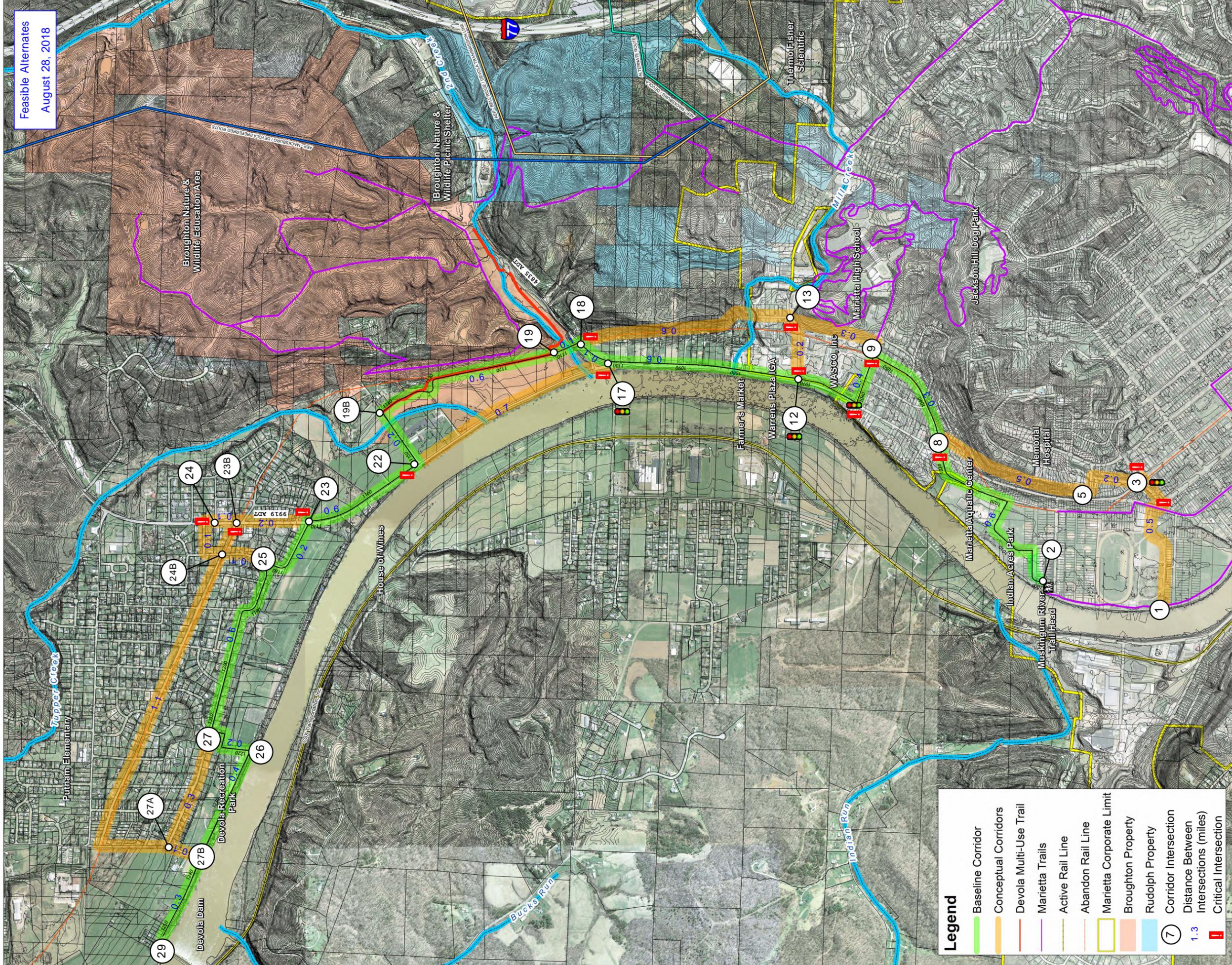


APPENDIX E:
FEASIBLE CORRIDORS AND STAKEHOLDER'S MEETING #4
PHASE 2 GEOTECHNICAL PAPER STUDY



Legend

- Baseline Corridor
- Conceptual Corridors
- Devola Multi-Use Trail
- Marietta Trails
- Active Rail Line
- Abandon Rail Line
- Marietta Corporate Limit
- Broughton Property
- Rudolph Property
- 7 Corridor Intersection
- 1.3 Distance Between Intersections (miles)
- ! Critical Intersection

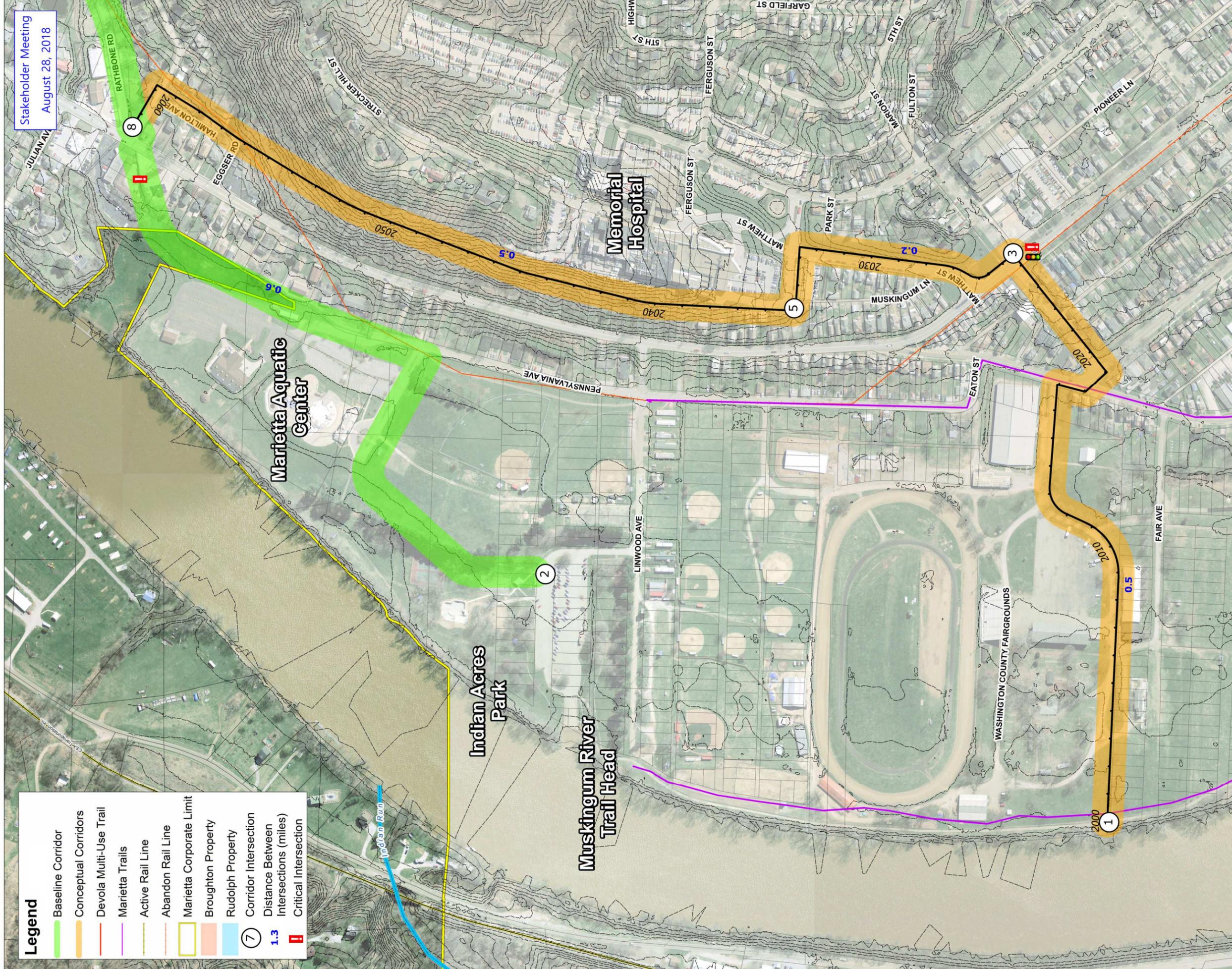


DMUT Conceptual Corridor 1

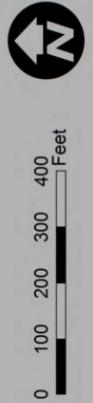
Washington County, Ohio

- Legend**
- Baseline Corridor
 - Conceptual Corridors
 - Devola Multi-Use Trail
 - Marietta Trails
 - Active Rail Line
 - Abandon Rail Line
 - Marietta Corporate Limit
 - Broughton Property
 - Rudolph Property
 - 7 Corridor Intersection
 - 1.3 Distance Between Intersections (miles)
 - I Critical Intersection

