# **Attachment D**

Structures Type Study

Segment 1 Structure Type Study



#### STRUCTURE TYPE STUDY

Wasson-Armleder Trail Bridges on Segment 1

February 27, 2024

Prepared for: ODOT - District 8

Prepared by: Stantec

The conclusions in the Report titled Structure Type Study are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

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This Report is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Report may be provided by the Client to applicable authorities having jurisdiction and to other third parties in connection with the project, Stantec disclaims any legal duty based upon warranty, reliance or any other theory to any third party, and will not be liable to such third party for any damages or losses of any kind that may result.

Prepared by:	
, ,	Signature
	Printed Name
Reviewed by:	
	Signature
	Printed Name

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### 1 Introduction

The purpose of this report is to determine and evaluate the estimated construction cost for each of the two structures on alignment A proposed for the Segment 1 portion of the trail. The evaluation is to aid in determining the preferred alignment with which to move forward.

The proposed paved shared-use path will be 12 feet wide with 5-foot shoulders on each side. Segment 1-A provides an extension of the existing Wasson Armleder trail. This segment commences from a point where the existing trail leaves the abandoned railroad bed to connect to Old Red Bank Road and extends the trail across Duck Creek, Red Bank Road, and US 50 following the abandoned railroad bed and utilizing the two existing railroad bridges. This segment of the trail terminates at a point just west of Wooster Road.

# 2 Design Considerations

## 2.1 Design Specifications

All proposed structures will be designed in accordance with the 2020 ODOT Bridge Design Manual, the ODOT Multimodal Design Guide (2023), the AASHTO LRFD Bridge Design Specifications, 9<sup>th</sup> Edition (2020) and the AASHTO Guide Specifications for the Design of Pedestrian Bridges, 2<sup>nd</sup> Edition (2009).

## 2.2 Bridge Design Criteria

- Pedestrian Live Load of 90 psf
- H15-44 vehicle loading (Ambulance or maintenance vehicles) without dynamic load allowance
- No Future Wearing Surface
- The width of the bridges preferably should provide 16 feet face to face of the railings in accordance with the ODOT Mulitmodal Design Guide.

#### 2.3 Geotechnical

No geotechnical borings will be performed for this segment since the trail utilizes existing structures. The structures appear to be stable without signs of settlement or movement in the substructures. The foundations supported railroad traffic for many years and the loadings from the proposed trail will not exceed the loadings from rail traffic.

# 2.4 Hydraulics

Hydraulics are not a consideration for these bridges since existing bridges will be utilized and none cross a body of water.



### 3 Alternatives

Alternatives have been considered for the utilization of the two abandoned railroad bridges on this segment. These alternatives are presented in this section.

## 3.1 Railroad Bridge over Duck Creek and Red Bank Road

#### 3.1.1 EXISTING RAILROAD BRIDGE

The existing bridge is a steel plate girder structure with two steel girders spaced 6'-6" on center. Timber ties set directly on the steel stringers. The structure is  $432'-8"\pm$  long with six spans,  $65.75'\pm - 125.00'\pm - 76.58'\pm - 39.00'\pm - 63.00'\pm - 63.33'\pm$ . No protective coating is visible on any of the members. In general, the plate girders are 75.5" $\pm$  deep except for Span 2 where the girders are 120.5"  $\pm$  deep.

Piers 1 and 2 are concrete wall type piers. Span 4, and the end of Spans 3 and 5, is supported by a steel-framed trestle. The pier supporting Spans 5 and 6 is a steel A-frame. Both the trestle and the A-frame are supported on concrete foundations. All the steel members in both the superstructure and substructure appear to be in good condition with surface corrosion on all members.

#### **3.1.1.1** Alternative 1

This alternative involves removing the timber ties and replacing them with a 9-inch± thick reinforced concrete deck supported on the steel stringers. The trail would be carried on top of the concrete slab with concrete barriers topped with steel tube railings. The height of the bridge from profile grade to the ground below varies from approximately 40 feet to 75 feet. Therefore, the railings will need to be taller than normal for the comfort and safety of cyclists and pedestrians.

The 2022 inspection report which was provided to us indicates the steel members of the superstructure are in fair condition with extensive surface corrosion. The concrete piers and abutments are in poor condition with significant amounts of cracking, efflorescence, and spalling. These will need to be cleaned and patched as part of this alternative.

#### **3.1.1.2** Alternative 2

This alternative would involve the removal of the existing superstructure and providing a new superstructure with a length of approximately 432 feet. The existing abutments and piers would be modified to support the new superstructure. It is apparent this alternative would be much more expensive than Alternative 1 and will not be studied further at this time.

## 3.2 Railroad Bridge over US 50

#### 3.2.1 EXISTING RAILROAD BRIDGE

The existing bridge is a two-span steel through-plate girder structure constructed in 1962 with spans of 67.00'± - 62.00'± and a total length of 129'±. All steel members are in good condition with the protective



#### Structure Type Study 4 Cost Estimates

coating intact. The concrete wall-type abutments and pier appear to be sound with no visible cracking or spalling.

Field measurements indicate the through-plate girders are spaced 15.5'± center to center with a clear distance between flanges of 12.5'±. The superstructure consists of steel floorbeams between the throughgirders topped with a steel plate deck. The floorbeams are located approximately mid-height of the through-girders.

#### 3.2.1.1 Alternative 1

This alternative utilizes the existing structure with minor modifications to accommodate the trail. The ballast and ties would be removed and the steel deck plate cleaned. An asphalt wearing surface would be placed on the steel deck plate to provide a wearing surface for the trail. Due to the geometry of the existing structure, the trail width would be reduced significantly while crossing the bridge. The existing structure provides only 12.5'± clear distance between the flanges of the girders. A rub rail would be required to protect cyclists from contacting the flanges, reducing the usable width to 11.5'±. This is less than the width of the trail off the bridge and well below the recommended minimum width of 14' for a 12' wide trail. A railing would be mounted on top of the flanges as fall protection for the riders.

#### 3.2.1.2 Alternative 2

This alternative would involve the removal of the existing superstructure and providing a new superstructure with a width sufficient to accommodate the trail. The existing abutments would be modified to support the new superstructure. It is apparent this alternative would be much more expensive than Alternative 1 and will not be studied further at this time.

#### 4 Cost Estimates

Preliminary construction cost estimates were developed for each proposed structure to aid in selecting a preferred trail alignment. Future maintenance costs are not included in these estimates, but will be significant over the life of the structures, particularly for the bridge over Duck Creek and Red Bank Road.

Alignment Segment	<b>Estimated Construction Cost</b>
1-A	
Bridge over Duck Creek/Red Bank Road	\$935,500
RR Bridge over US 50	\$151,200
Total Segment Cost	\$1,086,700



Project Number: 173620146

# **APPENDIX A**



# Appendix A

- A.1 Proposed Trail Alignments
- A.2 Estimated Construction Cost
- A.3 Estimated Quantities



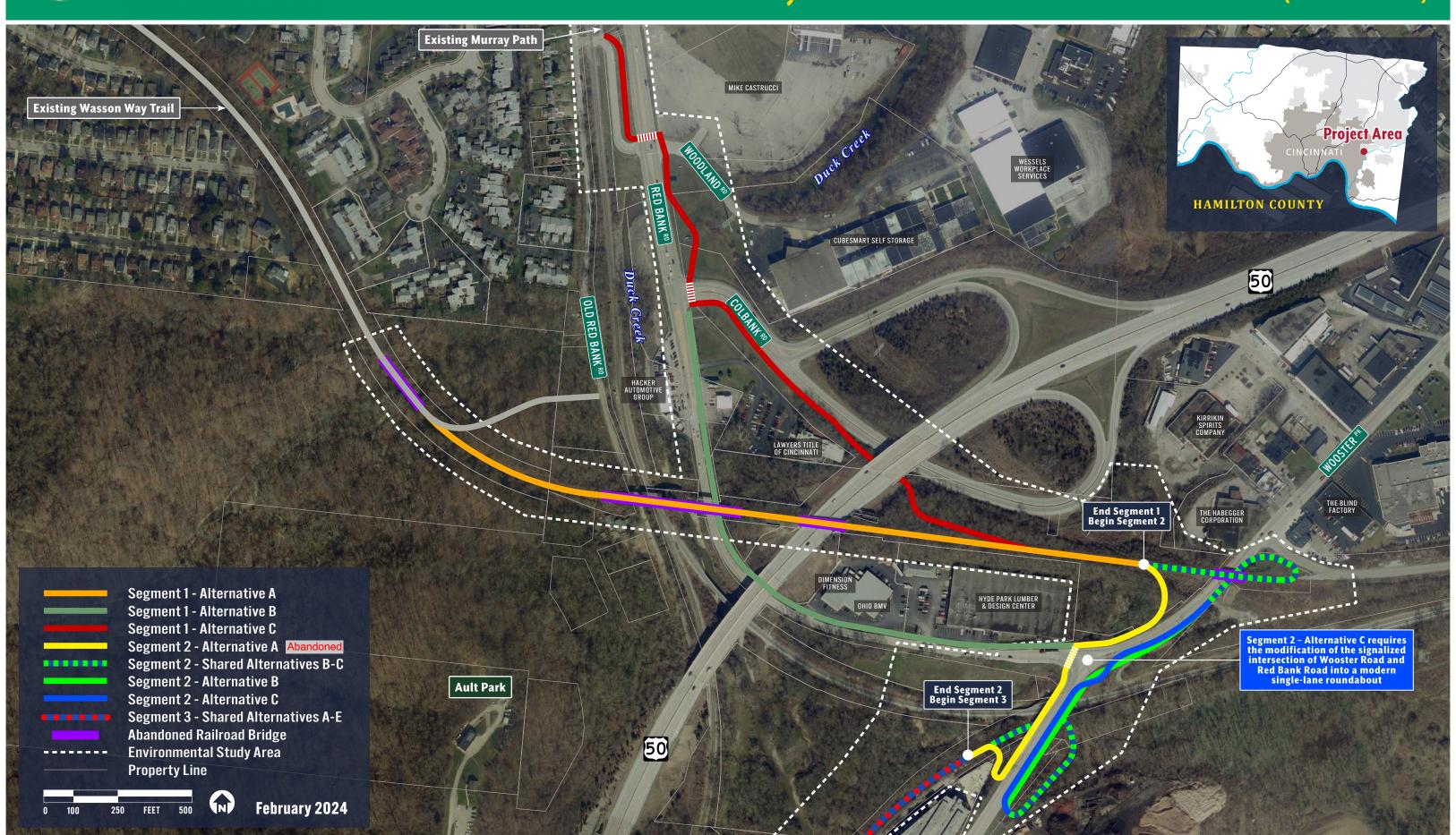
# **APPENDIX A.1**





# **Shared Use Path Alternatives**

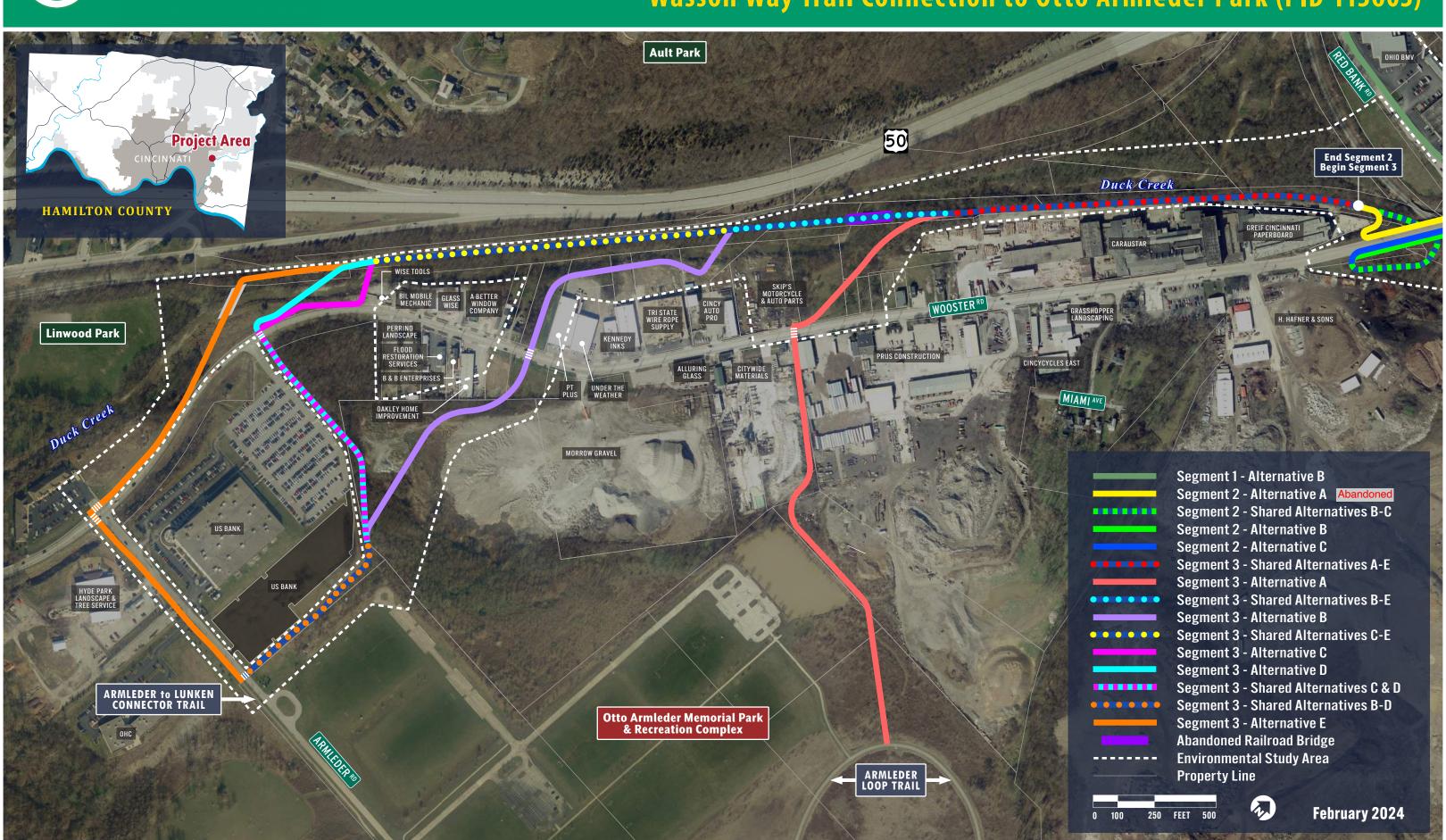
Wasson Way Trail Connection to Otto Armleder Park (PID 113603)





# **Shared Use Path Alternatives**

Wasson Way Trail Connection to Otto Armleder Park (PID 113603)



# **APPENDIX A.2**



# Estimate Seg 1-A RB

Estimated Cost:\$779,588.48

Contingency: 20.00%

**Estimated Total: \$935,506.18** 

Wasson Armleder Structure Type Study Segment 1-A, Railroad Bridge over Duck Creek & Red Bank

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

Prepared by Stantec on 02/27/24

Estimate: Seg 1-A RB

**Description** 

Line # Item Number

**Supplemental Description** 

Group 0001: Initial Group	
0005 202E11202 1.000 LS \$50,000.00000 PORTIONS OF STRUCTURE REMOVED, OVER 20 FOOT SPAN	\$50,000.00
0009 509E10000 60,100.000 LB \$1.92291 EPOXY COATED STEEL REINFORCEMENT	\$115,566.89
0010 511E34446 219.000 CY \$1,103.92587 CLASS QC2 CONCRETE WITH QC/QA, BRIDGE DECK	\$241,759.77
0012 511E44110 17.000 CY \$1,497.25943 CLASS QC1 CONCRETE, ABUTMENT NOT INCLUDING FOOTING	\$25,453.41
0015 517E75120 864.000 FT \$224.98307 RAILING (CONCRETE PARAPET WITH TWIN STEEL TUBE RAILING)	\$194,385.37
0016 518E21200 28.000 CY \$125.96998 POROUS BACKFILL WITH GEOTEXTILE FABRIC	\$3,527.16
0017 518E40000 50.000 FT \$10.49939 6" PERFORATED CORRUGATED PLASTIC PIPE	\$524.97
0018 518E40010 30.000 FT \$19.30129 6" NON-PERFORATED CORRUGATED PLASTIC PIPE, INCLUDING SPECIAL S	\$579.04
0019 519E11100 1,000.000 SF \$97.79187 PATCHING CONCRETE STRUCTURE	\$97,791.87
0020 519E12610 400.000 FT \$125.00000	\$50,000.00

SPECIAL - CONCRETE REPAIR BY EPOXY INJECTION INCLUDING SURFA CE PREPARATION

**Quantity** Units Unit Price

Total for Group 0001:\$779,588.48

**Extension** 

# Estimate Seg 1-A US 50

Estimated Cost:\$125,969.65

Contingency: 20.00%

**Estimated Total: \$151,163.58** 

Wasson Armleder Structure Type Study Segment 1-A, Railroad Bridge over US 50

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

Prepared by Stantec on 02/27/24

Estimate: Seg 1-A US 50

**Description** 

Line # Item Number

		plemental Description				
G	Group	0001: Initial Group				
	0005 POR	202E11202 TIONS OF STRUCTURE REMOVED, OVER	1.000 20 FOOT SF		\$25,000.00000	\$25,000.00
	0007 ASPI	441E10100 HALT CONCRETE SURFACE COURSE, TYI	9.000 PE 1, (446), F	_	\$300.00000	\$2,700.00
	0008 ASPI	441E10100 HALT CONCRETE SURFACE COURSE, TYI	15.000 PE 1, (446), F		\$300.00000	\$4,500.00
	0009 EPO	509E10000 XY COATED STEEL REINFORCEMENT	2,200.000	LB	\$2.56338	\$5,639.44
	0012 CLAS	511E44110 SS QC1 CONCRETE, ABUTMENT NOT INC	17.000 LUDING FOO		\$1,497.25943	\$25,453.41
	0015 RAIL	517E75120 ING (CONCRETE PARAPET WITH TWIN ST	258.000 FEEL TUBE F		\$224.98307	\$58,045.63
	0016 POR	518E21200 OUS BACKFILL WITH GEOTEXTILE FABRI	28.000 C	CY	\$125.96998	\$3,527.16
	0017 6" PE	518E40000 ERFORATED CORRUGATED PLASTIC PIPE	50.000	FT	\$10.49939	\$524.97
	0018	518E40010	30.000	FT	\$19.30129	\$579.04

6" NON-PERFORATED CORRUGATED PLASTIC PIPE, INCLUDING SPECIAL S

**Quantity Units Unit Price** 

Total for Group 0001:\$125,969.65

**Extension** 

# **APPENDIX A.3**





Bike Trail - Wasson Armleder
Segment 1-A Estimated Quantities

RR over Duck Creek & Red Bank - CIP Slab

		<u>Length</u>	Width	<u>Height</u>	Number	<u>Total</u>	<u>Units</u>
Item 507,	12" CIP Reinforced Piles, Driven						
	Abutment	50.00	1.00	1.00	0	0 L	F
	Pier	63.00	1.00	1.00	0	0	
		62.00	1.00	1.00	0	0	
					-	<u> </u>	F
tem 507,	12" CIP Reinforced Piles, Furnish	ed					
	Abutment	55.00	1.00	1.00	0	0 L	F
	Pier	68.00	1.00	1.00	0	0	
		67.00	1.00	1.00	0	0	
					-	0 L	F
tem 509,	Epoxy Coated Reinforcing Steel						
,	Abutment	Assume 1%				2205 L	В
	Pier	Assume 2%				0	
	Slab	Assume 2%	‰ steel			57859	
					-	60064 L	В
tem 511,	Class QC2 Concrete, Superstruct Slab	ture 432.00	17.33	0.75	4	208 C	`V
	Haunch	432.00	2.00	0.75	1 2	200 C	, Y
	Tidulion	402.00	2.00	0.17			
						219 C	Υ
tem 511,	Class QC1 Concrete, Abutment Ir	-	-	2.00	0	0.0	<b>'</b> 'V
	Footing Beam Seat	25.00 25.00	3.00 3.00	3.00 3.00	0 2	0 C 17	, Y
	Wingwalls	6.52	2.25	3.00	0	0	
	Villgwalls	0.02	2.20	0.00			
						17 C	Υ
tem 511,	Class QC1 Concrete, Pier above	Footing 16.47	3.00	2.00	0	0 0	Υ
					-		
					- -	0 C	Υ
tem 517,	Twin Steel Tube Railing, modified		1.00	4.00	2	004.1	_
		432.00	1.00	1.00	2	864 L	Г
tem 518.	Porous Backfill with Geotextile Fa	bric					
,	555.57	25.00	2.00	7.50	2	28 C	Υ
tem 518	6" Perforated Plastic Pipe						
,		25.00	1.00	1.00	2	50 L	F
tem 518,	6" Non-Perforated Plastic Pipe	15.00	1.00	1.00	2	30 L	

Designed by:



Bike Trail - Wasson Armleder
Segment 1-A Estimated Quantities

RR over Duck Creek & Red Bank - CIP Slab

	<u>Length</u>	<u>Width</u>	<u>Height</u>	Number	Total <u>Units</u>
Item 519, Patching Concrete Structures(	Assume 25%	of surface	area)		
rear abutment	13.00	1.00	15.00	1	49 SF
	34.50	1.00	15.00	2	259
pier 1	16.00	1.00	33.00	2	264
pier 2	16.00	1.00	41.00	2	328
forward abutment	21.00	1.00	10.00	1	53
	12.00	1.00	10.00	2	60
				-	1012 SF
Item 519, Epoxy Injection (Assume 10%	of surface are	a)			
rear abutment	13.00	1.00	15.00	1	20 LF
	34.50	1.00	15.00	2	104
pier 1	16.00	1.00	33.00	2	106
pier 2	16.00	1.00	41.00	2	131
forward abutment	21.00	1.00	10.00	1	21
	12.00	1.00	10.00	2	24
				_	405 LF

Designed by:\_ Checked by:\_



RR bridge over US 50

	<u>Length</u>	<u>Width</u>	<u>Height</u>	Number	<u>Total</u>	<u>Units</u>
tem 441 Asphalt Surface Course						
	129.00	15.50	0.13	1	9 (	CY
tem 445 Asphalt Intermediate Course						
	129.00	15.50	0.21	1	15 (	ĴΥ
tem 507, 12" CIP Reinforced Piles, Furni	shed					
Abutment	134.00	1.00	1.00	0	0 L	_F
Pier	5.00	1.00	1.00	0	0	
	5.00	1.00	1.00	0	0	
				_	0 L	_F
tem 509, Epoxy Coated Reinforcing Stee		/ -tl			2005 1	Б
Abutment Pier	Assume 19 Assume 29				2205 L 0	_B
Slab	Assume 2%				0	
				-	2205 L	_B
tem 511, Class QC2 Concrete, Superstru	ıcture					
Slab	129.00	17.33	0.75	0	0 (	CY
Curb	129.00	0.50	0.50	0	0	
				-	0 (	CY
tem 511, Class QC1 Concrete, Abutment			0.00	0	0.4	2)./
Footing Beam Seat	25.00 25.00	3.00 3.00	3.00 3.00	0 2	0 ( 17	JY
Wingwalls	6.52	2.25	3.00	0	0	
				-	17 (	CY
tem 511, Class QC1 Concrete, Pier abov	vo Footing					
terri 311, Class QC1 Coriclete, Fier abov	16.47	3.00	2.00	0	0 (	CY
				_	0 (	CY
tem 517, Twin Steel Tube Railing, modifi	ed. 129.00	1.00	1.00	2	258 L	F
		1.00	1.00	۷	200 L	_1
tem 518, Porous Backfill with Geotextile	Fabric 25.00	2.00	7.50	2	28 (	CY
tem 518, 6" Perforated Plastic Pipe						
3.0, 5 . 5.101atou i idollo i ipo	25.00	1.00	1.00	2	50 L	_F
tem 518, 6" Non-Perforated Plastic Pipe	15.00	1.00	1.00	2	30 L	F
	15.00	1.00	1.00	_	JU L	_1_

Designed by:

Segment 2 Structure Type Study



#### STRUCTURE TYPE STUDY

Wasson-Armleder Trail Bridges on Segment 2

February 27, 2024

Prepared for: ODOT - District 8

Prepared by: Stantec

The conclusions in the Report titled Structure Type Study are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

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Prepared by:		
	Signature	
	Printed Name	
Reviewed by:		
	Signature	
	Printed Name	

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### 1 Introduction

The purpose of this report is to determine and evaluate the estimated construction cost for each of the two alternative alignments (B and C) proposed for the Segment 2 portion of the trail. The evaluation is to aid in determining the preferred alignment with which to move forward. Segment 2 crosses the Wooster Road bridge over the Norfolk Southern tracks and this study will determine the recommended manner of accommodating the trail on the bridge and the cost of the proposed structure modification for each alternative.

The proposed paved shared-use path will be 12 feet wide with 5-foot shoulders on each side. Segment 2 begins at a point on the west side of Wooster Road, north of Red Bank Road and terminates on the west side of Wooster Road on the south side of the Norfolk Southern tracks. The trail will cross the existing railroad bridge over Wooster Road as well as the Wooster Road bridge over the Norfolk Southern tracks.

# 2 Design Considerations

## 2.1 Design Specifications

All proposed structures will be designed in accordance with the 2020 ODOT Bridge Design Manual, the ODOT Multimodal Design Guide (2023), the AASHTO LRFD Bridge Design Specifications, 9<sup>th</sup> Edition (2020) and the AASHTO Guide Specifications for the Design of Pedestrian Bridges, 2<sup>nd</sup> Edition (2009).

# 2.2 Bridge Design Criteria

- Pedestrian Live Load of 90 psf
- H15-44 vehicle loading (Ambulance or maintenance vehicles) without dynamic load allowance
- No Future Wearing Surface
- The width of the bridges preferably should provide 16 feet face to face of the railings in accordance with the ODOT Mulitmodal Design Guide.

#### 2.3 Geotechnical

A geotechnical investigation has not been performed at this stage of the project. Geotechnical information is based on historical borings in the vicinity of the bridges. The historical borings indicate the presence of sand, gravel, and clay to a depth of approximately 80 feet. Rock was not encountered in any of the borings. Therefore, the assumption for this is that new foundations for widening the Wooster Road bridge will be deep foundations using CIP piling.



No geotechnical investigation will be performed for the existing railroad bridge. The substructures appear to be stable without signs of settlement or movement. The foundations supported railroad traffic for many years and the loadings from the proposed trail will not exceed the loadings from rail traffic.

## 2.4 Hydraulics

Hydraulics are not a consideration for these bridges since existing bridges will be utilized and none cross a body of water.

## 3 Alternatives

Alternatives have been considered for the utilization of the abandoned railroad bridge over Wooster Road. These alternatives are presented in this section along with discussions for modifications to the Wooster Road bridge over the Norfolk Southern tracks which will be required in Segments 2-B or 2-C.

## 3.1 Segment 2-B

#### 3.1.1 ALIGNMENT

For this alignment, the trail begins at a point on the west side of Wooster Road, crosses over Wooster Road on an abandoned railroad bridge, then descends and runs along the east side of Wooster Road, crossing the active Norfolk Southern railroad tracks by widening the existing roadway bridge over the railroad before descending and crossing under Wooster Road alongside the active railroad tracks. The segment terminates at a point on the west side of Wooster Road, south of the railroad tracks. This alignment requires modifications to two structures, the abandoned railroad bridge over Wooster Road and the highway bridge carrying Wooster Road over the Norfolk Southern railroad tracks.

#### 3.1.2 ABANDONED RAILROAD BRIDGE

The existing bridge is a single-span steel through-plate girder structure with a length of 75'±. The superstructure consists of two steel stringers and five steel floorbeams spanning between the through-girders. All the steel members appear to be in good condition with surface corrosion on all members. No protective coating is visible on any of the members.

Knee braces on the inside of each girder stiffen the girders at the floorbeams. Timber ties span between the stringers and originally supported the tracks which were placed on longitudinal timber members. Field measurements indicate the through-girders are spaced 16'-4"± center-to-center with 14'-10"± clear between the flanges. The knee braces each extend into the deck 2'-6"± at the level of the timber ties and 5"± at the level of the top flange. The girders extend 4'-9"± above the timber ties.

#### 3.1.2.1 Alternative 1

This alternative involves removing the timber ties and replacing them with a 9-inch thick reinforced concrete deck supported on the steel stringers and floorbeams. The trail would be carried on top of the



concrete slab with curbs to contain drainage on the deck away from the steel through-girders. This alternative would only provide a clear distance between the knee braces of 11'-4"±. This would be significantly less than the 16'-0" recommended by the ODOT Multimodal Design Guide for a 12'-0" trail and less than the width of the trail off the bridge. A rub rail would be required inside of the knee braces to protect cyclists from contacting the steel braces. This would further reduce the available clear width.

#### **3.1.2.2** Alternative 2

This alternative also involves removing the timber ties and replacing them with a 9-inch thick reinforced concrete deck supported on the steel stringers and floorbeams. However, fill material would be placed on the deck to raise the elevation of the trail to a point where 14'-0" of clearance could be provided between the knee braces. This would involve raising the profile of the trail 3'-0"± across the bridge and would provide the minimum shy distance of 1'-0" recommended by the ODOT Multimodal Design Guide for a trail on a bridge. Raising the trail would put the trail profile grade 1'-9"± below the top of the throughgirders, therefore, railings would be required on each side of the trail. The railings would be installed in the fill material to provide a railing 4'-6" above the trail.

Lightweight fill would be used to minimize the additional dead load on the structure with asphalt paving on top of the fill. Based on the existing plans, we've determined the capacity of the structure is more than adequate to support the loading from the shared-use path.

#### **3.1.2.3** Alternative **3**

This alternative would involve the removal of the existing superstructure and providing a new superstructure with a width sufficient to accommodate the trail with the preferred shy distances. The existing abutments would be modified to support the new superstructure. It is apparent this alternative would be much more expensive than Alternatives 1 and 2 and will not be studied further at this time.

#### 3.1.3 WOOSTER ROAD HIGHWAY BRIDGE

This concept involves widening to the east the existing three-span Wooster Road bridge over the Norfolk Southern railroad tracks to accommodate the proposed shared-use path. The existing superstructure consists of rolled steel beams with a composite concrete deck. The deflector shaped parapet on the east side would remain in place to separate traffic from the shared-use path. The widening would be constructed outside of the barrier with the deck extended at the same cross slope. A 16'-0" clear trail would be provided with a bicycle railing on the outside, for an overall widened width of 17'-0". The widening would require three new W30x148 steel beams spaced at 5'-0" center-to-center, matching the beam size and spacing on the existing bridge. The existing hammerhead piers would be widened to support the new beams by filling in below the cantilevered cap on the east side and creating a wall-type pier on the east end. The wall-type abutment on the north end of the bridge and the spill-thru abutment on the south end would also be extended to support the new beams.

