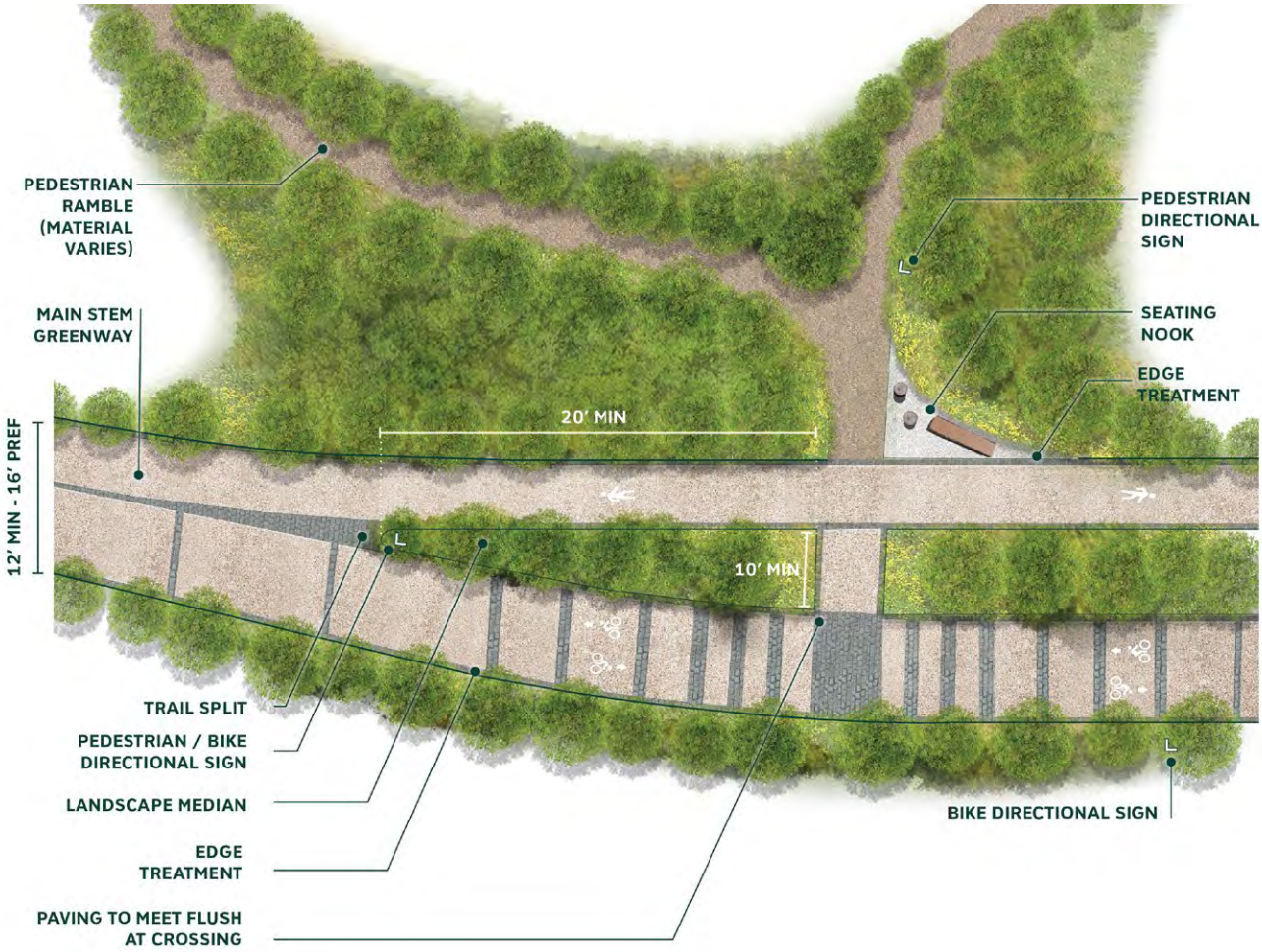
Trail Connection

OTHER CONSIDERATIONS:

- Trail use educational signage is imperative to maintain the condition of unpaved surfaces
- Curbing should be used to retain aggregate and control braiding.
- Consider e-scooter parking near bike parking locations.

ALTERNATE MARKINGS

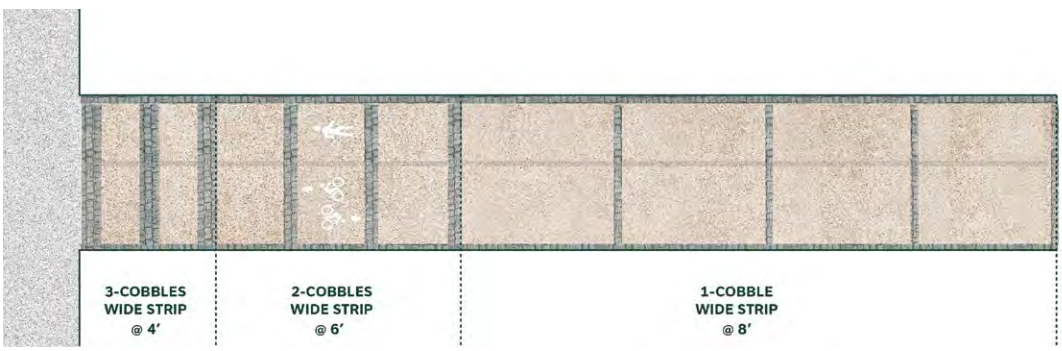
- Painted markings.
- Granite Pavers.
- Differing concrete finishes: sandblast or exposed aggregate.
- Permeable pavers, where limited tree canopy exists or maintenance is minimal.



Trail at Pedestrian Ramble

RUMBLE STRIP STRATEGY

Rumble Strips are flush at grade markings or pavers to alert the main stem greenway user to slow speed of travel. Due to the sudden changes in speeds at crossings, users usually do not adapt and underestimate their traveling speed. The preferred spacing is an adapted design from a NYSDOT roadway condition to the average speed of a bike trail and users. This study's aim is to improve the safety at transition zones by introducing perceptual measures. These rumble strips aim to produce the impression of decreased speed that could stimulate users to better adapt the transition mixing zones as they approach a crossing. Strips should be applied on the approach to the trail crossing in a gradual spacing pattern: markings are spaced farther apart initially and get closer together as one approaches the trail crossing, as illustrated in the diagram below.



TRAIL AT MID-BLOCK MINOR ROAD

Where the RiverLands main stem crosses moderate-to-low-speed streets at mid-block locations, the crossing strategy should prioritize of bicyclists and pedestrians over vehicles. Drivers will be alerted where low speeds are to be maintained. This mid-block location should be focused on roadway conditions where the crossing is a significantly desired connection.

Rectangular Rapid Flashing Beacons (RRFBs) are used to alert and warn motorists that bicyclists and pedestrians are present. They use high-intensity signal heads that flash in a rapid flickering pattern. RRFBs are proven to improve safety and user stopping rates and are a low-cost alternative to full pedestrian hybrid beacons (PHB).

TYPICAL DESIGN APPLICATION

- High visibility crossing markings split by uses are preferred. Green paint can be used to designate bike lane crossing and crosswalk pedestrian markings per MUTCD and GDOT Guidelines.
- Rectangular Rapid Flashing Beacons (RRFB) will supplement post-mounted signs, at least two W11-2, W16-7P, S1-1, or W11-15 crossing warning signs to be installed at the crosswalk, one on the right-hand side of the roadway and one on the left-hand side of the roadway. On a divided highway, the left-hand side assembly should be installed in the median, rather than on the left-hand side of the highway.
- Advance pedestrian / bicycle trail crossing signs and ahead plaque located before the crossing per GDOT Signage and Marking Guidelines.
- Pedestrian / bicycle crossing sign, trail x-ing, and downward arrow sign to be located at the crossing.
- Stop lines at mid-block signalized locations should be placed at least 40 ft in advance of the nearest signal indication.
- Stop here for pedestrians signs should be placed at the stop bar.
- Bicycle lane word and/or symbol arrow markings should be used to define the bike lane and designate the portion of the street for preferential use by bicycles.
- Installation of required curb ramps at all crossing locations to meet ADA standards and regulations.

Rectangular Rapid Flashing Beacon (RRFB)

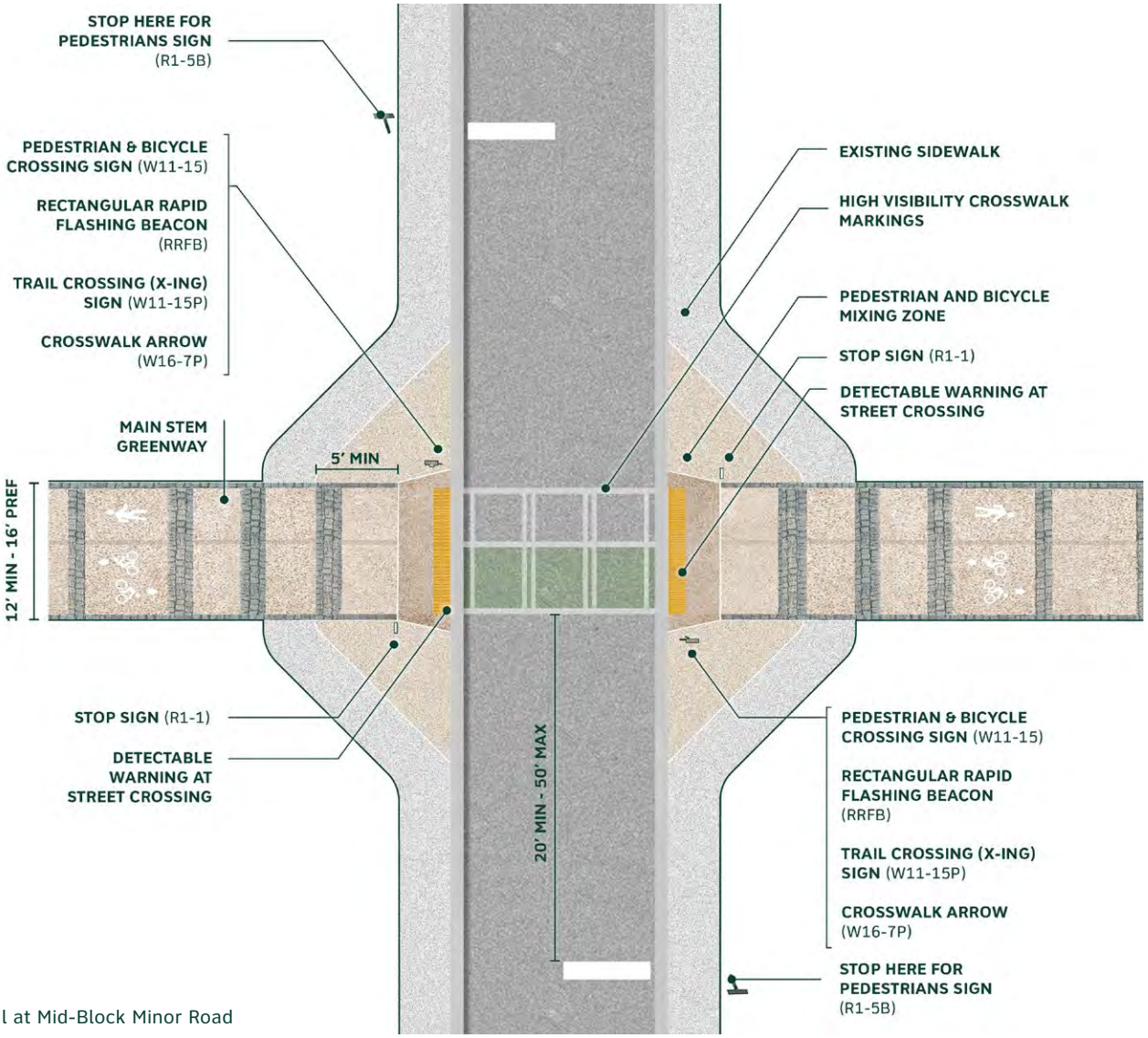
Pedestrian Hybrid Beacon (PHB)

OTHER CONSIDERATIONS:

Pedestrian Hybrid Beacon (PHB)

Pedestrian hybrid beacons (PHBs) are traffic control devices that help pedestrians (and cyclists) safely cross higher-speed roadways at mid-block locations and uncontrolled intersections.

- PHBs are an intermediate option between a flashing beacon and a full pedestrian signal because they assign right-of-way and provide positive stop control. They should be used where speed limits exceed 35 MPH.
- Typical application: Locations where pedestrians need to cross multiple lanes, and vehicle speeds or volumes are high. Refer to the MUTCD for details.



Trail at Mid-Block Minor Road

DESIGN STRATEGY

- See FHWA Proven Safety Countermeasures and the MUTCD Interim Approval 21 for details.
- Minimum pedestrian volume, speed limit, nearest controlled crossing, and other important traffic data should be considered.
- Aim to keep crossing distances as short as possible.
- Stripe the crosswalk as wide or wider than the walkway it connects to.
- Consider "No Motor Vehicles" signs at trail entrances to reinforce the trail is for non-motorized vehicles.
- Apply rumble strips in a gradual spacing pattern on the approach to the trail crossing. For spacing, refer to the Trail at Pedestrian Ramble detail enlargement.
- As an option, consider connecting the two sides of the RiverLands main stem greenway with an accessible crosswalk level with the sidewalk (raised crossing) to help slow vehicular speeds, increase yielding rates, and clarify road user priority.
- Parking should be prohibited in the area between the yield or stop line and the crosswalk.

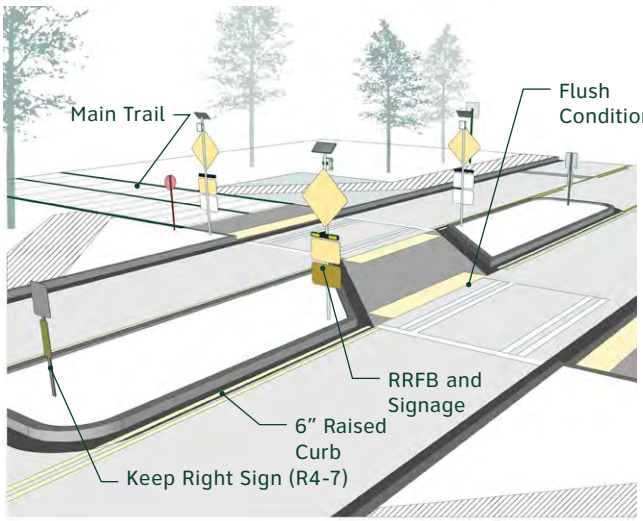
TRAIL AT MID-BLOCK WITH RAISED PEDESTRIAN ISLAND

Median pedestrian refuge islands provide a protected space to better support safe crossing of a minor roadway. This reduces the overall crossing distance by allowing the crossing of one direction of traffic at a time. Pedestrian refuge islands used in combination with marked crosswalks have been proven to reduce pedestrian crashes. They should be considered in curbed sections of urban and suburban multi-lane roadways, especially where a significant mix of pedestrian, bicycle, and vehicular traffic is expected. They should also be considered in areas with moderate posted speed limits and moderate traffic volumes. Where conditions allow, the pedestrian refuge highlights the priority of the RiverLands main stem and crossing right-of-way.

TYPICAL DESIGN APPLICATION

- A marked crosswalk without a full traffic signal consists of a raised median refuge island, high-visibility crosswalk markings, and signage.
- Islands should be at least 6’ wide, though 8-10’ is preferred. The island would ideally be 40’ long.
- Any roadway with three lanes or a median that is at least 8’ wide, or where wide travel lanes can be narrowed, can be retrofitted to provide at least 8’ of space for the island.
- The cut-through of the ramp should equal the width of the crosswalk.
- The crossing should be flush with the roadway paired with ADA compliant detectable warning surfaces.
- The island height should be 6 inches minimum.
- Reflective markers should be located at the nose of the island facing the approaching traffic.
- Stop lines at mid-block signalized locations should be placed at least 40’ in advance of the nearest signal indication.
- Stop here for pedestrians signs should be placed at the stop bar.
- Stop Signs (MUTCD R1-1) should face bicyclists and pedestrians along the shared-use path on both sides of the crosswalk.
- Advance warning bicycle/pedestrian signs should be used per MUTCD guidelines.
- Curb ramps should be provided at all crossings to meet ADA standards and regulations.
- Apply rumbler strips in a gradual spacing pattern on the approach to the trail crossing. For spacing, refer to the Trail at Pedestrian Ramble detail enlargement.

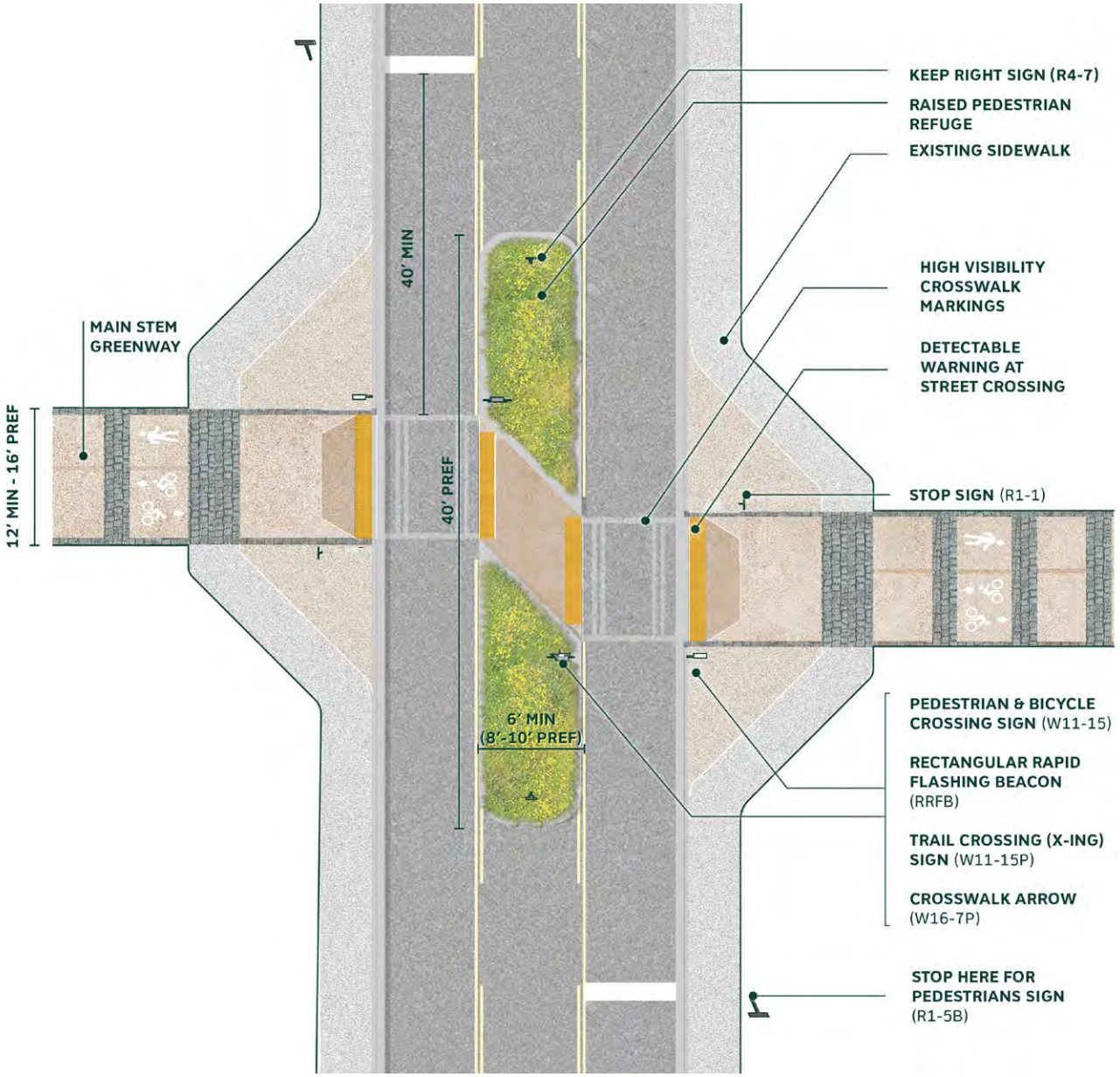
Angled Pedestrian Refuge Island with Landscape



Raised Pedestrian Refuge Island

OTHER CONSIDERATIONS

Landscaping should not block sight line or user visibility. Shrubs and groundcovers should meet GDOT height standards. Trees and shrubs are to be continuously maintained to not reduce visibility.



Trail at Mid-Block with Raised Pedestrian Island

DESIGN STRATEGY

- Where a trail intersects a street more than 400' from an existing traffic signal, a mid-block crossing can give trail users a dedicated, legal crossing without requiring them to travel out of their way to an existing signal.
- Engineering judgment and the context of the location should be considered when designing any crossing.
- Conditions at minor street mid-block crossings can vary depending on speed, number of lanes, and traffic volume. Existing conditions should be considered to determine the best application of safety and comfort of the shared-use path. Where the raised pedestrian island condition is combined with the Rectangular Rapid Flashing Beacon (RRFB), the two features can provide a highly visible crossing that increases safety.
- Lighting will improve the visibility of the crossing.
- Place "No Motor Vehicles" signs at trail entrances to reinforce that the trail is for non-motorized vehicles.
- A raised pedestrian island condition can be considered where a center turn lane or median can allow the space for the island.

TRAIL AT MINOR ROAD SIDE STREET CROSSING

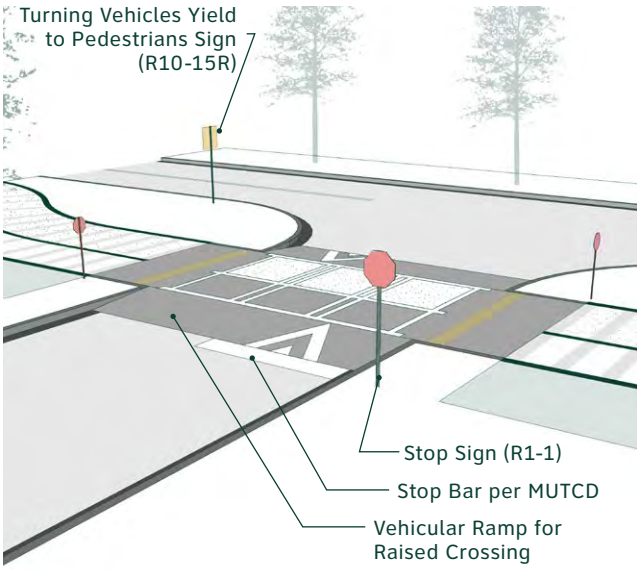
Side street crossings are somewhat common in suburban or urban settings where the RiverLands travels alongside or parallel to existing roadways. Bicyclists riding against traffic and crossing through intersections alongside paths are at the greatest risk for crashes. Crossings should bring attention to the presence of bicyclists and pedestrians.

TYPICAL DESIGN APPLICATION

- Crossing design should emphasize visibility and clarify expected yielding behavior.
- Crossings may be STOP or YIELD controlled, depending on sight lines and bicycle and motor vehicle volumes and speeds.
- "Turning vehicles yield to pedestrians" signs are recommended in advance of turns to remind motorists to yield to trail users.
- The combination bicycle and pedestrian crossing signs may be used in advance of crossings per MUTCD guidelines.
- The higher the posted speed limit along the main roadway, the farther set back from the roadway the crossing should be.
- A minimum distance of 6.5' from the edge of the roadway should be provided; a wider separation of 16' is preferred where space permits (an offset of 24' may be appropriate with posted speed limits of 55 MPH or greater).
- Rumble strips should be applied on the approach to the trail crossing, in a gradual spacing pattern. For spacing, refer to the Trail at Pedestrian Ramble detail enlargement.

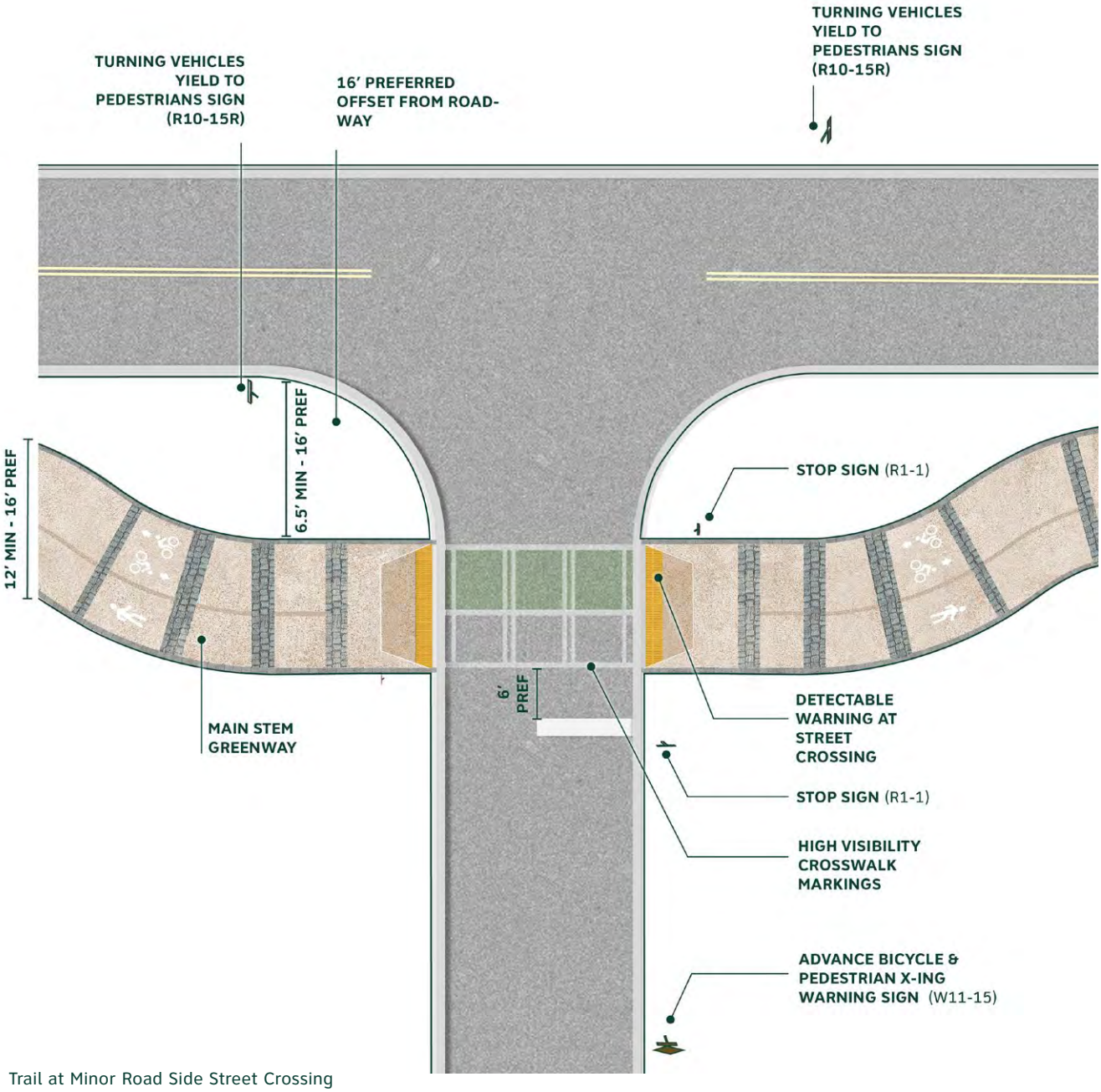
DESIGN STRATEGY

- The sidepath (trail alongside the roadway) should be given the same priority as the parallel roadway at all uncontrolled crossings. Geometric design should support this by providing clear sight triangles for all approaches.
- Establish priority and clarify the right-of-way with YIELD or STOP signs for motorists (provided warrant conditions are met), prioritizing bicyclists over motorists at unsignalized side street intersections.
- Consider "No Motor Vehicles" signs at trail entrances to reinforce that the trail is for non-motorized vehicle.s
- Agencies should consider roadway geometry and the MUTCD when integrating multiple speed reduction countermeasures.



A raised speed table provides additional traffic calming by slowing vehicles at the crossing location.

- Horizontal treatments can also help manage vehicle speeds. Where heavy vehicle volumes are low enough, reduce curb radii either by reconstructing curb corners, cost-effective delineators, or retrofitted truck aprons to slow vehicles down as they turn right.



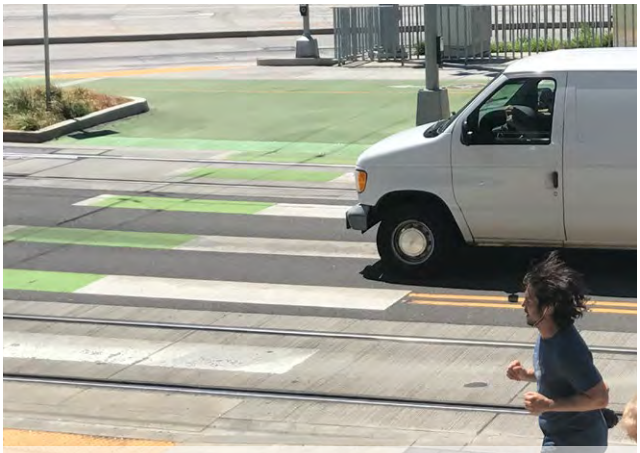
Trail at Minor Road Side Street Crossing

OTHER CONSIDERATIONS

- Consider using raised islands and narrower curb radii to slow vehicle turning movements.
- Similar treatments can be applied at signalized side street intersections with consideration given to the use of bicycle signals (based on volume thresholds), a possible raised sidepath crossing, offset distance, signs, and pavement markings.
- Colorado DOT has developed sidepath-specific warning signs that may be used along the RiverLands if local jurisdictions are amenable (an adapted W10-2 railroad crossing sign for sidepaths).

TRAIL AT SIGNALIZED INTERSECTION

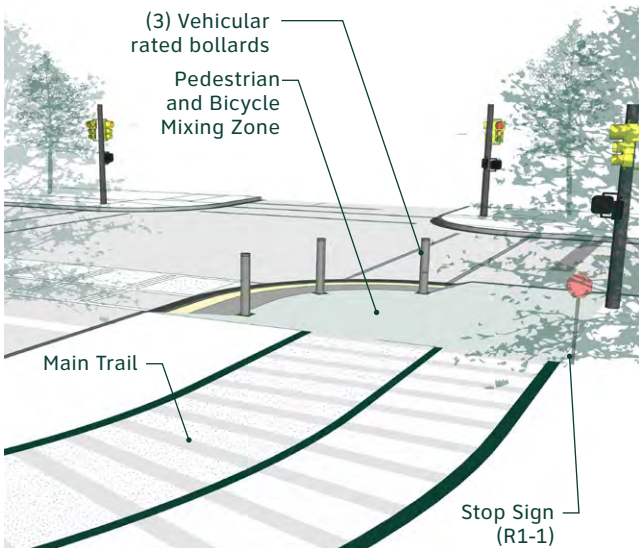
Providing safe access for the RiverLands across major arterial streets can be difficult; however, this will allow for much-needed multi-modal access by connecting communities, especially where the main stem (shared-use path) crosses a roadway intersection consisting of three or more lanes of vehicular traffic. Using high visibility crosswalk markings paired with signs, the crossing can provide many safety and comfort benefits.



