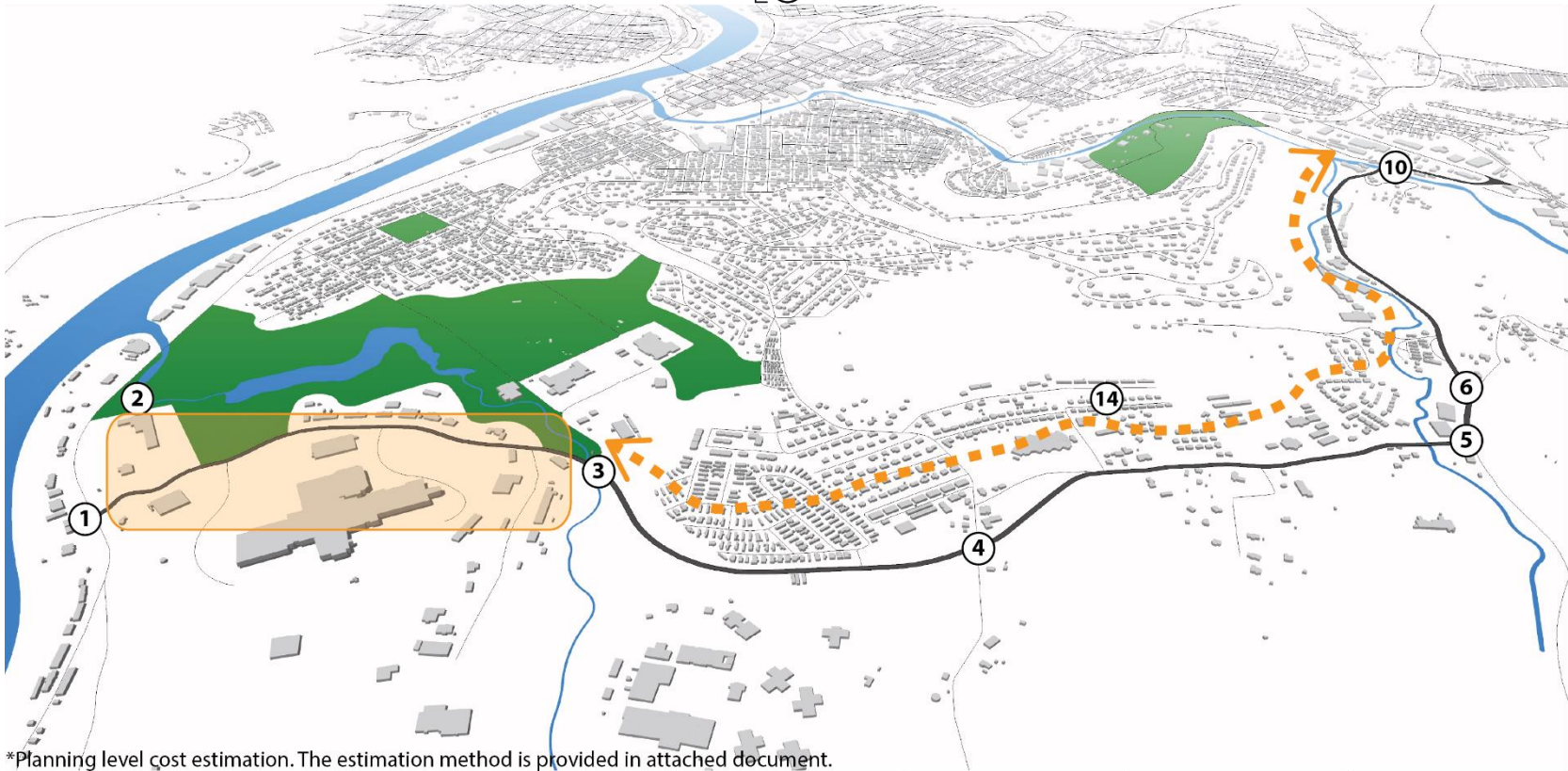


Greenbag Rd Corridor Study Appendix G:
Improvement Recommendations and Cost Estimate

- | Project # | Name |
|-----------|--|
| ① | US 119 / Greenbag Rd Intersection Improvements |
| ② | Multi-modal Transportation Improvements Between US 119 and Mississippi St On Greenbag Rd |
| ③ | Mississippi St/Greenbag Rd Intersection Improvements |
| ④ | Dorsey Ave/Greenbag Rd Intersection Improvements |
| ⑤ | Lower Aarons Creek Rd/Greenbag Rd Intersection Improvements |
| ⑥ | Diamond Ave/Greenbag Rd Intersection Improvements |
| ⑦ | Greenbag Rd Transit Waiting Condition Improvements (not on map) |

- | Project # | Name |
|-----------|--|
| ⑧ | Greenbag Rd Signage Improvements (not on map/entire corridor) |
| ⑨ | Greenbag Rd Roadway (thoroughfare) Improvements (not on map/entire corridor) |
| ⑩ | Deckers Creek Blvd/Greenbag Rd Intersection Improvements |
| ⑪ | Aaron Creek Drainage Improvements (not on map) |
| ⑫ | Greenbag Rd Access Management Program |
| ⑬ | Intersection Safety Monitoring Program |
| ⑭ | Non-motorized Transportation Improvements |
| ⑮ | Roadway Long Term Improvements (not on map/entire corridor) |

Long Term



*Planning level cost estimation. The estimation method is provided in attached document.

