Shepard to Rollins Connection Trail Study

City of Columbia, Missouri

2/6/2015

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Section 1 | Introduction

Introduction

The Shepard to Rollins Trail Connection has been a proposed trail for many years. It is included in Columbia's 2013 Trails Master Plan and was considered for the first round of funding in the Federal Highway Administration's Non-motorized Pilot Project. The connection is important to the connectivity of the overall trail system and will remove significant barriers to active transportation.

The main barrier to travel in this area is Hinkson Creek, and all alignments considered for this trail connection provide a means to cross the creek. Each alignment is based on previous alignment studies and previous public comments and represents the most prudent options based on their start and end points.

The Hinkson Creek valley and the surrounding neighborhoods are sensitive to the addition of the trail. The valley has been targeted for natural preservation by citizen and group efforts. A large tract of private property includes most of the forested hill between Old 63 and Hinkson Creek.

Study Goal

The City wishes to improve the bicycling and walking access in this area which will support the citywide network in a practical and prudent manner. Based upon direction by the City Council, the study's goal is to review four alignments for mode shift potential, environmental impacts, and overall cost to assist the Council in determining the best course of action.

Alignments

The four alignments were developed from initial information provided by the city and refined by the study team to minimize costs and environmental disruptions.

Alignments 1, 2, and 3 start at an assumed location for the crossing of Hinkson Creek, which is the connection point for a separate study being conducted by City staff.

Alignment 1 will be a shared-use trail, concrete surfaced, 10' in width that travels north from the creek crossing and connects to the cul-de-sac on Bluffdale Drive. The study team reviewed the option to place a sidewalk at the back of curb within the neighborhood to provide a formal pedestrian connection from the trail to the pedway on Old 63. Based on a field review of all of the roads within the neighborhood, the route with the least impacts would be on the west side of Bluffdale Drive up to Southwood Drive, and on the north side of Southwood Drive. This route was used to assess the costs and other implications. If the sidewalk option is carried forward, a detailed analysis would be necessary to determine the optimal facility.

Alignment 2 will be a shared-use trail, concrete surfaced, 10' in width that travels east from the creek crossing and connects to the pedway on Old 63 near Shepard Boulevard. Most of this route is at the maximum ADA trail grade of 5%. It also includes a few segments of 30' at 7.5%, which meet ADA classifications as a ramp, which were included to minimize the cost of the alignment and reduce its impact to the forested hillside.

Alignment 3 will be a shared-use trail, concrete surfaced, 10' in width that travels south from the creek crossing mostly following existing cleared areas, and connects to Hinkson Creek Trail where it passes under Stadium Boulevard just west of Old 63. Due to the steep bluffs on both sides of Hinkson Creek, this alignment requires two additional crossings of the creek.

Alignment 4 runs parallel to Stadium Boulevard starts at Ashland Road and ends at Old 63. In this area, there are existing bike lanes, so the new facility could be an independent sidewalk or a shared-use facility, such as a pedway or trail.