Separated Bicycle Lane and Pedestrian High Visibility Markings

TYPICAL DESIGN APPLICATION

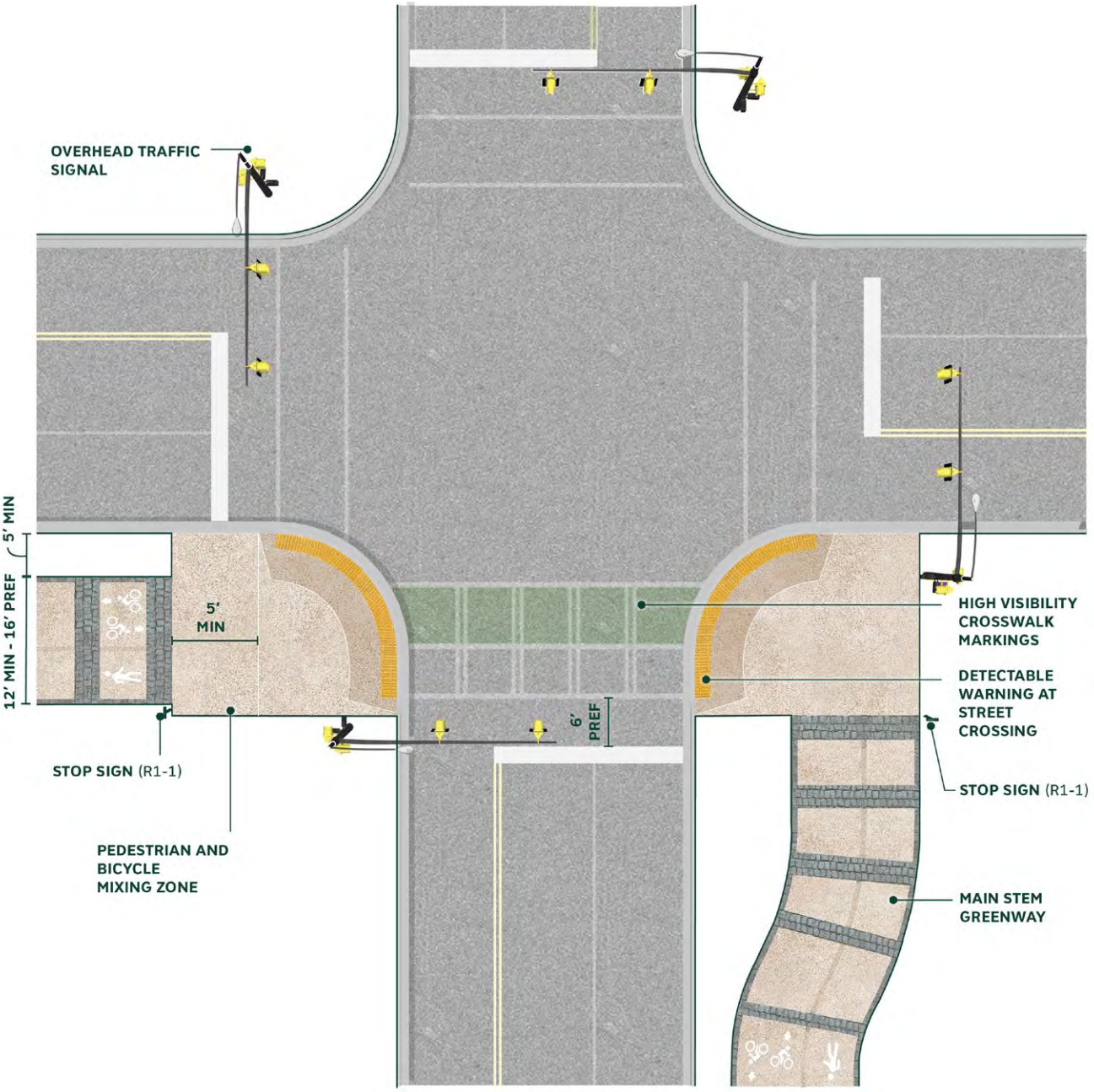
- High visibility crossing markings split between uses are preferred. Apply green paint to designate bike lane crossing and white crossbar pedestrian markings per MUTCD and GDOT guidelines.
- Bicycle lane word and/or symbol arrow markings (MUTCD Figure 9C-3) are used to define the bike lane and designate the portion of the street for preferential use of bicycles.
- Pedestrian Countdown (R10-3E) signs should be provided to indicate the direction of crossing associated with each push button.
- Stop bar lines should be placed a minimum of 4', with 6' preferred, in advance of the nearest crosswalk line at controlled intersections.
- Stop Signs (MUTCD R1-1) should be installed facing bicyclists and pedestrians along the shared-use path located on both sides of the crosswalk.
- Install required curb ramps at all crossing locations to meet ADA standards and regulations.
- Apply rumble strips in a gradual spacing pattern on the approach to the trail crossing. For spacing, refer to the Trail at Pedestrian Ramble detail enlargement.



Detail View of Mixing Zone Strategy

DESIGN STRATEGY

- Design strategy should consider posted speed limit, traffic volume, and anticipated crossings.
- Crosswalk should be set back from the intersection if existing conditions allow. This provides a safe protective distance from traffic flow and increases the visibility of people in the crosswalk to right-turning drivers.
- Left turn movements across the main stem should be allowed only on a dedicated protected left-turn phase. This reduces conflicts between left-turn movements and people in the main stem greenway crosswalk (protected-only left turn signal phasing).
- Where high crossing volume is expected, prohibit right turns on red across the main stem greenway crosswalk to reduce right-hook crash risk.
- On roadways with heavy traffic speeds and volume, crosswalk pavement markings alone are not adequate safety and comfort solutions. Additional traffic calming and signage strategies should be reviewed for safer crossing solutions.
- Bike signals are preferred where volumes are high.
- Leading Pedestrian Intervals (LPIs) can improve trail user safety. The WALK signal is displayed before the green vehicle indication allowing pedestrians to establish crosswalk presence.



Trail at Signalized Intersection

- Proper maintenance of highly visible markings is a priority to ensure lasting safe conditions.
- Where a high crossing volume is anticipated, a mixing zone in advance of the crossing at entrances or urban conditions should be provided to allow adequate space for users to congregate safely.
- Place vehicular rated bollards outside the accessible ramp with 4'-5' spacing maximum.

OTHER CONSIDERATIONS

- Full traffic signals must meet MUTCD standards.
- Trail crossings within approximately 400' of an existing signalized intersection with crosswalks should typically be diverted to the existing intersection.
- If a median is already present in the roadway, and geometry allows, consider extending the median nose to protect pedestrians and cyclists crossing.

APPENDIX A:
APPLICABLE EXISTING GUIDELINES AND REQUIREMENTS FOR DESIGN

TECHNICAL MEMO #1: APPLICABLE EXISTING GUIDELINES AND REQUIREMENTS FOR DESIGN

OVERVIEW

The Chattahoochee RiverLands encompasses a 100-mile corridor with a rich variety of parks, blueway access points, and trail systems from Buford Dam to Chattahoochee Bend State Park. This technical memo focused on the design of the greenway as a universally accessible shared-use path, with tributary feeder trails and parallel pedestrian rambles. In some instances, the chosen alignment may require consideration of separate pedestrian and bicycle facilities and appropriate intersection treatments. The design of pedestrian and bicycle specific facilities is covered in more detail in **Technical Memo #2 – Bicycle and Pedestrian Safety Recommendations, with further information on accessible treatments covered in Technical Memo #3 – Universal Access Recommendations**.

Memo Purpose and Introduction

The purpose of this technical memo is to summarize existing guidelines, standards, and requirements for bicycle and pedestrian trail design as well as relevant recommendations drawn from national and state resources, such as the Federal Highway Administration (FHWA), American Association of State Highway Transportation Officials (AASHTO), National Association of City Transportation Officials (NACTO), National Park Service (NPS), Georgia Department of Transportation (GDOT) and Georgia Power. Where applicable, local resources and guidance documents were also consulted. This technical memo is intended as a resource for the Design Team to help guide and inform development of Design Guidelines; it provides considerations related to the minimum standards and requirements that must be met. As the Design Team moves forward with development of Design Guidelines, it is important to understand the requirements so that as Design Guidelines are developed, they can comply with and/or exceed existing standards.

A majority of the Main Stem of the preferred alignment will likely be constructed as a shared-use path (also known as multi-use trail or path), for use by a variety of non-motorized forms of transportation, with the exception of locations where it is not feasible. This technical memo provides guidance to inform development of Design Guidelines for the Main Stem Greenway of the RiverLands, with additional consideration for parallel pedestrian rambles as well as tributary trails developed by other agencies. Throughout the memo, the terms “trail” and “greenway” are used interchangeably to refer to shared-use paths – these may be either alongside roadways or in their own independent right-of-way, such as through a park.

MEMO OUTLINE

1) Considerations for the Main Stem Greenway
    a) Alignment
    b) Trail Design Elements
    c) Structures
2) Stormwater Management
3) Considerations for Tributary Trails
4) Considerations for Pedestrian Rambles
5) Considerations for Intersections, Trail Crossings, and Safety
6) Seating Considerations
7) Considerations for Railings Fences and Walls
8) Considerations for Pull-Offs, Trailheads and Rest Areas
9) Local Resources
    a) Resources by County
    b) Resources by Municipality
10) Summary and Key Findings

CONSIDERATIONS FOR THE MAIN STEM GREENWAY

Alignment

The Chattahoochee RiverLands planning study developed a preferred alignment for the trail, seamlessly aligning the Main Stem trail, tributary trails, and blueway access throughout the 100-mile corridor. The Main Stem Greenway should follow the preferred alignment wherever possible; however, additional practical and other alternatives have been developed and may be considered during the design phases. The following additional considerations should be made in the design and alignment of the Chattahoochee RiverLands:

- The National Park Service (NPS) Chattahoochee River National Recreation Area (CRNRA) Trail Management Plan is currently under development, and the RiverLands design team will coordinate with NPS in developing the Design Guidelines. Additionally, design of any segments that tie into or connect with CRNRA properties will need to be coordinated with NPS.
- Locally specific tributary trails and other trail systems should be considered particularly in locations where local design guidelines exist and should be adhered to along the RiverLands; consideration will need to be given to how those trail systems interface with the RiverLands.
- Segments of the RiverLands Greenway will need to be developed in coordination with state and local agencies as applicable, particularly where the trail is aligned along streets and highways.

The RiverLands Greenway is envisioned primarily as a shared-use path, intended for use by bicyclists, pedestrians, and people using other non-motorized forms of transportation. Figure 1 shows overarching guidance for applications of shared-use paths from the *GDOT Pedestrian and Streetscape Guide* which are applicable to the RiverLands. More shared-use path design elements, specifications, and considerations are discussed under the Trail Design Elements section of this memo.

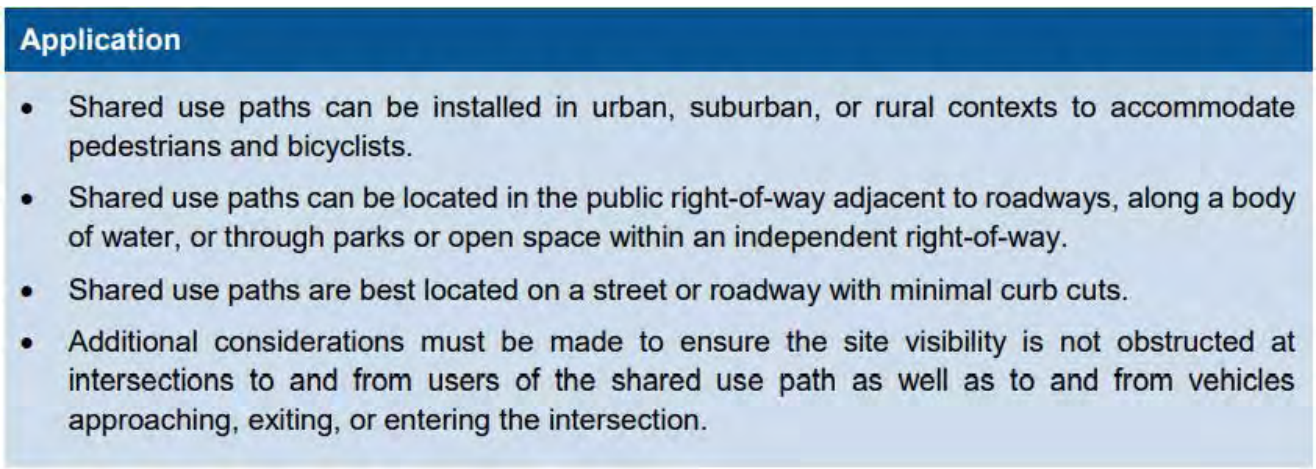


FIgure 1: Shared-use Path Alignment Applications from GDOT Pedestrian and Streetscape Guide

Utility Corridors

Alignments through utility corridors will require early coordination with partner agencies their specific needs, regulations and requirements during the planning, design, and construction phases of the trail. If the utility is not the underlying owner of the property under consideration, early communication, consent, and easement coordination with property owners will also be key to trail implementation. The information discussed below, current at the time of the writing of this technical memo, will need to be reviewed with partner agencies for accuracy. Maintenance of utilities should also be considered; trails that are built within active utility corridors may need to be designed to withstand the weight of maintenance vehicles or other maintenance activities.

Georgia Power has guidelines for bicycle and pedestrian trails within their right-of-way (ROW) and easements. Approval is needed for construction within the ROW by multiple parties including:

- Obtaining consent from the underlying property owners adjacent to the ROW
- Obtaining an easement for the construction of the trail within the ROW from the owner of the property, if utility company does not own the ROW land
- Obtaining consent from utility company whether or not they own the land within the ROW and permits to construct a trail in their ROW

General limitations on use within Georgia Power ROW include:

- Pedestrian and bike use only, no motor vehicles allowed
- Approval of surface material by utility company
- No trees higher than fifteen feet (15') in height
- Twenty-five-foot (25') distance away from pole, guy wire or other Georgia Power equipment
- Approval needed for lighting and landscaping proposed along the trail
- Signage must be provided and approved

Water/Sewer utility corridors and crossings typical needs and requirements:

- Obtain consent from the underlying property owners adjacent to the right-of-way
- Cannot obstruct access to pipelines or manholes
- No digging, clearing, or filling without approval
- Permanent structures and trees generally not permitted within a certain buffer of structures/pipes (varies by utility)
- Permanent structures within two feet (2') of edge of ROW require approval before construction
- Provide signage in event of a leak

Safety requirements in utility corridors:

- Inform trail users of potential risks of using utility corridor trails
  - Trailhead safety information
  - Regular safety signage about activities that are inadvisable
  - Designing the trail to steer people away from transmission tower bases and pipeline markers

Waterways, Wetlands, and Other Sensitive Habitats

Siting of trail structures crossing waterways, wetlands, and other sensitive habitats is dependent upon the trail alignment and surrounding waterway context. Greenways and trails should avoid skewed crossings, unstable slopes/soils, trail grades in excess of five percent (5%), and sudden shifts of alignment in alluvial fans to protect the environmental and geomorphic conditions of the stream. It is recommended to consult with subject matter experts to mitigate site-specific environmental and geomorphic concerns.

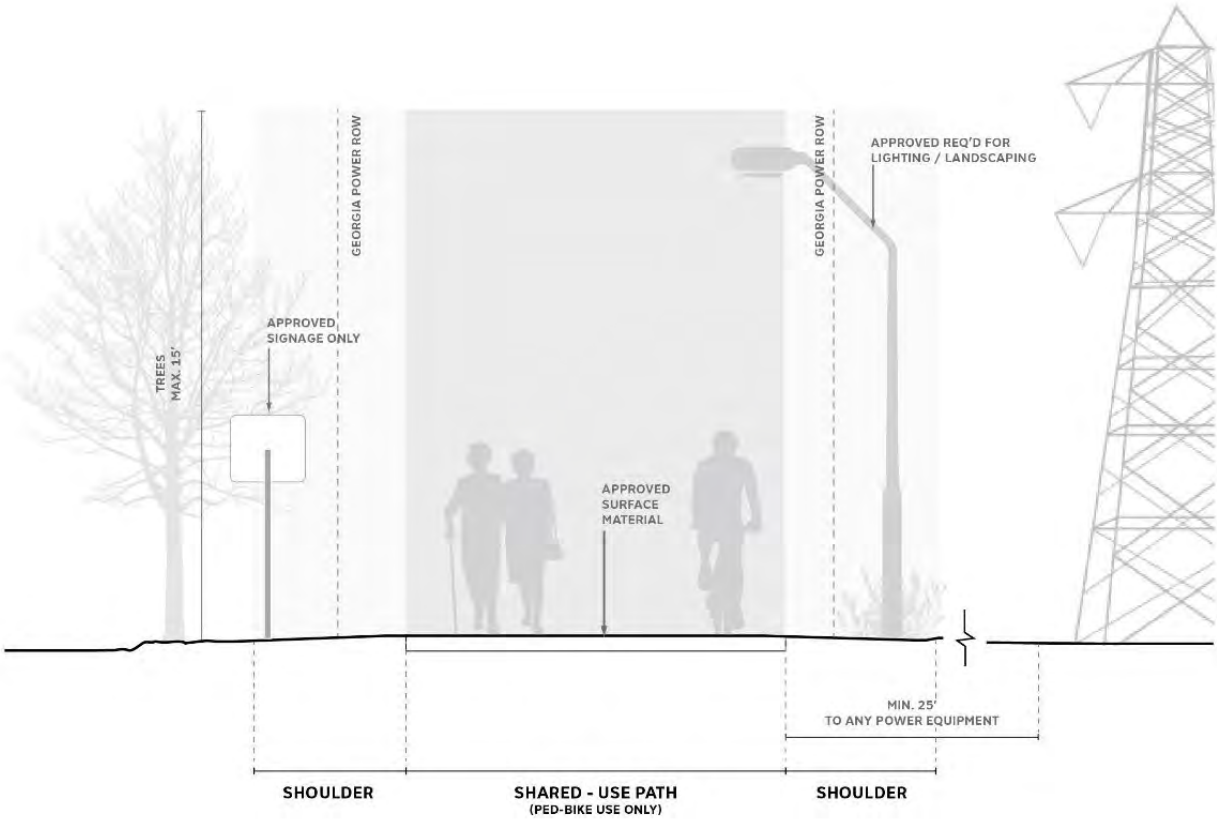


FIgure 2: Georgia Power ROW Typical Section

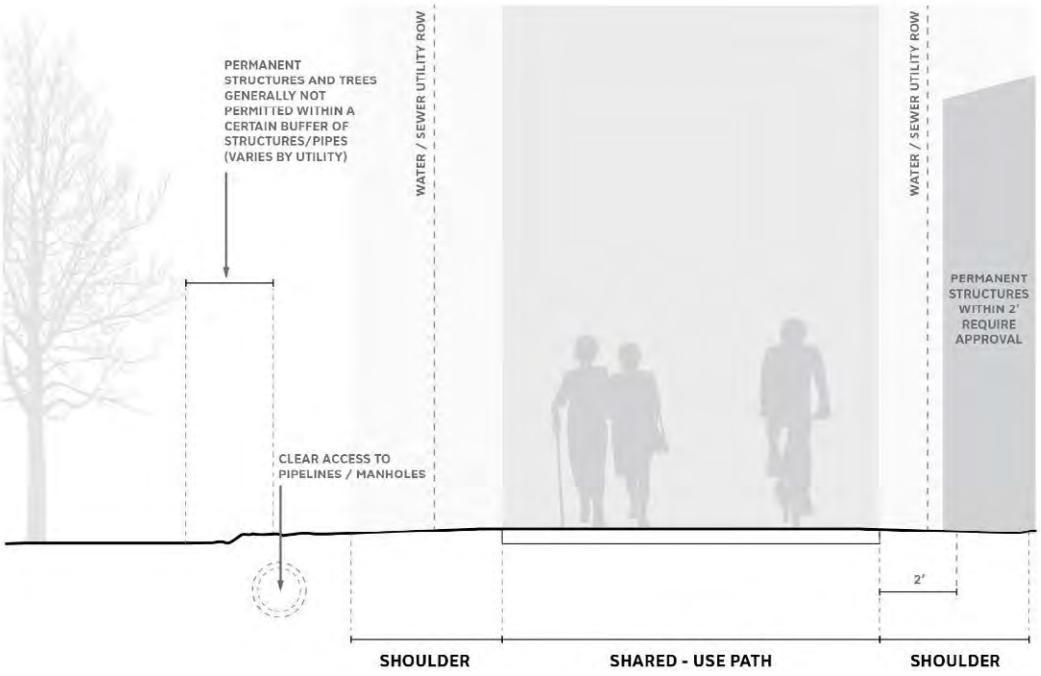


FIgure 3: Water/Sewer Utility Typical Section

Railroad Crossings
Shared-use paths and bicycle-specific facilities should cross railroads as near to 90 degrees as possible to prevent wheels catching in the flangeway openings, with an allowed minimum of 60 degrees. In severe skew instances, the path may be widened to allow a bicyclist or other wheeled mobility user to select the path across that best suit their needs. Additional guidance on rail crossing design is available in the AASHTO *Guide for the Development of Bicycle Facilities.* Coordination between trail designers and railroad companies should occur to ensure trails cross at legally designated locations or at negotiated locations.

TRAIL DESIGN ELEMENTS

Trail design elements, including grade, cross-slope, width, materials, and areas adjacent to the trail must be considered with national, state, and local design guidance and regulations. Typically, state and local guidance draw from nationally recognized best practices established by FHWA, AASHTO, and NACTO with additional considerations targeted to the specific location. A holistic approach to balancing national best practices with local needs will be key to a universally accessible Main Stem Greenway.

Grade
Trail grade is an important consideration in designing trails that are accessible to all.

- Generally, grade should not exceed five percent (5%)
- Most gradual slope possible should be used
- If slope exceeds five percent (5%) without steep slopes on either side:
  - 8.3 percent (8.3%) for a max. of two-hundred feet (200')
  - Ten percent (10%) for a max. of thirty feet (30')
  - 12.5 percent (12.5%) for a max. of ten feet (10')
  - Total grade that exceeds 8.3 percent (8.3%) should be less than thirty percent (30%) of the length of the trail
- For steeper grades, consider an additional four feet (4') to six feet (6') in width for bicyclists to dismount and walk uphill and maneuvering room for higher downhill speeds
- Consider stopping sight distance for bicyclists traveling along the trail and introduce vertical curvature to accommodate

Additional accessibility considerations related to grade are covered in more detail in **Technical Memo #3 – Universal Access Recommendations**.

Cross-Slope
- One percent (1%) is preferred, either a continuous cross-slope or crowned
- Generally, do not exceed two percent (2%)

Additional accessibility considerations related to cross-slope is covered in more detail in **Technical Memo #3 – Universal Access Recommendations.**

Width
This memo presents width considerations and requirements the design team should be aware of and establishes a foundation for developing the RiverLands Design Guidelines. The Guidelines will provide considerations for a range of options that vary by context. Trail width design considerations are primarily for paved, accessible trails as unpaved trails may vary widely in width based on site-specific conditions and anticipated use. AASHTO recommends a minimum ten feet (10') in width for paved shared-use path, with typical widths ranging from ten feet (10') to fourteen feet (14') depending on anticipated use and volume of activity. A constrained minimum of eight feet (8') is allowed in short segments due to site-specific restrictions preventing full width path. This may be applicable for narrower locations with anticipated less traffic at slower speeds including at proposed "pedestrian rambles" intended for foot traffic only (discussed in further detail on page 19). In areas where higher trail utilization is forecast and a greater mix of users is anticipated, wider shared-use paths should be considered. Additional considerations for path and specific bicycle and pedestrian facility width are covered in more detail in **Technical Memo #2 – Bicycle and Pedestrian Safety Recommendations**.

Shoulders and Slopes

- Minimum two-foot (2') shoulder (AASHTO Bike Guide, MUTCD), three feet (3') to five feet (5') preferred
- Max slope of 1V:6H preferred
- Steeper slopes with less than a five-foot (5') shoulder require safety railings

More specific guidance for bicycle and pedestrian safety are covered in **Technical Memo #2 – Bicycle and Pedestrian Safety Recommendations.**

Materials

The materials used for shared-use paths/multi-use trails and greenways is highly dependent upon context and maintenance guidance or priorities of local jurisdictions. Some communities highly prefer more durable materials due to lower long-term maintenance concerns, whereas others prefer a more natural trail surface or material. Other factors like floodways, imperviousness and conveyance of stormwater runoff should also be considered, particularly within the boundaries of the Metropolitan River Protection Act along the Chattahoochee River. **(Additional discussion of maintenance considerations is provided in Technical Memo #4).** General considerations for material selection are provided below.

- Concrete path, may be bordered with pavers, stamped concrete, and/or utilize pavers or stamped concrete to separate modes in high activity areas
  - Alternatively, colored concrete or asphalt may be used to signify mode separation
  - Stamped concrete texture, colored concrete, or pavers may be used to signify mixing zones at intersections, transit stops, and other constrained locations

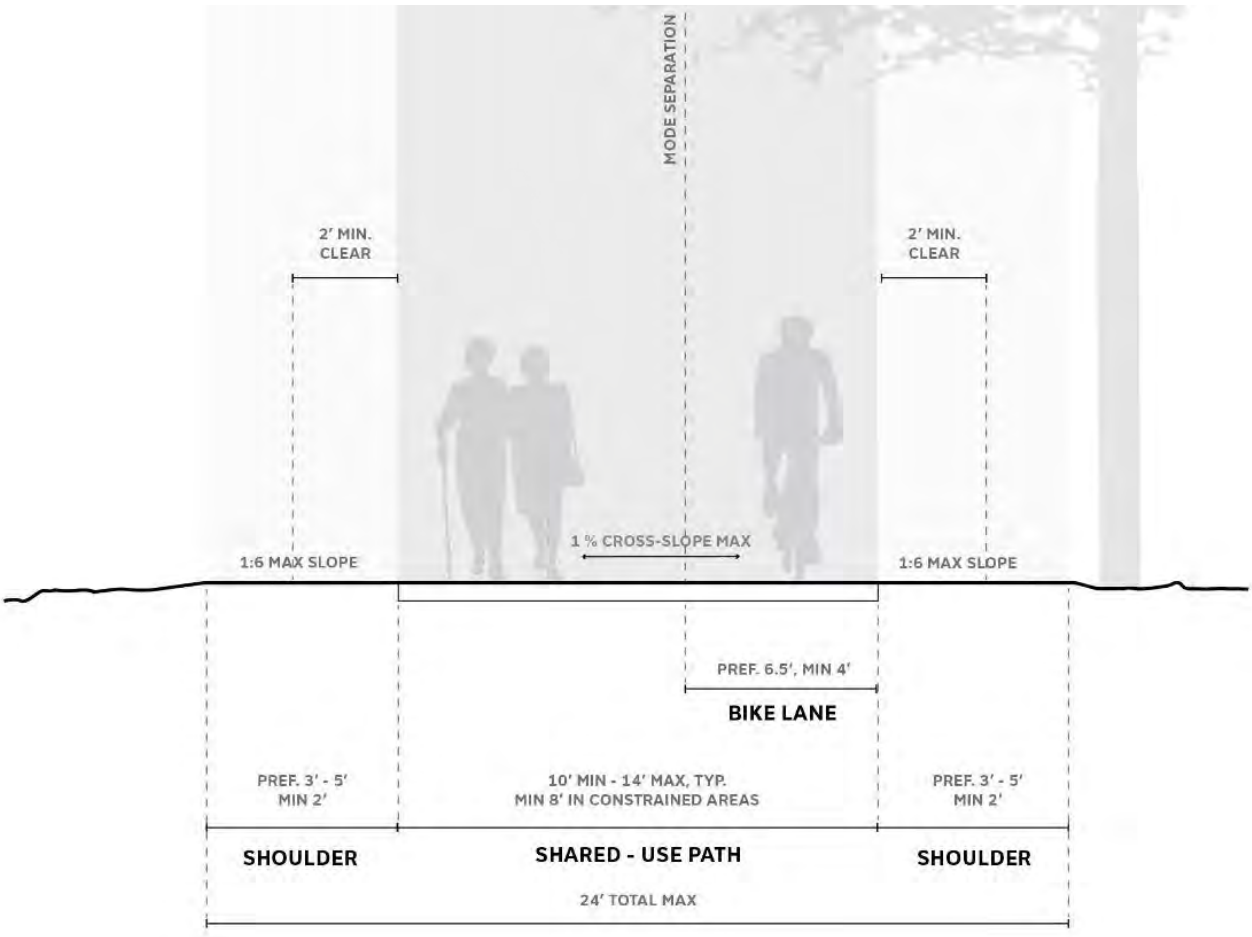


FIgure 4: Main Stem Shared Path (Off Road) Typical Section

- Alternatives include:
  - Asphalt outside of floodways may be used with concrete accessible ramps. The use of concrete in floodways prevents trail heave and floating during flood events
  - Crushed stone paths and other "natural" materials may be considered as long as maintenance and accessibility are maintained throughout. Consideration should be given to transition between "natural" materials and paved materials, to prevent tracking of material onto paved surfaces
  - Some trails utilize edge restraints to define trail width and to keep trail materials separate from the landscape
  - In locations where pedestrian rambles are anticipated, consideration should be given to materials that create a more natural feel

Roadside Safety, Trail Safety, and Trail Separation

In site-specific conditions, separation from motor vehicle traffic through the use of a verge (also known as a physical barrier) may be needed to prevent run off the road crashes near bodies of water, bridge piers, and other sensitive locations or to provide protected travel for bicyclists and/or pedestrians. Within the footprint of the Chattahoochee RiverLands, GDOT and local guidance will apply to site-specific context in coordination with AASHTO best practices. General guidance for the use of barriers is summarized below.

- On low speed streets, a raised curb is generally considered sufficient barrier from motor vehicle traffic
- On any street over 25 MPH, additional separation from motor vehicle traffic should be considered with a verge behind the raised curb
- Sidewalk/shared-use path adjacent to high speed motor vehicles may consider a physical barrier based on the following considerations:
  - Traffic volumes
  - Roadway geometry
  - Sidewalk/path offset
  - Cross section features
- Barrier separated bicycle lanes may also be considered on high speed and/or high traffic volume roadways, balancing bicyclist safety along with the potential consequences of physical barrier implementation:
  - Limit movement of bicyclists into/out of lane
  - Motorists block lane to view oncoming traffic at intersections and driveways
  - Collection of debris
  - Potential conflicts with right-turning vehicles at intersections (right-hook)
  - AASHTO also provides guidance on approved barrier design given selected MASH test level for the specific roadway context
  - Design strategies to protect pedestrians and bicyclists and reduce crash severity, and design strategies for placement of street furniture

For additional guidance on placement of landscaping, lighting, signs, and other roadside features for site specific design in the roadway right-of-way, consult AASHTO's *Roadside Design Guide*.

Additional design strategies for bicycle and pedestrian specific safety are covered in more detail in **Technical Memo #2 – Bicycle and Pedestrian Safety Recommendations.**

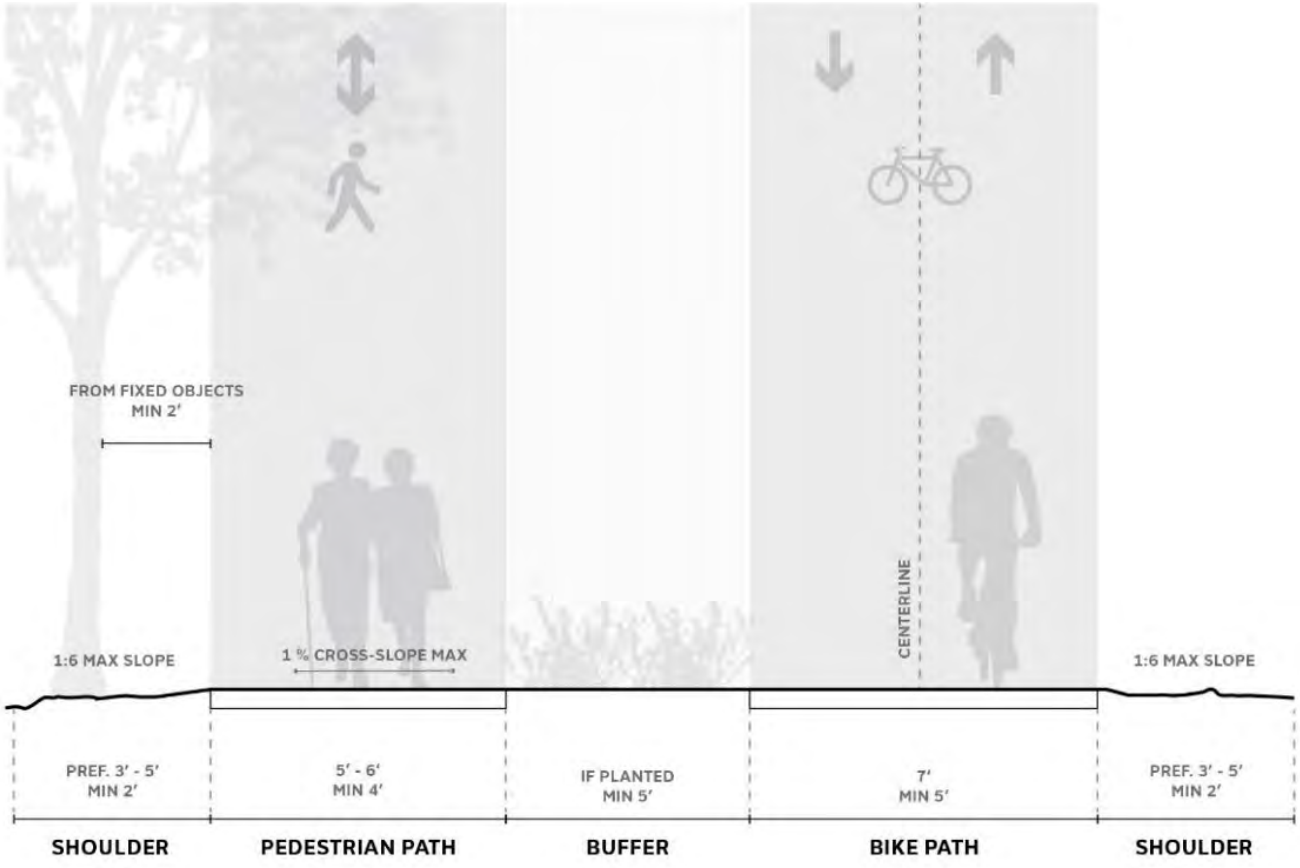


FIgure 5: Main Stem Split Path (Off Road) Typical Section

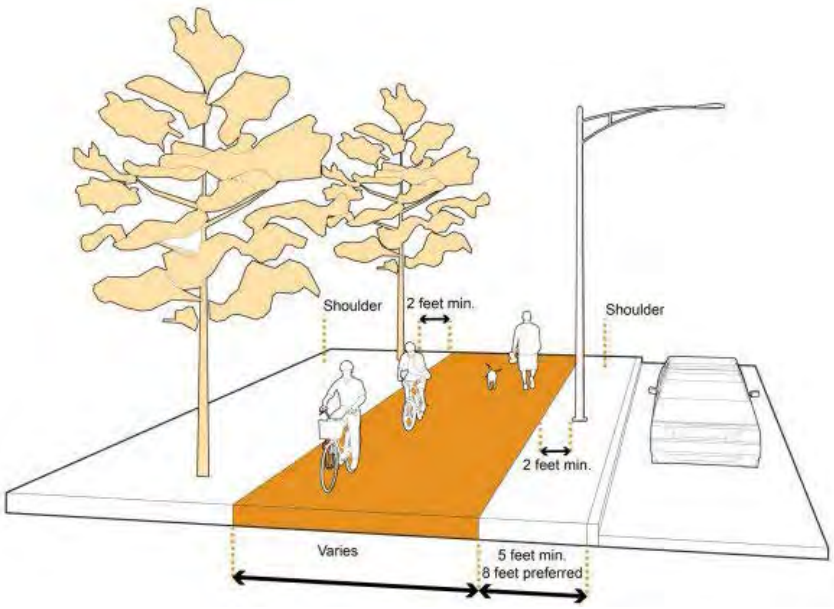


FIgure 6: Shared-use path adjacent to low-speed, 35 MPH or less streets from GDOT Pedestrian and Streetscape Guide

Mitigating Multi-Modal Conflicts

Much of the Chattahoochee RiverLands is anticipated to be a shared-user environment. In such a context, like shared-use paths or multi-use trails, it is important to consider how to mitigate potential conflicts between people traveling via different modes and at different speeds. Factors such as physical separation or buffers, surface color and material, signage, and design of the trail or path can help reduce potential conflicts. Design should be cognizant of the type of potential users that a given section of the RiverLands intends to accommodate and account for speed differentials between different modes such as walking, bicycling, or scooting. This is particularly important at intersections where segments of trail meet other segments of trail or cross streets or roadways. General strategies for mitigating potential multi-modal conflicts is summarized below.