US 119/Greenbag Rd Intersection Improvements

Short Term

Project # 1 Primary Travel Mode(s) Improved: Auto Evaluation Criteria Targeted: Safety, Mobility

Planning Level Cost Estimation:
from \$2 million to \$4 million

Identified Problems:

- Significant approach delay (LOS F) left-turn traffic on Greenbag Rd during PM peak hour
- Considerable approach delay (LOS D) southbound left-turn traffic during AM peak hour
- In 2034 peak hours, failing conditions left-turn and northbound through-movement approaches on US 119, and on the westbound left-turn approach on Greenbag Rd.
- Unsafe turning radius to and from Greenbag Rd, especially for large trucks
- Limited sight distance at the traffic signal for approaching vehicles on Greenbag Rd
- Unsafe bicycle left-turn from US 119 to Greenbag Rd

Primary Purposes:

- Reduce congestion
- Improve intersection safety

Project Scope and Concept:

- Add an exclusive left-turn lane on Greenbag Rd
- Optimize traffic signal phases
- Install traffic signal warnings on Greenbag Rd
- Improve turning radius (as a part of road/shoulder widening on Greenbag Rd)
- Provide a two-stage left turn bicycle box on the southwest leg of the intersection (Gas station)

Notes:

Improvements should be made in coordination with the US 119/CR 73 intersection

Traffic volume to/from Greenbag Rd are expected to grow at a rate higher than the regional average due to anticipated economic development and transportation infrastructure improvements along the Greenbag Rd corridor.

Multi-modal Transportation Improvements Between US 119 and Mississippi St On Greenbag Rd**Short Term**

Project # 2 Primary Travel Mode(s) Improved: Ped., Bicycle Evaluation Criteria Targeted: Safety, Community

Planning Level Cost
Estimation: from \$750,000 to \$800,000

Identified Problems:

- Pedestrian travel between Mississippi St and the mall is adversely impacted by vehicle speed, narrow shoulders, and other road conditions.
- The slope (5%) between Mississippi St and US 119 makes bicycle traveling difficult and unsafe.
- There is no designated location for safe pedestrian crossing on Greenbag Rd at this area.
- Anticipated growth in the area indicates a need to improve the the highway capacity to accommodate non-motorized travelers in that section of Greenbag Rd.

Primary Purposes:

- Improve pedestrian safety
- Enhance community livability and health
- Support business growth
- Provide connecting link
- Address potential social justice issue

Project Scope and Concept:

- Provide sidewalk on the north side of Greenbag Rd between the Mississippi St and the Mall west outlet (approximately 3,200 feet)
- Provide crosswalk and pedestrian signal phase at the intersection of Greenbag Rd and the Mall west outlet
- Provide a westbound bicycle climbing lane on the north side of Greenbag Rd between the Mississippi St and the Mall east outlet (approximately 1,100 feet)
- Provide an eastbound bicycle climbing lane on the south side of Greenbag Rd between US 119 and Mall east outlet (approximately 1,00 feet)

Notes:

Community survey and field observation have shown that there is a demand for safe multi-modal transportation facilities connecting the 1st Ward area and the mall area.

Proposed paved shoulders in this plan can be appropriately converted to bicycle climbing lanes at the locations recommended in the improvements.

Mississippi St/Greenbag Rd Intersection Improvements

Short Term

Project # 3

Primary Travel Mode(s) Improved: Auto

Evaluation Criteria Targeted: Safety, Mobility

Planning Level Cost

Estimation: from \$300,000 to \$400,000

Identified Problems:

- Unsafe turning movements caused by travel speed, limited sight-distance, slope, and horizontal alignment
- Crash data indicates a higher crash rate at this intersection than other intersections in the corridor.

Primary Purposes:

- Improve intersection safety
- Improve traffic flow

Project Scope and Concept:

- Add an eastbound exclusive left-turn lane to Mississippi St
- Provide appropriate warning signage
- Reduce speed limit for the eastbound traffic on Greenbag Rd between the Mall outlet (east) and Mississippi St.

Notes:

As a long term improvement, a crosswalk and a high intensity activated crosswalk signal at a bus stop close to this intersection (across from Morgantown City Garage on Mississippi St) is recommended to connect the proposed sidewalks (short term) and a multiuse path is proposed in the long term for this intersection.