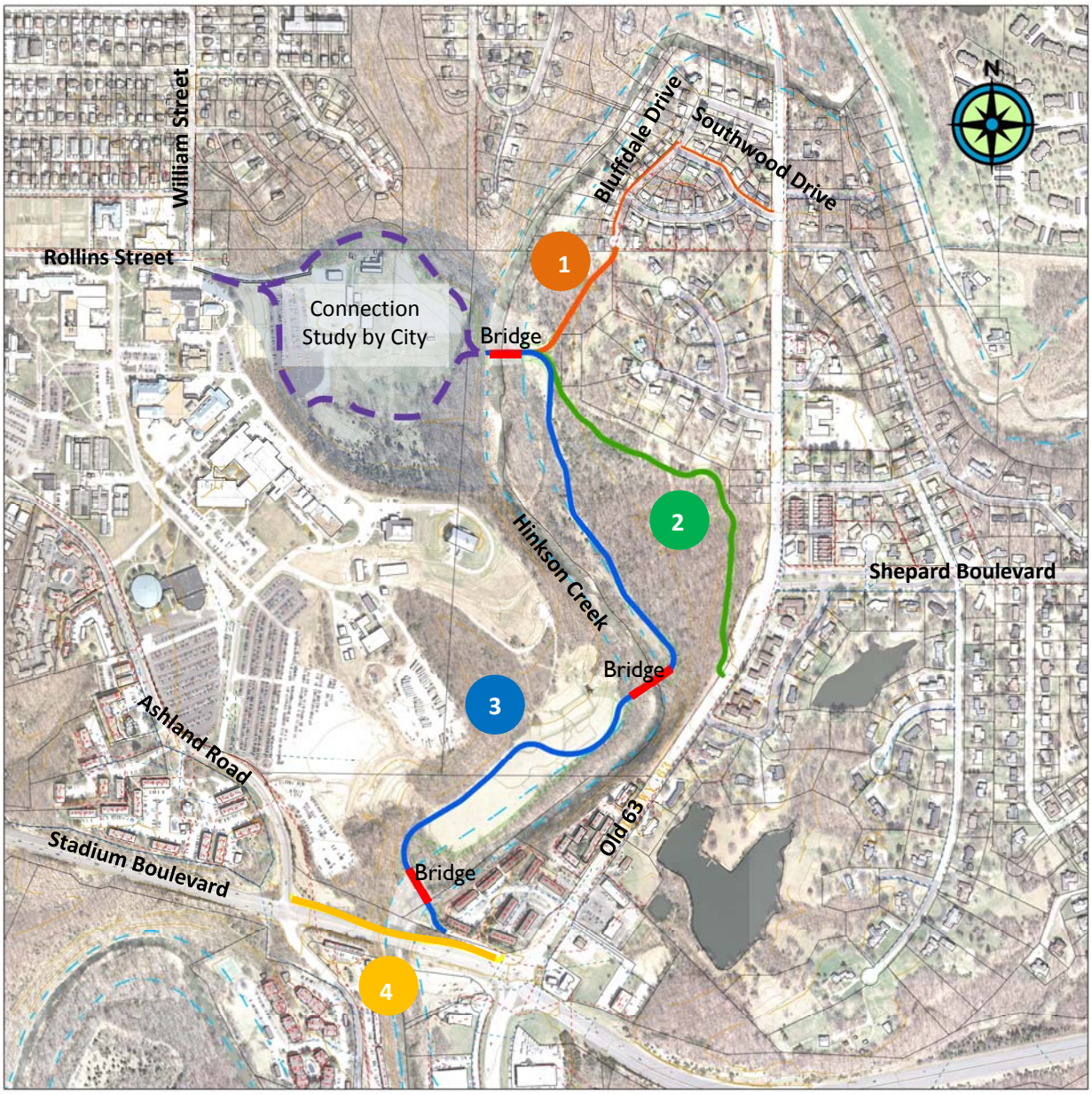


Figure 1 – Study Area and Alignments

Data Gathering

The study team was provided previous studies and GIS mapping from the City. The studies included "Garth to Gans Interchange Rollins-Hinkson-Stadium Connection" Report issued on May 13, 2008, and the "Low Water and Under Crossing of Hinkson Creek at Old 63" Feasibility Study issued on March 13, 2009. Once the studies were reviewed the team refined the four alignments and then reviewed the full length of each one in the field. In addition to reviewing property and environmental conditions, the team also reviewed changes to the alignments to take advantage of opportunities, or changes to avoid unnecessary impacts.

While in the field, the study team also reviewed the surrounding neighborhoods and the local bicycle and pedestrian routes to assess the existing facilities.

Design Standards

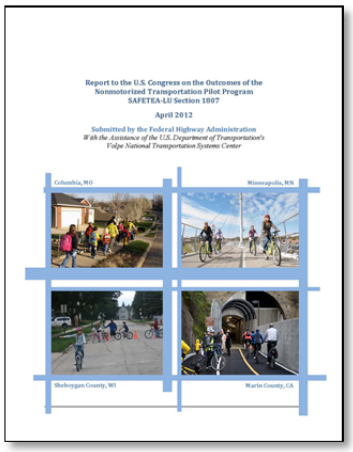
MoDOT and City design standards were reviewed to determine typical trail sections, bridge types and retaining wall types for the various alignments. All of the alignments will have facility sections consistent with the trail facilities found in Columbia today.

ADA requirements are crucial to accommodate the needs of all trail users, and these requirements were followed to develop the grades and alignments. Further refinement and surveys will be needed to develop the final construction plans, and ADA will continue to be a guiding principle in the design phase.

Section 2 | Mode Shift Potential

Mode shift potential describes the likelihood of someone riding a bicycle or walking for a trip that they might otherwise normally drive. This potential is measured by analyzing where people live, were they want to go, and if there is a facility that would make active transportation an attractive option.

Columbia has been a part of a four community Federal pilot project that has been very successful in generating mode shifts and this has provided insights into the factors that most affect mode shifts. The analysis of the pilot projects, and the US Department of Transportation's 2004 National Household Travel Survey (NHTS), have determined that most people will walk one-half to three-quarters of a mile to make a single purpose trip, such as commuting to work. According to the NHTS, most Americans will ride their bicycle 3.5 miles before preferring to drive that distance.


Report to the U.S. Congress on the Outcomes of the Nonmotorized Transportation Pilot Program SAFETEA-LU Section 1807

April 2012

Submitted by the Federal Highway Administration
With the Assistance of the U.S. Department of Transportation's Volpe National Transportation Systems Center

Columbia, MO | Minneapolis, MN | Sheboygan County, WI | Marin County, CA

Columbia
The national mode shift trip distances were compared to the average commute in Columbia to confirm these assumptions. The pilot project established Columbia's average commute time at 16 minutes, which, based on average walking and cycling speeds, equates to a 3 mile bike ride, or about a three-quarter of a mile walk.

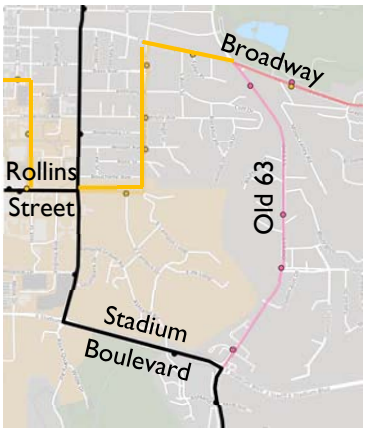
The data from the Federal pilot project indicates that Columbians will ride over 7 miles, however that figure includes recreational trips, so 5 miles was selected as the maximum mode shift distance for bicycling.

Pedestrian Mode Shift
This study only considers mode shift from vehicles to bicycles since none of the alignments will provide enough of a potential to switch from vehicles to walking. The length of trip from Rollins Street and Williams Street to the ends of Alignments 1, 2, and 3 are all greater than the maximum pedestrian mode shift distance.

Alignment 4 provides some mode shift potential, but it will be very limited. With only a few potential destinations within the 0.5 mile limit, the effect will be negligible. The upper end range for a three-quarter mile trip does not even reach to College Avenue, further demonstrating the limitation to Alignment 4's mode shift potential.

Bicycle Mode Shift
The key characteristics that influence mode shift are access to transit, facility user friendliness, and existing facilities.

Access to Transit
Transit has little effect on the mode shift potential for this area. COMO Connect has bus routes on Old 63, Stadium Boulevard, William Street, College Avenue, Rollins Street and Broadway. The Gold, Pink, and Black routes are shown on the right.



Facility User Friendliness
This describes the overall quality of a facility in terms of width, safety, maintenance, grades, and capacity. The key differentiator amongst these alignments is the grade. Bicyclists tend to prefer flatter grades and gentle hills to steep grades.

Existing Facilities
Existing facilities, such as bike lanes, pedways and trails have already influenced mode shift in some areas. Alignments that offer new connections have the potential to generate a higher percentage of mode shifts.

