

Howard County Department of Planning and Zoning

# Downtown Columbia

## Patuxent Branch Trail Extension Feasibility Study

Howard County, Maryland

FINAL-October 2014

**Capital Project ID:** T7107

**Submitted to:** Howard County – Department of Planning and Zoning

**Prepared by:** Toole Design Group, LLC.

**Date:** October 2014





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## Executive Summary

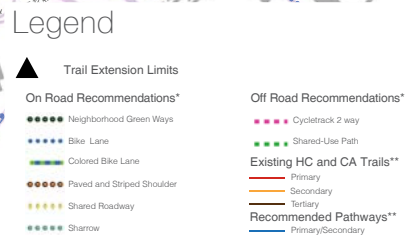
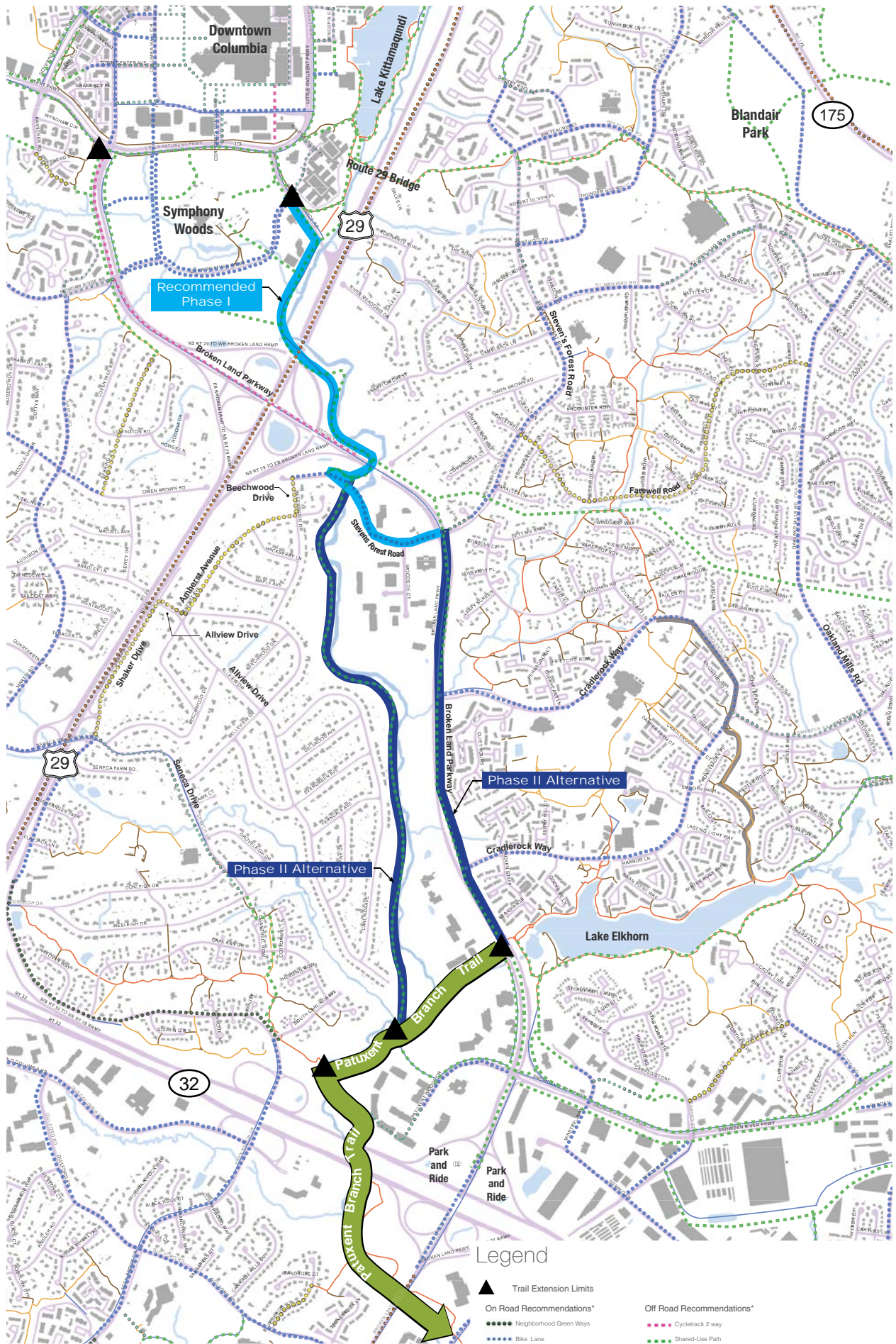
In December of 2013, the Howard County Department of Planning and Zoning initiated a study to assess the feasibility of linking Downtown Columbia to the Patuxent Branch Trail by exploring and evaluating both existing and potential on and off road pathways to develop a direct connection. The study was initiated in response to direction contained in Howard County Capital Project T7107 that called for a study to evaluate connections and routes to link Downtown Columbia and the Patuxent Branch Trail in relation to their community and environmental impacts and relationship to the Oakland Mills Bridge capital project.

### Method

The study reviewed and evaluated a wide range of segments between Downtown Columbia and the Patuxent Branch Trail to develop the direct connection and makes recommendations for a preferred alternative and future actions. The study identified 19 segments to connect Downtown Columbia to the Patuxent Branch Trail, organizing the 19 segments into five categories based on geographic location and their physical, connectivity and environmental constraints. Seven segments were determined not to be feasible because of their topographic and connectivity constraints and twelve were determined to be feasible. The study then refined the evaluation of the feasible segments based on environmental impacts, directness, comfort for uses, desirability, engineering and geographic feasibility and order-of-magnitude costs.

Recommends Segments C1 and A2 as a Phase 1 Route			
Segment Description	Primary Selection Criteria	Length	Preliminary Cost
Segment C1 is shared-use pathway along the existing sewer line corridor between Downtown Columbia and Stevens Forest Road; west of the Little Patuxent River	Is feasible and provides direct routing, relatively flat topography and minimal intersection crossings and connects to the Multi Use Pathway that will run from the hospital to Blandair Park.	0.87	\$749,000
Segment A2 is on-road bikeway connection along Stevens Forest Road from Broken Land Parkway to the intersection with the existing sewer line corridor	Is feasible and provides a key connection to the bike lanes on Stevens Forest Road, low cost, uses low volume street and improves access and connects to an existing bike lane.	0.40	\$40,000
Recommends Additional Actions on Segments B2 and C2 as part of a Phase 2 Route			
Segment Description	Primary Selection Criteria	Length	Preliminary Cost
Segment B2 is a shared-use pathway along Broken Land Parkway from Stevens Forest Road to the Patuxent Branch Trail	The segment provides a direct route, however could require significant reconfiguration of Broken Land Parkway. Traffic analysis needed.	1.10	\$1,782,000
Segment C2 is a shared-use pathway along the sewer line corridor from Stevens Forest Road to the Patuxent Branch Trail; west of the Little Patuxent River	The segment provides a direct, flat route, has no roadway crossings, provides a direct, car-free route and connects to the Patuxent Branch Trail, However since the alignment is near to existing homes, more discussion with stakeholders in the community is recommended.	1.53	\$1,621,000





Patuxent Branch Trail Extension Study Segment Alternatives



October 2014



## Section 1: Summary of Findings

### Introduction

In December of 2013, the Howard County Department of Planning and Zoning hired Toole Design Group (the “Consultant”) to assess the feasibility of linking Downtown Columbia to the Patuxent Branch Trail by exploring and evaluating several alternative alignments for a shared-use pathway. The scope of work included an assessment of the opportunities and constraints of each route alternative, including (but not limited to) environmental impacts, directness/desirability of route, feasibility and order-of-magnitude cost. This feasibility study was initiated in response to language in Section 5 of the remarks section of Howard County capital project T7107:

*5. The feasibility study shall evaluate:*

- a. potential alternatives for the alignment of the pathway, including but not limited to using BGE right of way that runs from Route 29 just north of Broken Land Parkway to just south of Oakland Mills Road before connecting with existing pathways that feed directly into the Patuxent Branch Trail*
- b. the impact of each proposed alignment on surrounding neighborhood and community including the effects the project will have on flooding*
- c. the relationship of this pathway to the Downtown-Oakland Mills bridge (Project B3863)*

### Background

Downtown Columbia is currently being redeveloped into a mixed use center. An important element of downtown Columbia’s transformation are the efforts, some of which are already underway, to ensure that downtown can serve all users by making downtown a connected highly walkable and bicycle friendly town center. Howard County is also in the final stages of finalizing a Bicycle Master Plan, which reinforces the need to improve non-motorized access to Downtown Columbia. Columbia Association (CA) recently completed and approved the *Active Transportation Action Agenda*, which recommended creating a shared-use path connection between Downtown Columbia and the Patuxent Branch Trail, a regional trail that extends from south-central Columbia and Lake Elkhorn to Savage. Through these efforts, there has been a growing interest and demand for a comfortable and convenient connection between Downtown Columbia and the Patuxent Branch Trail, as well as other destinations in south-central Columbia.