The existing vertical clearance over the Norfolk Southern tracks is shown as 23.3 feet on the Bridge Inventory and Appraisal sheet from ODOT. The required minimum clearance over the tracks is 23 feet. Extending the normal cross slope of 0.0156 ft/ft/ on the bridge across the proposed widening would



reduce the vertical clearance to 23.05± feet. Therefore, after the tracks have been surveyed to determine the actual clearance, it may be necessary to reduce the cross slope on the widened portion, or reverse the cross slope on the widened portion, to maintain the required minimum clearance.

## 3.2 Segment 2-C

#### 3.2.1 ALIGNMENT

For this alignment, the trail begins at a point on the west side of Wooster Road, crosses over Wooster Road on an abandoned railroad bridge, then descends and runs along the east side of Wooster Road, crossing the active Norfolk Southern railroad tracks by means of the existing roadway bridge over the railroad before descending and crossing under Wooster Road alongside the active railroad tracks. The segment terminates at a point on the west side of Wooster Road, south of the railroad tracks. This alignment requires modifications to two structures, the abandoned railroad bridge over Wooster Road and the highway bridge carrying Wooster Road over the Norfolk Southern railroad tracks.

#### 3.2.2 ABANDONED RAILROAD BRIDGE

The existing bridge is a single-span steel through-plate girder structure with a length of 75'±. The superstructure consists of two steel stringers and five steel floorbeams spanning between the through-girders. All the steel members appear to be in good condition with surface corrosion on all members. No protective coating is visible on any of the members.

Knee braces on the inside of each girder stiffen the girders at the floorbeams. Timber ties span between the stringers and originally supported the tracks which were placed on longitudinal timber members. Field measurements indicate the through-girders are spaced 16'-4"± center-to-center with 14'-10"± clear between the flanges. The knee braces each extend into the deck 2'-6"± at the level of the timber ties and 5"± at the level of the top flange. The girders extend 4'-9"± above the timber ties.

#### 3.2.2.1 Alternative 1

This alternative involves removing the timber ties and replacing them with a 9-inch thick reinforced concrete deck supported on the steel stringers and floorbeams. The trail would be carried on top of the concrete slab with curbs to contain drainage on the deck away from the steel through-girders. This alternative would only provide a clear distance between the knee braces of 11'-4"±. This would be significantly less than the 16'-0" recommended by the ODOT Multimodal Design Guide for a 12'-0" trail and less than the width of the trail off the bridge. A rub rail would be required inside of the knee braces to protect cyclists from contacting the steel braces. This would further reduce the available clear width.

#### **3.2.2.2** Alternative 2

This alternative also involves removing the timber ties and replacing them with a 9-inch thick reinforced concrete deck supported on the steel stringers and floorbeams. However, fill material would be placed on the deck to raise the elevation of the trail to a point where 14'-0" of clearance could be provided between the knee braces. This would involve raising the profile of the trail 3'-0"± across the bridge and would



provide the minimum shy distance of 1'-0" recommended by the ODOT Multimodal Design Guide for a trail on a bridge. Raising the trail would put the trail profile grade 1'-9"± below the top of the throughgirders, therefore, railings would be required on each side of the trail. The railings would be installed in the fill material to provide a railing 4'-6" above the trail.

Lightweight fill would be used to minimize the additional dead load on the structure with asphalt paving on top of the fill. Based on the existing plans, we've determined the capacity of the structure is more than adequate to support the loading from the shared-use path.

#### 3.2.3 WOOSTER ROAD HIGHWAY BRIDGE

This concept involves utilizing the existing three-span Wooster Road bridge over the Norfolk Southern railroad tracks without widening the bridge to accommodate the proposed shared-use path. The existing superstructure consists of rolled steel beams with a composite concrete deck. A raised 5'-0" sidewalk is provided on the west side of the bridge with a deflector shaped parapet on the east side. This alternative proposes to remove the existing sidewalk, reduce the number of traffic lanes on Wooster Road across the bridge from three to two, and provide the shared-use path on the east side of the bridge. A new traffic barrier would be required on the west side of the bridge. A traffic barrier would also be provided on the east side of the two traffic lanes to separate the shared-use path from traffic. A new bicycle railing would be provided on the east side of the shared-use path. Both edges of the deck would be replaced to accommodate the new barriers, but no structural changes to the existing bridge are required.

## 4 Cost Estimates

Preliminary construction cost estimates were developed for each proposed structure on each alignment. Since all structure types are of similar material, future maintenance costs will be similar for each alternative and thus do not impact the selection of the preferred alternative.

Alignment Segment	Estimated Construction Cost
2-B	
Alternative 1 – CIP concrete slab	\$252,231
Alternative 2 - CIP concrete slab with fill	\$271,635 (recommended)
Wooster Road Bridge Widening	\$1,640,272
Total Segment Cost using Alternative 2	\$1,911,907



Alignment Segment	Estimated Construction Cost
2-C	
Alternative 1 – CIP concrete slab	\$252,231
Alternative 2 - CIP concrete slab with fill	\$271,635 (recommended)
Wooster Road Bridge Modification	\$585,400
Total Segment Cost using Alternative 2	\$857,035

## 5 Recommendation

This recommendation is only for the alternatives considered for rehabilitation of the railroad bridge. The costs for the Wooster Road bridge modifications will be used to determine the preferred trail alignment.

Based on the estimated initial construction cost, Alternative 1 is the less expensive alternative for each alignment. However, as noted above, it does not provide sufficient width to carry the trail across the bridge without significant reduction in the width of the trail. Considering that Alternative 2 is only 7.7% more expensive than Alternative 1, we recommend Alternative 2 be utilized in the rehabilitation of the railroad bridge for each alignment. The Total Segment Cost will be utilized for each alignment to determine the preferred trail alignment.

**3** 

# **APPENDIX A**



# Appendix A

- A.1 Proposed Trail Alignments
- A.2 Segment 2-B Estimated Construction Costs and Quantities
- A.3 Segment 2-C Estimated Construction Costs and Quantities



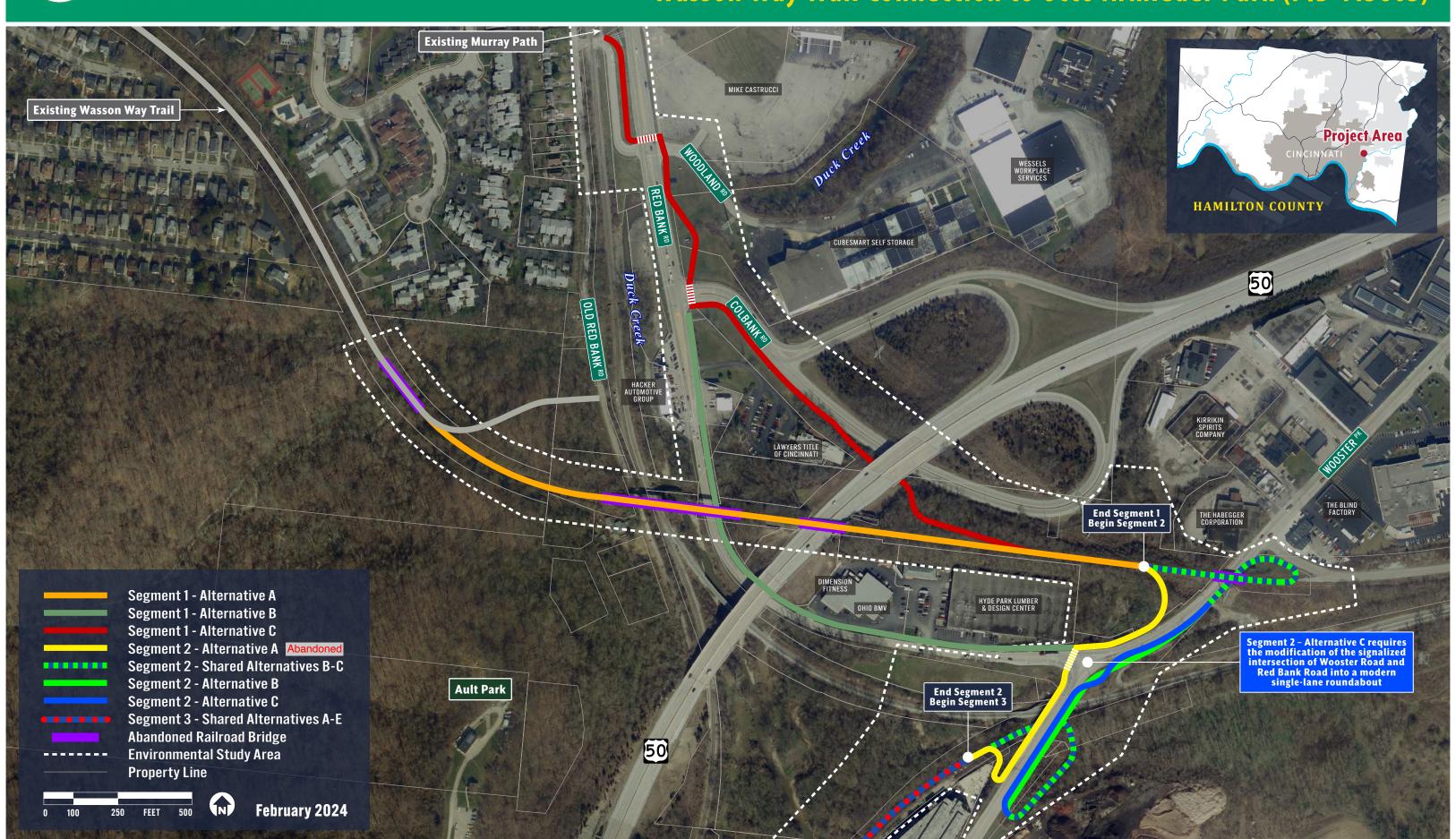
# **APPENDIX A.1**





# **Shared Use Path Alternatives**

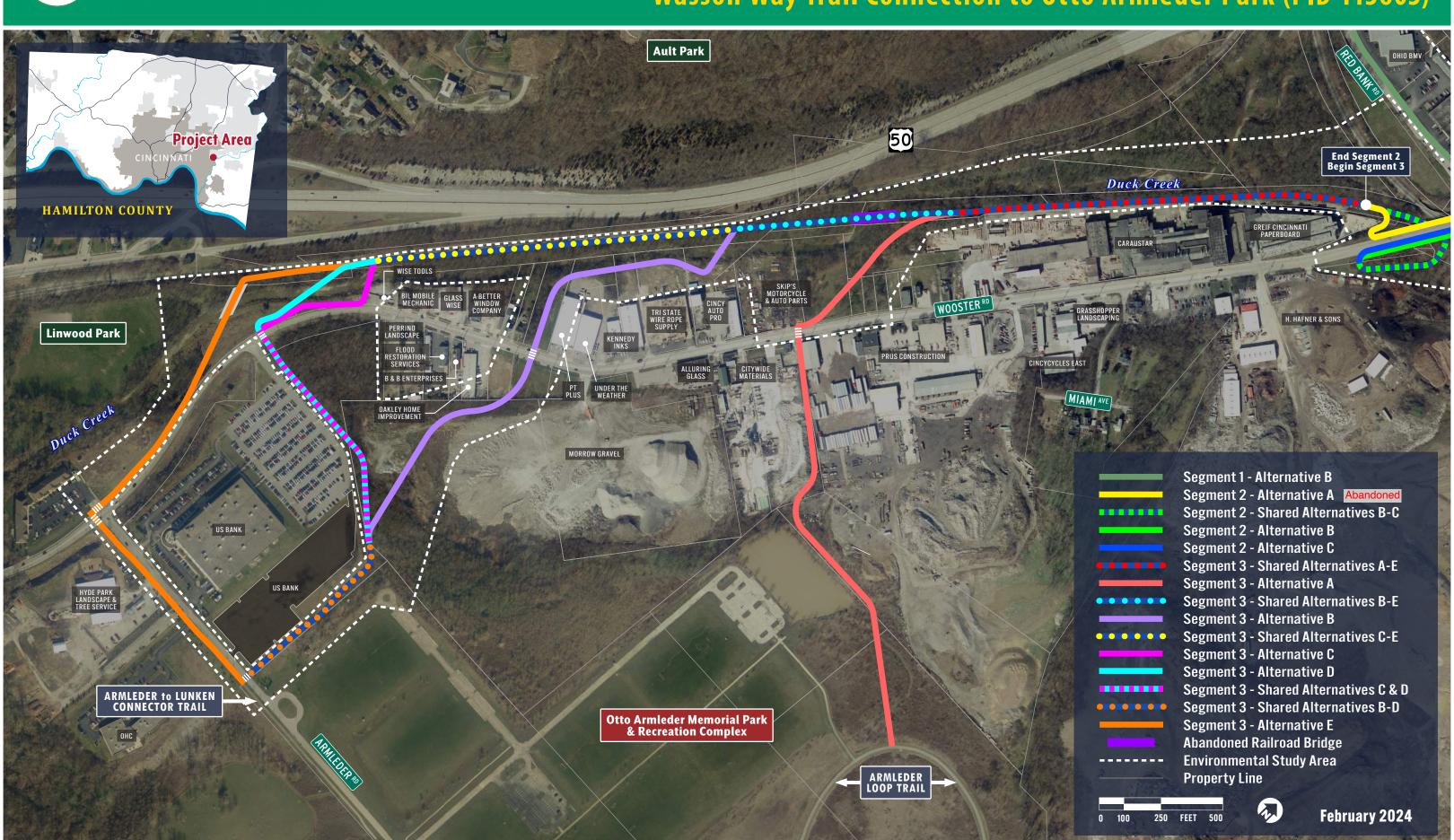
Wasson Way Trail Connection to Otto Armleder Park (PID 113603)





# **Shared Use Path Alternatives**

Wasson Way Trail Connection to Otto Armleder Park (PID 113603)



# **APPENDIX A.2**



## Estimate Seg 2-B, RR 1

Estimated Cost: \$210,192.21

Contingency: 20.00%

Estimated Total: \$252,230.65

Wasson Armleder Structure Type Study Segment 2-B, RR Bridge Rehab Alternative 1

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

Prepared by Stantec on 02/27/24

Estimate: Seg 2-B, RR 1

**Description** 

Line # Item Number

Supplemental Description				
Group 0001: Initial Group				
0005 202E11202 PORTIONS OF STRUCTURE REMOVED, OV	1.000 ER 20 FOOT SPA		\$25,000.00000	\$25,000.00
0009 509E10000 EPOXY COATED STEEL REINFORCEMENT	11,200.000	LB	\$2.22525	\$24,922.80
0010 511E34444 CLASS QC2 CONCRETE, BRIDGE DECK	34.000	CY	\$2,872.91304	\$97,679.04
0012 511E44110 CLASS QC1 CONCRETE, ABUTMENT NOT II		CY TING	\$1,497.25943	\$25,453.41
0015 517E75120 RAILING (CONCRETE PARAPET WITH TWIN		FT AILING)	\$224.98307	\$33,747.46
0017 518E21200 POROUS BACKFILL WITH GEOTEXTILE FAE		CY	\$129.47872	\$2,460.10
0018 518E40000 6" PERFORATED CORRUGATED PLASTIC P		FT	\$10.49939	\$524.97
0019 518E40010 6" NON-PERFORATED CORRUGATED PLAS		FT JDING SP	\$20.22156 ECIAL S	\$404.43

**Quantity** Units Unit Price

Total for Group 0001:\$210,192.21

**Extension** 

## Estimate Seg 2-B, RR 2

Estimated Cost: \$226,363.03

Contingency: 20.00%

**Estimated Total: \$271,635.64** 

Wasson Armleder Structure Type Study Segment 2-B, RR Bridge Rehab Alternative 2

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

Prepared by Stantec on 02/27/24

Estimate: Seg 2-B, RR 2

**Description** 

Line # Item Number

	upplemental Description				
Grou	p 0001: Initial Group				
000s	5 202E11202 ORTIONS OF STRUCTURE REMOVED, OVER	1.000 R 20 FOOT SI		\$25,000.00000	\$25,000.00
0007 AS	7 441E10100 SPHALT CONCRETE SURFACE COURSE, TY	6.000 PE 1, (446), I		\$300.00000	\$1,800.00
3000 A	3 441E10100 SPHALT CONCRETE SURFACE COURSE, TY	9.000 PE 1, (446), I		\$300.00000	\$2,700.00
0009 EI	9 509E10000 1 POXY COATED STEEL REINFORCEMENT	1,200.000	LB	\$2.22525	\$24,922.80
0010 C	) 511E34444 LASS QC2 CONCRETE, BRIDGE DECK	34.000	CY	\$2,872.91304	\$97,679.04
0012 C	2 511E44110 LASS QC1 CONCRETE, ABUTMENT NOT INC	17.000 LUDING FO	_	\$1,497.25943	\$25,453.41
0018 R	5 517E75120 AILING (CONCRETE PARAPET WITH TWIN S	150.000 TEEL TUBE I		\$224.98307	\$33,747.46
0017 P	7 518E21200 DROUS BACKFILL WITH GEOTEXTILE FABRI	19.000 IC	CY	\$129.47872	\$2,460.10
0018 6"	3 518E40000 PERFORATED CORRUGATED PLASTIC PIP	50.000 E	FT	\$10.49939	\$524.97
0019 6"	9 518E40010 NON-PERFORATED CORRUGATED PLASTI	20.000 C PIPE, INCL		\$20.22156 PECIAL S	\$404.43
0020	613E41200	136.000	CY	\$85.81483	\$11,670.82

**Quantity** Units Unit Price

Total for Group 0001:\$226,363.03

LOW STRENGTH MORTAR BACKFILL

**Extension** 

# Estimate Seg 2-B Wstr

Estimated Cost:\$1,366,893.32

Contingency: 20.00%

Estimated Total: \$1,640,271.98

Wasson Armleder Structure Type Study Segment 2-B, Wooster Bridge

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

Prepared by Stantec on 02/27/24

Estimate:	Seg	2-B	Wstr

Line # Item Number

Description Supplemental Description	<u>Quartity</u>	<u>omto</u>	<u> </u>	<u>Extension</u>
Group 0001: Initial Group				
0005 202E11202 PORTIONS OF STRUCTURE REMOVED, OVE	1.000 ER 20 FOOT SE		\$50,000.00000	\$50,000.00
0006 505E11100 PILE DRIVING EQUIPMENT MOBILIZATION	1.000	LS	\$30,000.00000	\$30,000.00
0007 507E00500 12" CAST-IN-PLACE REINFORCED CONCRET	760.000 TE PILES, DRI		\$14.46205	\$10,991.16
0008 507E00550 12" CAST-IN-PLACE REINFORCED CONCRET	830.000 TE PILES, FUR		\$48.61848	\$40,353.34
0009 509E10000 1 EPOXY COATED STEEL REINFORCEMENT	00,800.000	LB	\$1.83839	\$185,309.71
0010 511E32212 CLASS QC2 CONCRETE WITH QC/QA, SUPE	113.000 RSTRUCTURE		\$992.10438	\$112,107.79
0011 511E40512 CLASS QC1 CONCRETE WITH QC/QA, PIER A	239.000 ABOVE FOOTI		\$820.93787	\$196,204.15
0012 511E44112 CLASS QC1 CONCRETE WITH QC/QA, ABUTI	305.000 MENT NOT IN		\$764.21792 FOOTIN G	\$233,086.47
0013 511E46512 CLASS QC1 CONCRETE WITH QC/QA, FOOT	120.000 ING	CY	\$558.59356	\$67,031.23
0014 513E10240 1 STRUCTURAL STEEL MEMBERS, LEVEL 2	21,400.000	LB	\$2.29268	\$278,331.35
0015 516E44100 ELASTOMERIC BEARING WITH INTERNAL LA			\$1,398.56222 LATE ( NEOPRENE)	\$16,782.75
0016 517E70100 RAILING (THREE STEEL TUBE BRIDGE RAILI	241.000 ING)	FT	\$482.03582	\$116,170.63
0017 518E21200 POROUS BACKFILL WITH GEOTEXTILE FABR	256.000 RIC	CY	\$107.68990	\$27,568.61
0018 518E40000 6" PERFORATED CORRUGATED PLASTIC PIL	157.000 PE	FT	\$10.04178	\$1,576.56
0019 518E40010 6" NON-PERFORATED CORRUGATED PLAST	80.000 FIC PIPE, INCL		\$17.24461 PECIAL S	\$1,379.57

**Quantity** Units Unit Price

Total for Group 0001:\$1,366,893.32

**Extension** 



RR Alternative 1 - CIP Slab

		الدين الم	\A/: -!4!-	11=:	Ni. mar la a s	Tatal U-9
		<u>Length</u>	<u>Width</u>	<u>Height</u>	<u>Number</u>	<u>Total</u> <u>Units</u>
Item 507,	12" CIP Reinforced Piles, Driven					
	Abutment	50.00	1.00	1.00	0	0 LF
	Pier	63.00 62.00	1.00 1.00	1.00 1.00	0 0	0 0
		02.00	1.00	1.00	Ü	Ü
					•	0 LF
Item 507,	12" CIP Reinforced Piles, Furnish					
	Abutment	55.00	1.00	1.00	0	0 LF
	Pier	68.00 67.00	1.00 1.00	1.00 1.00	0 0	0 0
		07.00	1.00	1.00	O	O
					•	0 LF
Item 509,	Epoxy Coated Reinforcing Steel					
	Abutment	Assume 1%				2205 LB
	Pier Slab	Assume 2% Assume 2%				0 9004
	Clas	710001110 27	0 01001		_	
					•	11209 LB
Item 511,	Class QC2 Concrete, Superstruc					
	Slab Curb	75.00 75.00	16.33 0.50	0.75 0.50	1 0	34 CY
	Curb	75.00	0.50	0.50	U	0
					•	34 CY
Item 511,	Class QC1 Concrete, Abutment I	ncluding Foo	oting			
	Footing	25.00	3.00	3.00	0	0 CY
	Beam Seat Wingwalls	25.00 6.52	3.00 2.25	3.00 3.00	2 0	17 0
	vviilgwalls	0.32	2.23	3.00	U	U
					•	17 CY
Item 511,	Class QC1 Concrete, Pier above					
		16.47	3.00	2.00	0	0 CY
					•	0 CY
Item 517,	Twin Steel Tube Railing, modified		4.00	4.00	2	450 1 5
		75.00	1.00	1.00	2	150 LF
Item 518,	Porous Backfill with Geotextile Fa		<u>.</u>		_	
		25.00	2.00	5.00	2	19 CY
Item 518,	6" Perforated Plastic Pipe				_	
		25.00	1.00	1.00	2	50 LF
Item 518,	6" Non-Perforated Plastic Pipe	10.00	1.00	1.00	2	20.15
		10.00	1.00	1.00	2	20 LF

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Designed by:



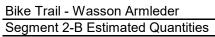
Stantec

Bike Trail - Wasson Armleder
Segment 2-B Estimated Quantities

RR Alternative 2 - CIP Slab w/ fill

	<u>Length</u>	Width	<u>Height</u>	<u>Number</u>	<u>Total</u>	<u>Units</u>
Item 441 Asphalt Surface Course						
,	75.00	16.33	0.13	1	6 (	CY
Item 445 Asphalt Intermediate Course						
	75.00	16.33	0.21	1	9 (	CY
Item 507, 12" CIP Reinforced Piles, Furnisi Abutment	hed 80.00	1.00	1.00	0	0.1	_
Pier	5.00	1.00 1.00	1.00 1.00	0 0	0 L 0	.г
r ICI	5.00	1.00	1.00	0	0	
	0.00	1.00	1.00	_		
					0 ι	.F
Item 509, Epoxy Coated Reinforcing Steel	A 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	/ oto-l			0005 1	ь
Abutment Pier	Assume 1% Assume 2%				2205 l 0	.B
Slab	Assume 29				9004	
				-	11209 l	R
					11209 1	.6
Item 511, Class QC2 Concrete, Superstruc		40.00	0.75	4	24.6	2)/
Slab Curb	75.00 75.00	16.33 0.50	0.75 0.50	1 0	34 ( 0	۲ ر
oui b	7 3.00	0.00	0.00	_		
					34 (	CY
Item 511, Class QC1 Concrete, Abutment						
Footing	25.00	3.00	3.00	0	0 (	CY
Beam Seat	25.00	3.00	3.00	2	17	
Wingwalls	6.52	2.25	3.00	0	0	
				<del>-</del>	17 (	CY
Item 511, Class QC1 Concrete, Pier above	Footing					
	16.47	3.00	2.00	0	0 (	CY
				-	0 (	CY
Item 517, Twin Steel Tube Railing, modifie						
	75.00	1.00	1.00	2	150 L	.F
Item 518, Porous Backfill with Geotextile F	abric					
	25.00	2.00	5.00	2	19 (	CY
Item 518, 6" Perforated Plastic Pipe						
	25.00	1.00	1.00	2	50 L	.F
Item 613, Low Strength Mortar Backfill	75.00	40.00	0.00	4	400.4	21/
	75.00	16.33	3.00	1	136 (	νY

Designed by: Checked by:





Designed by:

Alternative 1 - Wooster Bridge Widening

		<u>Length</u>	<u>Width</u>	<u>Height</u>	<u>Number</u>	<u>Total</u>	<u>Units</u>
Item 507	, 12" CIP Reinforced Piles, Driven						
nom our	Rear Abutment	50.00	1.00	1.00	4	200	l F
	Foward Abutment	65.00	1.00	1.00	4	260	
	Pier	50.00	1.00	1.00	3	150	
	r iei	50.00	1.00	1.00	3	150	
		30.00	1.00	1.00	3	130	
					-	760	LF
Itom 507	, 12" CIP Reinforced Piles, Furnish	and					
item 507	Abutment	55.00	1.00	1.00	4	220	I E
	Abulment				4		LF
	D'	70.00	1.00	1.00	4	280	
	Pier	55.00	1.00	1.00	3	165	
		55.00	1.00	1.00	3	165	
					-	830	LF
Item 509	, Epoxy Coated Reinforcing Steel						
	Abutment	Assume 19	√ steel			8090	LB
	Pier	Assume 2%	√ steel			63195	
	Slab	Assume 2%	√ steel			29473	
					_		
					-	100759	LB
Item 511,	, Class QC2 Concrete, Superstruc	ture					
	Slab	241.00	17.00	0.71	1	107	CY
	Haunch	241.00	0.88	0.17	3	4	
				• • • • • • • • • • • • • • • • • • • •	-	•	
					•	111	CY
Item 511.	, Class QC1 Concrete, Abutment I	ncluding Foo	oting				
Fwd	Footing	23.25	6.50	3.00	1	17	CY
	Beam Seat	23.25	4.75	5.50	1	22	
	Wingwalls	15.00	1.50	9.50	2	16	
	Backwall	23.25	1.75	4.00	1	6	
	Backwaii	20.20	1.70	1.00		Ü	
II <b>5</b> 44	01	L L P	F		•	61	CY
	, Class QC1 Concrete, Abutment r		-	00.00	<b>A</b>		0)/
Rear	Beam Seat	23.25	3.00	23.00	1	59	CY
	Wingwalls	40.00	3.00	27.00	2	240	
	Backwall	23.25	1.75	4.00	1	6	
					-	305	CY
Item 511,	, Class QC1 Concrete, Pier above	-					
		15.00	3.00	18.00	4	120	CY
		23.25	3.00	23.00	2	119	
					-	239	CY
Itom 511	Class OC1 Concrete Facting						
item 311,	, Class QC1 Concrete, Footing Rear Abutment	23.25	20.00	3.00	1	52	CV
					1 2		O I
	Piers	38.25	8.00	3.00	2	68	
					-	120	CV
						120	<b>0</b> 1

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Bike Trail - Wasson Armleder
Segment 2-B Estimated Quantities

Alternative 1 - Wooster Bridge Widening

	<u>Length</u>	<u>Width</u>	<u>Height</u>	Number	<u>Total</u> <u>Units</u>
Item 513, Structural Steel - Rolled beams Beams Diaphragms Miscellaneous (10%)	241.00 5.00	148 lb/ft 34 lb/ft	1.00 1.00	3.00 20.00	107004 LB 3390 11039
				-	121433 LB
Item 516, Elastomeric Bearings	1.00	1.00	1.00	12	12 EA
Item 517, Twin Steel Tube Railing, modified	241.00	1.00	1.00	1	241 LF
Item 518, Porous Backfill with Geotextile Fa	bric				
Rear Abutment	23.25	2.00	27.00	1	47 CY
	40.00	2.00	27.00	2	160
Forward Abutment	23.25 15.00	2.00 2.00	12.50 12.50	1 2	22 28
				-	256 CY
Item 518, 6" Perforated Plastic Pipe					
Rear Abutment	23.25	1.00	1.00	1	23 LF
	40.00	1.00	1.00	2	80
Forward Abutment	23.25	1.00	1.00	1	23
	15.00	1.00	1.00	2	30
				-	157 LF
Item 518, 6" Non-Perforated Plastic Pipe	20.00	1.00	1.00	4	80 LF

# **APPENDIX A.3**



# Estimate Seg 2-C, RR 1

Estimated Cost: \$210,192.21

Contingency: 20.00%

**Estimated Total: \$252,230.65** 

Wasson Armleder Structure Type Study Segment 2-B, RR Bridge Rehab Alternative 1

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

Prepared by Stantec on 02/27/24

Estimate: Seg 2-C, RR 1

**Description** 

0019

518E40010

Line # Item Number

Supplemental Description				
Group 0001: Initial Group				
0005 202E11202 PORTIONS OF STRUCTURE REMOVED, OVER	1.000 R 20 FOOT SI		\$25,000.00000	\$25,000.00
0009 509E10000 1 EPOXY COATED STEEL REINFORCEMENT	1,200.000	LB	\$2.22525	\$24,922.80
0010 511E34444 CLASS QC2 CONCRETE, BRIDGE DECK	34.000	CY	\$2,872.91304	\$97,679.04
0012 511E44110 CLASS QC1 CONCRETE, ABUTMENT NOT INC	17.000 LUDING FO		\$1,497.25943	\$25,453.41
0015 517E75120 RAILING (CONCRETE PARAPET WITH TWIN S	150.000 TEEL TUBE I	FT RAILING)	\$224.98307	\$33,747.46
0017 518E21200 POROUS BACKFILL WITH GEOTEXTILE FABR	19.000	CY	\$129.47872	\$2,460.10
0018 518E40000 6" PERFORATED CORRUGATED PLASTIC PIP	50.000 E	FT	\$10.49939	\$524.97