Analysis

Access to Transit
All alignments were essentially equal in this category.

Facility User Friendliness
Alignment 3 and Alignment 1 rated well in this category due to their gentler grades and shorter hill segments. Alignment 2 includes long grades of 5%, and much of the grade on Alignment 4 exceeds 5%.

Existing Facilities
Alignment 1 and Alignment 2 offer the most potential in this category. Alignment 3 is paralleled by on-street facilities on Stadium Boulevard and Ashland Road. Alignment 4 would include a new pedestrian facility, but already has bike lanes on Stadium Boulevard.

Service Area

Commuting to school and work are the trips that generate the highest percentages of mode shifts and as such were the focus of this analysis. With residential homes and apartments being the origins of these trips, the total number of dwelling units served by each alignment ("Service Area") was determined. The City's land use classification map was used to determine the number of housing units that would benefit from each alignment. This method and the resulting data provide an indication of mode shift potential.

Land use classifications indicate general density of housing units per acre. Based on the City Code and the Columbia Imagined Plan adopted in 2013, the densities were determined and are shown in Exhibit 1.

Mode shifts will occur in both directions along the three alignments reviewed, however, the trips going towards the campuses and downtown will show the greatest differences. Since the three alignments start at the intersection of Rollins Street and William Street, the area of potential mode shift is essentially the same. Each of the alignments creates a connection to similar employment centers, reducing the ability to accurately distinguish between them. The best method to distinguish the three alignments was to review the mode shifts of the population from the outskirts of town travelling into the campuses and downtown.

Exhibit 1. Land Use Density		
Category	**Description**	**Average Dwelling Units per Acre**
R-1 and R-1 PUD	Single Family	1.7
R-2 and R-2 PUD	Two Family	5.4
R-3 and R-3 PUD	Multi-Family (Medium Density)	8.1
R-4 and R-4 PUD	Multi-Family (High Density)	9.7
RMH	Residential Manufactured Housing	8
PUD	Planned Unit Development	As specified in the Land Use Plan

The following steps were used to determine the service area:

1. To account for trips that extended up to one mile through the Rollins Street and William Street intersection, a four mile buffer was used. This provided a reasonable boundary for trips that would go the maximum 5 miles.
2. All existing and proposed bicycle routes and trails were followed for four miles to determine the limits of each service area.
3. The areas already serviced by existing bicycle facilities were removed.
4. The main routes were reviewed for facility friendliness. For instance, if a route required a longer trip than taking another facility, then that area was removed from that alignment's service area.

The following exhibits show the four mile route lines and areas that benefit from each alignment. All of the residential land use classifications are colored according to density from white being the lowest to red as the highest. Note that there are some subdivisions currently outside the City limits that were not included in the land use classification map. Since these areas were served by multiple alignments, the areas were not included in the dwelling unit counts.

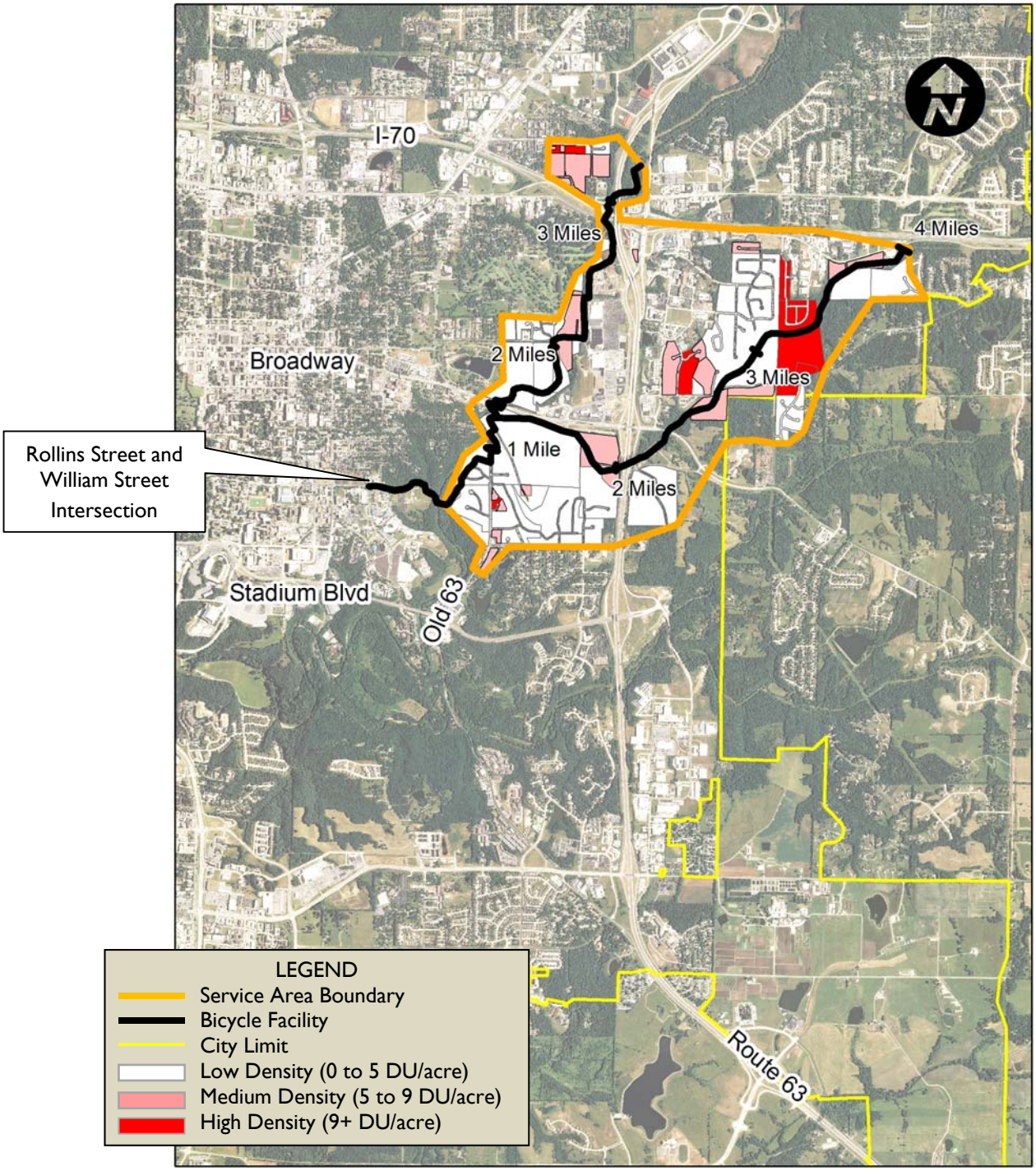


Figure 2 – Alignment 1 Service Area

Note that the northern route could include additional single family residential areas north of I-70, however the current connection proposed for this area is beyond the four mile limit.