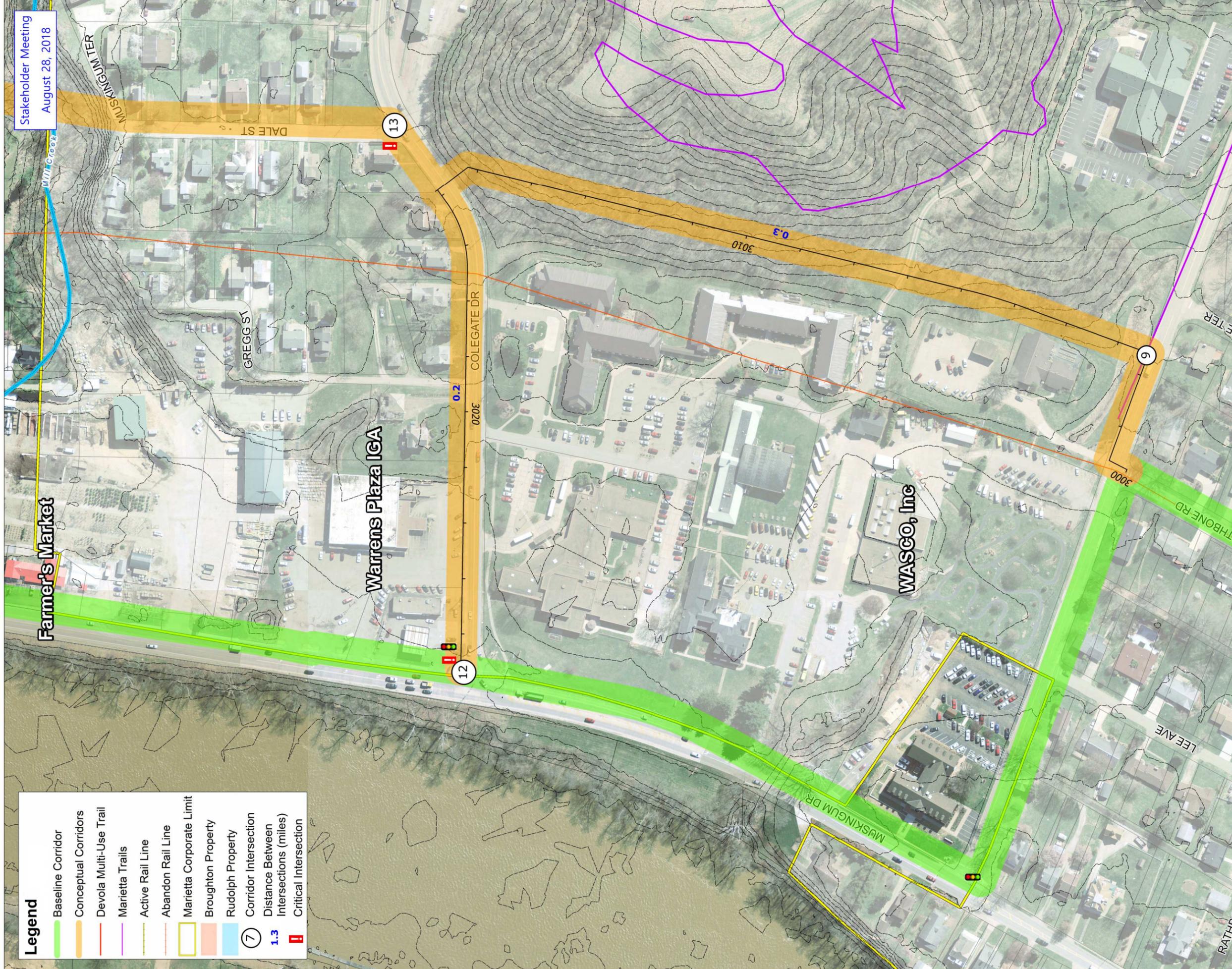
Stakeholder Meeting
August 28, 2018



DMUT Conceptual Corridor 2
Washington County, Ohio



- Legend**
- Baseline Corridor
 - Conceptual Corridors
 - Devola Multi-Use Trail
 - Marietta Trails
 - Active Rail Line
 - Abandon Rail Line
 - Marietta Corporate Limit
 - Broughton Property
 - Rudolph Property
 - 7 Corridor Intersection
 - 1.3 Distance Between Intersections (miles)
 - I Critical Intersection

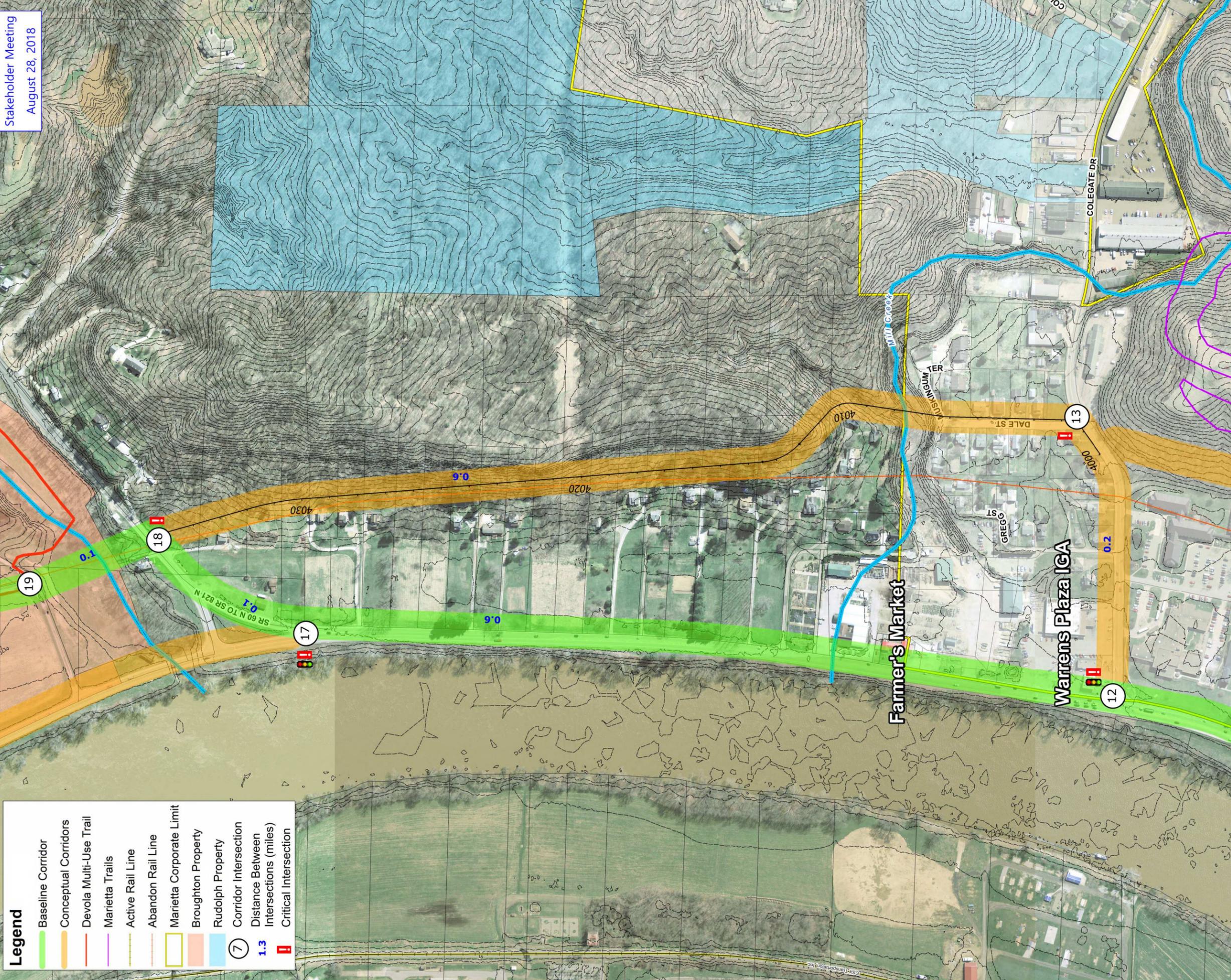


Stakeholder Meeting
August 28, 2018

DMUT Conceptual Corridor 3

Washington County, Ohio

Stakeholder Meeting
August 28, 2018



Legend

- Baseline Corridor
- Conceptual Corridors
- Devola Multi-Use Trail
- Marietta Trails
- Active Rail Line
- Abandon Rail Line
- Marietta Corporate Limit
- Broughton Property
- Rudolph Property
- Corridor Intersection
- Distance Between Intersections (miles)
- Critical Intersection

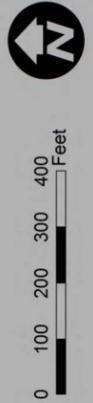
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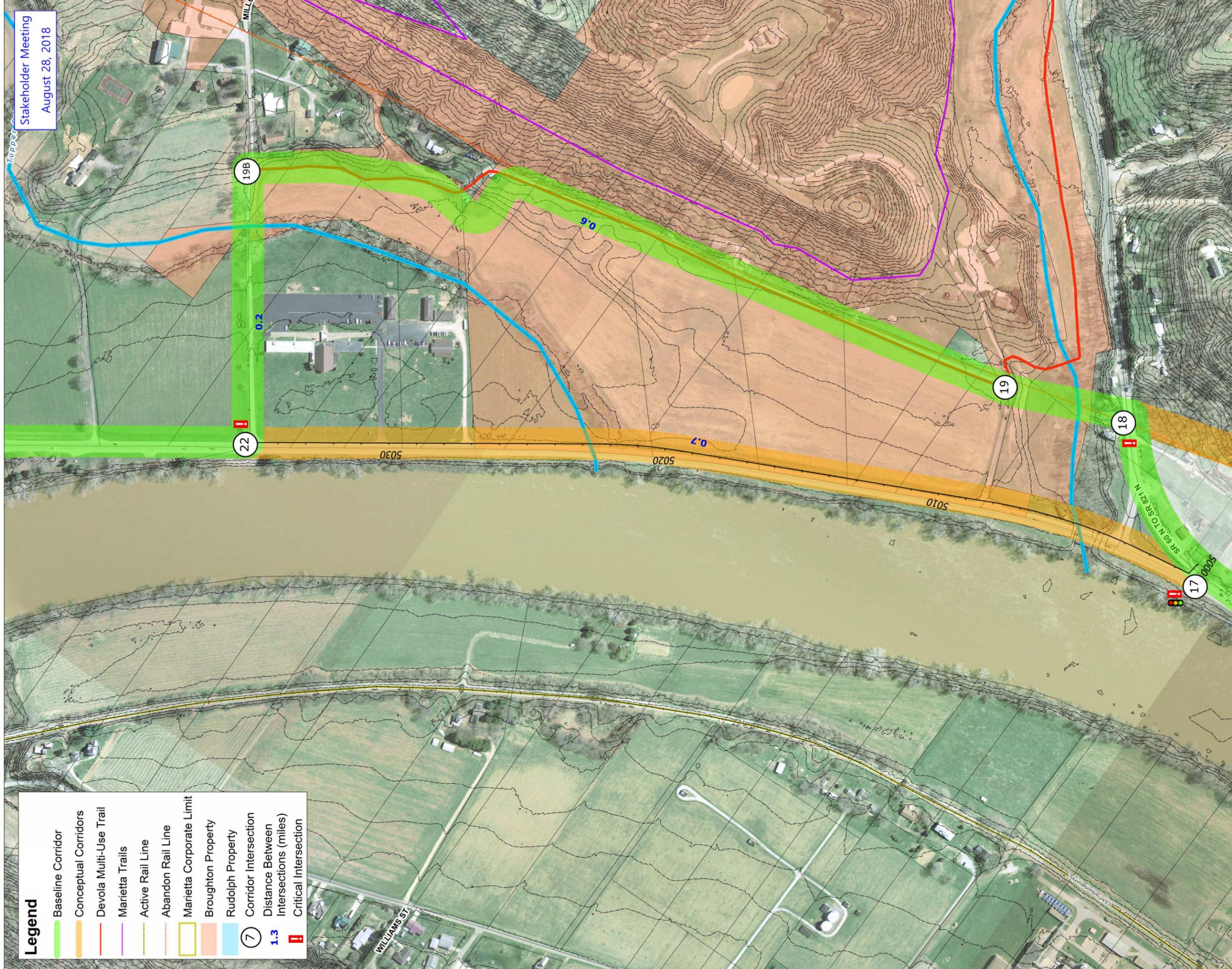
DMUT Conceptual Corridor 4