Dorsey Ave/Greenbag Rd Intersection Improvements

Short Term

Project # 4 Primary Travel Mode(s) Improved: Auto Evaluation Criteria Targeted: Safety, Mobility

Planning Level Cost
Estimation: \$1,100,000 to
\$2,000,000

Identified Problems:

- Intersection failure (LOS F) of the eastbound approach on Greenbag Rd during PM peak hour.
- Considerable delay (LOS D) of the westbound approach on Greenbag Rd during PM peak hour and northbound approach on Kingwood Pike.
- Roadway deficiencies, including substandard geometrics, and uneven road surface
- Substandard intersection approaches (angled intersection)

Primary Purposes:

- Reduce congestion
- Improve intersection safety

Project Scope and Concept:

- Add exclusive left-turn lanes on Greenbag Rd (both directions)
- Provide exclusive left-turn signal phases on Greenbag Rd (both directions)
- Widen travel lanes and adjust intersection approaching angles
- Provide Bicycle May Use Full Lane (MUTCD R4-11) signs at an appropriate distance to the intersection to increase bicycle safety

Notes:

Impacts to the adjacent properties should be considered.

This recommend action is based on the Dorsey Ave and Greenbag Rd Traffic Study conducted by MPO staff in May, 2014.

Lower Aarons Creek Rd/Greenbag Rd Intersection Improvements**Short Term**

Project # 5 Primary Travel Mode(s) Improved: Auto Evaluation Criteria Targeted: Safety

Planning Level Cost
Estimation: from \$340,000 to
\$400,000

Identified Problems:

- Unsafe turning caused by inadequate turning radius, slope, travel speed, and limited sight-distance

Primary Purposes:

- Improve intersection safety
- Improve traffic flow

Project Scope and Concept:

- Adjust road alignment to improve turning radius, including consideration of super elevation in horizontal curve design
- Provide appropriate warning signs for approaching traffic

Notes:

Impacts to the adjacent properties should be considered.

A further study is recommended to assess its geometric deficiency and crash history, and to evaluate the cost effectiveness of alternatives to improve this intersection.

Diamond Ave/Greenbag Rd Intersection Improvements**Short Term**

Project # 6

Primary Travel Mode(s) Improved: Auto

Evaluation Criteria Targeted: Safety

Planning Level Cost
Estimation: from \$300,000 to
\$400,000

Identified Problems:

- Unsafe turning movement caused by inadequate turning radius, slope, travel speed, and limited sight-distance

Primary Purposes:

- Improve intersection safety
-

Project Scope and Concept:

- provide appropriate warning signs for approaching traffic
 - improve turning radius for right-turn traffic from Diamond Ave
-

Notes:

Excessive slope on Diamond Ave prohibits extensive re-alignment of this intersection.

This intersection has been identified as a priority safety improvements location in the MPO's LRPT.

Deckers Creek Blvd/Greenbag Rd Intersection Improvements**Short Term**

Project # 7

Primary Travel Mode(s) Improved: Auto

Evaluation Criteria Targeted: Safety, Mobility

Planning Level Cost
Estimation: from \$600,000 to
\$700,000

Identified Problems:

- Unsafe turning movements caused by intersection configuration, travel speed, limited sight-distance, and horizontal alignment
 - Crash data indicates a higher crash rate at this intersection than other intersections in the corridor
-

Primary Purposes:

- Improve safety and mobility
-

Project Scope and Concept:

- Improve turning radius, especially for through-movement traffic on Greenbag Rd
 - Provide better signage for approaching traffic
 - Provide safer pedestrian crossings
 - Improve Deckers Creek Bridge on Greenbag Rd to accommodate multi-modal travels
-

Notes:

Further study is recommended to identify viable alternatives to improve this intersection under the proposed project scope and concept.

Greenbag Rd Roadway (thoroughfare) Improvements

Short Term

Project # 8 Primary Travel Mode(s) Improved: Auto Evaluation Criteria Targeted: Safety, Mobility, Community

Planning Level Cost Estimation: from \$6 million to \$10 million

Identified Problems:

- Narrow travel lanes in both directions. For most of the length of the project, travel lane varies from 9' to 10' and shoulders are not provided.
- Uneven road surface, especially between Glen Oaks Dr and the Aarons Creek Bridge and at the intersection of Greenbag Rd and Dorsey Ave
- Unsafe traffic weave movement in between the two outlets of Mountaineer Mall, as eastbound through traffic need to merge left when traveling through this area.

Primary Purposes:

- Improve safety and mobility
- Correct roadway deficiencies
- Improve corridor aesthetics

Project Scope and Concept:

- Widen and resurface westbound lane to 12' and eastbound lane to 11', and provide 4' shoulder on both sides of Greenbag Rd (approximately 3.4 miles)
- Re-configure travel lanes between the two outlets of Mountaineer Mall to eliminate left-merges for through traffic
- Provide appropriate lighting on Greenbag Rd, particularly at locations where pedestrians and bicyclists are expected
- Mitigation strategies should take into consideration eliminating or minimizing adverse effects, such as air and noise pollutions, to adjacent neighbors during and after the construction of the project.

Notes:

A wider westbound lane is to accommodate high volume of commercial truck traffic traveling from WV 7 to US 119. The use of No Engine Break signs is recommended at schools and residential areas as a means to mitigate adverse impacts of truck traffic to adjacent neighbors.