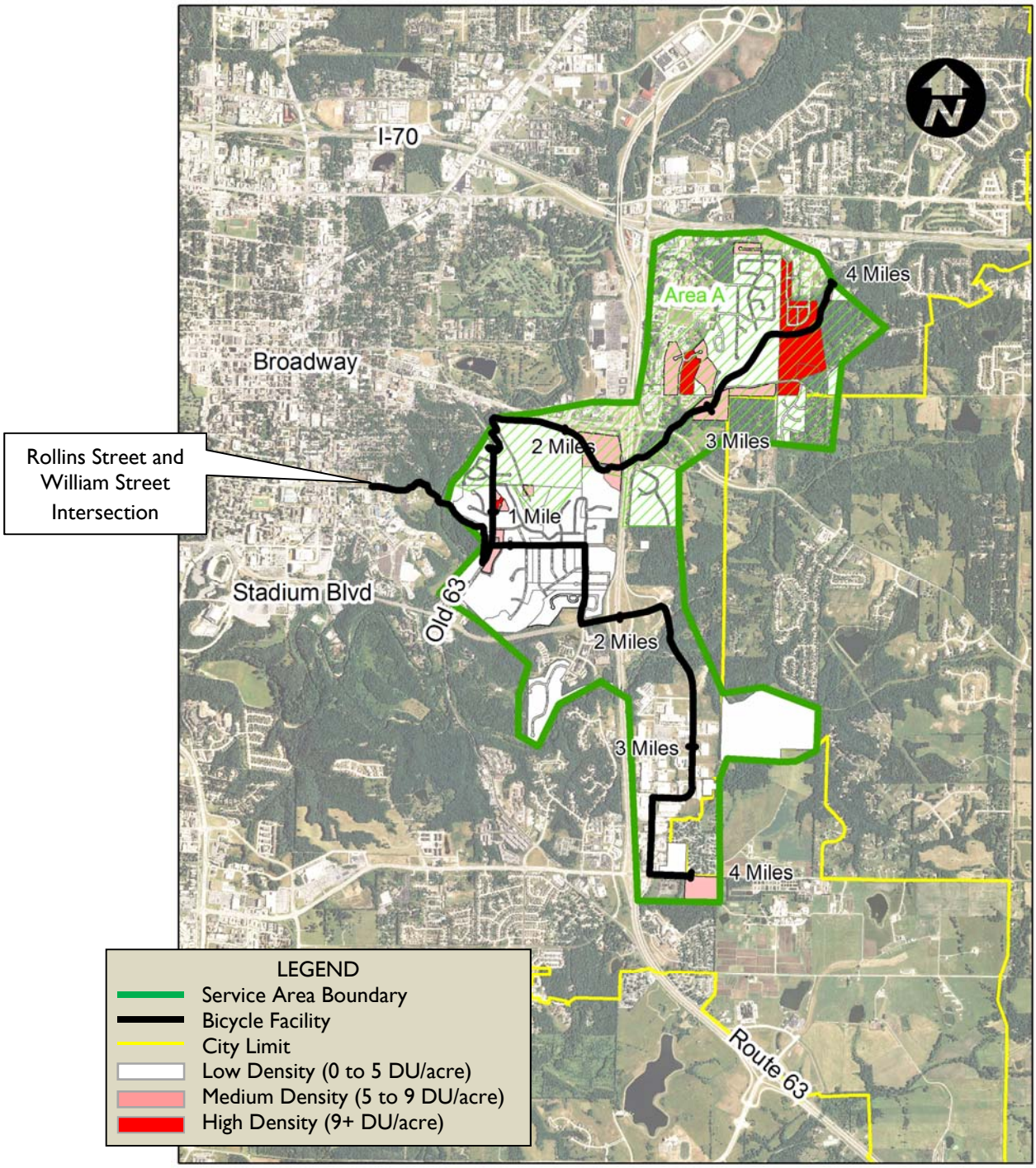


Figure 3 – Alignment 2 Service Area

Note that Area A has been reduced by 50% to account for the reluctance of most cyclists to traverse the hill along Old 63 rather than the hill on Broadway. Some cyclists may prefer to avoid the intersections and traffic along Broadway, so this area was not eliminated completely.