Washington County, Ohio



Legend

- Baseline Corridor
- Conceptual Corridors
- Devola Multi-Use Trail
- Marietta Trails
- Active Rail Line
- Abandon Rail Line
- Marietta Corporate Limit
- Broughton Property
- Rudolph Property
- 7 Corridor Intersection
- 1.3 Distance Between Intersections (miles)
- I Critical Intersection



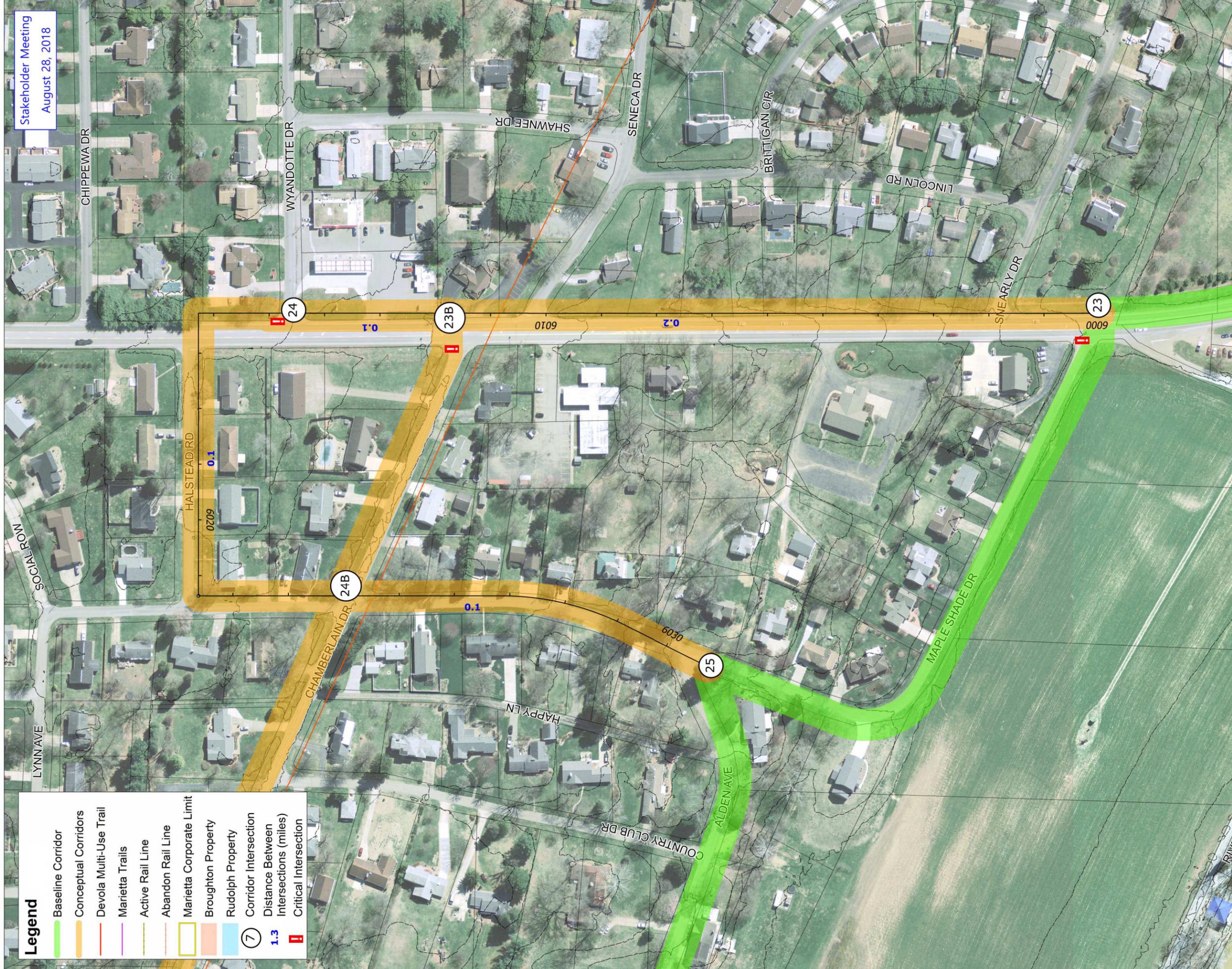
Stakeholder Meeting
August 28, 2018

DMUT Conceptual Corridor 5

Washington County, Ohio

- Legend**
- Baseline Corridor
 - Conceptual Corridors
 - Devola Multi-Use Trail
 - Marietta Trails
 - Active Rail Line
 - Abandon Rail Line
 - Marietta Corporate Limit
 - Broughton Property
 - Rudolph Property
 - 7 Corridor Intersection
 - Distance Between Intersections (miles)
 - Critical Intersection

Stakeholder Meeting
August 28, 2018



DMUT Conceptual Corridor 6

Washington County, Ohio



Legend

- Baseline Corridor
- Conceptual Corridors
- Devola Multi-Use Trail
- Marietta Trails
- Active Rail Line
- Abandon Rail Line
- Marietta Corporate Limit
- Broughton Property
- Rudolph Property
- Corridor Intersection
- Distance Between Intersections (miles)
- Critical Intersection



Stakeholder Meeting
August 28, 2018

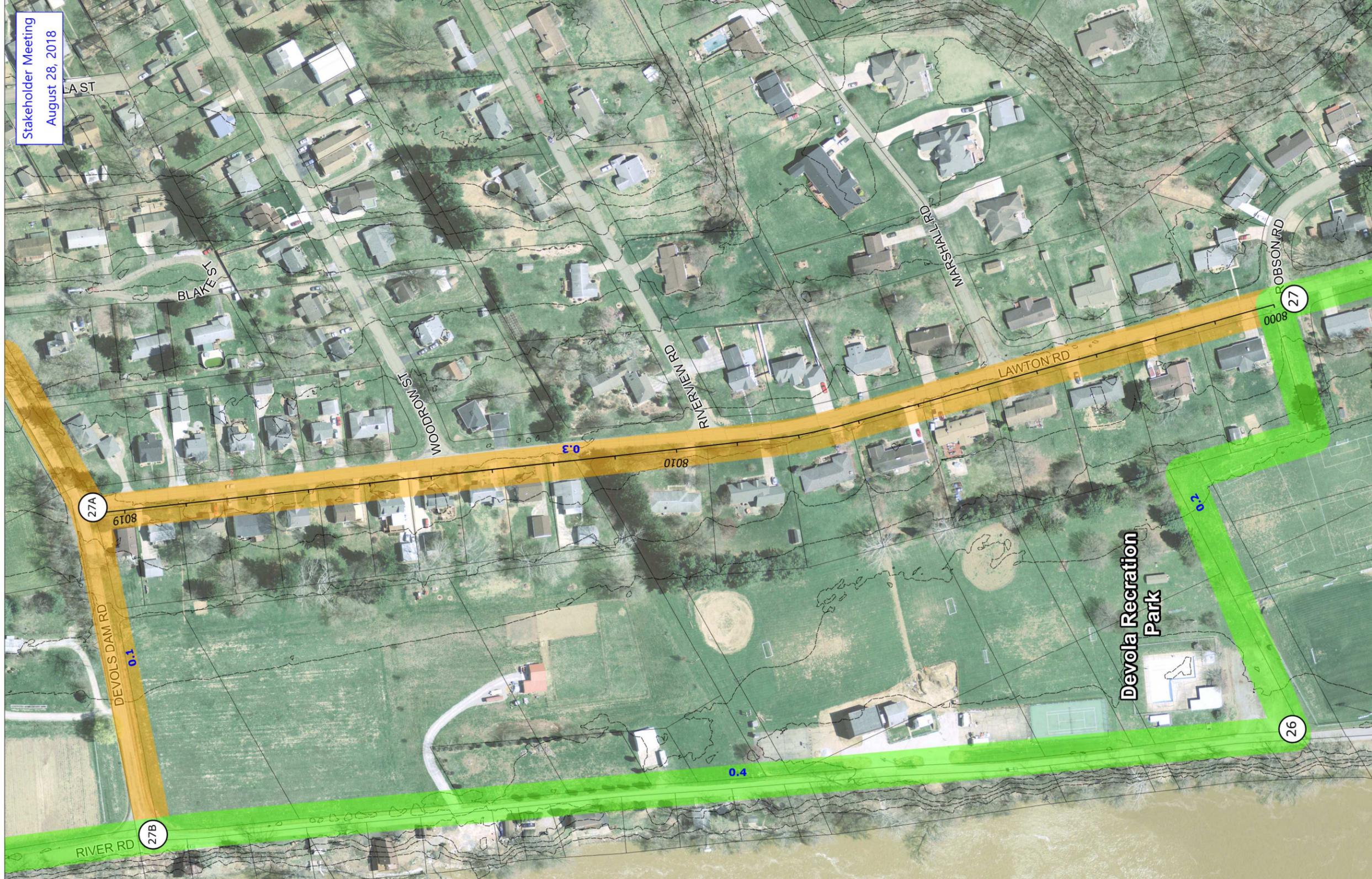
DMUT Conceptual Corridor 7

Washington County, Ohio



Legend

- █ Baseline Corridor
- █ Conceptual Corridors
- █ Devola Multi-Use Trail
- █ Marietta Trails
- █ Active Rail Line
- █ Abandon Rail Line
- Marietta Corporate Limit
- Broughton Property
- Rudolph Property
- 7 Corridor Intersection
- 1.3 Distance Between Intersections (miles)
- █ Critical Intersection



Stakeholder Meeting
August 28, 2018

DMUT Conceptual Corridor 8

Washington County, Ohio



Meeting Minutes

Date of Meeting: August 28, 2018
Re: Devola Multi-Use Trail Stakeholder Meeting
Location: Muskingum Township Hall
Issue Date: September 4, 2018
Submitted By: Paul Denny
Conference Call:
In Attendance: See sign in sheet

ITEMS DISCUSSED:

Paul Denny led the meeting off by providing a recap of the steps that have been required to develop the project to this point and discussed the goals of the meeting. He also informed the stakeholders that the geotechnical report is complete and has been submitted to the Township. The report noted that significant geotechnical issues should be anticipated in any upland areas, and these issues would not be anticipated if the trail was constructed at grade in the lowland areas.

