

WASHINGTON GROVE CONNECTOR AND CRABBS BRANCH WAY EXTENSION

PHASE I FACILITY PLANNING REPORT
MCDOT – DIVISION OF TRANSPORTATION ENGINEERING

October 2022

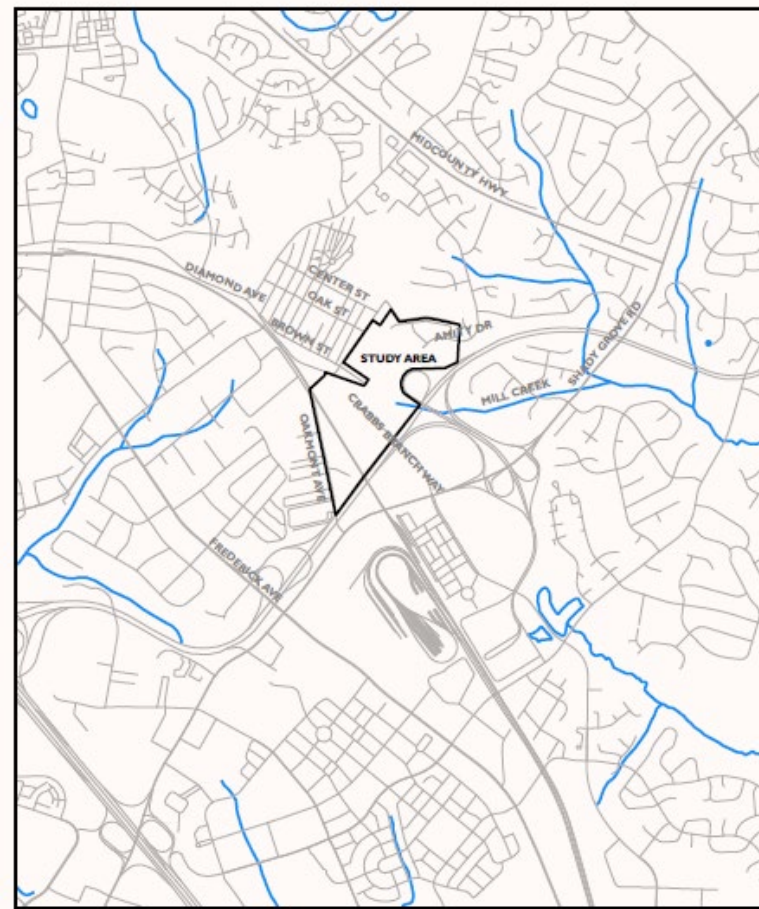


Table of Contents

| | | |
|--------|--|----|
| 1. | Executive Summary | 5 |
| 2. | Project Purpose | 5 |
| 3. | Feasibility Study Overview | 6 |
| 4. | Trail Connection Options and Impacts..... | 8 |
| 4.1 | <i>Alignment #1 - Railroad Street</i> | 8 |
| 4.2 | <i>Alignment #2 - Ridge Road</i> | 10 |
| 4.3 | <i>Alignment #3 - Brown Street</i> | 12 |
| 4.4 | <i>Alignment #4 – Picea View Court Connector</i> | 14 |
| 5. | Crabbs Branch Way Extension | 16 |
| 5.1 | <i>Crabbs Branch Way Extension</i> | 16 |
| 5.2 | <i>Crabbs Branch Way Trail</i> | 19 |
| 6. | Natural Environmental Features | 21 |
| 6.1 | <i>Groundwater and Soils</i> | 21 |
| 6.2 | <i>Watersheds and Wetlands</i> | 21 |
| 6.3 | <i>Floodplains</i> | 22 |
| 6.4 | <i>Forests and Parks</i> | 22 |
| 7. | Historical and Cultural Resources | 23 |
| 8. | Archeological Resources | 23 |
| 9. | Land Use | 23 |
| 10. | Utilities..... | 24 |
| 11. | Traffic Analysis | 24 |
| 11.1 | <i>Introduction</i> | 24 |
| 11.2 | <i>Existing Conditions</i> | 25 |
| 11.2.1 | <i>Analysis of Existing Conditions</i> | 25 |
| 11.2.2 | <i>Intersection Level of Service Standards and Thresholds</i> | 26 |
| 11.2.3 | <i>Capacity and Queue Analysis</i> | 26 |
| 11.3 | <i>2040 Total Conditions</i> | 28 |
| 11.3.1 | <i>2040 Traffic Forecast</i> | 28 |
| 11.3.2 | <i>No-Build Condition</i> | 30 |
| 11.3.3 | <i>Build Conditions- with Crabbs Branch Way Extension</i> | 32 |
| 11.3.4 | <i>Crabbs Branch Way- Rerouted Trips</i> | 32 |
| 11.3.5 | <i>Crabbs Branch Way Extension- Cut-Through Trips</i> | 33 |
| 11.3.6 | <i>Capacity and Queue Analysis (Crabbs Branch Way Extension)</i> | 33 |
| 11.4 | <i>Traffic Analysis Summary</i> | 35 |

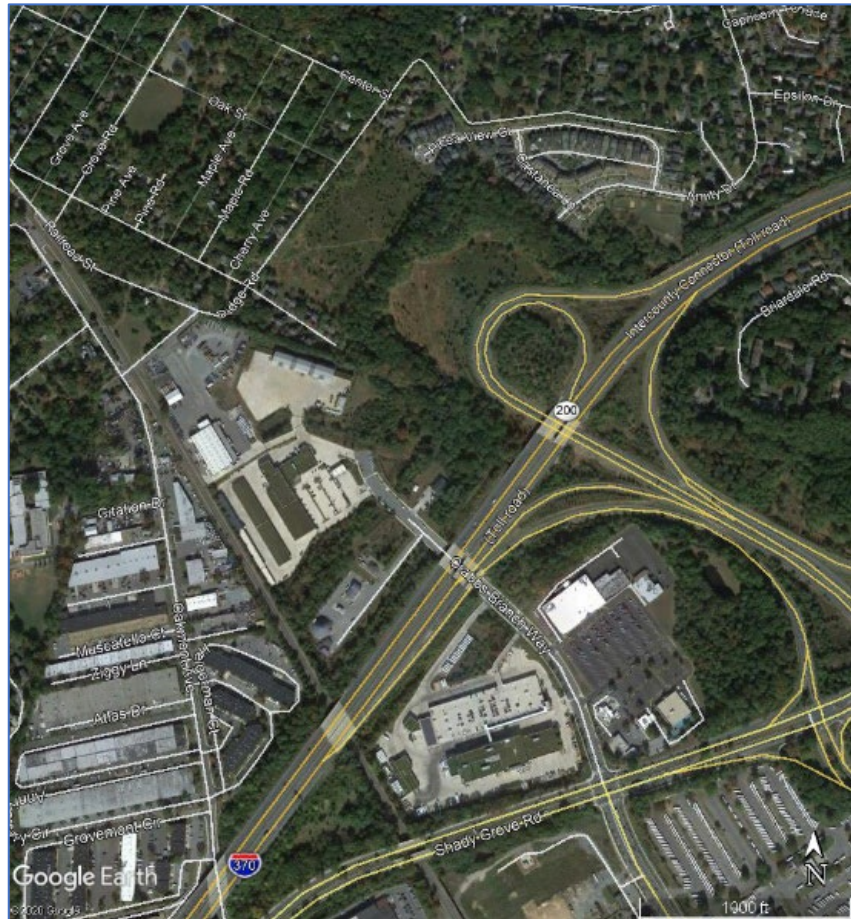
| | |
|--|-----------|
| 12. Public Input Summary | 37 |
| 12.1 Alignment #1- Railroad Street Survey Comments..... | 37 |
| 12.2 Alignment #2 – Ridge Road Survey Comments | 37 |
| 12.3 Alignment #3 – Brown St. Survey Comments..... | 37 |
| 12.4 Crabbs Branch Way Extension Survey Comments..... | 38 |
| 12.5 Trail Alternative Rating Chart..... | 38 |
| 13. Cost Estimate | 38 |
| 13.1 Construction Estimate | 38 |
| 13.2 Land Acquisition Estimate..... | 39 |
| 14. Conclusion | 39 |
| 14.1 Trail Options: | 39 |
| 14.2 Crabbs Branch Way Extension Option: | 39 |
| 15. List of Appendices and Exhibits | 41 |
| 15.1 Cost Estimates | |
| 15.2 Soil Types | |
| 15.3 Exhibit 1: Site Plan | |
| 15.4 Exhibit 2: Weekday AM/PM Peak Hour Volumes & Lane Configuration – Existing Conditions | |
| 15.5 Exhibit 3: Intersection Level of Service Standards and Thresholds | |
| 15.6 Exhibit 4: Weekday AM and PM Peak Hour Level of Service, Delay and Queue lengths – Existing Conditions | |
| 15.7 Exhibit 5: MDSHA Historic Traffic Data for Area Roadways | |
| 15.8 Exhibit 6: K-Factors and Year 2021 & Year 2040 ADT | |
| 15.9 Exhibit 7: Weekday AM/PM Peak Hour Volumes & Lane Configuration – Traffic Growth | |
| 15.10 Exhibit 8: Weekday AM/PM Peak Hour Volumes & Lane Configuration – 2040 No-Build Conditions | |
| 15.11 Exhibit 9: Weekday AM and PM Peak Hour Level of Service, Delay and Queue lengths – 2040 No-Build Conditions | |
| 15.12 Exhibit 10: Residential Trip Computation | |
| 15.13 Exhibit 11: Weekday AM/PM Peak Hour Trip Distribution to/From Amity Dr & Epsilon Dr | |
| 15.14 Exhibit 12: Weekday AM/PM Peak Hour Volumes & Lane Configuration – 2040 Build Conditions (Rerouted Trips) | |
| 15.15 Exhibit 13: Weekday AM/PM Peak Hour Volumes & Lane Configuration – 2040 Build Conditions (Estimated Cut-Through Traffic Volumes on Amity Dr) | |

| | |
|--|------------|
| 15.16 Exhibit 14: Weekday AM/PM Peak Hour Volumes & Lane Configuration – 2040 Build Conditions (Crabbs Branch Way Extension) | |
| 15.17 Exhibit 15: Weekday AM and PM Peak Hour Level of Service, Delay and Queue lengths – 2040 Build Conditions (with Crabbs Branch Way Extension) | |
| 15.18 Exhibit 16: Key Comparative Differences- 2040 No-Build and Build Conditions | |
| 15.19 APPENDIX A: TRAFFIC COUNT DATA | |
| 15.20 APPENDIX B: EXISTING CONDITIONS (SYNCHRO OUTPUT SHEETS) | |
| 15.21 APPENDIX C: M-NCPPC MODEL OUTPUT SHEETS | |
| 15.22 APPENDIX D: 2040 NO-BUILD CONDITIONS (SYNCHRO OUTPUT SHEETS) | |
| 15.23 APPENDIX E: 2040 BUILD CONDITIONS - CRABBS BRANCH WAY EXTENSION (SYNCHRO OUTPUT SHEETS) | |
| 15.24 Appendix Map A | |
| 15.25 Montgomery County Parks, Preliminary Archeological Review Form | |
| 15.26 Land Acquisition Agreement Deed | |
| 15.27 Town Washington Grove, Historic Preservation Report by Robinson & Associates, Inc | |
| 15.28 National Registration of Historic Places Form41 | |
| 16. List of Figures | 399 |
| 16.1 Forest Conservation Areas and Parks | |
| 16.2 Soils Map | |
| 16.3 Environmental Features | |
| 16.4 Zoning | |
| 16.5 Land Use | |
| 17. Reference and Sources | 405 |

1. Executive Summary

The Washington Grove Connector is a master planned bicycle and pedestrian trail connection from Crabbs Branch Way to the Town of Washington Grove and Amity Drive in Montgomery County, Md. The study area is bounded byⁱ. The Park is bounded by Ridge Road to the west, residential subdivisions to the north, Crabbs Branch Way to the south, and Route 370 ramps to the east.