## Summary of Findings

A total of 19 alternative routes connecting Downtown Columbia to the Patuxent Branch Trail (see the Segment Alternatives Map located on Page 4). The routes were divided into five categories:

- A Routes (primarily on-road segments through Allview Estates)
- B Routes (segments along Broken Land Parkway)
- C Routes (segments along the existing sewer line corridor)
- D Routes (segments along existing pathways to the east of Broken Land Parkway)
- X Routes (various segments throughout the study area that were eliminated from further consideration due to physical, connectivity and environmental constraints)

The study makes the following findings related to alignments, phasing and additional actions. A description of each segment and a summary of the findings is presented in Table 1.1 on Page 3.

A more detailed discussion of the opportunities and constraints of each route are provided later in this report and in the Segment Alternatives Matrix in Section 3 on Pages 16-19.

### Route Segment Summary

A detailed summary of each route series is provided in the descriptions below.

#### A Routes (A1, A2): Route Alignment on Local Streets West of Little Patuxent River

The A1 and A2 routes would connect Broken Land Parkway to the Patuxent Branch Trail via a series of on-road bikeways through Allview Estates and connecting to adjacent areas. This route would require a connection to downtown either via the B1 or C1 route.

The A1 route was determined to be less desirable because:

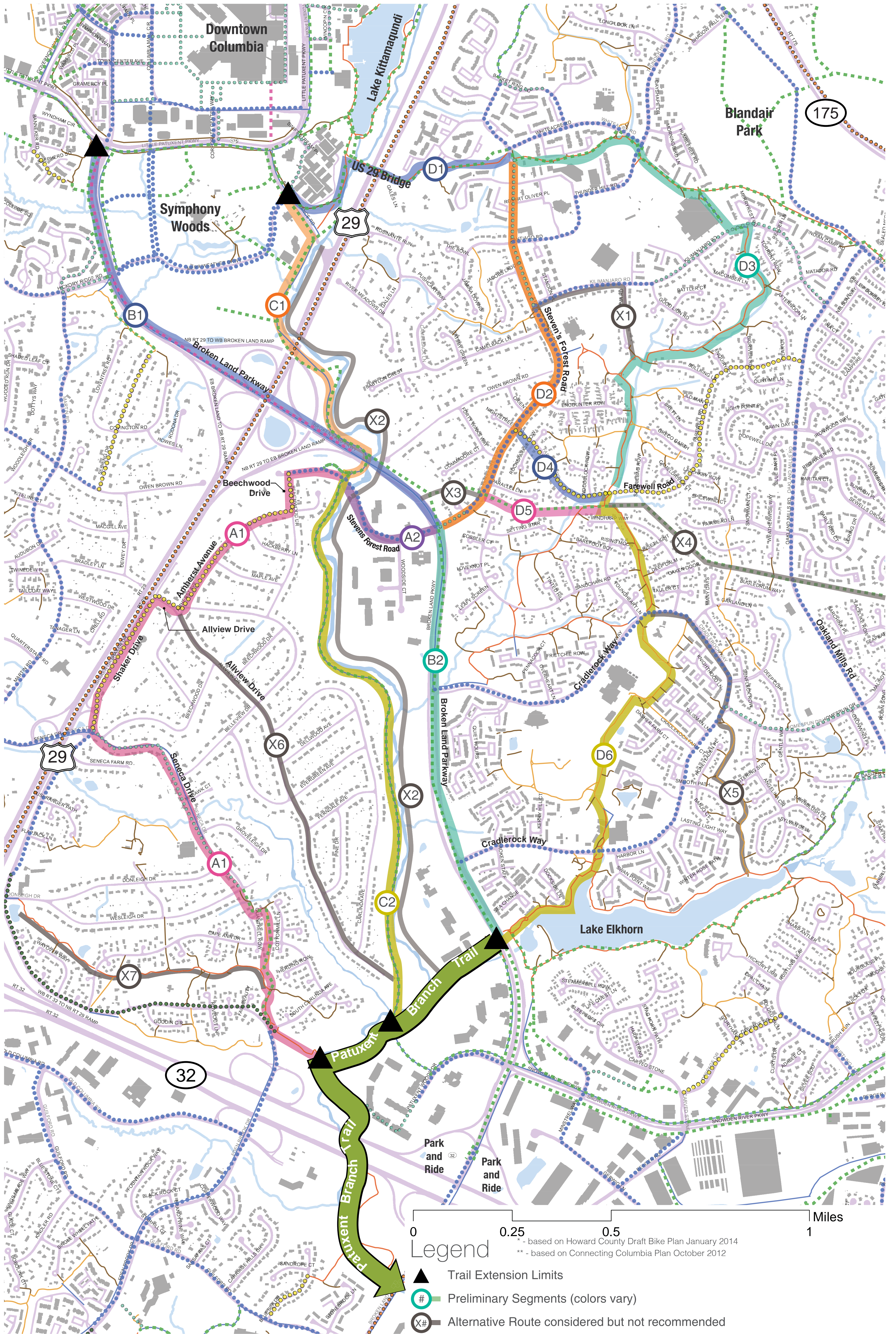
- It is .7 miles longer than the C2 route with steeper grades, making it longer and more difficult for casual cyclists. Therefore it does not meet the objectives of providing a comfortable and convenient connection between Downtown Columbia and the Patuxent Branch Trail.
- There are no existing sidewalks along the whole length of the A1 route. Therefore this route would not be able to safely serve pedestrians.
- The number of street crossings will increase the interactions and conflicts between motor vehicles, pedestrians and bicyclists. Therefore this route will be reducing the safety of the connection and the comfort of users.



Table 1.1 Summary of Feasible Alternatives

Segment Alternative	Description	Feasibility	Miles	Preliminary Cost	Finding
Phase 1	<i>The study recommends A2 and C1 as a phase 1 route</i>				
A2	<i>On-road bikeway connection along Stevens Forest Road from Broken Land Parkway to the intersection with the existing sewer line corridor</i>	<i>Recommended Alternative; provides a key connection to the bike lanes on Stevens Forest Road, regardless of whether B2 or the C2 Routes are chosen.</i>	0.40	\$40,000	<i>Recommended Alternative</i>
C1	<i>Shared-use pathway along the existing sewer line corridor between Downtown Columbia and Stevens Forest Road; west of the Little Patuxent River</i>	<i>Recommended Alternative; most desirable route due to its direct routing, relatively flat topography, minimal intersection crossings</i>	0.87	\$749,000	<i>Recommended Alternative</i>
Phase 2	<i>B2 or C2 could be considered as part of a phase 2 route with an alignment based on the outcomes of future studies and stakeholder discussions.</i>				
B2	<i>Shared-use pathway along Broken Land Parkway from Stevens Forest Road to the Patuxent Branch Trail</i>	<i>Feasible Option – Further Study Required; provides a direct route, however could require significant reconfiguration of Broken Land Parkway. Traffic analysis needed.</i>	1.10	\$1,782,000	<i>Feasible Option-Further Study Required</i>
C2	<i>Shared-use pathway along the sewer line corridor from Stevens Forest Road to the Patuxent Branch Trail; west of the Little Patuxent River</i>	<i>Feasible Option – Further Community Outreach Required; provides direct route, relatively flat topography, minimal crossings provide a direct, car-free route, however more discussion with stakeholders in the community is needed.</i>	1.53	\$1,621,000	<i>Feasible Option-Further Community Outreach Required</i>
A1	On-road bikeway along Seneca Drive, Shaker Drive, Allview Drive, Amherst Avenue, Beechwood Drive, and Stevens Forest Road within Allview Estates	Feasible; less desirable due to a lack of sidewalks, indirect routing, and multiple intersection crossings	2.22	\$364,000	Feasible; less desirable
B1	Shared-use pathway along Broken Land Parkway from Little Patuxent Pkwy to Stevens Forest Road	Feasible; less desirable due to multiple intersection crossings and the presence of high speed motor vehicles, decreasing user comfort	1.42	\$1,481,000	Feasible; less desirable
D Series Routes	Utilization of existing pathways and the future Downtown Columbia pathway from South Entrance Rd to Stevens Forest Road; utilizing the bicycle and pedestrian bridge over US 29 and a combination of pathway routes in the Oakland Mills and Owen Brown neighborhoods.	Feasible; less desirable due to indirect routing and multiple intersection crossings	3.94	\$1,992,00	Feasible; less desirable
X Series Routes	Refer to descriptions of each route in Section 3 and the Segment Alternatives Map on page 4.				





# Patuxent Branch Trail Extension Study Segment Alternatives

October 2014

0 0.25 0.5 1 Miles

Legend

- ▲ Trail Extension Limits
- Preliminary Segments (colors vary)
- ⊗ Alternative Route considered but not recommended

<p><b>On Road Recommendations*</b></p> <ul style="list-style-type: none"> <li>●●●● Neighborhood Green Ways</li> <li>●●●● Bike Lane</li> <li>— Colored Bike Lane</li> <li>●●●● Paved and Striped Shoulder</li> <li>●●●● Shared Roadway</li> <li>●●●● Sharrow</li> </ul>	<p><b>Off Road Recommendations*</b></p> <ul style="list-style-type: none"> <li>●●●● Cycletrack 2 way</li> <li>●●●● Shared-Use Path</li> </ul> <p><b>Existing HC and CA Trails**</b></p> <ul style="list-style-type: none"> <li>— Primary</li> <li>— Secondary</li> <li>— Tertiary</li> </ul> <p><b>Recommended Pathways**</b></p> <ul style="list-style-type: none"> <li>— Primary/Secondary</li> </ul>
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\* based on Howard County Draft Bike Plan January 2014  
 \*\* based on Connecting Columbia Plan October 2012





The A2 route will be recommended, regardless of whether the B2 route or the C2 route is chosen, because it provides a key connection to Broken Land Parkway and the bike lanes on Stevens Forest Road.