Ron Mattox presented the updated corridor exhibit to the stakeholders and noted the following:

- Modifications have been made to corridors located in Indian Acres Park, in Devola, and on Broughton's Nature and Wildlife Area. These modifications are a direct result of our previous stakeholder meeting held on June 12, 2018.
- The baseline corridor is a point of comparison, is not the preferred alignment, and can be changed based on feedback received from stakeholders.
- Corridor changes in Indian Acres part are based on feedback from Marietta, and the issues at the Magnusson Hotel/Gas Station and houses will have to be addressed for this portion of the trail to be constructed as drawn.
- ADA compliance would be very difficult to obtain on the routes going to the hospital (Route 1-3-5-8). This route will be very difficult to construct due to this issue, and geotechnical issues will require retaining walls to be constructed from 5 to 8. Additionally, ADA compliance would likely result in the need for switchback alignments.
- Two corridors are available between Node 9 and Node 18, one along SR 60 and the other east of the houses and buildings along SR 60. The availability of existing right of way along SR 60 makes constructing the trail along the road (9-12-17-18) more cost effective, but there are many access points along this route. However, geotechnical issues presented by constructing the multi-use trail behind the buildings (9-13-18) will make this route much more expensive and difficult to construct. It was noted that a trail next to SR-60 would not be as pleasant and comfortable compared to an alignment further away.
- Consideration to removing the high-speed movement from SR-60 to SR-821 needs to be discussed with ODOT. The State has been removing high-speed movements in areas with pedestrians to improve safety. Alan Craig stated this could be discussed.
- The sanitary sewer provides enough existing right of way along SR 60 to construct a trail offset from the road.
- Hawk signals have been approved for use and are viable options for crossing SR-60 and SR-821.
- At the north end of the existing Devola Multi-Use Trail the corridor was relocated to go towards SR-60. This modification was based on property owner objections. However, during the meeting it was decided that the

corridor might be able to be relocated to the west side of Tupper Creek, and this modification will be investigated.

- The full length of the trail will not be constructed at once. It will be constructed in pieces as opportunities present themselves and funding becomes available.

Use of the existing Devola Multi-Use Trail:

The Devola Multi-Use Trail committee was disappointed that the full length of existing multi-use trail on Broughton's Nature and Wildlife area is not being utilized. The Committee's opinion is that extending the trail through the wildlife area and along AEP's 100-ft easement will help the trail become a destination, and cyclists from outside the local community will come to use the facility. Several stakeholders agreed that this would be a nice facility for cyclists, however it does not meet the Purpose and Need: providing connectivity between communities for local users and all modes of travel.

The existing multi-use trail along SR-821 would be a nice connector from the proposed trail by providing connectivity from Devola and Marietta to Broughton's Nature and Wildlife Area.

Devola:

Following the last stakeholder's meeting the corridor along River Road was removed from the exhibit and replaced with two corridors in Devola. This change was made based on safety and right of way concerns associated with River Road. The Devola Multi-Use Trail Committee recommended changing River Road to a one-way street, thereby providing additional right of way for use as a multi-use trail.

The corridor map will be updated to include multiple corridors in Devola due to the issues associated with River Road and with resistance to a designated bikeway on Lawton Road. There is also concern with rerouting traffic onto residential streets in Devola. Converting River Road to one-way will be investigated further.

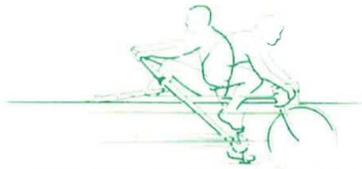
Action Items:

- Paul Lewis and Ken Schilling will discuss the corridor relocation with Jeremy James.
- Paul Denny will distribute the exhibit as it was presented at the meeting.
- Woolpert will update the exhibit based on feedback from the stakeholders.



Project Name/Description: Devola Multi-Use Trail Stakeholder Meeting
 Meeting Date/Time: August 28, 2018 - 10:00 am Meeting Location: Muskingum Township Hall

Name	Company	Email	Phone
George Gantzer	DMUT Comm. Htee	gbc4243@adelphia.net	740-434-3685
Paul Denny		plenny1942@aol.com	941-626-0062
Gary Dean	MUSKINGUM TWP	gkdean@yahoo.com	740-525-0060
Ken Schilling	Muskingum Twp	kschilling@muskingum.org	740-699-1492
Tracy Brown	WWW IPC	tracy.brown@movrc.org	304-422-4993
Joe Tucker	City of Marietta	joe.tucker@marietta.net	740-373-5495
Roger Wright	Washington County	rwright@washington.org	740-376-7428
Ron Mattox	Woolpert	RON.MATTOX@WOOLPERT.COM	614-827-6118
Paul Denny	Woolpert	PAUL.DENNY@WOOLPERT.COM	614-827-6118



Marietta Rowing & Cycling Club INC.

RECEIVED

OCT 18 2018

WOOLPERT
COLUMBUS, OHIO

October 12, 2018

Woolpert Engineering c/o Ron Maddox
One East Oval
Suite 310
Columbus OH 43219

Dear Mr. Maddox:

The Marietta Rowing and Cycling Club met on August 15 and reviewed the map of expected corridors and again on September 20th held a further lengthy discussion of the revised corridors represented by the map provided at the stake-holders meeting. There is wide spread agreement that the Baseline corridor between Colgate and 821 would be dangerous and does not represent an improvement over the multi-use sidewalk that currently exists there. This sidewalk is and has been for years in total disrepair. No one cares about this multi-use sidewalk and essentially no one uses it. The proposed crossing of Colgate and the crossing at 821 are both dangerous. The baseline corridor along Route 60 between Colgate and 821 would be noisy, unsafe, unsightly, and would not result in additional use over the current sidewalk.

It is widely perceived that cyclists who have talked to hundreds of trail users and who ride thousands of mile per year on roads and multi-use trails believe their understanding should be represented in the design of alignments used for new trail construction. This perception is correct. The MRCC has discussed at length the proposed corridors and after many decades of cycling and walking around Marietta, are highly familiar with the Marietta and Devola communities. After years of riding trails in and around Ohio and in many foreign countries, an understanding of what makes a trail attractive becomes apparent. An attractive trail is one that is quiet, safe, scenic, and smooth. All users are drawn to such trails. Joggers, commuters, cyclists, walkers, young parents pushing strollers, and the elderly are drawn to Multi-use trails. In part, all trail users want the same thing.

All of the supporters of trail construction have particular users in mind. ODNR encourages recreational uses and contact with the natural environment. TAP grants hope to provide alternative transportation opportunities. Others aim for reduced congestion and improved air quality. What all supporters have in common is that trails that are not attractive alternatives to other options will not contribute the expected benefits to the community. All trail users have alternatives: primarily cars. If a trail does not represent a more attractive alternative to what is already available, they will not use the trail. It doesn't matter how inexpensively a trail can be constructed, if it is not more attractive than the alternatives, users will not choose it. A trail which is not used, no matter how cheaply built, is a waste of time and money.

We therefore ask Woolpert Engineering to provide engineering details and a cost analysis of at least on alignment other than the Baseline corridor that runs across Colegate, along Rt60, and crosses 821 near the Rt60-821 intersection. In earlier maps provided by Woolpert, the woods to the east of route 60 between Colegate and 821 involved 3 excellent corridors connecting the Marietta City limits with the beginning of the DMUT. These now eliminated corridors represent and opportunity for the construction of a phenomenal asset. Any corridor in these woods represents, in the view of the MRCC, a far superior alignment compared to the Baseline corridor along RT 60. A priority in the view of the MRCC is including the full length of the DMUT trail. The DMUT would add a full mile of attractive exceptionally well maintained multi-use trail to the connection between the Marietta River Trail and the Devols Dam State Park.

Sincerely,


Dan Jones, President Marietta Rowing and Cycling Club

P.O. Box 223, Marietta, OH 45750

PHASE 2 GEOTECHNICAL PAPER STUDY



August 15, 2018

Woolpert LLP
One Easton Oval, Suite 310
Columbus, OH 43219

Attention: Mr. Paul Denny, P.E.

Reference: **Phase 2 - Geotechnical Paper Study (Revised)**
Devola Multi-Use Trail (PID 102092)
Washington County, Ohio
S&ME Project No. 1117-17-031

Mr. Denny:

In accordance with the Woolpert Sub-Consultant Agreement executed on June 29, 2017, which includes the November 15, 2016, S&ME, Inc. (S&ME) proposal for these services, S&ME is herewith submitting our revised Phase 2 Geotechnical Paper Study for the proposed Devola Multi-Use Trail in Washington County, Ohio. This study presents additional discussions of geotechnical issues relating to the revised Feasible Alternative alignments identified for the Multi-Use Trail which were provided by Woolpert on August 9, 2018.

◆ Scope of Project

S&ME understands that this project is to be a Feasibility Study for the recommended routing of new multi-use trail to connect the existing section of the Devola Multi-Use Trail (MUT) with the City of Marietta's River Trail and Devola's Dam/Masonic Road in Washington County, Ohio. Because previous bicycle infrastructure development has been performed in phases, consideration must be given to alternatives which provide for future trail development being performed in phases, and which include a combination of options ranging from sharing a roadway to dedicated paths.

Phase 1 of this project included a preliminary geotechnical assessment (desktop review) of the generalized project boundary area provided by Woolpert. A copy of S&ME's Phase 1 report dated September 12, 2017, is included in Appendix B of this submission.

As part of Phase 2 of this project, Woolpert provided S&ME with two Feasible Alternative alignments for the proposed MUT. Based on these feasible alignments, S&ME performed a limited site reconnaissance ("field walk") of the selected feasible alignments to observe, document, and photograph existing site features which may impact one potential alignment more than the others with respect to construction, cost, or maintenance. S&ME is herewith submitting a second letter report during Phase 2 which includes further discussion of the geotechnical issues related to specific sections of the selected feasible alternative alignments being considered. This letter also includes a brief discussion of future geotechnical field explorations and laboratory testing which may be required depending on the final selected alignment of the trail.