**Unit Price** 

\$20.22156

**Quantity** Units

20.000 FT

6" NON-PERFORATED CORRUGATED PLASTIC PIPE, INCLUDING SPECIAL S

Total for Group 0001:\$210,192.21

**Extension** 

\$404.43

# Estimate Seg 2-C, RR 2

Estimated Cost: \$226,363.03

Contingency: 20.00%

**Estimated Total: \$271,635.64** 

Wasson Armleder Structure Type Study Segment 2-B, RR Bridge Rehab Alternative 2

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

Prepared by Stantec on 02/27/24

Estimate: Seg 2-C, RR 2

**Description** 

0020 613E41200

LOW STRENGTH MORTAR BACKFILL

Line # Item Number

	upplemental Description				
Grou	O 0001: Initial Group				
0005 PC	202E11202 DRTIONS OF STRUCTURE REMOVED, OVER 2	1.000 20 FOOT SF		\$25,000.00000	\$25,000.00
0007 AS	441E10100 SPHALT CONCRETE SURFACE COURSE, TYP	6.000 E 1, (446), F		\$300.00000	\$1,800.00
0008 AS	441E10100 SPHALT CONCRETE SURFACE COURSE, TYP	9.000 E 1, (446), F		\$300.00000	\$2,700.00
0009 EF	509E10000 11 POXY COATED STEEL REINFORCEMENT	,200.000	LB	\$2.22525	\$24,922.80
0010 Cl	511E34444 ASS QC2 CONCRETE, BRIDGE DECK	34.000	CY	\$2,872.91304	\$97,679.04
0012 Cl	511E44110 ASS QC1 CONCRETE, ABUTMENT NOT INCL	17.000 UDING FOO	_	\$1,497.25943	\$25,453.41
0015 R/	5 517E75120 AILING (CONCRETE PARAPET WITH TWIN STI	150.000 EEL TUBE F		\$224.98307	\$33,747.46
0017 PC	518E21200 DROUS BACKFILL WITH GEOTEXTILE FABRIC		CY	\$129.47872	\$2,460.10
0018 6"	518E40000 PERFORATED CORRUGATED PLASTIC PIPE	50.000	FT	\$10.49939	\$524.97
0019 6"	518E40010 NON-PERFORATED CORRUGATED PLASTIC	20.000 PIPE, INCL	FT UDING SP	\$20.22156 PECIAL S	\$404.43

\$85.81483

136.000 CY

**Quantity Units Unit Price** 

Total for Group 0001:\$226,363.03

**Extension** 

\$11,670.82

# Estimate Seg 2-C Wstr

Estimated Cost:\$487,869.63

Contingency: 20.00%

**Estimated Total: \$585,443.56** 

Wasson Armleder Structure Type Study Segment 2-C, Wooster Bridge

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

Prepared by Stantec on 02/27/24

Estimate: Seg 2-C Wstr

**Description** 

Line # Item Number

Supplemental Description

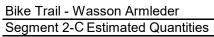
Group 0001: Initial Group				
0005 202E11202 PORTIONS OF STRUCTURE REMOVED, OV	1.000 ER 20 FOOT SI		\$75,000.00000	\$75,000.00
0009 509E10000 EPOXY COATED STEEL REINFORCEMENT	26,400.000	LB	\$2.06544	\$54,527.62
0010 511E34444 CLASS QC2 CONCRETE, BRIDGE DECK	100.000	CY	\$2,381.71379	\$238,171.38
0015 517E70100 RAILING (THREE STEEL TUBE BRIDGE RAI	241.000 LING)	FT	\$482.03582	\$116,170.63
0016 847E10100	20.000	SY	\$200.00000	\$4,000.00

**Unit Price** 

Quantity Units

Total for Group 0001:\$487,869.63

**Extension** 



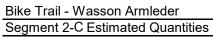


Designed by:

RR Alternative 1 - CIP Slab

		<u>Length</u>	Width	<u>Height</u>	Number	<u>Total</u>	<u>Units</u>
Item 507,	12" CIP Reinforced Piles, Driven						
	Abutment	50.00	1.00	1.00	0	0	LF
	Pier	63.00	1.00	1.00	0	0	
		62.00	1.00	1.00	0	0	
					_	0	LF
Item 507,	12" CIP Reinforced Piles, Furnish	ned					
	Abutment	55.00	1.00	1.00	0	0	LF
	Pier	68.00	1.00	1.00	0	0	
		67.00	1.00	1.00	0	0	
					-	0	LF
Item 509,	Epoxy Coated Reinforcing Steel						
	Abutment	Assume 1%				2205	LB
	Pier	Assume 2%				0	
	Slab	Assume 2%	6 steel			9004	
					-	11209	LB
Item 511,	Class QC2 Concrete, Superstruc	ture					
	Slab	75.00	16.33	0.75	1	34	CY
	Curb	75.00	0.50	0.50	0	0	
					-	34	CY
Item 511,	Class QC1 Concrete, Abutment I	ncluding Foo	oting				
	Footing	25.00	3.00	3.00	0	0	CY
	Beam Seat	25.00	3.00	3.00	2	17	
	Wingwalls	6.52	2.25	3.00	0	0	
					-	17	CY
Item 511.	Class QC1 Concrete, Pier above	Footing					
,	,	16.47	3.00	2.00	0	0	CY
					-	0	CY
Item 517.	Twin Steel Tube Railing, modified	<b>1</b> .					
,		75.00	1.00	1.00	2	150	LF
Item 518.	Porous Backfill with Geotextile Fa	abric					
,		25.00	2.00	5.00	2	19	CY
Item 518,	6" Perforated Plastic Pipe						
		25.00	1.00	1.00	2	50	LF
Itom E10	6" Non Parforated Plantic Pina						
nem old,	6" Non-Perforated Plastic Pipe	10.00	1.00	1.00	2	20	LF
					_		

Checked by:\_





RR Alternative 2 - CIP Slab w/ fill

	<u>Length</u>	<u>Width</u>	<u>Height</u>	<u>Number</u>	<u>Total</u>	<u>Units</u>
Item 441 Asphalt Surface Course						
	75.00	16.33	0.13	1	6 CY	1
Item 445 Asphalt Intermediate Course						
	75.00	16.33	0.21	1	9 CY	<b>(</b>
Item 507, 12" CIP Reinforced Piles, Furnis	shed					
Abutment	80.00	1.00	1.00	0	0 LF	
Pier	5.00	1.00	1.00	0	0	
	5.00	1.00	1.00	0	0	
				-	0 LF	•
tem 509, Epoxy Coated Reinforcing Steel		, , ,			0005.15	
Abutment Pier	Assume 1% Assume 2%				2205 LB 0	}
Slab	Assume 29				9004	
				_	11209 LE	}
tem 511, Class QC2 Concrete, Superstru						_
Slab	75.00	16.33	0.75	1 0	34 C\	<b>/</b>
Curb	75.00	0.50	0.50	U	0	
				_	34 CY	1
tem 511, Class QC1 Concrete, Abutment	-					_
Footing Beam Seat	25.00 25.00	3.00 3.00	3.00 3.00	0	0 CY 17	<b>(</b>
Wingwalls	6.52	3.00 2.25	3.00	2 0	0	
	0.02		0.00	_		_
					17 CY	<b>/</b>
tem 511, Class QC1 Concrete, Pier above	e Footing 16.47	3.00	2.00	0	0 CY	<i>(</i>
				-	0 CY	,
					0 01	(
Item 517, Twin Steel Tube Railing, modifie						
	75.00	1.00	1.00	2	150 LF	
tem 518, Porous Backfill with Geotextile F		0.00	F 00	0	40.0	,
	25.00	2.00	5.00	2	19 CY	ſ
Item 518, 6" Perforated Plastic Pipe	25.00	1.00	1.00	2	50 LF	
	20.00	1.00	1.00	2	30 LF	
Markon Davidi						
tem 613, Low Strength Mortar Backfill						



Bike Trail - Wasson Armleder
Segment 2-C Estimated Quantities

Alternative 1 - Wooster Bridge Modified

		<u>Length</u>	<u>Width</u>	<u>Height</u>	Number	<u>Total</u>	Units
Item 507,	12" CIP Reinforced Piles, Driven		4.00	4.00			_
	Rear Abutment	50.00	1.00	1.00	0	0 L	<u>.</u> F
	Foward Abutment Pier	65.00 50.00	1.00 1.00	1.00 1.00	0 0	0 0	
	i iei	50.00	1.00	1.00	0	0	
		00.00	1.00	1.00	ŭ	ŭ	
					•	<u>0</u> L	.F
lt	40! OID Dainfarrand Biles, Eurosial						
item 507,	12" CIP Reinforced Piles, Furnisl Abutment	nea 55.00	1.00	1.00	0	0 L	F
	Abdiment	70.00	1.00	1.00	0	0	-1
	Pier	55.00	1.00	1.00	0	0	
		55.00	1.00	1.00	0	0	
					-		_
						0 L	. <b>⊢</b>
Item 509,	Epoxy Coated Reinforcing Steel						
	Abutment	Assume 19				0 L	.B
	Pier	Assume 29				0	
	Slab	Assume 29	% steel			26373	
						26373 L	R
						200.02	
Item 511,	Class QC2 Concrete, Superstruc						
	Parapet	241.00	4.08 SF	1.00	2	73 (	CY
	Deck	241.00	2.00	0.75	2	27	
					•	100 C	CY
	Class QC1 Concrete, Abutment				_		
Fwd	Footing	23.25	6.50	3.00	0	0 0	CY
	Beam Seat Wingwalls	23.25 15.00	4.75 1.50	5.50 9.50	0 0	0 0	
	Backwall	23.25	1.75	4.00	0	0	
					-		
					•	0 (	CY
	Class QC1 Concrete, Abutment	-	-	22.00	0	0.0	2V
Rear	Beam Seat Wingwalls	23.25 40.00	3.00 3.00	23.00 27.00	0 0	0 0	·Υ
	Backwall	23.25	1.75	4.00	0	0	
	Baokwan	20.20	1.70	1.00	Ü	Ü	
					•	0 0	CY
Item 511,	Class QC1 Concrete, Pier above	-	2.00	10.00	0	0.0	<b>.</b>
		15.00 23.25	3.00 3.00	18.00 23.00	0 0	0 0	<b>ν</b> Υ
		20.20	5.00	20.00	U	U	
					•	0 0	CY
Itom 544	Hama F44, Olaca OO4 Oomanata Faatiina						
item 511,	Class QC1 Concrete, Footing Rear Abutment	23.25	20.00	3.00	0	0 0	CY
	Piers	38.25	8.00	3.00	0	0	<i>-</i> 1
		-	-	-			
					•	0 (	CY

Designed by: Checked by:\_



Bike Trail - Wasson Armleder
Segment 2-C Estimated Quantities

Alternative 1 - Wooster Bridge Modified

	<u>Length</u>	Width	<u>Height</u>	Number	Total <u>Units</u>	
Item 517, Twin Steel Tube Railing, modified	d. 241.00	1.00	1.00	1	241 LF	
Item 518, Porous Backfill with Geotextile Fabric						
Rear Abutment	23.25	2.00	27.00	0	0 CY	
	40.00	2.00	27.00	0	0	
Forward Abutment	23.25	2.00	12.50	0	0	
	15.00	2.00	12.50	0	0	
				-	0 CY	
Item 518, 6" Perforated Plastic Pipe						
Rear Abutment	23.25	1.00	1.00	0	0 LF	
	40.00	1.00	1.00	0	0	
Forward Abutment	23.25	1.00	1.00	0	0	
	15.00	1.00	1.00	0	0	
				-	0 LF	
Item 847, Concrete Overlay	241.00	6.00	0.13	1	20 SY	

Segment 3 Structure Type Study



## STRUCTURE TYPE STUDY

Wasson-Armleder Trail Bridges on Segment 3

February 27, 2024

Prepared for: ODOT - District 8

Prepared by: Stantec

The conclusions in the Report titled Structure Type Study are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

Stantec has assumed all information received from ODOT - District 8 (the "Client") and third parties in the preparation of the Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

This Report is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Report may be provided by the Client to applicable authorities having jurisdiction and to other third parties in connection with the project, Stantec disclaims any legal duty based upon warranty, reliance or any other theory to any third party, and will not be liable to such third party for any damages or losses of any kind that may result.

Prepared by:	
. , _	Signature
<u> </u>	
	Printed Name
Reviewed by: _	
	Signature
	Printed Name

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## 1 Introduction

The purpose of this report is to determine and evaluate the feasible structure types on each of the four alternative alignments (A-D) proposed for the Segment 3 portion of the trail. The evaluation is to aid in determining the preferred alignment with which to move forward. This study will determine the recommended structure type and the cost of the proposed structure for each alternative alignment.

The proposed paved shared-use path will be 12 feet wide with 5-foot shoulders on each side. Segment 3 extends from south of Red Bank Road to the Armleder-to-Lunken Connector Trail. The first portion of the segment runs along the west side of Duck Creek then crosses Duck Creek at one of four possible locations.

## 2 Design Considerations

## 2.1 Design Specifications

All proposed structures will be designed in accordance with the 2020 ODOT Bridge Design Manual, the ODOT Multimodal Design Guide (2023), the AASHTO LRFD Bridge Design Specifications, 9<sup>th</sup> Edition (2020) and the AASHTO Guide Specifications for the Design of Pedestrian Bridges, 2<sup>nd</sup> Edition (2009).

## 2.2 Bridge Design Criteria

- Pedestrian Live Load of 90 psf
- H15-44 vehicle loading (Ambulance or maintenance vehicles) without dynamic load allowance
- No Future Wearing Surface
- Bridges must minimize impacts to the 100-year recurrence backwater elevation from the Ohio River. The 100-year recurrence flood of Duck Creek does not control flooding in this area.
- The width of the bridges must provide 16 feet face to face of the railings in accordance with the ODOT Mulitmodal Design Guide.

## 2.3 Geotechnical

A geotechnical investigation has not been performed at this stage of the project. Geotechnical information is based on historical borings in the vicinity of the bridges. The historical borings indicate the presence of sand and gravel to a depth of approximately 20 feet, then clay and or sand to a depth of approximately 80 feet. Rock was not encountered in any of the borings. Therefore, the assumption for this study is that all foundations will be deep foundations using CIP piling.



## 2.4 Hydraulics

All four alignments, and thus all four bridges, lie in an area inundated by the 100-year flood. The FEMA 100-year water surface elevations at the bridges are controlled by backwater from the Ohio River by way of the Little Miami river. Based on the trail profiles all four of the bridges will be submerged for this condition

The four bridges also lie within the 100-year floodway of Duck Creek. The bridges will all be submerged for this condition as well.

To minimize the impact of the bridges on the 100-year floods, the waterway opening to the top of bank will be maintained with no fill being placed within the banks which would reduce the waterway opening.

A preliminary hydraulic analysis was performed on Duck Creek for this study. A summary of this analysis is included in the Feasibility Study. A detailed hydraulic study will be performed on the selected alternative and a separate report will be submitted.

## 3 Alternatives

The alternative structure types for Segments 3-B thru 3-E are presented in this section. Based on the hydraulic analysis results which indicate these bridges are subject to flooded conditions, the superstructure types have been limited to concrete or prestressed concrete. Steel has not been considered due to the potential for accelerated corrosion caused by frequent flooding.

## 3.1 Segment 3-B

#### 3.1.1 ALIGNMENT

The trail runs parallel to the adjacent railroad on the ground between the railroad and Duck Creek. Prior to crossing the bridge, the trail makes a 212.21-degree curve to the left and crosses the creek on a tangent before making a 212.21-degree curve to the right. The tangent is skewed approximately 39 degrees to the flow of the creek.

#### 3.1.2 SPAN ARRANGEMENT

The east bank of Duck Creek is sloped much steeper than 2:1. Therefore, to avoid disturbing the slope, the abutment on this side has been set back from the top of slope a reasonable distance while not extending further into the horizontal curve than is necessary. However, the extension into the curve is sufficient to require the end of the deck be curved. The west bank slopes up slightly steeper than 2:1, then levels out for a short distance. The proposed abutment was set by extending a 2:1 slope up from the top of this lower creek bank. However, this would require the deck be curved at the west end. Therefore, the abutment has been moved forward to allow the use of a straight deck while maintaining the minimum required horizontal clearances on the bridge.



The resulting length of the bridge is approximately 95 feet. As noted above, a continuous reinforced concrete slab bridge and a prestressed concrete box beam bridge will be considered for this alternative. Minimizing the superstructure depth is critical to reducing the impact of the bridge on the 100-year flood elevation. Therefore, a three-span will be considered since a single span bridge would require significantly deeper prestressed concrete box beams.

### 3.1.3 ALTERNATIVE 1

This alternative considers a three-span reinforced concrete slab bridge. The spans are set at 29-36.25-29 feet for an overall length of 94.25 feet. Based on Standard Drawing CS-1-08, the slab depth will be 18.5 inches. The standard drawing indicates the design is acceptable for skews up to 30 degrees, so the skew of the bridge substructure has been adjusted to be at 30 degrees to the centerline. This provides an acceptable alignment with the flow of the creek.

#### 3.1.4 ALTERNATIVE 2

This alternative considers a three-span prestressed concrete box beam bridge with a composite concrete slab. The spans are set at 32-32-32 feet. Preliminary design indicates four CB17-48 composite prestressed box beams are required for this alternative. A 6-inch concrete slab will be utilized to minimize flooding impacts on the bridge.

## 3.2 Segment 3-C

### 3.2.1 ALIGNMENT

The trail runs parallel to the adjacent railroad on the ground between the railroad and Duck Creek. Prior to crossing the bridge, the trail makes a 212.21-degree curve to the left and crosses the creek on a tangent before making a 212.21-degree curve to the right. The tangent is skewed approximately 33 degrees to the flow of the creek.

#### 3.2.2 SPAN ARRANGEMENT

For the initial layout, the overall length of bridge was set utilizing 2:1 slopes on the banks up from the creek bed. The existing west bank rise is steeper than 2:1, therefore, this bank will be maintained and the abutment footing placed at an elevation which allows for erosion of the bank to the 2:1 slope. The east bank is approximately at a 2:1 slope and the abutment will be placed near the top of the bank.

Setting the west abutment at the top of the existing slope caused the bridge to extend significantly into the horizontal curve on the west approach. Due to the skew and sharpness of the curve, the north edge of the deck did not reach the abutment. Therefore, this abutment was moved forward to a location where the bridge deck, while still within the curve, would be supported on the abutment and permit a straight bridge deck. The resulting overall length of the bridge is approximately 110 feet.

Due to the flooding concerns, only two superstructure types were considered, prestressed concrete box beams or a continuous reinforced concrete slab. Minimizing the superstructure depth is critical to



reducing the impact of the bridge on the 100-year flood elevation. Therefore, a three-span will be considered since a single span bridge would require significantly deeper prestressed concrete box beams.

#### 3.2.3 ALTERNATIVE 1

This alternative considers a three-span reinforced concrete slab bridge. The spans are set at 34-42.5-34 feet for an overall length of 110.50 feet. Based on Standard Drawing CS-1-08, the slab depth will be 21 inches. The standard drawing indicates the design is acceptable for skews up to 30 degrees, so the skew of the bridge substructure has been adjusted to be 30 degrees to the centerline. This provides an acceptable alignment with the flow of the creek.

#### 3.2.4 ALTERNATIVE 2

This alternative considers a three-span prestressed concrete box beam bridge with a composite concrete slab. The spans are set at 37-37-37 feet. Preliminary design indicates four CB17-48 beams are required for this alternative.

## 3.3 Segment 3-D

#### 3.3.1 ALIGNMENT

The trail runs parallel to the adjacent railroad on the ground between the railroad and Duck Creek. Prior to crossing the bridge, the trail makes a 9.55-degree curve to the left and crosses the creek on a tangent before making a 57.3-degree curve to the right. The tangent is skewed approximately 57 degrees to the flow of the creek.

#### 3.3.2 SPAN ARRANGEMENT

For the initial layout, the overall length of bridge was set utilizing a 2:1 slope extending up from the top of bank on the existing west bank. The existing east bank is approximately a 2:1 slope and the abutment will be placed near the top of the bank.

Setting the west abutment at the top of the 2:1 slope caused the bridge to extend into the horizontal curve on the west approach, requiring the deck to be curved at that end. By moving this abutment forward approximately 20 feet, a straight deck can be used with a resulting overall length of approximately 135 feet.

With a straight deck, the possible structure types were a three-span reinforced concrete slab bridge, and a single or three-span prestressed concrete bridge utilizing box beams or I-beams. Minimizing the superstructure depth is critical to reducing the impact of the bridge on the 100-year flood elevation. Therefore, the single span prestressed concrete I-beam structure was eliminated due to the depth of girder that would be required for a 135-foot span. The three-span prestressed concrete I-beam structure was determined to require a greater depth superstructure than a prestressed concrete box beam bridge.



Therefore, a three-span structure will be considered comparing composite prestressed box beams and a reinforced concrete slab structure.

#### 3.3.3 ALTERNATIVE 1

This alternative considers a three-span reinforced concrete slab bridge. The spans are set at 42-52.5-42 feet for an overall length of 136.50 feet. Based on Standard Drawing CS-1-08, the slab depth will be 25 inches. The standard drawing indicates the design is acceptable for skews up to 30 degrees, so the final design will need to be analyzed for the skew of the bridge which is 57 degrees.

#### 3.3.4 ALTERNATIVE 2

This alternative considers a three-span prestressed concrete box beam bridge with a composite concrete slab. The spans are set at 45-45-45 feet. Preliminary design indicates four CB21-48 beams are required for this alternative. Since the skew exceeds the maximum of 30 degrees permitted for the prestressed concrete box beams, the final design of the beams will require special detailing and design.

## 3.4 Segment 3-E

#### 3.4.1 ALIGNMENT

The trail runs parallel to the adjacent railroad on the ground between the railroad and Duck Creek. Prior to crossing the bridge, the trail makes a 212.21-degree curve to the left and crosses the creek on a tangent which extends well beyond the creek. The tangent is skewed approximately 43.5 degrees to the flow of the creek.

### 3.4.2 SPAN ARRANGEMENT

For the initial layout, the overall length of bridge was set utilizing a 2:1 slope extending up from the toe of bank on the existing west bank. The existing east bank is approximately a 2:1 slope. The existing bank will be extended up and the abutment will be placed near the top of the bank. This results in a total length of 128 feet for the bridge.

With a straight deck for the full length of the bridge, the possible superstructure types were a single span prestressed concrete I-beam, a three-span reinforced concrete slab bridge, and a three-span prestressed concrete bridge utilizing box beams or I-beams.

With a straight deck, the possible structure types were a three-span reinforced concrete slab bridge, and a single or three-span prestressed concrete bridge utilizing box beams or I-beams. Minimizing the superstructure depth is critical to reducing the impact of the bridge on the 100-year flood elevation. Therefore, the single span prestressed concrete I-beam structure was eliminated due to the depth of girder that would be required for a 128-foot span. The three-span prestressed concrete I-beam structure was determined to require a greater depth superstructure than a prestressed concrete box beam bridge. Therefore, a three-span structure will be considered comparing composite prestressed box beams and a reinforced concrete slab structure.



## 3.4.3 ALTERNATIVE 1

This alternative considers a three-span reinforced concrete slab bridge. The spans are set at 40-50-40 feet for an overall length of 130 feet. Based on Standard Drawing CS-1-08, the slab depth will be 24 inches. The standard drawing indicates the design is acceptable for skews up to 30 degrees, so the final design of the slab will need to be checked since the 43.5 degree skew of the bridge exceeds this limit.

### 3.4.4 ALTERNATIVE 2

This alternative considers a three-span prestressed concrete box beam bridge with a composite concrete slab. The spans are set at 43.5-43.5-43.5 feet. Preliminary design indicates four CB21-48 beams are required for this alternative. Since the skew exceeds the maximum of 30 degrees permitted for the prestressed concrete box beams, the final design of the beams will require special detailing and design.

## 4 Cost Estimates

Preliminary construction cost estimates were developed for each alternative structure type on each alignment. Since all structure types are of similar material, future maintenance costs will be similar for each alternative and thus do not impact the selection of the preferred alternative.

Alignment Segment	<b>Estimated Construction Cost</b>
3-B	
Alternative 1 – CIP concrete slab	\$528,179
Alternative 2 - PCBB	\$688,012
3-C	
Alternative 1 – CIP concrete slab	\$596,997
Alternative 2 - PCBB	\$728,543
3-D	
Alternative 1 – CIP concrete slab	\$682,020
Alternative 2 - PCBB	\$862,899
3-E	
Alternative 1 – CIP concrete slab	\$714,545
Alternative 2 - PCBB	\$900,754



## 5 Recommendation

Based on the estimated initial construction cost, Alternative 1 is recommended for each of the proposed trail segments, 3-B, 3-C, 3-D, and 3-E. This bridge type is a continuous concrete slab superstructure.



# **APPENDIX A**



# **Appendix A**

- A.1 Proposed Trail Alignments
- A.2 Segment 3-B Estimated Construction Costs and Quantities
- A.3 Segment 3-C Estimated Construction Costs and Quantities
- A.4 Segment 3-D Estimated Construction Costs and Quantities
- A.5 Segment 3-E Estimated Construction Costs and Quantities



# **APPENDIX A.1**

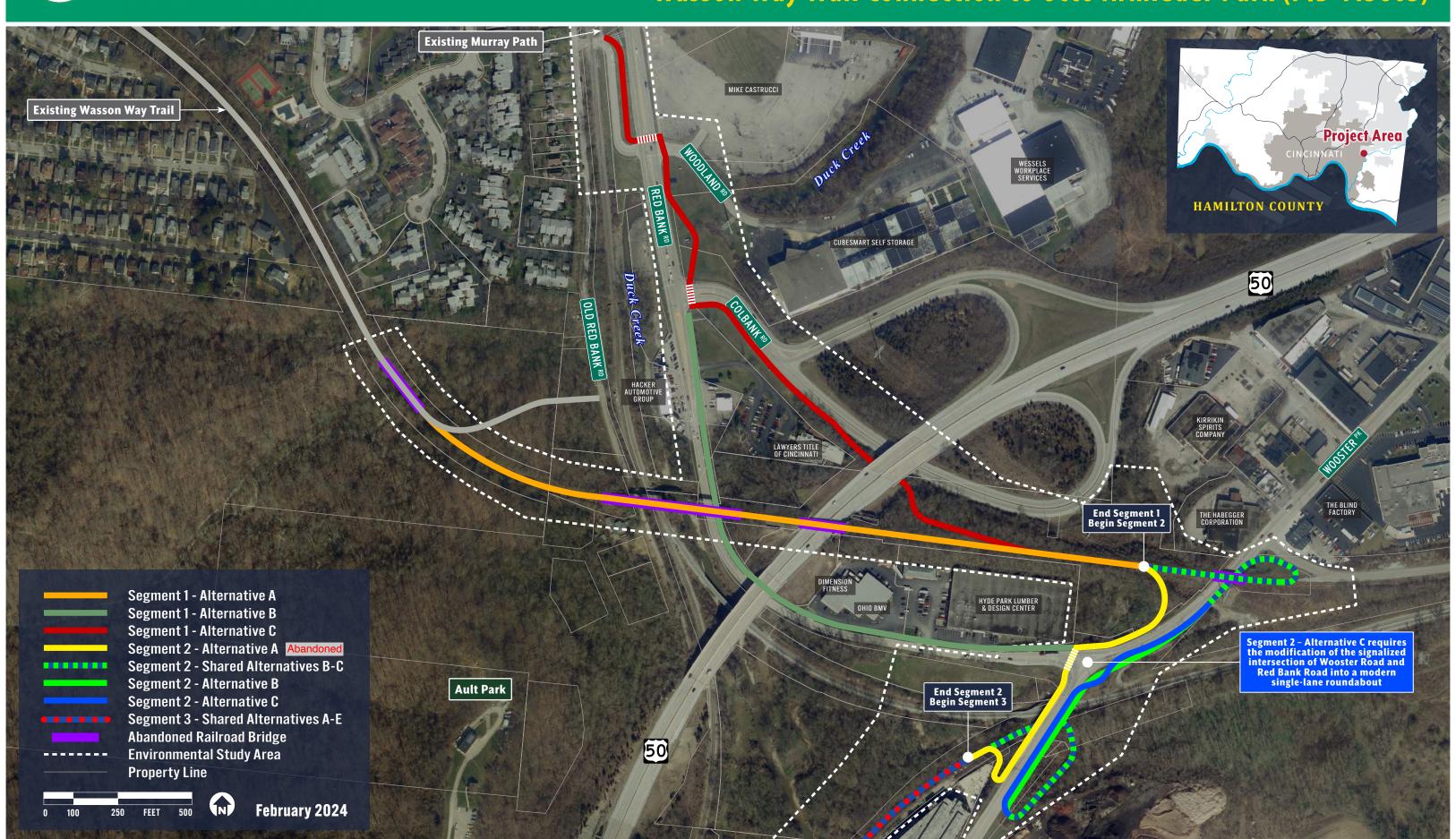


Project Number: 173620146



# **Shared Use Path Alternatives**

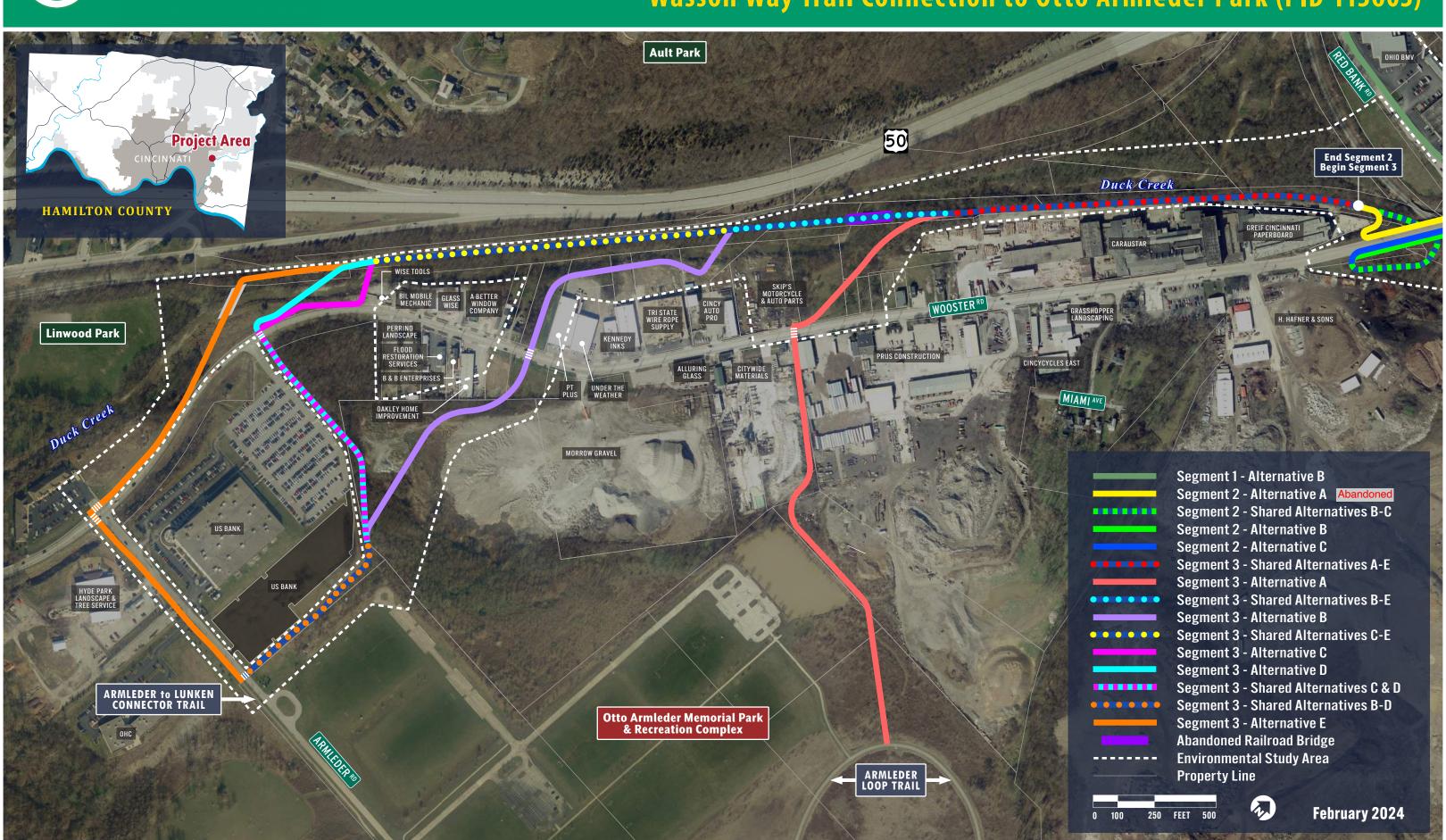
Wasson Way Trail Connection to Otto Armleder Park (PID 113603)