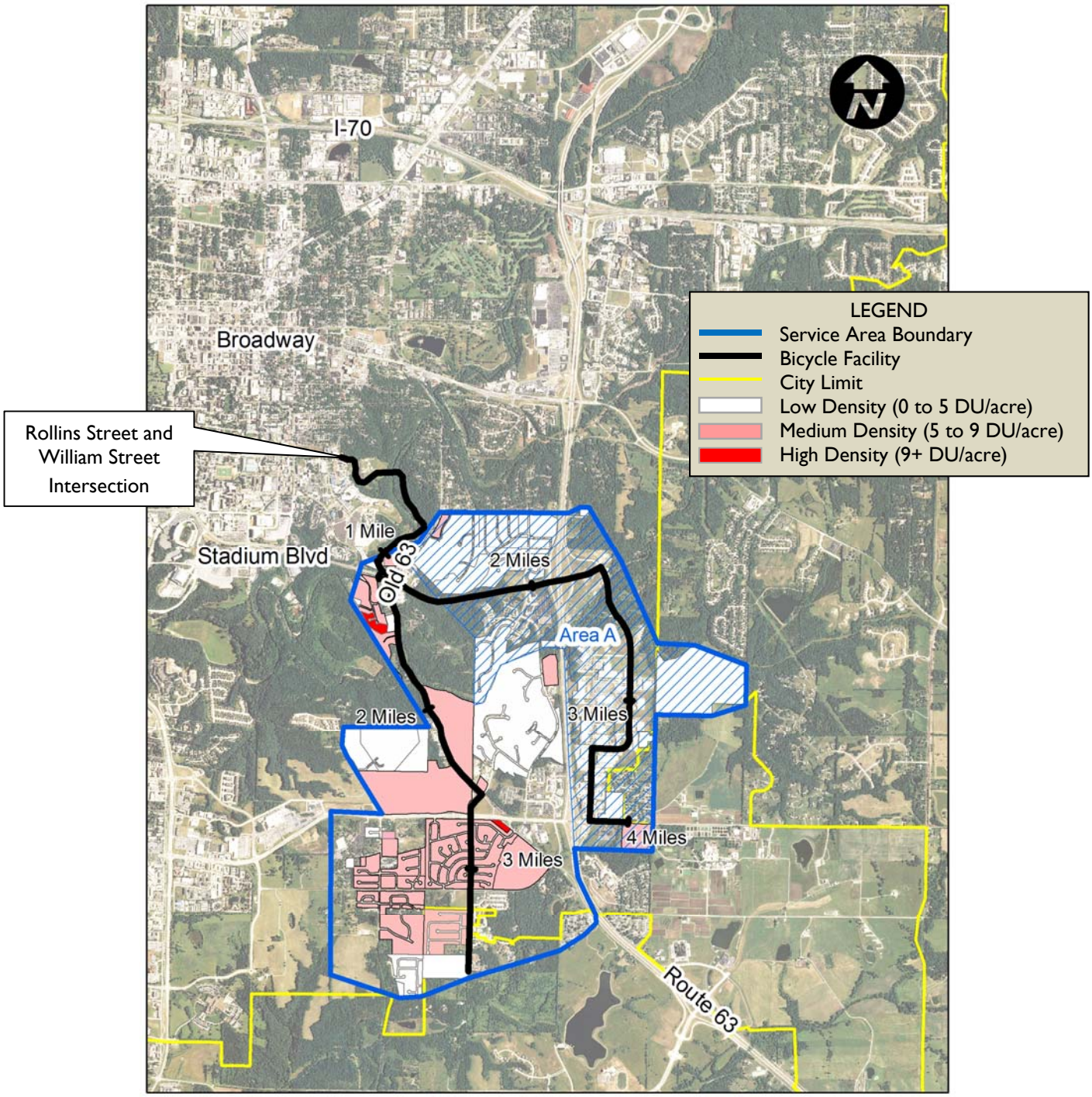


Figure 4 – Alignment 3 Service Area

Note that the overall area was reduced by 25% to account for the mode shift that has already occurred due to the existing Ashland Road bicycle facility. Alignment 3 will provide gentler grades, but will add about 0.2 miles to the trips that could use either option. Area A has been further reduced by 50% to account for the

reluctance of most cyclists to take Alignment 3 over the bike facilities on Stadium Boulevard and Ashland Road.

Note that Alignment 4 is located on an existing bicycle facility and would generate negligible bicycle mode shift.

Dwelling Unit Summary

Each alignment does meet the study goal of having mode shift potential. The dwelling units per area are shown in the following table.

Exhibit 2. Approximate Dwelling Units Served

Development	Zoning	Average Dwelling Unit per Acre	1	2	3
One-Family	R-1	1.7	866	893	450
Two-Family	R-2	5.4	119	41	68
Multi-Family (Medium Density)	R-3	8.1	737	348	1,302
Multi-Family (High Density)	R-4	9.4	49	10	33
Planned Unit Developments	R-1 PUD	1.7	129	65	-
Planned Unit Developments	R-2 PUD	5.4	-	-	121
Planned Unit Developments	R-3 PUD	8.1	14	14	295
Planned Unit Developments	R-4 PUD	9.4	-	-	-
Planned Unit Developments	PUD	Development Specific	424	272	620
Residential Manufactured Homes	RMH	8	390	195	11
		TOTALS	**2,730**	**1,839**	**2,901**

Alignment 3 has the highest number of dwelling units, and the highest number of high-density units. Mode shifts are generally higher from more dense developments, although this is less of a factor when these developments are not close to the main destinations.

Section 3 | Environmental Stewardship

This trail connection is an identified element of the 2013 Trail and Park Master plan and the Getabout Columbia plan. The goal is to provide a trail that prudently addresses and mitigates any environmental concerns. These include:

Cultural Resources

Parks
There are two public parks within the study limits, Wilson Park, and Wyatt Park. Although trail access is a great park amenity, it will be important to address any disruption to these parks.

Historic Properties
There is a National Register of Historic Places historic district nearby the alignments. The East Campus Neighborhood Historic District is located approximately 350 feet north of Rollins Street.

Forested Land

The Hinkson Creek valley is forested, with some areas designated as Urban Climax forest. City Code requires minimal clearing and targeted landscaping to restore cleared areas. Where tree removal can't be avoided, the contractor will be given very specific guidelines for removal, protection of adjacent trees and planting. These practices were successfully employed in the recent Scott's Branch Trail project.

Fish and Wildlife

Protected Species
The Indiana bat and the Gray bat are both endangered species and are found in forested areas such as these across Missouri. Both bats hibernate in caves, and will roost in certain trees during the non-winter months. Trees suitable for bat habitat may only be cleared between October and March.

Stream Crossings
In 2012, the US Army Corps of Engineers (Corps) revised their requirements on pipe culverts and low-water crossings in streams in an effort to improve the safe passage of fish and other aquatic organisms. The goal is to leave the stream in the natural condition, especially in relation to channel material and flow velocities. While this does not prevent the use of low-water crossings, it increases the requirements to obtain Corps approval.