- Delineate mode separation
  - Pavement color/type
  - Pavement markings including solid and dashed centerlines
  - Traversable grade separation
  - Physical separation – planting strips, barriers, etc.
- Bollards may be used selectively at intersections
- Pavement texture or color – indicate mixing zones between modes, bike rumbles to slow down, etc.
- Trail alignment (bicycles and other wheeled mobility devices)

Information about the use of signs, striping, and pavement markings is discussed elsewhere in this memo, as well as in **Technical Memo #2 – Bicycle and Pedestrian Safety** Recommendations and in **Technical Memo #3 – Universal Access Recommendations**.

Purpose	Strategy
Reduce motor vehicle–pedestrian crash likelihood at roadside locations	• Provide continuous pedestrian facilities • Install pedestrian refuge medians or channelized islands (see Section 10.2.1.3 on medians and islands) • Offset pedestrian locations away from traveled way with pedestrian buffers • Physically separate pedestrians from traveled way at high-risk locations • Improve sight distance by removing objects that obscure driver or pedestrian visibility
Reduce severity of motor vehicle–pedestrian crashes at roadside locations	• Reduce roadway design speed, operating speed, or both in high pedestrian volume locations

Purpose	Strategy
Reduce likelihood of crash	• Use wider curb lanes • Increase operational offsets
Reduce severity of crash	• Locate bicycle racks as far away from road as possible

Purpose	Strategy
Minimize likelihood of crash	• Locate street furniture as far from street as possible • Restrict street furniture placement to avoid sight distance issues for road users

FIgure 7: Design strategies from the *AASHTO Roadside Design Guide*

STRUCTURES

Bridges Spanning Waterways, Wetlands, and Other Sensitive Habitats

The USDA/FHWA details the siting, design, construction, inspection and maintenance of trail bridges and approaches based on Trail Management Objectives (TMOs). TMOs are a collection of trail oriented best practices related to safety, anticipated trail users, trail user experience, and longevity.[1] Structure design, decking and surface treatment, and specific railing design will be developed in coordination with the NPS CRNRA Trails Management Plan and available TMOs from local and regional sources. Many of these recommendations will also apply to tributary trails and pedestrian rambles.

Design

Permanent trail structures should follow the trail-specific TMOs, and be designed with a minimum 50-year lifespan to withstand at least a 100-year flood event. Selection of the bridge type, span, materials, and construction method will depend on TMOs and well as site-specific factors, anticipated loads, and specific user groups.

Surface

- Bridge decking is most commonly wood, but can also be glulam, concrete, steel grid or fiberglass.
- Surface should not become slick from use, particularly if the bridge experiences a variety of users.
- Surface can be treating with wearing surfaces to improve traction.

1 USDA/FHWA Sustainable Trail Bridge Design

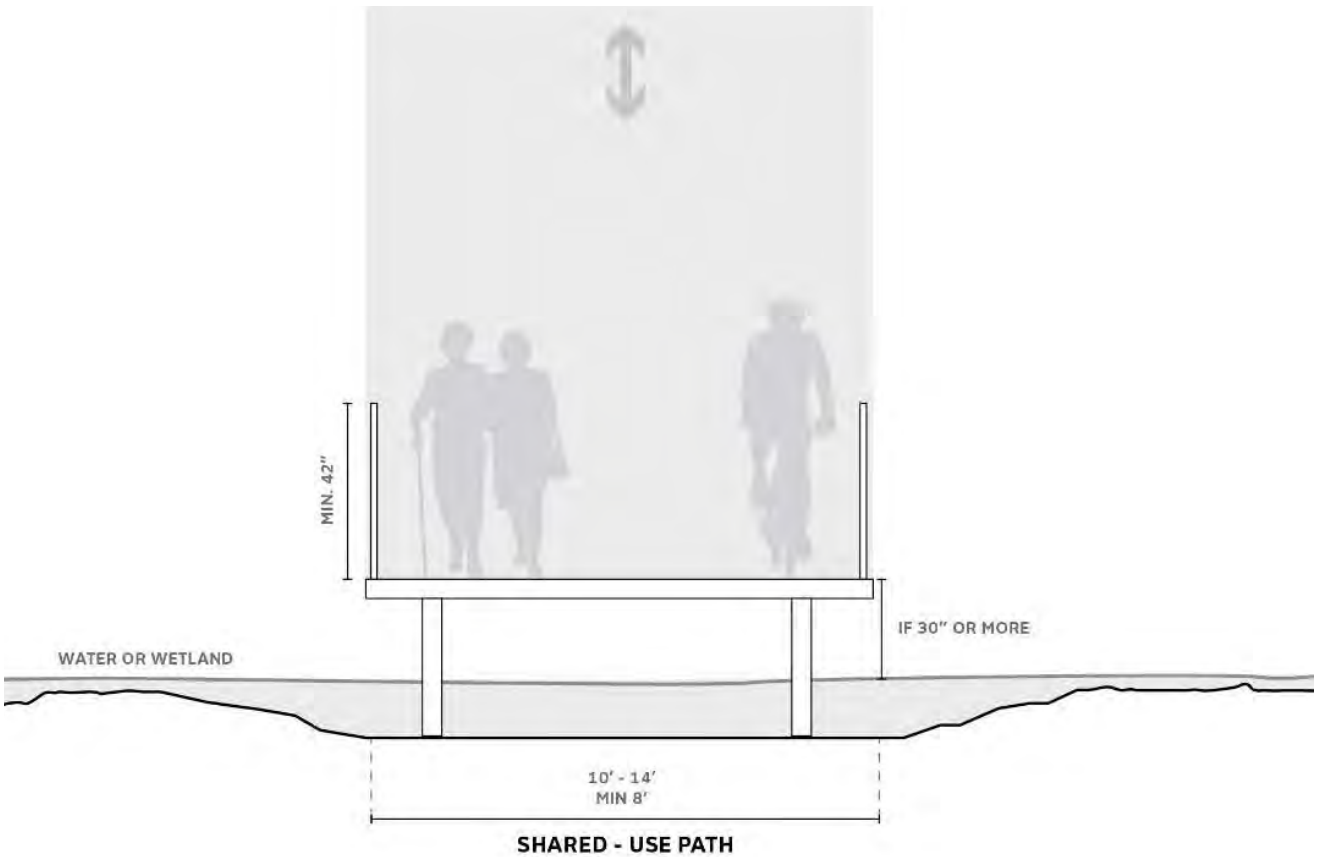


FIgure 8: Boardwalks and Bridges Typical Section

Railings

- Top rail must be at least forty-two inches (42") high
- Railings in high use areas, urban areas, urban-adjacent recreation areas, and scenic view areas should follow building code-based rail systems
- Intermediate rails should be vertical to prevent climbing and allow viewing for users in wheelchairs and similar wheeled mobility devices
- Railings in moderate use and rural areas should follow AASHTO railing systems
- Railings in low use areas may consider OSHA based railing systems
- Railings should not only be ADA-compliant but also allow for visibility for users who are shorter or use mobility devices such as wheelchairs

Multi-Modal Overpasses

- Multi-modal overpasses follow the same design guidance for grade, cross-slope, width, and surface as the Main Stem Greenway.
- Mitigating multi-modal conflicts in high use areas may require a wider overpass to allow separated uses and/or passing opportunities.
- Walls and railings protect the multi-modal users from falls. Additional use of mesh fencing may be used to further protect multi-modal users from falls and motorist below from thrown objects.
- Multi-modal overpasses must be designed in coordination with a professional licensed structural engineer
- Cobb County has further guidance on the design of multi-modal overpasses

Multi-Modal Underpasses

- Underpasses can create a stressful environment for bicyclists and pedestrians
- Width, lighting, and approach design all affect user comfort and perceived safety
  - Underpasses should be wider, with Cobb County recommending a minimum of fourteen feet (14') and greater width for tunnels longer than sixty feet (60')
  - Underpasses and approaches should be well-lit, with approach angles designed to reduce tunnel effect and allow for visibility through the entire underpass
- New multi-modal underpasses must be designed in coordination with a professional licensed structural engineer
- Cobb County has further guidance on the design of multi-modal underpasses

STORMWATER MANAGEMENT AND ECOLOGICAL CONSIDERATIONS

Stormwater management through green infrastructure is a key component of sustainable trail design in urban contexts. Development will continue to produce stormwater runoff, impervious paved surfaces disrupting natural hydrologic cycles, contributing to urban heat islands, and bringing contaminants in rapid pulses of warm water to the riparian system. These threats can be mitigated through sustainable stormwater management, which allows stormwater runoff to soak into the ground and be filtered by vegetation, reducing the volume of runoff, water ponding on roadways, and urban heat island by supporting vegetation and trees in urban corridors that beautify the corridor and provide shade for trail users. Key principles of streets that include green infrastructure in conjunction with traditional stormwater management systems include:[2]

- Protect and Restore Natural Resources
- Promote Health, Equity, and Human Habitat
- Design for Mobility and Safety
- Design for Life Cycle

2 NACTO Urban Street Stormwater Guide

- Design for Resilience
- Optimize for Performance

Protection against erosion is a critical component of green stormwater management to preserve the RiverLands corridor and protect ecologically sensitive habitats. Existing or constructed wetlands and areas where water typically ponds may be protected with segments of boardwalk to allow movement through these habitats. Visible stormwater outfalls, and those causing erosion, should be enhanced with nature-based stormwater Best Management Practices (BMPs) allowing infiltration and water quality improvement as described in the Georgia Stormwater Management Manual, Version 2. Additional erosion prevention and stormwater infiltration strategies include:

- Avoiding steep slopes and erodible soils
- Appropriate grading and establishment of vegetation
- Development of constructed or managed wetlands
- Planting of native trees and other native vegetation
- Following topographic contours
- Avoiding or minimizing clearing of existing trees and vegetation

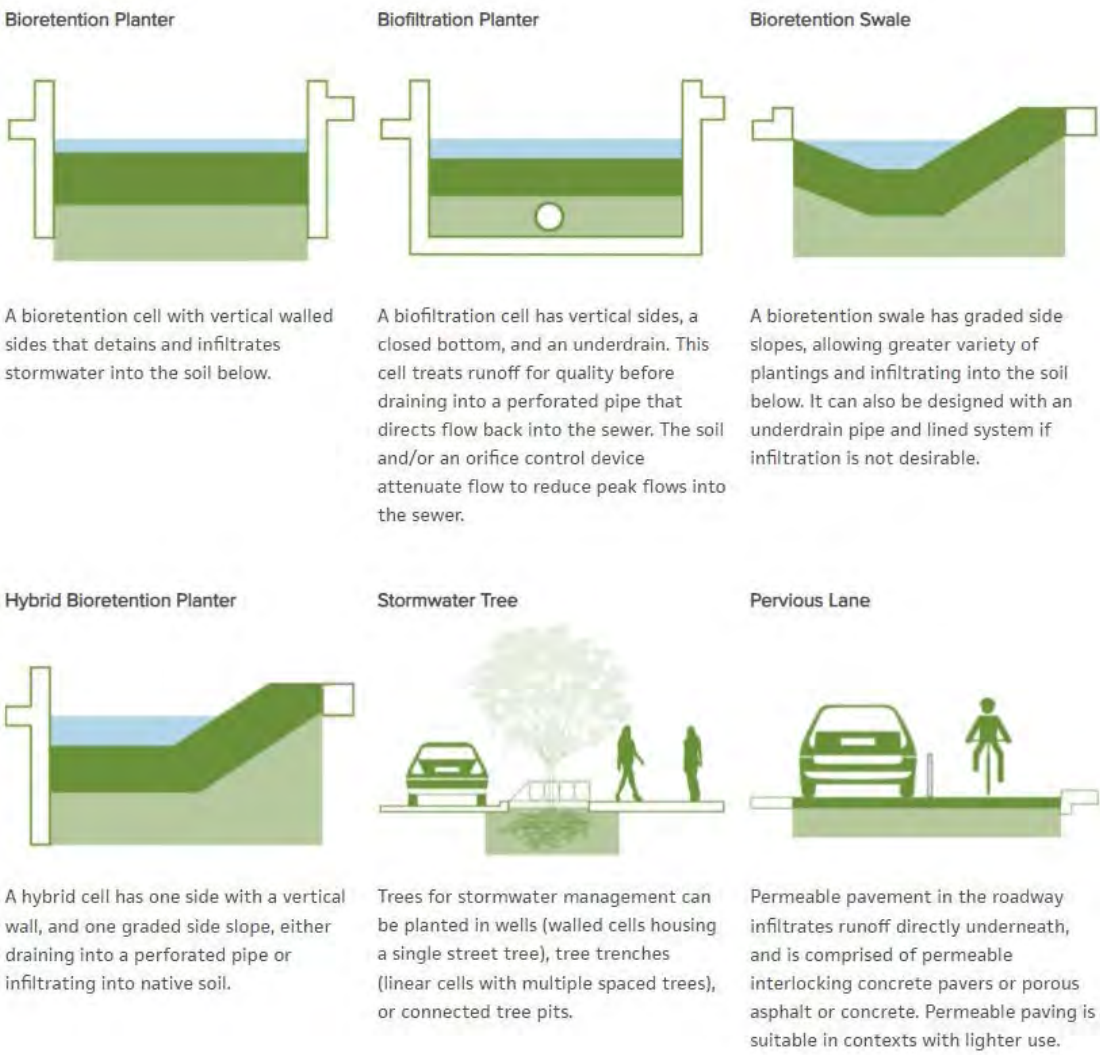


FIgure 9: Examples of sustainable stormwater management from the *NACTO Urban Street Stormwater Guide*

METROPOLITAN RIVER PROTECTION ACT

In 1972, the ARC completed the Chattahoochee Corridor Study to address growing debate over the future of the river. The following year, the Metropolitan River Protection Act (MRPA) was adopted, protecting a 48-mile stretch of River between Buford Dam and Peachtree Creek with a 2,000 foot (2000') buffer along each side of the River.[3] The Act was amended in 1998 to extend the Corridor an additional 36 miles to the downstream limits of Fulton and Douglas counties.

The MRPA standards include a 50-foot (50') undisturbed vegetative buffer along the River, a 35-foot (35') undisturbed vegetative buffer along streams in the corridor and a 150-foot (150') impervious surface setback from the River, as well as restrictions in the River's 100-year floodplains.

In developing the standards for MRPA, the Corridor Study developed a classification system for zones along the River based on natural factors including soil erodibility, vegetation, hydrology, and slope. From this, land vulnerability maps were developed to be used as recommendations for future planning along the corridor. Land is classified by category A through F, from slight to severe vulnerability. Any land-disturbing activity and impervious surfaces within the corridor must comply with the applicable rules pertaining to its classification type.

CONSIDERATIONS FOR TRIBUTARY TRAILS

Feeder trails developed by other entities (e.g., the Atlanta BeltLine, Big Creek Greenway, etc.) link regional population centers to the greenway, tributary trails may or may not be aligned with the Chattahoochee tributary corridors. Tributary trails may follow many of the same guidelines as the Main Stem Greenway for design and multi-modal accessibility. However, in some locations, they may also be considered mode-specific such as pedestrian-only trails or unpaved, natural trails depending on the location and expected usage by mode. Some such trails already exist and will be connected to the RiverLands in the future; others will be developed by local agencies in partnership with the Chattahoochee RiverLands, and should evaluate the following considerations:

- The planning study identified potential alternates to be considered for tie-in to the Main Stem Greenway
- Mode-choice and level of accessibility will determine path materials – concrete or asphalt fully accessible; crushed stone, mulched or similar partially accessible; or natural pedestrian-only trails
- Transition for unpaved trails to paved segments of the Main Stem Greenway to prevent material carry from unpaved to paved
- Connectivity to the larger regional network of trails
- Coordination with the NPS CRNRA Trails Management Plan, including accessibility guidelines on federally owned property according to the Architectural Barriers Act Accessibility Standards (ABAAS) unless otherwise excepted by NPS
- 2007 USDA *Trail Construction and Maintenance Notebook guidelines for the construction and maintenance of natural surface trails*
  - Control of drainage and prevention of erosion along unpaved trail systems

CONSIDERATIONS FOR PEDESTRIAN RAMBLES

Pedestrian rambles, considered to be "walk in the woods" style pedestrian paths for exploration of the RiverLands in parallel to the Main Stem Greenway, will be highly site-specific in terms of design, materials, and management. Due to the context sensitive nature of the pedestrian rambles, general guidance relating to unpaved nature trails should be considered in more detail during the design phase:

- Smooth transition from Main Stem Greenway, including consideration for transition of materials to prevent natural material tracking onto the accessible path

3 Atlanta Regional Commission, Metropolitan River Protection Act, https://atlantaregional.org/natural-resources/water/metropolitan-river-protection-act/

- Coordination with the NPS CRNRA Trails Management Plan, including accessibility guidelines on federally owned property according to the Architectural Barriers Act Accessibility Standards (ABAAS) unless otherwise excepted by NPS
- 2007 USDA *Trail Construction and Maintenance Notebook guidelines for the construction and maintenance of natural surface trails*
  - Control of drainage and prevention of erosion along unpaved trail systems

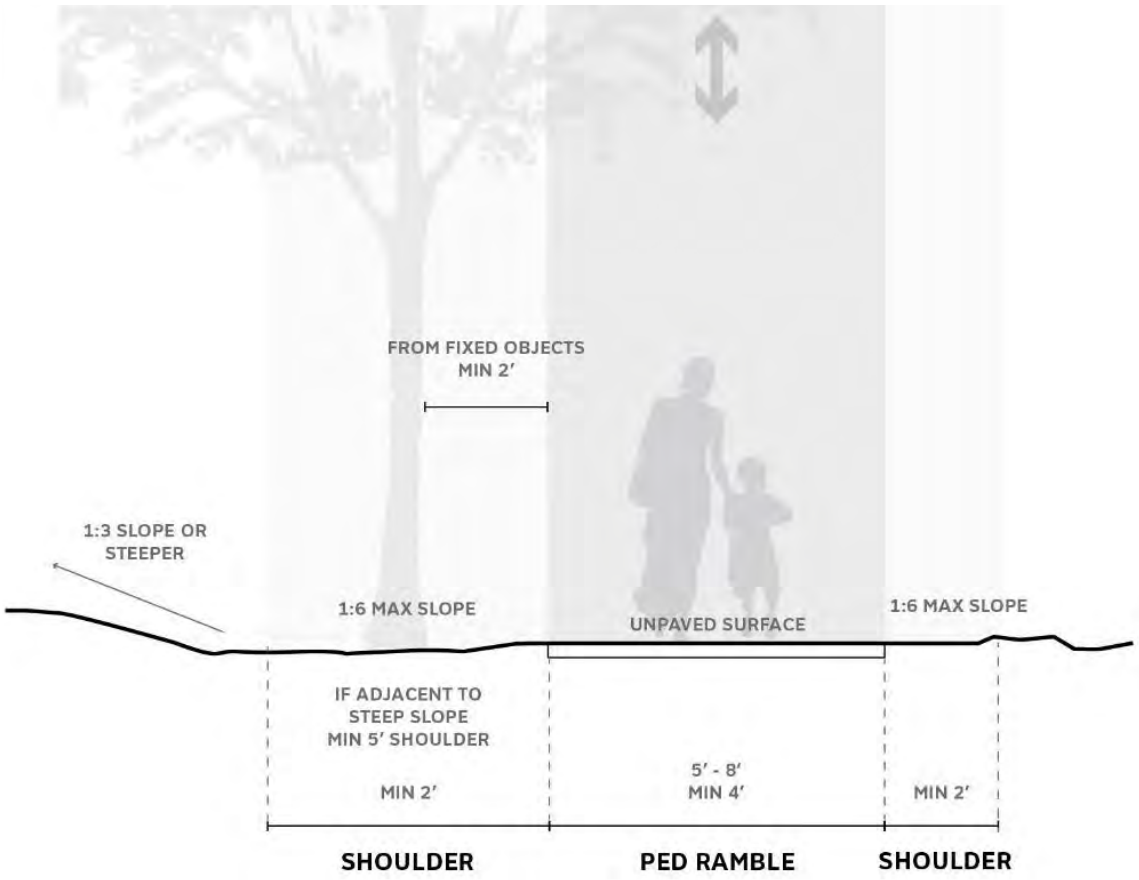


FIgure 10: Pedestrian Ramble Typical Section

INTERSECTIONS, TRAIL CROSSINGS, AND SAFETY CONSIDERATIONS

AASHTO outlines geometric guidelines for design of streets and highways. While the policy provides the framework for design, engineering judgement is not precluded, and allows for flexibility in implementation. The guidance sections provided for Multi-modal Considerations and Intersections are the most directly applicable standards for trail design, particularly for safe trail crossings and interactions between each of the modes at intersections. The crossing design guidance from the policy will depend on the functional classification, mode specific demand, and surrounding context.

For safe trail access for all users, pedestrian, bicycle, and other wheeled mobility devices safety must be considered in mixing zones with motor vehicles. Mitigation of the conflicts is covered more in depth in **Technical Memo #2 – Bicycle and Pedestrian Safety Recommendations.** Safe, comfortable, and dignified access must be provided at all trail crossings at roadways with ADA accessible ramps, crosswalk markings, signage and appropriate traffic control. Safe crossings and design for accessibility are covered in more detail in **Technical Memo #2 – Bicycle and Pedestrian Safety Recommendations** and **Technical Memo #3 – Universal Access Recommendations.**

Regulatory Signage, Striping, and Pavement Markings
The Manual on Uniform Traffic Control Devices (MUTCD) provides guidance on the use of striping, pavement markings, signs, and traffic control for highways, streets, and intersections. The guidance around safe crossing markings, signs, and traffic controls for intersections are the most applicable standards to trail design for safe trail crossings, with additional regulatory, wayfinding, and warning signage along the trail corridor to manage multi-modal conflicts and warn users of changes in alignment and trail conditions. This memo emphasizes guidance on regulatory and traffic control signage specific to roadway networks. A future memo and phase of the RiverLands Design Guidelines will address wayfinding and identity signage in greater detail.

Intersection and Trail Regulatory and Warning Signs
Sign choice and layout for intersections will depend on the specific crossing condition and mode interaction. Many of the same regulatory and warning signs discussed in the Trail Signs section will also apply to intersection signs, with specific intersection sign layout guidance. The MUTCD provides the prevailing guidance and regulations on sign design and usage.

Trail signage consists of warning, regulatory, and wayfinding signage. Warning signage indicates to the trail user that there is change in trail alignment, condition, or an upcoming potential conflict with other modes such as motor vehicles or trains. Regulatory signage conveys right-of-way between modes and mitigates conflicts.

SEATING CONSIDERATIONS

Seating may be formalized seating such as benches and chairs, or may be lowered (or leaning) walls. Seating may be found in specific locations such as trailheads and rest areas, but it also may be included throughout the corridor to provide opportunities to take a break or enjoy a specific view.

- Seating in roadway right-of-way: AASHTO *Roadside Design Guide*
- Placed to not restrict access through the use of wheelchairs or other mobility devices

Additional accessibility considerations are covered in **Technical Memo #3 – Universal Access Recommendations.**

CONSIDERATIONS FOR RAILINGS, FENCES AND WALLS

The AASHTO *Roadside Design Guide* provide guidance related to railings, fences and walls in roadway right-of-way. Outside of structures and roadside safety railings, fences and walls may be used for a variety of reasons, including but not limited to:

- Private property protection
- Protection of sensitive habitats
- Lowered walls for resting in lieu of formal seating

FIgure 11: Examples of trail and roadway warning signage from the MUTCD

FIgure 12: Examples of trail and roadway regulatory signage from the MUTCD

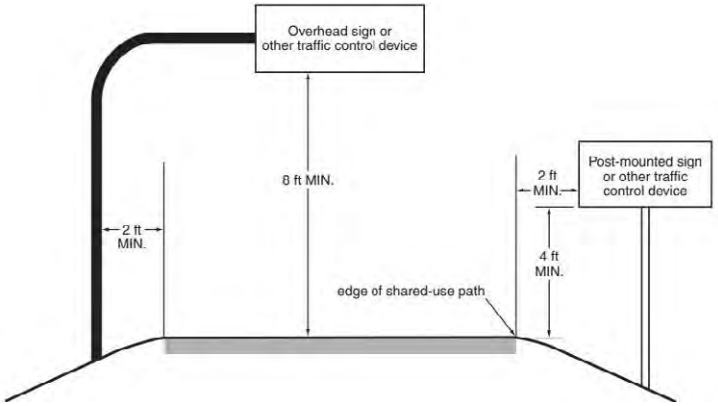


FIgure 13: Sign placement on shared-use paths from the MUTCD

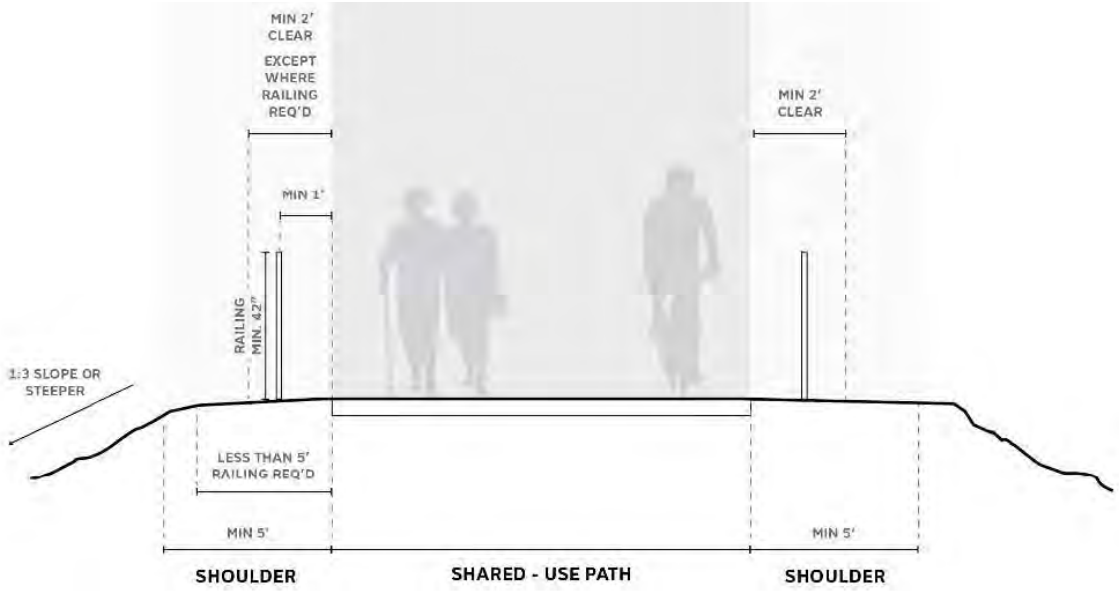


FIgure 14: Railing Typical Section

Railings must be at least forty-two inches (42") high, and consideration for taller railings at high bicycle activity locations and in areas where a bicyclist may be at risk for a fall. Railings must follow all building code, AASHTO, and OSHA requirements for the specific location. At scenic view locations, intermediate rails should be vertical to allow for viewing from a wheelchair or other mobility device.

More specific accessibility guidelines relating to railings, fences and walls are covered in **Technical Memo #3 – Universal Access Recommendations.**

CONSIDERATIONS FOR PULL-OFFS, TRAILHEADS, AND REST AREAS

- Trailheads provide opportunities to access Main Stem Greenway tributary trails, and intersections between. They may include seating, wayfinding, trash receptacles and other site amenities.
- Pull-offs and rest areas provide opportunities to rest along the trail, usually with seating or leaning walls, wayfinding and other amenities. They may be combined with a nook providing other amenities such social gathering space, direct water access, exploration of the Chattahoochee River ecosystem, culture, history, and educational programming.
- Coordination of design of trailhead, parking, and other trail access points and built amenities on NPS property with NPS CRNRA guidelines.
- Types of Access
  - Trailheads – federally owned and NPS managed property, including parking lot, trail access signage, and trail access. May also include restrooms, trash receptacles, seating, and other amenities.
  - Primary Trail Access Points – federally owned and NPS managed property, trail access and signage only.
  - Secondary Trail Access Points – on land not owned or managed by NPS with authorized trail access, typically trail access and signage only
  - Unauthorized Trail Access
  - Trail and Trailhead naming
  - Signage and Trail Markers

LOCAL RESOURCES

As the Main Stem Greenway, tributary, and pedestrian ramble trails flow through different jurisdictions, design of the trail system must also be developed in partnership with local jurisdictions and with consideration for locally available guidance at the municipality and county level. Although not an exhaustive list, the following jurisdictions currently have trails and parks master plans that provide some elements of design guidance that may be relevant to consider as part of the Chattahoochee RiverLands.

A number of other planning initiatives have been documented as part of the Chattahoochee RiverLands Greenway Study. This effort is building upon and expanding that initial scan of planning-level work and is an attempt to identify local jurisdictions that provide guidance on the design of various trail and greenway types. It should also be noted that several local trail projects are in development throughout the RiverLands footprint at the present time, and as individual projects move forward into the design phases, such projects may be looked to for guidance or as precedents, alongside examples from elsewhere.

RESOURCES BY COUNTY

Cobb County Greenways and Trails Master Plan

A successful trail network will take people where they want to go through a range of trail types for all users, providing a variety of experiences for all ages and abilities in a safe and comfortable manner through the use of design best practices. The successful trail network is supported through amenities, consistent and legible signage, wayfinding, art, and trail-oriented development. The legacy of the trail is protected through community partnerships, user friendly activities, maps, programming, branding, and marketing of the trail.