# **Shared Use Path Alternatives**

Wasson Way Trail Connection to Otto Armleder Park (PID 113603)



# **APPENDIX A.2**



Project Number: 173620146

#### Estimate Seg 3-B, Alt. 1

Estimated Cost:\$440,148.84

Contingency: 20.00%

**Estimated Total: \$528,178.61** 

Wasson Armleder Structure Type Study Segment 3-B, Alternative 1

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

Estimate: Seg 3-B, Alt. 1

**Description** 

Line # Item Number

Supplemental Description				
Group 0001: Initial Group				
0005 505E11100 PILE DRIVING EQUIPMENT MOBILIZATION	1.000	LS	\$30,000.00000	\$30,000.00
0006 507E00500 12" CAST-IN-PLACE REINFORCED CONCRI	1,000.000 ETE PILES, DRIV		\$12.61283	\$12,612.83
0007 507E00550 12" CAST-IN-PLACE REINFORCED CONCRI	1,090.000 ETE PILES, FURN		\$48.61848	\$52,994.14
0008 509E10000 EPOXY COATED STEEL REINFORCEMENT	34,500.000	LB	\$2.01795	\$69,619.27
0009 511E32212 CLASS QC2 CONCRETE WITH QC/QA, SUP	92.000 PERSTRUCTURE	CY	\$1,000.00000	\$92,000.00
0011 511E42510 CLASS QC1 CONCRETE, PIER CAP	7.000	CY	\$1,875.20968	\$13,126.47
0012 511E44110 CLASS QC1 CONCRETE, ABUTMENT NOT I	62.000 INCLUDING FOO		\$962.80458	\$59,693.88
0015 517E70100 RAILING (THREE STEEL TUBE BRIDGE RAI		FT	\$482.03582	\$92,550.88
0017 518E21200 POROUS BACKFILL WITH GEOTEXTILE FAI		CY	\$112.50923	\$15,526.27
0018 518E40000 6" PERFORATED CORRUGATED PLASTIC F		FT	\$10.41180	\$645.53
0019 518E40010 6" NON-PERFORATED CORRUGATED PLAS	80.000 STIC PIPE, INCLU		\$17.24461 PECIAL S	\$1,379.57

**Quantity** Units Unit Price

Total for Group 0001:\$440,148.84

#### Estimate Seg-3-B, Alt 2

Estimated Cost:\$573,343.63

Contingency: 20.00%

Estimated Total: \$688,012.36

Wasson Armleder Structure Type Study Segment 3-B, Alternative 2

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

Estimate:	Sea-3-B	Δlt	-
⊏siiiiate.	Seg-S-D,	ΑIL	4

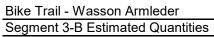
**Description** 

Line # Item Number

Supplemental Description	
Group 0001: Initial Group	
0005 505E11100 1.000 LS \$30,000.00000 PILE DRIVING EQUIPMENT MOBILIZATION	\$30,000.00
0006 507E00500 1,000.000 FT \$12.61283 12" CAST-IN-PLACE REINFORCED CONCRETE PILES, DRIVEN	\$12,612.83
0007 507E00550 1,090.000 FT \$48.61848 12" CAST-IN-PLACE REINFORCED CONCRETE PILES, FURNISHED	\$52,994.14
0008 509E10000 19,900.000 LB \$2.11681 EPOXY COATED STEEL REINFORCEMENT	\$42,124.52
0009 511E34444 48.000 CY \$2,705.78029 CLASS QC2 CONCRETE, BRIDGE DECK	\$129,877.45
0011 511E42510 12.000 CY \$1,875.20968 CLASS QC1 CONCRETE, PIER CAP	\$22,502.52
0012 511E43510 72.000 CY \$567.36696 CLASS QC1 CONCRETE, ABUTMENT INCLUDING FOOTING	\$40,850.42
0014 515E12030 12.000 EACH \$11,350.67337 PRESTRESSED CONCRETE COMPOSITE BOX BEAM BRIDGE MEMBERS, LEVE L 1, CB17-48	\$136,208.08
0016 516E43100 48.000 EACH \$117.70158  ELASTOMERIC BEARING WITH INTERNAL LAMINATES ONLY (NEOPRENE)  <2" THICK	\$5,649.68
0019 517E70100 193.000 FT \$482.03582 RAILING (THREE STEEL TUBE BRIDGE RAILING)	\$93,032.91
0020 518E21200 45.000 CY \$121.80587 POROUS BACKFILL WITH GEOTEXTILE FABRIC	\$5,481.26
0021 518E40000 62.000 FT \$10.41180 6" PERFORATED CORRUGATED PLASTIC PIPE	\$645.53
0022 518E40010 79.000 FT \$17.26955 6" NON-PERFORATED CORRUGATED PLASTIC PIPE, INCLUDING SPECIAL S	\$1,364.29

**Quantity Units Unit Price** 

Total for Group 0001:\$573,343.63





Designed by:

Alternative 1 - CIP Slab bridge

	<u>Length</u>	<u>Width</u>	<u>Height</u>	Number	<u>Total</u>	<u>Units</u>
Item 507, 12" CIP Reinforced Piles, Driven Abutment	50.00	1.00	1.00	10	500 L	г
Pier	63.00	1.00	1.00	4	252	
	62.00	1.00	1.00	4	248	
				-	1000 L	.F
Item 507, 12" CIP Reinforced Piles, Furnish	ned					
Abutment	55.00	1.00	1.00	10	550 L	_F
Pier	68.00	1.00	1.00	4	272	
1 101	67.00	1.00	1.00	4	268	
	07.00	1.00	1.00	7	200	
				<del>-</del>	1090 L	.F
Item 509, Epoxy Coated Reinforcing Steel						
Abutment	Assume 1%	√ steel			8151 L	В
Pier	Assume 29				1937	-
Slab	Assume 29				24424	
				_		_
					34512 L	_B
Item 511, Class QC2 Concrete, Superstruct	ture					
Slab	95.98	16.00	1.54	1	88 (	CY
Diaphragm	18.48	2.25	1.50	2	5	
				-	92 (	CY
						-
Item 511, Class QC1 Concrete, Abutment I	-					
Footing	31.00	3.00	3.00	2	21 (	CY
Beam Seat	31.00	2.25	5.50	2	28	
Wingwalls	12.52	2.25	3.00	4	13	
				_	62 (	~
					02 (	J 1
Item 511, Class QC1 Concrete, Pier above	_		c	_	_	<b></b>
	16.47	3.00	2.00	2	7 (	CY
				-	7 (	CY
Item 517, Twin Steel Tube Railing, modified	<b>1</b> .					
	95.98	1.00	1.00	2	192 L	_F
		- <del>-</del>				
Item 518, Porous Backfill with Geotextile Fa		0.00	40.00	_		<b>3</b> ) (
	31.00	2.00	10.00	2	46 (	ĴΥ
Item 518, 6" Perforated Plastic Pipe						
	31.00	1.00	1.00	2	62 L	.F
Item 518 6" Non Perference Plactic Pine						
Item 518, 6" Non-Perforated Plastic Pipe	20.00	1.00	1.00	4	80 L	F
	20.00	1.00	1.00	7	00 1	-1

Checked by:



Bike Trail - Wasson Armleder
Segment 3-B Estimated Quantities

Alternative 2 - PCBB Beam bridge

	<u>Length</u>	<u>Width</u>	<u>Height</u>	<u>Number</u>	<u>Total</u>	<u>Units</u>
rem 507, 12" CIP Reinforced Piles, Driven						
Abutment	50.00	1.00	1.00	10	500 L	F
Pier	63.00	1.00	1.00	4	252	
	62.00	1.00	1.00	4	248	
				_	1000 L	F
em 507, 12" CIP Reinforced Piles, Furnish	ned					
Abutment	55.00	1.00	1.00	10	550 L	F
Pier	68.00	1.00	1.00	4	272	
	67.00	1.00	1.00	4	268	
				_	1090 L	F
em 509, Epoxy Coated Reinforcing Steel						
Abutment	Assume 1%				9501 L	В
Pier	Assume 1%				1630	
Slab	Assume 2%	6 steel			8809	
				-	19939 L	В
em 511, Class QC2 Concrete, Superstruc						
Slab	96.31	16.00	0.58	1	33 C	Υ
Diaphragm	18.48	3.00	1.83	0	0	
				_	33 C	Υ
em 511, Class QC1 Concrete, Abutment I	ncluding Foo	oting				
Footing	31.00	3.00	3.00	2	21 0	Υ
Beam Seat	31.00	3.00	5.00	2	34	
Wingwalls	12.52	3.00	3.00	4	17	
				_	72 C	Υ
em 511, Class QC1 Concrete, Pier above	Footing 18.48	3.00	3.00	2	12 C	Υ
		3.00	3.00			
					12 C	Υ
em 515, PCBB CB17-48	4.00	4.00	4.00	40	40.5	٠,
	1.00	1.00	1.00	12	12 E	:A
F40 Flydy 1	Lond					
em 516, Elastomeric bearings with intenal	laminates 1.00	1.00	1.00	48	48 E	ΞA



Bike Trail - Wasson Armleder
Segment 3-B Estimated Quantities Alternative 2 - PCBB Beam bridge

	Length	Width	<u>Height</u>	Number	<u>Total</u> <u>Units</u>
Item 517, Twin Steel Tube Railing, modified.	96.31	1.00	1.00	2	193 LF
Item 518, Porous Backfill with Geotextile Fab	oric 31.00	2.00	9.83	2	45 CY
Item 518, 6" Perforated Plastic Pipe	31.00	1.00	1.00	2	62 LF
Item 518, 6" Non-Perforated Plastic Pipe	19.67	1.00	1.00	4	79 LF

Designed by: Checked by:\_

# **APPENDIX A.3**



Project Number: 173620146

## Estimate Seg 3-C, Alt. 1

Estimated Cost:\$497,497.53

Contingency: 20.00%

Estimated Total: \$596,997.04

Wasson Armleder Structure Type Study Segment 3-C, Alternative 1

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

Estimate: Seg 3-C, Alt. 1

**Description** 

Line # Item Number

Supplemental Description				
Group 0001: Initial Group				
0005 505E11100 PILE DRIVING EQUIPMENT MOBILIZATION	1.000	LS	\$30,000.00000	\$30,000.00
0006 507E00500 12" CAST-IN-PLACE REINFORCED CONCRE	1,000.000 TE PILES, DRIV		\$12.61283	\$12,612.83
0007 507E00550 12" CAST-IN-PLACE REINFORCED CONCRE	1,090.000 TE PILES, FUR		\$48.61848	\$52,994.14
0008 509E10000 EPOXY COATED STEEL REINFORCEMENT	42,100.000	LB	\$1.98333	\$83,498.19
0009 511E32212 CLASS QC2 CONCRETE WITH QC/QA, SUPE	121.000 ERSTRUCTURE		\$992.10438	\$120,044.63
0011 511E42510 CLASS QC1 CONCRETE, PIER CAP	7.000	CY	\$1,875.20968	\$13,126.47
0012 511E44110 CLASS QC1 CONCRETE, ABUTMENT NOT IN	62.000 NCLUDING FOC		\$962.80458	\$59,693.88
0015 517E70100 RAILING (THREE STEEL TUBE BRIDGE RAIL		FT	\$482.03582	\$107,976.02
0017 518E21200 POROUS BACKFILL WITH GEOTEXTILE FAB	138.000 BRIC	CY	\$112.50923	\$15,526.27
0018 518E40000 6" PERFORATED CORRUGATED PLASTIC P		FT	\$10.41180	\$645.53
0019 518E40010 6" NON-PERFORATED CORRUGATED PLAS		FT UDING SF	\$17.24461 PECIAL S	\$1,379.57

**Quantity Units Unit Price** 

Total for Group 0001:\$497,497.53

## Estimate Seg-3-C, Alt 2

Estimated Cost:\$607,119.36

Contingency: 20.00%

**Estimated Total: \$728,543.23** 

Wasson Armleder Structure Type Study Segment 3-C, Alternative 2

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

Estimate: Seg-3-C, Alt 2

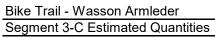
**Description** 

Line # Item Number

Supplemental Description				
Group 0001: Initial Group				
0005 505E11100 PILE DRIVING EQUIPMENT MOBILIZATION	1.000	LS	\$30,000.00000	\$30,000.00
0006 507E00500 12" CAST-IN-PLACE REINFORCED CONCRETE	1,000.000 E PILES, DRIV		\$12.61283	\$12,612.83
0007 507E00550 12" CAST-IN-PLACE REINFORCED CONCRETE	1,090.000 E PILES, FUR		\$48.61848	\$52,994.14
0008 509E10000 2 EPOXY COATED STEEL REINFORCEMENT	1,400.000	LB	\$2.10348	\$45,014.47
0009 511E34444 CLASS QC2 CONCRETE, BRIDGE DECK	55.000	CY	\$2,642.51050	\$145,338.08
0011 511E42510 CLASS QC1 CONCRETE, PIER CAP	12.000	CY	\$1,875.20968	\$22,502.52
0012 511E43510 CLASS QC1 CONCRETE, ABUTMENT INCLUDI	72.000 NG FOOTING		\$567.36696	\$40,850.42
0014 515E12030 PRESTRESSED CONCRETE COMPOSITE BOX			\$11,350.67337 BERS, LEVE L 1, CB17-48	\$136,208.08
0016 516E43100 ELASTOMERIC BEARING WITH INTERNAL LAN <2" THICK			\$117.70158 RENE)	\$5,649.68
0019 517E70100 RAILING (THREE STEEL TUBE BRIDGE RAILIN	225.000 G)	FT	\$482.03582	\$108,458.06
0020 518E21200 POROUS BACKFILL WITH GEOTEXTILE FABRI	45.000 C	CY	\$121.80587	\$5,481.26
0021 518E40000 6" PERFORATED CORRUGATED PLASTIC PIPE	62.000 E	FT	\$10.41180	\$645.53
0022 518E40010 6" NON-PERFORATED CORRUGATED PLASTIC	79.000 C PIPE, INCL		\$17.26955 PECIAL S	\$1,364.29

**Quantity** Units Unit Price

Total for Group 0001:\$607,119.36





Designed by:

Alternative 1 - CIP Slab bridge

		<u>Length</u>	<u>Width</u>	<u>Height</u>	<u>Number</u>	<u>Total</u>	<u>Units</u>
tem 507,	12" CIP Reinforced Piles, Driven						
	Abutment	50.00	1.00	1.00	10	500 l	_F
	Pier	63.00	1.00	1.00	4	252	
		62.00	1.00	1.00	4	248	
					-	1000 l	_F
tem 507,	12" CIP Reinforced Piles, Furnish						
	Abutment	55.00	1.00	1.00	10	550 l	_F
	Pier	68.00	1.00	1.00	4	272	
		67.00	1.00	1.00	4	268	
					-	1090 l	_F
tem 509,	Epoxy Coated Reinforcing Steel						
	Abutment	Assume 1%				8151 l	_B
	Pier Slab	Assume 2% Assume 2%				1937 32019	
	Siab	Assume 27	0 31661		_		Б
						42106 l	-R
tem 511,	Class QC2 Concrete, Superstructure Slab	ture 112.23	16.00	1.75	1	116 (	CY
	Diaphragm	18.48	2.25	1.50	2	5	
					-	121 (	CY
tem 511,	Class QC1 Concrete, Abutment I	ncluding Foo	oting				
	Footing	31.00	3.00	3.00	2	21 (	CY
	Beam Seat	31.00	2.25	5.50	2	28	
	Wingwalls	12.52	2.25	3.00	4	13	
					-	62 (	CY
tem 511,	Class QC1 Concrete, Pier above	Footing					
		16.47	3.00	2.00	2	7 (	CY
					-	7 (	CY
. 547	T : 0: 1T   D ::: 15						
tem 517,	Twin Steel Tube Railing, modified	1. 112.23	1.00	1.00	2	224 l	_F
tem 518,	Porous Backfill with Geotextile Fa	abric					
		31.00	2.00	10.00	2	46 (	CY
tem 518,	6" Perforated Plastic Pipe	04.05	4.00	4.05	•		_
		31.00	1.00	1.00	2	62 l	_Ի
em 518	6" Non-Perforated Plastic Pipe						

Checked by:\_

D-88



Bike Trail - Wasson Armleder
Segment 3-C Estimated Quantities

Alternative 2 - PCBB Beam bridge

	<u>Length</u>	Width	<u>Height</u>	<u>Number</u>	<u>Total</u> <u>Units</u>
Item 507, 12" CIP Reinforced Piles, Drive	n				
Abutment	50.00	1.00	1.00	10	500 LF
Pier	63.00	1.00	1.00	4	252
	62.00	1.00	1.00	4	248
				-	1000 LF
tem 507, 12" CIP Reinforced Piles, Furni					
Abutment	55.00	1.00	1.00	10	550 LF
Pier	68.00	1.00	1.00	4	272
	67.00	1.00	1.00	4	268
				-	1090 LF
tem 509, Epoxy Coated Reinforcing Stee					
Abutment	Assume 19				9501 LB
Pier	Assume 19				1630
Slab	Assume 2%	% steel			10273
				-	21403 LB
tem 511, Class QC2 Concrete, Superstru					
Slab	112.31	16.00	0.58	1	39 CY
Diaphragm	18.48	3.00	1.83	0	0
				-	39 CY
tem 511, Class QC1 Concrete, Abutmen	t Includina Foo	otina			
Footing	31.00	3.00	3.00	2	21 CY
Beam Seat	31.00	3.00	5.00	2	34
Wingwalls	12.52	3.00	3.00	4	17
				-	72 CY
tem 511, Class QC1 Concrete, Pier abov	e Footing				
	18.48	3.00	3.00	2	12 CY
				-	12 CY
					.2 01
tem 515, PCBB CB17-48	1.00	1.00	1.00	12	12 EA
	1.50	1.00	1.00	12	
tem 516, Elastomeric bearings with inten					
	1.00	1.00	1.00	48	48 EA



Bike Trail - Wasson Armleder
Segment 3-C Estimated Quantities

Alternative 2 - PCBB Beam bridge

	<u>Length</u>	<u>Width</u>	<u>Height</u>	<u>Number</u>	Total <u>Units</u>
Item 517, Twin Steel Tube Railing, modified.	112.31	1.00	1.00	2	225 LF
Item 518, Porous Backfill with Geotextile Fab	oric 31.00	2.00	9.83	2	45 CY
Item 518, 6" Perforated Plastic Pipe	31.00	1.00	1.00	2	62 LF
Item 518, 6" Non-Perforated Plastic Pipe	19.67	1.00	1.00	4	79 LF

\_Checked by:\_ Designed by:

# **APPENDIX A.4**



Project Number: 173620146

## Estimate Seg 3-D, Alt. 1

Estimated Cost:\$568,349.79

Contingency: 20.00%

**Estimated Total: \$682,019.75** 

Wasson Armleder Structure Type Study Segment 3-D, Alternative 1

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

Estimate: Seg 3-D, Alt. 1

**Description** 

Line # Item Number

Supplemental Description				
Group 0001: Initial Group				
0005 505E11100 PILE DRIVING EQUIPMENT MOBILIZATION	1.000	LS	\$30,000.00000	\$30,000.00
0006 507E00500 12" CAST-IN-PLACE REINFORCED CONCRET	1,325.000 TE PILES, DRI\		\$10.96187	\$14,524.48
0007 507E00550 12" CAST-IN-PLACE REINFORCED CONCRET	1,445.000 TE PILES, FUR		\$48.61848	\$70,253.70
0008 509E10000 EPOXY COATED STEEL REINFORCEMENT	48,400.000	LB	\$1.95944	\$94,836.90
0009 511E32212 CLASS QC2 CONCRETE WITH QC/QA, SUPE	125.000 RSTRUCTURE		\$992.10438	\$124,013.05
0011 511E42510 CLASS QC1 CONCRETE, PIER CAP	11.000	CY	\$1,875.20968	\$20,627.31
0012 511E44110 CLASS QC1 CONCRETE, ABUTMENT NOT IN	95.000 ICLUDING FOO		\$832.32890	\$79,071.25
0015 517E70100 RAILING (THREE STEEL TUBE BRIDGE RAIL		FT	\$482.03582	\$109,422.13
0017 518E21200 POROUS BACKFILL WITH GEOTEXTILE FABI	213.000 RIC	CY	\$109.10208	\$23,238.74
0018 518E40000 6" PERFORATED CORRUGATED PLASTIC PI	96.000 PE	FT	\$10.23601	\$982.66
0019 518E40010 6" NON-PERFORATED CORRUGATED PLAST		FT UDING SF	\$17.24461 PECIAL S	\$1,379.57

**Quantity** Units Unit Price

Total for Group 0001:\$568,349.79

#### Estimate Seg-3-D, Alt 2

Estimated Cost:\$719,082.49

Contingency: 20.00%

**Estimated Total: \$862,898.99** 

Wasson Armleder Structure Type Study Segment 3-D, Alternative 2

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

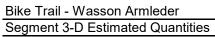
Estimate:	Sea 3 D	ΛIt C
Esimale.	Seg-s-D,	AIL ∠

Line # Item Number

Description Supplemental Description	<u> </u>	<u> </u>	<u></u>	<u>=xxx</u>
Group 0001: Initial Group				
0005 505E11100 PILE DRIVING EQUIPMENT MOBILIZATION	1.000	LS	\$30,000.00000	\$30,000.00
0006 507E00500 12" CAST-IN-PLACE REINFORCED CONCR	1,325.000 RETE PILES, DRIV		\$10.96187	\$14,524.48
0007 507E00550 12" CAST-IN-PLACE REINFORCED CONCR	1,445.000 RETE PILES, FURI		\$48.61848	\$70,253.70
0008 509E10000 EPOXY COATED STEEL REINFORCEMENT	28,400.000 Г	LB	\$2.05237	\$58,287.31
0009 511E34444 CLASS QC2 CONCRETE, BRIDGE DECK	43.000	CY	\$2,758.01002	\$118,594.43
0011 511E42510 CLASS QC1 CONCRETE, PIER CAP	20.000	CY	\$1,875.20968	\$37,504.19
0012 511E43510 CLASS QC1 CONCRETE, ABUTMENT INCL	110.000 UDING FOOTING		\$547.39813	\$60,213.79
0014 515E12050 PRESTRESSED CONCRETE COMPOSITE I			\$17,001.84924 BERS, LEVE L 1, CB21-48	\$204,022.19
0016 516E43100 ELASTOMERIC BEARING WITH INTERNAL <2" THICK			\$117.70158 RENE)	\$5,649.68
0019 517E70100 RAILING (THREE STEEL TUBE BRIDGE RA	227.000 IILING)	FT	\$482.03582	\$109,422.13
0020 518E21200 POROUS BACKFILL WITH GEOTEXTILE FA	70.000 ABRIC	CY	\$118.05197	\$8,263.64
0021 518E40000 6" PERFORATED CORRUGATED PLASTIC		FT	\$10.23601	\$982.66
0022 518E40010 6" NON-PERFORATED CORRUGATED PLA	79.000 STIC PIPE, INCLU		\$17.26955 PECIAL S	\$1,364.29

**Quantity Units Unit Price** 

Total for Group 0001:\$719,082.49





Designed by:

Alternative 1 - CIP Slab bridge

	<u>Length</u>	<u>Width</u>	<u>Height</u>	<u>Number</u>	<u>Total</u>	<u>Units</u>
14 507 408 OID D :- ( 1 D) D :						
Item 507, 12" CIP Reinforced Piles, Driven	50.00	1.00	1.00	14	700 L	F
Abutment						<b>-</b> Γ
Pier	63.00	1.00	1.00	5	315	
	62.00	1.00	1.00	5	310	
				-	1325 L	_F
Item 507, 12" CIP Reinforced Piles, Furnish	ned					
Abutment	55.00	1.00	1.00	14	770 L	_F
Pier	68.00	1.00	1.00	5	340	
	67.00	1.00	1.00	5	335	
	01.00	1.00	1.00	Ū	000	
				-	1445 L	_F
tem 509, Epoxy Coated Reinforcing Steel						
Abutment	Assume 19	√ steel			12519 L	_B
Pier	Assume 29				2872	
Slab	Assume 29				33020	
Siau	Assume 27	o SIEEI			აა∪∠U	
				-	48411 L	_B
tem 511, Class QC2 Concrete, Superstruct	ture					
Slab	113.25	16.00	1.75	1	117 (	CY
Diaphragm	29.38	2.25	1.50	2	7	
				_		
					125 (	CY
tem 511, Class QC1 Concrete, Abutment I	ncluding Foo	oting				
Footing	48.00	3.00	3.00	2	32 (	CY
Beam Seat	48.00	2.25	5.50	2	44	
Wingwalls	18.62	2.25	3.00	4	19	
Willigwalls	10.02	2.20	0.00	7	10	
				-	95 (	CY
tem 511, Class QC1 Concrete, Pier above	Footing					
, <u></u> ,,	24.42	3.00	2.00	2	11 (	CY
				-	11 (	~v
					11 (	J 1
tom 517 Twin Stool Tuba Bailing madifies	1					
Item 517, Twin Steel Tube Railing, modified	ı. 113.25	1.00	1.00	2	227 L	F
		1.00	1.00	<b>-</b>	<i>_</i>	
tem 518, Porous Backfill with Geotextile Fa		0.00	40.00	•		2) (
	48.00	2.00	10.00	2	71 (	ĴΥ
tem 518, 6" Perforated Plastic Pipe						
	48.00	1.00	1.00	2	96 L	_F
Item 518, 6" Non-Perforated Plastic Pipe						
	20.00	1.00	1.00	4	80 L	_F

Checked by:\_



Segment 3-D Estimated Quantities

Alternative 2 - PCBB Beam bridge

Alternati	ive 2 - PCBB E	Beam bridge	Э			
	<u>Length</u>	<u>Width</u>	<u>Height</u>	Number	<u>Total</u>	<u>Units</u>
	_	<u> </u>	<u> </u>	110111001	<u>10tar</u>	<u>011110</u>
Item 507, 12" CIP Reinforced Piles, Drive		4.00	4.00	4.4	700 1	_
Abutment	50.00	1.00 1.00	1.00	14	700 L	_F
Pier	63.00 62.00	1.00	1.00 1.00	5 5	315 310	
	02.00	1.00	1.00	3	310	
				-	1325 L	-F
Item 507, 12" CIP Reinforced Piles, Furnis	shed					
Abutment	55.00	1.00	1.00	14	770 L	.F
Pier	68.00	1.00	1.00	5	340	
	67.00	1.00	1.00	5	335	
				_	4445	_
					1445 L	<u>-</u> F
Item 509, Epoxy Coated Reinforcing Stee						
Abutment	Assume 19				14575 L	_B
Pier	Assume 19				2591	
Slab	Assume 2%	% steel			11264	
				-	28429 L	_B
Item 511, Class QC2 Concrete, Superstru	ıcture					
Slab	113.67	17.33	0.58	1	43 (	CY
Diaphragm	29.38	3.00	1.83	0	0	
				-	43 (	~
					43 (	<b>J</b> 1
Item 511, Class QC1 Concrete, Abutment	t Including Foo	otina				
Footing	48.00	3.00	3.00	2	32 (	CY
Beam Seat	48.00	3.00	5.00	2	53	<b>.</b>
Wingwalls	18.62	3.00	3.00	4	25	
-				_		
					110 (	CY
Item 511, Class QC1 Concrete, Pier abov						
	29.38	3.00	3.00	2	20 (	CY
				-	20 (	CY
Item 515, PCBB CB21-48	4.00	4.00	4.00	40	40.5	- A
	1.00	1.00	1.00	12	12 E	=A
Item 516, Elastomeric bearings with intens	al laminates 1.00	1.00	1.00	48	40 F	= Λ
	1.00	1.00	1.00	40	48 E	_^

Designed by:\_\_\_\_\_Checked by:\_\_\_\_\_



Bike Trail - Wasson Armleder
Segment 3-D Estimated Quantities Alternative 2 - PCBB Beam bridge

	<u>Length</u>	Width	<u>Height</u>	Number	Total Units
Item 517, Twin Steel Tube Railing, modified.	113.67	1.00	1.00	2	227 LF
Item 518, Porous Backfill with Geotextile Fab	eric 48.00	2.00	9.83	2	70 CY
Item 518, 6" Perforated Plastic Pipe	48.00	1.00	1.00	2	96 LF
Item 518, 6" Non-Perforated Plastic Pipe	19.67	1.00	1.00	4	79 LF