### B Routes (B1, B2): Route Alignment along Broken Land Parkway

The B1 and B2 routes would connect Downtown Columbia to the Patuxent Branch Trail via a center median path on the B1 section and a shared-use path on the B2 section along Broken Land Parkway. The B1 route is less desirable than the C1 Route because users would be negatively impacted by high speeds and high volumes of traffic along Broken Land Parkway. The negative impacts also include several wide road crossings which would result in conflicts between motor vehicles, pedestrians and bicyclists.

The feasibility of the B2 route is dependent on being able to either remove a lane of traffic from Broken Land Parkway or purchase additional right-of-way in order to gain the necessary land for a shared-use pathway. More study would be necessary to determine if this option is feasible.

### C Routes (C1, C2): Route Alignment along Sewer Line Corridor

The C1 and C2 routes would connect Downtown Columbia to the Patuxent Branch Trail via an off-road pathway located within the existing sewer line corridor. The C1 route is a recommended alternative because it would provide a safer and more direct connection than the B1 route.

The C1 section is recommended for the following reasons:

- This route provides a comfortable and convenient connection between Downtown Columbia and the Patuxent Branch Trail.
- This route is relatively flat and has only one roadway crossing, making bicycling and walking easier, safer and more comfortable.
- The route would provide several hundred homes in Allview Estates, which are currently isolated by three major roadways (Broken Land Parkway, RT 29 and RT 32), with a direct and off-road path connection to Downtown Columbia. This connection would provide access to the new Whole Foods Market, the mall, the library and other cultural attractions. This route would include under-crossings of RT 29 and RT 32, allowing users to safely bypass these roads. Both of these under-crossings would meet the minimum clearance requirements for a shared-use path, as defined by the AASHTO Guide for the Development of Bicycle Facilities.
- The route is feasible from an environmental standpoint. It should be designed to ensure a no-rise condition for the Little Patuxent River, meaning that the construction of the trail will not increase flood heights. Similar to the downstream portion of the river, this section overflows its banks during significant rainfall events. Existing sections of the Patuxent Branch Trail to the south are located within the floodway, and have been subjected to the river have not experienced significant maintenance impacts from flooding. As with all pathways and trails, maintenance will be necessary for the upkeep, which would include debris removal, mowing edge areas, trail sweeping, etc.

- The route is located in a corridor that has already experienced significant grading and leveling work, undertaken as part of the construction of the sewer line.
- The construction cost for this route is less than the next most feasible alternative, which is the B1 route.

The C2 route is a feasible option based on the technical analysis undertaken as part of this study. As with the B2 route, it could also provide a direct connection to the Patuxent Branch Trail and has the added benefit of being located in a corridor separated from motor vehicle traffic. This route would be within view of approximately 10 homes in Allview Estates (see discussion on page 7) and some Allview residents and community members have expressed concerns about this route. To further discuss, understand and address these concerns, it is recommended that additional engagement occur with homeowners, potential pathway users, landowners, and other stakeholders prior to pursuing this route.

#### D Routes (D1, D2, D3, D4, D5, D6): Route Alignments on Existing Pathways - East of Broken Land Parkway

The D series of routes would connect Downtown Columbia to the Patuxent Branch Trail via the Downtown-Oakland Mills Pedestrian Bridge and connect to the existing network of pathways that extend through the neighborhoods on the eastern side of Broken Land Parkway.

The D series were determined not to be desirable for the following reasons:

- The D routes are circuitous, and when combined to form a connection to the existing Patuxent Branch Trail, they represent a significantly longer distance than either the B or C routes which are both more direct (4 miles via the D routes, versus 2.5 miles for the B or C routes).
- The routes are characterized by significant grades, making the route more difficult and slower for casual cyclists. It therefore does not meet the objectives of providing a comfortable and convenient connection between Downtown Columbia and the Patuxent Branch Trail.
- All the D section routes would entail numerous road and intersection crossings, including unmarked and unsigned mid-block crossings. This will result in more conflicts between motor vehicles, pedestrians and bicyclists, therefore reducing safety and comfort of users.

#### X Routes

A number of additional routes and connections were evaluated, including the BGE right-of-way that runs from RT 29 just north of Broken Land Parkway to just south of Oakland Mills Road. Portions of the BGE right-of-way was determined not to be feasible due to the significant steep topography of the segments and because the segments would lead users away from the Patuxent Branch Trail. One segment of the BGE right-of-way, shown as Segment D5, was considered feasible from a topographical perspective, but did not meet the objective of being part of a direct connection to the Patuxent Branch Trail. The segment along the east side of the Little Patuxent River faces significant topographical constraints and would also require extensive woodland clearing. A discussion of these routes are included in this report on page 21.

## Community Impact Analysis

### Access

A Pathway User Preference Survey conducted as a part of CA's *Active Transportation Action Agenda* supports the need for convenient, direct bicycling and walking connections. The construction of the proposed C1/A2 pathway route along the sewer line corridor and then connecting over to Broken Land Parkway along Stevens Forest Road would have beneficial impacts for both current and future bicyclists and pedestrians. The significant impact would be a direct connection from and to Downtown Columbia that is protected from car traffic. This is a connection that has been repeatedly requested by stakeholders participating in the *Active Transportation Action Agenda* as well as Howard County's Bicycle Master Plan. Currently, people walk along the median of Broken Land Parkway to access Downtown because there are no sidewalks through the RT 29 interchange.

The C1/A2 route would provide several hundred homes currently isolated by major roadways (Broken Land Parkway, RT 29 and RT 32) with a direct, off-road connection to the new Whole Foods Market and Town Center. In addition to ultimately linking to the Patuxent Branch Trail, this route could also provide a connection to other destinations in south-central Columbia, potentially including the Park-and-Ride lot at the intersection of Broken Land Parkway and RT 32. However, additional pathway segments would be needed to complete this connection.

### Privacy

One concern that is typical for proposed shared-use paths is the potential loss of privacy in areas where shared-use paths are located in close proximity to adjacent homes. Historically, this has been less of a concern in Columbia, where much of the 94-mile pathway system is located directly adjacent to single-family homes, townhouses, apartments, and businesses. However, this concern has been raised by some residents of Allview Estates about the C2 route alignment. The route extends along property owned by CA, which granted Howard County an easement along this property for the construction and maintenance of public improvements, which included the sanitary sewer project. This route is within view of the backyards of approximately 10 homes in Allview Estates. The distance between the proposed pathway location and other adjacent homes ranges from approximately 50 to 365 feet. In most cases, the steep change in topography between the Allview Estates community and the Little Patuxent River/sewer line corridor places homes at a significantly higher elevation; thus creating a visual and physical barrier between the homeowners and the view of the sewer line corridor and the potential pathway.

In a few cases, some landowners appear to have encroached onto CA property along the C2 route, including erecting structures and "extending" a lawn onto CA property. It appears that one landowner has built a private basketball court on CA property.

The BGE right-of-way alignment also runs adjacent to residential areas and back yards; therefore it is possible that the same concerns would exist for that route.

### Automobile Traffic Impacts

The only proposed route segment that would have the potential to significantly impact automobile traffic is the B2 route along Broken Land Parkway. Analysis of the existing roadright-of-way determined there is insufficient right-of-way adjacent to the existing roadway to fully accommodate a 10-foot wide path with a 5-foot wide buffer between the path and the roadway. These are the minimum dimensions required for a two-directional shared-use path as detailed in the AASHTO Guide for the Development of Bicycle Facilities. The B2 segment follows the alignment of Broken Land Parkway, a road characterized by six car travel lanes with an ADT of approximately 20,000 to 30,000 vehicles per day. The volume of traffic could be accommodated on a four lane road, particularly given the distance between intersections on this portion of Broken Land Parkway. Furthermore, safety improvements are needed along this corridor. While 85<sup>th</sup> percentile speeds are currently unknown, anecdotal information suggests that speeding is an issue on this road. The current sidewalks on the east side of the road are narrow and generally non-compliant with current width requirements and are directly adjacent to the road. Plans are under consideration to also provide better transit service and identify a high quality transit option from Downtown Columbia, park and ride lots, employment centers and Anne Arundel County using the Broken Land Parkway corridor. This further reinforces the need to provide better pedestrian and bicycle access, as riders will need alternatives to access transit stops along the length of this route.

There are a series of solutions that can be explored to repurpose roadway space to provide more comfortable and safe accommodations for pedestrians and bicyclists. Given the width of the median, as well as the extra capacity on Broken Land Parkway, it could be possible to accommodate a shared-use path, as well as and transit vehicles, in this corridor. Potential solutions could be; implementing strategies to more effectively align the capacity of the roadway to automobile traffic volumes; or securing additional ROW. These would require high levels of public engagement, traffic analysis and engagement with landowners.

The remainder of this report provides more details regarding the analysis that resulted in the recommendations discussed in this summary.



## Section 2: Existing Conditions

The study area for the Patuxent Branch Trail Extension Feasibility Study encompasses the area between the northern limit of the existing Patuxent Branch Trail near Lake Elkhorn and Downtown Columbia. See Figure 2.1 for a map of the study area and the desired connection.