The Crabbs Branch Way Extension (to Amity Drive) was identified in the 2006 Shady Grove Sector Master Planⁱⁱ, as a road connection to Amity Drive with an accompanying bicycle and pedestrian path running alongside. This extension would link to the Washington Grove Connector.



The proposed neighborhood connector extension alignment was proposed to run east of Washington Grove Conservation Park and contains sensitive wetlands, forests, and cultural resources. The topography of the site is such that water drains across the site in an easterly direction. Therefore, drainage amenities along the trail or raised wooden trails would be required to prevent ponding of water along the trail. This would result in hydrological impacts to the existing wetland and forest areas. The environmental impacts on the forests, wetland, floodplain and archeological by the proposed trails are quantified Section 4.

Based on community inputs, four trail alignments for the Washington Grove Connector and the Crabbs Branch Way Extension were studied and are presented in this report. These alignments along the western boundary of the park are designed to minimize the environmental impact of the trail project to the forest conservation areas, wetland, and streams, which are detailed under the Trail Alternatives Section in this report.

2. Project Purpose

The purpose of Phase I Feasibility Study is to study potential connection alignments that address community needs for a direct pedestrian and bicycle link between the end of Crabbs Branch Way (on the east) and Town of Washington Grove (on the west), including adjoining communities while minimizing potential impacts to the natural and man-made environment. Also included in this

Report is the Crabbs Branch Way Extension (to Amity Drive) and the corresponding Master Planned Trail Connector that runs parallel to the road.

The layouts of the potential trail connections included in the Report, graphically super imposed on-site plans will guide stakeholders to understand the pros and cons of different alternative alignments.

3. Feasibility Study Overview

Montgomery County Department of Transportation (MCDOT) commenced with a Phase I Facility Planning Study in February 2020 to address community needs for connection between the Town of Washington Grove and residential neighborhoods around Amity Drive Neighborhood Park located west of Shady Grove Road and primarily commercial areas and metro rail transport hub east of shady Grove Road.

After the initial public meeting, the community identified three connections from Crabbs Branch Way to the Town of Washington Grove. These connections included Ridge Road, Railroad Street, and Brown Street. A fourth connection between Picea View Court and Ridge Road was also identified. All of these alignments were analyzed from a cost, environmental impact, and feasibility perspective.

This Report discusses the pros and cons of trail alignments and the potential impacts to existing natural and environmental conditions. The Feasibility study is based upon County GIS mapping and any existing natural and man-made environmental data, including historical and archeological information compiled from available sources. From the project outset “only visual review of the site was performed” during the development of this report.

The limits of the study area are bounded by Amity Drive on the north, Railroad Street/Ridge Road on the west, I-370 ramps on the east, and Crabbs Branch way on the south, which is the beginning point to all connections west and north. Bounded within these limits is the park reserve, the wetlands and streams that need to be considered to attain the trail connections.

As part of the analysis to identify potential viable trail connections, four (4) alternatives were considered, including the alignment depicted in the Master Plan running parallel to the Crabbs Branch Way Extension.

All Trail Connections considered have the following common features:

- Southerly end point is the existing sidewalks on Crabbs Branch Way.
- Paving will either be pervious/impervious asphalt or concrete over the drylands.
- Elevated wooden structure with railings will be used for stream and wetland crossings.
- Clear paved trail width is 10 feet with 2-foot shoulders on each side.
- This project will include pedestrian and bike alignments only. Trailhead design will be included in the final design.
- No improvements are considered at all trails start and end points- Crabbs Branch Way, Ridge Road, Brown Street and Ridge Road/Railroad Street.

This project will analyze four trail options:

- Alignment 1: Crabbs Branch Way to Railroad Street
- Alignment 2- Crabbs Branch Way to Ridge Road
- Alignment 3- Crabbs Branch Way to Brown Street
- Alignment 4- Ridge Road to Picea View Court

4. Trail Connection Options and Impacts

4.1 Alignment #1 - Railroad Street

This connection proceeds north from the starting point at Crabbs Branch Way, crosses an existing stream and wetland within the park reserve. It then heads towards Ridge Road/Railroad Street intersection area along Washington Suburban Sanitary Commission (WSSC) easement (west) located between salt storage area and residential neighborhoods.

Impacts include:

- Stream crossings, including 100-year floodplain- Minimal, one crossing near Crabbs Branch Way and associated Floodplain.
- Forest- Minimal, near the east end of Brown Street.
- Wetlands- none
- Land Acquisition– Significant, this Alignment requires acquisition of property from Robert's Oxygen.
- Unsightly as trail would be located between the salt storage area and residential neighborhoods.

Environmental Impacts of Alignment #1 are listed below: total length of trail = 1,425 feet (approx.)

| Impact | Length (LF) | Area (SF) | Remarks |
|---------------------|-------------|-----------|--|
| 100-year Floodplain | 100 | 1,400 | 14-foot width, 10-foot plus 2-foot shoulders |
| Forest | 135 | 3,250 | 24-foot width to LOD |
| Wetland | na | | none |
| ROW/Easement | 285 | 3,990 | 14-foot width |



LEGEND

- TRAIL 1B CENTER LINE
- - - TRAIL 1B SHOULDER LINE
- LOD TRAIL 1B LIMIT OF DISTURBANCE
- TRAIL 1B AREA
- LIMIT OF STUDY
- WETLAND AREA
- CONSERVATION EASEMENT
- - - SANITARY SEWER
- PARCEL LINE / ROW
- 500 CONTOURS

| | | |
|--|-------------------|-----------|
| MONTGOMERY COUNTY DEPARTMENT OF TRANSPORTATION | | |
| WASHINGTON CONECTOR / CRABBS BRANCH WAY OPTION 1 PROPOSED TRAIL | | |
| Date March 2022 | SCALE : 1" = 100' | Sheet No. |

4.2 Alignment #2 - Ridge Road

This connection proceeds north from the starting point at Crabbs Branch Way, and within the park reserve crosses an existing stream and wetland and stays on a northerly alignment past the WSSC easement and a Storm Water Management (SWM) pond (located at the east end of Brown Street). It then makes a sharp turn heading west to its ending point at Ridge Road, behind residential developments located on the north side of Brown Street.

Impacts include:

- Stream crossings, including 100-year floodplain- Minimal, one crossing near Crabbs Branch Way and associated Floodplain.
- Forest- Moderate, near the east end and north of Brown Street.
- Wetlands- none
- Land Acquisition – Moderate, at Town of Washington Grove and Maryland- National Capital Park property north and east of the salt storage area

Environmental impacts of Alignment #2 are listed below: total length of trail = 1,380 feet (approx.)

| Impact | Length (LF) | Area (SF) | Remarks |
|---------------------|------------------------|----------------------|--|
| 100-year Floodplain | 150 | 2,100 | 14-foot width, 10-foot plus 2-foot shoulders |
| Forest | 350 | 4,900 | 24-foot width to LOD |
| Wetland | na | | none |
| ROW/Easement | 780 | 10,920 | 14-foot width |



LEGEND

- - - TRAIL CENTER LINE
- - - TRAIL SHOULDER LINE
- - - LOD
- - - TRAIL LIMIT OF DISTURBANCE
- TRAIL AREA
- LIMIT OF STUDY
- WETLAND AREA
- - - CONSERVATION EASEMENT
- - - SANITARY SEWER
- - - PARCEL LINE / ROW
- - - 500 CONTOURS

| | |
|--|-----------|
| MONTGOMERY COUNTY DEPARTMENT OF TRANSPORTATION | |
| WASHINGTON CONECTOR / CRABBS BRANCH WAY OPTION 2 PROPOSED TRAIL | |
| Date 3/30/22 | 1" = 100' |

4.3 Alignment #3 - Brown Street

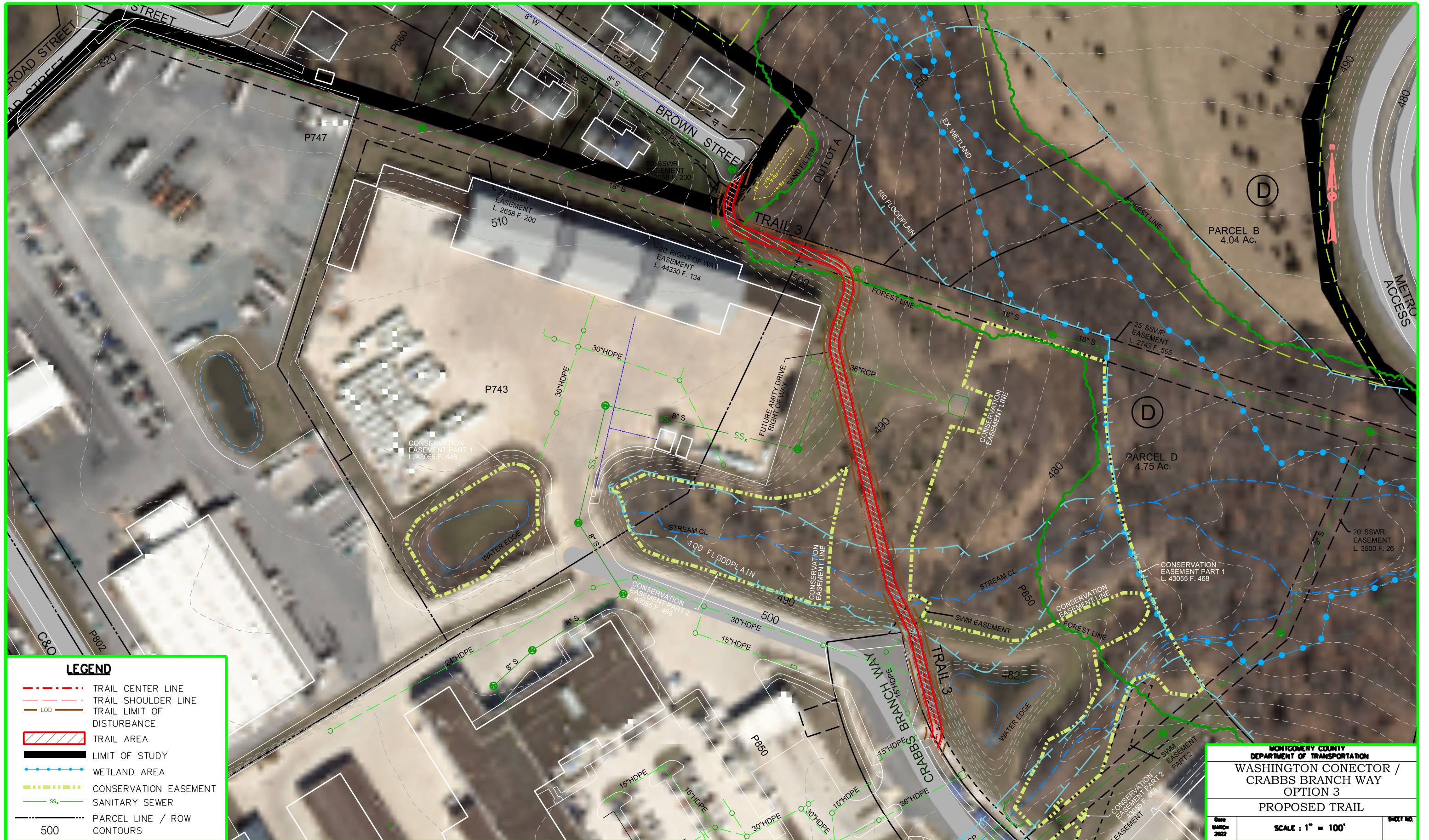
This connection proceeds north from the starting point at Crabbs Branch Way, crosses an existing stream and wetland, and continues north past WSSC easement and then makes a sharp turn west prior to a SWM pond (located at the east end of Brown Street) to its end point at Brown Street.