# **APPENDIX A.5**



Project Number: 173620146

## Estimate Seg 3-E, Alt. 1

Estimated Cost:\$595,453.97

Contingency: 20.00%

**Estimated Total: \$714,544.76** 

Wasson Armleder Structure Type Study Segment 3-E, Alternative 1

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

Estimate: Seg 3-E, Alt. 1

Line # Item Number

Description Supplemental Description  Group 0001: Initial Group	Quantity	<u>Units</u>	Unit Price	Extension
Group Goot I. Initial Group				
0005 505E11100 PILE DRIVING EQUIPMENT MOBILIZATION	1.000	LS	\$30,000.00000	\$30,000.00
0006 507E00500 12" CAST-IN-PLACE REINFORCED CONCE	1,100.000 RETE PILES, DRI\		\$12.02755	\$13,230.31
0007 507E00550 12" CAST-IN-PLACE REINFORCED CONCF	1,200.000 RETE PILES, FUR		\$48.61848	\$58,342.18
0008 509E10000 EPOXY COATED STEEL REINFORCEMENT	54,500.000 T	LB	\$1.93933	\$105,693.49
0009 511E32212 CLASS QC2 CONCRETE WITH QC/QA, SUI	162.000 PERSTRUCTURE		\$992.10438	\$160,720.91
0011 511E42510 CLASS QC1 CONCRETE, PIER CAP	8.000	CY	\$1,875.20968	\$15,001.68
0012 511E44110 CLASS QC1 CONCRETE, ABUTMENT NOT	71.000 INCLUDING FOO		\$919.28532	\$65,269.26
0015 517E70100 RAILING (THREE STEEL TUBE BRIDGE RA	264.000 AILING)	FT	\$482.03582	\$127,257.46
0017 518E21200 POROUS BACKFILL WITH GEOTEXTILE FA	160.000 ABRIC	CY	\$111.33629	\$17,813.81
0018 518E40000 6" PERFORATED CORRUGATED PLASTIC	72.000 PIPE	FT	\$10.35134	\$745.30
0019 518E40010 6" NON-PERFORATED CORRUGATED PLA		FT UDING SI	\$17.24461 PECIAL S	\$1,379.57

**Quantity** Units Unit Price

Total for Group 0001:\$595,453.97

#### Estimate Seg-3-E, Alt 2

Estimated Cost:\$750,628.09

Contingency: 20.00%

Estimated Total: \$900,753.71

Wasson Armleder Structure Type Study Segment 3-E, Alternative 2

Base Date: 02/27/24

Spec Year: 23

Unit System: E

Work Type: GEN CONST: INVLVS 2 OR MOR MAJ WRK TYPE

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: HAMILTON

Latitude of Midpoint: 0

Longitude of Midpoint: 0

District: 08

Federal/State Project Number:

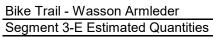
Estimate:	Sea-3-E.	Alt	2
Louinate.	Cog c L,	, vic	_

Line # Item Number

<u>Description</u> Supplemental Description	<u> </u>	<u> </u>	<u> </u>	<u>=.x.oo</u>
Group 0001: Initial Group				
0005 505E11100 PILE DRIVING EQUIPMENT MOBILIZATION	1.000	LS	\$30,000.00000	\$30,000.00
0006 507E00500 12" CAST-IN-PLACE REINFORCED CONCR	1,100.000 RETE PILES, DRIV		\$12.02755	\$13,230.31
0007 507E00550 12" CAST-IN-PLACE REINFORCED CONCR	1,200.000 RETE PILES, FUR		\$48.61848	\$58,342.18
0008 509E10000 EPOXY COATED STEEL REINFORCEMENT	30,000.000	LB	\$2.04262	\$61,278.60
0009 511E34444 CLASS QC2 CONCRETE, BRIDGE DECK	65.000	CY	\$2,566.88732	\$166,847.68
0011 511E42510 CLASS QC1 CONCRETE, PIER CAP	15.000	CY	\$1,875.20968	\$28,128.15
0012 511E43510 CLASS QC1 CONCRETE, ABUTMENT INCL	83.000 UDING FOOTING		\$560.58823	\$46,528.82
0014 515E12050 PRESTRESSED CONCRETE COMPOSITE E			\$17,001.84924 BERS, LEVE L 1, CB21-48	\$204,022.19
0016 516E43100 ELASTOMERIC BEARING WITH INTERNAL <2" THICK			\$117.70158 PRENE)	\$5,649.68
0019 517E70100 RAILING (THREE STEEL TUBE BRIDGE RA	266.000 IILING)	FT	\$482.03582	\$128,221.53
0020 518E21200 POROUS BACKFILL WITH GEOTEXTILE FA	52.000 ABRIC	CY	\$120.56452	\$6,269.36
0021 518E40000 6" PERFORATED CORRUGATED PLASTIC	72.000 PIPE	FT	\$10.35134	\$745.30
0022 518E40010 6" NON-PERFORATED CORRUGATED PLA	79.000 STIC PIPE, INCL		\$17.26955 PECIAL S	\$1,364.29

**Quantity Units Unit Price** 

Total for Group 0001:\$750,628.09





Designed by:

Alternative 1 - CIP Slab bridge

		<u>Length</u>	<u>Width</u>	<u>Height</u>	Number	<u>Total</u>	<u>Units</u>
tem 507, 1	2" CIP Reinforced Piles, Driven						
	Abutment	50.00	1.00	1.00	12	600 L	_F
	Pier	63.00	1.00	1.00	4	252	
		62.00	1.00	1.00	4	248	
					-	1100 L	.F
	2" CIP Reinforced Piles, Furnish						
	Abutment	55.00	1.00	1.00	12	660 L	_F
	Pier	68.00	1.00	1.00	4	272	
		67.00	1.00	1.00	4	268	
					-	1200 L	.F
	poxy Coated Reinforcing Steel						
	Abutment	Assume 1%				9386 L	-B
	Pier Slab	Assume 2% Assume 2%				2244 42876	
					-	54506 L	В
	Class QC2 Concrete, Superstruc		40.05	0.05		4	2) (
	Slab	132.07	16.00	2.00	1	157 (	ĴΥ
	Diaphragm	22.06	2.25	1.50	2	6	
					-	162 (	CY
	Class QC1 Concrete, Abutment I	-	-				
	Footing	36.00	3.00	3.00	2	24 (	CY
	Beam Seat	36.00	2.25	5.50	2	33	
· ·	Wingwalls	13.94	2.25	3.00	4	14	
					-	71 (	CY
tem 511, C	Class QC1 Concrete, Pier above	Footing 19.08	3.00	2.00	2	8 (	~~
		19.00	3.00	2.00	۷	0 (	۱ ر
					-	8 (	CY
tem 517, T	win Steel Tube Railing, modified	i.					
		132.07	1.00	1.00	2	264 L	.F
tem 518, P	Porous Backfill with Geotextile Fa	abric 36.00	2.00	10.00	2	53 (	CV
		50.00	2.00	10.00	۷	55 (	<i>1</i>
tem 518, 6	" Perforated Plastic Pipe	36.00	1.00	1.00	2	72 L	_
		30.00	1.00	1.00	2	1	<b>-</b> I¯
em 518, 6	" Non-Perforated Plastic Pipe						

Checked by:\_



Stantec

Bike Trail - Wasson Armleder
Segment 3-E Estimated Quantities

Alternative 2 - PCBB Beam bridge

	<u>Length</u>	<u>Width</u>	<u>Height</u>	<u>Number</u>	<u>Total</u> <u>Units</u>
Item 507, 12" CIP Reinforced Piles, Driven					
Abutment	50.00	1.00	1.00	12	600 LF
Pier	63.00	1.00	1.00	4	252
	62.00	1.00	1.00	4	248
				-	4400   5
					1100 LF
Item 507, 12" CIP Reinforced Piles, Furnish	ed				
Abutment	55.00	1.00	1.00	12	660 LF
Pier	68.00	1.00	1.00	4	272
	67.00	1.00	1.00	4	268
				-	1200 LF
					1200 EI
Item 509, Epoxy Coated Reinforcing Steel					
Abutment	Assume 19				10927 LB
Pier Slab	Assume 19 Assume 29				1945 12143
Slab	Assume 27	o Steel			12143
				-	25015 LB
Item 511, Class QC2 Concrete, Superstruct		40.00	0.50	4	40.007
Slab Diaphragm	132.76 22.06	16.00 3.00	0.58 1.83	1 0	46 CY 0
Біаріпаўііі	22.00	3.00	1.00	U	O
				-	46 CY
Item 511, Class QC1 Concrete, Abutment Ii	ncluding Foo	ntina			
Footing	36.00	3.00	3.00	2	24 CY
Beam Seat	36.00	3.00	5.00	2	40
Wingwalls	13.94	3.00	3.00	4	19
				-	OV
					83 CY
Item 511, Class QC1 Concrete, Pier above	•				
	22.06	3.00	3.00	2	15 CY
				-	15 CY
					15 01
Item 515, PCBB CB21-48					
	1.00	1.00	1.00	12	12 EA
Item 516, Elastomeric bearings with intenal					
	1.00	1.00	1.00	48	48 EA



Bike Trail - Wasson Armleder
Segment 3-E Estimated Quantities Alternative 2 - PCBB Beam bridge

	<u>Length</u>	Width	<u>Height</u>	Number	<u>Total</u> <u>Units</u>
Item 517, Twin Steel Tube Railing, modified.	132.76	1.00	1.00	2	266 LF
Item 518, Porous Backfill with Geotextile Fab	oric 36.00	2.00	9.83	2	52 CY
Item 518, 6" Perforated Plastic Pipe	36.00	1.00	1.00	2	72 LF
Item 518, 6" Non-Perforated Plastic Pipe	19.67	1.00	1.00	4	79 LF

Designed by: Checked by:\_

# **Attachment E**

**Hydraulic Calculations** 

Stantec

Memo

To: Mike Sturdevant From: Eric Adkins

Cincinnati, Ohio Cincinnati

Project/File: 173620146 Date: February 28, 2024

Reference: Wasson - Armleder Trail Extension Hydraulic Analysis for Feasibility Study

The hydraulic analysis started with the effective FEMA HEC-RAS model for Duck Creek. Average Cross section spacing in the approximately 1 mile long section of Duck Creek that our models were spread over was 300-400 feet. Interpolated cross sections were used between the model cross sections to bring the average spacing to approximately 100 feet. No Survey was performed for the feasibility study hydraulic analysis. A detailed stream survey will need to be conducted and an updated analysis performed once a preferred alternative is chosen.

**Alternate 3B** causes a rise in the 100 year water surface elevation of Duck Creek of 2.08 feet above the existing 100 year water surface elevation of 501.00' immediately upstream of the proposed bridge. The rise continues approximately 5400 feet upstream until it rejoins the existing profile.

**Alternate 3C** causes a rise in the 100 year water surface elevation of Duck Creek of 0.90 feet above the existing 100 year water surface elevation of 494.84' immediately upstream of the proposed bridge. The rise continues approximately 4900 feet upstream until it rejoins the existing profile.

**Alternate 3D** causes a rise in the 100 year water surface elevation of Duck Creek of 0.38 feet above the existing 100 year water surface elevation of 493.15' immediately upstream of the proposed bridge. The rise continues approximately 2000 feet upstream until it rejoins the existing profile.

**Alternate 3E** causes a rise in the 100 year water surface elevation of Duck Creek of 0.90 feet above the existing 100 year water surface elevation of 491.27' immediately upstream of the proposed bridge. The rise continues approximately 2200 feet upstream until it rejoins the existing profile.

A copy of the HEC-RAS Output for the 100-year flood of the Existing and all four alternates follows this memo.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Eric Adkins PE, MS

Structural Engineer Phone: (513) 619-6473 eric.adkins@stantec.com

stantec.com

Design with community in mind

		Reach: Reach											
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
Booch 1	5.415	100 year	Existing Prelim	(cfs) 7700.00	(ft) 538.90	(ft) 561.57	(ft) 554.47	(ft) 565.24	(ft/ft) 0.001658	(ft/s) 15.37	(sq ft) 500.93	(ft) 22.20	0.57
Reach-1	5.415		Proposed 3B		538.90		554.47		0.001658		500.93	22.20	0.57
Reach-1	5.415	100 year	Proposed 3C	7700.00 7700.00	538.90	561.57 561.57	554.47	565.24 565.24	0.001658	15.37	500.93	22.20	0.57
Reach-1	5.415	100 year 100 year	Proposed 3D	7700.00	538.90	561.57	554.47	565.24	0.001658	15.37 15.37	500.93	22.20	0.57
Reach-1	5.415	100 year	PR3E Raised	7700.00	538.90	561.57	554.47	565.24	0.001658	15.37	500.93	22.20	0.57
11000111	0.110	100 your	T TOE TUICOG	7700.00	000.00	001.01	00 1.17	000.21	0.001000	10.01	000.00	22.20	0.01
Reach-1	5.3675			Culvert									
Reach-1	5.32	100 year	Existing Prelim	7980.00	537.40	554.30	553.33	561.38	0.003671	21.34	374.03	22.20	0.92
Reach-1	5.32	100 year	Proposed 3B	7980.00	537.40	554.30	553.33	561.38	0.003671	21.34	374.03	22.20	0.92
Reach-1	5.32	100 year	Proposed 3C	7980.00	537.40	554.30	553.33	561.38	0.003671	21.34	374.03	22.20	0.92
Reach-1	5.32	100 year	Proposed 3D	7980.00	537.40	554.30	553.33	561.38	0.003671	21.34	374.03	22.20	0.92
Reach-1	5.32	100 year	PR3E Raised	7980.00	537.40	554.30	553.33	561.38	0.003671	21.34	374.03	22.20	0.92
Reach-1	5.308	100 year	Existing Prelim	7980.00	537.30	554.48	554.48	560.99	0.003177	20.47	389.86	30.00	1.00
Reach-1	5.308	100 year	Proposed 3B	7980.00	537.30	554.48	554.48	560.99	0.003177	20.47	389.86	30.00	1.00
Reach-1	5.308 5.308	100 year	Proposed 3C	7980.00 7980.00	537.30	554.48	554.48 554.48	560.99	0.003177 0.003177	20.47 20.47	389.86 389.86	30.00 30.00	1.00 1.00
Reach-1	5.308	100 year 100 year	Proposed 3D PR3E Raised	7980.00	537.30 537.30	554.48 554.48	554.48	560.99 560.99	0.003177	20.47	389.86	30.00	1.00
TCGCII-1	0.000	100 year	T NOE Naiscu	7300.00	307.00	354.40	354.40	500.55	0.0001111	20.41	303.00	50.00	1.00
Reach-1	5.213	100 year	Existing Prelim	7980.00	535.80	551.10	549.80	556.49	0.002501	18.62	428.64	30.00	0.87
Reach-1	5.213	100 year	Proposed 3B	7980.00	535.80	551.10	549.80	556.49	0.002501	18.62	428.64	30.00	0.87
Reach-1	5.213	100 year	Proposed 3C	7980.00	535.80	551.10	549.80	556.49	0.002501	18.62	428.64	30.00	0.87
Reach-1	5.213	100 year	Proposed 3D	7980.00	535.80	551.10	549.80	556.49	0.002501	18.62	428.64	30.00	0.87
Reach-1	5.213	100 year	PR3E Raised	7980.00	535.80	551.10	549.80	556.49	0.002501	18.62	428.64	30.00	0.87
Reach-1	5.14	100 year	Existing Prelim	7980.00	534.60	550.46	548.57	555.45	0.002258	17.92	445.39	30.00	0.82
Reach-1	5.14	100 year	Proposed 3B	7980.00	534.60	550.46	548.57	555.45	0.002258	17.92	445.39	30.00	0.82
Reach-1	5.14	100 year	Proposed 3C	7980.00	534.60	550.46	548.57	555.45	0.002258	17.92	445.39	30.00	0.82
Reach-1	5.14	100 year	Proposed 3D	7980.00	534.60	550.46	548.57	555.45	0.002258	17.92	445.39	30.00	0.82
Reach-1	5.14	100 year	PR3E Raised	7980.00	534.60	550.46	548.57	555.45	0.002258	17.92	445.39	30.00	0.82
Reach-1	5.113	100 year	Existing Prelim	8210.00	534.00	548.22	548.22	554.90	0.003276	20.72	396.16	29.97	1.00
Reach-1	5.113	100 year	Proposed 3B	8210.00	534.00	548.22	548.22	554.90	0.003276	20.72	396.16	29.97	1.00
Reach-1	5.113	100 year	Proposed 3C	8210.00	534.00	548.22	548.22	554.90	0.003276	20.72	396.16	29.97	1.00
Reach-1	5.113	100 year	Proposed 3D	8210.00	534.00	548.22	548.22	554.90	0.003276	20.72	396.16	29.97	1.00
Reach-1	5.113	100 year	PR3E Raised	8210.00	534.00	548.22	548.22	554.90	0.003276	20.72	396.16	29.97	1.00
Dh 4	F 404	400	Fuirting Dealing	0040.00	522.00	F 47 70	540.00	550.04	0.002397	40.00	440.07	24.07	0.90
Reach-1	5.104 5.104	100 year	Existing Prelim Proposed 3B	8210.00 8210.00	533.90 533.90	547.79 547.79	546.90 546.90	553.01 553.01	0.002397	18.32 18.32	448.07 448.07	34.97 34.97	0.90
Reach-1	5.104	100 year 100 year	Proposed 3C	8210.00	533.90	547.79	546.90	553.01	0.002397	18.32	448.07	34.97	0.90
Reach-1	5.104	100 year	Proposed 3D	8210.00	533.90	547.79	546.90	553.01	0.002397	18.32	448.07	34.97	0.90
Reach-1	5.104	100 year	PR3E Raised	8210.00	533.90	547.79	546.90	553.01	0.002397	18.32	448.07	34.97	0.90
11000111	0.101	100 you.	T TOE TUICOG	02.10.00	000.00	011.10	0.10.00	000.01	0.002007	10.02	1 10.01	01.01	0.00
Reach-1	5.095	100 year	Existing Prelim	8210.00	533.80	549.06		552.34	0.001300	14.54	564.64	39.98	0.68
Reach-1	5.095	100 year	Proposed 3B	8210.00	533.80	549.06		552.34	0.001300	14.54	564.64	39.98	0.68
Reach-1	5.095	100 year	Proposed 3C	8210.00	533.80	549.06		552.34	0.001300	14.54	564.64	39.98	0.68
Reach-1	5.095	100 year	Proposed 3D	8210.00	533.80	549.06		552.34	0.001300	14.54	564.64	39.98	0.68
Reach-1	5.095	100 year	PR3E Raised	8210.00	533.80	549.06		552.34	0.001300	14.54	564.64	39.98	0.68
Reach-1	5.076	100 year	Existing Prelim	8210.00	533.50	549.01		552.18	0.001238	14.29	574.73	39.98	0.66
Reach-1	5.076	100 year	Proposed 3B	8210.00	533.50	549.01		552.18	0.001238	14.29	574.73	39.98	0.66
Reach-1	5.076	100 year	Proposed 3C	8210.00	533.50	549.01		552.18	0.001238	14.29	574.73	39.98	0.66
Reach-1	5.076	100 year	Proposed 3D	8210.00	533.50	549.01		552.18	0.001238	14.29	574.73	39.98	0.66
Reach-1	5.076	100 year	PR3E Raised	8210.00	533.50	549.01		552.18	0.001238	14.29	574.73	39.98	0.66
Booch 4	E 020	100 1/	Eviating Design	0040.00	F00.00	E40.07		CC4 70	0.004055	40.70	000.01	20.00	0.01
Reach-1	5.029 5.029	100 year 100 year	Existing Prelim Proposed 3B	8210.00 8210.00	532.60 532.60	548.97 548.97		551.79 551.79	0.001055 0.001055	13.48 13.48	608.91 608.91	39.98 39.98	0.61 0.61
		100 year 100 year											
Reach-1	5.029	100 year	Proposed 3C Proposed 3D	8210.00 8210.00	532.60 532.60	548.97 548.97		551.79 551.79	0.001055	13.48	608.91	39.98 39.98	0.61
Reach-1	5.029	100 year	PR3E Raised	8210.00	532.60	548.97		551.79	0.001055	13.48	608.91	39.98	0.61
		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		10.00	232.00	2.10.07		-310	2.23.000	.0.10	- 50.01	55.56	0.51
Reach-1	5	100 year	Existing Prelim	8210.00	532.50	548.76		551.62	0.001075	13.58	604.61	39.98	0.62
Reach-1	5	100 year	Proposed 3B	8210.00	532.50	548.76		551.62	0.001075	13.58	604.61	39.98	0.62
Reach-1	5	100 year	Proposed 3C	8210.00	532.50	548.76		551.62	0.001075	13.58	604.61	39.98	0.62
Reach-1	5	100 year	Proposed 3D	8210.00	532.50	548.76		551.62	0.001075	13.58	604.61	39.98	0.62
Reach-1	5	100 year	PR3E Raised	8210.00	532.50	548.76		551.62	0.001075	13.58	604.61	39.98	0.62
Reach-1	4.994	100 year	Existing Prelim	8210.00	532.00	550.02		551.00	0.004518	6.83	1040.31	75.45	0.40
Reach-1	4.994	100 year	Proposed 3B	8210.00	532.00	550.02		551.00	0.004518	6.83	1040.31	75.45	0.40
Reach-1	4.994	100 year	Proposed 3C	8210.00	532.00	550.02		551.00	0.004518	6.83	1040.31	75.45	0.40
Reach-1	4.994	100 year	Proposed 3D	8210.00	532.00	550.02		551.00	0.004518	6.83	1040.31	75.45	0.40
Reach-1	4.994	100 year	PR3E Raised	8210.00	532.00	550.02		551.00	0.004518	6.83	1040.31	75.45	0.40
Peach 1	4 084	100 year	Evicting Prolim	9240.00	E30.00	EE0 40		EE0 70	0.001194	6.60	1400 40	00.00	0.00
Reach-1	4.984 4.984	100 year 100 year	Existing Prelim Proposed 3B	8210.00 8210.00	530.00 530.00	550.16 550.16		550.78 550.78	0.001194	6.68 6.68	1408.49 1408.49	90.00 90.00	0.28 0.28
Reach-1	4.984	100 year	Proposed 3C	8210.00	530.00	550.16		550.78	0.001194	6.68	1408.49	90.00	0.28
Reach-1	4.984	100 year	Proposed 3D	8210.00	530.00	550.16		550.78	0.001194	6.68	1408.49	90.00	0.28
Reach-1	4.984	100 year	PR3E Raised	8210.00	530.00	550.16		550.78	0.001194	6.68	1408.49	90.00	0.28
	7.504	700 year	. INDE INDISEU	02 10.00	330.00	330.10		330.76	0.001194	0.00	1400.49	30.00	0.20
Reach-1	4.975	100 year	Existing Prelim	8210.00	530.00	550.29		550.66	0.000798	5.49	1877.56	134.46	0.23
Reach-1	4.975	100 year	Proposed 3B	8210.00	530.00	550.29		550.66	0.000798	5.49	1877.56	134.46	0.23
Reach-1	4.975	100 year	Proposed 3C	8210.00	530.00	550.29		550.66	0.000798	5.49	1877.56	134.46	0.23
Reach-1	4.975	100 year	Proposed 3D	8210.00	530.00	550.29		550.66	0.000798	5.49	1877.56	134.46	0.23
Reach-1	4.975	100 year	PR3E Raised	8210.00	530.00	550.29		550.66	0.000798	5.49	1877.56	134.46	0.23
Reach-1	4.966	100 year	Existing Prelim	8210.00	530.00	549.98		550.59	0.001342	6.46	1414.02	139.83	0.29

IILC-IVAG I	River: RIVER-1	Reach: Reach	n-1 Profile: 100 year	(Continued)									
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
Dooch 1	4.966	100 year	Proposed 3B	(cfs)	(ft)	(ft) 549.98	(ft)	(ft) 550.59	(ft/ft)	(ft/s) 6.46	(sq ft)	(ft)	0.29
Reach-1 Reach-1	4.966	100 year 100 year	Proposed 3C	8210.00 8210.00	530.00 530.00	549.98		550.59	0.001342 0.001342	6.46	1414.02 1414.02	139.83 139.83	0.29
Reach-1	4.966	100 year	Proposed 3D	8210.00	530.00	549.98		550.59	0.001342	6.46	1414.02	139.83	0.29
Reach-1	4.966	100 year	PR3E Raised	8210.00	530.00	549.98		550.59	0.001342	6.46	1414.02	139.83	0.29
Reach-1	4.895	100 year	Existing Prelim	8210.00	530.00	549.36		550.04	0.001560	6.78	1329.33	135.52	0.31
Reach-1	4.895	100 year	Proposed 3B	8210.00	530.00	549.36		550.04	0.001560	6.78	1329.33	135.52	0.31
Reach-1	4.895 4.895	100 year 100 year	Proposed 3D Proposed 3D	8210.00 8210.00	530.00 530.00	549.36 549.36		550.04 550.04	0.001560 0.001560	6.78 6.78	1329.33 1329.33	135.52 135.52	0.3
Reach-1	4.895	100 year	PR3E Raised	8210.00	530.00	549.36		550.04	0.001560	6.78	1329.33	135.52	0.31
Reach-1	4.811	100 year	Existing Prelim	8210.00	530.00	548.66		549.35	0.001537	7.25	1355.51	95.00	0.32
Reach-1	4.811	100 year	Proposed 3B	8210.00	530.00	548.66		549.35	0.001537	7.25	1355.51	95.00	0.32
Reach-1	4.811	100 year	Proposed 3C	8210.00	530.00	548.66		549.35	0.001537	7.25	1355.51	95.00	0.32
Reach-1	4.811 4.811	100 year 100 year	Proposed 3D PR3E Raised	8210.00 8210.00	530.00 530.00	548.66 548.66		549.35 549.35	0.001537 0.001537	7.25 7.25	1355.51 1355.51	95.00 95.00	0.32
T TOUGHT	1.011	100 your	T TOE TUISOS	0210.00	000.00	0.10.00		0.10.00	0.001007	7.20	1000.01	55.55	0.01
Reach-1	4.788	100 year	Existing Prelim	5600.00	530.60	546.03	541.94	548.98	0.000917	13.77	406.58	123.37	0.62
Reach-1	4.788	100 year	Proposed 3B	5600.00	530.60	546.03	541.94	548.98	0.000917	13.77	406.58	123.37	0.62
Reach-1	4.788	100 year	Proposed 3C	5600.00	530.60	546.03	541.94	548.98	0.000917	13.77	406.58	123.37	0.62
Reach-1	4.788	100 year	Proposed 3D	5600.00	530.60	546.03	541.94	548.98	0.000917	13.77	406.58	123.37	0.62
Reach-1	4.788	100 year	PR3E Raised	5600.00	530.60	546.03	541.94	548.98	0.000917	13.77	406.58	123.37	0.62
Reach-1	4.783			Bridge									
Reach-1	4.778	100 year	Existing Prelim	5600.00	530.60	545.49	541.93	548.66	0.001034	14.28	392.18	121.86	0.66
Reach-1	4.778	100 year	Proposed 3B	5600.00	530.60	545.49	541.93	548.66	0.001034	14.28	392.18	121.86	0.66
Reach-1	4.778 4.778	100 year 100 year	Proposed 3D Proposed 3D	5600.00 5600.00	530.60 530.60	545.49 545.49	541.93 541.93	548.66 548.66	0.001034 0.001034	14.28 14.28	392.18 392.18	121.86 121.86	0.66
Reach-1	4.778	100 year	PR3E Raised	5600.00	530.60	545.49	541.93	548.66	0.001034	14.28	392.18	121.86	0.66
		, , , , , ,			230.00	2.10.10	211.00	2.0.00	2.23,004	20	-52.10	.21.50	0.00
Reach-1	4.775	100 year	Existing Prelim	5600.00	530.60	546.11		548.37	0.001755	12.06	464.19	30.00	0.54
Reach-1	4.775	100 year	Proposed 3B	5600.00	530.60	546.11		548.37	0.001755	12.06	464.19	30.00	0.54
Reach-1	4.775	100 year	Proposed 3C	5600.00	530.60	546.11		548.37	0.001755	12.06	464.19	30.00	0.54
Reach-1	4.775 4.775	100 year 100 year	Proposed 3D PR3E Raised	5600.00 5600.00	530.60 530.60	546.11 546.11		548.37 548.37	0.001755 0.001755	12.06 12.06	464.19 464.19	30.00 30.00	0.54 0.54
TCacii-1	4.773	100 year	FROE Naiseu	3000.00	330.00	340.11		340.37	0.001733	12.00	404.13	30.00	0.54
Reach-1	4.772	100 year	Existing Prelim	5600.00	530.60	546.50		548.17	0.001176	10.38	539.42	34.00	0.46
Reach-1	4.772	100 year	Proposed 3B	5600.00	530.60	546.50		548.17	0.001176	10.38	539.42	34.00	0.46
Reach-1	4.772	100 year	Proposed 3C	5600.00	530.60	546.50		548.17	0.001176	10.38	539.42	34.00	0.46
Reach-1	4.772	100 year	Proposed 3D	5600.00	530.60	546.50		548.17	0.001176	10.38	539.42	34.00	0.46
Reach-1	4.772	100 year	PR3E Raised	5600.00	530.60	546.50		548.17	0.001176	10.38	539.42	34.00	0.46
Reach-1	4.769	100 year	Existing Prelim	5600.00	530.60	547.02		547.93	0.000483	8.12	923.94	96.38	0.35
Reach-1	4.769	100 year	Proposed 3B	5600.00	530.60	547.02		547.93	0.000483	8.12	923.94	96.38	0.35
Reach-1	4.769	100 year	Proposed 3C	5600.00	530.60	547.02		547.93	0.000483	8.12	923.94	96.38	0.35
Reach-1	4.769	100 year	Proposed 3D	5600.00	530.60	547.02		547.93	0.000483	8.12	923.94	96.38	0.35
Reach-1	4.769	100 year	PR3E Raised	5600.00	530.60	547.02		547.93	0.000483	8.12	923.94	96.38	0.35
Reach-1	4.743	100 year	Eviating Prolim	5600.00	529.90	546.89		547.86	0.000464	8.24	987.52	115.80	0.35
Reach-1	4.743	100 year 100 year	Existing Prelim Proposed 3B	5600.00	529.90	546.89		547.86	0.000464	8.24	987.52	115.80	0.35
Reach-1	4.743	100 year	Proposed 3C	5600.00	529.90	546.89		547.86	0.000464	8.24	987.52	115.80	0.35
Reach-1	4.743	100 year	Proposed 3D	5600.00	529.90	546.89		547.86	0.000464	8.24	987.52	115.80	0.35
Reach-1	4.743	100 year	PR3E Raised	5600.00	529.90	546.89		547.86	0.000464	8.24	987.52	115.80	0.35
Reach-1 Reach-1	4.736 4.736	100 year 100 year	Existing Prelim Proposed 3B	8320.00 8320.00	529.60 529.60	546.71 546.71	542.41 542.41	547.84 547.84	0.000240 0.000240	9.99 9.99	1482.43 1482.43	144.40 144.40	0.43
Reach-1	4.736	100 year	Proposed 3C	8320.00	529.60	546.71	542.41	547.84	0.000240	9.99	1482.43	144.40	0.43
Reach-1	4.736	100 year	Proposed 3D	8320.00	529.60	546.71	542.41	547.84	0.000240	9.99	1482.43	144.40	0.43
Reach-1	4.736	100 year	PR3E Raised	8320.00	529.60	546.71	542.41	547.84	0.000240	9.99	1482.43	144.40	0.43
D 1 :	4.704-												
Reach-1	4.7315			Bridge									
Reach-1	4.727	100 year	Existing Prelim	8320.00	529.60	545.09	542.23	546.67	0.000372	11.62	1247.59	144.40	0.53
Reach-1	4.727	100 year	Proposed 3B	8320.00	529.60	545.09	542.23	546.67	0.000372	11.62	1247.59	144.40	0.53
Reach-1	4.727	100 year	Proposed 3C	8320.00	529.60	545.09	542.23	546.67	0.000372	11.62	1247.59	144.40	0.53
Reach-1	4.727	100 year	Proposed 3D	8320.00	529.60	545.09	542.23	546.67	0.000372	11.62	1247.59	144.40	0.53
Reach-1	4.727	100 year	PR3E Raised	8320.00	529.60	545.09	542.23	546.67	0.000372	11.62	1247.59	144.40	0.53
Reach-1	4.716	100 year	Existing Prelim	8320.00	529.30	541.05	541.05	546.27	0.002017	18.59	492.35	53.00	0.96
Reach-1	4.716	100 year	Proposed 3B	8320.00	529.30	541.05	541.05	546.27	0.002017	18.59	492.35	53.00	0.96
Reach-1	4.716	100 year	Proposed 3C	8320.00	529.30	541.05	541.05	546.27	0.002017	18.59	492.35	53.00	0.96
Reach-1	4.716	100 year	Proposed 3D	8320.00	529.30	541.05	541.05	546.27	0.002017	18.59	492.35	53.00	0.96
Reach-1	4.716	100 year	PR3E Raised	8320.00	529.30	541.05	541.05	546.27	0.002017	18.59	492.35	53.00	0.96
Reach-1	4.641	100 year	Existing Prelim	8200.00	527.40	539.31	538.93	543.88	0.001789	17.39	518.40	56.00	0.91
Reach-1	4.641	100 year	Proposed 3B	8200.00	527.40	539.31	538.93	543.88	0.001789	17.39	518.40	56.00	0.91
Reach-1	4.641	100 year	Proposed 3C	8200.00	527.40	539.31	538.93	543.88	0.001789	17.39	518.40	56.00	0.91
Reach-1	4.641	100 year	Proposed 3D	8200.00	527.40	539.31	538.93	543.88	0.001789	17.39	518.40	56.00	0.91
Reach-1	4.641	100 year	PR3E Raised	8200.00	527.40	539.31	538.93	543.88	0.001789	17.39	518.40	56.00	0.91
Doort 1	4 505	100	Eviation Do "	00100	500 70	500.50	F00.15	E40.0=	0.001005	45.00	F71.00	50.00	
Reach-1 Reach-1	4.595 4.595	100 year 100 year	Existing Prelim Proposed 3B	8040.00 8040.00	526.70 526.70	539.56 539.56	538.10 538.10	543.25 543.25	0.001302 0.001302	15.69 15.69	571.36 571.36	56.00 56.00	0.79
Reach-1	4.595	100 year	Proposed 3C	8040.00	526.70	539.56	538.10	543.25	0.001302	15.69	571.36	56.00	0.79
Reach-1	4.595	100 year	Proposed 3D	8040.00	526.70	539.56	538.10	543.25	0.001302	15.69	571.36	56.00	0.79
Reach-1	4.595	100 year	PR3E Raised	8040.00	526.70	539.56	538.10	543.25	0.001302	15.69	571.36	56.00	0.79