### Patuxent Branch Trail

The 4.6-mile Patuxent Branch Trail serves as a recreation and commuter trail in Howard County, Maryland. Following the north/south direction of the Patuxent River, the trail runs from Savage Park to Columbia's Lake Elkhorn at Broken Land Parkway. Currently, the trail serves as a hiker/biker trail with paved and unpaved segments.

### Downtown Columbia Revitalization

In 2010, Howard County approved a 30-year master plan for Downtown Columbia. Thirteen million square feet of retail, commercial, residential, hotel and cultural development is planned during the downtown development project. The plan includes a number of features and programs designed to enhance the sustainability of Downtown by improving public transportation, enhancing pedestrian and cycling connections within and into downtown, and improved stormwater and watershed management.

A key part of the Downtown Columbia Revitalization plan is the Downtown Columbia Multi-Use Path. The 10-foot wide shared-use path will run 3.25 miles from Howard General Hospital to Blandair Park, crossing the southern boundary of Downtown Columbia. The first phase of the pathway is under construction and future phases may potentially connect with the Patuxent Branch Trail Extension.

### Broken Land Parkway

Broken Land Parkway is considered a major roadway connection for motorists traveling in the north/south direction between Downtown Columbia and RT 32. The Parkway is comprised of 3 travel lanes along the north and southbound directions between Snowden River Parkway and Stevens Forest Road. Between Stevens Forest Road and Little Patuxent Parkway, travel lanes range from 2 to 3 lanes with additional turn lanes at major intersections at Stevens Forest Road, Hickory Ridge Road, and Little Patuxent Parkway. A center median, ranging from 6 to 60 feet in width, divides the north and southbound travel lanes from Snowden River Parkway to Little Patuxent Parkway. The posted speed on Broken Land Parkway is currently 45 miles per hour; however after discussions with the County's Department of Public Works, motorists are known to speed due to the width of the road and distance between stop lights.

Based on the most recent Howard County traffic counts on Broken Land Parkway, the average daily traffic per day (ADT) throughout the following locations is:

- 35,968 at East of Columbia Pike (US 29)
- 29,717 at North of Cradlerock Way South
- 33,062 at South of Little Patuxent Parkway
- 20,488 at North of Patuxent Freeway (MD 32)

Plans are under consideration to also provide better transit service and identify a high quality transit option from Downtown Columbia, park and ride lots, employment centers and Anne Arundel County using the Broken Land Parkway corridor. This further reinforces the need to provide better pedestrian and bicycle access, as riders will need alternatives to access transit stops along the length of this route.

### Broken Land Parkway Park and Ride

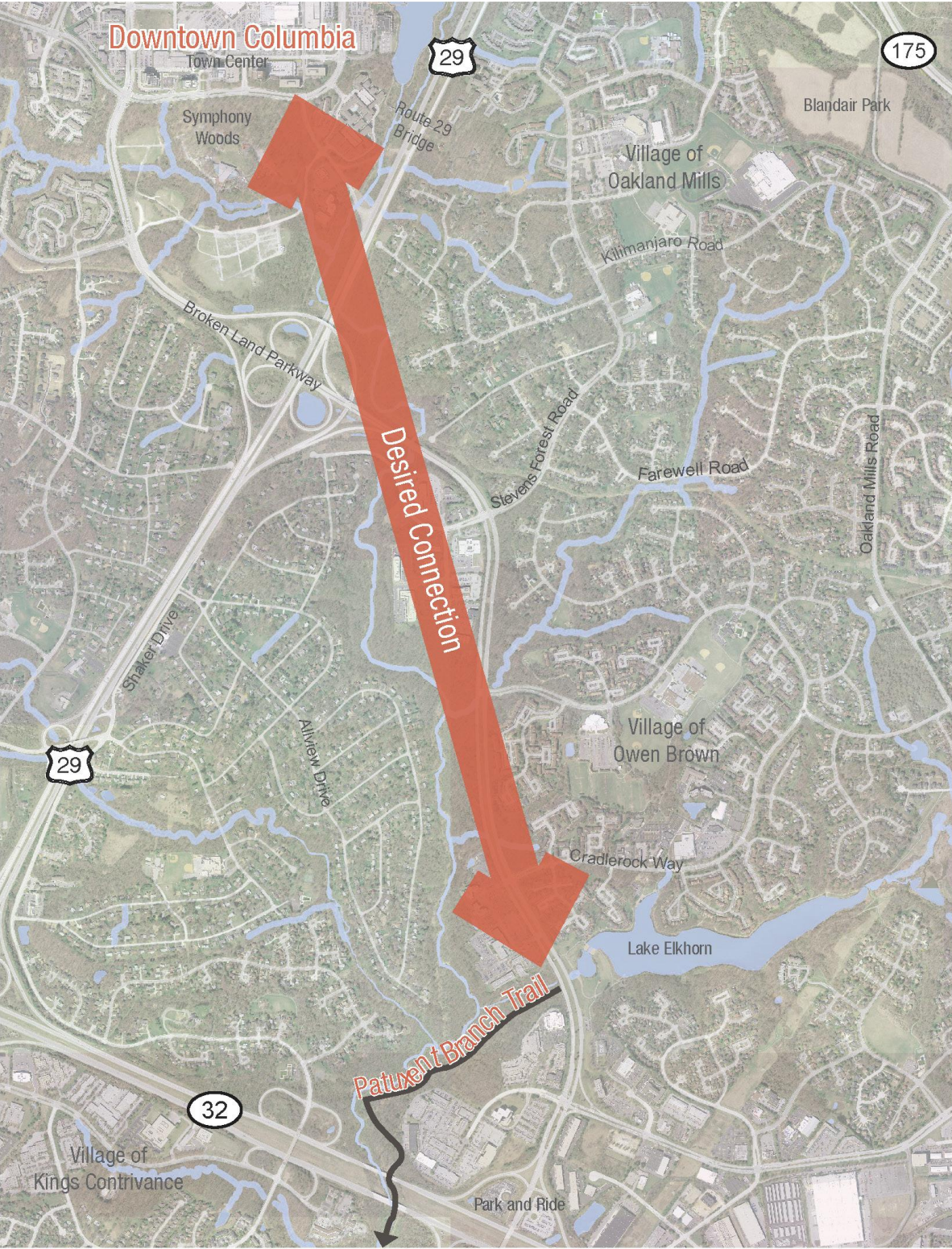
Connections to the Broken Land Parkway park and ride locations were taken into consideration during the evaluation of the potential pathway alternatives. The Broken Land Parkway park and ride lot operates as a major transportation hub with commuter bus routes serving both Baltimore and Washington DC. These commuters primarily use cars to access the lots, but a number of cyclists also use the lot.

### Pathway Safety and Crime

While a crime data report was unable to be obtained during the timeline of this study, based on the conclusions from discussions with the Howard County Department of Police (HCDP), there has been very few crime events reported on the Patuxent Branch Trail, as well as the Columbia Association's pathway network, within the last several years. The HCDP, in general, characterizes the current pathway system as "very safe".



Figure 2.1 Study Area





## Resource Analysis

The following resource analysis was developed based on a desk review of the relevant base mapping documentation.

### Environmental/Physical Resource Analysis

The following describes the range of physical and environmental features that make up the study area.

*Surface Waters* – The study area is located within the Patuxent River watershed. The Little Patuxent River runs in a north/south direction, and encompasses several branches and tributaries. Lake Elkhorn is a large stormwater management lake in Columbia (37 acres) and is located in the Village of Owen Brown; to the east of Broken Land Parkway.

*Wetlands* – The study area consists of Federal (NWI) and State (DNR) wetlands. Primarily, these wetlands are focused in areas within and surrounding the Little Patuxent River floodplain and its tributaries. The majority of wetlands within this study area are classified as Palustrine forested (PFO), which is defined as a forested swamp or wetland. Areas surrounding ponds or lakes (e.g. Lake Elkhorn) are classified as Palustrine Unconsolidated Bottom (PUB) wetlands or as Lacustrine (L) wetlands, which are described as a deep water reservoir basin. Similarly to southern sections of the Patuxent Branch Trail, boardwalks would be needed over wetland areas.

*Topography* – The study area, along with most areas of Columbia, largely consists of rolling topography. The steepest grades primarily lie within the stream valleys and lake perimeters, which include Lake Elkhorn and the Little Patuxent River and its tributaries; however, steep grades are also present along some county roads (i.e. Shaker Drive and Seneca Drive) and existing pathways.

*Floodplain* – The majority of the floodplains within the study area primarily lie within the buffers of the Little Patuxent River and its tributaries. The majority floodplains are located along the Little Patuxent River and are classified as 100-year floodplains (Zone AE-High Risk Flood Areas). One-hundred year floodplains are defined as areas with a 1-percent annual probability of flooding and where predicted flood water elevations, above mean sea level, have been established. Floodplains surrounding the Little Patuxent River's tributaries are classified as 500-year floodplains (Zone X-Moderate Flood Hazard Area) and are defined as areas with a 0.2-percent annual probability of flooding.