Impacts include:

- Stream crossings, including 100-year floodplain- Minimal, one crossing near Crabbs Branch Way and associated Floodplain.
- Forest- Minimal, near the east end of Brown Street.
- Wetlands- none
- Land Acquisition – Minimal, at Town of Washington Grove property north of the salt storage area at the end of Brown Street.

The environmental impacts of Alignment #3 are listed below: total length of trail = 750 feet (approx.)

| Impact | Length (LF) | Area (SF) | Remarks |
|---------------------|------------------------|----------------------|---|
| 100-year Floodplain | 100 | 1,400 | 14-foot width 10-foot plus 2-foot shoulders |
| Forest | 135 | 3,240 | 24-foot width to LOD |
| Wetland | na | | none |
| ROW/ Easement | 40 | 560 | 14-foot width 10-foot plus 2-foot shoulders |



LEGEND

- - - - - TRAIL CENTER LINE
- - - - - TRAIL SHOULDER LINE
- - - - - LOD
- - - - - TRAIL LIMIT OF DISTURBANCE
- TRAIL AREA
- LIMIT OF STUDY
- - - - - WETLAND AREA
- - - - - CONSERVATION EASEMENT
- - - - - SANITARY SEWER
- - - - - PARCEL LINE / ROW
- - - - - CONTOURS

| | | |
|--|-------------------|-----------|
| MONTGOMERY COUNTY DEPARTMENT OF TRANSPORTATION | | |
| WASHINGTON CONECTOR / CRABBS BRANCH WAY OPTION 3 PROPOSED TRAIL | | |
| Date 1/20/22 | SCALE : 1" = 100' | SHEET NO. |

4.4 Alignment #4 – Picea View Court Connector

This connection proceeds north from the starting point at Picea View Court/Castanea Lane sidewalk crossing Picea View Court to the sidewalk to the north.

Impacts include

- Stream crossings and Floodplain- none
- Forest- none
- Wetlands- none
- Land Acquisition – minimal, at Shady Grove Crossing HOA property between Picea View Court and Ridge Road.

Approximate length of trail = 130 feet.

| Impact | Length (LF) | Area (SF) | Remarks |
|---------------------|--------------------|------------------|---|
| 100-year Floodplain | na | | |
| Forest | na | | |
| Wetland | na | | |
| ROW/ Easement | 85 | 1,190 | 14-foot width 10-foot plus 2-foot shoulders |



LEGEND

- - - - - TRAIL CENTER LINE
- - - - - TRAIL SHOULDER LINE
- - - - - LOD - - - - - TRAIL LIMIT OF DISTURBANCE
- TRAIL AREA
- LIMIT OF STUDY
- - - - - WETLAND AREA
- - - - - CONSERVATION EASEMENT
- - - - - SS_x SANITARY SEWER
- - - - - PARCEL LINE / ROW
- 500 CONTOURS

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
WASHINGTON CONECTOR /
CRABBS BRANCH WAY
PICEA RIDGE CONNECTOR
 Date: MARCH 2022
 SCALE: 1" = 100'

5. Crabbs Branch Way Extension

5.1 Crabbs Branch Way Extension

Under the Master Planned Road connection, a two-lane extension will be provided from Crabbs Branch Way to Amity Drive. The road will assume 2-10.5-foot-wide lanes with 6-foot buffers, a 10-foot bike path and 6-foot sidewalk.

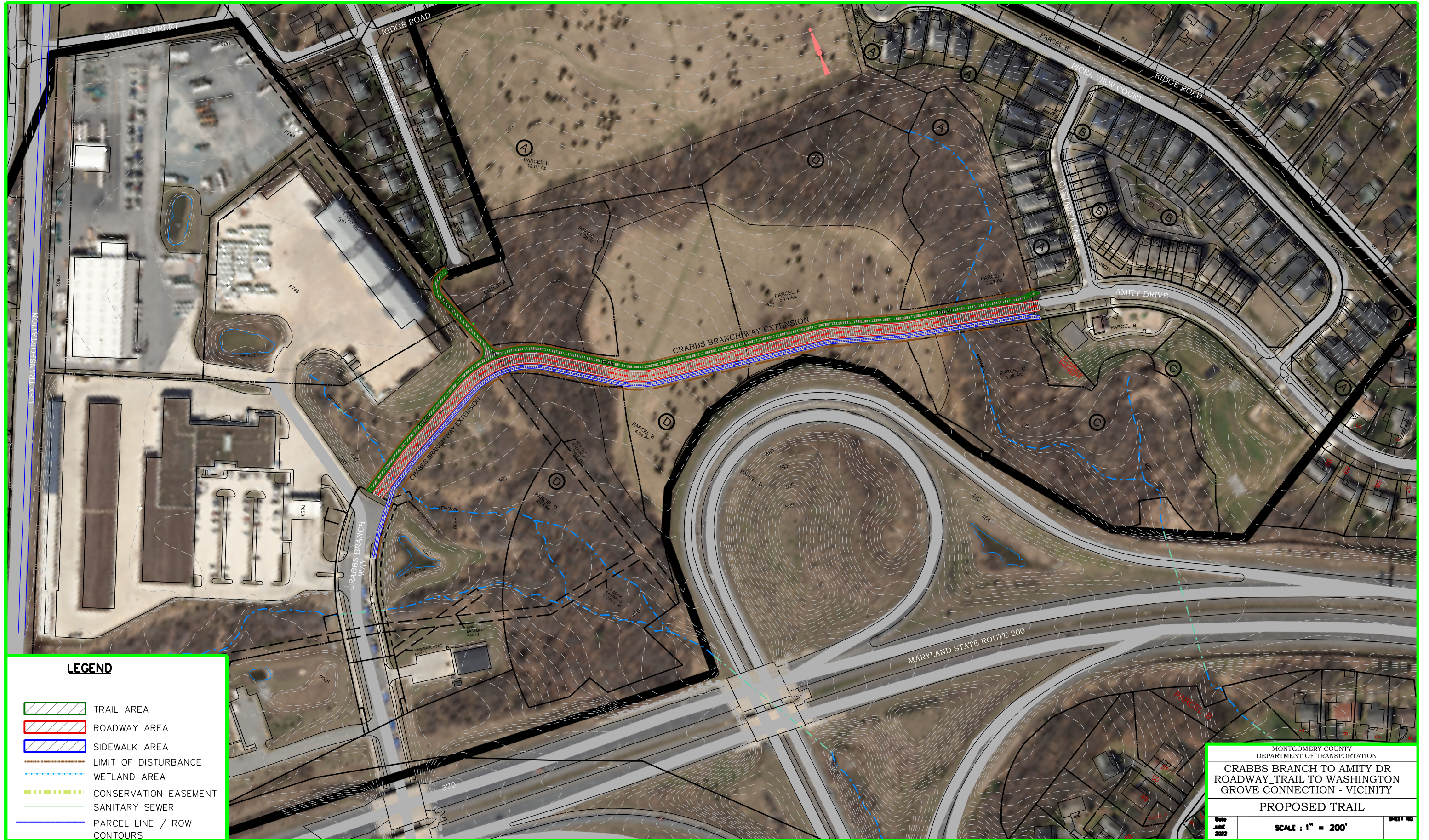
The Crabbs Branch Way Extension connection proceeds north from the starting point at Crabbs Branch Way, crosses an existing stream and wetland, and continues north past WSSC easement and continues north to Amity Drive.

Impacts include

- Stream crossings- Minimal, two crossings (one near Crabbs Branch Way and one near Amity Drive).
- Environmental Buffer- Moderate, at end of Amity Drive
- Floodplain- Significant, 2 areas along the road length
- Forest- Moderate, 2 areas along the road length
- Wetlands- Moderate, one wetland crossing approximately 75 feet long x 50 feet wide
- Land Acquisition – Significant, at Town of Washington Grove and Maryland- National Capital Park property between Crabbs Branch Way and Amity Drive and the trail to Brown Street.

The environmental impacts of Crabbs Branch Way Extension are listed below: total length of trail = 1,650 feet (approx.)

| Impact | Length (LF) | Area (SF) | Remarks |
|----------------------|-------------|-----------|---|
| 100-year Floodplain | 350 | 17,500 | 50-foot width, 2ea-10.5ft lanes with 2ea-6ft buffers, 10ft bike lane and 6ft sidewalk |
| Environmental Buffer | 270 | 13,500 | 50-foot width |
| Forest | 475 | 35,625 | 75-foot width to LOD |
| Wetland | 75 | 3,750 | 50-foot width |
| ROW/ Easement | 1,230 | 61,500 | 50-foot width + 14-foot trail |

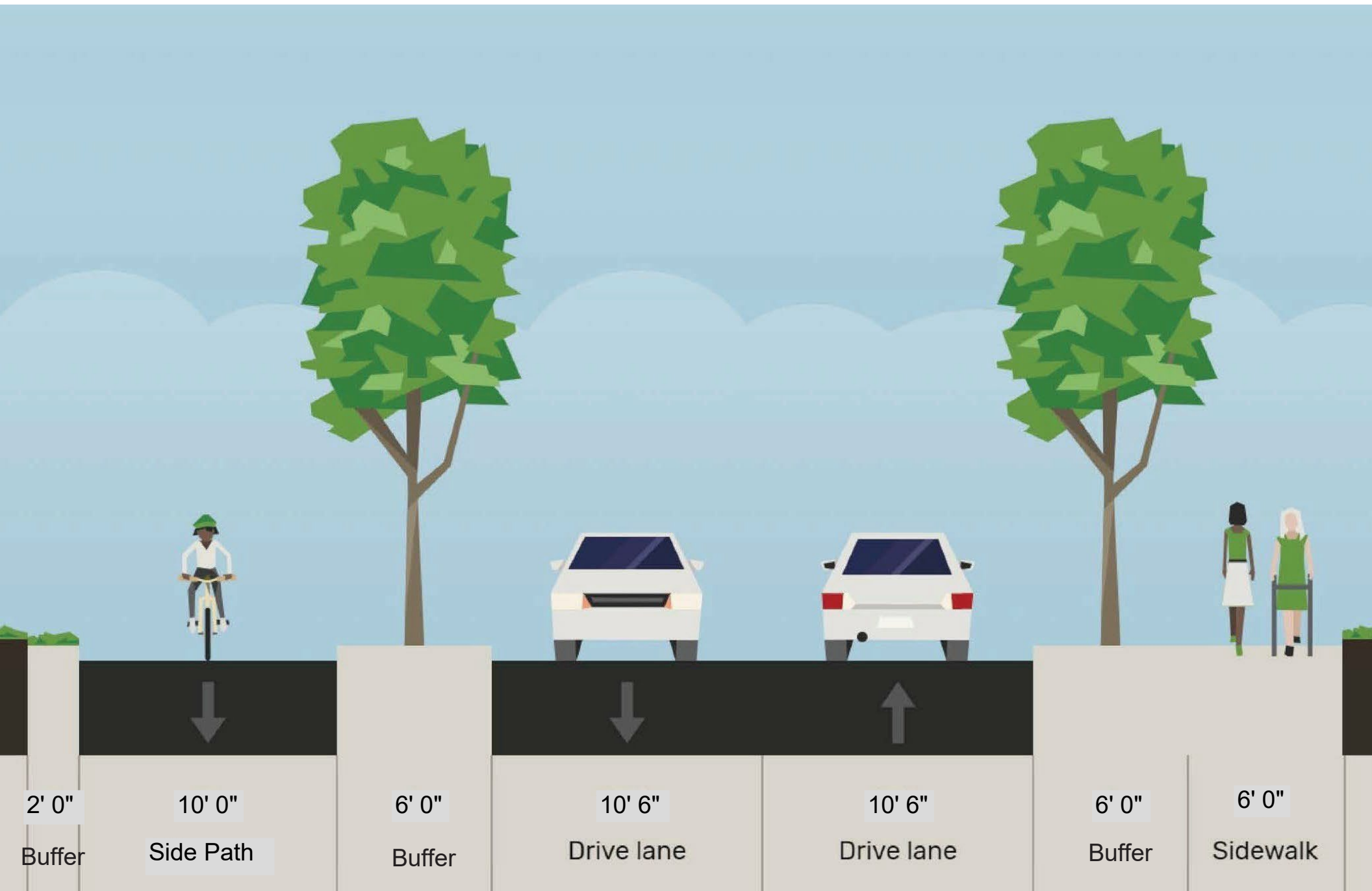


LEGEND

- TRAIL AREA
- ROADWAY AREA
- SIDEWALK AREA
- LIMIT OF DISTURBANCE
- WETLAND AREA
- CONSERVATION EASEMENT
- SANITARY SEWER
- PARCEL LINE / ROW
- CONTOURS