Phase 2 - Geotechnical Paper Study (Revised)
Devola Multi-Use Trail (PID 102092)
Washington County, Ohio
S&ME Project No. 1117-17-031

◆ Summary of Phase 1 Geotechnical Information

A brief summary of the geotechnical and geohazards discussions presented in S&ME's Phase 1 report is presented as follows:

- Significant geotechnical issues should be anticipated at all locations where the conceptual routing of the Multi-Use Trail (MUT) extends into the upland areas. The hillsides in the upland areas of the project study area are subject to severe slope failures. Several landslides and rock falls have been documented and/or repaired by ODOT in the upland areas. It should be anticipated that some of the soil overburden on these hillsides is likely at a reduced strength state (residual strength) because of having previously undergone movement during the former (historic) landslides. S&ME previously provided geotechnical services to investigate and remediate landslides which occurred in this area, particularly in the vicinity of the Marietta hospital and water treatment plant facilities uphill from SR 60 in the southern portion of the study area for this project.
- Significant geotechnical issues are not anticipated for portions of the MUT constructed at the approximate existing grade in the lowland portions of the study area. Lowland areas of the project are generally underlain by granular soils. Structures requiring below grade excavations should anticipate the presence of shallow groundwater in lowland areas, and significant dewatering efforts (both short and long term) may be required for these structures. Fill embankments required in lowland areas should anticipate undergoing several inches of settlement, depending on the height of the embankment. The settlement should, however, occur relatively quickly. Portions of the MUT constructed adjacent to streams or the Muskingum River may require embankment stabilization and/or scour protection.

A copy of S&ME's Phase 1 report is included in Appendix B of this submission.

◆ Phase 2 Geotechnical Information

Plate 1 of Appendix A is a copy of the selected feasible alternative alignments provided to S&ME by Woolpert on June 22, 2018. Based on this drawing, S&ME compared these alternative corridors to available aerial photography, topographic mapping, and the geohazard maps included in S&ME's Phase 1 report. Using these available maps, S&ME identified several sections of the feasible alignments with potential geotechnical/geohazard concerns. On July 12, 2018, the undersigned Senior Engineer made a site visit to examine the project area and the sections of the feasible alignments with potential geotechnical concerns.

Using the corridor intersection numbers included on Woolpert's June 22, 2018, drawing (see Plate 1, Appendix A) to sub-divide the potential alignments into sections, S&ME presents the following additional discussions pertaining to geotechnical conditions which may be encountered and issues which should be considered during route selection and final design of smaller, more specific areas of the project.

Intersection No. 1 to No. 3

Minimal geotechnical issues anticipated. Shallow groundwater may be encountered in excavations.



Intersection No. 2 to No. 8

Minimal geotechnical issues anticipated. Some hillside grading between aquatic center and SR 60 may require benching. Shallow groundwater should be anticipated in excavations.

Intersection No. 3 to No. 5

Some geotechnical issues should be anticipated where widening of Muskingum Lane or Matthew Street is required. Extent of potential impact will depend on the amount of fill placement and/or excavation required. Minor amounts of fill placement to add the path on the low side of the existing roadway may be possible. Slope rates flatter than 2(H):1(V) may be necessary. Excavations into any existing slope should be avoided if possible.

Intersection No. 5 to No. 8

Significant geotechnical issues should be anticipated. This hillside has a history of instability, including 3 landslides recorded by ODOT along SR 60. An existing parking lot for the Marietta hospital above SR 60 is currently supported by an H-pile and lagging wall (see Photo #1). The section of this hillside between SR 60 and the hospital wall is also hummocky (evidence of former shallow landslides) with several trees leaning downhill (see Photo #2). A section of Matthew Street uphill from the hospital appears to be currently supported by driven H-piles (see Photo #3), and existing soldier pile and lagging retaining walls are present along SR 60 (see Appendix A, Photo #4). Along this segment of the project, construction of new retaining structures should anticipate the need for design using residual strengths for soil and possibly bedrock, increasing the wall cost significantly. Excavations into the hillside and construction of fill embankments above SR 60 should be avoided, as these may result in destabilization of the hillside and damage to existing structures above the MUT. Small fill embankments on the downhill side of SR 60 may be possible, with slope rates potentially flatter than 2(H):1(V) being required.

Intersection No. 8 to No. 9

Minimal geotechnical issues are anticipated, particularly if the MUT is located on the downhill side of Rathbone Road. Depending on the final alignment, there may be a few locations near Lee Avenue, Rathbone Terrace, and Caro Lane with stability concerns, as these hillsides are mapped as being "landslide susceptible". Excavations into or construction of embankments on any existing slope should be avoided where possible.

Intersection No. 9 to No. 12

Minimal geotechnical issues are anticipated along Davis Avenue to the west of Rathbone Road. Minimal issues are also anticipated along this section of SR60, with the exception of an area on the west side, just south of the entrance to WASCO, where the width of embankment narrows and an existing culvert may be located. The slope of the embankment in this area steepens, and placement of additional fill in a stable fashion and in a manner resistant to flooding may be difficult. Additionally, structural support (i.e., scour resistant structural retaining wall) of the embankment, or a bridge spanning this area, may be required.

Intersection No. 9 to No. 13

Although development of this area has resulted in flatter slopes to the west (downslope) of Rathbone Road, the existing hillside to the rear of the development and between Davis Avenue and Colegate Drive is mapped as being a former landslide. For this reason, excavations into the hillside should be avoided, as these may result in destabilization of the hillside and damage to existing structures above the MUT. Any retaining structures required



in this area should anticipate the need for design using residual strengths for soil and possibly bedrock, which may increase wall costs significantly. Small fill embankments near the toe of the existing hillside may be possible; however, slope rates flatter than 2(H):1(V) will likely be necessary. Aerial photography indicates the presence of a drainage channel and possible wetland area just north of Davis Avenue and between Rathbone Road and Rathbone Terrace. This channel is lower than Davis Avenue and may require a new structure to cross. Additionally, because of the marginal existing stability of the hillside in this area discussed above, placement of fill for approach embankments of a new bridge will require geotechnical analyses, as the load from the additional fill could destabilize the existing hillside.

Intersection No. 12 to No. 13

Minimal geotechnical issues are anticipated along existing Colegate Drive, unless the location of the MUT requires widening of the roadway into existing sloping surfaces.

Intersection No. 12 to No. 17

This potential section of the MUT appears to parallel existing SR 60 on the eastern bank of the Muskingum River. Minimal geotechnical issues are anticipated if the MUT is positioned on the eastern side of SR 60. If, however, consideration is being given to constructing the MUT on the river side of the roadway, the need for placement of large quantities of erosion protection on the riverbank should be anticipated, and retaining structures of significant size may also be required if embankment widening becomes necessary. Two (2) "landslides" have been documented by ODOT along this section; however, these geohazard events were likely related to destabilization of the riverbanks as a result of erosion, instead of hillside instability. Some culvert replacements/improvements may be required, and high groundwater may be encountered during these excavations.

Intersection No. 13 to No. 18

The potential for significant geotechnical issues exist along this segment of the MUT. The existing hillside is documented as being a combination of recent and historic landslides, with an "active" landslide being recorded near Point 18, just south of SR 821 (see Appendix A, Photos #5 and 6). Such an "active" landslide indicates the presence of significant instability, where the soil overburden and also possibly the upper bedrock may be sliding as a result of excavation, loading, and changes in drainage conditions. Excavations into, and construction of fill embankments on, the existing hillside should be avoided, as these may result in further destabilization of the hillside and damage to existing structures above and below the MUT. Construction of new retaining structures should anticipate the need for design using residual strengths for soil and possibly bedrock, thus increasing the wall costs significantly. If the final location of the MUT is planned to be below the toe of the existing marginally stable existing hillside in this section (similar to that of the existing trail between Intersections 19 and 19B), it may be possible to construct the MUT on a small fill embankment at the toe of the existing hill; however, the need for embankment slope rates flatter than 2(H):1(V) should be anticipated.

Intersection No. 17 to No. 18

Minimal geotechnical issues are anticipated in this potential section of the MUT. Shallow groundwater may be encountered in excavations.



Intersection No. 18 to No. 19

This small section will likely include a new structure to carry the MUT across Second Creek to connect with the existing Broughton Trail. Support of this structure with shallow spread foundations may be possible if a precast concrete culvert is used to cross the creek. If, however, a bridge is required, extended foundations consisting of driven steel piles may be required. The type of pile used will likely depend on the anticipated loads, along with the depth to bedrock. Because the soil overburden is anticipated to consist primarily of fine-grained granular soil, a scour analysis should also be planned.

Intersection No. 19 to No. 19B

The MUT trail has been constructed in this area, and has been positioned generally below the toe of the existing hillside (see Photo #7). By positioning the MUT in this manner, geotechnical concerns related to destabilization from excavations into the slopes have been reduced or eliminated.

Intersection No. 17 to No. 22

Minimal geotechnical concerns are anticipated provided the MUT is constructed on the northbound side of SR 60. If, however, consideration is being given to constructing the MUT on the river side of the roadway, the need for placement of large quantities of erosion protection on the riverbank should be anticipated, and retaining structures of significant size may be required if the embankment must be widened toward the river to accommodate the trail. One (1) "landslide" has been documented by ODOT along this section; however, this geohazard event was likely related to destabilization of the riverbank by erosion. High groundwater levels may be encountered in excavations in this area.

Intersection No. 19B to No. 22

Minimal geotechnical issues anticipated. Shallow groundwater may be encountered in excavations.

Intersection Nos. 22 to 23/23B/24, Nos. 24 to 24B/25, and Nos. 24B to 27A

Minimal geotechnical issues anticipated. Some ditch line overexcavation, minor cut slopes, and/or fill embankment construction with special benching may be required between Maple Shade and Seneca Drives, depending on which side of SR 60 the MUT is located. Significant stability issues of the fill embankments are not anticipated, although relatively small retaining walls may be required in areas of cut slopes. Shallow groundwater may be encountered in excavations.

Intersection Nos. 23 to 25, Nos. 25 to 27, Nos. 26 to 27, and Nos. 27 to 27A

Minimal geotechnical issues anticipated.

Intersection No. 26 to No. 27B and No. 27B to No. 29

Minimal geotechnical concerns are anticipated provided the MUT is constructed on the north side of River Road. If, however, consideration is being given to constructing the MUT on the river side of the roadway, the need for placement of large quantities of erosion protection on the riverbank should be anticipated. One (1) "landslide" has been documented by ODOT along this section; however, this geohazard event was likely related to



destabilization of the riverbank by erosion. High groundwater levels may be encountered in excavations in this area.