Cobb County defines trails locally through typology and classification: Greenway Trails, Sidepath Trails, Neighborhood Connector Trails, Greenway Connectors, Trails within Park Properties. Trails also follow the US Forest Service classifications for level of development from Trail Class 1 (Minimally Developed) to Trail Class 5 (Fully Developed). Greenway Trails design guidance largely follows national best practices as outlined in the Main Stem Greenway portion of this memo. Greenway Trails design considerations also recommend guidance for low-stress facilities along roadways and through intersections, including the following features:

- Posted speed limit
- Observed median speed
- Annual average daily traffic volume
- Prevalence of heavy vehicles
- Presence of on-street parking
- Crash history
- Roadway and lane width
- Number of lanes
- Sight lines
- Slope
  - Potential barriers or pinch points (bridges, tunnels)
  - Intersection density
  - Complexity/stress of intersections
  - Surrounding land uses
  - Implementation costs

The following guidance is also available for trail amenities and conflict mitigation:

- Lighting may be installed as necessitated by use and location
- Wayfinding, regulatory, and etiquette signage is critical to minimize the impacts of high user volumes, bicycle speeds, inappropriate uses, and multiple use
- Prioritized amenities include restrooms, water fountains, waste receptacles, seating, art, and lighting
- Surface tread material: concrete or asphalt
- Yellow dashed centerlines can indicate direction of travel and that the path is intended for multiple modes
- Document and log any problems and identify trends or problem spots for mitigating user conflict

Additional specific guidance is available for paddle trails:

- Signage - road to access point directions; high visibility vs low visual intrusiveness
- Road signs leading to launch sites
  - Trailhead signs or kiosks with posted information such as a trail map, safety measures and water trail warnings, “leave no trace” guidelines and interpretive information
  - Campsite and day-use site signs
  - Signs along the paddle trail that identify distances to access points, intersecting streams and points of interest
  - Interpretive signage for natural environments and historic landmarks
  - Quick Response (QR) codes for Smart Phones and devices for wayfinding and interpretive Signage
- Launches
  - Follow ADA guidelines whenever possible and ensure the launch pier is no more than 12” above high water level

- Space every 4 miles for day use paddling and every 8 to 12 miles for more long-distance
- Launch should be five feet (5') wide and twenty-five feet (25') long to allow dry access
- Slopes should be five percent (5%) or less and not exceed fifteen percent (15%).
- Naturally occurring banks with gradual slopes are the most cost effective. More ideal locations with steep banks can be regraded to create a ramp or steps leading down to the water. Hardy materials suitable for a canoe/kayak launch will help prevent erosion. Removable or permanent floating dock launches can also be used but are more costly. However, removable launches are a cost-effective way of providing ADA accessibility and comfort for paddle trail users
- Storage space for canoes or kayaks
- Space for small boat rentals
- Amenities such as picnic tables, restrooms, and parking

Gwinnett County Trails Master Plan
The design guidance for off-road trails and roadway-adjacent sidepaths in Gwinnett County largely follows national best practices, with specific recommendations for off-road paths to be typically constructed with concrete and minimal lighting and sidepaths with asphalt and frequent lighting with luminaires for safe visibility along the roadway. Additional design guidance includes:

- Timber bridge and boardwalks
- Concrete wall with handrails where needed
- Signalized roadway crossings or grade separation where needed
- Trailhead signage, wayfinding signage, mile markers
- Restrooms and/or parking in key locations
- Branding and Wayfinding
    a. Mile markers
    a. Roadside signage
    a. Directional signage
    a. Emblems
    a. Metal or full-color
    a. Banners hung from light posts

Forsyth County Parks and Recreation Comprehensive Plan
No specific design guidelines related to greenways are available in the Comprehensive Plan; however, any recommendations in Forsyth County parks should be developed in coordination with the Comprehensive Plan.

RESOURCES BY MUNICIPALITY

Streets Atlanta Design Manual for Multimodal Streets
The design manual largely pertains to streetscape within the City of Atlanta. Many of the design principles are covered in **Technical Memo #2 – Bicycle and Pedestrian Safety Recommendations**, with accessibility covered in more detail in **Technical Memo #3 – Universal Access Recommendations**.

Chattahoochee Hill Country Regional Trail Master Plan
The Chattahoochee Hill Country Regional Greenway Trail includes portions of four counties (Carroll, Coweta, Douglas, and Fulton) and the City of Chattahoochee Hills. It is a long-term plan for a 98-mile proposed trail that would connect throughout these areas, to be developed in segments over time.

The first segment of the trail is now open in the Boundary Waters Park in Douglas County. It is a ¾-mile-long, 12-foot (12') wide trail that is completely accessible and constructed of concrete. Phase two of the trail is an 11-mile-long, six-foot (6') wide aggregate trail with a short segment proposed to be eight-foot (8') wide concrete. The plan also include approximately 46 miles of equestrian trail.

Coweta County / Newnan Greenway Master Plan / LINC
Completed in 2017, the LINC Master Plan for the Newnan/Coweta Trail Plan & Implementation Strategy outlines a strategy for development of dozens of miles of greenspace and trails to establish enjoyable spaces for walking, biking, and socializing in Newnan/Coweta County. The plan defines several types of greenways and trails, including greenways, side paths, and neighborhood greenways that will ultimately comprise the trail system. Design guidance and considerations are provided for each of these types, generally drawing from AASHTO standards, as well as the MUTCD, ADA, and NACTO *Urban Bikeway Design Guide.*

- Greenway trails should be a minimum of ten feet (10') wide, hard surfaced, and follow AASHTO specifications
- Vegetation mush be cleared within ten feet (10') of the height of the trail and at least two feet (2') on either side
- Side paths should have a minimum five foot (5') minimum landscaped buffer from roadways and markings on the trail to heighten awareness of the mix of users present
- Neighborhood greenways can be designed with a range of treatments and are most suitable for streets with low volumes of motorized traffic

FIgure 15: Example of off-road trail from the Gwinnett County Trails Master Plan

FIgure 16: Example of off-road trail from the Gwinnett County Trails Master Plan

In addition, precedent images and general guidance are provided for trail amenities and features including but not limited to bike parking, boardwalk segments, bridges, and pocket parks. The plan also provides guidance on proposed trail signage with specific recommendations for kiosk signs, secondary signs, regulatory signage, and mile markers.

Roswell River Parks Master Plan
Adopted in May 2016, the Master Plan covers 15 parcels of land along the river west of GA 400, including the Don White Park and Ace Sand property, and extends from Willeo Park to Don White Memorial Park. The Master Plan includes design observations for summer and special occasions, such as lack of parking and use of shoulders on Riverside Road and Azalea Drive for parking and lack of intermediate crosswalk access for residents living on the north side of the roads. Design guidance revolves around thirty-five-foot (35') height limits on buildings along the master plan study area and a number of potential wayfinding and branding concepts, such as:

- Develop a common design language or "system" of fonts, graphics, maps and other visual elements as a part of new monument, directional and interpretive signs and mile markers for the Riverwalk and each park site
- Create continuity across the system for both vehicular and pedestrian users through consistent use of visual elements and content
- Identify and enhance pedestrian nodes within the exterior environment
- Carry the design elements of the signage through the interiors of proposed public buildings and structures in the parks
- Develop improved interpretive waysides to communicate the historic and environmental importance of park features
- Improve facility and amenity identification and pedestrian origin/ destination understanding of the Riverwalk and park sites
- Improve mobility impaired access and route identification

Sandy Springs Trails Master Plan
Design guidance for greenways in the Sandy Springs Master Plan follow national best practices as outlined in the Main Stem Greenway portion of this memo.

Sugar Hill Greenway Plan
The Sugar Hill Sugar Loop Greenway Master Plan was completed in April of 2016. The planning area includes potential connections to and considerations for accessing portions of the Chattahoochee Riverfront near Settles Bridge Park, the Orr's Ferry Chattahoochee River National Recreation Area (CRNRA), and Bowman's Island Unit of the CRNRA. The plan identified a number of opportunities and challenges, including steep slopes, protected creeks and streams, roadway crossings, and gated communities, among others. It identifies a range of design considerations, including trail types, accessibility, safety and security, but as it is a master plan, does not provide specific guidance on design of individual trail segments.

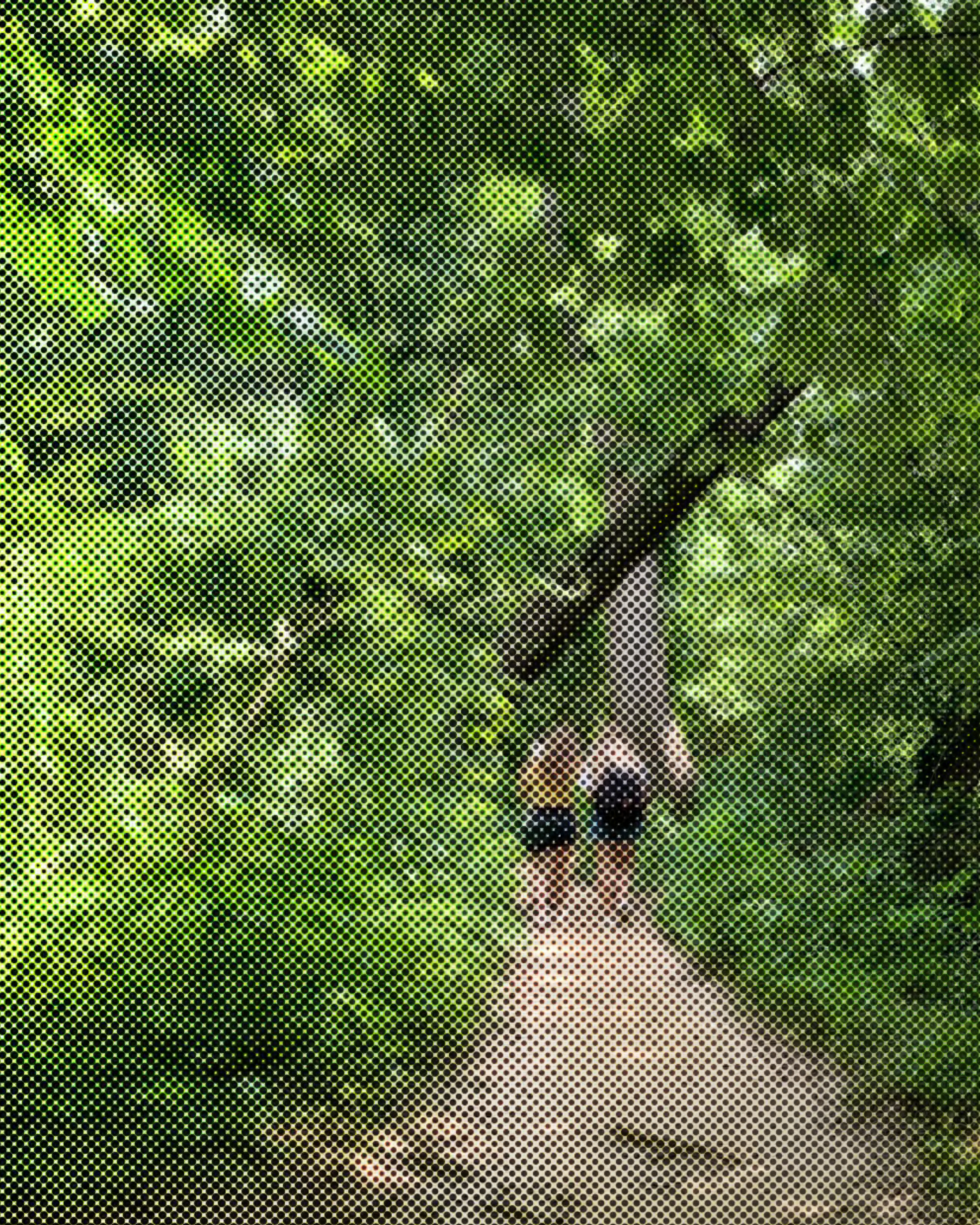
SUMMARY AND KEY FINDINGS

FHWA, AASHTO, NACTO, NPS and other national design resources provide a wealth of trail design ideas and concepts to develop a regional asset in the Chattahoochee RiverLands, along with targeted design guidance from GDOT and local counties and municipalities. Together, the guidance and standards referenced in this technical memo summarize the design opportunities for the universally accessible Main Stem Greenway, tributary trails feeding in from adjacent communities, and a collection of pedestrian ramble experiences along the Chattahoochee River providing opportunities to gather, explore, learn and have fun for all ages and abilities.

Coordination between the national, regional, and local design guidelines will be key for a cohesive, safe, sustainable and enjoyable trail system, with a diverse range of trail experiences for a wide variety of users.

Key considerations include:

- Alignment of the Main Stem Greenway, tributary trails, and pedestrian rambles should be sited to protect sensitive habitats and cross roadways, railroads, and other transportation and utility network rights-of-way legally and safely.
- Trail cross-slope and grade are key considerations for universally accessible trail and shared-use path, which is also discussed in Technical Memo #3 – Universal Access Recommendations. Trail width and materials are informed by the type of trail (such as Main Stem Greenway or pedestrian ramble), desired uses, and anticipated volume of use.
- Design along roadway right-of-way and through intersections is key for the safe and comfortable access of vulnerable roadway users, and safety measures to mitigate conflicts between users and protect vulnerable roadway users should be considered in coordination with Technical Memo #2 – Bicycle and Pedestrian Safety Recommendations. Regulatory signage, striping and pavement markings may further be used to define who has right-of-way and warn users of changes in trail conditions.
- Trail structures should be designed for a 50-year lifespan to protect sensitive habitats, protect vulnerable roadway users, be a sufficient width and well-lit for safe and comfortable access, and in water crossings withstand a 100-year flood event.
- Stormwater management and protection against erosion are key to preserving the RiverLands corridor and protect ecologically sensitive habitats. Green stormwater infrastructure and outfall protection that mimics natural erosion prevention and water infiltration should be utilized to manage urban stormwater runoff. Natural areas may utilize a variety of techniques that prevent erosion and encourage water infiltration through wetlands and native vegetation.
- Trail amenities provide comfortable access throughout the trail system, and will vary based on trail type, planned uses, and level of access



APPENDIX B:
BICYCLE AND PEDESTRIAN SAFETY RECOMMENDATIONS

TECHNICAL MEMO #2: BICYCLE AND PEDESTRIAN SAFETY RECOMMENDATIONS

OVERVIEW

Roads and streets are some of our most important – and often overlooked – public spaces. Many people share our roadways, and we also share the responsibility to work hard to make them safer. Bicyclists and pedestrians are among the most vulnerable roadway users; pedestrians are disproportionately struck and killed compared to people using other modes. In fact, there has been a forty-five percent (45%) increase in the number of people struck and killed while walking in the past decade, and the last four years were the deadliest in three decades.[1] We have a shared responsibility to take steps to improve safety for all users, especially the most vulnerable ones. Data shows that older adults, people of color, and people walking in low-income communities are disproportionately represented in fatal crashes while walking.[2]

Movements and strategies known as "Vision Zero" and "Toward Zero Deaths" acknowledge that even one death on our transportation system is unacceptable and focus on safe mobility for everyone. The Federal Highway Administration (FHWA) and many State, regional, and local jurisdictions are following the "Safe System Approach," which is based on six principles: deaths and serious injuries are unacceptable, humans make mistakes, humans are vulnerable, responsibility is shared, safety is proactive, and redundancy is crucial.

Within the Metro Atlanta area, the Atlanta Regional Commission is developing a Regional Safety Strategy to address the safety of all road users through a collaborative multidisciplinary approach. Specifically, the Strategy will identify regional safety goals, safety emphasis areas and risk factors, and evidence-based countermeasures that can be incorporated into infrastructure projects. The Strategy is anticipated to be completed in the fall of 2022 and will be a go-to resource for local government agencies and jurisdictions looking to address safety for all roadway users, including pedestrians and cyclists.

MEMO PURPOSE AND INTRODUCTION

The purpose of this technical memo is to summarize best practices for bicycle and pedestrian safety as it pertains to the development of Design Guidelines for the Chattahoochee RiverLands – a proposed network of greenways, blueways, and public spaces along a one-hundred mile (100 mi) stretch of the Chattahoochee River from Buford Dam to Chattahoochee Bend State Park. The memo summarizes relevant recommendations drawn from national and regional resources, such as the Federal Highway Administration (FHWA), American Association of State Highway Transportation Officials (AASHTO), National Association of City Transportation Officials (NACTO), and the Atlanta Regional Commission (ARC). In recent regional bicycle and pedestrian planning work, ARC has identified several roadway characteristics that are associated with an increased risk for crashes involving bicyclists and pedestrians:[3]

- **Speed**: Well over half of pedestrian and bike crashes occur on streets with speed limits at or above thirty-five miles per hour (35 MPH).
- **Number of Lanes:** Streets with four or more lanes have a significantly higher number of crashes per mile.
- **Lighting**: Crashes after dark disproportionately result in severe outcomes, especially for pedestrians where there is no street lighting.
- **Crosswalks**: Missing or inadequate crosswalks and sidewalks leave pedestrians vulnerable to being hit.

1 Smart Growth America. Dangerous By Design 2021, https://smartgrowthamerica.org/dangerous-by-design/.
2 Ibid.
3 Atlanta Regional Commission, Safe Streets for Walking and Bicycling, p. 7.

This memo will help the Design Team consider ways to mitigate risks by addressing these and other characteristics in a variety of settings through sound design. As the Chattahoochee RiverLands takes shape it will be important to design trail segments and roadway crossings that reduce the potential risk for collisions that may result in injuries and fatalities. The goal in preparing this memo is for the Design Team to understand best practices and considerations for bicycle and pedestrian safety and provide key findings and take-aways to inform the Design Guidelines.

MEMO OUTLINE

1) Corridor Safety Strategies and Treatments
   a) Corridor Safety Principles
   b) Separated Facilities
   c) Shared Facilities
   d) Separation from Travel Lanes
   e) Corridor Speed Management
2) Intersection Safety Strategies and Treatments
   a) Intersection Safety Principles
   b) Crosswalk Markings and Signage
   c) Intersection Design and Treatments
   d) Mid-Block and Uncontrolled Crossings
3) Applicability and Considerations
4) Summary and Key Findings

Source: FHWA

CORRIDOR SAFETY STRATEGIES AND TREATMENTS

The core of the Chattahoochee RiverLands as envisioned in the Greenway Study is a 125-mile (125 mi) shared-use path (also known as multi-use path) from Buford Dam to Chattahoochee Bend State Park. It is intended to be used by people walking, biking, rolling, and scooting. The RiverLands will connect communities and destinations along the river and will be accessible to people of all backgrounds, ages, and abilities. In some locations there may be opportunities to align the Greenway along existing roadways, like Roswell's Riverwalk and the sidepath trail along Lower Roswell Road in Cobb County, while in other areas, new Greenway segments will be developed to parallel the river to the extent feasible. Based on calculations included in the Chattahoochee RiverLands Greenway Study, approximately forty-nine miles (49 mi) of preferred alignment or Main Stem Greenway is anticipated to run alongside existing roadways. To that end, this section summarizes best practices for managing safety along transportation corridors. It includes references and strategies for designing multi-modal facilities along various types of roadways, including configuration of shared-use paths or trails, as well as alternative types of facilities where a true shared-use path may not be feasible. The selection of the facility type will depend on prevalent modes and the context of the surrounding natural and built environments. It should also be noted that maintenance will vary significantly depending on the facility itself, as well as context and location.

CORRIDOR SAFETY PRINCIPLES

- Speed management is key to creating safer environments for people walking and biking.
- Separation between vehicular traffic and non-motorized traffic is important, especially where there are higher traffic volumes and faster speeds.
- The configuration should consider the degree of mixing or separation between travelers of all modes to reduce the risk of crashes and increase comfort.
- Context is a critical parameter in design of multimodal facilities. Streets and trails should be designed to simultaneously respond to and influence the desired conditions in an area; what works for a commercial strip is not the same as what works for neighborhood streets.
- Design and treatments at any given intersection should highly depend on the location, context, facility type, and other factors.

SEPARATED FACILITIES

Sidewalk

A sidewalk is a type of walkway - a defined space or pathway designed for use by a person traveling on foot or using a wheelchair. Sidewalks help improve the safety and mobility of people walking. Ideally, they provide direct and connected networks between destinations. Sidewalks are generally separated from vehicular traffic by a physical barrier – usually a curb and gutter – and sometimes with a planted or paved buffer strip (the area between the curb and sidewalk or path). It is important to provide and maintain accessible walkways on both sides of the road in more densely populated urban areas, as well as near schools and along transit routes, or in areas with higher amounts of pedestrian activity. According to the FHWA, sidewalks have been shown to reduce crashes involving people walking by sixty-five percent (65%) to eighty-nine percent (89%).[4]

- Potential RiverLands Application: Sidewalk may be needed in locations where the Greenway is separated into parallel facilities for bicyclists and pedestrians - as an alternative to the Main Stem or Tributary Trail where space is constrained and unable to accommodate a shared-use path.

Paved Shoulder

Paved shoulders on the edge of roadways can serve as functional space for bicyclists and pedestrians in the absence of other facilities with more separation, depending on context. They are appropriate on roads with moderate volumes

4 Gan et al. Update of Florida Crash Reduction Factors and Countermeasures to Improve the Development of District Safety Improvement Projects. Florida DOT, (2005), cited in FHWA, Proven Safety Countermeasures.

(up to 12,000 AADT) and vehicle speeds between thirty miles per hour (30 MPH) and fifty-five miles per hour (55 MPH). They can be used on multilane roads with heavy traffic, but do not provide a low-stress experience in these conditions.
FHWA's Small Town and Rural Multimodal Networks guide recommends a minimum width of four feet (4') for the paved shoulder, plus an additional 1.5-foot (1.5') to four-foot (4') buffer space to provide comfortable separation between bicyclists and motor vehicles; however, wider paved shoulders are recommended on roadways with higher daily traffic volumes. Rumble strips can be used on the edge line or buffer space to help reinforce which spaces are for vehicles and bicyclists, so long as they do not reduce the amount of space for bicyclists. Additional consideration must be given to design of paved shoulders where bypass and turn lanes are present.

- Potential RiverLands Application: As an alternative to the Main Stem or Tributary Trail where space is constrained and unable to accommodate a shared-use path or separate facilities outside the roadway.

Bike Lanes
Where appropriate within the RiverLands footprint, FHWA's *Bikeway Selection Guide and other resources can help agencies determine which facilities provide the most benefit in various contexts. FHWA recommends that dedicated bicycle facilities along roadways can mitigate or prevent potential conflicts and crashes between motor vehicles and bicyclists. They designate exclusive space for bicyclists through the use of pavement markings and signs, and are generally located directly adjacent to vehicular travel lanes and follow the same direction as vehicular traffic. Where used, separated bike lanes should be paired with sidewalks for people walking.*

Bike lanes can reduce crashes by up to fifty-seven percent (57%) on urban four-lane undivided roads and by up to thirty percent (30%) on urban two-lane undivided roads.[5] Separated bicycle lanes – with a painted or physical buffer between vehicle travel lanes and the bike lane – may offer even greater safety benefits. A range of guidance for bike lanes is available from various resources and the design depends highly on the specific setting and context, including the presence of turn lanes. Bike lanes are appropriate on streets with moderate traffic volumes (up to 12,000 to 15,000 AADT) and moderate vehicle speeds (from twenty-five miles per hour (25 MPH) to forty miles per hour (40 MPH), depending on context. For streets with higher speeds and/or greater volumes, significant truck traffic, and high on-street parking turnover, facilities that provide greater separation should be considered.

In general, the minimum width for bike lanes is four feet (4') if no curb and gutter or guardrail is present. The preferred width is 6.5 feet (6.5') or more to allow for bicyclists riding side-by-side, passing, and for comfortable operation adjacent to on-street parallel parking. Optional buffers between bike lanes and travel lanes or parking range in width, depending on the specific setting and what the buffer is providing separation from. The total combined width of bike lanes and buffers should be considered. For example, a wider buffer may be desired to separate bike lanes from parked vehicles so that cyclists can avoid the door zone. Buffered bike lanes may be narrower than conventional bike lanes because the buffer assumes some of the distance bicyclists need to maneuver away from travel lanes, parked vehicles, or fixed objects, like planters. Configuration of bike lanes requires consideration of traffic volumes, behaviors, buffers from fixed objects (guardrail or fence, for example), and parked and moving vehicles, among other factors. Bicycle lane word and/or symbol markings must be used to define the bike lane and designate that are for use by bicyclists. Solid white lines shall be used to separate motor vehicle traffic from the bike lane. Additional site-specific guidance on the use of bicycle lane pavement markings, striping, signage, and mixing zones are available through the MUTCD, AASHTO *Guide for the Development of Bicycle Facilities, and NACTO.*

- Potential RiverLands Application: Bike lanes may be needed in locations where the Greenway is separated into parallel facilities for bicyclists and pedestrians - as an alternative to the Main Stem or Tributary Trail where space is constrained and unable to accommodate a shared-use path.

5 FHWA, *Proven Safety Countermeasures.*

Separated Bike Lanes

Separated bike lanes are exclusively for use by bicyclists and are located within or directly adjacent to the roadway, physically separated from vehicular traffic by pavement markings (striping) or vertical elements such as a curb or delineator post. Separated bike lanes are more comfortable to a wider range of users than on-street bike lanes and can reduce the incidence of people riding on the sidewalk and potential user conflicts. Where used, separated bike lanes should be paired with sidewalks for people walking. They may be one-way or two-way and may be at street level or level with the sidewalk.

Separated bike lanes are appropriate on any road where standard bike lanes are being considered, and may be more appropriate on streets with high traffic volumes and moderate-to-high vehicle speeds. Separated bike lanes are generally preferred over conventional bike lanes in scenarios where speed limits are greater than thirty-five miles per hour (35 MPH) and traffic volumes exceed 4,000 AADT, depending on context.

The width of the separation depends upon the type of separation and the configuration of the roadway. In general, if the separated bike lane is at sidewalk level, a curb or median separates them from vehicular traffic, while a different pavement color or texture separates the bike lane from the sidewalk. If at street level, they can be separated from vehicular traffic by raised medians, on-street parking, or bollards. A minimum separation from vehicular traffic of one foot (1') is possible with a vertical curb although a separation width of three feet (3') is preferred. If painted buffers are used instead of physical barriers, they shall be marked with two solid white lines and diagonal cross hatching or chevron marks if they are three (3') or more feet wide. The generally preferred width for separated bike lanes is five feet (5') to seven feet (7') for one-way bike lanes, which allows for side-by-side riding or passing. Separation from sidewalk is also a consideration to reduce unwanted encroachment or potential conflicts between the sets of users. Additional site-specific guidance on the use of separated bicycle lane pavement markings, striping, signage, delineators/barriers, and mixing zones are available through the MUTCD, AASHTO *Guide for the Development of Bicycle Facilities, and NACTO.*

- Potential RiverLands Application: Separated bike lanes may be needed in locations where the Greenway is separated into parallel facilities for bicyclists and pedestrians on high-volume or high-speed roadways - as an alternative to the Main Stem or Tributary Trail where space is constrained and unable to accommodate a shared-use path.

Shared Use Path

Shared-use paths (also sometimes called multi-use trails or paths) provide travel areas separate from vehicular traffic and may be used by bicyclists, pedestrians, skaters, wheelchair users, joggers, scooters, and others. They are typically in their own right-of-way, separate from the roadway, and provide a low-stress experience for recreation and transportation purposes.

A range of guidance is provided for design of shared-use paths depending on context; the dimensions and design should support the speed and volume of expected users. They are intended for use by pedestrians and cyclists and must meet accessibility guidelines for walkways and curb transitions; they must be accessible to all users including those using mobility devices and who have visual impairments.

Typical recommendations range from eight feet (8') to ten feet (10') wide for low-volume, low user mix conditions to twelve feet (12') to fourteen feet (14') wide for high volume, highly mixed user conditions. A ten-foot-wide (10') path is adequate for moderate to heavy use and is appropriate for most situations; however narrower paths may be appropriate in lower volume settings and wider paths may be needed in densely populated areas or where high user volumes are expected, particularly if there is a mix of uses (walking, biking, scooting, skating). Two-foot (2') horizontal clearance or shoulders are recommended on either side of the path in most circumstances. Guidance on the requirements of safety railing and placement in the roadway right-of-way is available in the AASHTO *Guide for the Development of Bicycle Facilities and GDOT's Pedestrian and Streetscape Guide.*

- Potential RiverLands Application: Much of the RiverLands Greenway is anticipated to be configured as a shared-use path, including a majority of the Main Stem and portions of the Tributary trails. In most cases it is anticipated that the Main Stem trail will be shared-use path, but there are some locations where this may not always be possible.

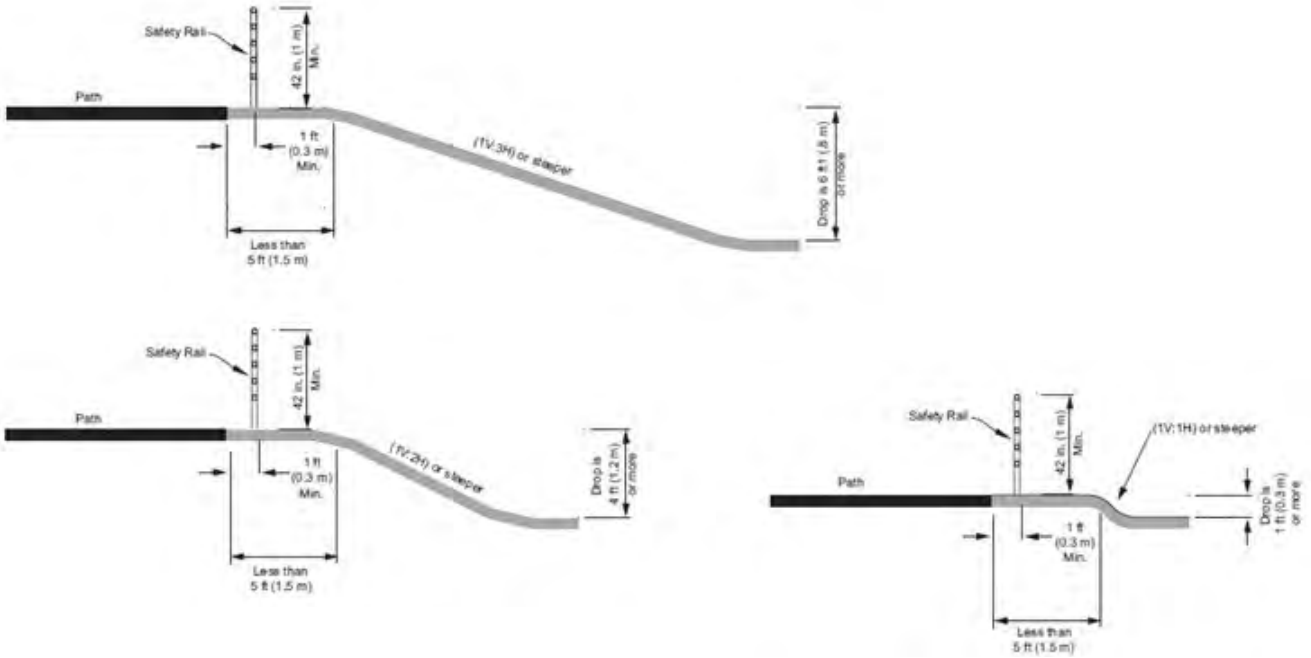


FIgure 1: Safety railing by slope grade and drop height from the AASHTO *Guide for the Development of Bicycle Facilities,* 2012 Fourth Edition.

Resource	Typical Minimum Width	Notes
FHWA *Small Town and Rural Multimodal Networks*	8-10'	Lower volume, low user mix
	12'	Equal cyclists and pedestrians
	12-14'	Higher volume, high user mix
AASHTO *Guide for the Development of Bicycle Facilities* (2012)	10-14'	A reduced width of 8' may be used in certain limited circumstances; wider paths are recommended in areas with ≥ thirty percent (30%) pedestrians and 300+ users in a peak hour
GDOT *Pedestrian and Streetscape Guide*	10-14'	Should be a minimum of 10' wide except in constrained conditions, where they may be as narrow as 8'; preferred width of 14' or larger in areas with high volumes of pedestrians

Table 1: Typical Guidance for Shared-Use Path and Sidepath Dimensions

Sidepath

Sidepaths are bidirectional shared-use paths located alongside and parallel to roadways. Typically, they are separated from the roadway by a grassed or vegetated buffer strip. They provide low-stress, comfortable transportation, and recreation experience for travelers of all ages and abilities, separated from the roadway. They are designed to serve pedestrians and cyclists and may be used be skaters, wheelchair users, people using mobility devices, scooters, and others. They may be used on roadways with moderate to high traffic volumes and moderate to high vehicle speeds, such as collectors and arterials, depending on context. They can make cycling and walking comfortable in areas where high traffic volumes and high posted speed limits might otherwise discourage such activities.