	River: RIVER-1				M: 01 E1	W 0 FI	0.1111.0	505	500	Vel Chnl	F1 A	T 145 W	
Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	(ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	4.533	100 year	Existing Prelim	8040.00	526.10	539.97	(11)	542.55	0.000941	13.55	(sq II) 904.02	108.00	0.65
Reach-1	4.533	100 year	Proposed 3B	8040.00	526.10	539.97		542.55	0.000941	13.55	904.02	108.00	0.68
Reach-1	4.533	100 year	Proposed 3C	8040.00	526.10	539.97		542.55	0.000941	13.55	904.02	108.00	0.68
Reach-1	4.533	100 year	Proposed 3D	8040.00	526.10	539.97		542.55	0.000941	13.55	904.02	108.00	0.68
Reach-1	4.533	100 year	PR3E Raised	8040.00	526.10	539.97		542.55	0.000941	13.55	904.02	108.00	0.68
Reach-1	4.455	100 year	Existing Prelim	7780.00	525.20	538.99	536.68	542.08	0.001119	14.33	673.67	96.36	0.70
Reach-1	4.455	100 year	Proposed 3B	7780.00	525.20	538.99	536.68	542.08	0.001119	14.33	673.67	96.36	0.70
Reach-1	4.455	100 year	Proposed 3C	7780.00	525.20	538.99	536.68	542.08	0.001119	14.33	673.67	96.36	0.70
Reach-1	4.455	100 year	Proposed 3D	7780.00	525.20	538.99	536.68	542.08	0.001119	14.33	673.67	96.36	0.70
Reach-1	4.455	100 year	PR3E Raised	7780.00	525.20	538.99	536.68	542.08	0.001119	14.33	673.67	96.36	0.70
Reach-1	4.355	100 year	Existing Prelim	7780.00	524.40	539.52		541.29	0.000539	11.36	948.77	105.82	0.52
Reach-1	4.355	100 year	Proposed 3B	7780.00	524.40	539.52		541.29	0.000539	11.36	948.77	105.82	0.52
Reach-1	4.355	100 year	Proposed 3C	7780.00	524.40	539.52		541.29	0.000539	11.36	948.77	105.82	0.52
Reach-1	4.355	100 year	Proposed 3D	7780.00	524.40	539.52		541.29	0.000539	11.36	948.77	105.82	0.52
Reach-1	4.355	100 year	PR3E Raised	7780.00	524.40	539.52		541.29	0.000539	11.36	948.77	105.82	0.52
Reach-1	4.325	100 year	Existing Prelim	7780.00	524.00	540.04		540.84	0.002487	7.52	1134.36	110.70	0.36
Reach-1	4.325	100 year	Proposed 3B	7780.00	524.00	540.04		540.84	0.002487	7.52	1134.36	110.70	0.36
Reach-1	4.325	100 year	Proposed 3C	7780.00	524.00	540.04		540.84	0.002487	7.52	1134.36	110.70	0.36
Reach-1	4.325	100 year	Proposed 3D	7780.00	524.00	540.04		540.84	0.002487	7.52	1134.36	110.70	0.36
Reach-1	4.325	100 year	PR3E Raised	7780.00	524.00	540.04		540.84	0.002487	7.52	1134.36	110.70	0.36
Reach-1	4.242	100 year	Existing Prelim	7470.00	521.10	539.75		540.10	0.000899	5.00	1638.46	139.88	0.22
Reach-1	4.242	100 year	Proposed 3B	7470.00	521.10	539.75		540.10	0.000899	5.00	1638.46	139.88	0.22
Reach-1	4.242	100 year	Proposed 3C	7470.00	521.10	539.75		540.10	0.000899	5.00	1638.46	139.88	0.22
Reach-1	4.242	100 year	Proposed 3D	7470.00	521.10	539.75		540.10	0.000899	5.00	1638.46	139.88	0.22
Reach-1	4.242	100 year	PR3E Raised	7470.00	521.10	539.75		540.10	0.000899	5.00	1638.46	139.88	0.22
Reach-1	4.178	100 year	Existing Prelim	7470.00	519.40	539.34		539.76	0.001082	5.53	1496.55	118.36	0.23
Reach-1	4.178	100 year	Proposed 3B	7470.00	519.40	539.34		539.76	0.001082	5.53	1496.55	118.36	0.23
Reach-1	4.178	100 year	Proposed 3C	7470.00	519.40	539.34		539.76	0.001082	5.53	1496.55	118.36	0.23
Reach-1	4.178	100 year	Proposed 3D	7470.00	519.40	539.34		539.76	0.001082	5.53	1496.55	118.36	0.23
Reach-1	4.178	100 year	PR3E Raised	7470.00	519.40	539.34		539.76	0.001082	5.53	1496.55	118.36	0.23
Reach-1	4.166	100 year	Existing Prelim	7470.00	519.00	538.54	528.43	539.58	0.004179	8.17	914.25	235.37	0.33
Reach-1	4.166	100 year	Proposed 3B	7470.00	519.00	538.54	528.43	539.58	0.004179	8.17	914.25	235.37	0.33
Reach-1	4.166	100 year	Proposed 3C	7470.00	519.00	538.54	528.43	539.58	0.004179	8.17	914.25	235.37	0.33
Reach-1	4.166	100 year	Proposed 3D	7470.00	519.00	538.54	528.43	539.58	0.004179	8.17	914.25	235.37	0.33
Reach-1	4.166	100 year	PR3E Raised	7470.00	519.00	538.54	528.43	539.58	0.004179	8.17	914.25	235.37	0.33
Reach-1	4.165			Bridge									
Reach-1	4.164	100 year	Existing Prelim	7470.00	519.00	538.12	528.43	539.20	0.004501	8.35	894.10	234.07	0.34
Reach-1	4.164	100 year	Proposed 3B	7470.00	519.00	538.12	528.43	539.20	0.004501	8.35	894.10	234.07	0.34
Reach-1	4.164	100 year	Proposed 3C	7470.00	519.00	538.12	528.43	539.20	0.004501	8.35	894.10	234.07	0.34
Reach-1	4.164 4.164	100 year	Proposed 3D PR3E Raised	7470.00 7470.00	519.00 519.00	538.12	528.43 528.43	539.20 539.20	0.004501 0.004501	8.35	894.10	234.07 234.07	0.34
Reacti-1	4.104	100 year	FR3E Raiseu	7470.00	519.00	538.12	520.43	559.20	0.004301	8.35	894.10	234.07	0.34
Reach-1	4.142	100 year	Existing Prelim	7470.00	518.80	538.58		538.72	0.000890	3.64	2633.99	264.06	0.16
Reach-1	4.142	100 year	Proposed 3B	7470.00	518.80	538.58		538.72	0.000890	3.64	2633.99	264.06	0.16
Reach-1	4.142	100 year	Proposed 3C	7470.00	518.80	538.58		538.72	0.000890	3.64	2633.99	264.06	0.16
Reach-1	4.142	100 year	Proposed 3D	7470.00	518.80	538.58		538.72	0.000890	3.64	2633.99	264.06	0.16
Reach-1	4.142	100 year	PR3E Raised	7470.00	518.80	538.58		538.72	0.000890	3.64	2633.99	264.06	0.16
Reach-1	4.057	100 year	Existing Prelim	7060.00	518.10	537.98		538.28	0.000966	4.79	1707.20	134.96	0.20
Reach-1	4.057	100 year	Proposed 3B	7060.00	518.10	537.98		538.28	0.000966	4.79	1707.20	134.96	0.20
Reach-1	4.057	100 year	Proposed 3C	7060.00	518.10	537.98		538.28		4.79	1707.20	134.96	0.20
Reach-1	4.057 4.057	100 year	Proposed 3D PR3E Raised	7060.00 7060.00	518.10 518.10	537.98 537.98		538.28 538.28	0.000966 0.000966	4.79 4.79	1707.20 1707.20	134.96 134.96	0.20
Reach-1	4.007	100 year	I NOE Naised	7000.00	318.10	537.98		538.28	0.000966	4.79	1707.20	134.96	0.20
Reach-1	4.041	100 year	Existing Prelim	7060.00	517.90	533.62	531.21	537.79	0.001583	16.38	430.98	104.18	0.76
Reach-1	4.041	100 year	Proposed 3B	7060.00	517.90	533.62	531.21	537.79	0.001583	16.38	430.98	104.18	0.76
Reach-1	4.041	100 year	Proposed 3C	7060.00	517.90	533.62	531.21	537.79	0.001583	16.38	430.98	104.18	0.76
Reach-1	4.041	100 year	Proposed 3D	7060.00	517.90	533.62	531.21	537.79	0.001583	16.38	430.98	104.18	0.76
Reach-1	4.041	100 year	PR3E Raised	7060.00	517.90	533.62	531.21	537.79	0.001583	16.38	430.98	104.18	0.76
Reach-1	4.0285			Bridge									
Dec 1	4.040	400	Estate S ::	7000					0.00===	,			
Reach-1	4.016	100 year	Existing Prelim	7060.00	517.90	531.21	531.21	537.22	0.002914	19.67	358.88	101.54	1.00
Reach-1 Reach-1	4.016 4.016	100 year 100 year	Proposed 3B Proposed 3C	7060.00 7060.00	517.90 517.90	531.21 531.21	531.21 531.21	537.22 537.22	0.002914 0.002914	19.67 19.67	358.88 358.88	101.54 101.54	1.00
Reach-1	4.016	100 year 100 year	Proposed 3D	7060.00	517.90	531.21	531.21	537.22	0.002914	19.67	358.88	101.54	1.00
Reach-1	4.016	100 year	PR3E Raised	7060.00	517.90	531.21	531.21	537.22	0.002914	19.67	358.88	101.54	1.00
		,			250								
Reach-1	4.001	100 year	Existing Prelim	7060.00	517.60	532.02		533.57	0.000738	10.85	1005.44	102.41	0.52
Reach-1	4.001	100 year	Proposed 3B	7060.00	517.60	532.02		533.57	0.000738	10.85	1005.44	102.41	0.52
Reach-1	4.001	100 year	Proposed 3C	7060.00	517.60	532.02		533.57	0.000738	10.85	1005.44	102.41	0.52
Reach-1	4.001	100 year	Proposed 3D	7060.00	517.60	532.02		533.57	0.000738	10.85	1005.44	102.41	0.52
Reach-1	4.001	100 year	PR3E Raised	7060.00	517.60	532.02		533.57	0.000738	10.85	1005.44	102.41	0.52
Reach-1	3.948	100 year	Existing Prelim	7330.00	517.00	531.85		533.36	0.000691	10.73	1117.85	150.25	0.50
Reach-1	3.948	100 year	Proposed 3B	7330.00	517.00	531.85		533.36	0.000691	10.73	1117.85	150.25	0.50
Reach-1	3.948 3.948	100 year	Proposed 3D	7330.00	517.00	531.85		533.36	0.000691	10.73 10.73	1117.85	150.25 150.25	0.50
	3.948	100 year 100 year	Proposed 3D PR3E Raised	7330.00 7330.00	517.00 517.00	531.85 531.85		533.36 533.36	0.000691 0.000691	10.73	1117.85 1117.85		0.50
Reach-1			II INOL INDISEU	1 330.00	317.00	001.00		223.30	0.000091	10.73	65.1111	100.25	0.50

	River: RIVER-1				Min Ch El	W.C. Fl	Crit W.S.	F 0 Fl	F.O. 01	\/-I Ob-I	Fla A == =	T \0/: J41-	Froude # Chl
Reach	River Sta	Profile	Plan	Q Total (cfs)	(ft)	W.S. Elev (ft)	(ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Cni
				(013)	(11)	(it)	(11)	(10)	(1010)	(103)	(54 11)	(10)	
Reach-1	3.866	100 year	Existing Prelim	7330.00	516.10	531.77		533.01	0.000566	9.94	1375.15	242.97	0.4
Reach-1	3.866	100 year	Proposed 3B	7330.00	516.10	531.77		533.01	0.000566	9.94	1375.15	242.97	0.4
Reach-1	3.866	100 year	Proposed 3C	7330.00	516.10	531.77		533.01	0.000566	9.94	1375.15	242.97	0.4
Reach-1	3.866	100 year	Proposed 3D	7330.00	516.10	531.77		533.01	0.000566	9.94	1375.15		0.4
Reach-1	3.866	100 year	PR3E Raised	7330.00	516.10	531.77		533.01	0.000566	9.94	1375.15	242.97	0.4
Reach-1	3.82	100 year	Existing Prelim	7330.00	515.80	530.56	526.83	532.72	0.001146	12.15	799.27	134.99	0.5
Reach-1	3.82	100 year	Proposed 3B	7330.00	515.80 515.80	530.56	526.83 526.83	532.72 532.72	0.001146	12.15	799.27	134.99 134.99	0.5
Reach-1 Reach-1	3.82	100 year 100 year	Proposed 3D Proposed 3D	7330.00 7330.00	515.80	530.56 530.56	526.83	532.72	0.001146 0.001146	12.15 12.15	799.27 799.27	134.99	0.5
Reach-1	3.82	100 year	PR3E Raised	7330.00	515.80	530.56	526.83	532.72	0.001146	12.15	799.27	134.99	0.5
1100011 1	0.02	100 your	T TOE TUBOU	7.000.00	010.00	000.00	020.00	OOLITE	0.001110	12.10	700.27	101.00	0.0.
Reach-1	3.79	100 year	Existing Prelim	7330.00	515.50	530.87		532.36	0.000820	10.55	1046.75	135.84	0.48
Reach-1	3.79	100 year	Proposed 3B	7330.00	515.50	530.87		532.36	0.000820	10.55	1046.75	135.84	0.48
Reach-1	3.79	100 year	Proposed 3C	7330.00	515.50	530.87		532.36	0.000820	10.55	1046.75	135.84	0.48
Reach-1	3.79	100 year	Proposed 3D	7330.00	515.50	530.87		532.36	0.000820	10.55	1046.75	135.84	0.48
Reach-1	3.79	100 year	PR3E Raised	7330.00	515.50	530.87		532.36	0.000820	10.55	1046.75	135.84	0.48
D 1.4	0.700	400	F : " B "	7000 00	545.00	500.54	505.00	500.00	0.004470	40.44	704.00	55.40	0.5
Reach-1	3.766 3.766	100 year	Existing Prelim	7330.00 7330.00	515.30	530.54 530.54	525.82 525.82	532.22 532.22	0.001172 0.001172	10.41 10.41	704.00 704.00	55.40 55.40	0.5° 0.5°
Reach-1		100 year	Proposed 3B		515.30								0.5
Reach-1 Reach-1	3.766 3.766	100 year 100 year	Proposed 3D Proposed 3D	7330.00 7330.00	515.30 515.30	530.54 530.54	525.82 525.82	532.22 532.22	0.001172 0.001172	10.41	704.00 704.00	55.40	0.5
Reach-1	3.766	100 year	PR3E Raised	7330.00	515.30	530.54	525.82	532.22	0.001172	10.41	704.00		0.5
	1	111,000		. 555.56	0.0.00	555.54	020.0Z	JUL.ZZ	5.001.72	10.71		55.10	3.0
Reach-1	3.7645			Bridge									
Reach-1	3.763	100 year	Existing Prelim	7330.00	515.30	530.33	525.84	532.07	0.001229	10.58	692.63	55.37	0.53
Reach-1	3.763	100 year	Proposed 3B	7330.00	515.30	530.33	525.84	532.07	0.001229	10.58	692.63	55.37	0.53
Reach-1	3.763	100 year	Proposed 3C	7330.00	515.30	530.33	525.84	532.07	0.001229	10.58	692.63	55.37	0.53
Reach-1	3.763	100 year	Proposed 3D	7330.00	515.30	530.33	525.84	532.07	0.001229	10.58	692.63	55.37	0.53
Reach-1	3.763	100 year	PR3E Raised	7330.00	515.30	530.33	525.84	532.07	0.001229	10.58	692.63	55.37	0.53
Reach-1	3.754	100 year	Existing Prelim	7330.00	515.20	530.27		532.02	0.000941	10.63	705.63	60.33	0.51
Reach-1	3.754	100 year	Proposed 3B	7330.00	515.20	530.27		532.02	0.000941	10.63	705.63	60.33	0.51
Reach-1	3.754	100 year	Proposed 3C	7330.00	515.20	530.27		532.02	0.000941	10.63	705.63	60.33	0.5
Reach-1	3.754	100 year	Proposed 3D	7330.00	515.20	530.27		532.02	0.000941	10.63	705.63	60.33	0.5
Reach-1	3.754	100 year	PR3E Raised	7330.00	515.20	530.27		532.02	0.000941	10.63	705.63	60.33	0.51
Reach-1	3.71	100 year	Existing Prelim	7330.00	514.50	530.09		531.80	0.000905	10.53	744.37	75.97	0.50
Reach-1	3.71	100 year	Proposed 3B	7330.00	514.50	530.09		531.80	0.000905	10.53	744.37	75.97	0.50
Reach-1	3.71	100 year	Proposed 3C	7330.00	514.50	530.09		531.80	0.000905	10.53	744.37	75.97	0.50
Reach-1	3.71	100 year	Proposed 3D	7330.00	514.50	530.09		531.80	0.000905	10.53	744.37	75.97	0.50
Reach-1	3.71	100 year	PR3E Raised	7330.00	514.50	530.09		531.80	0.000905	10.53	744.37	75.97	0.50
Reach-1	3.686	100 year	Existing Prelim	7330.00	514.20	530.45		531.53	0.000448	8.43	971.43	103.10	0.40
Reach-1	3.686	100 year	Proposed 3B	7330.00	514.20	530.45		531.53	0.000448	8.43	971.43	103.10	0.40
Reach-1	3.686	100 year	Proposed 3C	7330.00	514.20	530.45		531.53	0.000448	8.43	971.43	103.10	0.40
Reach-1	3.686	100 year	Proposed 3D	7330.00	514.20	530.45		531.53	0.000448	8.43	971.43	103.10	0.40
Reach-1	3.686	100 year	PR3E Raised	7330.00	514.20	530.45		531.53	0.000448	8.43	971.43	103.10	0.40
Reach-1	3.628	100 year	Existing Prelim	7330.00	514.00	530.03		531.34	0.000643	9.61	1153.65	248.15	0.44
Reach-1	3.628	100 year	Proposed 3B	7330.00	514.00	530.03		531.34	0.000643	9.61	1153.65	248.15	0.44
Reach-1	3.628	100 year	Proposed 3C	7330.00	514.00	530.03		531.34	0.000643	9.61	1153.65	248.15	0.44
Reach-1	3.628	100 year	Proposed 3D	7330.00	514.00	530.03		531.34	0.000643	9.61	1153.65	248.15	0.44
Reach-1	3.628	100 year	PR3E Raised	7330.00	514.00	530.03		531.34	0.000643	9.61	1153.65	248.15	0.44
Reach-1	3.593	100 year	Existing Prelim	7330.00	513.40	529.19		531.07	0.000977	11.24	756.01	75.61	0.51
Reach-1	3.593	100 year	Proposed 3B	7330.00	513.40	529.19		531.07	0.000977	11.24	756.01	75.61	0.5
Reach-1	3.593	100 year	Proposed 3C	7330.00	513.40	529.19		531.07	0.000977	11.24	756.01	75.61	0.5
Reach-1	3.593	100 year	Proposed 3D	7330.00	513.40	529.19		531.07	0.000977	11.24	756.01	75.61	0.51
Reach-1	3.593	100 year	PR3E Raised	7330.00	513.40	529.19		531.07	0.000977	11.24	756.01	75.61	0.51
Reach-1	3.568	100 year	Existing Prelim	7330.00	513.20	528.28	524.30	530.86	0.001173	12.90	568.41	98.33	0.61
Reach-1	3.568	100 year	Proposed 3B	7330.00	513.20	528.28	524.30	530.86	0.001173	12.90	568.41	98.33	0.61
Reach-1	3.568	100 year	Proposed 3C	7330.00	513.20	528.28	524.30	530.86	0.001173	12.90	568.41	98.33	0.61
Reach-1	3.568	100 year	Proposed 3D PR3E Raised	7330.00	513.20	528.28	524.30	530.86	0.001173	12.90	568.41	98.33	0.61
Reach-1	3.568	100 year	FR3E Kalsed	7330.00	513.20	528.28	524.30	530.86	0.001173	12.90	568.41	98.33	0.61
Reach-1	3.5635			Bridge									
	0.0000			Dridge									
Reach-1	3.559	100 year	Existing Prelim	7330.00	513.20	526.72	524.30	529.99	0.001736	14.51	505.34	90.35	0.72
Reach-1	3.559	100 year	Proposed 3B	7330.00	513.20	526.72	524.30	529.99	0.001736	14.51	505.34	90.35	0.72
Reach-1	3.559	100 year	Proposed 3C	7330.00	513.20	526.72	524.30	529.99	0.001736	14.51	505.34	90.35	0.72
Reach-1	3.559	100 year	Proposed 3D	7330.00	513.20	526.72	524.30	529.99	0.001736	14.51	505.34	90.35	0.72
Reach-1	3.559	100 year	PR3E Raised	7330.00	513.20	526.72	524.30	529.99	0.001736	14.51	505.34	90.35	0.72
D 1 :	0.540	400		7									
Reach-1	3.548	100 year	Existing Prelim	7330.00	513.00	527.10		529.69	0.001565	13.08	673.34	91.91	0.63
Reach-1	3.548	100 year	Proposed 3B	7330.00	513.00	527.10		529.69	0.001565	13.08	673.34	91.91	0.63
Reach-1 Reach-1	3.548 3.548	100 year 100 year	Proposed 3D	7330.00 7330.00	513.00 513.00	527.10 527.10		529.69 529.69	0.001565 0.001565	13.08 13.08	673.34 673.34	91.91 91.91	0.63 0.63
	3.548	100 year 100 year	PR3E Raised	7330.00	513.00	527.10		529.69	0.001565	13.08	673.34	91.91	0.63
Reach-1	0.040	700 year	. NOL Naiscu	7 330.00	313.00	321.10		323.09	0.001005	13.00	013.34	31.31	0.63
Reach-1					544.00	507.00		528.84	0.000938	10.70	1246.99	197.10	0.49
Reach-1	3.462	100 year	Existing Prelim	7330.00	511.90	527.30							
	3.462 3.462	100 year 100 year	Proposed 3B	7330.00	511.90	527.30		528.84	0.000938	10.70	1246.99		
Reach-1												197.10	0.49

HEC-RAS	River: RIVER-1	Reach: Reach-1	Profile: 100 year (Continued)