◆ **Additional Geotechnical Services**

The need for additional geotechnical explorations should be anticipated. However, the number, magnitude, and depth of borings may only be determined once the final alignment and profile are established. Once the MUT alignment has been selected, and the project proceeds to final design, S&ME recommends that the MUT alignment be surveyed, and cross sections be developed, as early as possible in the design process. With this information, the Geotechnical Engineer may then review the proposed P&P information to determine where additional geotechnical explorations and information are required. S&ME recommends that as a minimum, explorations be performed in accordance with the ODOT SGE for sidehill cuts and fills, culverts, embankments, and retaining structures. The need for additional structure borings should also be anticipated for the new structure between Intersection Points No. 18 and No. 19. Also, depending on the location of the MUT, laboratory strength testing will likely be required where hillside slopes and/or retaining structures are anticipated, and slope inclinometers may need to be installed to check for and monitor any existing hillside instability.

◆ **Final Considerations**

The discussions and topics presented for consideration in this Phase 2 geotechnical paper study are based on publically available information, the feasible alignment alternatives being considered at the time of this document, and our knowledge of the area. Detailed site plan and profile information was not available. It should also be noted that no field explorations, sampling, or laboratory testing were performed during this Phase 2 study. This report and its contents were prepared to present general geotechnical issues for consideration during final alignment selection, and shall not be relied upon during detailed geotechnical analyses or engineering design.

If you have any questions regarding this revised Phase 2 submission, please don't hesitate to contact our office.

Respectfully,

S&ME, Inc.


 Richard S. Weigand, P.E.
 Senior Engineer




 Bethanie L. Meek, P.E.
 Senior Reviewer

Attachments: Appendix A (5 sheets)
 Appendix B (Phase 1 Report - 9 sheets)



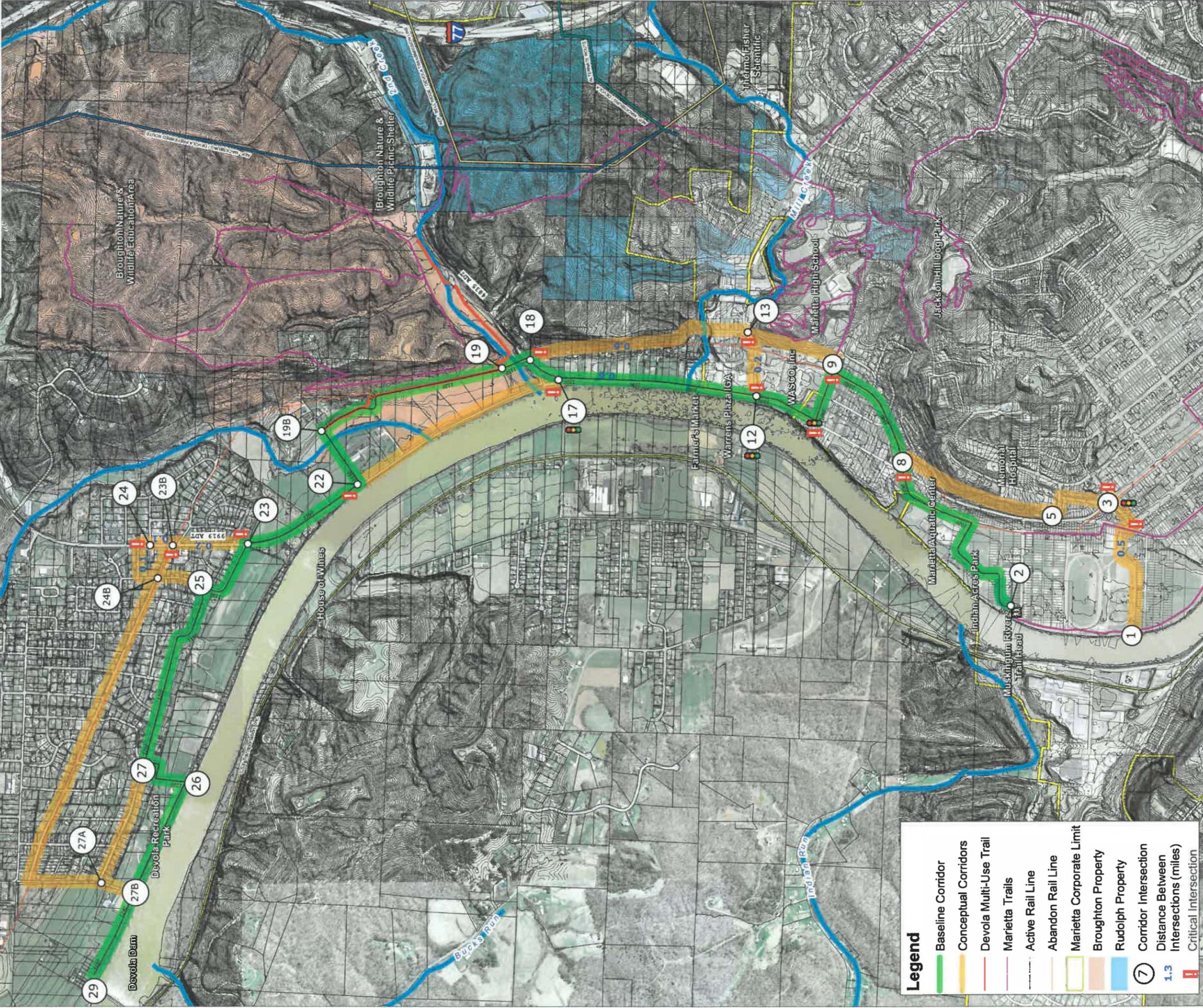
Phase 2 - Geotechnical Paper Study (Revised)
Devola Multi-Use Trail (PID 102092)
Washington County, Ohio
S&ME Project No. 1117-17-031

Appendix A



Devola Multi-Use Trail Alternative Alignments

PLATE 1

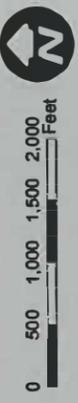


Legend

- Baseline Corridor
- Conceptual Corridors
- Devola Multi-Use Trail
- Marietta Trails
- Active Rail Line
- Abandon Rail Line
- Marietta Corporate Limit
- Broughton Property
- Rudolph Property
- Corridor Intersection
- Distance Between Intersections (miles)
- Critical Intersection

DMUT Conceptual Corridor 1

Washington County, Ohio





1	Location / Orientation	Marietta Hospital	Date: 7/12/2018
	Remarks	Drilled shaft and lagging retaining wall above SR 60	
		Photographer: RSW	

2	Location/Orientation	Looking downhill at SR 60 from above retaining wall	Date: 7/12/2018
	Remarks	Hummocky ground surface, few tilted trees	
		Photographer: RSW	

Plate 2



3	Location/Orientation	Matthew Street, North of Marietta Hospital	Date: 7/12/2018
	Remarks	H-piles likely driven for slope stabilization	
		Photographer: RSW	

4	Location/Orientation	SR 60 below Marietta Hospital	Date: 3/21/2018
	Remarks	Soldier-pile & Lagging Wall for slope stabilization. ODOT records also indicate two geohazards (landslides) in this section of hillside.	
		Photographer: CRW	

Plate 3



5	Location / Orientation	Looking S from Point 18 toward Point 13
	Remarks	Looking at toe of hillside with historic landslides

Date: 7/12/2018

 Photographer: RSW

6	Location / Orientation	Look N along SR 821 (Point 18)
	Remarks	Base of existing hillside with mapped landslide

Date: 7/12/2018

 Photographer: RSW

Plate 4

7	Location / Orientation	Looking SE from Millgate Rd (Point 19B)
	Remarks	Section of MUT constructed generally below the toe of the hillside

Date: 7/12/2018

 Photographer: RSW

Plate 5



Phase 2 - Geotechnical Paper Study (Revised)
Devola Multi-Use Trail (PID 102092)
Washington County, Ohio
S&ME Project No. 1117-17-031

Appendix B



September 12, 2017

Woolpert
One Easton Oval, Suite 310
Columbus, OH 43219

Attention: Mr. Paul Denny, P.E.

Reference: **Phase 1 - Geotechnical Paper Study**
Devola Multi-Use Trail (PID 102092)
Washington County, Ohio
S&ME Project No. 1117-17-031

Mr. Denny:

In accordance with the Woolpert Sub-Consultant Agreement which was executed on June 29, 2017, and which includes the November 15, 2016, S&ME, Inc. (S&ME) proposal for these services, S&ME is herewith submitting our Phase 1 report summarizing our review of available information for the above referenced project.

◆ Scope of Project

S&ME understands that this project is to be a Feasibility Study for the recommended routing of new multi-use trail to connect the existing section of the Devola Multi-Use Trail with the City of Marietta's River Trail and Devola's Dam/Masonic Road in Washington County, Ohio. Because previous bicycle infrastructure development has been performed in phases, consideration must be given to alternatives which provide for future trail development being performed in phases, and which include a combination of options ranging from sharing a roadway to dedicated paths.

Phase 1 of this project is to include a preliminary geotechnical assessment (desktop review) of the generalized project boundary area provided by Woolpert (see Plate 1 in the Appendix). Phase 2 will include a closer examination of roughly 3 Feasible Alternatives to be identified. We understand that depending on the feasible alternative(s) selected, future phases of the project may include geotechnical explorations, laboratory testing, analyses, and recommendations.

◆ Phase 1 Geotechnical Information

Using the generalized project boundary map provided by Woolpert on July 25, 2017, S&ME has reviewed readily available geologic and groundwater maps published by outside agencies such as ODNR, ODOT's Transportation Information Mapping System (TIMS) for the results of explorations from prior infrastructure projects, ODNR water well logs, and S&ME in-house resources, which include the findings from the previous geotechnical explorations/investigations we have performed in the vicinity of the project site. A summary of the geotechnical conditions which may be encountered by the proposed multi-use trail are herewith presented.



Geology of the Site

Devola is located in the portion of Ohio which was not glaciated, and which is adjacent to the Muskingum River. In general, the soil and bedrock conditions anticipated to be encountered during this project may be divided into either the lowland areas adjacent to the river or the upland areas on the hillsides rising above the river.

In the upland areas, the soil overburden typically consists of a relatively thin layer of decomposed bedrock underlain by bedrock typically consisting of interbedded sandstone, siltstone, and shale of the Dunkard Group of Permian and Pennsylvanian ages. The upper portions of this bedrock may be highly weathered, fractured, and fragmented to a significant depth prior to encountering more intact bedrock. Two coal seams (Washington and Waynesburg) are known to be present in this bedrock formation in the Devola-Marietta area. Based on ODNR bedrock mapping, the Washington seam is typically located in the mid- to upper portions of the hillsides (approximate El. 775 - 790), whereas the Waynesburg coal is mapped near approximate El. 650. Based on the ODNR Mines of Ohio website, no known underground mines are mapped within the anticipated project limits provided by Woolpert.