*Little Patuxent River Flood Monitoring Data* – Based on flood monitoring information received from the county's Stormwater Management Division, the stream met the "overbank" level (where the water level of a river or stream rises above bank level) an average of 9.5 times a year for the past five years. Most of these storm events are minor, however 2-3 times per year, the water continued to rise into the adjacent floodplain. Flows into the overbank area tend to be shallow and of low velocity. This flooding also occurs further south where the existing Patuxent Branch Trail extends adjacent to the Little Patuxent River. During significant overbank flood events, it is Howard County's practice to close the

Patuxent Branch Trail. Past flood events have caused minor damage to the existing Patuxent Branch Trail, such as sedimentation and slight damage to boardwalks requiring replacement of a few boards.

*Woodland Area* – The majority of the woodland areas commonly lie within the Little Patuxent River stream valleys and its tributaries.

The following environmental features were part of the study's evaluation, however were found to be not applicable to the study area: General Sensitive Species Habitat.

Refer to maps in Appendix A for a physical representation of the existing environmental and physical resources.

### Cultural Resources, Utilities, and Transportation Analysis

*Historic Landmarks* – Based on a review of Howard County's historic GIS data, there are several historic landmarks in the study area, however a preliminary desktop analysis found that no historic landmarks would be disturbed as a result of the potential pathway alignments.

*Utility Easements* – There are two significant utility easements located within the study. A BGE power line easement runs in an east/west direction between Broken Land Parkway and the Sewells Orchard Community; just east of Oakland Mills Road. Additionally, a parallel sewer easement runs in a north/south direction, paralleling the Little Patuxent River, between Patuxent Hwy (RT 32) and Lake Kittamaquundi, and beyond.

*Property Ownership* – Within the study area, land ownership is distributed between private properties, Columbia Association property, County and County Board of Education property, State-owned property, and utility easements.

#### *Bicycle and pedestrian facilities* –

*Off Road Facilities:* Within the study area, off-road facilities include the Columbia Association pathway system, county pathways, and the Patuxent Branch Trail. These pathways make up an extensive network, however, there is a gap in the network's connection from the Patuxent Branch to Downtown Columbia. Additionally, the current conditions of the pathway network vary within the study area. Many pathways consist of steep grades, are fairly narrow, and do not meet the current AASHTO pathway guidelines. Columbia Association's Active Transportation Action Agenda, known as "Connecting Columbia", plans for significant pathway improvements for the pathway network within this study area, as well as the rest of Columbia. Some roads in the study area have sidewalks, others (including many in Allview Estates) do not. Additionally, the county's future 10-foot wide, Downtown Columbia Shared-use Pathway will be located within the study area and will extend from Howard General Hospital to Blandair Park.

**On Road Facilities:** There is currently a bike lane along Stevens Forest Road from south of Kilimanjaro Road to just east of Broken Land Parkway. The County is currently developing the Howard County Bicycle Master Plan which is anticipated to be completed in 2014. An extensive amount of bicycle facilities are recommended with this study area.

Refer to maps in Appendix A for additional detail on the physical resources in the study area.



## Section 3: Alternatives Analysis

Opportunities and constraints within each segment alternative were identified based on the findings of the existing conditions through desktop and field reviews. The alternatives analysis was developed using the following criteria and data;

- assessment of potential land-use
- environmental impacts
- connectivity
- user comfort
- easement acquisitions
- access to surrounding communities
- directness of the desired north/south travel

Based on the preliminary analysis segments (A1,A2,B1,B2,C1,C2,D1,D2,D3,D4,D5,D6) were identified as potentially feasible and were analyzed further to determine the preferred alternatives and additional actions. This study ultimately considered over 13 miles of potential pathways or bicycle facilities. See the Segment Alternatives Matrix (presented on the pages that follow) for the overall analysis of each segment. See page 4 for a map of the proposed routes.





SEGMENT ALTERNATIVES	DESCRIPTION	ENVIRONMENTAL ISSUES	OPPORTUNITIES	CONSTRAINTS	LENGTH (mi)	PRELIMINARY COST
<b>A1</b>	<p><b>On– Road Bikeway along Streets in Allview Estates</b> This potential on–road bike route from the sewer line connection at Stevens Forest Road to the Patuxent Branch Trail, following Beechwood Drive, Amherst Avenue, Allview Drive, Shaker Drive, Seneca Drive, and existing CA pathways.</p>	No potential impacts are expected.	<ul style="list-style-type: none"> <li>Route is supported by Draft Howard County Bike Plan</li> <li>Utilizes existing CA pathways, connecting direct to the Patuxent Branch Trail</li> <li>Utilizes low volume streets</li> <li>On–road facilities allow for quick implementation</li> <li>Utilizes existing County right–of–way</li> </ul>	<ul style="list-style-type: none"> <li>Route is indirect (2.2 miles compared to C2/B2, both of which are 1.5/1.1 miles) and involves steep topography, reducing it’s practical viability as a bicycle route</li> <li>Bicyclists will be required to share the road with mo–torists, which is less comfortable for casual cyclists</li> <li>Route would require multiple directional signs and pavement markings to ensure pathway users do not get lost in the Allview neighborhood</li> <li>Route is different in character to existing Patuxent Branch Trail</li> <li>Multiple unsignalized pathway/roadway intersections</li> <li>Lack of sidewalks along this route decreases pedestrian safety</li> </ul>	Proposed pathway = 0.00 Existing pathway = 0.60 On–road facility = 1.62 <b>Total Length = 2.22</b>	<p>Approximately <b>\$364,000*</b> (\$31/lf)</p> <p>*Estimate includes design and construction</p>
<b>A2</b>	<p><b>Spur Connection along Stevens Forest Road from Broken Land Parkway to the Intersection with Sewer Line</b> This potential on–road facility corridor follows Stevens Forest Road from the Sewer Line intersection to Broken Land Parkway – a spur trail that would be necessary if Routes B1 and C1 were selected.</p>	No potential impacts are expected.	<ul style="list-style-type: none"> <li>Route is supported by Draft Howard County Bike Plan</li> <li>Utilizes existing County right–of–way</li> <li>Utilizes low volume streets</li> <li>On–road facilities allow for quick implementation</li> <li>Allows for access to surrounding properties</li> <li>Connects to existing bike lane; east of Broken Land Parkway on Stevens Forest Road</li> </ul>	<ul style="list-style-type: none"> <li>Route is indirect</li> <li>Limited right–of–way for pathway along the side of the road – on–road bike lane may be feasible</li> <li>Route is different in character to existing Patuxent Branch Trail</li> </ul>	Proposed pathway = 0.00 Existing pathway = 0.00 On–road facility = 0.40 <b>Total Length = 0.40</b>	<p>Approximately <b>\$40,000*</b> (\$19/lf)</p> <p>*Estimate includes design and construction</p>
<b>B1</b>	<p><b>Shared–Use Pathway along Broken Land Parkway from Little Patuxent Parkway to Stevens Forest Road</b> This potential shared–use pathway follows Broken Land Parkway from the intersection of the future Downtown Columbia Trail at Little Patuxent Parkway to the intersection at Stevens Forest Road, crossing at grade at intersections with Hickory Ridge Road and Columbia Pike (US 29).</p>	Will also require environmental permitting. However, because this pathway would be located along an existing roadway, environmental impact will be minimal.	<ul style="list-style-type: none"> <li>Routes are supported by Connecting Columbia and DRAFT Howard County Bike Plan</li> <li>Direct N/S route from downtown Columbia, comparable to C2 (1.5 miles compared to A1 which is 2.2 miles)</li> <li>Utilizes existing County right–of–way</li> <li>Allows for access to other roads and routes such as Hickory Ridge Road</li> <li>Pathway in this location would solve long–standing travel issues (pedestrians and bicyclists already attempt to cross here) and provide another east–west connection across US 29 for non–motorized users</li> </ul>	<ul style="list-style-type: none"> <li>Route does not directly connect to the heart of Downtown Columbia, rather to the western edge</li> <li>Only feasible location for pathway through the interchange is the center median without reconstructing Broken Land Parkway Bridge over US 29</li> <li>User experience would be negatively impacted by high speeds, and high volumes of traffic</li> <li>Center median design would require at least two at–grade crossings of Broken Land Parkway.</li> <li>Would require significant alterations to intersections at Hickory Ridge Road and Stevens Forest Road to ensure user safety</li> </ul>	Proposed pathway = 1.42 Existing pathway = 0.00 On–road facility = 0.00 <b>Total Length = 1.42</b>	<p>Approximately <b>\$1,481,000*</b> (\$198/lf)</p> <p>*Estimate includes design and construction</p>
<b>B2</b>	<p><b>Shared–Use Pathway along Broken Land Parkway from Stevens Forest Road to the Patuxent Branch Trail</b> This potential shared–use pathway follows Broken Land Parkway from Stevens Forest Road to the northern most end of the Patuxent Branch Trail, crossing at grade with two Cradlerock Way intersections and the Lakeview Offices driveways.</p>	Will also require environmental permitting. However, because this pathway would be located along an existing roadway, environmental impact will be minimal.	<ul style="list-style-type: none"> <li>Routes are supported by Connecting Columbia and DRAFT Howard County Bike Plan</li> <li>Direct N/S route from downtown Columbia, comparable to C1 (0.9 miles compared to D1+D2 which is 1.9 miles)</li> <li>Uses existing County right–of–way</li> <li>A portion of path has already been built on each side of Broken Land connecting to Lake Elkhorn</li> <li>Allows potential for access to other roads and properties such as Cradlerock Way and office complexes along the west side of Broken Land</li> <li>Creates potential to connect to the Park and Ride by extending the pathway to the south</li> </ul>	<ul style="list-style-type: none"> <li>Feasibility would require cross section of Broken Land Parkway from 6 to 4 lanes</li> <li>Traffic study would need to be completed</li> <li>Multiple conflict locations where path would cross side streets and driveways</li> <li>User experience would be negatively impacted by high speeds and high volumes of traffic</li> </ul>	Proposed pathway = 1.10 Existing pathway = 0.00 On–road facility = 0.00 <b>Total Length = 1.10</b>	<p>Approximately <b>\$1,782,000*</b> (\$313/lf)</p> <p>*Estimate includes design and construction</p>