The guidance for sidepath design varies highly depending on context. The typical recommended widths range from ten feet (10') to fourteen feet (14'), with absolute minimum width of eight feet (8') in constrained areas. A minimum two-foot-wide (2') horizontal clearance is recommended to fixed objects or other vertical elements. The separation distance from the roadway should depend on the speed and configuration of the adjacent roadway. On streets with a speed limit of thirty-five miles per hour (35 MPH) or greater, sidepaths should strive for a five-foot (5') separation; where that is not possible, a physical barrier may be used to separate the roadway and sidepath. A three-foot (3') horizontal clearance is recommended between trees and the sidepath. Similar to a shared-use path, for sidepath fill slopes greater than 1V:3H or adjacent to bodies of water with less than five feet (5') of shoulder separation, a forty-two-inch high (42") safety railing should be considered at a one-foot (1') minimum offset from the path edge depending on overall drop height. Guidance on the requirements of safety railing and placement in the roadway right-of-way is available in the AASHTO *Guide for the Development of Bicycle Facilities and the AASHTO Roadside Design Guide.*

- Potential RiverLands Application: Several segments of the RiverLands Main Stem Greenway and Tributary Trails are anticipated to be configured as sidepaths, running adjacent to exiting roadways, such as along Barnwell Road in Peachtree Corners, Atlanta Road in Smyrna, or South Fulton Parkway in Chattahoochee Hills.

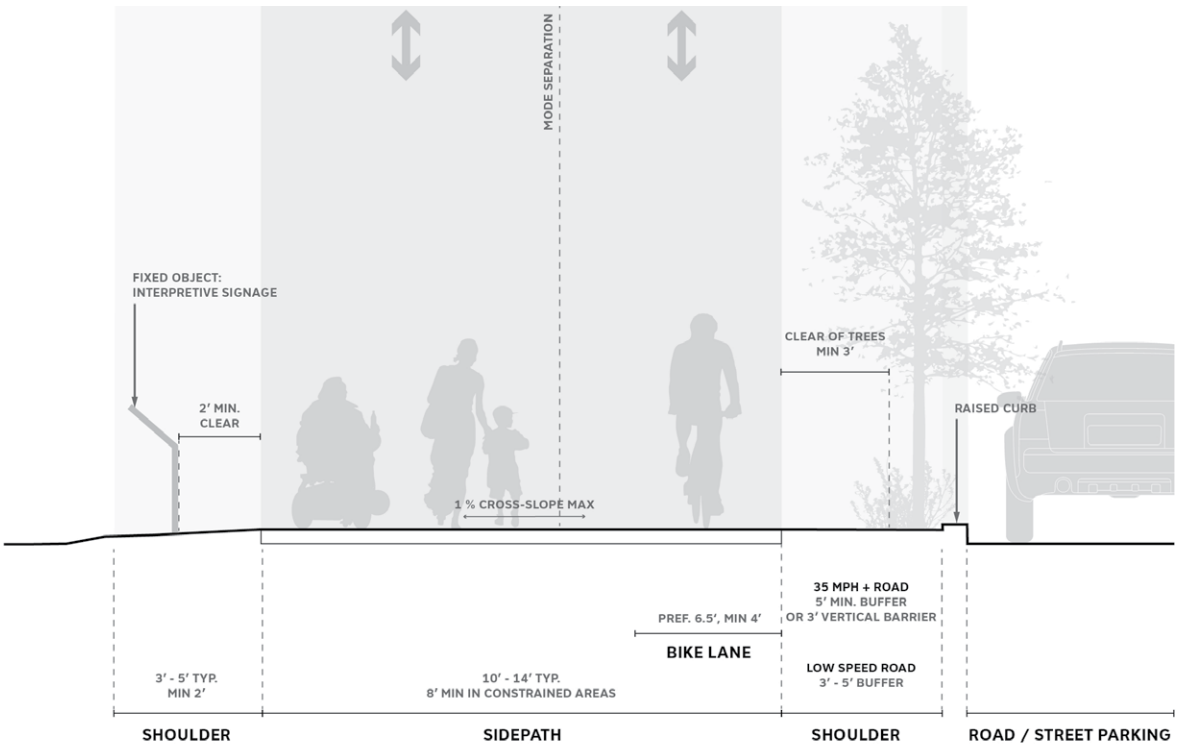


Figure 2: Sidepath (Roadside) Typical Section

Separation from Travel Lanes

The separation distance from the roadway should depend on the speed and configuration of the adjacent roadway. While it also depends on the type of facility, separating vehicular travel from non-motorized travel is an overall strategy for managing safety along corridors. In general, on streets with a speed limit of thirty five miles per hour (35 MPH) or greater, sidepaths should strive for a five-foot (5') separation; where that is not possible, a physical barrier may be used to separate the roadway and sidepath. In particular, multimodal facilities near schools should provide increased separation that is more appropriate and comfortable for younger users.

Critical Design Requirements

- Shared use paths should be a minimum of 10 feet wide, except constrained shared use paths may be as narrow as 8 feet wide (AASHTO *Guide for the Development of Bicycle Facilities*). A preferred width of a shared use path is 14 feet and sometimes larger in areas with high volumes of pedestrians such as the Beltline in Atlanta, Georgia.
- A vertical clearance of 10 feet from fixed objects should be maintained. In some cases, vertical clearance should be taller than 10 feet to accommodate emergency and maintenance vehicles (AASHTO *Guide for the Development of Bicycle Facilities*).
- Horizontal clearance of 2 feet from fixed objects (trees, signs, etc.) should be maintained on each side of the path. Where smooth features such as bicycle railings or fences are introduced with flaring end treatments, a minimum clearance of 1 foot is acceptable. If adequate clearance cannot be provided between the path and lateral obstructions, reflective warning signs and markings should be used to capture the attention of pedestrians (AASHTO *Guide for the Development of Bicycle Facilities*).
- On streets with a speed limit of 35 mph or greater, shared used paths should maintain a 5-foot separation from through travel lanes. If the minimum separation cannot be accommodated, a vertical barrier with a minimum height of 3.5 feet may be needed to separate the path from vehicular traffic in through travel lanes.
- On streets with a speed limit greater than 40 mph, the vertical barrier and end treatments should be crash worthy.
- Side slopes or ditches should have a minimum of 4 feet of clear, level area (including shoulder) before the up slope or down slope (or ditch) begins.
- Where the shared use path is parallel to a street, the grade should not exceed the grade established for the adjacent street.
- Drainage grates and inlets should be located at the outside edge or adjacent to shared use paths. Grid style grates are recommended over grates with parallel bars. Grates should be set flush, less than 0.5 inch below the surface of the surrounding pavements, with no raised edges.
- Refer to AASHTO *Guide for the Development of Bicycle Facilities* (2012) for formulas and guidance for calculating the minimum radius for horizontal curves on shared use paths.
- Refer to Section 5.2.1 of this Guide for further guidance on material selection (e.g., asphalt or concrete).

Figure 3: Critical Design Requirements for Shared Use Paths
Source: GDOT Pedestrian and Streetscape Guide (Rev. 3.0, p. 4-41)

SHARED FACILITIES

Bicycle Boulevards and Yield Roadways

Local streets with very low volumes (under 2,000 AADT) and speed limits below thirty miles per hour (30 MPH) may be appropriate candidates to be used as shared facilities for vehicles, bicyclists, and pedestrians. These include streets with shared-lane markings or "sharrows," bicycle boulevards and yield roadways. Candidate locations for such facilities include connections between residential neighborhoods and collector streets or residential streets that provide access to destinations like parks or trailheads. Several design features contribute to low-stress conditions on shared lanes: adequate sight distances, traffic calming to reduce motor vehicle speeds, and bicycle-friendly pavement and features such as inlets, railroad crossings, and bridge expansion joints.[6]

Low-volume, local streets with speeds limits less than thirty miles per hour (<30 MPH) can be configured as bicycle boulevards to provide a bicycle-priority route that provides convenient, low-stress access to local destinations and through neighborhoods.[7] Speed management and traffic calming may be used to help maintain low vehicle speeds and improve bicyclists' comfort. Bicycle route signs and shared lane markings or "sharrows" are recommended to provide route guidance and to identify proper positioning of bicyclists within the roadway. Additional site-specific guidance on the placement of signage, shared lane markings, and other pavement markings may be found in the MUTCD and AASHTO *Guide for the Development of Bicycle Facilities.*

- Potential RiverLands Application: Shared roadways may be needed for short portions of the RiverLands Greenway on low-volume roadways that provide connections to or within parks, trailheads, or neighborhoods.

Advisory Shoulder

Advisory shoulders create usable shoulders for bicyclists on roadways with that are too narrow to accommodate a bike lane or other dedicated facility. Different from dedicated paved shoulders, advisory shoulders are intended to accommodate low volumes of two-way vehicular traffic and provide prioritized space for bicyclists with little or no widening of the paved roadway surface. The shoulder is delineated by dashed pavement markings and optional pavement color. The preferred width for an advisory shoulder is six feet (6'), with ten feet (10') to eighteen feet (18') of vehicle travel space; a minimum width of four feet (4') may be used if no curb or gutter is present. Motorists may use the shoulder when cyclists are not present. They are most appropriate on streets with low to moderate volumes (≤3000 AADT) and speed limits no higher than thirty-five miles per hour (≤35 MPH).8 Advisory shoulders are relatively new in the U.S. and an approved Request to Experiment is required to install advisory shoulders per section 1A.10 in the MUTCD.

- Potential RiverLands Application: Advisory shoulders are likely to be less common within the RiverLands footprint. They may be appropriate on some of the more rural roads in the southern portion of the study area, where a true shared-use path is not feasible due to constraints.

CORRIDOR SPEED MANAGEMENT

Speed management is an important consideration in the development of multimodal networks. Vehicular speed is a significant factor in crashes of all types and increases the severity when crashes do happen. Higher speeds increase the risk of severe injuries and fatalities, especially for pedestrians and cyclists. At higher speeds, motorists are less likely to see and to be able to react to pedestrians or cyclists, and vehicles traveling at higher speeds require greater stopping distances.

There are generally two types of speed reduction measures: physical measures such as horizontal shifts, speed tables or humps, and narrowing roadways and non-physical measures such as signs and pavement markings. Other types of traffic calming or diversion treatments can help dissuade cut-through traffic and may help in reducing volume on local or neighborhood streets.

Generally, traffic calming devices, such as speed humps, speed tables, pinch points, and lateral shifts are most appropriate on local or collector streets – those with lower traffic volumes – than on major roadways or arterials. Other speed-reducing measures, such as roundabouts, speed feedback signs, and median islands, may be appropriate

6 AASHTO *Guide for the Development of Bicycle Facilities, 2012 Fourth Edition*
7 FHWA *Small Town and Rural Multimodal Networks*
8 Ibid.

on a slightly wider range of roadways. Where used, speed reduction measures should generally be applied in concert to create continuous slower conditions along a segment of roadway. Context is extremely important, and treatments will highly depend upon a range of factors.

INTERSECTION SAFETY STRATEGIES AND TREATMENTS

As a multimodal Greenway that is anticipated to run along dozens of miles of roadway segment, it is important to consider design of intersections and roadway crossings. Intersections exhibit many risk factors for certain types of crashes, including crashes between motor vehicles and bicyclists and/or pedestrians. The Chattahoochee RiverLands Greenway Study identified up to twenty-four potentially high-risk bicycle and pedestrian crossings and twelve potential crossings of major roadways along the Preferred Alignment.

There are a number of design and other strategies that can help create safer environments for all users at intersections where bicyclist and pedestrian facilities such as shared-use paths or multi-use trails, sidewalks, and bike lanes are present. This section summarizes several best practice and national guidance documents, with a focus on strategies that strive to reduce the likelihood of potential crashes and create a safer and more comfortable environment for everyone.

INTERSECTION SAFETY PRINCIPLES

- Design of intersections where pedestrians and bicyclists (and other vulnerable road users) are present should focus on reducing potential conflict between these users and motor vehicles by increasing visibility, communicating a clear right-of-way, and facilitating eye contact and awareness of one another.
- Configuration of safe intersections for bicyclists may include color, signage, medians, signals and detection, and pavement markings.
- Intersection and crossing design should consider the degree of mixing or separation between travelers of all modes to reduce the risk of crashes and increase comfort.
- Design and treatments at any given intersection should highly depend on the location, context, facility type, and other factors.
- Design of lighting to improve visibility of bicyclists and pedestrians at intersections, driveways, and entrances to mitigate crashes in low-light and dark conditions.

CROSSWALK MARKINGS AND SIGNAGE

Crosswalk pavement markings and warning signage are used to raise awareness of the crossing itself and alert motorists to the potential presence of people crossing a roadway. A simple marked crosswalk may be appropriate at crossings with low motor vehicle speeds and volumes. High-visibility crosswalks (bar pairs, piano keys, or ladders) are now preferred over conventional transverse lines. Advance warning signs can be used to alert road users in advance of locations where people, bicycles, or wheelchairs may enter or cross the roadway. The MUTCD provides additional guidance on the types of signs appropriate for different locations.

- Potential RiverLands Application: All road and street crossings within the RiverLands footprint should meet minimum requirements of the MUTCD and provide high-visibility crosswalk with appropriate signage. Consideration should be given to adding visibility enhancements (see below) in select locations.

Visibility Enhancements

For any pedestrian crossing, whether at an intersection, or a midblock location, the FHWA recommends the use of high-visibility crosswalks, lighting, and signing and pavement markings, as part of its suite of Proven Safety Countermeasures (PSCs). Certain conditions and obstructions such as parked cars, signage or objects, and vertical and horizontal curvature can reduce visibility contributing to potential safety issues. Typically, for locations where people would cross multiple lanes and daily traffic volumes exceed 10,000 Average Annual Daily Traffic (AADT), a marked crosswalk alone is not sufficient. FHWA recommends more substantial crossing improvements to reduce the risk of potential crashes. According to the Proven Safety Countermeasures website:

- High visibility crosswalks can reduce pedestrian injury crashes by up to forty percent (40%).
- These include patterns like bar pairs and ladders that are visible to drivers and pedestrians from farther away compared to traditional transverse lines.
- Intersection lighting can reduce pedestrian crashes up to forty-two percent (42%).
- Careful placement of luminaries in forward locations can eliminate creating silhouette effects and make it easier for drivers to see pedestrians
- Advance yield or stop sign markings and signs can reduce pedestrian crashes up to twenty-five percent (25%).
- Use of "YIELD Here to Pedestrians" to "STOP Here for Pedestrians" signs twenty feet (20') to fifty feet (50') in advance of marked crosswalks helps indicate where drivers should stop or yield to pedestrians, depending on State law.
- STOP or YIELD pavement markings can be used to supplement the signage.
- In-street use of "STOP Here for Pedestrians" or "YIELD Here to Pedestrians" may be appropriate on two- or three-lanes roads with posted speed limits of thirty miles per hour (30 MPH) or lower.

INTERSECTION DESIGNS AND TREATMENTS

Leading Pedestrian Intervals

Leading pedestrian intervals (LPIs) give people on foot the opportunity to enter the crosswalk between three and seven seconds before vehicles are given a green light. This allows pedestrians to establish their presence in the crosswalk before vehicles turn, making it more likely drivers will notice them and reducing the potential for collisions. LPIs have been demonstrated to reduce pedestrian-vehicle crashes at intersections by up to thirteen percent (13%).[9] The MUTCD provides additional guidance on timing of LPIs and to ensure they are accessible to all users.

- Potential RiverLands Application: Intersections with anticipated high-volume crossings and in high-pedestrian traffic areas should consider LPIs.

Curb Extensions

Curb extensions – sometimes called bulb-outs or neckdowns - reduce pedestrian exposure to traffic and increase visibility of people crossing by providing extra space for people waiting to cross the road. Simultaneously, they shorten the distance pedestrians mush cross, reducing the amount of time that pedestrians are in the roadway. Curb extensions must not extent into travel lanes or across bike lanes. They are appropriate in locations where on-street parking is provides and where transit vehicles and bicycles are either not present or travel outside of the roadway (behind the curb).

- Potential RiverLands Application: Curb extensions should be considered at intersections in locations where on-street parking is provided on roadways that carry segments of the RiverLands Main Stem trail.

Bicycle Treatments

There are an array of treatments for facilitating safe and comfortable on-street or separated bicycle movements through both signalized and unsignalized intersections. These include pavement markings that indicate the intended path of cyclists through an intersection or across a driveway or ramp, bike boxes, through bike lanes, and combined bike/turn lanes. Strategies like bike boxes are most appropriate in locations where there are higher volumes of bicycles and/or motor vehicles and with frequent bicycle left-turns, such as to follow designated routes or to access shared-use paths. Additional details on the recommended guidance and configuration of these treatments are available in the NACTO Urban Bikeway Design Guide.

Bicycle Signals

There may be some locations within the RiverLands footprint where a combination of on-street bike lanes and sidewalks may be needed to bridge short distances between segments of shared-use paths. Depending on the context, speed limit, average daily traffic, and anticipated bicycle traffic crossing a given road, it may be worthwhile to consider the use of bicycle signals. They may be particularly helpful at complex intersections that may be difficult to navigate. They can help to clarify when bicyclists should enter an intersection and may restrict vehicular movements to reduce the potential for conflicts. The NACTO Urban Bikeway Design Guide provides additional details

9 FHWA, Proven Safety Countermeasures.

on bike signal components like signal heads, signal detection and actuation, and the use of active warning beacons or hybrid beacons for crossing major streets. Internationally, the use of "green wave" traffic signal progression provides timed signal progression for at-grade bicycle lanes at intersections to reduce bicycle stopping and improve both flow and safety. This type of signal progression is often also utilized with Lead Pedestrian Intervals, more green time for bicyclists, green in-pavement LED signal indicators for green signal cycle length, and additional split phases to protect against conflicting movements.[10]

10 FHWA Delivering Safe, Comfortable, and Connected Pedestrian and Bicycle Networks: A Review of International Practices

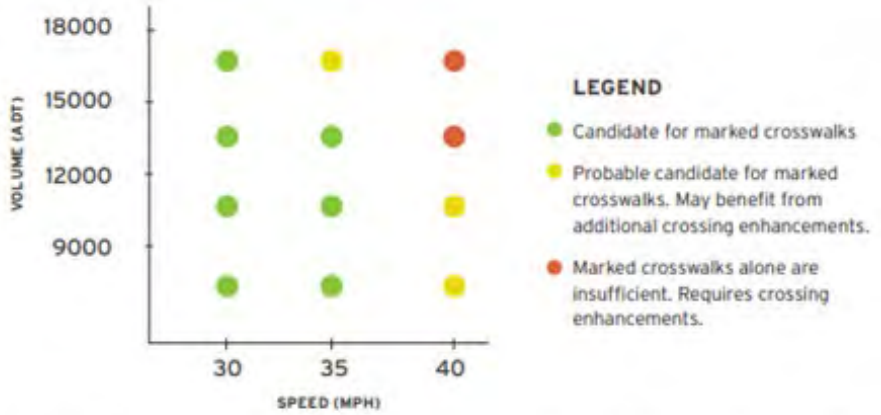


Figure 4-3. *Conditions unsuitable for a marked crosswalk alone are candidates for additional enhancements such as curb extensions, median islands and/or active warning beacons. Chart adapted from* ***FHWA Safety Effects of Marked Crosswalks at Uncontrolled Locations 2005*** *Table 2-11 (data for two-lane roadway at non school crossings).*

Figure 4: Suitability Guidance for Marked Crosswalks
Source: FHWA Small Town and Rural Multimodal Networks

Figure 5: Example of bicycle intersection crossing markings from NACTO

Bike Lanes at Intersections

Design of bike lanes at intersections should emphasize reducing vehicle speeds, minimizing exposure, raising awareness, and communicating right-of-way priority.[11] In most conditions, bicyclists have priority over turning traffic and signs and markings should remind motorists to yield. The MUTCD and other resources provide specific guidance on the types of signage and markings to be used on the approach to and at intersections.

- Potential RiverLands Application: Bicycle-specific treatments should be considered at intersections along RiverLands segments where on-street bicycle facilities are provided as alternatives to shared-use paths or Greenways.

Sidepaths at Intersections

Design of sidepath crossings at intersections should raise awareness of potential conflict points and encourage proper yielding of motorists to bicyclists and pedestrians. Separation distance of the sidepath from the intersection should be selected based upon traffic volumes and speeds. As the speeds on the parallel roadway increase, so should the separation distance of the sidepath from the roadway. The range recommended by the Small Town and Rural Multimodal Networks is from 6.5 feet (6.5') on roads with speed limits less than twenty-five (25 MPH) to upwards of sixteen feet (16') on roads with speed limits of fifty-five (55 MPH) or more. The STAR guide also offers guidance on design strategies for minor street crossings and connections with on-street bikeways.

The sidepath crossings themselves incorporate many of the standard crosswalk elements described above, including pavement markings and striping, signage, and lighting as appropriate. AASHTO describes the following attributes of a good intersection crossing design[12:]

- Clarity – pedestrian and bicycle presence is obvious and expected by motorists.
- Predictability – convenient and appropriately frequent crossings.
- Visibility – location and lighting promote visibility of bicyclists and pedestrians to motorists.
- Short Wait – bicyclists and pedestrians do not have to wait an excessive amount of time to cross.
- Adequate Crossing Time – controlled by pedestrian walking speed, everyone of all ages and abilities have enough time to cross the intersection safely.
- Limited Exposure – potential conflicts with motorists is limited, and may be mitigated with crossing islands, curb extensions, and other design features.
- Clear Crossing – the crosswalk is free of obstacles and is fully accessible.
- Potential RiverLands Application: The RiverLands Greenway Main Stem and Tributary Trails will cross numerous roads as a shred-use path. Consideration should be given to recommended sidepath crossing treatments at each of these locations, based on context and roadway characteristics, incorporating pavement markings, lighting, and signage as appropriate.

MID-BLOCK AND UNCONTROLLED CROSSINGS

FHWA recommends consideration of high-visibility crosswalks at all midblock and uncontrolled crossing locations. Materials such as inlay or thermoplastic tape is preferred over paint or brick to increase reflectivity. Additional safety recommendations and guidance for midblock and uncontrolled crossings based on roadway configuration, AADT, and speed limit are available through the FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations.

11 Ibid.
12 AASHTO *Guide for the Planning, Design, and Operation of Pedestrian Facilities (July 2004)*

Rectangular Rapid Flashing Beacons (RRFB)

While marked crosswalks or pedestrian warning signs can improve safety for people crossing a road, they may not be sufficient for drivers to see and notice crossing locations and pedestrians. FHWA recommends the use of RRFBs to increase visibility of pedestrians and increase driver awareness at uncontrolled, marked crosswalks. RRFBs can reduce pedestrian crashes by up to forty-seven percent (47%).[13] They may be used in many types of pedestrian crossings but are particularly effective at multilane crossings with speed limits less than forty miles per hour (40 MPH).

- Potential RiverLands Application: RRFBs should be considered in areas where the Main Stem trail crosses multilane, low-to-moderate speed roadways.

Pedestrian Hybrid Beacons (PHB)

Pedestrian hybrid beacons are traffic control devices that help pedestrians safety cross higher-speed roadways at midblock and uncontrolled locations. They are pedestrian-actuated, meaning they remain dark until someone pushes the call button to activate the beacon. The beacons illuminate flashing yellow lights, alternating red lights, and then solid red lights to direct motorists to slow and then come to a stop, and provide right-of-way for people to cross the road. In general, PHBs are most appropriate where it is difficult for people to cross on foot, such as when speed limits exceed thirty-five miles per hour (35 MPH), where three or more lanes are to be crossed, and where traffic volumes exceed 9,000 AADT. They have been shown to reduce pedestrian crashes by up to fifty-nine percent (59%) and to reduce serious injury and fatal crashes by up to fifteen percent (15%).[14]

- Potential RiverLands Application: PHBs should be considered in areas where the Main Stem trail crosses multilane, moderate speed roadways.

13 Ibid.
14 Ibid.

Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
2 lanes (1 lane in each direction)	❶ 2 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6 7 9	① 5 6 7 9	① 5 6 ❾
3 lanes with raised median (1 lane in each direction)	❶ 2 3 4 5	❶ ❸ 5 7 9	① ❸ 5 ❼ ❾	① 3 4 5 7 9	① ❸ 5 ❼ ❾	① ❸ 5 ❼ ❾	① ❸ 4 5 7 9	① ❸ 5 7 ❾	① ❸ 5 ❾
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	❶ 2 3 4 5 6 7 9	❶ ❸ 5 6 7 9	① ❸ 5 6 ❾	① 3 4 5 6 7 9	① ❸ 5 6 ❼ ❾	① ❸ 5 6 ❾	① ❸ 4 5 6 7 9	① ❸ 5 6 ❾	① ❸ 5 6 ❾
4+ lanes with raised median (2 or more lanes in each direction)	❶ ❸ 5 7 8 9	❶ ❸ 5 7 8 9	① ❸ 5 8 ❾	① ❸ 5 7 8 9	① ❸ 5 ❼ 8 ❾	① ❸ 5 8 ❾	① ❸ 5 ❼ 8 ❾	① ❸ 5 8 ❾	① ❸ 5 8 ❾
4+ lanes w/o raised median (2 or more lanes in each direction)	❶ ❸ 5 6 7 8 9	① ❸ 5 6 7 8 9	① ❸ 5 6 8 ❾	① ❸ 5 6 7 8 9	① ❸ 5 6 ❼ 8 ❾	① ❸ 5 6 8 ❾	① ❸ 5 6 ❼ 8 ❾	① ❸ 5 6 8 ❾	① ❸ 5 6 8 ❾

Given the set of conditions in a cell,

- # Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.
- ● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.
- ○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

1 High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs
2 Raised crosswalk
3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line
4 In-Street Pedestrian Crossing sign
5 Curb extension
6 Pedestrian refuge island
7 Rectangular Rapid-Flashing Beacon (RRFB)**
8 Road Diet
9 Pedestrian Hybrid Beacon (PHB)**

*Refer to Chapter 4, 'Using Table 1 and Table 2 to Select Countermeasures,' for more information about using multiple countermeasures.

**It should be noted that the PHB and RRFB are not both installed at the same crossing location.

This table was developed using information from: Zegeer, C.V., J.R. Stewart, H.H. Huang, P.A. Lagerwey, J. Feaganes, and B.J. Campbell. (2005). Safety effects of marked versus unmarked crosswalks at uncontrolled locations: Final report and recommended guidelines. FHWA, No. FHWA-HRT-04-100. Washington, D.C.: FHWA. Manual on Uniform Traffic Control Devices, 2009 Edition, (revised 2012). Chapter 4F, Pedestrian Hybrid Beacons. FHWA, Washington, D.C.: FHWA. Crash Modification Factors (CMF) Clearinghouse. http://www.cmfclearinghouse.org/. FHWA. Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE). http://www.pedbikesafe.org/PEDSAFE/. Zegeer, C., R. Srinivasan, B. Lan, D. Carter, S. Smith, C. Sundstrom, N.J. Thirsk, J. Zegeer, C. Lyon, E. Ferguson, and R. Van Houten. (2017). NCHRP Report 841: Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments. Transportation Research Board, Washington, D.C.. Thomas, Thirsk, and Zegeer. (2016). NCHRP Synthesis 498: Application of Pedestrian Crossing Treatments for Streets and Highways. Transportation Research Board, Washington, D.C., and personal interviews with selected pedestrian safety practitioners.

Figure 6: FHWA Guidance on Selection of Midblock and Uncontrolled Crossing Countermeasures

Medians and Pedestrian Refuge Islands

A median is the area between opposing lanes of traffic. They can be defined by pavement markings on the road surface or raised above the road surface to physically separate motorized and non-motorized traffic. Pedestrian refuge islands are medians with refuge areas intended to protect people crossing a road.

Refuge areas that are flush with the roadway surface located between two sections of raised median are preferable to raised refuge areas, as they are more conducive to wheeled devices like wheelchairs, strollers, or bicycles. Medians and refuge islands allow people to focus on crossing one direction of traffic at a time. According to the FHWA PSCs, medians with marked crosswalks have been shown to reduce pedestrian crashes by up to forty-six percent (46%) and pedestrian refuge islands can reduce crashes by up to fifty-six percent (56%). They are typically installed on two or three-lane local and collector roads with low-to-moderate speeds and moderate daily traffic volumes. They are especially beneficial for people who may travel more slowly, such as children, older adults, and people with disabilities.

According to AASHTO, although median or refuges may be painted or raised, raised is preferred as they are more visible to motorist and provide greater safety and comfort to crossing pedestrians or bicyclists. Crossing islands should be considered wherever possible but must be considered when the crossing distance exceeds sixty feet (60'). In pedestrian only crossing movements, the minimum preferred width is six feet (6'), with an allowed four-foot (4') minimum in constrained retrofit scenarios. The minimum width for mixed pedestrian and bicyclist movements is eight feet (8'), to allow storage for a bicyclist. Wherever possible, a wider island or refuge width should be considered for comfort, safety, and allowable storage for multiple users.[15]

When used in conjunction with a shared-use path or sidepath, crosswalk medians or refuge areas should be at least eight feet (8') deep to accommodate bicycles.[16]

- Potential RiverLands Application: Medians and pedestrian refuge islands should be considered in locations where people have to cross more than two lanes, at midblock crossing locations, where center raised medians are already in place, as the available right-of-way allows.

15 AASHTO *Guide for the Planning, Design, and Operation of Pedestrian Facilities (July 2004)*
16 FHWA, *Small Town and Rural Multimodal Networks*

SUMMARY AND KEY FINDINGS

While roadways can be dangerous built environments, intersections are one of the places where pedestrians and bicyclists are most vulnerable. Context sensitive design strategies at intersections and throughout the trail corridor will be key to mitigate potential user conflicts and reduce the severity of injuries that do occur, particularly in instances where the greenway will need to utilize roadway right-of-way. In addition to design considerations, emergency location and wayfinding signage and markings are also critical to safety. Key considerations include:

- Separation of multi-modal facilities from higher speed and higher volume roadways will help create a safer and more comfortable environment for all users.
- A center stripe or marking is helpful to differentiate space for users of different types or people traveling in different directions.
- While most of the Chattahoochee RiverLands is intended to be a shared-use or multi-use Greenway, it is anticipated that there will be segments where the paths are pulled apart to provide dedicated space for pedestrians and for bicyclists or other wheeled modes. This document summarizes some strategies that can inform design of safe, comfortable alternatives to a shared-use path where needed due to constrains and limitations.
- Intersections are among the locations where trail users may be most vulnerable; careful consideration should be given to strategies to increase visibility, provide clarity on who has the right-of-way, and raising awareness of other users
- Mid-block crossings will be important in developing a continuous network.
- Design and treatments at any given intersection should highly depend on the location, context, facility type, and other factors. Similarly, design of bike lanes, shared-use paths, crossings, and other elements of the RiverLands network should be based on location-specific characteristics, including motor vehicle volumes and speeds, among others.
- When designing specific segments of Chattahoochee RiverLands Greenway, local standards, design guides, and manuals should be consulted.

APPENDIX C:
UNIVERSAL ACCESS RECOMMENDATIONS

TECHNICAL MEMO #3: UNIVERSAL ACCESS RECOMMENDATIONS

Access is a concept that has different connotations for various groups of people. Four goals structure the approach to the Chattahoochee RiverLands and define a framework for design that equally prioritizes access, equity, ecology, and identity, and among these is creating a common ground for all.

A core component of the Chattahoochee RiverLands vision is to connect communities and destinations along the River in a way that are accessible to people of all backgrounds, ages, and abilities and transform park and trail access for all users. The resources of the River must be inviting to the widest possible range of people, creating a common ground for recreation and transportation that equitably serves the diverse and expanding communities of the Metro Atlanta Region. Anyone including young children to senior citizens, people using mobility devices, people with limited vision, or other vulnerable users should not face barriers when attempting to access and utilize the RiverLands. Furthermore, public transportation will strategically connect to the RiverLands, enabling access and use of the Greenway as a resource for all residents of the Metro Atlanta Region.

Not only is accessing the trail vital to the success of the RiverLands, but having a safe and comfortable and welcoming experience along the greenway and being able to access a diverse array of amenities will be essential for residents and visitors. This memo explores access in the sense of reaching a trailhead but also using the trail and its connections. This supports the design strategy of planning for accessibility which was presented in the Chattahoochee RiverLands Greenway Study Final Report. Understanding the various facets of access as it relates to different facets of the population will help trail designers and stewards make the trail an equitable and comfortable asset to people within the Metro Atlanta region.

MEMO PURPOSE AND INTRODUCTION

The purpose of this technical memo is to review accessibility standards and guidelines at the federal level to understand their applicability to the development of the Chattahoochee RiverLands Design Guidelines. This technical memo draws heavily from the Americans with Disabilities Act (ADA) of 1990 and other resources tailored to implementing ADA in outdoor and recreational settings. The memo covers accessibility with respect to both paved and un-paved surfaces, roadway crossings, trailheads, and amenities, among other features. The memo also discusses the limitations of ADA standards with respect to shared-use paths and how best practices from other guidelines can supplement ADA standards to strive for an environment that epitomizes universal design principles.