Improved roadway condition on Greenbag Rd may result in higher vehicle traffic speed. Appropriate treatments should be considered to discourage unsafe travel speed and thus reduce speeding-related crashes. Those treatments include implementation of variable speed limits, compatible roadside design, signage improvements to heighten driver awareness of speeding-related safety issues.

The intent of the paved 4' shoulders is to provide safety for motor vehicles and to control roadway erosion. It is not intended as a pedestrian or bicycle facility on Greenbag Rd, due to the prevailing motor vehicle travel speed and heavy truck traffic on Greenbag Rd.

Greenbag Rd Transit Waiting Condition Improvements

Short Term

Project # 9 Primary Travel Mode(s) Improved: Transit Evaluation Criteria Targeted: Safety, Community

Planning Level Cost
Estimation: from \$68,000
to \$88,000

Identified Problems:

- Unsafe and unattractive transit waiting environment caused by vehicle speed and absence of shade during inclement weather.

Primary Purposes:

- Improve transit safety and comfort

Project Scope and Concept:

- provide bus shelters at appropriate locations
- provide appropriate passenger protection from passing traffic
- provide lighting and pedestrian crossing road signs (MUTCD W11-2) at the designated transit waiting area

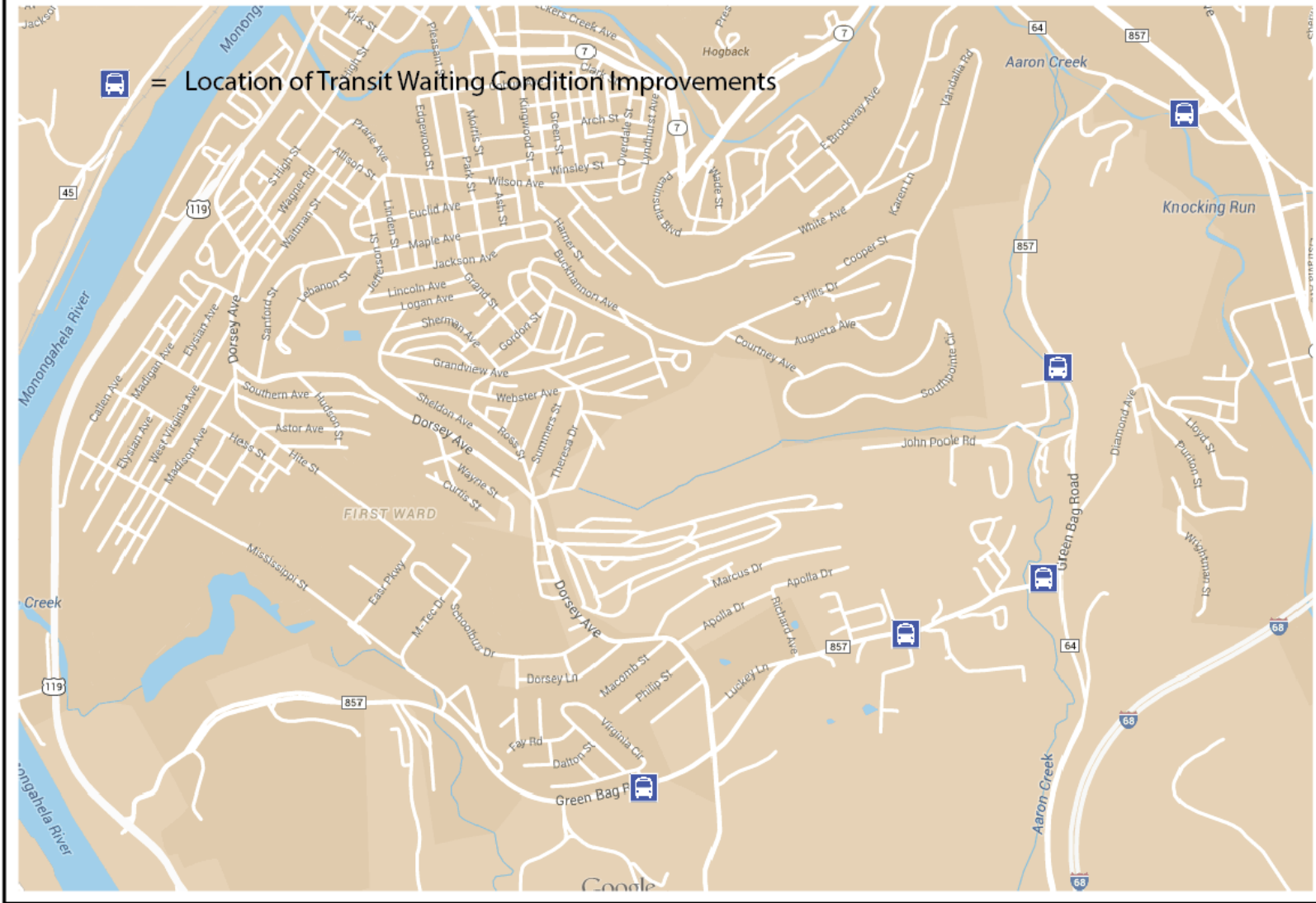
Notes:

Specific locations for bus shelters recommended by Mountain Line Transit Authority are illustrated in the map on the following page.