HEC-RAS F	River: RIVER-1												
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	3.462	100 year	PR3E Raised	7330.00	511.90	527.30		528.84	0.000938	10.70	1246.99	197.10	0.49
Reach-1	3.441	100 year	Existing Prelim	7330.00	511.80	525.56	522.56	528.57	0.001183	13.92	526.42	92.40	0.68
Reach-1	3.441	100 year	Proposed 3B	7330.00	511.80	525.56	522.56	528.57	0.001183	13.92	526.42	92.40	0.68
Reach-1	3.441	100 year	Proposed 3C	7330.00	511.80	525.56	522.56	528.57	0.001183	13.92	526.42	92.40	0.68
Reach-1	3.441	100 year	Proposed 3D	7330.00	511.80	525.56	522.56	528.57	0.001183	13.92	526.42	92.40	0.68
Reach-1	3.441	100 year	PR3E Raised	7330.00	511.80	525.56	522.56	528.57	0.001183	13.92	526.42	92.40	0.68
Reach-1	3.434			Bridge									
Reach-1	3.427	100 year	Existing Prelim	7330.00	511.80	525.19	522.57	528.38	0.001301	14.33	511.65	89.66	0.71
Reach-1	3.427	100 year	Proposed 3B	7330.00	511.80	525.19	522.57	528.38	0.001301	14.33	511.65	89.66	0.71
Reach-1	3.427	100 year	Proposed 3C	7330.00	511.80	525.19	522.57	528.38	0.001301	14.33	511.65	89.66	0.71
Reach-1	3.427	100 year	Proposed 3D	7330.00	511.80	525.19	522.57	528.38	0.001301	14.33	511.65	89.66	0.71
Reach-1	3.427	100 year	PR3E Raised	7330.00	511.80	525.19	522.57	528.38	0.001301	14.33	511.65	89.66	0.71
Reach-1	3.41	100 year	Existing Prelim	7330.00	511.60	525.58		528.04	0.001481	12.83	738.72	108.61	0.61
Reach-1	3.41	100 year	Proposed 3B	7330.00	511.60	525.58		528.04	0.001481	12.83	738.72	108.61	0.61
Reach-1	3.41	100 year	Proposed 3C	7330.00	511.60	525.58		528.04	0.001481	12.83	738.72	108.61	0.61
Reach-1	3.41	100 year	Proposed 3D	7330.00	511.60	525.58		528.04	0.001481	12.83	738.72	108.61	0.61
Reach-1	3.41	100 year	PR3E Raised	7330.00	511.60	525.58		528.04	0.001481	12.83	738.72	108.61	0.61
rtodon i	0.11	100 your	T TOE TRAIDOG	7 000.00	011.00	020.00		020.01	0.001101	12.00	7 00.12	100.01	0.01
Reach-1	3.308	100 year	Existing Prelim	7330.00	510.60	525.15		526.29	0.005237	9.68	1020.15	129.28	0.46
Reach-1	3.308	100 year	Proposed 3B	7330.00	510.60	525.15		526.29	0.005237	9.68	1020.15	129.28	
													0.46
Reach-1	3.308	100 year	Proposed 3C	7330.00	510.60	525.15		526.29	0.005237	9.68	1020.15	129.28	0.46
Reach-1	3.308	100 year	Proposed 3D	7330.00	510.60	525.15		526.29	0.005237	9.68	1020.15	129.28	0.46
Reach-1	3.308	100 year	PR3E Raised	7330.00	510.60	525.15		526.29	0.005237	9.68	1020.15	129.28	0.46
Reach-1	3.219	100 year	Existing Prelim	7330.00	509.70	524.14		524.61	0.002086	5.54	1387.06	153.03	0.29
Reach-1	3.219	100 year	Proposed 3B	7330.00	509.70	524.14		524.61	0.002086	5.54	1387.06	153.03	0.29
Reach-1	3.219	100 year	Proposed 3C	7330.00	509.70	524.14		524.61	0.002086	5.54	1387.06	153.03	0.29
Reach-1	3.219	100 year	Proposed 3D	7330.00	509.70	524.14		524.61	0.002086	5.54	1387.06	153.03	0.29
Reach-1	3.219	100 year	PR3E Raised	7330.00	509.70	524.14		524.61	0.002086	5.54	1387.06	153.03	0.29
Reach-1	3.132	100 year	Existing Prelim	7330.00	508.30	523.22		523.66	0.001997	5.49	1469.63	178.82	0.29
Reach-1	3.132	100 year	Proposed 3B	7330.00	508.30	523.22		523.66	0.001997	5.49	1469.63	178.82	0.29
Reach-1	3.132	100 year	Proposed 3C	7330.00	508.30	523.22		523.66	0.001997	5.49	1469.63	178.82	0.29
Reach-1	3.132	100 year	Proposed 3D	7330.00	508.30	523.22		523.66	0.001997	5.49	1469.63	178.82	0.29
Reach-1	3.132	100 year	PR3E Raised	7330.00	508.30	523.22		523.66	0.001997	5.49	1469.63	178.82	0.29
TCGCII-1	0.102	100 year	I NOL INGISCO	7000.00	300.50	020.22		020.00	0.001337	0.40	1403.00	170.02	0.23
Reach-1	3.038	100 year	Existing Prelim	7330.00	504.90	519.80		521.62	0.010300	10.81	678.29	67.42	0.60
				7330.00	504.90				0.010300	10.81	678.29	67.42	0.60
Reach-1	3.038	100 year	Proposed 3B			519.80		521.62					
Reach-1	3.038	100 year	Proposed 3C	7330.00	504.90	519.80		521.62	0.010300	10.81	678.29	67.42	0.60
Reach-1	3.038	100 year	Proposed 3D	7330.00	504.90	519.80		521.62	0.010300	10.81	678.29	67.42	0.60
Reach-1	3.038	100 year	PR3E Raised	7330.00	504.90	519.80		521.62	0.010300	10.81	678.29	67.42	0.60
Reach-1	3.03475*	100 year	Existing Prelim	7330.00	504.80	519.82		521.39	0.007516	10.05	729.28	70.27	0.55
Reach-1	3.03475*	100 year	Proposed 3B	7330.00	504.80	519.82		521.39	0.007516	10.05	729.28	70.27	0.55
Reach-1	3.03475*	100 year	Proposed 3C	7330.00	504.80	519.82		521.39	0.007516	10.05	729.28	70.27	0.55
Reach-1	3.03475*	100 year	Proposed 3D	7330.00	504.80	519.82		521.39	0.007516	10.05	729.28	70.27	0.55
Reach-1	3.03475*	100 year	PR3E Raised	7330.00	504.80	519.82		521.39	0.007516	10.05	729.28	70.27	0.55
Reach-1	3.0315*	100 year	Existing Prelim	7330.00	504.70	519.86		521.22	0.005316	9.35	784.42	73.15	0.50
Reach-1	3.0315*	100 year	Proposed 3B	7330.00	504.70	519.86		521.22	0.005316	9.35	784.42	73.15	0.50
Reach-1	3.0315*	100 year	Proposed 3C	7330.00	504.70	519.86		521.22	0.005316	9.35	784.42	73.15	0.50
Reach-1	3.0315*	100 year	Proposed 3D	7330.00	504.70	519.86		521.22	0.005316	9.35	784.42	73.15	0.50
Reach-1	3.0315*	100 year	PR3E Raised	7330.00	504.70	519.86		521.22	0.005316	9.35	784.42	73.15	0.50
Reach-1	3.02825*	100 year	Existing Prelim	7330.00	504.60	519.91		521.09	0.003898	8.73	841.91	78.00	0.45
Reach-1	3.02825*	100 year	Proposed 3B	7330.00	504.60	519.91		521.09	0.003898	8.73	841.91	78.00	0.45
Reach-1	3.02825*	100 year	Proposed 3C	7330.00	504.60	519.91		521.09	0.003898	8.73	841.91	78.00	0.45
Reach-1	3.02825*	100 year	Proposed 3D	7330.00	504.60	519.91		521.09	0.003898	8.73	841.91	78.00	0.45
Reach-1	3.02825*	100 year	PR3E Raised	7330.00	504.60	519.91		521.09	0.003898	8.73	841.91	78.00	0.45
. 104011-1	5.02020	.00 ,001	. rtoz rtalocu	. 555.56	304.00	313.31		321.03	3.300030	0.73	0-1.31	70.00	0.40
Reach-1	3.025*	100 year	Existing Prelim	7330.00	504.50	519.96		520.99	0.002740	8.18	903.83	84.78	0.41
Reach-1	3.025*	100 year	Proposed 3B	7330.00	504.50	519.96		520.99	0.002740	8.18	903.83	84.78	0.41
			<del>                                     </del>						0.002740				
Reach-1	3.025*	100 year	Proposed 3C	7330.00	504.50	519.96		520.99		8.18	903.83	84.78	0.41
Reach-1	3.025*	100 year	Proposed 3D	7330.00	504.50	519.96		520.99	0.002740	8.18	903.83	84.78	0.41
Reach-1	3.025*	100 year	PR3E Raised	7330.00	504.50	519.96		520.99	0.002740	8.18	903.83	84.78	0.41
	0.004==:	100		70									
Reach-1	3.02175*	100 year	Existing Prelim	7330.00	504.40	520.00		520.92	0.001915	7.67	972.62	94.90	0.37
Reach-1	3.02175*	100 year	Proposed 3B	7330.00	504.40	520.00		520.92	0.001915	7.67	972.62	94.90	0.37
Reach-1	3.02175*	100 year	Proposed 3C	7330.00	504.40	520.00		520.92	0.001915	7.67	972.62	94.90	0.37
Reach-1	3.02175*	100 year	Proposed 3D	7330.00	504.40	520.00		520.92	0.001915	7.67	972.62	94.90	0.37
Reach-1	3.02175*	100 year	PR3E Raised	7330.00	504.40	520.00		520.92	0.001915	7.67	972.62	94.90	0.37
Reach-1	3.0185*	100 year	Existing Prelim	7330.00	504.30	520.06		520.86	0.001319	7.20	1053.87	103.92	0.34
Reach-1	3.0185*	100 year	Proposed 3B	7330.00	504.30	520.06		520.86	0.001319	7.20	1053.87	103.92	0.34
Reach-1	3.0185*	100 year	Proposed 3C	7330.00	504.30	520.06		520.86	0.001319	7.20	1053.87	103.92	0.34
Reach-1	3.0185*	100 year	Proposed 3D	7330.00	504.30	520.06		520.86	0.001319	7.20	1053.87	103.92	0.34
Reach-1	3.0185*	100 year	PR3E Raised	7330.00	504.30	520.06		520.86	0.001319	7.20	1053.87	103.92	0.34
		,		. 500.00	5050	525.50		320.00	2.20.0.0	7.20	.000.01	.00.02	0.04
Reach-1	3.01525*	100 year	Existing Prelim	7330.00	504.20	520.11		520.81	0.000947	6.77	1142.88	105.24	0.31
Caul-1	3.01525*	100 year	Proposed 3B	7330.00	504.20	520.11		520.81	0.000947	6.77	1142.88	105.24	0.31
Reach 1		100 year	i iohosea sp										
Reach-1		100 year	Proposed 2C	7000 00	E04 001	E00 441						405 041	0.04
Reach-1	3.01525*	100 year	Proposed 3D	7330.00	504.20	520.11		520.81	0.000947	6.77	1142.88	105.24	0.31
		100 year 100 year 100 year	Proposed 3C Proposed 3D PR3E Raised	7330.00 7330.00 7330.00	504.20 504.20 504.20	520.11 520.11 520.11		520.81 520.81 520.81	0.000947 0.000947 0.000947	6.77 6.77 6.77	1142.88 1142.88 1142.88	105.24 105.24 105.24	0.31 0.31 0.31

Limits of WSE effects from bridges for alt. 3B HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: 100 year (Continued)

Limits of WSE effects from bridges for alt. 3C

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	3.012	100 year	Existing Prelim	7330.00	504.10	520.04	512.45	520.78	0.000818	6.93	1058.47	106.55	0.32
Reach-1	3.012	100 year	Proposed 3B	7330.00	504.10	520.04	512.45	520.78		6.93	1058.47	106.55	0.32
Reach-1	3.012	100 year	Proposed 3C	7330.00	504.10	520.04	512.45	520.78		6.93	1058.47	106.55	0.32
Reach-1	3.012	100 year	Proposed 3D	7330.00	504.10	520.04	512.45	520.78		6.93	1058.47	106.55	0.32
Reach-1	3.012	100 year	PR3E Raised	7330.00	504.10	520.04	512.45	520.78	0.000818	6.93	1058.47	106.55	0.32
Decel 4	3.011			Delder									
Reach-1	3.011			Bridge									
Reach-1	3.01	100 year	Existing Prelim	7330.00	504.10	518.69	512.46	519.60	0.000284	7.65	958.33	106.55	0.37
Reach-1	3.01	100 year	Proposed 3B	7330.00	504.10	518.69	512.46	519.60		7.65	958.33	106.55	0.37
Reach-1	3.01	100 year	Proposed 3C	7330.00	504.10	518.69	512.46	519.60	0.000284	7.65	958.33	106.55	0.37
Reach-1	3.01	100 year	Proposed 3D	7330.00	504.10	518.69	512.46	519.60	0.000284	7.65	958.33	106.55	0.37
Reach-1	3.01	100 year	PR3E Raised	7330.00	504.10	518.69	512.46	519.60	0.000284	7.65	958.33	106.55	0.37
Reach-1	3.008	100 year	Existing Prelim	7330.00	503.70	518.48		519.55		8.31	882.48	63.98	0.39
Reach-1	3.008	100 year	Proposed 3B	7330.00	503.70	518.48		519.55	0.000295	8.31	882.48	63.98	0.39
Reach-1	3.008	100 year	Proposed 3C	7330.00 7330.00	503.70 503.70	518.48		519.55	0.000295	8.31	882.48	63.98 63.98	0.39
Reach-1	3.008	100 year 100 year	Proposed 3D PR3E Raised	7330.00	503.70	518.48 518.48		519.55 519.55	0.000295 0.000295	8.31 8.31	882.48 882.48	63.98	0.39
Reach-1	3.006	100 year	FR3E Raiseu	7330.00	503.70	310.40		319.33	0.000293	0.31	002.40	03.90	0.39
Reach-1	3.006	100 year	Existing Prelim	7330.00	503.30	518.19	511.60	519.48	0.000235	9.36	858.53	59.00	0.43
Reach-1	3.006	100 year	Proposed 3B	7330.00	503.30	518.19	511.60	519.48		9.36	858.53	59.00	0.43
Reach-1	3.006	100 year	Proposed 3C	7330.00	503.30	518.19	511.60	519.48		9.36	858.53	59.00	0.43
Reach-1	3.006	100 year	Proposed 3D	7330.00	503.30	518.19	511.60	519.48	0.000235	9.36	858.53	59.00	0.43
Reach-1	3.006	100 year	PR3E Raised	7330.00	503.30	518.19	511.60	519.48	0.000235	9.36	858.53	59.00	0.43
Reach-1	2.850			Culvert									
Reach-1	2.800	100 year	Existing Prelim	7330.00	502.80	515.20	511.64	517.45		12.04	608.67	49.10	0.60
Reach-1	2.800	100 year	Proposed 3B	7330.00 7330.00	502.80 502.80	515.20	511.64 511.64	517.45 517.45		12.04 12.04	608.67	49.10 49.10	0.60
Reach-1	2.800	100 year 100 year	Proposed 3D	7330.00	502.80	515.20 515.20	511.64	517.45		12.04	608.67 608.67	49.10	0.60
Reach-1	2.800	100 year	PR3E Raised	7330.00	502.80	515.20	511.64	517.45		12.04	608.67	49.10	0.60
rtodori i	2.000	100 your	T TOE TUICOU	7.000.00	002.00	0.10.20	011.01	011.10	0.000111	12.01	000.07	10.10	0.00
Reach-1	2.700			Culvert									
Reach-1	2.519	100 year	Existing Prelim	7330.00	496.00	511.81		513.12	0.000213	9.28	912.59	59.00	0.41
Reach-1	2.519	100 year	Proposed 3B	7330.00	496.00	512.04		513.32		9.15	926.18	59.00	0.40
Reach-1	2.519	100 year	Proposed 3C	7330.00	496.00	511.81		513.13		9.28	912.85	59.00	0.41
Reach-1	2.519	100 year	Proposed 3D	7330.00	496.00	511.81		513.12		9.28	912.62	59.00	0.41
Reach-1	2.519	100 year	PR3E Raised	7330.00	496.00	511.81		513.12	0.000213	9.28	912.62	59.00	0.41
Roseh 1	2.481	100 year	Eviating Dralim	7630.00	495.40	512.31		512.79	0.001113	5.92	1461.68	151.05	0.29
Reach-1	2.481	100 year 100 year	Existing Prelim Proposed 3B	7630.00	495.40	512.51		512.79	0.001113	5.92	1495.56	151.05	0.29
Reach-1			Proposed 3C	7630.00	495.40	512.32		512.79		5.92	1462.34	151.06	0.29
	2.481	100 year 100 year						512.79	0.001113	5.92			
Reach-1	2.481	100 year	Proposed 3D	7630.00	495.40	512.31		512.79 512.79	0.001113 0.001113	5.92 5.92	1461.76	151.06	0.29
								512.79 512.79		5.92 5.92			
Reach-1	2.481	100 year	Proposed 3D	7630.00	495.40	512.31					1461.76	151.06	0.29
Reach-1 Reach-1	2.481 2.481 2.430 2.430	100 year 100 year	Proposed 3D PR3E Raised	7630.00 7630.00 7630.00 7630.00	495.40 495.40	512.31 512.31		512.79 512.58 512.80	0.001113 0.000252 0.000238	5.92	1461.76 1461.76	151.06 151.06	0.29 0.29 0.18 0.17
Reach-1 Reach-1 Reach-1 Reach-1 Reach-1	2.481 2.481 2.430 2.430 2.430	100 year 100 year 100 year 100 year 100 year	Proposed 3D PR3E Raised Existing Prelim Proposed 3B Proposed 3C	7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.40 495.10 495.10	512.31 512.31 512.38 512.60 512.38		512.79 512.58 512.80 512.59	0.001113 0.000252 0.000238 0.000252	3.63 3.56 3.63	1461.76 1461.76 2144.50 2186.83 2145.30	151.06 151.06 190.70 191.70 190.72	0.29 0.29 0.18 0.17 0.18
Reach-1 Reach-1 Reach-1 Reach-1 Reach-1 Reach-1	2.481 2.481 2.430 2.430 2.430 2.430	100 year 100 year 100 year 100 year 100 year 100 year 100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.10 495.10 495.10 495.10	512.31 512.31 512.38 512.60 512.38 512.38		512.79 512.58 512.80 512.59 512.58	0.001113 0.000252 0.000238 0.000252 0.000252	3.63 3.56 3.63 3.63	1461.76 1461.76 2144.50 2186.83 2145.30 2144.58	151.06 151.06 190.70 191.70 190.72 190.70	0.29 0.29 0.18 0.17 0.18 0.18
Reach-1 Reach-1 Reach-1 Reach-1 Reach-1	2.481 2.481 2.430 2.430 2.430	100 year 100 year 100 year 100 year 100 year	Proposed 3D PR3E Raised Existing Prelim Proposed 3B Proposed 3C	7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.40 495.10 495.10	512.31 512.31 512.38 512.60 512.38		512.79 512.58 512.80 512.59	0.001113 0.000252 0.000238 0.000252 0.000252	3.63 3.56 3.63	1461.76 1461.76 2144.50 2186.83 2145.30	151.06 151.06 190.70 191.70 190.72	0.29 0.29 0.18 0.17 0.18
Reach-1 Reach-1 Reach-1 Reach-1 Reach-1 Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430	100 year 100 year 100 year 100 year 100 year 100 year 100 year 100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.40 495.10 495.10 495.10 495.10	512.31 512.31 512.38 512.60 512.38 512.38		512.79 512.58 512.80 512.59 512.58 512.58	0.001113 0.000252 0.000238 0.000252 0.000252	3.63 3.56 3.63 3.63 3.63	1461.76 1461.76 2144.50 2186.83 2145.30 2144.58	151.06 151.06 190.70 191.70 190.72 190.70	0.29 0.29 0.18 0.17 0.18 0.18
Reach-1 Reach-1 Reach-1 Reach-1 Reach-1 Reach-1 Reach-1 Reach-1	2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.430	100 year 100 year 100 year 100 year 100 year 100 year 100 year 100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 495.10	512.31 512.31 512.38 512.60 512.38 512.38 512.38		512.79 512.58 512.80 512.59 512.58 512.58	0.001113 0.000252 0.000238 0.000252 0.000252 0.000252	5.92 3.63 3.56 3.63 3.63 3.63	1461.76 1461.76 2144.50 2186.83 2145.30 2144.58 2144.58	151.06 151.06 190.70 191.70 190.72 190.70 190.70	0.29 0.29 0.18 0.17 0.18 0.18 0.18
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.430 2.430	100 year 100 year 100 year 100 year 100 year 100 year 100 year 100 year 100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 495.10 493.00 493.00	512.31 512.33 512.38 512.60 512.38 512.38 512.38 510.78 511.10		512.79 512.58 512.80 512.59 512.58 512.58 512.60	0.001113 0.000252 0.000238 0.000252 0.000252 0.000252 0.003152 0.002878	3.63 3.56 3.63 3.63 3.63 3.63 9.83	1461.76 1461.76 2144.50 2186.83 2145.30 2144.58 751.87 775.89	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 74.21	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.56
Reach-1 Reach-1 Reach-1 Reach-1 Reach-1 Reach-1 Reach-1 Reach-1	2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.430	100 year 100 year 100 year 100 year 100 year 100 year 100 year 100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 495.10	512.31 512.31 512.38 512.60 512.38 512.38 512.38		512.79 512.58 512.80 512.59 512.58 512.58	0.001113 0.000252 0.000238 0.000252 0.000252 0.000252 0.003152 0.002878 0.003146	5.92 3.63 3.56 3.63 3.63 3.63	1461.76 1461.76 2144.50 2186.83 2145.30 2144.58 2144.58	151.06 151.06 190.70 191.70 190.72 190.70 190.70	0.29 0.29 0.18 0.17 0.18 0.18 0.18
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410	100 year 100 year	Proposed 3D PR3E Raised Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised Existing Prelim Proposed 3B	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 495.10 493.00 493.00	512.31 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78		512.79 512.58 512.80 512.59 512.58 512.38 512.38	0.001113 0.000252 0.000252 0.000252 0.000252 0.000352 0.003152 0.003146 0.003151	3.63 3.56 3.63 3.63 3.63 10.15 9.83	1461.76 1461.76 2144.50 2186.83 2145.30 2144.58 2144.58 751.87 775.89	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 74.21	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.56
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410	100 year 100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.40 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00	512.31 512.31 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78		512.79 512.58 512.80 512.59 512.58 512.58 512.38 512.38 512.38 512.38	0.001113 0.000252 0.000258 0.000252 0.000252 0.000252 0.003152 0.003151 0.003151	5.92 3.63 3.56 3.63 3.63 3.63 10.15 9.83 10.14 10.15	1461.76 1461.76 2144.50 2186.83 2144.58 2144.58 2144.58 751.87 775.89 762.34 751.92	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 74.21 73.75 73.74	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410	100 year 100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00	512.31 512.38 512.60 512.38 512.38 512.38 512.38 510.78 510.78 510.78 510.78 509.87		512.79 512.58 512.59 512.59 512.58 512.38 512.38 512.38 512.38	0.001113 0.000252 0.000253 0.000252 0.000252 0.000252 0.003152 0.003151 0.003151 0.003151	5.92 3.63 3.56 3.63 3.63 3.63 10.15 9.83 10.14 10.15 10.15	1461.76 1461.76 2144.50 2186.83 2145.30 2144.58 2144.58 7751.87 751.87 751.92 751.92	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 74.21 73.75 73.74 68.23	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.18 0.56 0.56 0.56
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.38 2.38	100 year 100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00	512.31 512.31 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78 510.78		512.79 512.58 512.80 512.59 512.58 512.58 512.38 512.60 512.38 512.38 512.30 512.38	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.003152 0.003151 0.003151 0.003151	5.92 3.63 3.56 3.63 3.63 3.63 10.15 9.83 10.14 10.15 10.15 11.11 10.63	1461.76 1461.76 2144.50 2186.83 2145.30 2144.58 751.87 775.89 762.34 751.92 761.92	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 74.21 73.75 73.74 73.74 68.23 73.06	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410	100 year 100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3D PR3E Raised	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00 493.00	512.31 512.31 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.78		512.79 512.58 512.80 512.59 512.59 512.58 512.38 512.38 512.38 512.38 512.38 512.38 512.38	0.001113 0.000252 0.000253 0.000252 0.000252 0.000252 0.003152 0.003154 0.003151 0.003151 0.003151	5.92 3.63 3.56 3.63 3.63 3.63 3.63 10.15 9.83 10.14 10.15 10.15 11.11 10.63 11.10	1461.76 1461.76 2144.50 2186.83 2144.58 2144.58 2144.58 751.87 775.89 762.34 751.92 761.92 686.50 718.05 687.13	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 74.21 73.75 73.74 68.23 73.06 68.25	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.38 2.38 2.38 2.38	100 year 100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Existing Prelim Proposed 3B Existing Prelim Proposed 3B Proposed 3B Proposed 3B Proposed 3D Proposed 3D	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00	512.31 512.38 512.60 512.38 512.38 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.78		512.79 512.80 512.58 512.80 512.58 512.80 512.38 512.38 512.38 512.38 512.38 512.38 512.38 512.37 512.07	0.001113 0.000252 0.000252 0.000252 0.000252 0.003152 0.003152 0.003151 0.003151 0.003151 0.003835 0.003626 0.003826	5.92 3.63 3.63 3.63 3.63 10.15 10.15 11.11 10.63 11.11 11.11	1461.76 1461.76 2144.50 2186.83 2144.58 2144.58 2144.58 751.87 775.89 762.34 751.92 751.92 686.50 778.05 687.13 686.57	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 73.74 73.74 68.23 73.06 68.25 68.25	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410	100 year 100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3D PR3E Raised	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00 493.00	512.31 512.31 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.78		512.79 512.58 512.80 512.59 512.59 512.58 512.38 512.38 512.38 512.38 512.38 512.38 512.38	0.001113 0.000252 0.000252 0.000252 0.000252 0.003152 0.003152 0.003151 0.003151 0.003151 0.003835 0.003626 0.003826	5.92 3.63 3.56 3.63 3.63 3.63 3.63 10.15 9.83 10.14 10.15 10.15 11.11 10.63 11.10	1461.76 1461.76 2144.50 2186.83 2144.58 2144.58 2144.58 751.87 775.89 762.34 751.92 761.92 686.50 718.05 687.13	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 74.21 73.75 73.74 68.23 73.06 68.25	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.38 2.38 2.38 2.38	100 year 100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3B Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3C Proposed 3B Proposed 3C Proposed 3B Proposed 3C Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00	512.31 512.31 512.38 512.60 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78		512.79 512.58 512.80 512.59 512.59 512.58 512.58 512.38 512.38 512.38 512.39 511.39 511.79	0.001113 0.000252 0.000253 0.000252 0.000252 0.000252 0.0003152 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003602	5.92 3.63 3.56 3.63 3.63 3.63 3.63 3.63 10.15 9.83 10.14 10.15 11.11 11.11 11.11	1461.76 1461.76 2144.50 2186.83 2144.58 2145.30 2144.58 751.87 775.89 762.34 751.92 761.92 666.50 718.05 687.13 686.57	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 74.21 73.75 73.74 73.74 68.23 73.06 68.25 68.23	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.56 0.56 0.56
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.38 2.38 2.38 2.38	100 year 100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Existing Prelim Proposed 3B Existing Prelim Proposed 3B Proposed 3B Proposed 3B Proposed 3D Proposed 3D	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00	512.31 512.38 512.60 512.38 512.38 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.78		512.79 512.80 512.58 512.80 512.58 512.80 512.38 512.38 512.38 512.38 512.38 512.38 512.38 512.37 512.07	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.003152 0.003152 0.003151 0.003151 0.003151 0.003826 0.003834 0.003834	5.92 3.63 3.63 3.63 3.63 10.15 10.15 11.11 10.63 11.11 11.11	1461.76 1461.76 2144.50 2186.83 2144.58 2144.58 2144.58 751.87 775.89 762.34 751.92 751.92 686.50 778.05 687.13 686.57	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 73.74 73.74 68.23 73.06 68.25 68.25	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.62 0.62 0.62
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.38 2.38 2.38 2.38 2.38	100 year 100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3C Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3B Proposed 3B Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Existing Prelim Proposed 3D PR3E Raised	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00	512.31 512.38 512.60 512.38 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 509.87 509.87 509.88 509.88 509.88		512.79 512.80 512.58 512.80 512.59 512.58 512.58 512.38 512.38 512.38 512.38 512.37 511.79 511.79	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.003152 0.003152 0.003151 0.003151 0.003151 0.003826 0.003826 0.003826 0.003834 0.003834	5.92 3.63 3.56 3.63 3.63 3.63 3.63 10.15 10.14 10.15 11.11 11.11 11.11 5.70	1461.76 1461.76 2144.50 2186.83 2144.58 2144.58 2144.58 751.87 775.89 762.34 751.92 751.92 686.50 718.05 687.13 686.57	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 74.21 73.76 73.74 73.74 68.23 73.06 68.25 68.23 68.23	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.56
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.38 2.38 2.38 2.38 2.38 2.38 2.38 2.38	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3C Existing Prelim Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 493.00	512.31 512.31 512.38 512.60 512.38 512.38 510.78 510.78 510.78 510.78 509.87 509.88 509.88 509.88		512.79 512.80 512.80 512.80 512.80 512.88 512.88 512.88 512.88 512.80 512.80 512.30 512.30 512.31 511.79 511.79 511.79 511.79	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.0003152 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003152 0.003834 0.003834 0.003834 0.003834 0.003834 0.003834 0.003834 0.003834 0.003834	5.92 3.63 3.63 3.63 3.63 10.15 9.83 10.14 10.15 11.11 11.11 11.11 5.70 5.47	1461.76 1461.76 2144.50 2186.83 2145.30 2144.58 2144.58 751.87 775.89 762.34 761.92 761.92 686.50 718.05 687.13 686.57 686.57	151.06 151.06 190.70 191.70 190.72 190.70 73.74 74.21 73.75 73.74 73.74 68.23 68.23 68.23 68.23	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.62 0.62 0.62
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.38 2.38 2.38 2.38 2.38 2.38 2.38 2.38	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3D PR3E Raised  Existing Prelim Proposed 3D PR3E Raised  Existing Prelim Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3D PR3E Raised	7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00 7630.00	495.40 495.40 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00	512.31 512.31 512.38 512.60 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78		512.79 512.58 512.80 512.59 512.58 512.58 512.58 512.60 512.38 512.38 512.38 512.39 511.79 511.79 511.79 511.38 511.38	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.0003152 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003152 0.003834 0.003834 0.003834 0.003834 0.003834 0.003834 0.003834 0.003834 0.003834	5.92 3.63 3.63 3.63 3.63 3.63 3.63 3.63 3.6	1461.76 1461.76 2144.50 2186.83 2144.58 2144.58 2144.58 751.87 775.89 762.34 751.92 751.92 768.57 686.50 718.05 687.13 686.57 686.57	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 74.21 73.75 73.74 73.74 68.23 73.06 68.25 68.23 68.23 138.67	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.62 0.62 0.62
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.38 2.38 2.38 2.38 2.38 2.347 2.347 2.347 2.347	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3D PR3E Raised	7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 495.00	512.31 512.31 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78		512.79 512.58 512.80 512.90 512.95 512.58 512.60 512.38 512.60 512.38 512.38 512.38 512.38 512.38 512.38 512.38 512.38 512.38 512.38 512.38 512.38 512.30 511.79 511.79 511.70 511.80 511.30 511.30 511.01	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.000252 0.003152 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.00385 0.00383 0.00383 0.00383 0.00383 0.001086 0.001086 0.001086	5.92 3.63 3.63 3.63 3.63 3.63 3.63 3.63 3.6	1461.76 1461.76 1461.76 2144.50 2186.83 2144.58 2145.30 2144.58 751.87 775.89 762.34 751.92 751.92 686.50 718.05 687.13 686.57 1369.78 1369.78 1369.79 1369.90	151.06 151.06 190.70 191.70 190.72 190.70 73.74 74.21 73.75 73.74 73.74 68.23 68.25 68.23 138.67 139.80 138.69	0.29 0.29 0.18 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.56 0.62 0.62 0.62 0.62 0.62 0.62 0.62 0.6
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.38 2.38 2.38 2.38 2.38 2.38 2.38 2.38	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3B Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3C Proposed 3B PR3E Raised  Existing Prelim Proposed 3B PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3D PR3E Raised  Existing Prelim Proposed 3D PR3E Raised	7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 495.00 495.00 495.00 495.00 495.00	512.31 512.31 512.38 512.60 512.38 512.38 512.38 510.78		512.79 512.58 512.58 512.58 512.58 512.58 512.68 512.38 512.38 512.38 512.38 512.38 512.38 512.39 511.79 511.79 511.79 511.04 511.04 511.04 511.04	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.000252 0.003152 0.003151 0.003151 0.003151 0.003151 0.003835 0.003834 0.003834 0.003834 0.001086 0.000963 0.001086 0.001086 0.001086	5.92 3.63 3.63 3.56 3.63 3.63 3.63 3.63 3.63	1461.76 1461.76 2144.50 2186.83 2144.58 2145.80 751.87 775.89 762.34 751.92 761.92 666.50 718.05 687.13 686.57 1369.78 1422.60 1370.90 1369.90	151.06 151.06 190.70 191.70 190.72 190.70 73.74 74.21 73.75 73.74 68.23 73.06 68.25 68.23 68.23 138.67 139.80 138.67 138.67	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.62 0.62 0.62 0.62 0.28 0.28 0.28 0.28
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.38 2.38 2.38 2.38 2.38 2.38 2.38 2.347 2.347 2.347 2.347 2.347	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3D PR3E Raised  Existing Prelim Proposed 3D PR3E Raised	7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 493.00 495.00	512.31 512.31 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78 510.78 509.87 510.32 509.88 509.88 509.88 509.88 510.56 510.56 510.56 510.56		512.79 512.80 512.58 512.80 512.58 512.80 512.58 512.88 512.88 512.88 512.38 512.38 512.37 511.79 511.79 511.04 511.38 511.04 511.04 511.04 511.04	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.000252 0.003152 0.003152 0.003151 0.003151 0.003151 0.003834 0.003802 0.003834 0.003803 0.001083 0.001083 0.001086 0.001086	5.92 3.63 3.63 3.63 3.63 3.63 10.15 10.14 10.15 11.11 11.11 11.11 5.70 5.47 5.70 5.70	1461.76 1461.76 2144.50 2186.83 2144.58 2144.58 2144.58 751.87 775.89 762.34 751.92 751.92 686.50 718.05 687.13 686.57 686.57 1369.78 1422.60 1369.90 1369.90	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 74.21 73.74 68.23 73.06 68.25 68.23 138.67 138.67 138.67	0.29 0.29 0.18 0.17 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.62 0.63 0.64
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.417 2.38 2.38 2.38 2.38 2.38 2.38 2.38 2.38	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3D PR3E Raised	7630.00 7630.00	495.40 495.40 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 495.00 495.00 495.00 495.00 495.00 495.00 495.00	512.31 512.31 512.38 512.60 512.38 512.38 510.78 510.78 510.78 510.78 510.32 509.88 509.88 509.88 510.56 510.56 510.56 510.56 510.56 510.56 510.56		512.79 512.58 512.58 512.58 512.58 512.58 512.38 512.38 512.38 512.38 512.38 511.79 511.79 511.79 511.04 511.04 511.04 511.04 511.05 510.86	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.0003152 0.003152 0.003151 0.003151 0.003151 0.003802 0.003802 0.003804 0.003804 0.001086 0.001086 0.001086 0.001086 0.001086 0.001086	5.92 3.63 3.63 3.63 3.63 3.63 10.15 9.83 10.14 10.15 11.11 10.63 11.10 5.70 5.70 5.70 5.84	1461.76 1461.76 1461.76 2144.50 2186.83 2144.58 2145.30 2144.58 751.87 775.89 762.34 751.92 751.92 686.50 718.05 687.13 686.57 686.57 1369.90 1369.90 1369.90 1465.23 1548.26 1467.01	151.06 151.06 190.70 191.70 190.72 190.70 73.74 74.21 73.75 73.74 73.74 73.76 68.23 68.23 68.23 68.23 68.23 68.23 138.67 139.80 138.67 138.67 138.67	0.29 0.29 0.18 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.62 0.62 0.62 0.62 0.62 0.62 0.62 0.6
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.38 2.38 2.38 2.38 2.38 2.38 2.38 2.38	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3D PR3E Raised  Existing Prelim Proposed 3D PR3E Raised  Existing Prelim Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised	7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 493.00 494.00 495.00	512.31 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.32 509.87 510.32 509.87 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56		512.79 512.80 512.80 512.80 512.80 512.80 512.80 512.88 512.88 512.80 512.88 512.80 512.38 512.38 512.38 512.38 512.38 511.79 511.79 511.79 511.04 511.04 510.86 511.22 510.87 510.86	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.000252 0.0003152 0.003151 0.003151 0.003151 0.003151 0.003835 0.003834 0.003834 0.003834 0.001086 0.001086 0.001086 0.001086 0.001086 0.000955	5.92 3.63 3.63 3.63 3.63 3.63 3.63 3.63 3.6	1461.76 1461.76 1461.76 2144.50 2186.83 2144.58 2144.58 2144.58 751.87 775.89 762.34 751.92 751.92 761.92 1369.78 1369.78 1422.60 1370.90 1369.90 1465.23 1548.26 1467.01 1465.43	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 74.21 73.75 73.74 73.74 73.76 68.23 73.06 68.25 68.23 138.67 139.80 138.69 138.67 138.67	0.29 0.29 0.18 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.62 0.62 0.62 0.62 0.28 0.28 0.28 0.28 0.28 0.28 0.28 0.2
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.417 2.38 2.38 2.38 2.38 2.38 2.38 2.38 2.38	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3D PR3E Raised	7630.00 7630.00	495.40 495.40 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 495.00 495.00 495.00 495.00 495.00 495.00 495.00	512.31 512.31 512.38 512.60 512.38 512.38 510.78 510.78 510.78 510.78 510.32 509.88 509.88 509.88 510.56 510.56 510.56 510.56 510.56 510.56 510.56		512.79 512.58 512.58 512.58 512.58 512.58 512.38 512.38 512.38 512.38 512.38 511.79 511.79 511.79 511.04 511.04 511.04 511.04 511.05 510.86	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.000252 0.0003152 0.003151 0.003151 0.003151 0.003151 0.003835 0.003834 0.003834 0.003834 0.001086 0.001086 0.001086 0.001086 0.001086 0.000955	5.92 3.63 3.63 3.63 3.63 3.63 10.15 9.83 10.14 10.15 11.11 10.63 11.10 5.70 5.70 5.70 5.84	1461.76 1461.76 1461.76 2144.50 2186.83 2144.58 2145.30 2144.58 751.87 775.89 762.34 751.92 751.92 686.50 718.05 687.13 686.57 686.57 1369.90 1369.90 1369.90 1465.23 1548.26 1467.01	151.06 151.06 190.70 191.70 190.72 190.70 73.74 74.21 73.75 73.74 73.74 73.76 68.23 68.23 68.23 68.23 68.23 68.23 138.67 139.80 138.67 138.67 138.67	0.29 0.29 0.18 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.62 0.62 0.62 0.62 0.62 0.62 0.62 0.6
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.417 2.410 2.314 2.314 2.314 2.314 2.314	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3D PR3E Raised  Existing Prelim Proposed 3D PR3E Raised  Existing Prelim Proposed 3D PR3E Raised  Existing Prelim Proposed 3D PR3E Raised  Proposed 3D PR3E Raised	7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00 493.00 495.00 495.00 495.00 495.00 495.00 495.00 495.00 495.00 495.00 495.00 495.00	512.31 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56		512.79 512.80 512.80 512.80 512.80 512.80 512.80 512.80 512.80 512.80 512.80 512.80 512.38 512.79 511.79 511.79 511.80 511.04 511.04 511.04 511.04 511.04 511.08 511.05 510.86 510.86	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.003152 0.003152 0.003151 0.003151 0.003151 0.003836 0.003836 0.003834 0.001086 0.001086 0.001086 0.001086 0.000956 0.000955	5.92 3.63 3.63 3.63 3.63 3.63 3.63 3.03 3.03	1461.76 1461.76 1461.76 2144.50 2186.83 2144.58 2144.58 751.87 775.89 752.34 751.92 751.92 686.50 718.05 687.13 686.57 686.57 1369.90 1369.90 1465.23 1548.26 1467.01 1465.43	151.06 151.06 190.70 191.70 190.72 190.70 73.74 74.21 73.75 73.74 73.74 73.76 68.23 68.23 68.23 68.23 68.23 68.23 68.23 68.23 68.20 138.67 139.60 138.67 120.60 206.00 206.00 206.00	0.29 0.29 0.18 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.62 0.62 0.62 0.62 0.62 0.28 0.28 0.28 0.28 0.28 0.28 0.28 0.2
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.38 2.38 2.38 2.38 2.38 2.347 2.347 2.347 2.347 2.314 2.314 2.314 2.314 2.314	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3D PR3E Raised  Existing Prelim Proposed 3D PR3E Raised  Existing Prelim Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3D PR3E Raised	7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 495.10 495.10 495.10 493.00 49	512.31 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.56 510.56 510.56 510.56 510.56 510.35 510.35 510.35		512.79 512.80 512.80 512.80 512.80 512.80 512.88 512.88 512.88 512.88 512.88 512.88 512.38 512.38 512.38 512.39 511.79 511.79 511.79 511.04 511.04 511.04 510.86 510.86 510.86	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.000252 0.0003152 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003835 0.003834 0.003834 0.003834 0.001086 0.000963 0.001086 0.001086 0.000965 0.000955 0.000955	5.92 3.63 3.63 3.63 3.63 3.63 3.63 3.63 3.6	1461.76 1461.76 1461.76 2144.50 2186.83 2144.58 2144.58 2144.58 751.87 775.89 762.34 751.92 751.92 768.57 1369.78 1369.78 1422.60 1370.90 1369.90 1465.23 1548.26 1467.01 1465.43	151.06 151.06 190.70 191.70 190.72 190.70 73.74 74.21 73.75 73.74 73.74 73.76 68.23 73.06 68.25 68.23 138.67 139.80 138.69 138.67 138.67 206.00 206.00 206.00	0.29 0.29 0.18 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.56 0.56 0.56
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.417 2.38 2.38 2.38 2.38 2.38 2.38 2.38 2.38	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3B Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Existing Prelim Proposed 3B Proposed 3C Existing Prelim Proposed 3D PR3E Raised	7630.00 7630.00	495.40 495.40 495.10 495.10 495.10 495.10 495.10 493.00 495.00	512.31 512.31 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.32 509.88 509.88 509.88 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56		512.79 512.80	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.000252 0.003152 0.003151 0.003151 0.003151 0.003151 0.00383 0.00383 0.003834 0.003834 0.001086 0.000965 0.000965 0.000965 0.000955 0.000955	5.92 3.63 3.63 3.63 3.63 3.63 3.63 3.63 3.6	1461.76 1461.76 1461.76 2144.50 2186.83 2144.58 2144.58 2144.58 751.87 775.89 762.34 751.92 686.50 718.05 687.13 686.57 1369.78 1422.60 1369.90 1369.90 1465.23 1548.26 1467.01 1465.43	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 74.21 73.75 73.74 68.23 73.06 68.25 68.23 68.23 138.67 138.67 138.69 138.67 138.69 206.00 206.00 206.00 206.00	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.62 0.62 0.62 0.28 0.28 0.28 0.28 0.28 0.25 0.24 0.25 0.25 0.25 0.25
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.38 2.38 2.38 2.38 2.38 2.347 2.347 2.347 2.347 2.314 2.314 2.314 2.314 2.314	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3B Proposed 3B Proposed 3C	7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 493.00 495.00	512.31 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.78 510.56 510.56 510.56 510.56 510.56 510.35 510.35 510.35		512.79 512.80 512.58 512.80 512.58 512.80 512.58 512.80 512.80 512.38 512.38 512.38 512.38 512.37 511.79 511.79 511.79 511.04 511.38 511.05 511.04 511.05 510.86 510.86 510.88	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.000252 0.0003152 0.003152 0.003151 0.003151 0.003151 0.003834 0.003834 0.003834 0.003834 0.001083 0.001083 0.001083 0.001086 0.000955 0.000955 0.000955 0.000955	5.92 3.63 3.63 3.63 3.63 3.63 3.63 3.63 3.6	1461.76 1461.76 1461.76 2144.50 2186.83 2145.30 2144.58 2144.58 751.87 775.89 752.34 751.92 751.92 686.50 718.05 687.13 686.57 686.57 1369.90 1369.90 1465.23 1548.26 1467.01 1465.43 1279.90 1369.45	151.06 151.06 190.70 191.70 190.72 190.70 73.74 74.21 73.74 73.74 68.23 68.23 68.23 68.23 68.23 68.23 68.23 68.23 68.20 08.20	0.29 0.29 0.18 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.62 0.62 0.62 0.62 0.62 0.62 0.62 0.6
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.318 2.38 2.38 2.38 2.38 2.38 2.38 2.38 2.3	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3B Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Existing Prelim Proposed 3B Proposed 3C Existing Prelim Proposed 3D PR3E Raised	7630.00 7630.00	495.40 495.40 495.10 495.10 495.10 495.10 495.10 493.00 495.00	512.31 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.78 510.32 599.88 599.88 599.88 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56 510.56		512.79 512.80	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.000252 0.0003152 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003834 0.003834 0.003834 0.003834 0.001086 0.000963 0.001086 0.000965 0.000955 0.000955 0.000955 0.000289	5.92 3.63 3.63 3.63 3.63 3.63 3.63 3.63 3.6	1461.76 1461.76 1461.76 2144.50 2186.83 2144.58 2144.58 2144.58 751.87 775.89 762.34 751.92 686.50 718.05 687.13 686.57 1369.78 1422.60 1369.90 1369.90 1465.23 1548.26 1467.01 1465.43	151.06 151.06 190.70 191.70 190.72 190.70 190.70 73.74 74.21 73.75 73.74 68.23 73.06 68.25 68.23 68.23 138.67 138.67 138.69 138.67 138.69 206.00 206.00 206.00 206.00	0.29 0.29 0.18 0.17 0.18 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.62 0.62 0.62 0.28 0.28 0.28 0.28 0.28 0.25 0.24 0.25 0.25 0.25 0.25
Reach-1	2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.410 2.38 2.38 2.38 2.38 2.38 2.38 2.38 2.38	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3D PR3E Raised  Existing Prelim Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised	7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 495.00	512.31 512.38 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.56 510.56 510.56 510.56 510.56 510.34 510.75 510.35 510.35 510.35 510.35 510.36		512.79 512.80 512.80 512.80 512.80 512.80 512.80 512.80 512.88 512.80 512.80 512.80 512.80 512.80 512.80 512.80 512.80 512.80 512.80 512.90 511.79 511.79 511.79 511.04 510.86 510.86 510.86 510.83 511.20 510.87 510.88	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.000252 0.0003152 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003834 0.003834 0.003834 0.003834 0.001086 0.000963 0.001086 0.000965 0.000955 0.000955 0.000955 0.000289	5.92 3.63 3.63 3.63 3.63 3.63 3.63 3.63 3.6	1461.76 1461.76 1461.76 2144.50 2186.83 2144.58 2145.30 2144.58 751.87 775.89 762.34 751.92 761.92 761.92 1369.78 1369.78 1369.78 1422.60 1370.90 1369.90 1465.23 1548.26 1467.01 1465.43 1465.43 1279.90 1369.90	151.06 151.06 190.70 191.70 190.72 190.70 73.74 74.21 73.75 73.74 73.74 73.06 68.23 68.23 68.23 138.67 138.67 138.67 206.00 206.00 206.00 206.00 206.00 206.00	0.29 0.29 0.18 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.56 0.56 0.56
Reach-1	2.481 2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.38 2.38 2.38 2.38 2.38 2.38 2.38 2.38	100 year	Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3D PR3E Raised  Existing Prelim Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised	7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 495.10 495.10 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 493.00 495.00	512.31 512.38 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.56 510.56 510.56 510.56 510.56 510.34 510.75 510.35 510.35 510.35 510.35 510.36		512.79 512.80 511.79 511.79 511.70 511.04 510.86 510.86 510.86 510.83 510.83 510.83	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.000252 0.000351 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003826 0.003834 0.003834 0.001886 0.000983 0.001086 0.001086 0.000955 0.000955 0.000955 0.002089 0.002089 0.002089 0.002089	5.92 3.63 3.63 3.63 3.63 3.63 3.63 3.63 3.6	1461.76 1461.76 1461.76 2144.50 2186.83 2144.58 2145.30 2144.58 751.87 775.89 762.34 751.92 761.92 761.92 1369.78 1369.78 1369.78 1422.60 1370.90 1369.90 1465.23 1548.26 1467.01 1465.43 1465.43 1279.90 1369.90	151.06 151.06 190.70 191.70 190.72 190.70 73.74 74.21 73.75 73.74 73.74 73.06 68.23 68.23 68.23 68.23 138.67 138.67 206.00 206.00 206.00 206.00 206.00 206.00 206.00	0.29 0.29 0.18 0.18 0.17 0.18 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.56 0.56 0.56
Reach-1	2.481 2.481 2.481 2.430 2.430 2.430 2.430 2.430 2.430 2.410 2.38 2.38 2.38 2.38 2.38 2.38 2.38 2.38	100 year	Proposed 3D PR3E Reised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3C Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3D PR3E Raised  Existing Prelim Proposed 3B Proposed 3B Proposed 3B Proposed 3C Proposed 3B Proposed 3B Proposed 3C Proposed 3D PR3E Raised	7630.00 7630.00	495.40 495.10 495.10 495.10 495.10 495.10 495.10 495.10 493.00 495.00	512.31 512.38 512.60 512.38 512.38 512.38 510.78 510.78 510.78 510.78 510.78 510.32 509.88 509.88 509.88 510.56		512.79 512.80 512.58 512.80 512.58 512.80 512.80 512.80 512.38 512.38 512.38 512.38 512.37 511.79 511.79 511.04 511.38 511.05 511.04 511.05 510.87 510.88 510.88 510.83 510.83	0.001113 0.000252 0.000252 0.000252 0.000252 0.000252 0.000252 0.000351 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003151 0.003826 0.003834 0.003834 0.001886 0.000983 0.001086 0.001086 0.000955 0.000955 0.000955 0.002089 0.002089 0.002089 0.002089	5.92 3.63 3.63 3.63 3.63 3.63 3.63 3.63 3.6	1461.76 1461.76 2144.50 2186.83 2145.30 2144.58 2144.58 751.87 775.89 762.34 761.92 751.92 686.50 718.05 687.13 686.57 686.57 1369.90 1369.90 1465.23 1548.26 1467.01 1465.43 1279.90 1369.45 1281.82 1280.11	151.06 151.06 190.70 191.70 190.72 190.70 73.74 74.21 73.75 68.23 68.23 68.23 68.23 68.23 68.23 68.23 68.23 68.23 68.23 68.20 06.00 206.00 206.00 206.00 206.00 206.00 206.00	0.29 0.29 0.18 0.18 0.17 0.18 0.18 0.56 0.56 0.56 0.56 0.56 0.62 0.62 0.62 0.62 0.62 0.62 0.62 0.6