This memo will help the team identify commonalities and differences in accessibility considerations in a variety of settings. The goal is to understand best practices and considerations for access which will inform the Design Guidelines. This is meant to be a “living document” that will be updated throughout the course of the design process. It is anticipated that the standards set for the different components of the project will require further discussion and confirmation from the Trust for Public Land and project stakeholders and agencies. Upon the completion of the Design Guidelines, the accessibility standards will be integrated into the RiverLands design criteria and guidelines to establish baseline criteria for future subprojects.

MEMO OUTLINE

1) Americans with Disabilities Act (ADA)
   a) Overview and Summary
   b) ADA Compliance
2) Accessibility Considerations
   a) Hearing
   b) Visual
   c) Wheelchairs and Mobility Devices
3) Trail Design Elements
4) Case Study: Whispering Woods Braille Trail
5) Applicability and Considerations
6) Summary and Key Findings

AMERICANS WITH DISABILITIES ACT (ADA)

OVERVIEW AND SUMMARY

The Americans with Disabilities Act (ADA) was passed by Congress and signed into law by President George H.W. Bush in 1990. It is a civil rights law which prohibits discrimination on the basis of disability. ADA applies to various facets of life as well as infrastructure, including transportation. Roads, sidewalks, trails, and other amenities related to transportation all fall under ADA to ensure equal opportunity for access.[1] ADA was amended in 2008 to give a broader definition of "disability."[2] ADA governs dimensions of the built environment, the types of amenities required in specific situations and settings, and signage such as the International Symbol of Access shown in Figure 1.

1 ADA National Network (n.d.) What is the Americans with Disabilities Act (ADA)? What is the Americans with Disabilities Act (ADA)? | ADA National Network (adata.org)
2 The Americans with Disabilities Act Amendments Act of 2008 (n.d.). U.S. Equal Employment Opportunity Commission. https://www.eeoc.gov/statutes/americans-disabilities-act-amendments-act-2008

Figure 1: International Symbol of Access
Source: MUTCD D9-6

ADA COMPLIANCE

Responsibility for developing and updating accessibility guidelines under ADA is held by the U.S. Access Board, which published its Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG) in 2011. A supplemental notice for shared-use paths was issued in 2013.[3] As of December 2021, the Board had not issued a final PROWAG rule. This technical memo refers to the draft PROWAG in anticipation of the final PROWAG being adopted as the enforceable standard in the near future by the U.S. Departments of Justice and Transportation. Public entities and/or recipients of Federal financial assistance for the design and construction of the RiverLands are responsible for complying with current ADA accessibility standards. For elements not covered in the 2010 ADA Standards, PROWAG is the best resource of proposed guidelines for design elements.

In addition to PROWAG, this technical memo cites best practices for design and implementation of trails, sidewalks, and shared-use paths from the United States Department of Agriculture (USDA), the United States Forest Service (USFS), Federal Highway Administration (FHWA), and the Pennsylvania Land Trust Association. This memo will distinguish guidelines from best practices as trail surfaces and elements applicable to the RiverLands are highlighted in detail in the following section. In addition to compliance with ADA standards, the RiverLands should coordinate with ADA Transition Plans for Cities and Counties along the preferred alignment.

ACCESSIBLE DESIGN CONSIDERATIONS

As of 2020, over 61 million Americans live with some kind of disability, and among this subset of the population, 13.7 percent (13.7%) have a mobility disability, 5.9 percent (5.9%) have difficulty hearing, and 4.6 percent (4.6%) have a vision disability.[4] A multimodal trail environment should be inviting to the widest array of users possible, and this includes people with hearing loss and visual impairment as well as users of mobility devices such as wheelchairs. This section provides some basic considerations for each of these subsets of the population which will be important to consider during the development of the RiverLands Design Guidelines.

HEARING

Some common information barriers for those with partial or total hearing impairments include inaccessible formats of information and a limited ability to receive information. To support trail users with auditory and hearing impairments, it is important to include visuals and wayfinding in alternative formats which easily and accurately communicate information about the trail including rules and regulations, maps and location, hazards, and emergency contact information. Any infrastructure that requires hearing ability should be accommodating to those who utilize hearing aids.[5] Sight lines along the trail should enable adequate warning and reaction time.[6]

VISUAL

Several forms of vision disability are legally acknowledged including limited field of vision, peripheral loss, loss of central vision, acuity loss (blurriness), and night blindness.[7] All of these have varying effects of reduced visual capability in the built environment, and to ensure an accessible trail system, the RiverLands Design Guidelines must account for people who are visually impaired and understand typical behaviors and needs of this population. People with visual impairments use several mechanisms for navigating including human guides, long white canes, and guide dogs. Canes are used to anticipate an obstacle and are commonly used through the sweeping and touch techniques as shown in Figure 2 which will impact design dimensions of the RiverLands. The design of the trail system should account for space needed to comfortably allow those with visual impairments to understand their surroundings.

3 FHWA (2017). Small Town and Rural Multimodal Networks Guide, p. 1-15.
4 Centers for Disease Control and Prevention (2021). Disability Impacts All of Us. https://www.cdc.gov/ncbddd/disabilityandhealth/infographic-disability-impacts-all.html
5 FHWA (2001). Designing Sidewalks and Trails for Access Part II: Best Practices Design Guide, p. 2-24.
6 Ibid, p. 16-9.
7 FHWA (2017). Accessible Shared Streets, p. 5.

In addition to providing space, surface indicators should be explored to allow detection of a hazard. These include yellow detectable warning surfaces (or truncated domes), and directional indicators.[8] At crossings, audible crossings are cues for knowing when it is safe to cross at a given location.

WHEELCHAIRS AND MOBILITY DEVICES

Wheelchairs should be able to maneuver the built environment without duress or complications, and this includes designing and maintaining a smooth or packed surface and providing a surface that has an appropriate width. This width should allow for both through and turning movements. The 2010 ADA Standards stipulate a tuning space of at least sixty inches (60") and be clear of obstructions. This space is depicted in Figure 3.

In addition to turning, the Design Team should be mindful of reaching height and distance for wheelchair users when placing and planning amenities, signage, and wayfinding along the trail.

8 Ibid, p. 9.

Figure 2: Common Cane Techniques
Source: FHWA Accessible Shared Streets, p. 7

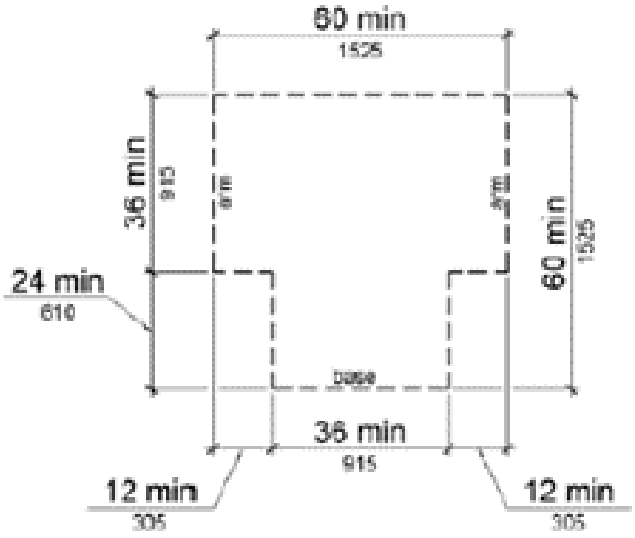


Figure 3: T-Shaped Turning Space
Source: 2010 ADA Standards, p. 80

TRAIL DESIGN ELEMENTS

Based on the scope of Phase I of the Design Guidelines, this technical memo includes accessibility considerations for surface materials, trail, street, and road crossings, site furniture such as seating and railing, and signage and wayfinding at trailheads and along the trail itself. This will align with the below cross-section and dimensions of the Chattahoochee RiverLands shown in Figure 4 below and ensure it is accessible and compliant with ADA standards and other accessibility best practices. The RiverLands should strive to be a network of accessible elements that is safe, comfortable, and direct.[9] Maintenance of infrastructure is essential to maintaining and preserving accessibility along the RiverLands.

SIDEWALKS

Sidewalks along streets offer pedestrians separation from the vehicular roadway as well as provide access to nearby destinations. They should meet accessibility guidelines for both turning and maneuvering. PROWAG states that the absolute minimum of an accessible pedestrian node is four feet (4') in locations with constrained available right-of-way and obstructions like utility poles; however, most resources recommend sidewalks be five feet (5') or six feet (6') wide.

SHARED-USE PATH

Shared-use paths (also sometimes called multi-use trails or paths) provide travel areas separate from vehicular traffic and may be used by bicyclists, pedestrians, skaters, wheelchair users, joggers, scooters, and others. They are intended for use by pedestrians and cyclists and must meet accessibility guidelines for walkways and curb transitions; they must be accessible to all users including those using mobility devices and who have visual impairments. In addition to providing access, a shared-use path should be wide enough to allow adequate passing areas. In areas with steeper grades and varying topography, a wider cross-section should be considered for passing and users traveling at different speeds. Shared-use paths should consider including graded areas on either side with a different surface or pavement for different users to allow right-of-way on asphalt or concrete surfaces for those with mobility devices.

SIDEPATHS

Sidepaths are bidirectional shared-use paths located alongside and parallel to roadways. They are designed to serve pedestrians and cyclists and may be used be skaters, wheelchair users, people using mobility devices, scooters, and others.

UNPAVED TRAILS

FSTAG provides guidance on material types for unpaved trails as well as their durability and capabilities for accommodating with respect to access. When attainable, unpaved path surfaces should be firm, stable, and packed hard enough for wheelchair usage.

INTERSECTION AND MID-BLOCK CROSSINGS

The design of intersections where pedestrians and bicyclists (and other vulnerable road users) are present should focus on reducing potential conflict between these users and motor vehicles by increasing visibility, communicating a clear right-of-way, and facilitating eye contact and awareness of one another. This includes proper striping, signage, and curb ramps with truncated domes. Design could also consider textured surfaces or slight grade changes in proximity to intersections.[10] Crossings should either include audible features, countdown timers, or a combination of the two, particularly when crossing busy arterial or collector routes. At locations meeting signal and pedestrian warrants, design should consider including pedestrian hybrid beacons (PHBs), rectangular rapid flashing

9 FHWA (2017). *Small Town and Rural Multimodal Networks Guide, p. 1-11.*
10 Metro (2015). Best Practices for Busy Shared-Use Paths, p. 15-16.

beacons (RRFBs), or other similar treatment to promote safety, visibility, and accessibility, simultaneously.[11] Leading pedestrian intervals (LPIs) are another best practice to give any multimodal user a head start when crossing at major intersections.

BOARDWALKS

While the 2010 ADA Standards do not explicitly discuss boardwalks, FSORAG and FSTAG provide best practice guidance for the design, construction, and maintenance of boardwalk facilities to ensure accessibility.

RESTING INTERVALS

Resting intervals are discussed in FSTAG and outline the frequency and spacing of resting spaces along trail surfaces. Amenities at resting spaces include benches, wayfinding signage, and trash receptacles. Design should consider length, width, slope, and turning space.

ACCESSIBLE ROUTES AND SURFACES

Surfaces should be designed in accordance with standards and guidance for accessible routes. This includes floor and ground surface, slope, changes in level, clear widths (see Figure 5), and ramps. Asphalt is the most common surface for shared use paths; however, the use of concrete for paths has proven to be more durable. For concrete pavement, saw-cut concrete joints rather than troweled improve the experience for users in wheelchairs.[12]

Slope is typically expressed as either cross slope or running slope. Based on PROWAG definitions, cross slope is the grade that is perpendicular to the direction of pedestrian travel while running slope is the grade that is parallel to the direction of pedestrian travel. 2010 ADA Standards stipulate that running slope of walking surfaces shall not be steeper than 1:20 and the cross slope of walking surfaces shall not be steeper than 1:48.[13]

RAIL HEIGHTS

Handrail heights at buildings and along trail pavement should comply with 2010 ADA Standards. Advisory heights for stairs, ramps, and walking surfaces are depicted in Figure 5.

11 GDOT (2019) Pedestrian and Streetscape Guide (Rev. 3.0), p. 5-7 – 5-12.
12 FHWA (2017). *Small Town and Rural Multimodal Networks Guide, p. 4-8.*
13 2010 ADA Standards, p. 90

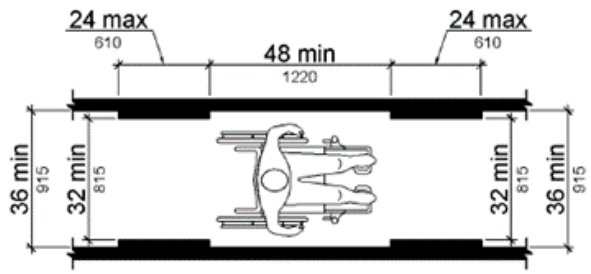


Figure 4: Clear Width of an Accessible Route
Source: 2010 ADA Standards, p. 91

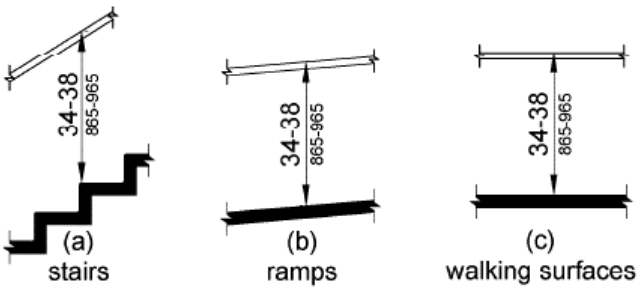


Figure 5: Handrail Height
Source: 2010 ADA Standards, p. 129

TRAIL AMENITIES

Stairways
Where appropriate, stairways should comply with 2010 ADA Standards including stair treads and risers as well as surfaces and nosings. Stairs in outdoor settings should be designed in a method that prevents the pooling of water.

Parking
At parking facilities, the dimensions and allowance of total and accessible parking spaces is provided within the 2010 ADA Standards. Based on the figure below, car parking spaces shall be at least ninety-six inches (96") wide and van parking spaces shall be at least 132 inches (132") wide. Up to two parking spaces can fit a common striped access aisle.

Table 1 shows that the minimum number of accessible parking spaces is based on a proportion to the total number of parking spaces. There should be one accessible space for every 25 parking spaces up to 100 where it then increases to increments of 50 spaces. Where more than one parking facility is provided on a given site, ADA standards stipulate that the number of accessible spaces provided on the site shall be calculated according to the number of spaces required for *each parking facility.*

Curb Ramps
Curb ramps should be present at trailhead facilities to allow for entry onto sidewalks and trail facilities from designated parking areas. In addition, curb ramps must be sloped and include truncated domes or a similar textured surface in accordance with 2010 ADA Standards.

Boat Launches
The 2010 ADA Standards include regulations for recreational boating facilities and launches, which will be essential to the Chattahoochee RiverLands experience.

Benches
Bench dimensions, including height and backrest, are discussed in the 2010 ADA Standards. Figure 8 shows required backrest dimensions for bench seating. This will be necessary to comply with for both trailheads and along the main trail and tributaries.

Picnic Tables
Picnic tables should appropriately accommodate wheelchair users, and the typical dimensions of a picnic table, including length, width, and height are included in Figure 9. FSORAG details the number of wheelchair seating spaces required based on picnic table top perimeter and dimensions. While this is required for National Forest units, it is a best practice for the RiverLands Design Guidelines to consider.

Restroom Facilities and Drinking Fountains
Restroom facilities and drinking fountains should comply with 2010 ADA Standards. This includes stall dimensions, height of sinks, toilets, and grab bars, and access through stairs and ramps in situations where these are necessary.

Signage and Wayfinding
Signage and wayfinding should be clear and capable of presenting information to a variety of audiences. FSTAG discusses trailhead signage in detail and accounts for clear space, sign contents, and reach ranges for wheelchair users. Sign contents should include a mileage chart or length information, surface type, any potential hazards, slope information, and any amenities along the trail or trail segment.

Braille Dimensions
Braille dimensions are detailed in the 2010 ADA Standards and further expounded upon in PROWAG to detail applicability to the built environment. These dimensions include, but are not limited to, dot base diameter, dot height, distance between dots in the same cell, and distance between dots in adjacent cells.

CASE STUDY: WHISPERING WOODS BRAILLE TRAIL

An example of an inclusive trail environment is located not far from the Chattahoochee RiverLands in Buford, Georgia within Gwinnett County. On the site of the Gwinnett Environmental and Heritage Center, a braille nature trail was completed in 2015 to allow access for the visually impaired and their guide dogs. This trail includes 18 signs in Braille (see Figure 10) and encourages sensory experiences in nature to allow people to learn about the natural environment around them regardless of visual ability. Additionally, there is guide rope along the trail to help those with visual impairments to stay on the path.

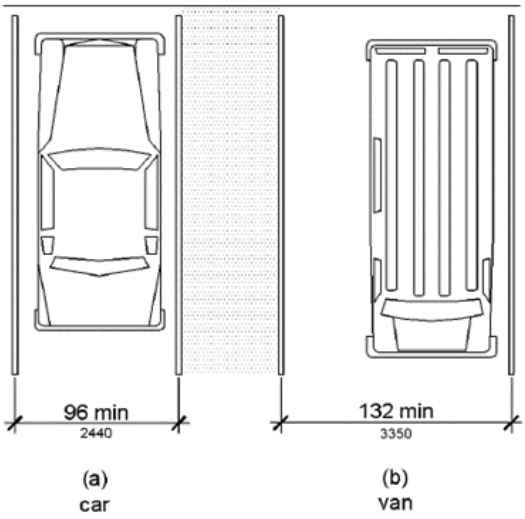


Figure 6: Vehicle Parking Space Dimensions
Source: 2010 ADA Standards, p. 124

Total Number of Parking Spaces Provided in Parking Facility	Minimum Number of Required Accessible Parking Spaces
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	Two percent (2%) of total
1001 and over	20, plus 1 for each 100, or fraction thereof, over 1000

Table 1. Minimum Number of Accessible Parking Based on Total Parking
Source: 2010 ADA Standards, p. 33

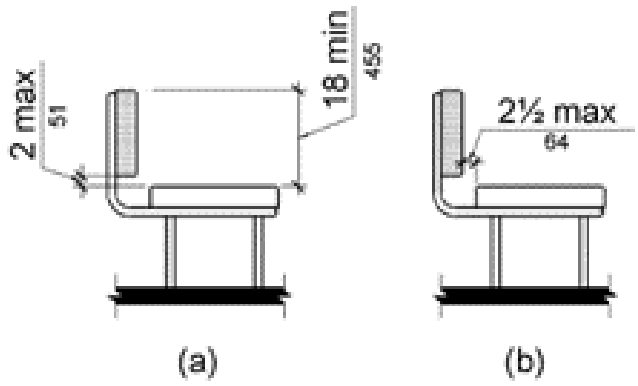


Figure 7: Bench Backrest Dimensions
Source: 2010 ADA Standards

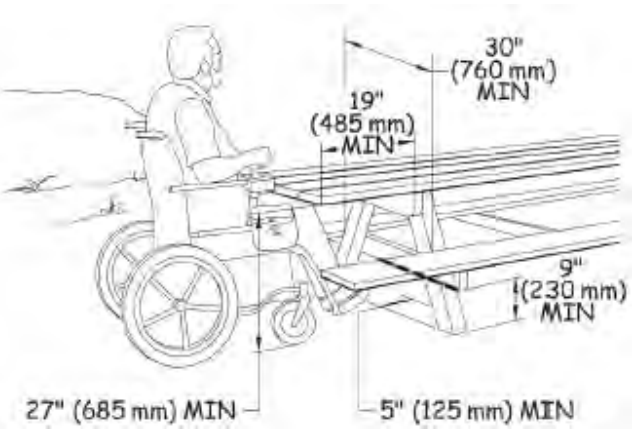


Figure 8: Picnic Table Wheelchair Seating Space
Source: FSORAG, p. 22

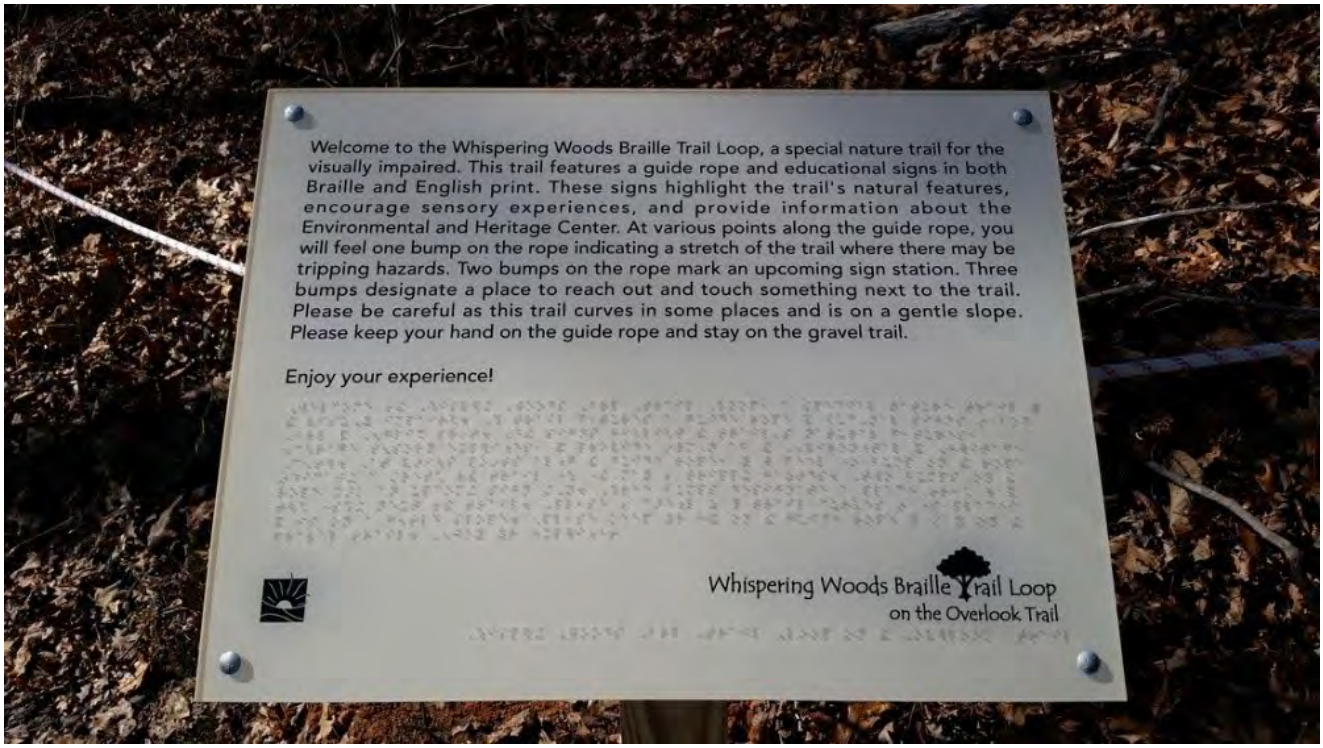
SUMMARY AND KEY FINDINGS

This technical memo provides a high-level overview of vulnerable populations and potential design strategies to accommodate them and strive for a universal design strategy for the RiverLands. This includes considerations for those with hearing, visual, and mobility impairments. Design should promote a safe and inclusive environment for all users, regardless of age or ability.

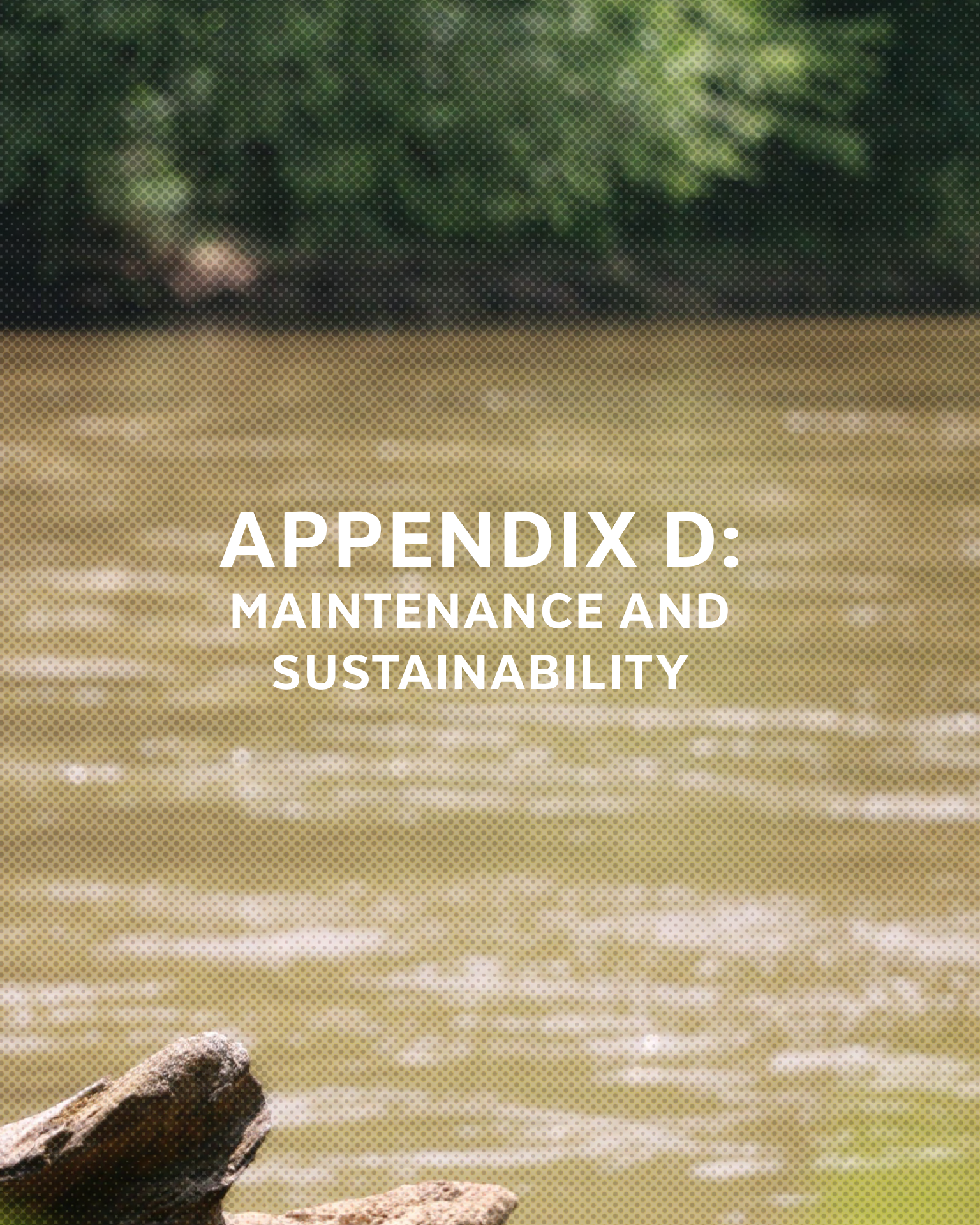
Compliance with the 2010 ADA Standards will be vital to the success of the RiverLands Design Guidelines as well as the ability to acquire federal funding. In addition to ADA, this memo outlines resources from PROWAG, FHWA, USDA, and USFS to develop the RiverLands Design Guidelines. Key considerations include:

- While most of the Chattahoochee RiverLands is intended to be a shared-use or multi-use Greenway, it is anticipated that there will be segments where the paths are pulled apart to provide dedicated space for pedestrians and for bicyclists or other wheeled modes. These designs must all be accessible for all users, including those with disabilities.
- City, County, and State policies may provide additional requirements for design elements in accordance with ADA regulations and PROWAG guidance. Cities and Counties also have federally-required ADA Transition Plans which outline their plan for ensuring the built environment is ADA compliant. When designing specific segments of Chattahoochee RiverLands greenway, local standards, design guides, and manuals should be consulted to ensure ADA compliance.
- Where certain items are not covered in the 2010 ADA Standards, designers should consult best practices from PROWAG, FHWA, USDA, and USFS to develop the RiverLands Design Guidelines.
- ADA Standards of Accessible Design Guidelines should be consulted for appropriate ADA-compliant signage during the design process.
- Signage is important on many levels. Universal signs should remind people about sharing space with others, provide guidance on direction of travel and nearby destinations, behavior while using trails, and on water safety where applicable.
- Disabilities affect people in many different ways. About 15 percent of the population lives with some form of disability which affects how people move, see, hear, and get around more generally. Trail design should consider all of these, not just in the design of the primary paths or trails, but also in development of overlooks, ramps, fishing piers, viewing platforms, and more.

By incorporating and applying some of the practices and strategies outlined in this memo (and by aligning with other companion memos prepared during Phase I of the Design Guidelines), partners working to complete segments of the Chattahoochee RiverLands can strive for developing a trail system that goes beyond ADA compliance and ensures an equitable and accessible built environment within the RiverLands.



Source: Braille Nature Trail (n.d.). Photos of the Whispering Woods Braille Trail. http://www.braillenaturetrail.com/wwbt-photos.html



APPENDIX D:
MAINTENANCE AND SUSTAINABILITY

TECHNICAL MEMO #4: MAINTENANCE AND SUSTAINABILITY

The Chattahoochee RiverLands encompasses a 100-mile corridor with a rich variety of parks, blueway access points, and trail systems from Buford Dam to Chattahoochee Bend State Park. The purpose of this technical document is to catalog relevant maintenance standards that have potential applicability to the RiverLands trail system.

It is important to acknowledge that the RiverLands will run through many independent jurisdictions, each having established agencies that govern maintenance standards. All of these standards have been established prior to the development of the Chattahoochee RiverLands Study. That Study put forth four guiding Design Goals that will guide the development of the RiverLands Design Guidelines including the Maintenance recommendations. While the recommendations put forward here will establish baseline standards, through the development of the Design Guidelines, the Design Team may challenge traditional trail maintenance practices where relevant to ensure that the RiverLands vision is retained.

This document is a "living document" that will be updated throughout the design process. It is anticipated that the standards set for different components of the project will require further discussion and confirmation from the Trust for Public Land and project stakeholders / agencies. Upon the completion of the Design Guidelines, the maintenance recommendations will be integrated into the RiverLands design criteria and guidelines to establish baseline criteria for future subprojects.

MEMO OUTLINE

1) Overview of Trail Maintenance Considerations
2) Potential Funding Sources and Partners for Trail Maintenance
3) Maintenance Responsibilities and Tasks Overview
    a) Types of Maintenance for Share Use Trails
    b) Pedestrian-Specific Routines
    c) Bicycle-Specific Routines
    d) Sustainability-Specific Routines
4) Further Maintenance Considerations by Trail Element
    a) Hardscape Materials
    b) Furniture
    c) Comfort Stations and Shelters
    d) Stormwater Management
    e) Planting
    f) Signage and Markings
5) National and Industry Standards for Trail Maintenance
6) Standards for Trail Maintenance by State and Local Jurisdiction

OVERVIEW OF TRAIL MAINTENANCE CONSIDERATIONS

The first step to creating a maintenance program is **understanding local capacity and practices.** Trail designers and municipalities must assess the existing maintenance practices of each unique jurisdiction.

- What are existing maintenance practices for already installed trails / greenways?
- What funding is currently available?
- What is the source of that funding?
- Who executes the maintenance contracts – is it maintained by municipal employees or private contractors?
- In summary, do the existing practices or capacity for maintenance meet or fall short of the level of care we may require for the RiverLands?

During the design process, each individual trail project that comprises the RiverLands will require a unique assessment to understand anticipated maintenance needs, the projected level of service required, and an assessment of the local capacity to meet these needs.

Level of service (LOS) is generally defined as how well a transportation facility (in this case, a multi-modal greenway) is operating from a trail user's. The quality and frequency of maintenance is shaped by the projected LOS. The LOS for specific trail segments will likely vary for each jurisdiction and environment. Considerations that may affect level of service include:

- Pavement/surface condition and materials
- Volume or frequency of use
- Climatic conditions
- Flood plain proximity and location
- Frequency and design of curves
- Presence and degree of grade changes (hills)
- Proximity to adjacent motor vehicle traffic
- Quality of scenery.
- Physical siting (including environmental sensitivities / habitat vulnerability)
- Quality of bicycling equipment in use
- Perceived safety of the surrounding neighborhood. Public visibility and sight distance are example considerations.

The RiverLands Design Guidelines will provide maintenance recommendations based on the anticipated LOS, however it will ultimately be up to local jurisdictions to determine the LOS for the trail segments within their purview. Individual jurisdictions may be required to conduct an audit of their existing maintenance practices.