| | | |
|--|--------------------------|-----------|
| MONTGOMERY COUNTY DEPARTMENT OF TRANSPORTATION | | |
| CRABBS BRANCH TO AMITY DR ROADWAY TRAIL TO WASHINGTON GROVE CONNECTION - VICINITY | | |
| PROPOSED TRAIL | | |
| Date APR 2022 | SCALE : 1" = 200' | SHEET NO. |

Road and Trails Cross Section



5.2 **Crabbs Branch Way Trail**

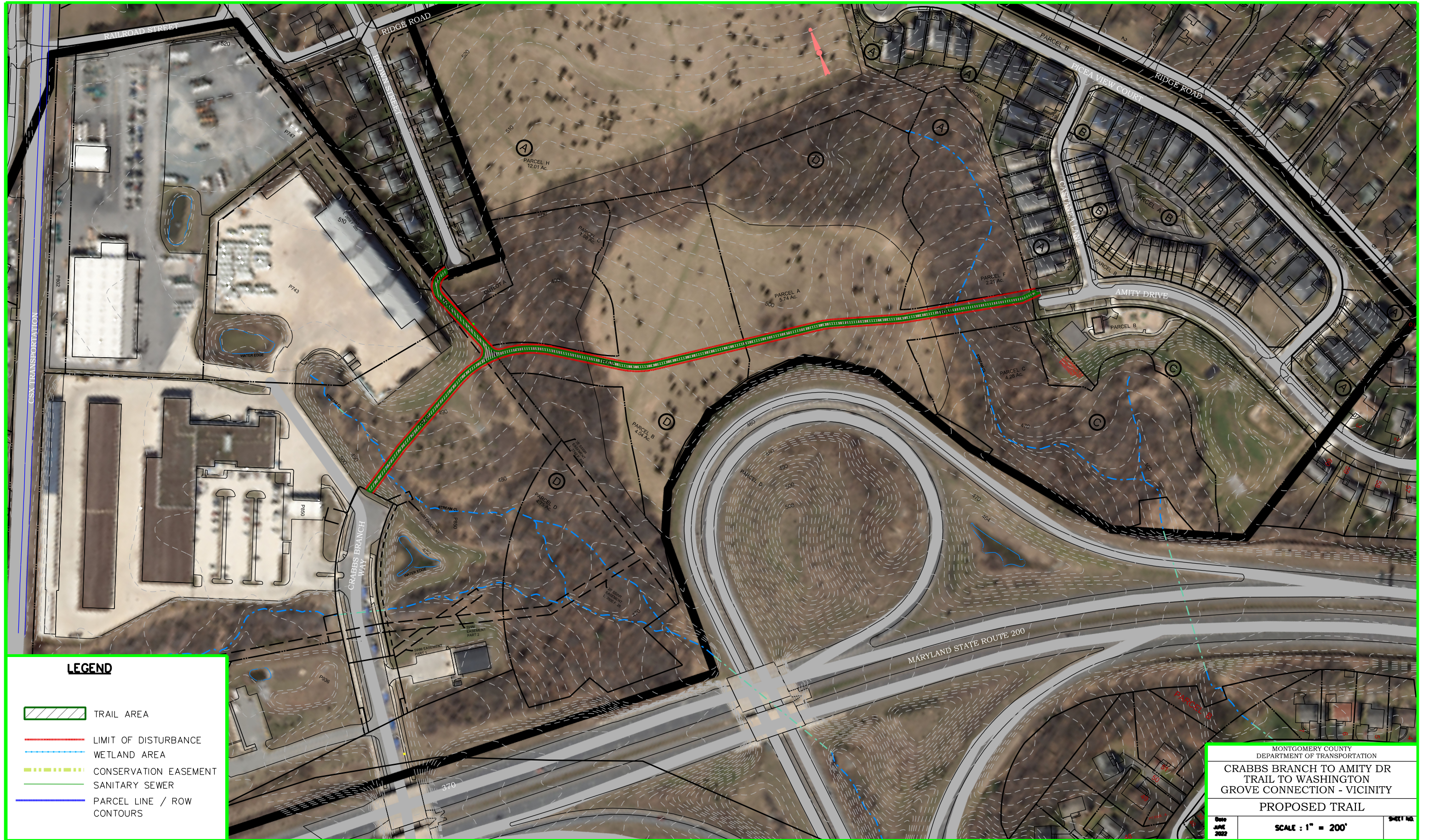
Under the Master Plan Option, trail connections will be provided from Crabbs Branch Way to Amity Drive.

The Crabbs Branch Way to Amity Drive trail will run parallel to the Crabbs Branch Way Extension. This trail alignment could be constructed prior to the construction of the Crabbs Branch Way Connector.

Impacts include

- Stream crossings- Minimal, two crossings (one near Crabbs Branch Way and one near Amity Drive).
- Environmental Buffer- Minimal, at end of Amity Drive
- Floodplain- Minimal, 2 areas along the road length
- Forest- Moderate, 2 areas along the road length
- Wetlands- Minimal, one wetlands crossing approximately 75 feet long x 15 feet wide
- Land Acquisition – Significant, at Town of Washington Grove and Maryland- National Capital Park property between Crabbs Branch Way and Amity Drive and the trail to Brown Street.
- The environmental impacts of Crabbs Branch Way Extension are listed below: total length of trail = 1,650 feet (approx.)

| Impact | Length (LF) | Area (SF) | Remarks |
|----------------------|------------------------|----------------------|---|
| 100-year Floodplain | 350 | 4,900 | 14-foot width 10-foot plus 2-foot shoulders |
| Environmental Buffer | 135 | 1,890 | 14-foot width to LOD |
| Forest | 475 | 11,400 | 24-foot width to LOD |
| Wetland | 75 | 1,050 | 14-foot width |
| ROW/ Easement | 1,230 | 17,220 | 14-foot width |



LEGEND

- TRAIL AREA
- LIMIT OF DISTURBANCE
- WETLAND AREA
- CONSERVATION EASEMENT
- SANITARY SEWER
- PARCEL LINE / ROW
- CONTOURS

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION

**CRABBS BRANCH TO AMITY DR
TRAIL TO WASHINGTON
GROVE CONNECTION - VICINITY**

PROPOSED TRAIL

| | | |
|----------------------|-------------------|-----------|
| Date JUNE 2022 | SCALE : 1" = 200' | SHEET NO. |
|----------------------|-------------------|-----------|

6. Natural Environmental Features

6.1 Groundwater and Soils

The Groundwater Atlas of the United States, Delaware, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, West Virginia (USGS, 1997) indicates the geology of the study area is located within the Piedmont Physiographic Province, which is underlain by dense, highly impermeable bedrock. The topography is comprised of low, rolling hills and subdued topography. The impermeable bedrock is crystalline rock and undifferentiated sedimentary-rock aquifers. Recharge within the Piedmont Province takes place primarily in interstream areas via precipitation and moves laterally and discharges to a stream or depression ⁱⁱ.

Soil information in the study area was collected from the USDA Web Soil Survey and is indicated on the Soils Map (Figure 3). Nine different soil types were identified within the study area:

Table 1: Soil Types

| Soil Type | Percent Slope |
|-----------------------------------|------------------------|
| Gaila silt loam (1B) | 3 to 8 percent slopes |
| Gaila silt loam (1C) | 8 to 15 percent slopes |
| Glenelg silt loam (2B) | 3 to 8 percent slopes |
| Baile silt loam (6A) | 0 to 3 percent slopes |
| Neshaminy silt loam (27B) | 3 to 8 percent slopes |
| Chrome and Conowingo soils (35B) | 3 to 8 percent slopes |
| Travilah silt loam (37B) | 3 to 8 percent slopes |
| Wheaton-Urban land complex (66UB) | 0 to 8 percent slopes |
| Urban land (400) | NA |

The majority of the study area is comprised of 2A - Glenelg silt loam, 3 to 8 percent slopes (2B). The wetland areas are primarily characterized as 6A - Baile silt loam, 0 to 3 percent slopes (6A). The Gaila silt loam and the Wheaton-Urban land complex soils are listed as hydric soils per the "Hydric Soils of the United States ⁱⁱⁱ." Hydric soils are formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Most the soils in the study area are well draining with the exception of the urban land soils in the southern portion of the study area.

6.2 Watersheds and Wetlands

The study area drains to an unnamed tributary of Mill Creek. Mill Creek is located within the Upper Rock Creek sub-watershed which flows into Rock Creek and eventually into the Potomac River. The entire study area is located within the Mill Creek watershed which is identified as a Class Use IV - Recreational Trout Waters ^{iv}.

The station at Mill Creek was sampled in 2012 by Montgomery County and was observed to be in Fair Condition. Fair condition watersheds are impacted by androgenic stressors and major agricultural development. The streams still support biological communities and are comprised of species which can survive most conditions. However, sensitive species are less common due to the high anthropogenic impacts^v. Wetlands designated by Maryland DNR are located within the study area. Unnamed tributaries run easterly across the park reserve with additional wetland areas designated along the northern boundary of the park (see Environmental Feature Map - Figure 4).

Potential habitat for Forest Interior Dwelling Species (FIDS) exists within the conservation area. These areas have not been field test or field verified. The area is designated for the purposes of planning and analysis only. FIDS require habitat conditions in the interior of forests for optimal reproduction and survival^{vi}. The same area is designated as Tier 5 – Significant for Biodiversity Conservation under BioNet which is a digital map tool developed for prioritizing areas for terrestrial and freshwater biodiversity conservation. Tier 5 BioNet areas are significant to conserve for maintenance of habitat according to Maryland Department of Natural Resources website.ⁱⁱ No known sensitive species have been identified within the study area.

6.3 Floodplains

The one hundred floodplain is mapped at the site according to a Natural Resources Inventory and Forest Stand Delineation conducted in 2001 for the Piedmont Crossing Development plans. The 100-year floodplain is not mapped by FEMA nor is it recorded on the County plats. However, the FSD report from the Piedmont Crossing development plans states disturbance to this area would require joint permitting through the US Army Corp of Engineers and MD DNR. Impact to the floodplain for the proposed alternatives has been minimized to maximum extent possible.