The ITE Designing Walkable Urban Thoroughfares suggests that every bus stop at the opposite side of the street should be considered as a pedestrian crossing point.

Greenbag Rd Corridor Study • Proposed Improvements

Project 9. Greenbag Rd Transit Waiting Condition Improvements



Greenbag Rd Signage Improvements

Short Term

Project # 10 Primary Travel Mode(s) Improved: All Modes

Evaluation Criteria Targeted: Safety, Community

Planning Level Cost Estimation: from \$14,000 to \$24,000

Identified Problems:

- Unsafe cycling environment caused by vehicle speed (prevailing speed over 50 MPH) and limited roadway width (9'-11')

Primary Purposes:

- Improve cycling safety
- Improve pedestrian safety

Project Scope and Concept:

- Provide Truck Route signs, MUTCD R14-1, to mark Greenbag Rd as a designated route for truck traffic
- Provide Bicycle May Use Full Lane signs, MUTCD R4-11, at appropriate locations as recommended by relevant MUTCD guidelines
- Provide Pedestrian Crossing Road signs, MUTCD W11-2, at the proposed designated transit waiting area (included in the Transit Waiting Condition Improvements)

Notes:

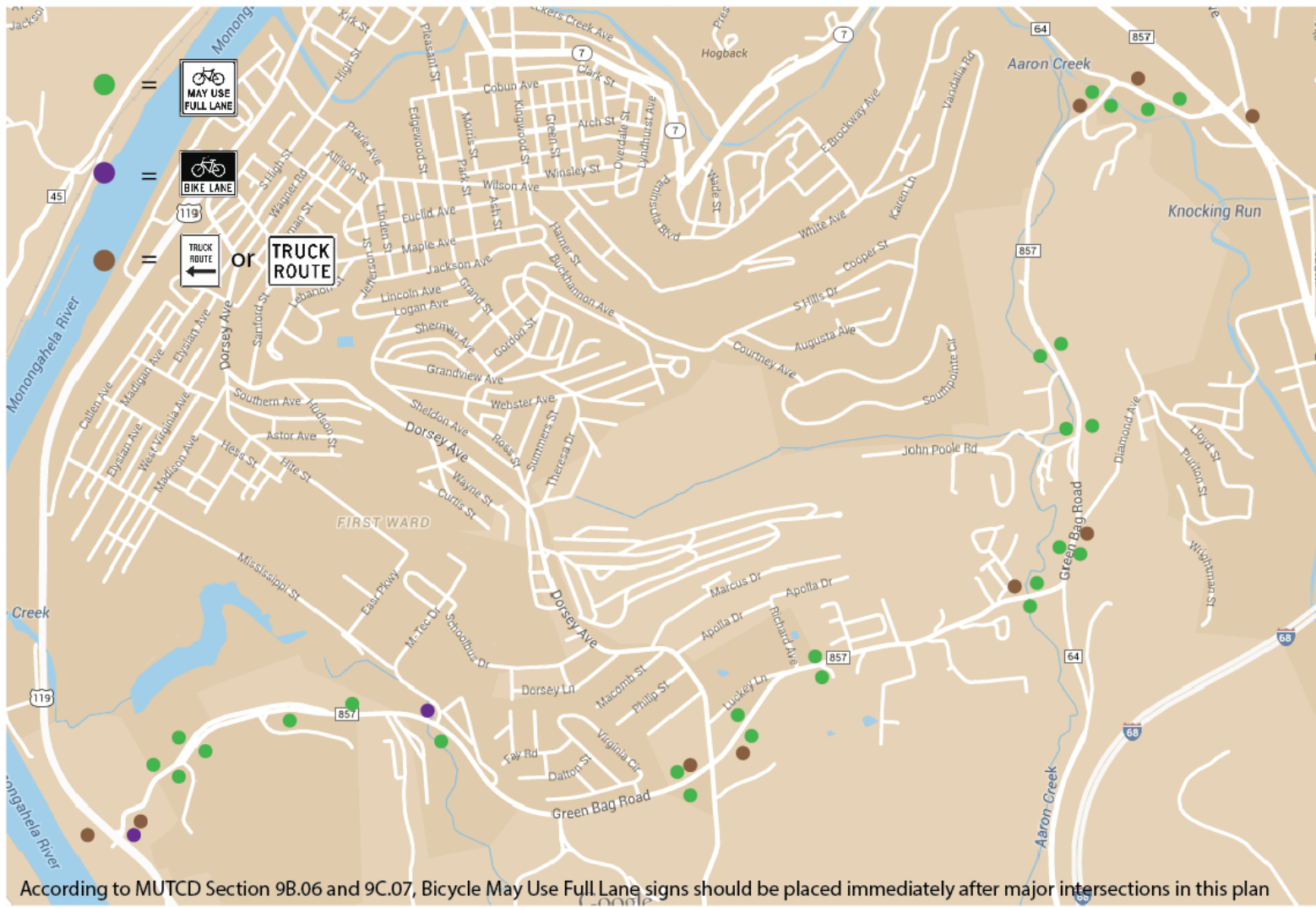
Specific locations for proposed signs are illustrated in the map on the following page.