In the lowland areas at the base of the hillsides, the soil overburden is thicker, consisting primarily of a thin layer of cohesive soil underlain by alluvial soils (sand, gravel, and silt). The results of borings previously performed by S&ME for a sanitary sewer in the Village of Devola indicate these granular soils range widely in relative density from very-loose to very-dense. The ODNR Mines of Ohio website also indicates the locations of surficial sand and gravel quarries in the Muskingum River overbank area to the west of Devola. In general, the depth to bedrock in the lowland areas will increase based on the proximity of the Muskingum River. Based on ODNR water well log information, the depth to bedrock increases from roughly 20 to 40 feet near the base of the hillside to in excess of 75 feet beneath the Muskingum River. Additionally, the bedrock beneath the lowland areas typically consists of Monongahela Group sandstone, siltstone, and shale.

The "Ohio Karst Areas" map published by ODNR does not show any probable karst features in the immediate vicinity of the site.

Geohazards

The ODNR "Landslides in Ohio" map indicates the upland areas of the project study area are within a portion of Ohio that is subject to severe slope failures. Plate 3A included with this submission presents a copy of the USGS landslide map for the Marietta quadrangle and includes the approximate boundaries of the study area for the proposed multi-use trail. Also, included on Plate 3A are the locations of documented landslides and rockfalls from the ODOT Transportation Information Mapping System (TIMS). Plate 3B presents the Legend for the symbology used on Plate 3A.

In general, Plate 3A indicates that the majority of the upland portions of this study area are susceptible to landslides. It should be anticipated that some of the soil overburden on these hillsides is likely at a reduced strength state (residual strength) because of having previously undergone movement during the former (historic) landslides.



S&ME also has significant experience providing geotechnical services to investigate and remediate landslides which have occurred in this area, particularly in the vicinity of the Marietta hospital and water treatment plant facilities uphill from SR 60 in the southern portion of the study area for this project.

General Geotechnical Considerations

Based on our review of available geologic mapping, our prior experience with the Devola-Marietta geology, and the existing boring information for the Devola-Oak Grove Sanitary Sewer project, S&ME presents the following summary of geotechnical issues for consideration during conceptual route planning of the proposed Multi-Use Trail:

- Significant geotechnical issues are not anticipated for portions of the Multi-Use Trail (MUT) constructed at the approximate existing grade in the lowland portions of the study area.
- Structures, such as pedestrian tunnels or bridges requiring below grade excavations, should anticipate the presence of shallow groundwater in lowland areas, and significant dewatering efforts (both short and long term) may be required for these structures.
- Structure foundations in the lowland portion of the study area should not anticipate bearing on bedrock. Factored foundation bearing resistance values between 2 and 3 kips per square foot may be required where very-loose to loose granular soils are present,
- Fill embankments required in lowland areas should anticipate undergoing several inches of settlement, depending on the height of the embankment. This settlement, however, should occur relatively quick.
- Portions of the MUT constructed adjacent to streams or the Muskingum River may require embankment stabilization and/or scour protection.
- **Significant geotechnical issues should be anticipated at all locations where the conceptual routing of the MUT extends into the upland areas.** S&ME anticipates that providing stable embankments and sidehill cut/fill slopes will be difficult, and likely require either the purchase of more right-of-way than usual to provide stable slopes (potentially 3(H):1(V) or flatter), or the installation of retaining structures to maintain long-term stability of the hillsides above and or below the proposed MUT alignment.
- Where existing mapping shows the presence of former or historic landslides, it should be anticipated that any retaining structures will need to be designed using residual soil strengths and higher than normal lateral earth pressures. Additionally, the presence of weathered bedrock may result in a larger foundation embedment than is typically required.
- Any rock cut slopes in the upland areas should anticipate needing to be sloped at angles between 1(H):1(V) and 2(H):1(V).



◆ Final Considerations

The discussions and topics presented for consideration in this Phase 1 geotechnical paper study are based on publicly available information, the preliminary project boundaries available at the time of this document, and our knowledge of the area. It should be noted that conditions within the study area may change based on the time of year and the weather conditions. It should also be noted that no field explorations, sampling, or laboratory testing were performed during this Phase 1 study. This report and its contents were prepared to provide conceptual information only, and shall not be relied upon during any detailed geotechnical analyses or engineering design.

Phase 2 of this study will include a closer examination of roughly 3 Feasible Alternatives, and will include more detailed discussion of potential geotechnical issues for the short-listed Feasible Alternative alignments for the trail. S&ME will prepare a second brief letter report for Phase 2 that includes further and more discussion of the geotechnical issues related specifically to the Feasible Alternative alignments being considered, including any field observations or photographs. The Phase 2 letter report will also include discussion of future geotechnical field explorations and laboratory testing which may be required for the Feasible Alternatives of the trail.

If you have any questions regarding this Phase 1 submission, please don't hesitate to contact our office.

Respectfully,

S&ME, Inc.

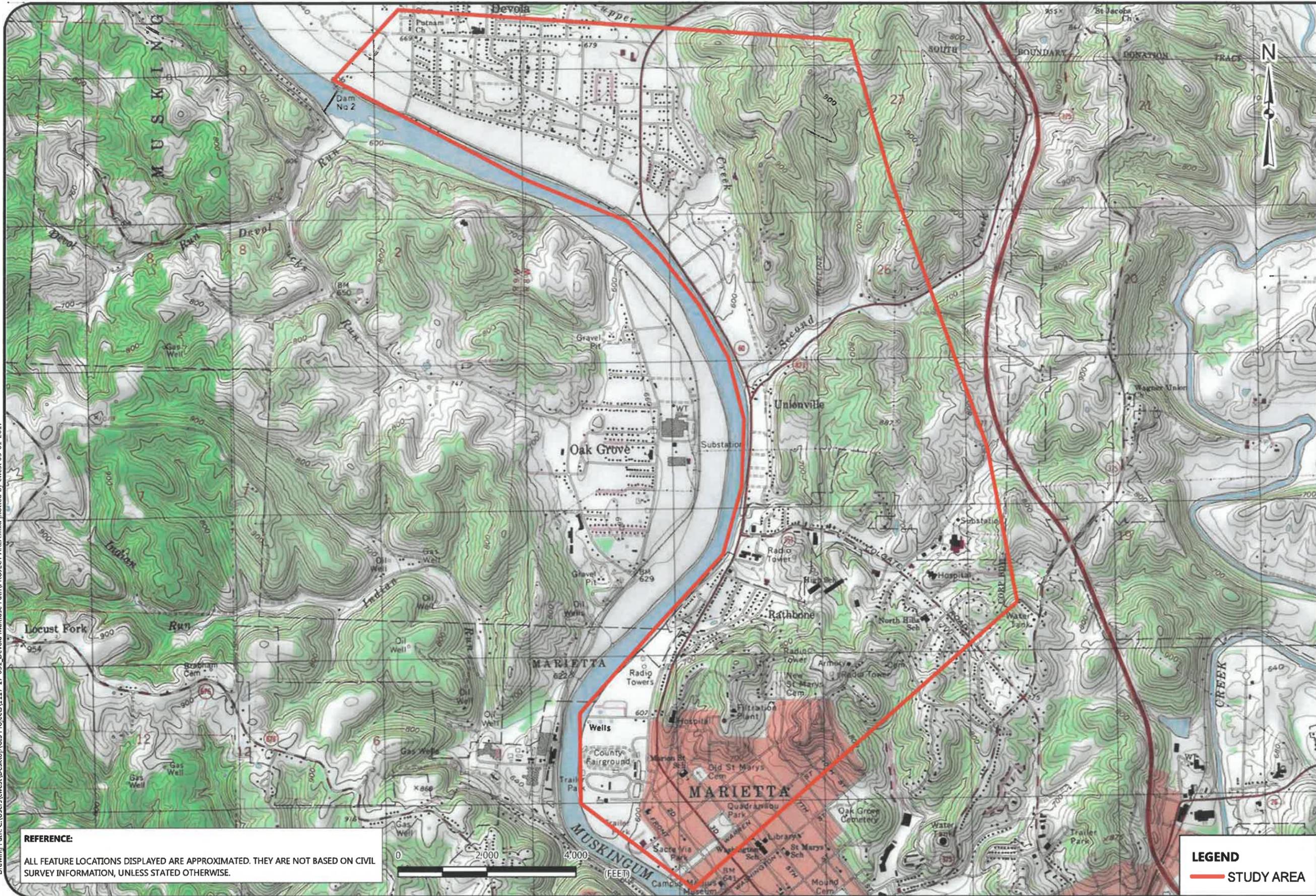
Richard S. Weigand, P.E.
Senior Engineer

Bethanie L. Meek, P.E.
Senior Reviewer

Attachments: Appendix (4 sheets)

Appendix

Drawing Path: C:\Users\cwest\Desktop\GIS Projects\1117-17-031_Devola Multituse Path\PROJECT AREA.mxd plotted by cwest 09-01-2017



PROJECT AREA

DEVOLA MULTITUSE PATH
DEVOLA, WASHINGTON COUNTY, OHIO

SCALE:
1" = 2,000'

DATE:
9-1-17

PROJECT NUMBER
1117-17-031

PLATE NO.

1

REFERENCE:

ALL FEATURE LOCATIONS DISPLAYED ARE APPROXIMATED. THEY ARE NOT BASED ON CIVIL SURVEY INFORMATION, UNLESS STATED OTHERWISE.



LEGEND
— STUDY AREA

Drawing Path: C:\Users\cwest\Desktop\GIS Projects\1117-17-031_Devola Multiuse Path\PROJECT AREA.mxd plotted by cwest 09-01-2017

REFERENCE:

ALL FEATURE LOCATIONS DISPLAYED ARE APPROXIMATED. THEY ARE NOT BASED ON CIVIL SURVEY INFORMATION, UNLESS STATED OTHERWISE.