Additional partners and funding sources may be required to bolster individual jurisdictions capacity to provide adequate maintenance. See following section for potential funding sources and partners for trail maintenance.

On-going monitoring may be required for the life of the project to assess if maintenance programs are fully meeting service needs.

While the Metropolitan River Act (MRPA) primarily provides guidance for the construction of new trails in the region, its fundamental intent can be supported by maintenance practices. For example, in buffer zones along watercourses it will be important to maintain any undisturbed natural vegetation natural buffers, as well as any setbacks other protective setbacks established through MRPA. Within each jurisdiction, individuals and organizations responsible for maintenance should be familiar with the regulations and setbacks put forward in MRPA in order to ensure the protection of the of the Chattahoochee River.

POTENTIAL FUNDING SOURCES AND PARTNERS FOR TRAIL MAINTENANCE

Often, despite a lack of funding and technical support, local trail managers are obligated to maintain any federally funded trailways in accordance with federal standards for public safety and access rights. This often exceeds the capacity of the local jurisdiction. Understanding capacity and needs early in the design process can prevent or anticipate short fall in trail maintenance.

Initial construction costs dwarf the costs of routine maintenance and enhancement of existing facilities. However, deferring maintenance can dramatically increase maintenance costs and invert that cost balance. Public, private, and non-profit entities may all ultimately play a role in funding trail maintenance. Later phases of the Design Guidelines will identify and evaluate potential maintenance funding structures and offer recommendations. Potential funding sources and partners for trail maintenance may include:

PUBLIC

- Individual Municipalities – Funding, Fees, Taxes
- Transportation and Community Services or Parks and Recreation County Operating Budgets
- Grants
- Community Improvement Districts (CIDs)
- Zoning Regulations (that require developers to fund the trail through their private developments)
- State and County DOT
- DOT's Roadway Maintenance Division
- Special Purpose Local Option Sales Taxes (SPLOST)
- Grants
- Recreational Trails Programs
- Georgia Outdoor Stewardship Program

PRIVATE

- Annual Giving Campaign
- Maintenance Endowment
- Private development opportunities that can incorporate trail and greenway design into their infrastructure plans

NON-PROFIT

- Non-Profit Conservancy Model
- "Adopt a Trail" Programs
- Foundation Grants
- Community Improvement Districts (CIDs)
- Local non-profit groups and advocacy organizations
- Cycling, "Friends Of," and Other Groups

MAINTENANCE RESPONSIBILITIES AND TASKS OVERVIEW

TYPES OF MAINTENANCE FOR SHARED USE TRAILS

The maintenance routines for the shared-use trail are not exhaustive and not limited to the trail itself. Other trail elements, such as the parking areas, trailheads, comfort stations, seating, etc., will also be considered in maintenance programs and addressed in subsequent sections of this memo.

Routine Maintenance
Routine Maintenance refers to the ongoing regimen of litter pick-up, debris removal, sweeping, sign repair and replacement, mowing, tree and shrub trimming, and other regularly scheduled activities. It also includes minor repairs and replacements such as fixing cracks and potholes or repairing a broken hand railing (Cobb County Greenways and Trails Master Plan).

Trail User Safety Concerns: Safety is central to all maintenance operations and is the single most important trail maintenance concern. Items for consideration include scheduling and documentation of inspections, the condition of railings, bridges, and trail surfaces, proper and adequate signage, removal of debris, and coordination with other agencies associated with trail maintenance.

Trail Inspection: Trail inspections are integral to all trail maintenance operations. Inspections should occur on a regularly scheduled basis, the frequency of which will depend on the amount of trail use, location, age, and the type of construction.

Trail Sweeping: One of the most important aspects of trail maintenance, helping ensure trail user safety, is sweeping or clearing of trail surfaces. The type of sweeping to be performed depends on trail design and location. Trails that require sweeping of the whole system will be swept by machine. Trails that require only spot sweeping of bad areas will be swept by hand or with blowers.

Trash Removal: Trash removal from trail corridors is important from both a safety and aesthetic viewpoint and includes removing ground debris and emptying trash containers. Trash removal should be done on a regularly scheduled basis, the frequency of which will be fairly low.

Scheduling: Inspections, maintenance and repair of trail-related concerns will be scheduled. Inspection and repair priorities should be dictated by trail use, location, and design. Scheduled maintenance tasks is a key item towards the goal of consistently clean and safe trails.

Remedial (or Corrective) Maintenance
Remedial Maintenance refers to correcting significant defects in the network, as well as repairing, replacing, or restoring major components that have been destroyed, damaged, or significantly deteriorated from normal wear and tear. Some items (“minor repairs”) may occur on a five- to ten-year cycle such as repainting, seal coating asphalt pavement or replacing signage. Examples of major reconstruction include stabilization of a severely eroded hillside, repaving a trail surface or a street used for biking, or replacing a footbridge. Remedial maintenance should be part of a long-term capital improvement plan (Cobb County Greenways and Trails Master Plan).

Trail Repair: Repair of asphalt or concrete trails will be closely tied to the inspection schedule. Prioritization of repairs is part of the process. The time between observation and repair of a trail will depend on whether the needed repair is deemed a hazard, to what degree the needed repair will affect the safety of the trail user, and whether the needed repair can be performed by the trails maintenance crew or if it is so extensive that it needs to be repaired by outside entities. Trial repairs could include:

- Replenishing gravel, mulch, or other materials
- Repainting/re-striping/staining
- Repaving/sealing

- Removing debris along paved trail/sidewalk edges

Trail Replacement: The decision to replace a trail and the type of replacement depends on many factors. These factors include the age of the trail, and the money available for the replacement. Trail replacement could include:

- Replacing asphalt or concrete
- Regrading to prevent or eliminate low spots and drainage issues
- Adding culverts, bridges, boardwalks retaining walls, etc. to prevent or eliminate drainage / erosion issues

Trail edging: Trail edging maintains trail width and improves drainage. Problem areas include trail edges where berms tend to build up, and where uphill slopes erode onto the trails. Removal of this material will allow proper draining of the trail surface, allow the flowing action of the water to clean the trail, and limit standing water on trail surfaces. Proper drainage of trail surfaces will also limit ice build-up during winter months.

Preventative Maintenance
Preventative Maintenance consists of treatments to extend the functional condition of a facility. "[Preventative] maintenance is typically applied to pavements in good condition having significant remaining service life" and is commonly done by applying treatments to the surface or near-surface of structurally sound pavements (FHWA). This includes short- and long-term maintenance categories and strategies also included in routine and remedial maintenance.

Mud-jacking: the preferred technique for raising and stabilizing settled concrete slabs. Over time, concrete slabs settle as a result of changes in the underlying soils. Mud-jacking addresses these changes and restores the integrity of the concrete by lifting it to its original level position.

Joint sealing: stitching together two slabs of concrete with a soft sealer that prevents harmful intrusions from above and below the slab.

Grinding: smoothing a rough concrete surface by sanding off the portion with abrasions, cracks, or undesirable texture.

Horizontal cutting for sidewalks: when two sidewalk panels have shifted to present a change in grade, a horizontal cutting saw can be used to shave off the protruding edge and create a smooth slope.

Chip sealing and slurry for asphalt sidewalks and paths: a strategy for rejuvenating asphalt surfaces by affixing "chips" through an asphalt emulsion, then applying a slurry seal about a week later.

SUSTAINABILITY-SPECIFIC MAINTENANCE CONSIDERATIONS FOR SHARED TRAILS

Consider Resilient Materials to Lessen Maintenance
The best approach to reducing the cost of maintaining pedestrian and bicycles facilities is to build these facilities with maintenance in mind:

Sidewalks and paths with a suitable base course and pavement thickness will last longer than those that are not well constructed.

Concrete surfaces that have been properly finished with a very slight cross-slope will provide slip resistance and shed water (which can become ice).

Avoid Critical Habitat
Trails can be designed to minimize human disturbance impacts on wildlife and thus reduce any ongoing maintenance that would be required to protect such habitats. Key design considerations for avoiding critical habitat from the USDA include:

- Align trails along or near existing human-created or natural edges rather than bisecting undisturbed areas.
- Keep a trail and its zone of influence away from specific areas of known sensitive species.

- Avoid or limit access to critical habitat patches.
- Provide diverse trail experiences so that trail users are less inclined to create trails of their own.
- Use spur trails or dead-end trails to provide access to sensitive areas because these trails have less volume.
- Generally, concentrate activity rather than disperse it.
- Keep trail construction impact as narrow as possible.
- Concentrate weed control at road and trail crossings, trailheads, and riparian areas.
- Where bypassing habitat is required, consider ecologically sensitive detailing and construction practices. Integrate habitat crossings or structures where key habitat is known to exist and will be disrupted.

Engage People Directly in Stewardship of the Land

The management and maintenance of trail networks across the U.S. is largely supported by trail stewardship organizations and volunteers who leverage government resources to maintain and expand these trails. With reduced funding sources devoted to trail maintenance, volunteers are a key component to being able to manage and maintain park and trail systems (American Trails Organization). The American Trails Organization has several suggestions for keeping trail maintenance volunteers:

- Have a plan and goals in place for your volunteer program before you recruit volunteers. Use these goals as a guide in your volunteer stewardship.
- Make sure your volunteers feel valued. Show recognition, communicate accomplishments, and give them reasons to come back.
- Record keeping is key. Track volunteers, hours, projects, etc. so you can measure the success of your volunteer program. Communicate that success back to the volunteers and to your stakeholders.

FURTHER MAINTENANCE CONSIDERATIONS BY TRAIL ELEMENT

HARDSCAPE MAINTENANCE CONSIDERATIONS

As it traverses wilderness, suburban sprawl, and Atlanta's urban fabric, the Chattahoochee negotiates a wide range of environmental conditions. Answering these conditions in a positive and ecologically responsible way demands a diverse assembly of hardscape strategies deployed over decades. Considering the maintenance requirements of each hardscape alternative will result in an enduring and cohesive trail network.

HARD SURFACES

Hard surfaces typically require less maintenance than soft ones. However, their installation processes are often technical and invasive, limiting their usefulness along remote trail segments. When maintenance issues do arise, they are often more costly to address, and will likely require heavy equipment and technical knowledge on the part of maintenance staff. In general, maintenance plans for hard surfaces should consider preventative maintenance strategies as well as partial or total replacement and determine what threshold will trigger replacement.

Concrete

- Concrete trails generally require minimal maintenance. With proper subgrade preparation and joint placement, a concrete trail will resist heaving, shoving and excessive cracking.
- Freeze/thaw cycles can cause buckling, creating potholes and cracks in concrete and asphalt pavement which can be dangerous to users and costly to repair.
- As described in Types of Maintenance for Shared Use Trails, mud-jacking, joint sealing, grinding, and horizontal cutting are all maintenance measures that can be taken to maintain user safety on aging and damaged concrete trails. However, even well-maintained concrete trails will eventually require costly and disruptive replacement.

- Horizontal cutting and grinding methods are most suitable when sidewalks displace by one-quarter inch (1/4") to one-half inch (1/2") inch at a joint or for a temporary repair when sidewalks displace between one-half inch (1/2") and one inch (1").

Asphalt

- Asphalt trails are more vulnerable than concrete trails to cracking, creating more costs and requirements to keep the trail well-maintained.
- Crack sealing is required for maintenance of asphalt trails. A lack of crack sealing can lead to vegetation growing up through the cracks and will contribute to deterioration of the asphalt surface.
- Asphalt pavement repairs such as crack sealing can be quick, inexpensive, and blended into the existing pavement structure.
- Periodically sealing the surface of asphalt pavement is a simple maintenance measure that can extend the life of an asphalt trail.
- Asphalt is typically used for temporary patching and wedging when small corners of hard surfaces (both asphalt and concrete) break off or as a temporary repair when concrete lifts by more than a half inch (1/2") to less than two inches (2").

Pavers and Bricks

- Bricks have unique maintenance requirements, and most communities consider bricks to be more costly and problematic to maintain than concrete.
- The major maintenance problems with pavers and bricks are usually associated with displacement of the material itself and not the surface deterioration of the material.
- One of the shortcomings of bricks and pavers is that they can pop out of place and present a tripping hazard more easily than concrete or asphalt slab sidewalks. Both concrete and asphalt can also be horizontally cut or ground to mitigate tripping hazards, whereas bricks and pavers can be reused, but often must be removed and repositioned so the base material can be modified to effectuate the leveling of the sidewalk.
- On the other hand, bricks and pavers can be individually replaced by experienced personnel with a smaller amount of effort than replacing entire sections of concrete or asphalt trails.

Crushed Aggregate

- One challenge with compacted aggregate paths is that they are prone to dipping and spreading over time, whether due to heavy traffic or environmental factors.
- Different types of aggregate require different maintenance practices and impact the surrounding environment in different ways. For example, small, round

Figure 1: Concrete Trail at the Proctor Creek Greenway

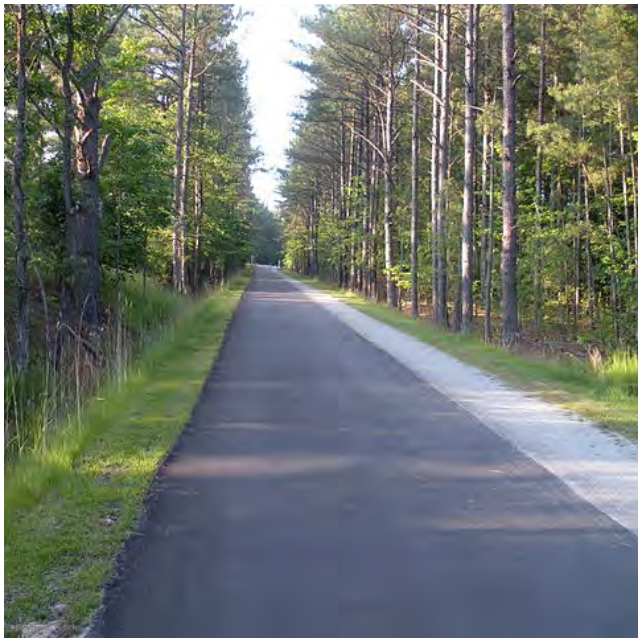


Figure 2: Asphalt along the American Tobacco Trail in Chatham County, NC

pea gravel requires significant edging on either side of the tread, as the slippery stones are easily displaced.

- To lessen maintenance requirements, only aggregates between one-quarter inch (1/4") and one inch (1") in diameter with flat surfaces to lock the stones in place should be considered for pedestrian trails.
- To preserve the path, aggregate should be raked over the stones regularly (depending on level of service) to keep the surface even and level.
- A leaf blower can be used to remove debris. The stones are heavy enough that they won't blow away.

Soil Cement

- Soil cement is a mixture of pulverized native soil, Portland cement, and water, rolled and compacted into very dense surface. It is cheaper than asphalt, but drainage is very important to prevent erosion.
- Soil cement is low maintenance and long lasting. Its maintenance requirements are well-documented and easily fulfilled because it is used as an inexpensive material for many roadways.
- Areas deficient in thickness should also be remedied by replacing the material to a full depth of treatment rather than by adding a thin layer of soil-cement to the completed work, which can be labor and cost intensive.

Resin-Based Stabilized Material

- Resin is a tree product that binds aggregate or soil particles together. A resin-based trail surface impacts the environment less than asphalt and can be cheaper.
- The aesthetics can be controlled through the choice of aggregate or soil, making for a better match with the surrounding environment.
  Because it is a relatively new product, not much is known about the longevity and durability of resin-based pavement. This uncertainty makes predicting and accounting for maintenance requirements challenging and necessitates considering replacement or resurfacing as potential maintenance costs.

Boardwalk

- In flooding scenarios, boardwalk railings can catch debris and create dams that both disrupt drainage patterns and ultimately require replacement once demolished by flood waters.
- Special maintenance practices for boardwalks should be established around flood events.
- Because boardwalks require piles and constructed foundations for support and are most useful in wet marshy areas, replacing portions of a boardwalk can be technically challenging and costly.
- Although relatively inexpensive and aesthetically inoffensive, traditional wooden boardwalk

Figure 3: Crushed aggregate trail at Cochran Shoals Trail

Figure 4: One-year-old resin pavement trail

presents unique maintenance challenges.

- Wildlife such as beavers or insects can damage wooden piles supporting a boardwalk, requiring occasional replacement of piles.
- Long term exposure to the elements can rot or weaken wood, posing urgent maintenance challenges that threaten the safety of users if not addressed.
- When constructed of wood, boardwalks should make use of naturally decay- and insect-resistant wood (cedar, redwood) and preservative-treated wood wherever possible to limit maintenance requirements.
- Composite decking can be an environmentally friendly and low-maintenance boardwalk material, but special care should be taken to ensure that composite decking is not a detriment to the aesthetic quality of the trail.
- As the texture imprinted on composite decking wears down, slip and fall concerns may demand maintenance measures.
- Reinforced, precast concrete panels are a durable and maintenance free boardwalk material.
- The panels require light lifting equipment and a more rigid construction plan for installation, posing a challenge for more remote portions of the trail and demanding a level of specific technical expertise from maintenance staff if any issues do arise.

SOFT SURFACES

In accordance with the Metropolitan River Protection Act, trails within the national park will likely not be paved. Rather, these trails will consist of permeable surfaces that protect water quality and prevent erosion.

Particularly for more remote trail segments, less invasive and maintenance intensive hardscaping is preferred.

Figure 5: Wooden boardwalk at Cochran Shoals Trail

Figure 6: Reinforced, precast concrete panel boardwalk from PermaTrak

Natural Earth

- Flood events erode natural earth trails, requiring relocation of sediment to the path to maintain an even grade and rendering the trails impassible for many users until maintenance is performed. This is particularly true in wet areas or project sites with poor drainage.
- Although natural earth trails are exceptionally vulnerable to erosion, best practices for their design and maintenance will slow the flow of water across these trails and direct drainage away from their surface.
- Removing vegetation is a significant maintenance consideration for natural earth trails.
- Natural earth trails do not typically require any mechanical equipment or even technical knowledge to maintain. As such, maintenance planning for natural earth trails can incorporate volunteer groups and community organizations committed to maintaining the RiverLands' ecological welfare.

Figure 7: Slaughter Mountain and Lake Winfield Scott Loop

Wood Chips

- Wood chips are a natural material that seamlessly blend with the natural environment and can be maintained without mechanical equipment or technical knowledge. As woodchips decompose, they contribute positively to the soil profile of their surrounding environment and counteract erosion.
- Trails hardscaped with wood chips require constant maintenance as the units are wash
- ed and blown away, and after about two years decompose to the point of requiring a full replacement.
- Wood chips can be useful as a temporary hardscape to mark a trail's extent and discourage vegetation, such as on routes that are awaiting additional funding for a hard surface installation.
- Wood chips should not be used on trails to which there is no alternative route or in areas that flood frequently.
- Wheelchair users cannot easily travel on wood chip trails.
- As wood chips rot in place, they can create a slimy surface that presents slip and fall risks and wet areas or project sites with poor drainage result in a soggy path.

Figure 8: Wood chips spread easily and quickly, even with blocks

PERMEABLE PAVING

Permeable paving claims the maintenance and accessibility benefits of hard surfaces with significantly less severe drainage and erosion challenges. Additionally, rainwater and runoff water that filters through permeable paving brings fewer pollutants to underlying soil and neighboring water bodies. Although installation processes and materials can still be invasive, permeable paving presents an ecologically responsible alternative to traditional hard surfaces for main trailways. Regular maintenance requirements across permeable paving types include frequent leaf blowing and bi-annual vacuuming to remove the sediment that collects in hardscape voids, preventing water infiltration. Paving should be inspected annually as well as after storms or flood events.

Pervious Concrete

- Pervious concrete is a mix of coarse aggregate, cement, water, and little to no sand Rainwater filters through the open cell structure to underlying soil or additional drainage systems.
- Although pervious concrete has a higher infiltration rate than porous asphalt or traditional pavers, it is also significantly more costly.
- Pervious
- concrete that is properly installed and maintained can last beyond 20 years.
- If the surface is saturated and experiences a freeze-thaw cycle, damage can be significant, a risk that is enhanced by lack of frequent leaf blowing or vacuuming.

Permeable Rubber

- Similar to permeable concrete, permeable rubber is a porous mix that relies on rubber granulate. Rubber is often recycled, as from post-consumer tires, and provides a wide range of potential colors and granule shapes.
- Permeable rubber sustains many desirable qualities of non-permeable rubber: the surface is nonslip, resistant to freeze-thaw cycles, and low-impact. Its porosity encourages deep rooting of trees without sidewalk cracking.
- Although permeable rubber typically lasts 10-15 years, the material is amiable to spot repairs and can be refreshed with a thin additional coat of rubber granule mixture.
- Roll coat, protection from excessive sun exposure, and frequent leaf-blowing are all preventative maintenance measures to extend the life of permeable rubber.
- Permeable rubber hardscapes are not appropriate along trail segments that will be inundated for extended periods of time. The rubber is light and buoyant.

Porous Asphalt

- Porous asphalt is less expensive than permeable concrete and can have a life span beyond 20 years through similar preventative maintenance techniques as traditional asphalt.
- Porous asphalt overcomes many of the water and freeze-thaw related maintenance issues incurred by traditional asphalt. The voids in porous asphalt allow water to freeze and expand without causing cracks or potholes, unless the pavement is saturated.
- As with pervious concrete, damage to porous asphalt when it is saturated and experiences a freeze-thaw cycle can be severe.
- Surface raveling is one drawback of porous asphalt.

HARDSCAPE SUSTAINABILITY CONSIDERATIONS

The RiverLands hardscapes will be walked, rolled, and ridden by generations of Atlanta residents. However, they should be designed with the welfare of Chattahoochee's sensitive species and ecosystem in mind. Improving the region's long-term ecological welfare will require careful consideration of various hardscapes' sustainability implications.

Erosion

- Impermeable surfaces can speed up sheet flow without absorbing any water, which increases erosion downgrade to the detriment of the surrounding environment.
- When improperly graded, natural earth trails can shift drainage patterns and interrupt sheet flow to create gullies or other disruptive patterns. Special care should be taken to design and maintain the grading of natural trails to address sustainability considerations.

Soil Contamination

- Some multi-layered hardscape strategies may introduce unfamiliar materials or chemicals into the soil/environment.
- Reclaimed or recycled asphalt pavement can contain significant concentrations of polycyclic aromatic hydrocarbons and lead that leach into soil.
- Crushed aggregate should be carefully selected to ensure that its inevitable integration into the soil surrounding trailways will not bring negative environmental impacts.
- Some crushed aggregate recycled from concretes contains cancer-causing chemicals that can negatively impact soil or groundwater quality in the long term.

Wildlife Protection

- In regard to wood chips, aggregate, or other particulate strategies for hardscaping, local wildlife may ingest materials or displace them, introducing them to the surrounding environment in unanticipated ways. All materials should be wildlife safe.
- Permeable rubber in particular is a hardscape made up almost entirely of alien materials. Although it brings many benefits, these should be weighed against the potential costs of rubber granules entering the surrounding environment, and permeable rubber should be sited accordingly.

Floodplain Siting

- Asphalt and concrete can survive inundation when properly sited and installed. However, it is best practice to limit the use of both to higher elevations. The repairs and replacements that repeated or prolonged inundation of impermeable surface demand are costly and environmentally invasive.
- Asphalt in particular is vulnerable to cracking, which can allow water to travel to the foundation material and cause permanent failure.
- Hardscapes that incorporate toppers such as crushed aggregate, mulch, or wood chips are likely not a cost-effective option for floodway.
- These hardscapes can introduce unfamiliar

Figure 9: Pervious concrete bike path

Figure 10: Porous asphalt surface

substances to the surrounding environment when units are picked up and moved by flood waters.

- Natural earth trails and boardwalk are hardscapes well-suited to the floodway. Both introduce minimal new materials to the surrounding environment when damaged, and both can most often be repaired without great cost or technical knowledge.

Additional Resources

Wetland Trail Design and Construction, USDA Forest Service, 2007

- *Maintenance Costs and Practices of Rail Trails*, Rails to Trails Conservancy, 2015
- *Pedestrian and Streetscape Guide*, GDOT, 2019
- *Accessible Trail Surfaced with Resin-Based Pavement*, USDA Forest Service, 2013
- *Maintenance Resources*, American Trails Organization
- *Program Guidance,* Federal Highway Administration
- *Preliminary Trails Management Plan*, 2021, Chattahoochee River National Recreation Area, National Park Service

FURNITURE MAINTENANCE CONSIDERATIONS

Furniture and fixtures are a powerful tool to positively shape user experience and codify the RiverLands' identity. Careful consideration of how each element will be maintained ensures that the trails remain accessible and appropriately represented.

Placement

- When placing seating near other fixed objects, maintenance and trash removal needs to be considered. Seating may be offset a minimum of one foot (1') from fixed objects for maintenance needs.
- The design and materiality of furniture should reflect how accessible the element is for future maintenance and repairs. More maintenance-intensive elements can be located along the main trailway or at entry points.

Metal Furniture

- The most durable frame finish for outdoor furniture is galvanized. A galvanized finish is more durable and resistant to scratching and exposure over time than a painted or powder coat finish.

Wood Furniture

- For wood products such as wooden park benches or picnic tables, be cognizant of splintering. Splintering will require repair by

Figure 11: Permeable pavement must be frequently leaf blown or vacuumed to keep the voids between granules clear

Figure 12: Asphalt cracks and creates potholes as a result of inundation and/or freeze-thaw cycles

sanding to a smooth touch or replacing.

- Picnic tables in particular are anticipated to require regular maintenance and repairs due to high volumes of anticipated use.
- Ensuring that high use furniture elements are designed to be repaired (standardized, modular, etc.) can make repair possible without trained labor or heavy equipment.

Stone Furniture

- For certain RiverLands sites or sub projects, natural furniture such as large boulders or stacked stone may be appropriate.
- Selecting a durable stone that is appropriately coordinated with existing natural landscape elements and heavy enough to avoid environmental disruption is an exceptionally low maintenance furniture strategy.

Figure 13: Stepped stone seating

Trash Cans

Providing enough trash cans to discourage users from littering and frequently maintaining these trash cans is vital to stewardship of the trails.

Trash cans should be comfortably accessible to both trail users and maintenance workers.

Consideration should be given to how often trash will be removed, whether the frequency of removal will be uniform across receptacles, etc.

Receptacles should be wildlife proof to prevent environmental disturbance.

Figure 14: Animal-proof trash receptacle

Guardrails

- In a flooding event, guardrails can both disrupt drainage patterns and sustain significant damage from debris.
- Guardrails should be designed to allow for the free movement of water, sediment, and debris across the trail while still exceeding safety and accessibility standards.
- Selecting material elements for guardrails and handrails based on ease of potential replacement without trained labor or heavy equipment will reduce required future maintenance.

Figure 15: Wooden picnic tables are heavily used and vulnerable to damage from wildlife and the elements

FURNITURE SUSTAINABILITY CONSIDERATIONS

The right materials and design will blend a fixture seamlessly into its surrounding environment while facilitating visitors' connection to the RiverLands. Each fixture should be evaluated by its potential impact on the ground it is rooted to and revised accordingly.

Material Life Cycle

- Some materials will inherently require removal and replacement after a certain number of years. Benefits of using such materials must outweigh the future costs of replacement.
- Some materials may release toxic chemicals only as they age, including certain paints or plastics. Ideally all furniture will be designed to last indefinitely.

Environmental Disruption

- Whether because of a disaster event or more typical wear and tear, it is not unlikely that some portion of the fixture may break off or be re-sited in the environment. Consider which materials
- will be least disruptive in such a scenario.
- Some materials may introduce sealants or other applied/naturally occurring chemicals that will be harmful to environmental quality, particularly when disbursed through flood waters.

Drainage

- For larger fixtures, consider how drainage patterns across the site will be impacted in a variety of storm scenarios. Fixtures may interrupt sheet flow and increase erosion, creating unanticipated gullies or puddles on the site that present accessibility, maintenance, and sustainability challenges.
- Standing water can rust, rot, or otherwise damage fixtures if drainage is not considered.

Inundation

- Depending on siting, a flood event may inundate fixtures for an extended period or put atypical stress on fixtures such as through the powerful flow of flood waters. Fixtures should be designed to withstand short term shocks, such as flood water and inundation.

Capacity to Withstand Long-Term Stresses, Such as Annual Climatic Conditions

- All materials and fixtures should consider the annual climatic conditions of the Atlanta region such as sun exposure, humidity, long periods of rainfall, and occasional freezes.

Material Sources and Life Cycles

- To meet the RiverLands sustainability goals, Materials chosen for furniture should be easily accessible as opposed to materials requiring complication extraction, storage and transportation methods. This may include domestically-modified hardwood materials and regionally sourced stone that will lessen the overall carbon footprint of the RiverLands construction process.

Additional Resources

- *Activate ATL Master Plan*, 2021, Atlanta Parks and Recreation Department

COMFORT STATIONS / SHELTERS MAINTENANCE CONSIDERATIONS

Comfort stations and shelters will allow visitors to enjoy the RiverLands rich landscape in a controlled and respectful way. Particularly in the case of more robust, plumbing-equipped shelters, placement and design will incur varied maintenance needs. Consideration should be given to ensure that these amenities are as well-maintained as the Chattahoochee itself, demonstrating the respect owed to the site.

Placement Considerations

- Placement of comfort stations and shelters should correspond to the ease with which these facilities can be maintained.
- Comfort stations with plumbing should be located primarily at trailheads or other major points along the main trailway. Smaller, simpler shelters can be sited with fewer considerations.

Rest Shelters

- Rest shelters should be monitored regularly to ensure that materials continue to perform appropriately (wood, metal, etc.) and that all elements are in good condition.

- Rest shelters should be graffiti resistant.

Comfort Stations

- Comfort stations will likely require daily attention to maintain plumbing and cleanliness. However, design strategies can be used to minimize required maintenance including unconditioned spaces with passive ventilation and natural lighting.
- Comfort stations must be lockable to prevent unnecessary maintenance issues.
- Comfort stations should be graffiti resistant.

COMFORT STATIONS / SHELTERS SUSTAINABILITY CONSIDERATIONS

Comfort stations are effectively small buildings. Selection of materials for stations' foundation, enclosure, fixtures, and so on should prioritize sustainability and longevity, limiting the impact of their construction, presence, and maintenance on the surrounding environment. Similarly, shelters throughout the RiverLands should be built to last beyond the plan's generations-long implementation.

Environmental Disruption

- Some materials may introduce sealants or other applied/naturally occurring chemicals that will be harmful to environmental quality, particularly when disbursed through flood waters.
- Trash receptacles, plumbing, and all other infrastructure should be animal proofed to prevent potentially harmful waste from entering the surrounding environment.

Flooding

- Depending on siting, a flood event may inundate shelters for an extended period or put atypical stress on fixtures such as through the powerful flow of flood waters. Shelters should be designed to withstand short term shocks, such as flood water and inundation.
- Generally, it is likely advisable that comfort stations be located at higher ground to avoid the environmental and maintenance challenges presented by flooded plumbing.
- Care should be taken to site shelters and stations in such a way as not to worsen soil erosion or impend drainage strategies through their impact on rainwater flow across the site.

Capacity to Withstand Long-Term Stresses, Such as Annual Climatic Conditions

- All structures should consider the annual climatic conditions of the Atlanta region such as sun exposure, humidity, long periods of rainfall, and occasional freezes.

Additional Resources

- *Guide to the ABA*, US Access Board

Figure 16: Simple trail shelter

Figure 17: Covered picnic area in Exploding Whale Memorial Park, OR

STORMWATER MANAGEMENT CONSIDERATIONS

Trailways can interrupt and ripple the hydrology of their surrounding environment, increasing erosion. When trails are soft and boggy, users tend to navigate around the tread, leading to maintenance issues and harmful environmental impacts. Intentional and thoughtful water management strategies maintain the natural drainage systems that protect both trails and their surrounding environment.

Trail Drainage Control

- In places where low spots on the trail catch water, trail surfaces should be raised, or drains should be built to carry away water in a controlled flow.
- Some trail drainage control can be achieved through the proper edging of trails.
- If trail drainage is corrected near steep slopes, the possibility of erosion must be considered.
- While a well-designed natural drainage system requires little maintenance, over time the RiverLands' local drainage patterns will undoubtedly shift. A set system for the monitoring and maintenance of trailways should make use of the following strategies.

Outsloping

- When one side of a tread is at a higher elevation than the other, the tread should always be modestly outsloped towards the lower elevation to prevent water from standing.
- If water is channeled down the trail, it will erode the tread along with any crushed aggregate, woodchips, soil cement, or other hardscape materials that top it. Letting sheet flow across the thread through well maintained outsloping prevents these more costly maintenance challenges.