SEGMENT ALTERNATIVES	DESCRIPTION	ENVIRONMENTAL ISSUES	OPPORTUNITIES	CONSTRAINTS	LENGTH (mi)	PRELIMINARY COST
C1	<p><b>Shared–Use Pathway along the Sewer Line between Downtown Columbia and Stevens Forest Road</b>  This potential shared–use pathway follows the existing sewer line from the intersection of the future Downtown Columbia Trail at Swift Stream Road to Stevens Forest Road. The segment is runs parallel to the existing sewer line on the west side of Little Patuxent River, crossing at grade with Stevens Forest Road and underneath Columbia Pike (US 29) and Broken Land Parkway.</p>	<p>Located within the 100–year floodplain, will require environmental permitting, however because corridor has already been disturbed by sewer line construction, environmental impact would be minimal. Trail would be designed to create no rise condition for the Little Patuxent River.</p> <p>Located within 0.3 miles of potential low lying areas and may require boardwalks over wetland zones.</p> <p>A portion of the pathway could have a beneficial impact on environmental conditions by restoring a former roadbed and a blocked and failing culvert.</p>	<ul style="list-style-type: none"> <li>• Route is supported by Connecting Columbia and the DRAFT Howard County Bike Plan.</li> <li>• Most direct N/S route from downtown Columbia (0.9 miles to C2/B2 connection compared to 1.4 mile via B1)</li> <li>• Eliminates travel along busy roads, increasing safety and comfort of user</li> <li>• Minimal path/roadway intersections</li> <li>• Scenic views of river and adjacent natural areas</li> <li>• Minimal/gradual topography change</li> <li>• Provides an experience similar to the existing Patuxent Branch Trail</li> <li>• Under–crossings of US 29 and Broken Land Parkway are feasible</li> </ul>	<ul style="list-style-type: none"> <li>• May require some property acquisition, easements, or use agreements near Downtown</li> <li>• Several feeder creek crossings will require bridges or culverts</li> <li>• Similar to other sections of the Patuxent Branch Trail, area is within an open space/stream corridor and not within view of streets or residential areas.</li> </ul>	<p>Proposed pathway = 0.87  Existing pathway = 0.00  On–road facility = 0.00  <b>Total Length = 0.87</b></p>	<p>Approximately <b>\$749,000*</b>  (\$163/lf)</p> <p><small>*Estimate includes design and construction</small></p>
C2	<p><b>Shared–Use Pathway from Stevens Forest Road to the Patuxent Branch Trail</b>  This potential shared–use pathway follows the existing sewer line from Stevens Forest Road to the Patuxent Branch Trail. The segment runs along the west side of the Little Patuxent River and crosses underneath the Stevens Forest Road underpass.</p>	<p>Located within the 100–year floodplain, will require environmental permitting, however because corridor has already been disturbed by sewer line construction, environmental impact would be minimal. Trail would be designed to create no rise condition for the Little Patuxent River.</p> <p>Located within 0.2 miles of potential low lying areas and may require boardwalks over wetland zones.</p> <p>A portion of the pathway could have a beneficial impact on environmental conditions by restoring a former roadbed and a blocked and failing culvert.</p>	<ul style="list-style-type: none"> <li>• Route is supported by Connecting Columbia and the DRAFT Howard County Bike Plan.</li> <li>• Direct N/S route from downtown Columbia, comparable to B2 (1.0 miles compared to A1 which is 1.4 miles)</li> <li>• Eliminates travel along busy roads, increasing safety and comfort of user</li> <li>• Minimal path/roadway intersections</li> <li>• Scenic views of river and adjacent natural areas</li> <li>• Provides an experience similar to the existing Patuxent Branch Trail</li> <li>• Located primarily on CA property within an existing county–controlled easement</li> <li>• Generally, there is minimal/gradual topography change</li> </ul>	<ul style="list-style-type: none"> <li>• Limited access points to surrounding areas (i.e., businesses along Broken Land Parkway)</li> <li>• One hill near Stevens Forest Road underpass would need design mitigation</li> <li>• Proximity to back yards of approximately 10 homes in Allview Estates may create privacy concerns, design may need to mitigate visual access between homes and pathway</li> <li>• Requires bridge connection over Patuxent to connect with existing Patuxent Branch Trail</li> </ul>	<p>Proposed pathway = 1.53  Existing pathway = 0.00  On–road facility = 0.00  <b>Total Length = 1.53</b></p>	<p>Approximately <b>\$1,621,000*</b>  (\$200/lf)</p> <p><small>*Estimate includes design and construction</small></p>





SEGMENT ALTERNATIVES	DESCRIPTION	ENVIRONMENTAL ISSUES	OPPORTUNITIES	CONSTRAINTS	LENGTH (mi)	PRELIMINARY COST
 Series	<b>Overall Analysis of Routing Options using Existing/New Paths on the East Side of US 29/Broken Land Parkway</b> The D Series of Routes use a combination of existing CA pathways and potentially new pathways on the east side of US 29 and Broken Land Parkway. Individual segments are described in more detail below. This provides an overall analysis of their viability to meet overall project objectives of a direct transportation route for bicyclists and pedestrians from Downtown Columbia to the Patuxent Branch Trail.	Minimal environmental impacts are expected; however, environmental permitting may be required in locations where there is limited space to widen the existing trails along the stream buffer.	<ul style="list-style-type: none"> <li>• Routes are supported by Connecting Columbia and DRAFT Howard County Bike Plan</li> <li>• Utilizes existing County and CA right-of-way</li> <li>• Allows for access to surrounding properties such as Lake Elkhorn, Owen Brown Community Center, and Blandair Park</li> </ul>	<ul style="list-style-type: none"> <li>• Route is the least direct of all the alternatives and is impractical as a transportation route (approximately 4.0 miles compared to B1/B2 which is 2.5 miles, and C1/C2 which is 2.4 miles)</li> <li>• Route includes steep topography, reducing its viability as a bicycle route</li> <li>• Route would require multiple directional signs and pavement markings to ensure pathway users do not get lost</li> <li>• Route includes multiple unsignalized roadway crossings and mid-block crossings.</li> </ul>	<b>Total Length (D1+D3+D6)= 3.94</b>	<p>Approximately <b>\$1,992,000*</b></p> <p><small>*Estimate includes design and construction; total is an approximate sum of D1+D3+D6</small></p>
	<b>Utilization of Existing Pathways and future Downtown Columbia pathway along the bicycle and pedestrian bridge over US 29</b> This potential on-road facility corridor follows the future 10-foot wide Downtown Columbia Pathway from the intersection at South Entrance Road to the intersection at Stevens Forest Road. This segment utilizes the bicycle and pedestrian bridge over US 29.	No potential impacts expected.	<ul style="list-style-type: none"> <li>• Route is supported by Connecting Columbia; the US 29 bicycle and pedestrian bridge is currently being studied/analyzed for potential improvements (Capital Project B3863)</li> <li>• Allows for access to surrounding trails and amenities</li> <li>• Eliminates travel along busy roads, increasing safety and comfort of user</li> <li>• Utilizes existing HC and CA pathways/right-of-way</li> <li>• Utilizes the future (10 ft. wide) Downtown Columbia Trail</li> </ul>	<ul style="list-style-type: none"> <li>• Route (D1+D2) is indirect (1.9 miles compared to C1/B1 which are 0.9/1.5 miles)</li> <li>• Route includes severe steep topography, reducing its viability as a bicycle route</li> </ul>	Proposed pathway = 0.00 Existing pathway = 0.76 On-road facility = 0.00 <b>Total Length = 0.76*</b>	<p>Approximately <b>\$41,000*</b></p> <p>(\$10/lf)</p> <p><small>*Estimate includes design and construction; total accounts for the minor intersection improvement only; no pathway widening is needed due to the future construction of the (10 ft wide) Downtown Columbia Pathway</small></p>
	<b>On-Road Bikeway along Stevens Forest Road</b> This potential on-road bike route follows Stevens Forest Road from Whiteacre Road to the intersection at Broken Land Parkway.	No potential impacts expected.	<ul style="list-style-type: none"> <li>• Route is supported by the Draft Howard County Bike Plan</li> <li>• Allows for access to surrounding trails and amenities</li> <li>• Utilizes 0.5 miles of existing bike lanes</li> <li>• Utilizes existing County right-of-way</li> <li>• On-road facilities allow for quick implementation</li> </ul>	<ul style="list-style-type: none"> <li>• Route (D1+D2) is indirect (1.9 miles compared to C1/B1, both of which are 0.9/1.5 miles)</li> <li>• Route includes multiple unsignalized roadway crossings; increases travel time</li> <li>• Route is different in character to existing Patuxent Branch Trail</li> </ul>	Proposed pathway = 0.00 Existing pathway = 0.00 On-road facility = 1.14 <b>Total Length = 1.14</b>	<p>Approximately <b>\$27,000*</b></p> <p>(\$8/lf)</p> <p><small>*Estimate includes design and construction; total excludes 0.5 miles of existing bike lanes</small></p>
	<b>Utilization of Existing Pathways within the Village of Oakland Mills</b> This potential pathway widening corridor follows of the future Downtown Columbia Trail (2,900 ft) and existing CA pathways (6,000 ft) from Stevens Forest Road to Farewell Road.	Minimal environmental impacts are expected; however, environmental permitting may be required in locations where there is limited space to widen the existing trails along the stream buffer.	<ul style="list-style-type: none"> <li>• Route is supported by Connecting Columbia</li> <li>• Allows for access to surrounding trails and amenities</li> <li>• Utilizes existing CA and County pathways/right-of-way</li> <li>• Eliminates travel along busy roads, increasing safety and comfort of user</li> </ul>	<ul style="list-style-type: none"> <li>• Route (D1+D3+D5) is indirect (2.73 miles compared to C1/B1, both of which are 0.9/1.5 miles)</li> <li>• Route includes multiple unsignalized roadway crossings; increases travel time</li> <li>• Route includes steep topography, reducing its viability as a bicycle route</li> </ul>	Proposed pathway = 0 Existing pathway = 1.69 On-road facility = 0.00 <b>Total Length = 1.69*</b>	<p>Approximately <b>\$844,000*</b></p> <p>(141/lf)</p> <p><small>*Estimate includes design and construction; total excludes the 0.5 miles that consists of the future (10ft wide) Downtown Columbia Pathway</small></p>