LEGEND
— STUDY AREA



PROJECT AREA

DEVOLA MULTIUSE PATH
DEVOLA, WASHINGTON COUNTY, OHIO

SCALE:
1" = 2,000'

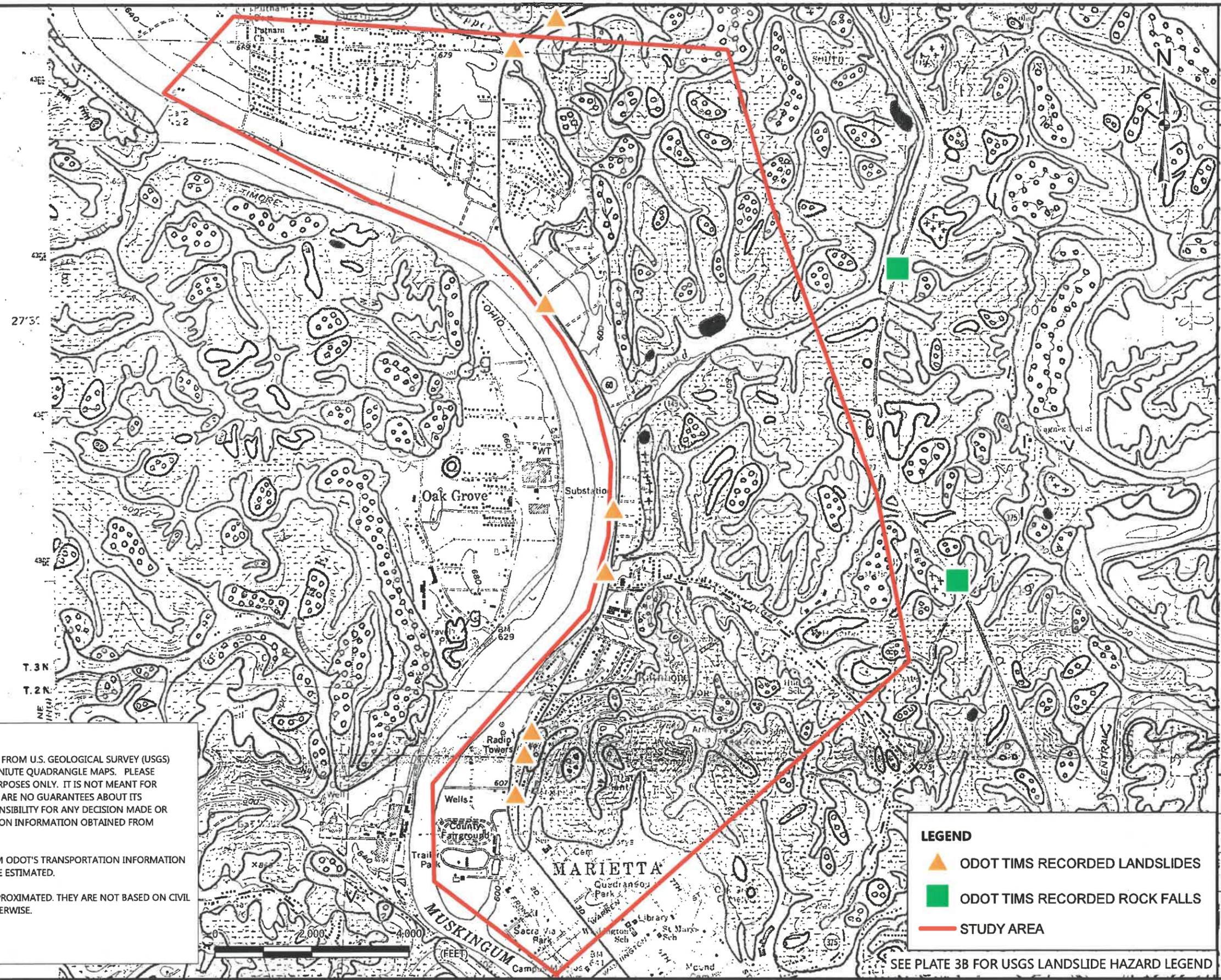
DATE:
9-1-17

PROJECT NUMBER
1117-17-031

PLATE NO.

2

Drawing Path: C:\Users\cwest\Desktop\GIS Projects\1117-031_Devola Multiuse Path\Landslide Hazard map.mxd plotted by cwest 09-01-2017



REFERENCE/SOURCE:

THE ABOVE LANDSLIDE DATA WAS OBTAINED FROM U.S. GEOLOGICAL SURVEY (USGS) "LANDSLIDE AND RELATED FEATURES" 7.5 MINUTE QUADRANGLE MAPS. PLEASE NOTE THIS DATA IS FOR INFORMATIONAL PURPOSES ONLY. IT IS NOT MEANT FOR DESIGN, LEGAL, OR ANY OTHER USES. THERE ARE NO GUARANTEES ABOUT ITS ACCURACY. S&ME, INC. ASSUMES NO RESPONSIBILITY FOR ANY DECISION MADE OR ANY ACTIONS TAKEN BY THE USER BASED UPON INFORMATION OBTAINED FROM THE ABOVE DATA.

ODOT GEOHAZARDS WERE OBTAINED FROM ODOT'S TRANSPORTATION INFORMATION MANAGEMENT SYSTEM, AND LOCATIONS ARE ESTIMATED.

ALL FEATURE LOCATIONS DISPLAYED ARE APPROXIMATED. THEY ARE NOT BASED ON CIVIL SURVEY INFORMATION, UNLESS STATED OTHERWISE.

- LEGEND**
-  ODOT TMS RECORDED LANDSLIDES
 -  ODOT TMS RECORDED ROCK FALLS
 -  STUDY AREA

SEE PLATE 3B FOR USGS LANDSLIDE HAZARD LEGEND



MAPPED GEOHAZARDS

DEVOLA MULTIUSE PATH
DEVOLA, WASHINGTON COUNTY, OHIO

SCALE:
1" = 2,000'

DATE:
9-1-17

PROJECT NUMBER
1117-17-031

PLATE NO.

3A



ACTIVE OR RECENTLY ACTIVE LANDSLIDE
Complex landslide composed of earthflow, debris slide, earth and rock slump. Identified from historical records, and from scars, debris and other field evidence. Ground extremely unstable; sliding accelerated by excavation, loading and changes in drainage conditions. May include areas with several active slides too small to be shown separately. Questioned where doubtful.



OLD LANDSLIDE
Area of extensive hummocky ground caused by earthflow and earth and rock slump. Lacks clear evidence of active sliding. Relatively stable in natural, undisturbed state, generally not affected by small structures properly sited in areas away from the edge of the toe; can be reactivated by extensive, rapid excavation, loading, and changes in ground water and surface water conditions. Area of old landslide probably includes recent ones not identified from field evidence or otherwise documented. Upslope boundary of landslide generally defined by modified scarp, but downslope (toe) may be gradational and not well defined. Questioned where doubtful.



COMBINATION LANDSLIDE
Area of recent and old slides in which individual slides are not identified.



COLLUVIAL SLOPE
Valley wall along major streams with slope as steep as 40° (85%); stony, clayey silt soil up to 50 ft. (15 m) thick; commonly buttressed by a terrace or bench at the toe of the slope; very susceptible to sliding by cutting of toe area, removal of terrace or bench, and overloading; slide commonly activated without apparent cause.



COLLUVIAL SLOPES WITH LANDSLIDES
Landslides too small or obscure to map individually.



AREAS SUSCEPTIBLE TO DEBRIS FLOWS AND DEBRIS AVALANCHES
Primarily shallow, narrow ravines and chutes with accumulation of stony colluvium generally 10 ft. (3 m) or less in thickness; susceptible to rapid movement during intense rainfall. Most ravines and chutes designated show evidence of former debris flows and avalanches. Symbol & designates historical debris flow or debris avalanche.



AREAS SUSCEPTIBLE TO ROCKFALL
Steep, locally vertical, natural and man-made slopes and cliffs 15 ft. (4.5 m) or more high; formed dominantly of sandstone, limestone, sandy shale, mudstone and claystone. Interbedded mudstone, claystone and shale weather rapidly leaving sandstone and limestone rock faces unsupported.



COVE UNDERLAIN BY CLAY LAYER
Rounded or U-shaped valley with steep concave slope of valley floor (coves) and valley heads underlain by clayey soils forming a coherent layer generally 8 ft. (2.5 m) or less in thickness. Zone of water commonly at the base of the clay layer is under 2 to 8 ft. (0.6 - 2.5 m) artesian head. Clay soil is underlain by claystone and shale. Clay slab moves as a coherent mass up to 1 ft. (0.3 m) per year; very susceptible to more rapid sliding when overloaded by fill or structure and by excavations that break the continuity of slope. Recent soil slips (earth flows) as much as 40,000 square feet (3,700 square meters) in size are common.



SOIL AND ROCK SUSCEPTIBLE TO LANDSLIDING
Soil and rock similar to that involved in landslides elsewhere in map area; primarily areas underlain by claystone, mudstone and shale associated with other rock types. Rock weathers rapidly on exposure forming clayey soil highly susceptible to sliding. Includes coves (U-shaped, shallow valleys) containing thick layers of clayey soil that are very susceptible to sliding where excavation breaks continuity of slope and where overloaded by artificial fill.

AREAS LEAST PRONE TO LANDSLIDES
Map areas in which no patterns or symbols are shown; primarily valley floors, ridge tops and broad benches; modification by excavation and fill may lead to local landslides.

MAN-MADE FEATURES
Strip mines (combination of letter symbols) indicates complex formed of more than one type of strip mine)

- sh bench with high wall
- sf furrowed with high wall
- sd multiple furrows and multiple benches
- srg reclaimed by grading
- sru reclaimed by secondary use
- sh/r regraded in part, high wall remains

- Coal refuse banks**
- r identified on aerial photographs; not classified in field check
 - rb not burnt nor on fire
 - rbb burnt
 - rbd burning
 - rbs sludge
- Quarries**
- q quarry site
 - qub spoil bank, quarry waste

- Gravel pits**
- g site of gravel pit

NOTE
Information shown is intended as a general guide to ground conditions as of the date of field check. Additional landslides and rockfalls should be anticipated in all map units. The map unit depicts the dominant condition in the area delineated and variations in slope stability may occur at any point in the unit. This map is suitable for general planning purposes and as a supplement to more detailed studies for site selection. The map cannot be used as a substitute for detailed geologic and engineering investigations to establish design and construction criteria of specific sites. Some symbols may not appear on this map because the description is applicable to a series of maps.

REFERENCE:
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SCALE: N/A
DATE: 08-31-17
DRAWN BY: CRW
PROJECT NO:



USGS LANDSLIDE AND RELATED FEATURES QUADRANGLE
LEGEND

PLATE NO.
3B