Knicks and Rolling Grade Dips

- A knick is a shaved down semicircle about ten feet (10') long and the width of the tread that is outsloped about fifteen percent (15%) in the center.
- Knicks are designed into new trails and are effective in draining puddles from flat areas towards areas at a lower elevation.
- Knicks are effective only if terrain allows for outsloping.
- A rolling grade dip is a knick along a steeper trail. From its lower elevation, the tread ramps up at a five percent (5%) slope for ten to twenty feet (20'), then returns to a fifteen percent (10%) decent of the knick. The ramp directs water flowing from the tread's higher elevation off of the path by forcing it down the knick's outslope
- Anticipating portions of unpaved trail that may create puddling and designing in knicks and/ or rolling grade dips will prevent erosion from sheet flow and tread spread from users attempting to go off-trail to avoid puddling, limiting future maintenance.
- Supplementing knicks with rolling grade dips is a maintenance strategy that can be implemented as the drainage patterns of the RiverLands evolve and new instances of puddling occur.

Puddle Drains

- A puddle drain addresses standing water on trailways by creating a shallow channel across the entire tread. Puddle drains should be about twenty-four inches (24") wide and feathered into the tread on either side to prevent trip hazards or accessibility challenges.
- Puddle drains are a maintenance measure that may be needed as the drainage patterns of the RiverLands evolve and new instances of puddling occur, or in scenarios where terrain prevents the provision of knicks.

Water Bars

- Wood or stone water bars are lodged across a tread, creating a "step" that acts as a micro-dam and redirects water off the trail. A slightly exaggerated downgrade from the trail's higher elevation allows for a sharp shift up at the water bar.
- Water bars can require significant maintenance, as they become ineffective when debris is accumulated and can often dislodge from the trail under the pressure of flood waters.
- Water bars can present accessibility challenges
- Typically grade changes are a preferrable maintenance strategy to water bars.

Paved Trails

- Grade changes reminiscent of knicks, rolling grade dips, puddle drains, and so on may be realistically

designed into paved trails, however implementing them as maintenance strategies following the completion of a trail is less pragmatic.

- The relatively invasive nature of paved trails may allow for technically advanced stormwater management systems such as conventional storm drains.
- Paved trails hardscaped with concrete or asphalt may require grinding, horizontal cutting, mud-jacking, chip and slurry sealing, or even partial replacement to prevent drainage issues or as a result of drainage issues.
- Paved trails should be monitored regularly so that less invasive and disruptive maintenance measures can be deployed as soon as drainage issues are noted, preventing costly replacement.
- Even with proper design and maintenance, periodic partial replacement as a result of water management damage is a significant maintenance consideration for paved trails and should be weighed against the benefits of paved trail segments.

Relocation

- Even with intentional drainage strategies and proper maintenance measures, local drainage patterns may experience significant changes over the years as a result of erosion, development, climate change, and so on.
- If strategies to manage stormwater are consistently failing along particular segments of the trail network, potential relocation of problematic segments is a last resort stormwater "management" consideration.

Additional Resources

- *Stormwater System Inspection and Maintenance Manual,* 2020, GDOT
- *Georgia Stormwater Management Manual,* 2016, Atlanta Regional Commission
- *Trail Construction and Maintenance Notebook*, 2007, USDA
- *Best Management Practices for Erosion Control During Trail Maintenance and Construction*, 2017, USDA
- Integrating Stormwater Management, Best Practices: Greenspace and Flood Protection Guidebook

PLANTING MAINTENANCE CONSIDERATIONS

Significant maintenance measures are required both to protect RiverLands users and the native plants and animals that call the Chattahoochee home. Appropriate maintenance practices will control invasive species, celebrate native ones, and contribute to a healthy and sustainable RiverLands ecosystem.

Seasonality

- The season for the landscaping work will likely take place

Figure 18: Knick

Figure 19: Water Bars

the first week of March though the first week of November of each year.

- A schedule that takes into account the full breadth of planting maintenance considerations should be developed as part of the design and construction process to ensure that funding and staffing are sufficient to meet the level of care required by the RiverLands.

Trail Planting Buffer

- All paved trails should be maintained a minimum of 5' on either side of the trail edge by using a weed eater, loppers, pruners, or a mower.
- All nature trails should be kept free of fallen limbs, trees, and other plant debris. The trails should be maintained a minimum of 3' on either side of the trail edge by using a weed eater.

Invasive and Hazardous Removal

- Hazardous plants such as privet, poison ivy/oak, sumac, brambles, branches etc. should be removed from all areas accessible to pedestrian traffic/use.
- Invasive species should be removed, particularly along pedestrian routes where frequent traffic increases the likelihood of hitch-hiking seeds.
- Efforts should be made to educate visitors on personal maintenance efforts that help stop the spread of invasive species, such as by checking clothing for seeds, by not dumping aquatic plants such as from aquariums into the river, and by leaving firewood in its place of origin.

Tree Pruning

- All overhanging branches should be pruned back to a minimum height of seven feet (7') and a distance of five feet (5') from the edge of the trail to allow for good user visibility.
- Trees need no pruning (except for deadwood or growth on the main tree trunk) unless the tree is disorganized and needs pruning in certain areas to achieve balance.

Revegetation

- Areas adjacent to trails that have been disturbed for any reason should be revegetated to minimize erosion.

Trail Construction

- Maintenance staff should be engaged in early decision making and educated about the care of retained and proposed trees and their requirements for protection during construction.

ECOLOGY & SUSTAINABILITY CONSIDERATIONS

Decisions about what to plant where and what to prune when have major impacts on the RiverLands' ecological health. Defaulting to native plants that can thrive where they are sited with minimal maintenance is key to stewardship of the RiverLands.

Native Plants

- Native plants should be used in greenway landscaping to minimize maintenance responsibilities and encourage wildlife-friendly techniques.
- Native plants that actively support native wildlife should be preferred. Further, these plants should be maintained in a way that is beneficial to the supported species.
- For example, milkweed should not be cut back during Georgia's monarch migratory periods (September and early October).
- Invasive plants should not be used.

Low Water and Water Tolerant Plants

- While all landscaping planting will require an establishment period in which watering is required, Landscaping should be responsive to the amount of water that different elevations and sections of the RiverLands receive.
- Low water plants should be utilized at higher ground to limit required watering and maintenance, while water tolerant plants should be utilized at elevations that are frequently inundated.

Noninvasive Landscaping

- Although significant landscape maintenance is required along the trail network, care should be taken to ensure that maintenance and construction staff are equipped to perform work with as little impact on the

surrounding environment as possible.

Additional Resources

- See Appendix A: GDOT Pedestrian and Streetscape Guide, Appendix B: Landscape Maintenance Program
- Maintaining Greenspaces in the Floodplain, Best Practices: Greenspace and Flood Protection Guidebook
- *RFP for Landscape Maintenance Services for County Parks*, 2021, DeKalb County

SIGNAGE & MARKING MAINTENANCE CONSIDERATIONS

Signage and markings are vital tools for the safety and security of the Chattahoochee and its many visitors. Further, they can explicitly and implicitly communicate the RiverLands' vision and ethos. Proper consideration of signage maintenance requirements will help to ensure that communication is clear and consistent across the trail network.

Markings

- The maintenance of markings is a priority and is the major maintenance need for crosswalks along the trail.
- The type of marking material (paint, epoxy, thermoplastic, tape) used will be a major factor in how often the marking will have to be maintained to achieve an acceptable level of conspicuity (FHWA).
- Markings in standard road paint would likely require reapplication every one to three years, regardless of maintenance measures taken to preserve them.

Signage

- Unlike trail markings, signs can often last more than 10 years.
- Major maintenance concerns for signage include ultraviolet radiation (sun exposure), airborne pollutants, mold or algae, and vandalism.
- Replacement of pedestrian-related signage tends to be deprioritized in favor of regulatory signs (such as stop and yield signs), making regular maintenance to prevent untimely replacement even more advantageous.
- Signage should be sited in shaded areas to prevent unnecessary ultraviolet radiation.
- Signage should be cleaned regularly by maintenance staff to prevent buildup and untimely replacement.
- Constructing signage using graffiti-resistant materials may be an effective strategy against vandalism.
- Constructing signage with a limited number of specialty parts may make future maintenance easier and prevent replacement through piecemeal repair opportunities.

Figure 20: Privet, a plant species invasive in the RiverLands study area

Figure 21: Trees should be trimmed routinely for user safety

Figure 22: Milkweed, a native plant that supports the life cycle of monarch butterflies

SIGNAGE & MARKING SUSTAINABILITY CONSIDERATIONS

After the trailways themselves, signage and markings are some of the RiverLands' most consistent and ever-present infrastructure. Making use of materials and design strategies that are durable, inclusive, and celebratory of the Chattahoochee's continued ecological health will both contribute to and expound the RiverLands role as an ecological refuge for the region.

Markings

- Because most marking materials slowly wear off the trail surface and into the surrounding environment, selecting a material that can enter the river and soil without damaging ecosystems is necessary.

Signage

- Using natural materials such as wood or stone rather than acrylic plastic, particularly for larger signs and in more remote areas of the RiverLands, will limit the potential waste shed by signage and ultimately its long-term footprint.
- Any inks, sealants, adhesives, and so on used to assemble signage should be able to leak into the surrounding environment (such as in an inundation scenario) without damaging impacts.

Additional Resources

- *Activate ATL Master Plan*, 2021, Atlanta Parks and Recreation Department

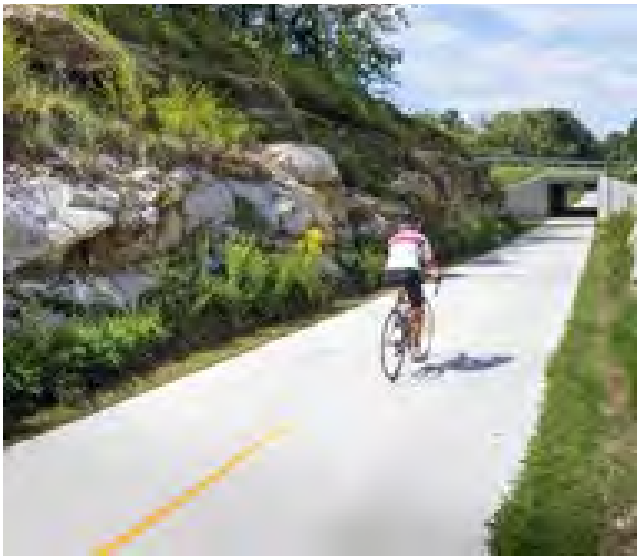


Figure 23:: Silver Comet Trail

Figure 24:: Signage executed in durable, natural materials

Figure 25: Arsenal Eco-Pavers

APPENDIX E:
COMPLETE LIST OF RESOURCES

COMPLETE LIST OF RESOURCES

The following is a complete list of resources consulted for each Technical Memo, reviewed by the SCAPE Team and Project Management Team (PMT).

MEMO #1: APPLICABLE EXISTING GUIDELINES AND REQUIREMENTS FOR DESIGN

- *Recreational Trails Program: Manuals and Guides for Trail Design, Construction, Maintenance, and Operation, and for Signs, US Department of Transportation* Federal Highway Administration (FHWA)
- *Sustainable Trail Bridge Design*, US Department of Agriculture (USDA)/ Federal Highway Administration
- *A Policy on Geometric Design of Highways and Streets: 7th Edition (2018)*, American Association of State Highway and Transportation Officials (AASHTO)
- *FHWA Manual on Uniform Traffic Control Devices (MUTCD)*, Federal Highway Administration
- *Wetland Trail Design and Construction: 2007 Edition*, US Department of Agriculture (USDA)/ Federal Highway Administration
- *Chattahoochee River National Recreation Area Preliminary Trails Management Plan 2021*, National Parks Service (NPS)
- *Pedestrian and Streetscape Guide,* Georgia Department of Transportation (GDOT)
- Right-of-Way Use (georgiapower.com), Georgia Power
- NACTO Urban Street Stormwater Guide, National Association of Transportation Officials

LOCATION SPECIFIC MASTER PLANS

Links to location specific master plans, to be considered in trail design.

- *Cobb County Greenways and Trails Master Plan*
- *Gwinnett Trails: Countywide Trails Master Plan*
- *Streets Atlanta: A Design Manual for Multimodal Streets*
- *Roswell River Parks Master Plan*
- *Sandy Springs Riverfront Vision Plan*
- *Forsyth County Parks and Recreation Comprehensive Plan*

MEMO #2: BICYCLE AND PEDESTRIAN SAFETY RECOMMENDATIONS

- *Safe Streets for Walking and Bicycling*, Atlanta Regional Commission
- *Proven Safety Countermeasures*, Federal Highway Administration
- *Small Town and Rural Multimodal Networks,* Federal Highway Administration (report number FHWA-HEP-17-024)
- *Urban Bikeway Design Guide*, National Association of City Transportation Officials (NACTO)
- *Urban Street Design Guide,* National Association of City Transportation Officials (NACTO)
- *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations*, Federal Highway Administration
- *Guide for the Planning, Design, and Operation of Pedestrian Facilities, July 2004,* American Association of State Highway Transportation Officials (AASHTO)
- *Guide for the Development of Bicycle Facilities, Fourth Edition, 2012*, American Association of State Highway Transportation Officials (AASHTO)
- *FHWA Manual on Uniform Traffic Control Devices (MUTCD)*, Federal Highway Administration

MEMO #3: UNIVERSAL ACCESS RECOMMENDATIONS

- *Americans with Disabilities Act (ADA) Accessibility Standards (2010)*, US Access Board
- *Designing Sidewalks and Trails for Access Part I of II: Review of Existing Guidelines and Practices (1999),* Federal Highway Administration
- *Designing Sidewalks and Trails for Access Part II of II: Best Practices Design Guide (2001)* Federal Highway Administration
- *Accessible Shared Streets – Notable Practices and Considerations for Accommodating Pedestrians with Vision Disabilities,* Federal Highway Administration (report number FHWA-HEP-17-096)
- *Small Town and Rural Multimodal Networks,* Federal Highway Administration (report number FHWA-HEP-17-024)
- Forest Service Outdoor Recreation Accessibility Guidelines (FSORAG) (2013), USDA Forest Service
- Forest Service Trail Accessibility Guidelines (FSTAG) (2013), USDA Forest Service
- Best Practices for Busy Shared-Use Paths, Metro (Portland, Oregon)
- Outdoor Developed Areas: A Summary of Accessibility Standards for Federal Outdoor Developed Areas (2014), US Access Board
- Universal Access Trails and Shared Use Paths (2014) , Pennsylvania Land Trust Association
- *Proposed Public Rights-of-Way Accessibility Guidelines (2013)*, US Access Board
- *Whispering Woods Braille Trail*
- *Guidelines for Providing Trail Information to People with Disabilities*. Oregon State Parks (October 2013)

MEMO #4: MAINTENANCE AND SUSTAINABILITY

NATIONAL AND INDUSTRY STANDARDS FOR TRAIL MAINTENANCE

The list below outlines resources that contain national and industry standards maintenance standards that are applicable to the design of the major components of the RiverLands:

- *Program Guidance,* Federal Highway Administration
- *Accommodating Bicycle and Pedestrian Travel: A Recommended Approach,* Federal Highway Administration
- *Guide for Maintaining Pedestrian Facilities for Enhanced Safety*, Federal Highway Administration
- *Guide for the Planning, Design, and Operation of Pedestrian Facilities*, July 2004, AASHTO
- *Guide for the Development of Bicycle Facilities* 2012, Fourth Edition, AASHTO
- *Trail Construction and Maintenance Notebook* USDA, 2007, Forest Service and Federal Highway Administration
- *Maintenance Practices and Costs of Rail-Trails*, 2015, Rails-to-Trails Conservancy
- *Urban Bikeway Design Guide*, 2011, NACTO
- *Maintenance Resources*, American Trails Organization
- *Guide to the ABA, US Access Board*

STANDARDS FOR TRAIL MAINTENANCE BY STATE AND LOCAL JURISDICTION

- *Pedestrian and Streetscape Guide*, 2019, State of Georgia Department of Transportation (GDOT)
- *Preliminary Trails Management Plan,* 2021, Chattahoochee River National Recreation Area, National Park Service
- *Cobb County Greenways and Trails Master Plan,* 2018, Cobb County Georgia
- *Beltline Infrastructure Sustainability: Best Practices in Trail Maintenance Funding*, 2010, Atlanta Beltline
- *Activate ATL Master Plan, 2021, Atlanta Parks and Recreation Department*
- *Georgia Stormwater Management Manual,* 2016, Atlanta Regional Commission

SUSTAINABIITY RESOURCES

- Conservation Buffers: Design Guidelines for Buffers, Corridors, and Greenways, 2008, USDA and Forest Service Southern Research Station

MEMO #5: BEST PRACTICES

LOCAL PRECEDENTS

- Atlanta BeltLine Website
- Atlanta BeltLine Typologies, 2013
- Silver Comet Trail Georgia
- Northwest Corridor Trail / Mountain to River Trail
- Big Creek Greenway
- Western Gwinnett Bikeway
- Path 400
- Stone Mountain Trail
- Arabia Mountain Path Trail
- Roswell Riverwalk Trail

NATIONAL PRECEDENTS

- San Francisco Bay Trail: Design Guidelines and Toolkit, June 2016
- Morris Canal Greenway Study, June 2018
- Empire State Trail Design Guide, October 2017
- The Great Allegheny Passage
- The Great Allegheny Passage Graphic Identity & Sign Guidelines Manual, August 2008
- Louisville Loop Design Guidelines, December 2009

INTERNATIONAL PRECEDENTS

- Industrial Heritage Trail
- Lower Don Trail
- Narrabeen Lagoon Trail

IMAGE CREDITS

The Chattahoochee RiverLands Design Team created and edited all images unless otherwise stated below:

THE RIVERLANDS ELEMENTS

Page 22 **Grind Lane Separation**
High Line Network
https://network.thehighline.org/projects/dequindre-cut/
Painted Lane Separation
Sonny Tomic
https://twitter.com/SonnyTomic/status/489545890437165056
Wausau V-Series Permeable Pavers
Wausau Tile. Permeable Brochure (2021).
https://wausautile.com/Products/V-Series-Permeable.cfm

Page 24 **Asphalt with Metal Edge**
Permaloc Sustainable Edging Solutions
https://permaloc.com/edging/asphaltedge/
Asphalt with Cobble Edge
Mannng Tree & Landscape
www.manningtreelandscape.com
Sand Colored Permeable Rubber
Rubberway, Inc.
https://www.rubberway.com/rubber-sidewalks

Page 25 **ADA-Accessible Gravel**
National Parks Service, Acadia, Accessibility
https://www.nps.gov/acad/planyourvisit/accessibility.htm
Gravel Sample
Gravelshop M10 Granite Screening
https://www.gravelshop.com/p/m10-granite-screening-452.asp

Page 28 **Color Recommendation**
Colorado Hardscapes, Inc.
https://www.coloradohardscapes.com/job-profile/boulder-civic-area-park/
Typical Bioswale Planting
Nasrin Alamdar, Florida A&M University-Florida State University College of Engineering
https://www.eng.famu.fsu.edu/news/alamdari-stormwater-tool
Bioswale After Heavy Rain
The Baltic Smart Water Hub
https://www.balticwaterhub.net/solutions/bioswale-parking-lot

Page 30 **ADA-Compliant Mulch Pedestrian Trail**
https://www.tripadvisor.com/Attraction_Review-g182150-d4480787-Reviews-Heritage_Forest- Qualicum_Beach_Vancouver_Island_British_Columbia.html#/media-atf/4480787/71080435:p/?albumid=-160&type=0&category=-160
Mulch Trail Beside Slope
Steven L. Markos, 2014
https://npplan.com/parks-by-state/georgia/at-a-glance-chattahoochee-river-national-recreation- area/hiking-trails-chattahoochee-river-national-recreation-area/
Wheelchair on ADA Mulch
National Parks Service, Catoctin Mountain, Accessibility
https://www.nps.gov/cato/planyourvisit/accessibility.htm
ADA-Compliant Gravel Pedestrian Trail
Conservation Works, LLC.
https://www.conservationworksllc.com/portfolio/retirement-community-trail/

Page 34 **Open Grid Pavers**
Water Environment Federation Stormwater Report
https://stormwater.wef.org/2013/10/pervious-permeable-porous-pavers-really/
Mulch
Terrascapes Landscape Design, LLC.
https://terrascapeslandscapedesign.com/portfolio-items/back-yard-built-on-a-slope/
Pavers
Wausau Tile. Permeable Brochure (2021).
https://wausautile.com/Products/V-Series-Permeable.cfm

Page 38 **One-Way Protected Bike Lane**
Oregon City, Bike Infrastructure in the Beavercreek Road Concept Plan
https://www.orcity.org/planning/webform/bike-infrastructure-beavercreek-road-concept-plan
Two-Way Protected Bike Lane
Hamilton River Plan, p.20
https://gis.hamilton-oh.gov/webdocs/Dept%20Planning/2018.04.09%20HAMILTON%20RIVER%20PLAN%20FINAL%20REPORT.pdf
Raised Bike Lane
www.pedbikeimages.org / Carl Sundstrom
https://www.pedbikeimages.org/details.php?picid=607

Page 44 **Concrete Boardwalk Planks**
PermaTrak
https://www.permatrak.com/news-events/bid/97244/what-kind-of-maintenance-is-required-for-a-concrete-boardwalk
Wood
Chattahooche National Parks Conservancy for The Atlanta Journal-Constitution
https://www.ajc.com/news/atlanta-news/three-new-river-overlooks-open-on-chattahoochee-river-at-cochran-shoals-trail/64D4HMSWOVBMPBOUYKE5SCCS7U/

Page 45 **Expanded Metal Grate**
Rambøll Architecture and Urban Development.
https://landezine.com/farum-midtpunkt-by-ramboll-architecture-and-urban-development/

SITE FURNISHINGS

Page 50 **Bridge**
Jordan Mitchell, Copyright: Creative Commons Attribution-ShareAlike 3.0 United States
https://www.wncoutdoors.info/photo-gallery/pisgah-national-forest-davidson-river-area/2012-03-25_pisgah-davidson-river_art-loeb-estatoe-trail-steel-arch-bridge-above-jpg/
Weathered Steel Installation
Bärbel Miemietz, 2022
https://commons.wikimedia.org/wiki/File:2022-01-01_Stadtteilpark_Misburg,_Birkenhain.JPG

Page 51 **Mulch Trail**
South Carolina Botanical Garden at Clemsen University
https://secure.touchnet.net/C20569_ustores/web/product_detail.jsp?PRODUCTID=2079
Bridge
Cumberland Trails.
https://cumberlandtrails.org/west-palisades-trail/
River
Tom Wilson

Page 60 **Concrete Retaining Wall with Textured Formwork**
Read Civil
https://readcivil.com/what-is-retaining-wall-and-its-pictures-of-retaining-wall/

Page 61 **Concrete Formwork Examples**
Plasmacem
https://www.plasmacem.com/en/prefabricated-concrete-slabs-exposed-concrete-walls/cph-6-matrices

SIGNAGE AND WAYFINDING

Page 68 **Clockwise From Top Left**
Arches
Matthijs van der Burgt. Arcade by Gijs van Vaerenbergh.
https://www.archdaily.com/925668/arcade-gallery-gijs-van-vaerenbergh/5d9187bd284dd1d6fc000016-arcade-gallery-gijs-van-vaerenbergh-photo?next_project=no
Corten Bike Sign
Peter Legris Photography via PLANT.
https://branchplant.com/projects/pottery
Corten Vertical Sign
pfp, disseny
https://www.pfpdisseny.com/portfolio/punts-dinteres-historic/
Posts in Field
SWA Group, Jeffrey Open Space Park
https://www.swagroup.com/projects/jeffrey-open-space-park/
Perforated Canopies
Hanns Joosten via Architonic
https://www.architonic.com/en/project/melk-the-park/5103486
Arrow Close-Up
Annabell Sievert via Behance
https://www.behance.net/gallery/33869664/Bleckmar
River
Tom Wilson

Page 103 **Regulatory Signs**
MUTCD

TRAIL CROSSINGS

Page 110 **Trail Connection**
Tulatin Hills Park & Recreation District
http://www.thprd.org/connect/news/community-meeting-for-new-trail-at-sexton-mountain-drive Page 112
Rectangular Rapid Flashing Beacon
FHWA
https://usa.streetsblog.org/2019/06/14/building-a-safer-mid-block-crossing/
Pedestrian Hybrid Beacon
FHWA via the Partnership for the National Trails System

Page 114 **Angled Pedestrian Refuge Island with Landscape**
City Of Charlotte via Project for Public Spaces
https://www.pps.org/article/rightsizing-streets-to-create-great-public-spaces

Page 116 **Upper Image**
Michigan DOT
https://www.michigan.gov/-/media/Project/Websites/MDOT/Travel/Safety/Road-User/Bicycling/Research/Sidepath-Intersection-Crossing-Treatment-Guide.pdf?rev=0e176c86dac34470ab7baa688cbce943

APPENDIX A: APPLICABLE EXISTING GUIDELINES AND REQUIREMENTS FOR DESIGN

Page A-123 **Figure 1.**
GDOT Pedestrian and Streetscape Guide, Rev. 3.0, p. 4-40
http://www.dot.ga.gov/PartnerSmart/DesignManuals/TrafficOps/

GDOT%20Pedestrian%20and%20Streetscape%20Guide.pdf

Page A-129 **Figure 6.**
GDOT Pedestrian and Streetscape Guide, Rev. 3.0, p. 4-44
http://www.dot.ga.gov/PartnerSmart/DesignManuals/TrafficOps/GDOT%20Pedestrian%20and%20Streetscape%20Guide.pdf

Page A-130 **Figure 7.**
AASHTO Roadside Design Guide, Fourth Edition, 2011, p.10-11 to 10-13
https://trust.dot.state.wi.us/ftp/dtsd/bts/environment/library/PE/AASHTO-RSDG-4-2011-with-2012-&-2015-errata.pdf

Page A-133 **Figure 9.**
NACTO Urban Street Stormwater Guide
https://nacto.org/publication/urban-street-stormwater-guide/

Page A-137 **Figure 11.**
MUTCD

Figure 12.
MUTCD

Figure 13.
MUTCD
https://mutcd.fhwa.dot.gov/htm/2009/part9/part9b.htm

Page A-141 **Figure 15.**
Gwinnett Trails, Countywide Trail Master Plan, 2018
https://www.gwinnettcounty.com/static/departments/communityservices/gwinnett_trails/pdf/GwinnettCountywideTrailsMasterPlan_ExecutiveSummary_DigitalViewing.pdf

Figure 16.
Gwinnett Trails, Countywide Trail Master Plan, 2018
https://www.gwinnettcounty.com/static/departments/communityservices/gwinnett_trails/pdf/GwinnettCountywideTrailsMasterPlan_ExecutiveSummary_DigitalViewing.pdf

APPENDIX B: BICYCLE AND PEDESTRIAN SAFETY RECOMMENDATIONS

Page A-147 **The Safe System Approach.**
FHWA
https://safety.fhwa.dot.gov/zerodeaths/zero_deaths_vision.cfm

Page A-151 **Figure 1.**
AASHTO Guide for the Development of Bicycle Facilities, 2012, Fourth Edition, p.5-7
https://njdotlocalaidrc.com/perch/resources/aashto-gbf-4-2012-bicycle.pdf

Page A-153 **Figure 3.**
GDOT Pedestrian and Streetscape Guide, Rev. 3.0, p. 4-41
http://www.dot.ga.gov/PartnerSmart/DesignManuals/TrafficOps/GDOT%20Pedestrian%20and%20Streetscape%20Guide.pdf

Page A-157 **Figure 4.**
FHWA Small Town and Rural Multimodal Networks, 2016, p.4-7
https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/small_towns/fhwahep17024_lg.pdf

Figure 5.
NACTO Urban Bikeway Design Guide
https://nacto.org/publication/urban-bikeway-design-guide/intersection-treatments/intersection-crossing-markings/#design

Page A-159 **Figure 6.**
FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations, 2018, p.16
https://safety.fhwa.dot.gov/ped_bike/step/docs/STEP_Guide_for_Improving_Ped_Safety_at_Unsig_Loc_3-2018_07_17-508compliant.pdf

APPENDIX C: UNIVERSAL ACCESS RECOMMENDATIONS

Page A-165 **Figure 1.**
MUTCD D9-6

Page A-167 **Figure 2.**
FHWA Accessible Shared Streets, 2017, p.7
https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/accessible_shared_streets/fhwahep17096.pdf

Figure 3.
2010 ADA Standards for Accessible Design, p.80
https://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards_prt.pdf

Page A-169 **Figure 4.**
2010 ADA Standards for Accessible Design, p.91
https://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards_prt.pdf

Figure 5.
2010 ADA Standards for Accessible Design, p.129
https://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards_prt.pdf

Page A-171 **Figure 6.**
2010 ADA Standards for Accessible Design, p.124
https://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards_prt.pdf

Table 1.
2010 ADA Standards for Accessible Design, p.33
https://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards_prt.pdf

Figure 7.
2010 ADA Standards for Accessible Design, p.220
https://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards_prt.pdf

Figure 8.
USDA FSORAG, p. 22
https://www.fs.fed.us/t-d/pubs/pdfpubs/pdf15232811/pdf15232811dpi300.pdf

Page A-173 **Braille Nature Trail**
Whispering Woods Braille Trail
http://www.braillenaturetrail.com/wwbt-photos.html

APPENDIX D: MAINTENANCE AND SUSTAINABILTY

Page A-182 **Figure 2.**
Kevinawilk, 2010
https://commons.wikimedia.org/wiki/File:ATT_chatham.jpg

Page A-183 **Figure 4.**
USDA Forest Service and U.S. Department of Transportation Federal Highway Administration
https://www.fs.fed.us/t-d/pubs/pdfpubs/pdf12232309/pdf12232309dpi100.pdf

Page A-184 **Figure 6.**
PermaTrak
https://www.permatrak.com/permatrak-project-profiles/crabtree-lake-greenway

Page A-185 **Figure 7.**
The Peaceful Place, LLC.
https://www.thepeacefulplacellc.com/mensretreat

Figure 8.
Roger Jones, 2020
https://www.geograph.org.uk/photo/6585217

Page A-187 **Figure 9.**
National Ready Mixed Concrete Association Pervious Pavement
https://www.perviouspavement.org/applications/paths.html

Figure 10.
Pavement Interactive
https://pavementinteractive.org/porous-on-purpose-permeable-pavements/

Page A-188 **Figure 11.**
Joe Wessels, Loveland Local News, 2021
https://lovelandlocalnews.com/2021/07/28/bike-trail-reopens-at-foster-under-recently-reopened-u-s-22-3-bridge/

Figure 12.
Town of Matthews, North Carolina
https://www.matthewsnc.govnewsview.aspx?nid=6195

Page A-189 **Figure 13.**
NYC Department of Parks & Recreation via Champlain Stone LTD.
https://www.champlainstone.com/projects/nyc-department-of-parks-recreation/

Figure 14.
Paris 68 Gal. Rust-Resistant Metal Animal Proof Trash Receptacle, The Home Depot
https://www.homedepot.com/p/Paris-68-Gal-Metal-Animal-Proof-Trash-Can-in-Brown-461-314-0002/206430859

Figure 15.
Ethan Wang
https://www.gofundme.com/f/ethan-wang-eagle-project

Page A-191 **Figure 16.**
Walton Outdoors
https://waltonoutdoors.com/watersound-trail-opens-in-st-joe-origins-community/

Figure 17.
Rick Obst, 2021
https://www.flickr.com/photos/discoveroregon/51493801190

Page A-193 **Figure 18.**
USDA United States Forest Service
https://www.fs.fed.us/t-d/pubs/htmlpubs/htm07232806/page06.htm

Figure 19.
Acton Wakefield Watersheds Alliance (AWWA)
https://awwatersheds.org/waterbars-do-it-yourself-conservation-practices/

Page A-194 **Figure 20.**
CRNRA
https://www.nps.gov/chat/learn/nature/privet.htm

Figure 21.
Eli Christman, 2019
https://www.flickr.com/photos/gammaman/48982705056

Figure 22.
Using Georgia Native Plants
http://usinggeorgianativeplants.blogspot.com/2018/04/milkweeds-in-georgia.html

Page A-196 **Figure 23.**
Decatur Troop 134
https://bsa134decatur.org/product/nov-13-silver-comet-bicycle-campout/

Figure 24.
Niagara Benchlands, Lincoln, Ontario
https://speakuplincoln.ca/tourism-brand/widgets/99897/photos/24324

Figure 25.
Arsenal Eco-Pavers
https://www.arsenalecopavers.com/why


TRUST FOR PUBLIC LAND™
For more information and to get involved:
WWW.CHATTAHOOCHEERIVERLANDS.COM