6.4 Forests and Parks

The forests within the parks are Category 1 easements which are considered the most protective easement type which prohibits clearing of any tree, bush, or vegetation. A forest stand delineation was conducted in 2001 as part of the development approvals for the northern subdivision development at Piedmont Crossing which was formerly known as the Casey Property at Mill Creek. The report indicates there are 6 forest stands, totaling 29.21 acres. The FSD found there are some stands of high quality due to the age, species diversity, large caliper trees, moderately steep slopes, and location adjacency to stream and wetlands. It was recommended that these areas be preserved. The other forest stands were of low priority however still provide benefit to wildlife habitat.

The Forest Conservation Easement and Parks Map (Figure 6) indicates the areas of Washington Grove Conservation Park and Piedmont Crossing that are dedicated as parks and forest conservation. Washington Grove Conservation Park was deeded to the Town of Washington Grove in 2010. The municipal limits to the town could include the open space in the future^{viii}. It is categorized as Legacy Open Space (LOS) – Natural Area and contains 12.0112 acres of land^{ix}. The Park meadow is currently maintained by the M-NCPPC.

Piedmont Crossing Local Park was also deeded to MNCPPC in 2010. The county mapped forest conservation areas and park area exclude portions of the formerly proposed right-of-way for the Amity Drive – Crabbs Branch Way Extension within the Piedmont Crossing Local Park as indicated in the Forest Conservation and Parks Map.

There are several trails mapped within the Washington Grove Conservation Park and the Piedmont Crossing Local Park. These trails are mapped under the Park Information data set of the Montgomery County Atlas website (see Appendix 15.24).

7. Historical and Cultural Resources

Located adjacent to the Washington Grove Conservation Park is Washington Grove Historic District, a 200-acre incorporated town within its own forest preserve. The woodlands consist of two tracts East Woods and West Woods which are 45 acres and 47 acres respectively ^x. The town served as a religious camp retreat for several Methodist Church retreats in the 1870s and is recognized for its cottage style architecture and well-guarded forest landscape ^{xi}. A portion of the property of the Washington Grove Conservation Park meets the Heritage Resources criteria due to its importance as a rural setting for the Town of Washington Grove. 13 acres of meadow were dedicated as a “Heritage Resource” to the 2001 M-NCPPC Legacy Open Space Master Plan ^{xii}.

No known cultural or historical resources are mapped within the study area. According to a presentation given by M-NCPPC in 2012 on park planning for the WGCP however, a prehistoric steatite mine located within the park may have historical significance. The M-NCPPC recommended queuing the site for researching archeological artifacts of the mine. However, it is unknown if the research had been conducted since then as there are no mapped historical resources within the park. (See Appendices: 15.25 Montgomery County Parks, Preliminary Archeological Review Form, 15.26 Land Acquisition Agreement Deed, 15.27 Town Washington Grove, Historic Preservation Report by Robinson & Associates, Inc., and 15.28 National Registration of Historic Places Form)

8. Archeological Resources

Part of the project site, particularly the area located from Picea View Court on the west to I-370 ramps on the east and extending 200 feet to the south Amity Drive is located potentially within a High Potential Prehistoric Zone.

This area primarily impacts the Master Plan Alignment connecting with Amity Drive. However, it is recommended that archaeological testing needs to be conducted during the next phase of study, Facility Planning Phase II to establish impacts from the preferred alternatives connecting Crabbs Branch Way with Ridge Road, Rail Road Street Brown Street. (See Appendix: 15.25 Montgomery County Parks, Preliminary Archeological Review Form)

9. Land Use

The study area is comprised of three areas zoned as Moderate Industrial (IM), Employment Office (EOF), and Residential (R-90) (see Zoning and Land Use Maps – Figure 5 and Figure 6). Subdivisions with residential lots are located to the north, east and west. Interstate 370 is located along the southern boundary of the study area. The area within the Washington Grove Conservation Park (WGCP) and Piedmont Crossing is also zoned as Residential. The Moderate Industrial zoning area is comprised of auto dealership services, warehouses and building supplies ^{xiii}. The adjacent Employment Office zone includes an operations facility for the Maryland Transportation Authority.

TABLE 2: ZONING TYPES IN STUDY AREA

| Zoning Type | Description |
|--|---|
| Moderate Industrial (IM) | The IM zone is intended to provide land for industrial activities where major transportation links are not typically necessary and noise, dust, vibration, glare, odors, and other adverse environmental impacts are usually minimal. |
| Employment Office (EOF-0.5 and EOF-0.75) | The EOF zone is intended for office and employment activity combined with limited residential and neighborhood commercial uses. Building |
| Residential (R-90) | The R-90 Zone results in medium density residential neighborhoods. Properties zoned R-90 are typically found in down-County areas away from transportation hubs. |

The study area is comprised of a variety of land uses including single family attached and single-family detached homes, open space and recreation at the Amity Drive neighborhood, and research and development, retail, offices, and warehouses in the industrial area. The MTA properties are mapped as vacant currently according to the MCATLAS website.

10. Utilities

The study area in proximity to the proposed trails contains several underground utilities including sewer and water. An 18-inch sanitary sewer runs west to east along the northern boundary of the Maryland Transportation Authority property adjacent to the Brown Street subdivision. A 25-foot county owned easement also exists for the sanitary sewer. Brown Street includes a water sewer line as well as a stormwater sand filter. The sand filter is located at the east end of Brown Street. The Maryland Transportation Authority property includes a variety of underground stormwater detention and Contech CDS systems, and Storm Filter systems in the right of way along Crabbs Branch Way.ⁱⁱⁱ No other known utilities were identified in the area of the Project.

11. Traffic Analysis

11.1 Introduction

This report documents the traffic analysis and findings for the proposed Crabbs Branch Way Extension, a road connecting Crabbs Branch Way to Amity Drive, south of Washington Grove, Maryland. The Crabbs Branch Way Extension between Crabbs Branch Way and Amity Drive is master planned as a Primary Residential Street in the Master Plan of Highways and Transitways. This planned connection was included in the 2006 Shady Grove Sector Plan and has been continued as a recommendation in the recent Minor Master Plan Amendment. The planned street is classified as Primary Residential. Access to the proposed roadway extension would be through Amity Drive in the north and Crabbs Branch Way to the south. The general site plan of the proposed extension is shown in Appendix 15.3 (Exhibit 1). For this study, the Existing conditions

are based on year 2021 traffic volumes. The design year for the Crabbs Branch Way Extension is 2040; therefore, the traffic analysis for the future year conditions are based on projected year 2040 volumes. Intersection capacity was analyzed using the Highway Capacity Analysis (HCM) method.

The study scope, methodologies, and parameters were established with the representatives of Montgomery County Department of Transportation (MCDOT).

11.2 Existing Conditions

11.2.1 Analysis of Existing Conditions

The study area consists of Washington Grove Lane to the northwest, Midcounty Highway to the northeast, Shady Grove Road to south and Oakmont Avenue to west. Washington Grove Lane is a two-lane undivided roadway and classified as Urban Minor Arterial, in the vicinity of the study area. Midcounty Highway is a four-lane divided highway and classified as Urban Principal Arterial Other, in the vicinity of the study area. Shady Grove Road is a six-lane divided highway and classified as Urban Principal Arterial Other, in the vicinity of the study area. Oakmont Avenue is a two-lane undivided roadway and classified as Urban Local, in the vicinity of the study area. Amity Drive is a two-lane undivided roadway and classified as Primary Residential.

The study area intersections and existing lane configurations are shown in Appendix 15.4 (Exhibit 2). Turning movements counts were conducted at the following locations during the AM and PM peak periods:

1. Midcounty Highway and Shady Grove Road
2. Shady Grove Road and Tupelo Drive
3. Shady Grove Road and Crabbs Branch Way
4. Shady Grove Road and Oakmont Avenue
5. Amity Drive and Epsilon Drive
6. Midcounty Highway and Washington Grove Lane
7. Amity Drive and Washington Grove Lane
8. Washington Grove Lane and Railroad Street

All intersections are signalized except two. The two unsignalized intersections are Amity Drive at Epsilon Drive and Amity Drive at Washington Grove Lane. Vehicle turning movement counts were conducted on Thursday, June 3rd, 2021, at the study intersections from 6:00 to 9:00 AM and from 3:30 to 6:30 PM. The traffic counts consisted of four vehicles classes, automobiles, buses, single unit trucks and trailers. The traffic counts also captured bicycles and pedestrians using the roadway facility. The data was analyzed to develop AM and PM peak hours. The traffic count data is included in Appendix 15.19 (Appendix A). The AM and PM peak hour traffic volumes are shown in Appendix 15.4 (Exhibit 2). Traffic data was also collected on Amity Drive, south of Epsilon Drive on June 28th and June 29th 2022, to verify data from 2021 was reasonably close to the existing traffic conditions. This data was used to compute the K-Factor for Amity Drive and to estimate the ADT. Table 1 below shows the AM and PM Peak hour data matches reasonably well with June 2021 counts. Synchro model for the study area was developed that included the existing signal timing and phasing information from Montgomery County Department of Transportation (MCDOT).

Table 1: Spot Check Comparison of Traffic Counts on Amity Drive

| NB | | | |
|----------------|----------|-----------|-----------|
| Time Period | 6/3/2021 | 6/28/2022 | 6/29/2022 |
| AM Peak Period | 66 | 56 | 56 |
| PM Peak Period | 47 | 60 | 57 |
| SB | | | |
| AM Peak Period | 22 | 15 | 16 |
| PM Peak Period | 84 | 87 | 79 |

11.2.2 Intersection Level of Service Standards and Thresholds

This section presents the methodologies used to perform peak hour intersection capacity analysis for signalized and unsignalized intersections.

The signalized intersections were analyzed using the Highway Capacity Manual 2000 (HCM) with Synchro 11 software package. This allowed for analyzing intersections with non-standard National Electrical Manufacturing Association (NEMA) phasing using operational analysis procedure outlined in the 2000 HCM. This method defines Level of Service (LOS) in terms of delay (average stopped delay per vehicle). This technique uses 1,900 vehicles per hour per lane (VPHPL) as the maximum saturation volume of an intersection. This saturation volume is adjusted to account of lane width, on-street parking, pedestrians, traffic composition (truck percentage), and shared lane movements. The level of service thresholds used for this method are shown in Appendix 15.5 (Exhibit 3).

Unsignalized intersections were analyzed using the HCM 2000 unsignalized intersection methodology with Synchro 11 software package. The LOS for a two-way stop controlled (TWSC) intersection is determined by the computed or measured control delay and is defined for each minor movement. Appendix 15.5 (Exhibit 3) summarizes the level of service thresholds utilized for unsignalized intersection analysis.

11.2.3 Capacity and Queue Analysis

The traffic data were analyzed using the method contained in the Highway Capacity Manual 2000 (HCM) with Synchro 11 software package. Synchro analyzes each of the intersections and estimates how each intersection would operate for the given conditions. The turning-movement data (automobiles, heavy vehicle percentages) and geometrics (lane configuration, storage length, gradient, speed limit etc.) of each intersection are coded into the software to make this determination. The existing heavy truck percentages for individual movements at study intersections are shown in the Synchro output sheets in Appendix 15.20 (Appendix B).