SEGMENT ALTERNATIVES	DESCRIPTION	ENVIRONMENTAL ISSUES	OPPORTUNITIES	CONSTRAINTS	LENGTH (mi)	PRELIMINARY COST
D4	<b>On-Road Bikeway along Farewell Drive</b> This potential on-road bike route follows Farewell Road from the existing pathway midblock intersection to Stevens Forest Road.	No potential impacts expected.	<ul style="list-style-type: none"> <li>Route is supported by the Draft Howard County Bike Plan</li> <li>Allows for access to surrounding trails and amenities</li> <li>Utilizes low volume street</li> <li>On-road facilities allow for quick implementation</li> <li>Utilizes existing County right-of-way</li> </ul>	<ul style="list-style-type: none"> <li>Route (D1+D3+D4) is indirect (2.8 miles compared to C1/B1, both of which are 0.9/1.5 miles)</li> <li>Bicyclists will be required to share the road with motorists, which is less comfortable for casual cyclists</li> <li>Route is different in character to existing Patuxent Branch Trail</li> </ul>	Proposed pathway = 0.00 Existing pathway = 0.00 On-road facility = 0.32 <b>Total Length = 0.32</b>	Approximately <b>\$9,000*</b> (\$6/lf)  *Estimate includes design and construction
D5	<b>Shared-Use Pathway along the BG&amp;E utility easement</b> This potential shared-use pathway follows the existing BGE utility alignment from the existing pathway (south of Farewell Road) to Stevens Forest Road.	Minimal environmental impact because the corridor has already been disturbed by the utility line construction (BG&E ROW); however may require some minor clearing of trees/vegetation.	<ul style="list-style-type: none"> <li>Route is supported by the Draft Howard County Bike Plan</li> <li>Sustains the character of the existing CA pathways</li> <li>Eliminates travel along busy roads, increasing safety and comfort of user</li> </ul>	<ul style="list-style-type: none"> <li>Route (D1+D3+D5) is indirect (2.73 miles compared to C1/B1, both of which are 0.9/1.5 miles)</li> <li>Requires potential acquisition of BG&amp;E right-of-way</li> <li>Requires bridge connection over Patuxent tributary to connect to existing pathways</li> <li>Proximity to back yards of approximately 12 homes in Owen Brown communities may create privacy concerns, design may need to mitigate visual access between homes and pathway</li> </ul>	Proposed pathway = 0.28 Existing pathway = 0.00 On-road facility = 0.00 <b>Total Length = 0.28</b>	Approximately <b>\$405,000*</b> (\$270/lf)  *Estimate includes design and construction
D6	<b>Utilization of Existing Pathways within the Village of Owen Brown</b> This potential pathway widening corridor follows of the existing CA pathways from Farewell Road, passing the Owen Brown Village Center and Lake Elkhorn, to the Patuxent Branch Trail.	Minimal environmental impacts are expected; however, environmental permitting may be required in locations where there is limited space to widen the existing trails between the stream buffer and private properties.	<ul style="list-style-type: none"> <li>Route is supported by Connecting Columbia</li> <li>Allows for access to surrounding trails and amenities</li> <li>Utilizes existing CA and County pathways/right-of-way</li> <li>Eliminates travel along busy roads, increasing safety and comfort of user</li> </ul>	<ul style="list-style-type: none"> <li>Route is indirect (1.6 miles compared to C2/B2, both of which are 1.5/1.1 miles)</li> <li>Multiple unsignalized pathway/roadway intersections</li> <li>Feasibility is dependent on space available to widen pathway between stream corridors and private properties; may require property acquisition</li> <li>Route includes steep topography, reducing its viability as a bicycle route</li> </ul>	Proposed pathway = 0.00 Existing pathway = 1.6 On-road facility = 0.00 <b>Total Length = 1.6</b>	Approximately <b>\$1,107,000*</b> (\$131/lf)  *Estimate includes design and construction



## Segments Not Recommended

Segments X1-X7 were analyzed and based on the analysis, the segments described below were determined not to be feasible.

Segment Alternative	Description	Feasibility
X1	<i>Considered shared-use path connection from existing CA pathways at Bullring Lane to Pamplona Road and an on-road bike route from the cul-de-sac at Pamplona Road to Kilimanjaro Road.</i>	This segment was not recommended due to the challenges of an existing steep and narrow pathway spur connection onto the Pamplona Road cul-de-sac from the existing spine network.
X2	<i>Considered shared-use path connection, running parallel and to the east of the Little Patuxent River</i>	This segment was not recommended due to the challenges of steep topography, especially in the spaces between the Little Patuxent River and the Hillcroft Executive Park property along Woodside Court. Additionally, extensive woodland clearing would be necessary for a pathway corridor.
X3	<i>Considered shared-use path connection, running along the BG&amp;E utility easement, from Broken Land Parkway to Stevens Forest Road</i>	This segment was not recommended due to the challenges of steep topography.
X4	<i>Considered shared-use path connection, running along the BG&amp;E utility easement, from the existing CA pathways (north of Windharp Way) to Oakland Mills Road.</i>	This segment was not recommended because it extends beyond the project study area and does not serve as a north/south connection from Downtown Columbia and the Patuxent branch Trail.
X5	<i>Considered shared-use path widening connection, running along the existing CA pathways, from Cradlerock Way to Lake Elkhorn.</i>	This segment was not recommended due to the challenges of steep topography. Additionally, this segment does not serve as an optimal connection as direct north/south route.
X6	<i>Considered on-road bike route along Allview Drive, from Amherst Avenue to Carlinda Avenue and a shared-path from Carlinda Avenue to Segment C2</i>	This segment was not recommended due to its challenging topography. Additionally, this bike route is not supported by the Draft Howard Bicycle Master Plan as a recommended bicycle facility.
X7	<i>Considered shared-use path widening connection, running along the existing CA pathways, from Shaker Drive to Segment A1 .</i>	This segment was not recommended because it does not serve as an optimal connection as direct north/south route.

See page 4 for a map of the segment locations.



## Section 4: Recommendations

A combination of routes is recommended to make a comfortable and convenient connection between Downtown Columbia and the Patuxent Branch Trail. The C1/A2 route (sewer line pathway between Downtown and Stevens Forest Road) should be combined with either the C2 (sewer line route adjacent to Allview Estates) or B2 route (pathway adjacent to Broken Land Parkway) to form this connection.

Both the C2 and B2 routes are feasible, however further community engagement (for C2) and further traffic analysis (for B1) is recommended.

Below is a summary of the reasons this is the preferred route:

- The B and C routes are relatively flat, making bicycling and walking much easier than other alternatives.
- The segments would provide efficient connections between Downtown and the Patuxent Branch Trail. The B and C routes are approximately 2.5 miles, compared to the A and D routes, which are approximately 3 and 4 miles, respectively.
- This route would provide several hundred homes currently isolated by major roadways (Broken Land Parkway, RT 29 and RT 32) with a direct, off-road path connection to Downtown Columbia. This includes under-crossings of Stevens Forest Road, RT 29 and RT 32, all of which meet the minimum clearance requirements for a shared-use path (which is eight feet of clearance, as defined by the *AASHTO Guide for the Development of Bicycle Facilities*).

Both routes are feasible from an environmental standpoint. The pathway can be designed to ensure a no-rise condition for the Little Patuxent River. If the C2 route is chosen, it will be located in a corridor that has already experienced significant grading and leveling due to sewer line construction. Flooding is not expected to be a concern, as other sections of the Patuxent Branch Trail are located in similar proximity to the river and are not experiencing significant impacts from flooding. However, it will be necessary for the County to maintain the pathway, as is done with other trails, including the Patuxent Branch Trail (Refer to the Maintenance Schedule in Section 5 for a summary of recommended annual maintenance procedures)

The C route has the potential to promote and create environmental education opportunities, because of its location along the Little Patuxent River stream valley. This could include interpretive signage, ecological educational programming, and stream restoration projects. Some aspects of environmental restoration could be incorporated into the pathway design, such as restoration of several drainage structures that have failed along the former roadbed on the north side of RT 29.