The alignment analysis was conducted with the assumption that the trail, and the bridges, will be engineered to provide a low-maintenance facility. Large flood events will scour the streambed around objects such a bridge abutments. The trail designers will engineer the bridges and their foundations to resist the force of the flood waters, and to provide a foundation that will greatly reduce or even eliminate the need for rock rip rap bank armoring. These are methods considered "best practices" by the Corps of Engineers.

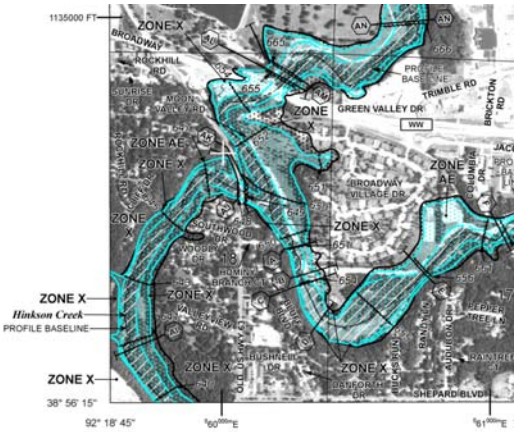
Hinkson Creek

The creek has an active, ongoing watershed restoration effort, and City codes have established a 100' stream bank buffer to protect the creek. Federal guidelines with FEMA regulate the creek's flood elevations and the US Army Corps of Engineers regulate the waterways. Trails and bridges are allowed in these areas, but must be engineered to meet regulations.

Stream Bank Buffer
The City code prefers trails to be placed in the outer 50' of the 100' buffer, but allows trails to be within the inner 50'. A stream assessment will be required for any trail that is within the 100' buffer.

Watershed Restoration Project
There is a Collaborative Adaptive Management approach being used to protect Hinkson Creek as a natural resource. This includes monitoring, mapping, and active efforts to improve water quality and support biological communities. The trail design will need to address construction and infrastructure impacts to Hinkson Creek, and demonstrate environmental sensitivity, coordinated with the restoration efforts.

Flooding
The Federal Emergency Management Agency (FEMA) has flood maps and studies for creeks, including Hinkson Creek. These maps determine if homes and properties have potential to be flooded. Since flood waters are very destructive and potentially life threatening, it is important that any new infrastructure within mapped creeks meet the strict criteria set forth by FEMA and adopted and enforced by the City.


1135000 FT
ZONE X
BROADWAY
ROCKHILL RD
SUNRISE
MOON VALLEY RD
ZONE AE
ZONE X
ZONE X
ZONE X
Hinkson Creek
PROFILE BASELINE
ZONE X
ZONE X
ZONE X
ZONE X
ZONE X
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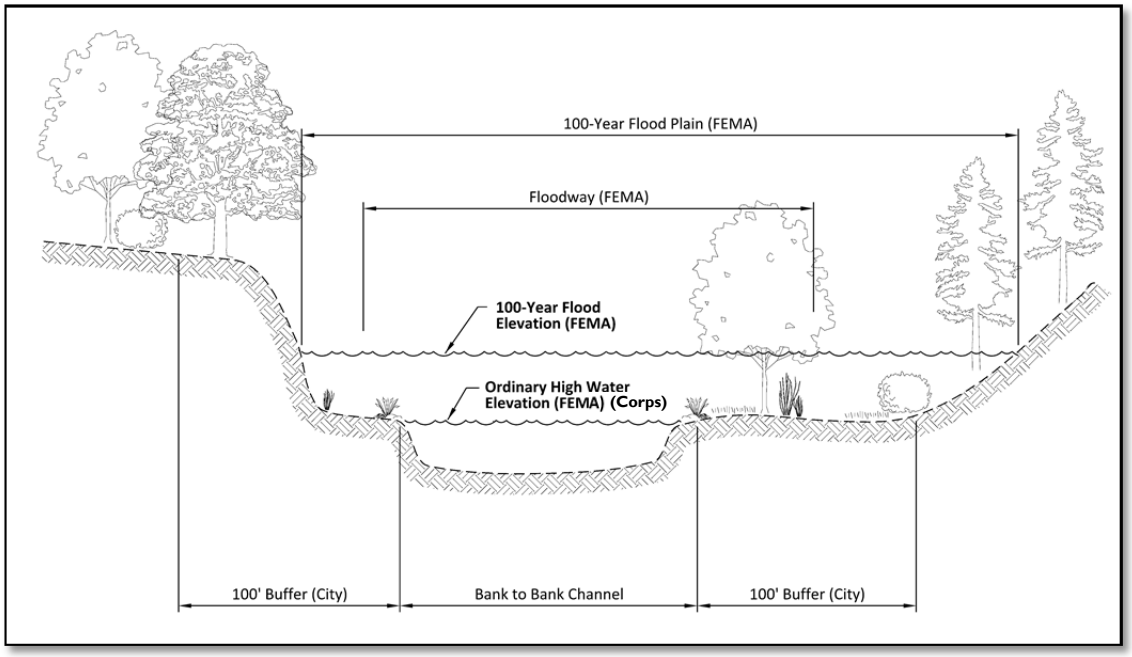


Figure 5 - Floodplain Regulation Zones

To avoid additional costs and time to update the FEMA model, the crossings of the creek are assumed to be bridges that span the entire floodway. A low-water crossing on Hinkson Creek might eventually be approved by FEMA, but it would take substantial time, funding, and effort to support that approach.

The US Army Corps of Engineers also has jurisdiction over Hinkson Creek and the associated wetlands. Consequently, Section 401 and 404 permits are required prior to construction. In this role the Corps is protecting the environment from pollutants and sediment transport. All construction activities that disturb the creek within the normal channel, or disturb certain low-lying areas defined as a "wetland," must meet the Corps procedures.