They range between 0% and 18%, and slightly higher for low volume movements. Single unit trucks or trailers were not observed on Amity Drive during the AM and PM peak hours. It is assumed that the extension road will carry similar mix of vehicles as seen on Amity Drive. Based on the input data, the Level of service (LOS), average vehicle delay, and length of the queue on each approach can be estimated. The existing operational analysis results (levels of service, delay and 95th percentile queues) are presented in Appendix 15.20 (Appendix B). The overall delay and level of service (LOS) information for the eight study intersections are summarized in Table 2. The LOS and delay information by individual movements for the eight intersections are summarized in Appendix 15.6 (Exhibit 4). The results of the Existing Conditions intersection capacity analysis are as follows:

Table 2: Existing Conditions Overall Intersection Level of Service (LOS) and Delays

| INTERSECTION | AM Peak Hour | | PM Peak Hour | |
|--|--------------|-------|--------------|-------|
| | LOS | Delay | LOS | Delay |
| 1. Midcounty Hwy & Shady Grove Rd | C | 32.4 | C | 28.4 |
| 2. Shady Grove Rd & Tupelo Dr | B | 16.3 | B | 15.7 |
| 3. Shady Grove Rd & Crabbs Branch Way | C | 31.0 | D | 46.7 |
| 4. Shady Grove Rd & Oakmont Ave | C | 29.4 | D | 36.9 |
| 5. Amity Drive & Epsilon Drive | A | 7.4 | A | 7.6 |
| 6. Midcounty Hwy & Washington Grove Ln | D | 36.5 | D | 36.3 |
| 7. Amity Drive & Washington Grove Lane | A | 3.7 | A | 4.5 |
| 8. Washington Grove La & Railroad St | B | 13.9 | B | 16.8 |

Approach Level of Service:

Midcounty Highway & Shady Grove Road: All approaches are currently operating at LOS D or better during the AM and PM peak hour, except the northbound left turn movement which is currently operating at LOS F during the AM peak hour.

Shady Grove Road & Tupelo Drive: The eastbound approach is currently operating at LOS F during the AM peak hour and LOS E during the PM peak hour. The westbound approach is currently operating at LOS E during the AM and PM peak hours. The eastbound right and southbound left turn movements are operating at LOS F during the AM peak hour. All other approaches are currently operating at LOS B or better during the AM and PM peak hour.

Shady Grove Road & Crabbs Branch Way: The northbound and southbound approaches are currently operating at LOS E for both the AM and PM peak hours. All other approaches are operating at LOS D or better during the AM and PM peak hour.

Shady Grove Road & Oakmont Avenue: The northbound approach is currently operating at LOS E for both the AM and PM peak hours. All other approaches are operating at LOS D or better during the AM and PM peak hour.

Amity Drive & Epsilon Drive: All the approaches are currently operating at LOS A for both the AM and PM peak hours.

Midcounty Highway & Washington Grove Lane: The northbound approach is currently operating at LOS E for both the AM and PM peak hours. All other approaches are operating at LOS D or better during the AM and PM peak hour.

Amity Drive & Washington Grove Lane: All the approaches are currently operating at LOS C for both the AM and PM peak hours.

Washington Grove Lane & Railroad Street: All the approaches are currently operating at LOS C for both the AM and PM peak hours.

Appendix 15.6 (Exhibit 4) also summarizes the 95th percentile queues at study intersections. The signalized intersection results are reported using the synchro model, while the stop-controlled intersection results are reported HCM 2010. The 95th percentile queue is typically defined as the maximum back of queue with 95th percentile traffic volumes.

The 95th percentile queue lengths do not exceed the available storage lengths at all intersections, except for intersection of Shady Grove Road and Crabbs Branch Way. At this intersection, the 95th percentile queue exceeds the available storage length for the southbound and westbound left turn lanes during the PM peak hour.

11.3 2040 Total Conditions

11.3.1 2040 Traffic Forecast

The generalized traffic projection methodology for the analysis year 2040 is described in this section. The historical Annual Average Daily Traffic (AADT) volumes on area roadways were downloaded from the State Highway Administration’s (SHA) Internet Traffic Monitoring System (I-TMS) and is shown in Appendix 15.7 (Exhibit 5). Growth rate and average k-factor were computed from this data and is shown in Table 3 below. The average growth rate for all roadways is about 0.23% for years between 2012 and 2018. The traffic data for the post COVID recovery year 2021 was not considered for computation purposes because the volumes were lower than 2018 volumes.

Table 3: Growth Rate and K-factor on Area Roadways

| SHACountLocations | Growth (2012-2018) | Average K-factor |
|--|--------------------|------------------|
| SHADY GROVE RD-.20 MI S OF MIDCOUNTY HWY | 0.30% | 8.33 |
| CRABBS BRANCH WAY - .05 MILE NORTH OF SHADY GROVE RD | -- | 8.01 |
| CRABBS BRANCH WAY - .10 MI SOUTH OF SHADY GROVE RD | 0.46% | 8.41 |
| SHADY GROVE RD-.10 MI N OF MD355 | -3.45% | 7.65 |
| MIDCOUNTY HWY-.10 MI S OF WASHINGTON GROVE LA | 0.99% | 9.10 |
| WASHINGTON GROVE LA - BETWEEN AMITY DR & MIDCOUNTY HWY | 0.86% | 8.79 |
| RAILROAD ST - BETWEEN E DIAMOND AVE & HICKORY RD | 0.92% | 9.02 |
| E DIAMOND AVE - .10 MI WEST OF RAILROAD ST | 1.52% | 8.80 |

The year 2040 traffic volume projections on area roadways were obtained from Maryland-National Capital Park and Planning Commission (M-NCPPC) which were based on the Metropolitan Washington Council of Governments (MWCOC) Regional Travel Demand Model using Round 9.1 Cooperative Land Use Forecasts. The 2040 model network incorporates growth in the area, planned roadway configurations, employment data and other variables. The model output is included in Appendix 15.21 (Appendix C).

Table 4 shows the comparison of Average Daily Traffic volumes for the year 2016 and year 2040. The model output indicate that the volumes will drop on Shady Grove Road and Midcounty Highway by the year 2040. There are several factors for lower volumes in the year 2040. Some of them are as follows: Crabbs Branch Way Extension, network updates in 2040 which significantly reduces the free flow speeds on some of the roadways as desired by the planning board, change to free flow speed on Shady Grove Road from 50 miles per hour to 35 miles per hour between Crabbs Branch Way and Midcounty Highway, change to free flow speed on Crabbs Branch Way between Shady Grove Road and Indianola Drive from 35 miles per hour to 25 miles per hour, consistent with Vision Zero Principles and the Geographic Location (Urban Road Code), incorporating centroid connectors in Metro Station Policy Area to reduce travel time to metro, revised land use data in the 2040 model, the model assumes all Bus Rapid Transit Lines within the Constrained Long-Range Plan (CLRP) exist by 2040, including: Veirs Mill Transitway, MD 355 Transitway (north and south segments), North Bethesda Transitway, Randolph Road Transitway, US 29 Transitway, MD 650 Transitway etc.

Table 4: M-NCPPC ADT Comparison (2016 – 2040)

| INTERSECTIONS | | M-NCPPC ADT (2016) | | | |
|---------------|-------------------------------------|--------------------|----------|-----------|-----------|
| | | East Leg | West Leg | North Leg | South Leg |
| #1 | Midcounty Hwy & Shady Grove Rd | | 31,354 | 40,033 | 45,970 |
| #2 | Shady Grove Rd & Tupelo Dr | | | | |
| #3 | Shady Grove Rd & Crabbs Branch Way | 23,074 | 22,914 | | 5,768 |
| #4 | Shady Grove Rd & Oakmont Ave | | | | |
| #5 | Amity Drive & Epsilon Drive | | | | |
| #6 | Midcounty Hwy & Washington Grove Ln | | | | |
| #7 | Amity Drive & Washington Grove Lane | | 11,941 | | |
| #8 | Washington Grove La & Railroad St | 11,289 | | | |
| INTERSECTIONS | | M-NCPPC ADT(2040) | | | |
| | | East Leg | West Leg | North Leg | South Leg |
| #1 | Midcounty Hwy & Shady Grove Rd | | 28,895 | 35,659 | 36,951 |
| #2 | Shady Grove Rd & Tupelo Dr | | | | |
| #3 | Shady Grove Rd & Crabbs Branch Way | 12,122 | 21,612 | | 4,242 |
| #4 | Shady Grove Rd & Oakmont Ave | | | | |
| #5 | Amity Drive & Epsilon Drive | | | 9,732 | |

| #6 | Midcounty Hwy & Washington Grove Ln | | | | |
|---------------|-------------------------------------|---------------------------|----------|-----------|-----------|
| #7 | Amity Drive & Washington Grove Lane | | 12,773 | | |
| #8 | Washington Grove La & Railroad St | 12,158 | | | |
| INTERSECTIONS | | Growth Rate (2016 - 2040) | | | |
| | | East Leg | West Leg | North Leg | South Leg |
| #1 | Midcounty Hwy & Shady Grove Rd | | -0.43% | -0.61% | -1.14% |
| #2 | Shady Grove Rd & Tupelo Dr | | | | |
| #3 | Shady Grove Rd & Crabbs Branch Way | -3.33% | -0.31% | | -1.60% |
| #4 | Shady Grove Rd & Oakmont Ave | | | | |
| #5 | Amity Drive & Epsilon Drive | | | | |
| #6 | Midcounty Hwy & Washington Grove Ln | | | | |
| #7 | Amity Drive & Washington Grove Lane | | 0.36% | | |
| #8 | Washington Grove La & Railroad St | 0.39% | | | |

The average historical growth rate based on SHA data for study area roadways is about 0.23% per year between 2012 and 2018. On an average, the Montgomery County model resulted in -0.83% per year negative growth for the roadway links in the study area. For this study, it was therefore conservatively assumed that the traffic in the area will increase at 1% per year between 2021 and 2040. K-factors computed from MDSHA data and traffic counts done by MCV on Amity Drive was used with bi-directional PM peak hour volumes to develop the ADT for the year 2021. The volumes were grown at 1% between the years 2021 and 2040 to obtain ADT for the year 2040. The k-factor and ADT data for the years 2021 and 2040 are shown in Appendix 15.8 (Exhibit 6).

11.3.2 No-Build Condition

This scenario analyzes traffic conditions at area intersections without the Crabbs Branch Way Extension for the year 2040. The 2040 ADT was used to estimate turning movement volumes based on the existing count patterns and directional distribution of traffic during peak hours. The growth in traffic volumes on study area intersections are shown in Appendix 15.9 (Exhibit 7). The 2040 traffic volumes for the study area intersections are shown Appendix 15.10 (Exhibit 8). The same methodology was adopted as in the existing conditions to estimate roadway capacity, delays, and queues using the HCM methodologies and Synchro model. The Peak Hour Factor (PHF) that was higher of 0.92 or the existing PHF was used for the 2040 analysis. The 2040 No-Build Conditions operational analysis results (levels of service, delay and 95th percentile queues) are presented in Appendix 15.22 (Appendix D). The level of service (LOS) information for the eight study intersections are summarized in Table 5. The LOS and delay information by individual movements for the eight intersections are summarized in Appendix 15.11 (Exhibit 9). The results of the 2040 No-build Conditions intersection capacity analyses are as follows:

Table 5: 2040 No-Build Conditions Overall Intersection LOS and Delays

| INTERSECTION | AM Peak Hour | | PM Peak Hour | |
|--|--------------|-------|--------------|-------|
| | LOS | Delay | LOS | Delay |
| 1. Midcounty Hwy & Shady Grove Rd | D | 41.8 | C | 31.3 |
| 2. Shady Grove Rd & Tupelo Dr | B | 18.6 | B | 16.2 |
| 3. Shady Grove Rd & Crabbs Branch Way | C | 33.7 | E | 56.0 |
| 4. Shady Grove Rd & Oakmont Ave | C | 34.1 | C | 34.6 |
| 5. Amity Drive & Epsilon Drive | A | 7.5 | A | 7.6 |
| 6. Midcounty Hwy & Washington Grove Ln | D | 37.3 | D | 37.4 |
| 7. Amity Drive & Washington Grove Lane | A | 3.2 | A | 4.2 |
| 8. Washington Grove La & Railroad St | B | 13.7 | B | 17.8 |

Approach Level of Service:

Midcounty Hwy & Shady Grove Road: All approaches are projected to operate at LOS D or better during the AM and PM peak hour, except the northbound left turn movement which is projected to continue operating at LOS F during the AM peak hour.