If the B2 route (along Broken Land Parkway) is chosen, there are a number of solutions that can be explored to repurpose roadway space to provide more comfortable and safe accommodations for pedestrians and bicyclists. Given the width of the median, as well as the extra capacity on Broken Land

Parkway, it would be possible to accommodate a shared-use path as well as transit vehicles in this corridor. There are a series of solutions that can be explored to repurpose roadway space to provide more comfortable and safe accommodations for pedestrians and bicyclists. Given the width of the median, as well as the extra capacity on Broken Land Parkway, it could be possible to accommodate a shared-use path, as well as and transit vehicles, in this corridor. Potential solutions could be; implementing strategies to more effectively align the capacity of the roadway to automobile traffic volumes; or securing additional ROW. These would require high levels of public engagement, traffic analysis and engagement with landowners.

## Recommended Phasing

Design and construction phasing for the connections will depend on the amount of funds available for initial construction, and developing a Phase 1 project that is logical and serves clear origin and destination points. For those reasons, the combination of Segments C1 and A2 are recommended for a Phase 1 route. This would provide a shared-use pathway from Downtown Columbia to Stevens Forest Road, and therefore would serve the needs of many people who seek to avoid walking along Broken Land Parkway at the RT 29 Interchange to access Downtown Columbia. It will be important to build the A2 section of this route (along Stevens Forest Road), as this segment is needed to connect to the bike lanes on Stevens Forest Road and connect to the Oakland Mills community.

An existing sewer line maintenance spur connection extends from the limits of C1 (south of the Broken Land Parkway underpass) and connects, at grade, with Stevens Forest Road. The utilization of this connection would provide feasible transition between segment design and construction phases. A logical Phase 2 route would be either the B2 or C2 routes. As discussed, further community engagement, (for C2) and traffic analysis (for B2) is recommended.

## Preliminary Opinion of Probable Cost

A preliminary opinion of probable cost for the design and construction of Phase 1 (Segment C1+A2) is approximately \$790,000 dollars. The preliminary cost estimate does not include the budget for land or easement acquisition, or other unforeseen conditions that were beyond the scope of this study. A detailed preliminary opinion of probable cost is included in Appendix B.



## Section 5: Design and Maintenance Guidelines

### Pathway Design Standards

New pathway and on-road facilities should comply with all applicable federal, state, and local design standards including Howard County, State Highway Administration (SHA) Maryland Department of Natural Resources (MD-DNR), Manual on Uniform Traffic Control Devices (MUTCD), American Association of State Highway and Transportation Officials (AASHTO), [AASHTO Guide for the Development of Bicycle Facilities](#) (June 2012 edition), the latest pathway guidance issued by the U.S. Access Board (draft “Shared Use Path Accessibility Guidelines”) and other guidelines, standards and specifications as appropriate. Refer to Pathway Design Criteria in Table 5.1 and Figure 5.1.

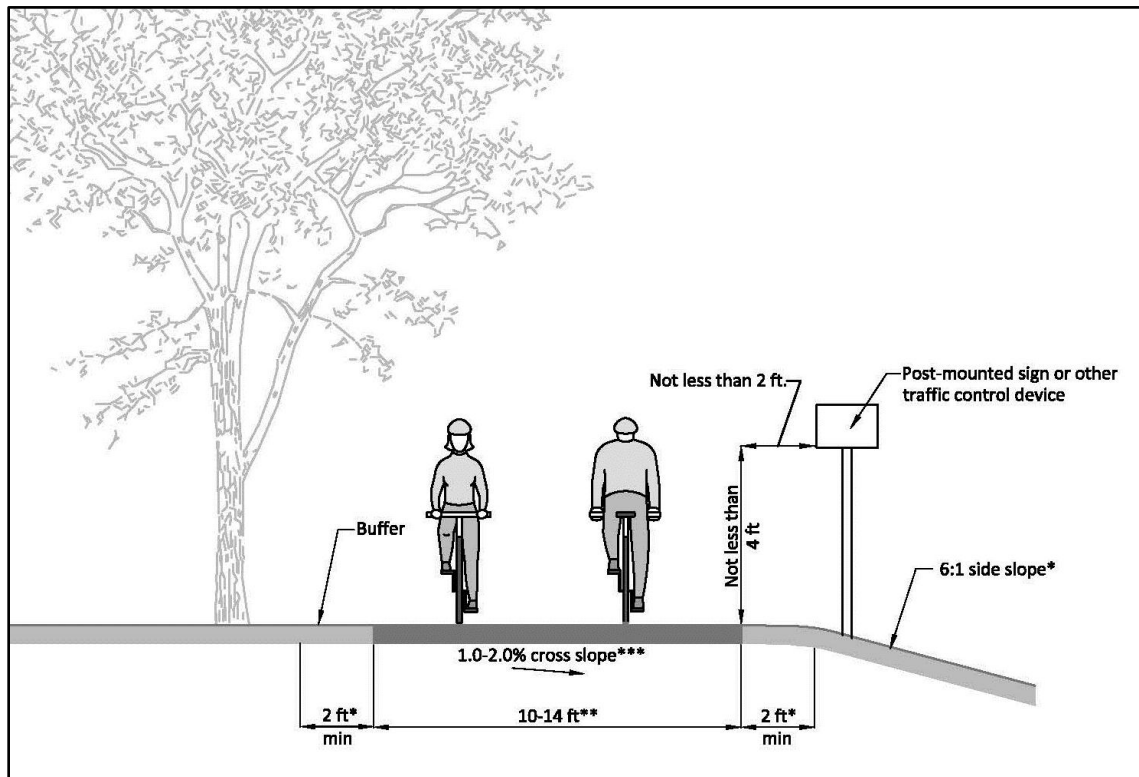
Table 5.1 Pathway Design Criteria

Pathway Design Criteria*		
Component	Relevant Guideline	Comments
Path Surface	All weather, smooth, stable and slip resistant	Preferably paved asphalt. Bridge surface materials are recommended to be slip resistant.
Width	10-ft wide; 12-ft to allow width for maintenance vehicles	Wider pathways (11-ft to 14-ft) may be necessary in locations with higher volumes of users. In locations with known conflicts between users, it can be beneficial to provide a centerline stripe to separate one direction of travel from the other.
Buffer/ Clear Zone	3-5 ft; cross slope 6:1	2-ft minimum, unless adjacent to a water hazard or steep downward slope, in which case 5-ft is desirable.
Vertical Clearance	10-ft	8-ft minimum to vertical obstructions
Cross Slope	1-2%	2% maximum to meet ADA
Longitudinal Slope	Adjacent to Roads: Match slope of roadway.  Independent Corridors: 5% desired.	Refer to Draft ADA “Guidelines for Shared Use Paths” for conditions under which 5% slopes can be exceeded. If pathway meets these conditions, attempts should be made to mitigate steeper slopes, including: <ul style="list-style-type: none"> <li>- Provide resting intervals</li> <li>- Design path for a higher design speed (i.e., 18-20 mph)</li> <li>- Provide additional width</li> <li>- Provide warning signage</li> <li>- Provide additional horizontal clearance for path users</li> </ul> In the event that a pathway slope of 5% is not achievable, the County should document the evaluation that was completed, the reasons the guidelines could not be met, and mitigation factors considered.
Horizontal Alignment	Design Speed: 12 to 30 mph (approximately 27-ft to 166-ft radius)	Horizontal curvature should generally be based on a design speed of 14 mph for 10- ft wide new or rehabilitated pathways .

\*Refer to the [AASHTO Guide for the Development of Bicycle Facilities](#) (June 2012 edition) for more information.

The preferred width for pedestrian bridges should be a minimum of 14 feet wide (10' treadway with 2' buffer on either side) composed of slip resistant wood or composite material. The bridge loading capacity should meet AASHTO guidelines (~100 lb/sf) and be capable of handling a utility maintenance vehicle for maintenance and emergency access (John Deere Gator or equivalent: 60"W x 113"L and vehicle weight: 1,500 lbs.). Proposed design dimensions of the bridges should comply with local, state, and federal guidelines and include universal design elements to enhance the pedestrian experience for all users.

Figure 5.1 Typical Off-Road Pathway Cross Section



### Maintenance and Operations

It is recommended that pathways are monitored on a daily and /an as-needed basis if a maintenance issue arises. For example, path segments located in the floodplain which are known to flood frequently demand more care than other open space area pathways and are regularly checked for sediment and other debris. A seasonal maintenance schedule example is located in Table 5.2.



Table 5.2 Recommended Maintenance Schedule

Season	Maintenance Description
Spring	Clean-up of deadwood, debris, etc.; mowing (bi-weekly)
Summer	Mowing/ Edging (weekly), trail sweeping (weekly), light pruning (as-needed)
Fall	Leaf removal (weekly), major pruning
Winter	Snow removal (as-needed)
As needed	Clean-up of fallen trees, debris, boardwalk repair, sediment, etc.
Immediately	Vandalism and graffiti removal