The Corps have issued "nationwide" general permits that cover most minor construction. If there is significant work in the streambed, channel realignments, or significant wetland degradation, then the City will submit an "individual" permit request.

Section 4 | Cost

There are numerous design details yet to be determined in order to provide an accurate estimate of construction cost. For this study, a range of costs has been developed for each alignment. Costs are shown for major construction items such as bridges, pavement and structures including drainage and retaining walls.

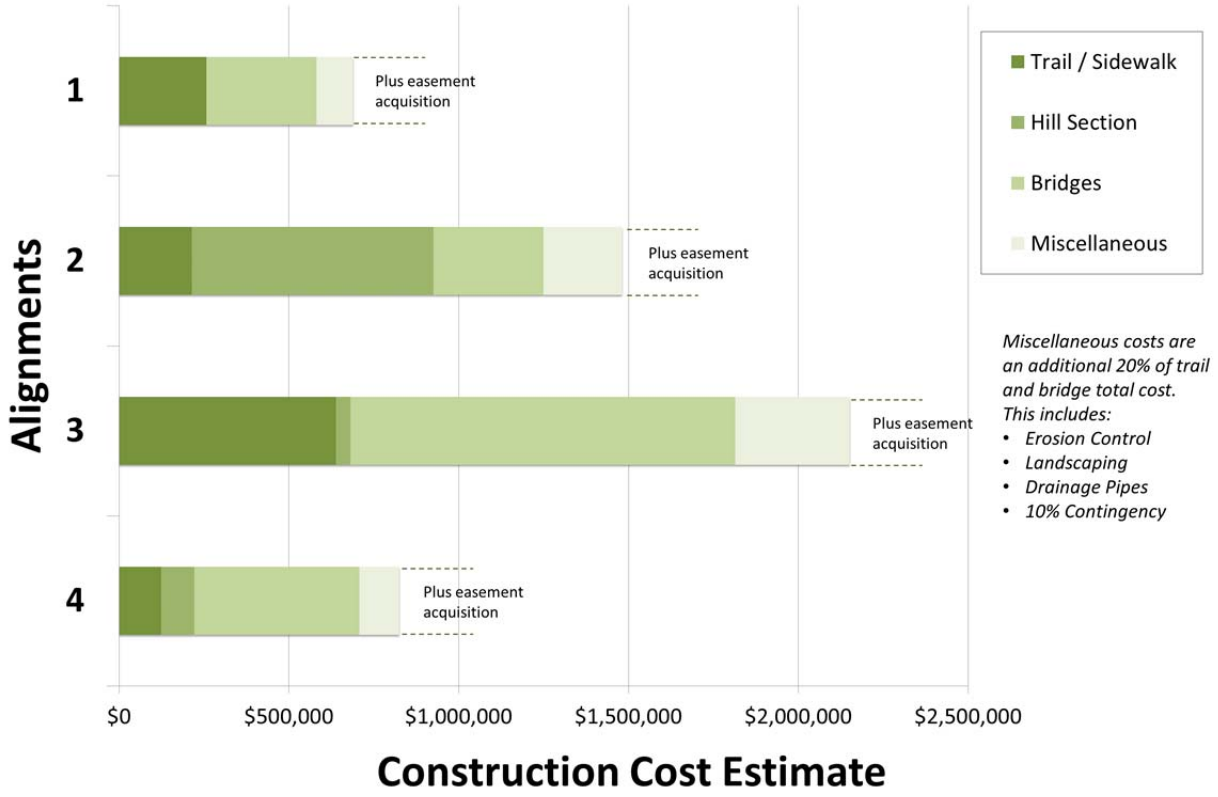
When the GetAbout Phase 2 projects were approved in 2013, the construction estimate for this project was $1.74M, not including easement acquisition, and included the area west of the creek to be studied by the City.

Cost Considerations
Bridges are often the single highest cost for any trail. Prefabricated bridges have been included in this analysis due to their minimal floodplain encroachments and low maintenance costs.

The "Hill Section" refers to a trail built in very steep terrain. This is typically accomplished with a retaining wall on one side of the trail, or with a boardwalk section. Alignments 2, 3, and 4 have Hill Sections.

All alignments will require some degree of construction or permanent easements from private land owners. The number of affected properties and the approximate clearing areas are shown in the Evaluation Summary though easement acquisition costs have not been assigned.

Note that Alignment 1 includes the cost for a proposed sidewalk along Bluffdale Drive up to Southwood Drive and then along Southwood Drive to the pedway.



Section 5 | Evaluation Summary

Each of the alignments and corresponding facility types were reviewed by the major categories of mode shift potential, environmental considerations, and construction costs. Quantifiable data was assembled and aggregated to a qualified level ranging from very poor to very good.

LEGEND ●○○○○ Very Poor ●●○○○ Poor ●●●○○ Fair ●●●●○ Good ●●●●● Very Good	Alignments				
	West of Hinkson Creek (City study)	1	2	3	4
Mode Shift Potential		●●●●○	●●●○○	●●●●○	●○○○○
Travel Demand					
Approximate Dwelling Units Within Trip Boundary	(Included)	2,700	1,800	2,900	N/A (Existing Facility)
Access to Transit					
Transit Route/Stop Connection	Gold	Pink	Pink	Black	Pink/Black
Facility Friendliness					
Average / Steepest Gradient	TBD	3.3% / 5%	4.8% / 7.5%	1.6% / 5%	5.6% / 7.5%
Existing Facilities					
Improves Connections	(Included)	Hominy Branch Trail, Campuses	Campuses	Grindstone Creek Trail, Campuses	Grindstone Creek Trail, Campuses
Bicycle Trip Length Reduction (Miles)	(Included)	0.7	0.9	0.1	0.0
Walking Trip Length Reduction (Miles)	(Included)	0.7	1.4	0.5	0.3
Environmental Consideration		●●●●○	●●●○○	●●●○○	●●●●●
Clearing Open Ground for Construction (Acres)	TBD	0.3	0.3	2.4	0.2
Clearing Forested Ground for Construction (Acres)	TBD	0.4	1.8	1.0	0.0
Potential Wetland Disruption	TBD	Minor	Limited	Significant	None
Floodplain and Stream Bank Buffer Encroachments	TBD	Limited	Limited	Significant	None
Endangered Species Habitat Disruption	TBD	Minor	Limited	Limited	Minor
Construction Cost Estimate		●●●●●	●●●○○	●○○○○	●●●●○
Construction Cost	TBD	$700,000	$1,500,000	$2,200,000	$900,000
Overall Trail Length	TBD	950' + 1,200' Sidewalk	2,500'	4,300'	1,200'
Trail Bridge Length	TBD	180'	180'	630' (180'+220'+230')	-
Roadway Bridge Modification Length	TBD	-	-	-	270'
Hill Section Length	TBD	-	1,100'	80'	150'**
Properties with Construction and Permanent Easements	TBD	16*	2	2	1
		*14 due to sidewalk			**east of creek