Shady Grove Road & Tupelo Drive: The eastbound approach is projected to continue operating at LOS F during the AM peak hour and LOS E during the PM peak hour. The westbound approach is projected to continue operating at LOS E during the AM and PM peak hours. The eastbound right and southbound left turn movements are projected to continue operating at LOS F during the AM peak hour. All other approaches are projected to continue operating at LOS B or better during the AM and PM peak hour.

Shady Grove Road & Crabbs Branch Way: The northbound and southbound approaches are projected to continue operating at LOS E for both the AM and PM peak hours. The eastbound approach is projected to operate at LOS E during the PM peak hour. All other approaches are projected to continue operating at LOS D or better during the AM and PM peak hour.

Shady Grove Road & Oakmont Avenue: The northbound approach is projected to continue operating at LOS E for both the AM and PM peak hours. All other approaches are projected to operate at LOS D or better during the AM and PM peak hour.

Amity Drive & Epsilon Drive: All the approaches are projected to continue operating at LOS A for both the AM and PM peak hours.

Midcounty Highway & Washington Grove Lane: The northbound approach is projected to continue operating at LOS E for both the AM and PM peak hours. All other approaches are projected to operate at LOS D or better during the AM and PM peak hour.

Amity Drive & Washington Grove Lane: All the approaches are projected to continue operating at LOS C for both the AM and PM peak hours.

Washington Grove Lane & Railroad Street: All the approaches are projected to continue

operating at LOS C for both the AM and PM peak hours.

Appendix 15.11 (Exhibit 9) also summarizes the 95th percentile queues at study intersections. The 95th percentile queue lengths do not exceed the available storage lengths at all intersections, except for intersection of Shady Grove Road and Crabbs Branch Way. At this intersection, the 95th percentile queue exceeds the available storage length for the northbound and southbound left turn lanes during the PM peak hour and westbound left turn lane during the AM and PM peak hour.

11.3.3 Build Conditions- with Crabbs Branch Way Extension

This scenario analyzes traffic conditions at area intersections with the Crabbs Branch Way Extension for the year 2040. The 2040 ADT was used to estimate turning movement volumes based on the existing count patterns and directional distribution of traffic during peak hours. A portion of the residential traffic from Amity Drive accessing the only two access points of entry/exit within the network was diverted to/from the Crabbs Branch Way Extension. The detailed methodology is described in the following sections.

11.3.4 Crabbs Branch Way- Rerouted Trips

The residential traffic from Amity Drive has two access points of entry/exit within the network as shown in Appendix 15.12 (Exhibit 10). On the north, Amity Drive intersects with Washington Grove Lane to form the first access point. To the south, it intersects with Epsilon Drive which in turn connects to Shady Grove Rd to the east, forming the second access point. Turning movement counts at the intersection of Amity Drive and Washington Grove Ln and Epsilon Drive and Shady Grove Rd were used to compute the trips entering and exiting Amity Drive during the AM and PM peak hour. A total of 395 trips were generated during the AM peak hour and 638 trips were generated during the PM peak hour from within the neighborhood during the existing conditions. To determine the peak hour trips per residential unit, the number of trips were divided by the number of residential units within the neighborhood. About 882 units were estimated within the neighborhood. This included all the Single Family Detached Homes and Apartment/Condominium units. The trip generation rate per unit was found to be 0.45 trips/unit during the AM peak hour and 0.72 trips/unit during the PM peak hour for the existing conditions.

The existing trips to/from the neighborhood were grown at 1% for the 2040 conditions. The growth assumption is very conservative as residential subdivisions usually do not have new residential units built and no new trips are generated because of it. A total of 476 trips were estimated for the AM peak hour and 771 trips for the PM peak hour from within the neighborhood during the 2040 Build conditions. The trip generation rate per unit was estimated to be 0.54 trips/unit during the AM peak hour and 0.87 trips/unit during the PM peak hour for the 2040 Build conditions.

To estimate the traffic diversion potential of Crabbs Branch Way Extension, the existing trip distribution pattern of trips originating and ending inside the neighborhood was computed. The turning volume percentages into and out of Amity Drive and Epsilon Drive was calculated and is shown in Appendix 15.13 (Exhibit 11). About 43% of the AM peak hour and 33% of the PM

peak hour trips exit Epsilon Drive onto Shady Grove while 20% of the trips turn west onto Washington Grove Lane during the AM and PM peak hours from Amity Drive. About 27% of the AM peak hour and 34% of the PM peak hour trips exit Amity Drive onto Washington Grove Lane going east. Similar trip patterns were observed for vehicles entering the neighborhood on Amity Dr and Epsilon Drive.

To estimate the trips on Crabbs Branch Way Extension, it was assumed that 65% of the trips originated on Amity Drive, North of Epsilon Drive, 25% of the trips originated on Epsilon Drive and 10% of the trips originated on Amity Drive, South of Epsilon Drive. This assumption was based on the density and distribution of residential units on Amity Drive and Epsilon Drive. These trips were then distributed to the network based on the trip distribution assumption shown in Appendix 15.10 (Exhibit 8). This distribution was based on existing trip patterns, distance between origin and destination, general speed limit of roadways and estimated travel times, access to the metro, proximity to the major roadways such as MD 200, MD 355 and I-270. As such, most of the trips diverted to Crabbs Branch Way Extension are going south in the existing conditions. It was also assumed, that Shady Grove Metro station was the origin/destination of about 5.6% of the trips from/to the neighborhood during the peak hours. This was based on the mode split assumptions within Local Area Transportation Review Guidelines (LATR) for Derwood policy area. The 2040 rerouted trips are shown in Appendix 15.14 (Exhibit 12).

11.3.5 Crabbs Branch Way Extension- Cut-Through Trips

It was assumed that a certain portion of traffic, outside the neighborhood will use the extension road to cut-through and get around congested roads and intersections. The cut-through traffic percentage was conservatively assumed to be about 15% of the ADT on Amity Drive. The traffic distribution and volumes of the cut-through traffic for the peak hours are shown in Appendix 15.15 (Exhibit 13).

11.3.6 Capacity and Queue Analysis (Crabbs Branch Way Extension)

The rerouted and cut-through traffic volumes were added to obtain total traffic for the build conditions with Crabbs Branch Way Extension. The traffic volumes for the study intersections are shown in Appendix 15.16 (Exhibit 14). The same methodology was adopted as in the existing conditions to estimate roadway capacity, delays, and queues using the HCM methodologies and Synchro model. The Peak Hour Factor (PHF) that was higher of 0.92 or the existing PHF was used for the 2040 analysis. The 2040 Build Conditions operational analysis results (levels of service, delay and 95th percentile queues) are presented in Appendix 15.23 (Appendix E). The level of service (LOS) information for the eight study intersections are summarized in Table 6. The LOS and delay information by individual movements for the eight intersections are summarized in Appendix 15.17 (Exhibit 15). The results of the 2040 Build Conditions intersection capacity analysis are as follows:

Table 6: 2040 Build Conditions Overall Intersection LOS and Delays

| INTERSECTION | AM Peak Hour | | PM Peak Hour | |
|--|--------------|-------|--------------|-------|
| | LOS | Delay | LOS | Delay |
| 1. Midcounty Hwy & Shady Grove Rd | D | 38.6 | C | 30.8 |
| 2. Shady Grove Rd & Tupelo Dr | A | 8.5 | B | 10.2 |
| 3. Shady Grove Rd & Crabbs Branch Way | D | 41.1 | E | 56.3 |
| 4. Shady Grove Rd & Oakmont Ave | C | 33.9 | D | 35.8 |
| 5. Amity Drive & Epsilon Drive | A | 11.3 | A | 8.1 |
| 6. Midcounty Hwy & Washington Grove Ln | D | 36.3 | D | 37.1 |
| 7. Amity Drive & Washington Grove Lane | A | 2.8 | A | 3.7 |
| 8. Washington Grove La & Railroad St | B | 13.4 | B | 17.8 |

Approach Level of Service:

Midcounty Highway & Shady Grove Road: All approaches are projected to operate at LOS D or better during the AM and PM peak hour, except the northbound left turn movement which is projected to continue operating at LOS F during the AM peak hour.

Shady Grove Road & Tupelo Drive: The eastbound approach is projected to improve from LOS F to LOS E during the AM peak hour. The eastbound approach is projected to continue operating at LOS E during the PM peak hour. The westbound approach is projected to continue operating at LOS E during the AM and PM peak hours. The eastbound right turn movement is projected to improve from LOS F to LOS E during the AM peak hour. The southbound left turn movement is projected to continue operating at LOS F during the AM peak hour. All other approaches are projected to continue operating at LOS B or better during the AM and PM peak hour.

Shady Grove Road & Crabbs Branch Way: The northbound and southbound approaches are projected to continue operating at LOS E for both the AM and PM peak hours. The westbound approach is projected to operate at LOS E during the PM peak hour. All other approaches are projected to continue operating at LOS D or better during the AM and PM peak hour.

Shady Grove Road & Oakmont Avenue: The northbound approach is projected to continue operating at LOS E for both the AM and PM peak hours. All other approaches are projected to operate at LOS D or better during the AM and PM peak hour.

Amity Drive & Epsilon Drive: All the approaches are projected to continue operating at LOS A for both the AM and PM peak hours.

Midcounty Highway & Washington Grove Lane: The northbound approach is projected to continue operating at LOS E for both the AM and PM peak hours. All other approaches are projected to operate at LOS D or better during the AM and PM peak hour.

Amity Drive & Washington Grove Lane: All the approaches are projected to operate at LOS B for both the AM and PM peak hours.

Washington Grove Lane & Railroad Street: All the approaches are projected to continue operating at LOS C for both the AM and PM peak hours.

Appendix 15.17 (Exhibit 15) also summarizes the 95th percentile queues at study intersections. The 95th percentile queue lengths do not exceed the available storage lengths at all intersections, except for intersection of Shady Grove Road and Crabbs Branch Way. At this intersection, the 95th percentile queue exceeds the available storage length for the northbound left turn lane during the PM peak hour and for the southbound and westbound left turn lanes during the AM and PM peak hours. The key comparative differences between the No-build and Build Conditions are as shown in Appendix 15.18 (Exhibit 16).

11.4 Traffic Analysis Summary

A detailed analysis of the proposed Crabbs Branch Way Extension was conducted, and the findings are summarized below:

- All intersections operate at satisfactory level of service in the existing conditions.
- Per the Local Area Transportation Review Guidelines (LATR), the HCM average vehicle delay standard for the Derwood Policy Area is 59 seconds per vehicle and the threshold for LOS E is 55 seconds per vehicle for signalized intersections. In the Existing Conditions, the minimum and maximum delay during the AM peak hour at all the studied intersections is 3.7 seconds and 36.5 seconds, respectively. The minimum and maximum delay during the PM peak hour at all the studied intersections is 4.5 seconds and 46.7 seconds, respectively. These delays are below the congestion threshold for the Derwood Policy Area.
- The forecasted Average Daily Traffic, which is the total daily traffic volume on the Crabbs Branch Way Extension in both directions of travel, is estimated to be about 3600 vehicles per day in the year 2040.
- The Crabbs Branch Way Extension would improve accessibility for area residents and other road users by providing a direct access option to Shady Grove Road bypassing Midcounty Highway.
- The Crabbs Branch Way Extension is expected to divert part of existing traffic on Epsilon Drive to the east, to Amity Drive to the south. As a result, the traffic on Epsilon Drive is expected to drop and Amity Drive, south of Epsilon Drive to increase moderately.
- A conservative 15% cut-through traffic was included in the forecasted traffic volume, as worse-case scenario to analyze impacts on study area intersections.
- The overall intersection LOS and delay for the eight study intersections for the two scenarios, 2040 No-Build and 2040 Build Conditions are

summarized in Table 7.