The need for safe bicycling facilities has been identified in community surveys and public meeting comments.

According to AASHTO Guide to Bicycle Facilities, the 4' paved shoulders as proposed in this plan are not wide enough for safe bicycling, due to the prevailing motor vehicle travel speed and heavy truck traffic on Greenbag Rd. According to West Virginia Code 17C-1-37 and 17C-11-2, shoulder are not part of the roadway and bicyclist rights and duties on the shoulder are undefined.

Greenbag Rd Corridor Study • Proposed Improvements

Project 8. Greenbag Rd Signage Improvements



Aaron Creek Drainage Improvements**Short Term**

Project # 11 Primary Travel Mode(s) Improved: Auto Evaluation Criteria Targeted: Environment

Planning Level Cost
Estimation: Data Not Available

Identified Problems:

- Frequent flooding has been reported at the Aarons Creek Bridge area and the Deckers Creek Bridge area (behind the HomeWarehouse).

Primary Purposes:

- Prevent roadway flooding
-

Project Scope and Concept:

- Re-grade the Aaron Creek bank to improve drainage conditions and preserve species living in the creek.
 - Encourage up-stream soil conservation on Aaron Creek
-

Notes:

The improvement should avoid using gabion baskets which could lead to long term erosion problems by increasing scour on the stream bottom and increasing velocity as water travels downstream.

Greenbag Rd Access Management Program**Ongoing**

Project # 12 Primary Travel Mode(s) Improved: All Modes

Evaluation Criteria Targeted: Safety, Mobility

Planning Level Cost
Estimation: non-capital cost

Identified Problems:

- Anticipated growth along the Greenbag Rd corridor necessitates means to maintain the safety, efficiency and functional integrity of Greenbag Rd as a minor arterial in the region.

Primary Purposes:

- Maintain safety
 - Maintain traffic flow
-

Program Scope and Concept:

-- Encourage land-use regulatory agencies to address access management during the site plan review process of proposed development occurring along Greenbag Rd.

Notes:

The actions of regulatory authorities in planning, reviewing, and approving land development can significantly impact the effectiveness of this corridor study. Staff and MPO staff are expected to coordinate with local land-use agencies to address the accessibility issue.

Based on ITE Transportation Impact Analyses for Site Development, it is recommended that criteria such as ones below should be implemented through the city and county planning process. MPO staff will work with relevant agencies to implement this program.

A transportation impact study is requested under one of the following conditions:

- Development will generate 1000 vehicle trips per day.
 - Development will generate 100 vehicle trips per peak hour.
 - A specified amount of acreage is being rezoned.
 - At judgment of staff, based on upon unusual circumstance.
-

Intersection Safety Monitor Program**Ongoing**

Project # 13 Primary Travel Mode(s) Improved: All Modes

Evaluation Criteria Targeted: Safety, Mobility

Planning Level Cost
Estimation: non-capital cost

Identified Problems:

- Some locations have higher crash frequency than others in the corridor

Primary Purposes:

- Improve safety
-

Program Scope and Concept:

-- MPO staff provide an annual report on crashes occurring on Greenbag Rd, to assess the need for further mitigation actions improving safety on Greenbag Rd in future conditions. Focused areas include following intersections

- MUB driveway/Greenbag Rd Intersection
 - Bluegrass Village/Greenbag Rd Intersection
 - Luckey Ln/Greenbag Rd Intersection
-

Notes:

Accidents data include pedestrian, bicyclists, as well as motor vehicles.

Non-motorized Transportation Improvements**Long Term**

Project 14 Primary Travel Mode(s) Improved: Ped. Bicycle Evaluation Criteria Targeted: Safety, Community

Planning Level Cost
Estimation: from
\$800,000 to \$850,000

Identified Problems:

- Unsafe travel conditions for pedestrians and bicyclists between Mississippi St and Dorsey Ave
 - Anticipated growth along the Greenbag Rd Corridor may increase future demand for alternative transportation facilities connecting school, residential, and shopping areas within the corridor.
-

Primary Purposes:

- Improve safety and mobility
-

Project Scope and Concept:

- Provide multi-use path (independent right-of-way) connecting following locations. (approximately 1.5 miles)
 - East Section: from Mississippi St to Dorsey Ave
 - Middle Section: from Dorsey Ave to Prairie Neighborhood
 - West Section: from Prairie Neighborhood to Brookstone Plaza
 - North Section: from Brookstone Plaza to Deckers Creek Blvd
 - provide a high intensity activated crosswalk (HAWK) at the intersection of multi-use path with Dorsey Ave and Mississippi St.
-