Construction cost evaluations are based upon the programmed budget and availability of funds.

Each alignment scored "good" in at least one of the categories, except Alignment 2, which scored "fair" in each category. From a balanced perspective, Alignment 1 scored well in each category.

Section 6 | Communication Process

In addition to information posted on the City's website, an Interested Parties Meeting was held on January 26, 2015 from 6:30-8 pm at the Shepard Elementary School.

The Interested Parties' meeting was attended by approximately 185 people. The format of the meeting was an open-house style with a welcoming/informational board, and two rows of six displays. Attendees were greeted by City staff and directed to the displays. Public Works Department Staff and TranSystems and Landworks Studio Staff answered specific questions from the attendees near the displays. Media outlets attended, and a reporter from a local television station recorded interviews with attendees.

Attendees were encouraged to submit written comments on the forms provided, and some correspondence was received from people who were not able to attend the meeting. The comment forms were generic, asking only for comments, and did not require a name on the form. By the end of the meeting, City Staff had received a combined total of 180 comment forms and correspondence. A handful of forms appeared to be from the same person, and one commenter admitted to completing "a few" forms, however the majority of the forms either gave their names, or appeared to be unique in other ways. Although there were some general statements made, the overwhelming majority of the commenters did discuss their preferences and concerns with each alignment.

City Staff and TranSystems Staff reviewed the comments, and completed the following tally. Note that this should not be interpreted as a vote; it simply is tallying the comments received at the meeting.

- 75% of the commenters favored Alignments 1 and 3, with a high percentage of those recommending that 1 and 3 be considered a combined option. (Only 10% of the commenters favored Alignments 1 and 3 independent of each other.)
- 10% of the commenters favored Alignment 2.
- 10% of the commenters favored Alignment 4.
- The sidewalk option on Alignment 1 received 2 positive comments, while receiving 14 negative comments.
- Each alignment received 14-18 negative comments, with some commenters mentioning the drawbacks of the other alignments compared to their preferred route.

Although this study considers each of the four alignments independently, many commenters felt Alignments 1 and 3 should be considered as one option. The PedNet Coalition had previously presented their own analysis of these alignments to their membership, and encouraged their members to voice their support of a combination of Alignments 1 and 3. Their efforts likely increased the attendance at the meeting, and influenced the support for the combination of the two alignments.

General Summary of Major Themes

- The majority of commenters were supportive of bicycle and pedestrian connections.
- Environmental sensitivity was mentioned often, but many people felt that the impacts described for their preferred alignment would be an acceptable tradeoff to the benefits.

- Alignment 1 was thought to provide an important connection while **minimizing costs and environmental impacts**. The sidewalk option was deemed **too disruptive** to the neighborhood and **overly expensive for the limited benefits**.

- Alignment 2 was thought to provide the **best connection to Shepard Boulevard**, but would be **very expensive and very steep**.

- Alignment 3 was thought to provide both **recreational benefits and high mode shift potential**, but overall **cost**, **increased flooding, and environmental disturbances were concerns**.

- Alignment 4 was thought to provide **very limited mode shift potential**, but was **affordable** and had **negligible impacts to the environment and flooding**.

Alternate Alignment Suggestions

Alignment 1-

1. A few comments were made about a potential Valley View Drive connection. TranSystems reviewed the feasibility of connecting to the cul-de-sac on Valley View Road. This option would require significant switchbacks and would displace one property owner. Due to the full property acquisition and the limited functionality of the switchbacks, this option was not further developed.

Alignment 2 –

1. One comment was made about a gondola system. Gondola systems require significant capital, operational, and maintenance investment. In addition, the system would greatly increase travel times, significantly reducing the mode shift potential. Since the gondola system does not meet the goals of the study, it was eliminated from further development.
2. Many attendees expressed concern about the mode shift service area from the north due to the hill on the Old 63 pedway, the mode shift from this area was reduced by 50% to account for these comments.

Alignment 3 –

1. Some attendees expressed concern about the mode shift potential from the east. Since this alignment would be a longer trip, and it would require the on-street cyclist to change facilities, the cyclists would prefer to remain on Stadium Boulevard. The mode shift from this area was reduced by 50% to account for these comments.
2. Based on attendees' comments and a field check to confirm the extreme conditions on Rock Quarry Road, the service area was expanded to include more area near Rock Quarry Road and Grindstone Parkway.

Post Meeting Comments

The City posted the information from the Interested Parties meeting and allowed further comments. The thirty additional comments received were in line with the original comments. Some of the additional commenters had already submitted their comments at the Interested Parties meeting.

Section 7 | Technical Recommendation

Based on the scoring of the four alignments and considering the goals of the project, Alignment 1 is recommended as the alignment that best balances the environmental impacts, funding constraints, and generates reasonable mode shift potential. The sidewalk option on this alternative should be considered, but is not a requirement.

Alignment 2 could be included in future development plans for the private property.

Alignment 3 could be considered a future phase of the trail system.

Alignment 4 should be considered to be combined with future work on the Stadium Boulevard bridge over Hinkson Creek, or as a standalone project.