- Comparing the 2040 No-Build and 2040 Build Conditions, the overall intersection delay at six study intersections is projected to improve during the AM peak hour in the 2040 Build Conditions. The overall intersection delay at four study intersections is projected to improve during the PM peak hour in the 2040 Build Conditions.

Table 7: Comparison of 2040 No-Build and Build Conditions Overall Intersection LOS and Delays

| INTERSECTION | 2040 No-Build | | | | 2040 Build Alternative | | | |
|-----------------------------------|---------------|-------|---------|-------|------------------------|-------|---------|-------|
| | AM Peak | | PM Peak | | AM Peak | | PM Peak | |
| | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay |
| 1. Midcounty Hwy & Shady Grove | D | 41.8 | C | 31.3 | D | 38.6 | C | 30.8 |
| 2. Shady Grove Rd & Tupelo Dr | B | 18.6 | B | 16.2 | A | 8.5 | B | 10.2 |
| 3. Shady Grove Rd & Crabbs | C | 33.7 | E | 56.0 | D | 41.1 | E | 56.3 |
| 4. Shady Grove Rd & Oakmont Ave | C | 34.1 | C | 34.6 | C | 33.9 | D | 35.8 |
| 5. Amity Drive & Epsilon Drive | A | 7.5 | A | 7.6 | A | 11.3 | A | 8.1 |
| 6. Midcounty Hwy & Washington | D | 37.3 | D | 37.4 | D | 36.3 | D | 37.1 |
| 7. Amity Drive & Washington Grove | A | 3.2 | A | 4.2 | A | 2.8 | A | 3.7 |
| 8. Washington Grove La & Railroad | B | 13.7 | B | 17.8 | B | 13.4 | B | 17.8 |

■ Improvement in Delay
 ■ Deterioration in Delay
 ■ No Change in Delay

- The intersection of Crabbs Branch Way and Shady Grove Road is projected to experience LOS E with an overall delay of 56 seconds per vehicle during the PM peak hour, in the 2040 No-Build Conditions. The delay increases by 0.3 seconds to 56.3 seconds per vehicle during the Build Conditions. The vehicle delays for northbound and southbound approaches at this intersection are projected to increase minimally due to the Crabbs Branch Way Extension. This increase in delay over the No-Build Conditions can be offset by increasing the green split for the northbound and southbound approaches. Leading Pedestrian Interval (LPI) is recommended at this intersection. According to the Federal Highway Administration (FHWA-SA-21-032), an LPI of 3-7 seconds will make pedestrians more visible to motorists and can potentially reduce pedestrian related incidents. As No Turn on Red has already been implemented at this intersection, no additional delay for right turning vehicles is anticipated in the 2040 conditions. The overall per-vehicle delay at all intersections, for all conditions analyzed, are projected to be well within the LATR congestion standards for the Derwood Policy Area of Montgomery County.
- The intersection of Shady Grove Road & Oakmont Avenue is currently operating at LOS D, with a delay of 36.9 seconds during the PM peak hour. In the 2040 No-Build and Build Conditions, the intersection is projected to operate at LOS C, with a delay of 34.6 seconds and LOS D, with a delay of 35.8 seconds during the PM peak hour, respectively. The Build Condition increase in delay over the No-Build Condition is only 1.2 seconds and will have minimal impact to the intersection.
- At the intersection of Shady Grove Road and Tupelo Drive, No Turn on Red is currently operational for the EB approach during the AM peak period. The overall delay in the 2040

Build Conditions is projected to improve by 48% during the AM peak hour and by 35% during the PM peak hour. The vehicular delay is projected to improve considerably with the Crabbs Branch Way Extension.

12. Public Input Summary

Public opinions regarding Washington Grove Connector trails and Crabbs Branch Road Extension were provided in the first Public Workshop held in February 2020. A second Public Workshop was held in February 2021 after which a survey was conducted. The majority in the survey voted for Alternate No. 3 which is Brown Street.

Washington Grove held a special town meeting on December 4, 2021 during which a non-binding vote went 92-24 in favor of the Brown Street connector.

On December 12, 2021, the Washington Grove Town Council voted unanimously to approve the Brown Street connector.

The following comments and chart represent the results of a survey conducted after the Public Workshop of 54 residents of the community.

12.1 Alignment #1- Railroad Street Survey Comments

- Railroad Street is a dangerous road for walking and bicycling
- No bike or pedestrian infrastructure on Railroad Street
- Requires purchase of private land (Roberts Oxygen)
- Very close to backyards and eliminates buffer between homes and salt barn
- Least disruptive to neighborhood
- Would feel uncomfortable walking behind salt barns and Robert's Oxygen property when dark
- Least use of shared roadways
- Most expensive option
- Does not use Town of Washington Grove roads

12.2 Alignment #2 – Ridge Road Survey Comments

- Expensive and environmentally impactful to conservation meadow
- Close to backyards
- Requires paving parkland
- Sacrifices natural meadow to avoid Brown St
- Minimizes impact to Brown St residences

12.3 Alignment #3 – Brown St. Survey Comments

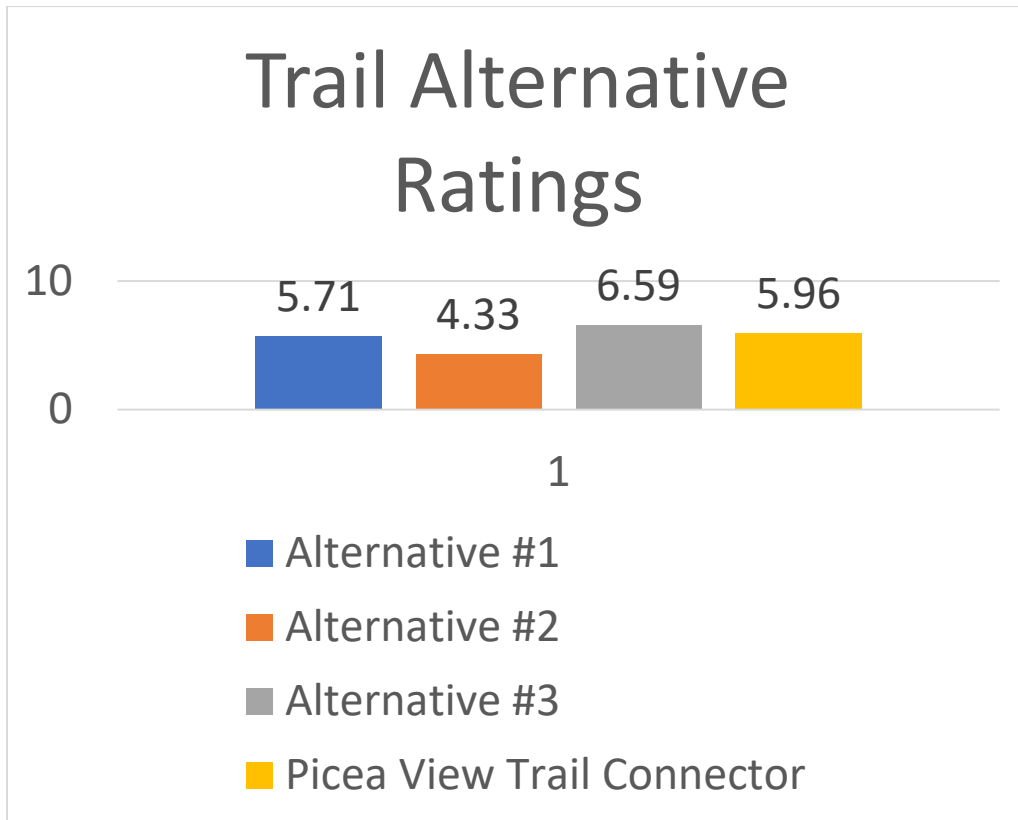
- Safest option
- Avoids backyards
- Shortest and least costly alternative
- Minimizes impact on trees

- Consistent with 1994 annexation agreement, adopted resolution, and conveyance of outlot
- Would increase traffic on Town of Washington Grove roads.

12.4 Crabbs Branch Way Extension Survey Comments

- Increase traffic on Amity Drive
- Creates a new cut-through rout
- Increased noise and light pollution
- Would destroy wildlife habitat
- Would reduce passive recreation area
- Would improve connectivity to Shady Grove Metro
- Access to Amity Drive Neighborhood Park would be more difficult with increased traffic.

12.5 Trail Alternative Rating Chart



13. Cost Estimate

13.1 Construction Estimate

An order of magnitude construction cost estimate has been provided for all proposed trails and Crabbs Branch Extension in Appendix 15.1.

13.2 Land Acquisition Estimate

For each of the trail alignment options Land Acquisition will be required.

- Alignment #1- Crabbs Branch Way to Railroad Street: Land Acquisition = \$47,338
- Alignment #2- Crabbs Branch Way to Ridge Road: Land Acquisition = \$27,563
- Alignment #3- Crabbs Branch Way to Brown Street: Land Acquisition = \$12,500
- Picea View Connector: Land Acquisition = \$2,567
- Crabbs Branch Way Extension: Land Acquisition = \$538,300

| Alignment | Permanent | | Construction Access | | Total Cost |
|------------------------------|-----------|-----------|---------------------|---------|------------|
| | Area (AC) | Cost | Area (AC) | Cost | |
| No. 1 | 0.458 | \$43,890 | 0.818 | \$3,448 | \$47,338 |
| No. 2 | 0.444 | \$25,536 | 0.792 | \$2,027 | \$27,563 |
| No. 3 | 0.241 | \$12,500 | 0.430 | \$0 | \$12,500 |
| Picea View | 0.042 | \$2,380 | 0.075 | \$187 | \$2,567 |
| CB Way Ext.- Road with Trail | 3.068 | \$525,000 | 4.545 | \$0 | \$525,000 |
| CB Way Ext.- Trail | 0.270 | \$12,300 | 0.146 | \$1,000 | \$13,300 |

14. Conclusion

14.1 Trail Options:

Any of the alternative trail connections from Ridge Road, Railroad Street, Picea View Court and Brown Street will provide much needed connection between Town of Washington Grove and the nearby residential areas with the mass transit hub and commercial areas located east of Shady Grove Road.

Phase II Facility Planning will identify stream and wetland crossing structures in more detail, including their associated constructability and durability issues.

14.2 Crabbs Branch Way Extension Option:

The ADT for the proposed Crabbs Branch Way Extension is estimated to be about 3600 vehicles per day. The overall per vehicle delay at all intersections, for all conditions analyzed are well within the congestion standards of Montgomery County. Incorporating Vision Zero Principles of the county, such as LPI and No Turn on Red can improve pedestrian safety at the intersection of Shady Grove Road and Crabbs Branch Way.

Based on the current analyses and from a traffic perspective alone, the Crabbs Branch Way Extension roadway is expected to improve vehicular and pedestrian mobility within the community. Nevertheless, the County should compare the traffic analyses presented in this report to all other advantages and disadvantages of building the extension roadway, including overall goals, environmental and right-of-way constraints, the county master plan, and public input to assess the project’s implementation.