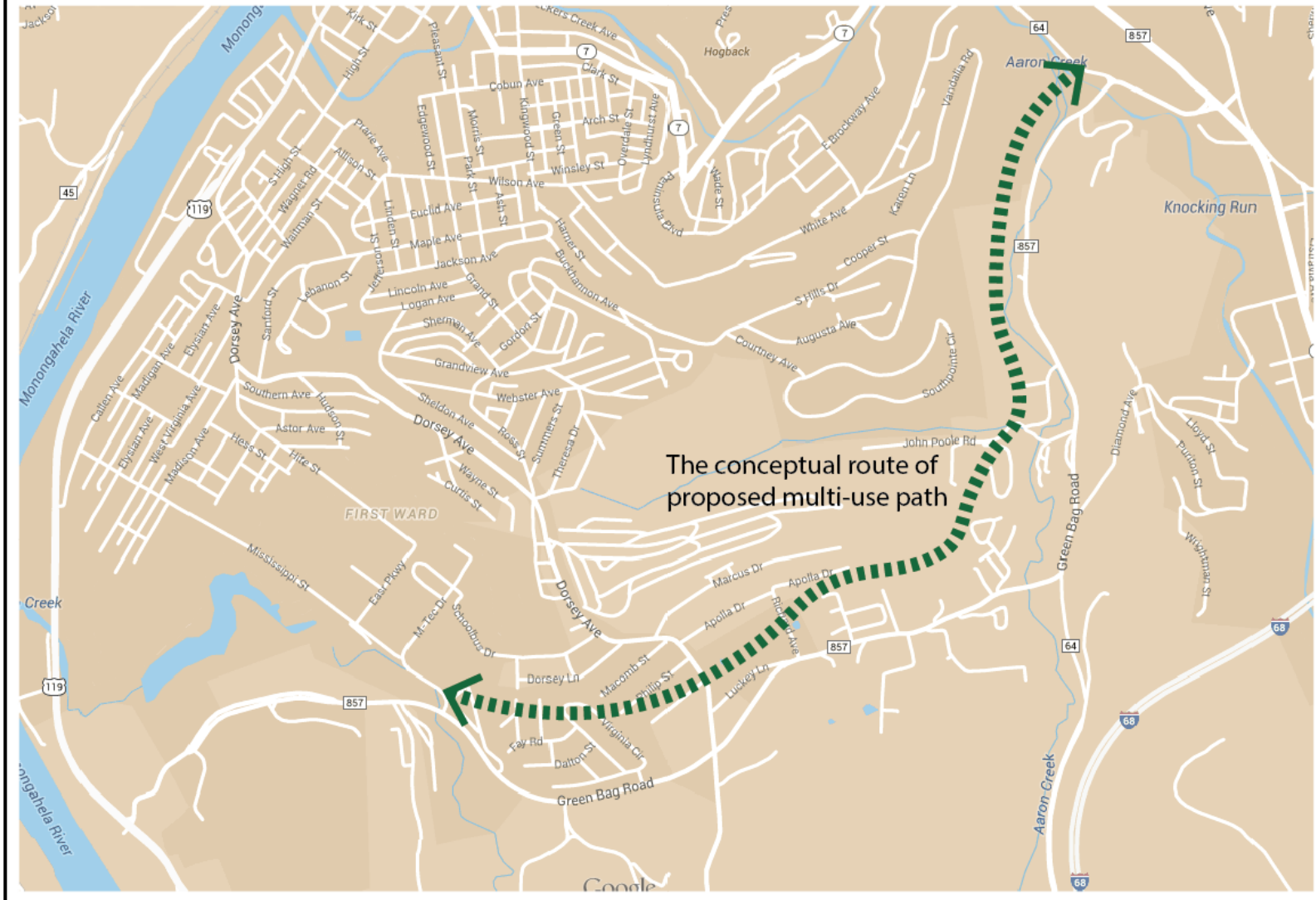
Notes:

Further study is recommended to identify potential routes and to evaluate feasibility and cost-effectiveness, as well as to estimate economic, social and environment benefits and impacts.

The conceptual route of the proposed multi-use path is illustrated on the map on the following page.

Greenbag Rd Corridor Study • Proposed Improvements

Project 14. Non-motorized Transportation Improvements



Roadway Long Term Improvements

Long Term

Project # 15 Primary Travel Mode(s) Improved: Auto Evaluation Criteria Targeted: Safety, Mobility

Planning Level Cost
Estimation: from 6 million to
10 million

Identified Problems:

- Anticipated growth along the Greenbag Rd corridor and the region necessitates a more efficient and safer Greenbag Rd.

Primary Purposes:

- Improve safety and mobility

Project Scope and Concept:

-- provide a two-way-left-turn-lane for entire length of Greenbag Rd (approximately 3.4 miles).

Notes:

Further study is recommended to estimate its economic, social and environment benefits and impact, and to develop alternative courses of action to address potential capacity and safety issues in future conditions.

Summary of Cost Estimation

Project #	Project		Est. Cost ¹	Methodology	Resource
1	US 119/Greenbag Rd Intersection improvements		\$2,000,000 to \$4,000,000	Analogy	WVDOH TIP Project: Patteson Dr +1 and University Ave Intersection Improvements. Estimated cost: \$1,780,000 (2012)
2	Multi-modal Transportation Improvements Between US 119 and Mississippi St On Greenbag Rd	Sidewalk (Concrete Sidewalk + Curb)	\$740,000 to \$800,000	-- \$230/Linear Foot (Maximum High Cost) -- Length: 3,186 feet	Costs for Pedestrian and Bicyclist Infrastructure Improvements-A Resource for Researchers, Engineers, Planners, and the General Public (prepared for FHWA by UNC Highway Safety Research Center)
		Crosswalk + Pedestrian signal	\$2,000 to \$4,000	-- \$770/Each Striped Crosswalk (Average Cost) -- \$800/Each Pedestrian Signal (Average Cost)	
		Bicycle Climbing Lane	Included in the Roadway (thoroughfare) Improvements.		
3	Mississippi St/Greenbag Rd Intersection Improvements		\$300,000 to \$400,000	Analogy	WVDOH TIP Project: WV 7 at CR 64 Turning Lane. Estimated cost: \$285,000 (2012)
4	Dorsey Ave/Greenbag Rd Intersection Improvements		\$1,100,000 to \$2,000,000	\$550,000/Each 11' turn lane (200' long)	MMMPO LRTP Cost Estimation for Urban Intersection Improvements. The rest of improvement cost are included in others relevant projects in this plan.
5	Lower Aarons Creek Rd/Greenbag Rd Intersection Improvements		\$300,000 to \$400,000	Analogy	MMMPO LRTP Cost Estimation for Intersection improvements on Stewart Street at Willowdale Rd, Protzman Street, and Chestnut Ridge Rd (additional right-of-way for geometric improvements). \$340,000 / Each Intersection
6	Diamond Ave/Greenbag Rd Intersection Improvements		\$300,000 to \$400,000	Analogy	
7	Deckers Creek Blvd & Greenbag Rd Intersection Improvements		\$600,000 to \$700,000	Analogy	Intersection improvements: MMMPO LRTP Cost Estimation for Intersection improvements on Stewart Street at Willowdale Rd, Protzman Street, and Chestnut Ridge Rd (additional right-of-way for geometric improvements). \$340,000 / Each Intersection Bridge improvements: WVDOH TIP Project: Wadestown W-Beam Bridge (0.05 mile): \$335,000 (2013)

¹ Cost estimation includes conceptual design, right-of-way acquisition, and construction. Cost are adjusted to 2014 dollar, using the CPI Inflation Calculator provided by the Bureau of Labor Statistics.

8	Greenbag Rd Roadway (thoroughfare) Improvements	\$6,000,000 to \$10,000,000	-- \$1,820,000/roadway widening -- \$1,478,400/utility relocation -- \$1,137,500/mic cost	MMMPO LRTP Cost Estimation. Greenbag Rd Roadway widening (entire length of Greenbag Rd)
9	Greenbag Rd Transit Waiting Condition Improvements	\$68,000 to \$88,000	-- \$12,000/Each shelter x 5 -- \$730/Bollard (Average Cost) x 10	Shelter cost estimation: Mountain Lane Transit Bollard cost estimation: Costs for Pedestrian and Bicyclist Infrastructure Improvements-A Resource for Researchers, Engineers, Planners, and the General Public (prepared for FHWA by UNC Highway Safety Research Center)
10	Greenbag Rd Signage Improvements	\$14,000 to \$24,000	-- \$300/Each sign (Average Cost) x 45	Costs for Pedestrian and Bicyclist Infrastructure Improvements (prepared for FHWA by UNC Highway Safety Research Center)
11	Aaron Creek Drainage Improvements	Cost estimation not available		
12	Greenbag Rd Access Management Program	This involves non-capital or operating budget investments of employee time to provide advocacy, manage programs, and other initiatives to coordinate with other agencies in implementing this program		
13	Safety Monitor Program			
14	Non-motorized Transportation Improvements	\$800,000 to \$850,000 (cost may significantly change, depending on route choice)	-- \$57,680/pedestrian hybrid beacon (HAWK) (average cost) x 2 -- \$481,140/mile of paved multi-use path(average cost) x 1.5	Costs for Pedestrian and Bicyclist Infrastructure Improvements-A Resource for Researchers, Engineers, Planners, and the General Public (prepared for FHWA by UNC Highway Safety Research Center)
15	Roadway Long Term Improvements	\$6,000,000 to \$10,000,000	Analogy	Based on Cost estimation of Project 9 in this plan

Cost Estimation Summary

	Estimated Cost	Notes
Cost of Short Term Improvements	\$10.4 million – 18.8 million	-- Capital cost only -- Do not include Aaron Creek Drainage Improvements
Cost of Long Term Improvements	\$6.8 million – 10.8 million	
Total Cost	\$ 17.2 million – 29.6 million	
Budgeted Cost in the LRTP for Greenbag Rd Improvements	\$15 million	