Reach	River Sta	Reach: Reach	n-1 Profile: 100 year Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
Neacii	Triver Sta	FIOIIIC	Fiaii	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	1 Todde # CIII
Reach-1	2.310	100 year	Proposed 3C	7630.00	489.70	510.26	( )	510.78	0.000977	5.89	1447.71	206.00	0.20
Reach-1	2.310	100 year	Proposed 3D	7630.00	489.70	510.25		510.78	0.000979	5.89	1446.07	206.00	0.2
Reach-1	2.310	100 year	PR3E Raised	7630.00	489.70	510.25		510.78	0.000979	5.89	1446.07	206.00	0.26
Reach-1	2.28	100 year	Existing Prelim	7630.00	489.50	508.99		510.43	0.003294	9.83	832.70	70.83	0.42
Reach-1	2.28	100 year	Proposed 3B	7630.00	489.50	509.51		510.43	0.003294	9.46	870.30	72.96	0.40
Reach-1	2.28	100 year	Proposed 3C	7630.00	489.50	509.00		510.43	0.003285	9.82	833.49	70.88	0.42
Reach-1	2.28	100 year	Proposed 3D	7630.00	489.50	508.99		510.43	0.003293	9.83	832.78	70.83	0.42
Reach-1	2.28	100 year	PR3E Raised	7630.00	489.50	508.99		510.43	0.003293	9.83	832.78	70.83	0.42
Darah 4	0.005	400	Friefe - Destina	7000.00	400.00	500.40		540.40	0.004220	7 77	004.00	69.59	0.36
Reach-1	2.265 2.265	100 year 100 year	Existing Prelim Proposed 3B	7630.00 7630.00	489.00 489.00	509.18 509.68		510.12 510.56	0.001338 0.001214	7.77 7.50	981.90 1017.24	70.34	0.35
Reach-1	2.265	100 year	Proposed 3C	7630.00	489.00	509.19		510.30	0.001214	7.76	982.65	69.60	0.36
Reach-1	2.265	100 year	Proposed 3D	7630.00	489.00	509.18		510.12	0.001338	7.77	981.97	69.59	0.36
Reach-1	2.265	100 year	PR3E Raised	7630.00	489.00	509.18		510.12	0.001338	7.77	981.97	69.59	0.36
Reach-1	2.253	100 year	Existing Prelim	7630.00	489.20	509.38	498.66	509.90	0.001747	5.76	1324.08	176.02	0.24
Reach-1	2.253	100 year 100 year	Proposed 3B Proposed 3C	7630.00 7630.00	489.20 489.20	509.87 509.39	498.66 498.66	510.36 509.91	0.001593 0.001743	5.61 5.76	1361.07 1324.87	179.71 176.10	0.23
Reach-1	2.253	100 year	Proposed 3D	7630.00	489.20	509.38	498.66	509.91	0.001746	5.76	1324.16	176.03	0.24
Reach-1	2.253	100 year	PR3E Raised	7630.00	489.20	509.38	498.66	509.91	0.001746	5.76	1324.16	176.03	0.24
Reach-1	2.252			Bridge									
Peach 1	2 2F4	100	Evietica De-line	7000.00	400.00	507.04	400.00	E00 F5	0.000000	0.00	4044.00	100.40	0.00
Reach-1	2.251	100 year	Existing Prelim Proposed 3B	7630.00 7630.00	489.20 489.20	507.94 508.40	498.66 498.66	508.55 508.98	0.002326 0.002117	6.28 6.11	1214.99 1249.78	168.42 170.56	0.28
Reach-1	2.251	100 year 100 year	Proposed 3B	7630.00	489.20 489.20	508.40	498.66	508.98	0.002117	6.28	1249.78	170.56	0.28
Reach-1	2.251	100 year	Proposed 3D	7630.00	489.20	507.93	498.66	508.55	0.002322	6.28	1215.74	168.43	0.28
Reach-1	2.251	100 year	PR3E Raised	7630.00	489.20	507.94	498.66	508.55	0.002326	6.28	1215.07	168.43	0.28
Reach-1	2.237	100 year	Existing Prelim	7630.00	488.50	507.93		508.38	0.001498	5.39	1446.40	103.27	0.24
Reach-1	2.237	100 year	Proposed 3B	7630.00	488.50	508.39		508.81	0.001364	5.23	1494.84	104.72	0.23
Reach-1	2.237	100 year	Proposed 3C Proposed 3D	7630.00 7630.00	488.50 488.50	507.94 507.93		508.38 508.38	0.001495 0.001497	5.38 5.39	1447.43 1446.51	103.30 103.28	0.24
Reach-1	2.237	100 year 100 year	PR3E Raised	7630.00	488.50	507.93		508.38	0.001497	5.39	1446.51	103.28	0.24
TCacii-1	2.201	100 year	FROE Naiseu	7030.00	400.50	307.33		300.30	0.001497	3.33	1440.51	103.20	0.24
Reach-1	2.209	100 year	Existing Prelim	7630.00	487.70	507.87		508.16	0.000918	4.43	1883.63	175.08	0.20
Reach-1	2.209	100 year	Proposed 3B	7630.00	487.70	508.35		508.61	0.000817	4.27	1968.89	180.42	0.19
Reach-1	2.209	100 year	Proposed 3C	7630.00	487.70	507.88		508.17	0.000915	4.43	1885.44	175.15	0.20
Reach-1	2.209	100 year	Proposed 3D	7630.00	487.70	507.87		508.16	0.000918	4.43	1883.81	175.09	0.20
Reach-1	2.209	100 year	PR3E Raised	7630.00	487.70	507.87		508.16	0.000918	4.43	1883.81	175.09	0.20
Reach-1	2.181	100 year	Existing Prelim	7630.00	486.70	507.88		508.01	0.000540	3.54	2935.13	335.02	0.15
Reach-1	2.181	100 year	Proposed 3B	7630.00	486.70	508.37		508.48	0.000340	3.34	3099.58	339.61	0.14
Reach-1	2.181	100 year	Proposed 3C	7630.00	486.70	507.89		508.02	0.000538	3.53	2938.66	335.12	0.15
Reach-1	2.181	100 year	Proposed 3D	7630.00	486.70	507.88		508.01	0.000540	3.54	2935.48	335.03	0.15
Reach-1	2.181	100 year	PR3E Raised	7630.00	486.70	507.88		508.01	0.000540	3.54	2935.48	335.03	0.15
Reach-1	2.112	100 year	Existing Prelim	10120.00	484.20	507.70		507.82	0.000480	3.54	4040.26	422.31	0.15
Reach-1	2.112	100 year 100 year	Proposed 3B Proposed 3C	10120.00 10120.00	484.20 484.20	508.21 507.71		508.32 507.83	0.000416 0.000479	3.36 3.54	4258.34 4044.95	429.68 422.47	0.14 0.15
Reach-1	2.112	100 year	Proposed 3D	10120.00	484.20	507.71		507.82	0.000479	3.54	4044.93	422.47	0.15
Reach-1	2.112	100 year	PR3E Raised	10120.00	484.20	507.70		507.82	0.000480	3.54	4040.72	422.32	0.15
Reach-1	2.091	100 year	Existing Prelim	10120.00	483.90	506.16		507.57	0.005464	9.59	1111.17	118.67	0.42
Reach-1	2.091	100 year	Proposed 3B	10120.00	483.90	506.84		508.10	0.004659	9.10	1192.48	119.11	0.39
Reach-1	2.091	100 year	Proposed 3D	10120.00	483.90	506.18		507.58	0.005445	9.58	1112.96	118.68	0.42
Reach-1	2.091	100 year 100 year	Proposed 3D PR3E Raised	10120.00 10120.00	483.90 483.90	506.16 506.16		507.57 507.57	0.005462 0.005462	9.59 9.59	1111.35 1111.35	118.67 118.67	0.42 0.42
reacil-1	2.031	100 year	I NOL Naiseu	10120.00	403.90	300.16		307.37	0.003462	9.09	1111.33	110.07	0.42
Reach-1	2.084	100 year	Existing Prelim	10120.00	483.90	505.88		507.36	0.005841	9.80	1077.45	118.49	0.43
Reach-1	2.084	100 year	Proposed 3B	10120.00	483.90	506.61		507.92	0.004918	9.27	1164.75	118.96	0.40
Reach-1	2.084	100 year	Proposed 3C	10120.00	483.90	505.89		507.37	0.005818	9.79	1079.39	118.50	0.43
Reach-1	2.084	100 year	Proposed 3D	10120.00	483.90	505.88		507.36	0.005838	9.80	1077.64	118.49	0.43
Reach-1	2.084	100 year	PR3E Raised	10120.00	483.90	505.88		507.36	0.005839	9.80	1077.64	118.49	0.43
Reach-1	2.054	100 year	Existing Prelim	10120.00	483.60	505.88		506.54	0.002550	6.97	1861.04	335.58	0.32
Reach-1	2.054	100 year	Proposed 3B	10120.00	483.60	506.70		507.24	0.002330	6.35	2160.41	388.04	0.32
Reach-1	2.054	100 year	Proposed 3C	10120.00	483.60	505.90		506.56	0.002534	6.96	1867.47	336.37	0.32
Reach-1	2.054	100 year	Proposed 3D	10120.00	483.60	505.88		506.55	0.002549	6.97	1861.68	335.66	0.32
Reach-1	2.054	100 year	PR3E Raised	10120.00	483.60	505.88		506.55	0.002549	6.97	1861.67	335.66	0.32
Boock 4	1.044	100 4	Eviating Desline	10400.00	400.00	505.40		FOF 10	0.001177	4.00	0404.07	070.07	
Reach-1	1.944	100 year 100 year	Existing Prelim Proposed 3B	10120.00 10120.00	483.20 483.20	505.18 506.17		505.46 506.40		4.62 4.23	2464.97 2734.68	270.37 277.87	0.21
Reach-1	1.944	100 year	Proposed 3C	10120.00	483.20	505.20		505.48	0.000910	4.23	2471.36	270.53	0.10
Reach-1	1.944	100 year	Proposed 3D	10120.00	483.20	505.18		505.46	0.001176	4.62	2465.61	270.39	0.21
Reach-1	1.944	100 year	PR3E Raised	10120.00	483.20	505.18		505.46		4.62	2465.59	270.39	0.21
Reach-1	1.833	100 year	Existing Prelim	10120.00	482.80	503.38		504.22	0.004204	7.36	1375.77	113.91	0.37
Reach-1	1.833	100 year	Proposed 3B	10120.00	482.80	504.80		505.47	0.002979	6.56	1554.06	133.94	0.32
Reach-1	1.833	100 year	Proposed 3D	10120.00	482.80	503.41		504.25	0.004172	7.33	1379.85	114.09 113.93	0.37
Reach-1 Reach-1	1.833	100 year 100 year	Proposed 3D PR3E Raised	10120.00 10120.00	482.80 482.80	503.38 503.38		504.22 504.22	0.004201 0.004201	7.35 7.35	1376.18 1376.17	113.93	0.37
cuori- i	1.000	.oo year	. INOL INGISEU	10120.00	+02.00	303.30		304.22	0.004201	1.33	1310.11	113.92	0.37
Reach-1	1.801	100 year	Existing Prelim	10120.00	482.80	502.89	493.21	503.62	0.002705	6.84	1478.62	347.34	0.29
Reach-1	1.801	100 year	Proposed 3B	10120.00	482.80	504.91	493.21	505.10	0.000787	3.97	3233.03	352.30	0.16
Reach-1			Proposed 3C	10120.00	482.80	502.93	493.21	503.66	0.002685	6.83	1481.96	347.72	0.29

Limits of WSE effects from bridges for alts. 3D, 3E HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: 100 year (Continued) E.G. Slope W.S. Elev Crit W.S. E.G. Elev Vel Chnl Froude # Chl Reach River Sta Profile Plan Q Total Min Ch El Flow Area Top Width (cfs) (ft) (ft) (ft) (ft) (ft/ft) (ft/s) (sq ft) (ft) Reach-1 1.801 100 year Proposed 3D 10120.00 482.80 502.90 493.2 503.63 0.002703 6.84 1478.95 347.38 0.29 Reach-1 1.801 PR3F Raised 10120.00 482.80 502.90 493.2 503.63 0.002703 6.84 1478.95 347.38 0.29 100 year Reach-1 1.799 Existing Rail Bridge Bridge Reach-1 1.797 100 vear Existing Prelim 10120.00 482.80 501.34 493.20 502.22 0.003706 7.52 1345.33 332.10 0.34 Reach-1 1.797 100 vear Proposed 3B 10120.00 482.80 503.31 493.20 503.60 0.001320 4.86 2670.12 351.43 0.20 10120.00 482.80 501.38 493.20 0.003678 7.51 1348.38 332.45 Reach-1 1.797 100 year Proposed 3C 502.25 0.33 501 35 7 52 osed 3D 10120.00 482 80 493.20 502.23 0.003703 1345 63 332.14 0.33 Reach-1 1.797 PR3E Raised 10120.00 482.8 501.35 493.20 0.00370 7.52 1345.63 332.14 0.33 100 year 502.23 10120.00 6.87 329.10 0.36 Reach-1 1.771 100 year Existing Prelim 482.6 501.00 501.65 0.003791 1785.18 0.001607 1.771 10120.00 482.60 503.08 495.50 503.40 5.01 2488.37 349.13 0.24 Reach-1 100 year Proposed 3B 482.60 Reach-1 1.771 100 year Proposed 3C 10120.00 501.05 501.69 0.003711 6.82 1800.94 329.57 0.36 482.60 501.01 6.87 329.15 Reach-1 10120.00 501.65 0.003783 1786.76 0.36 100 year Proposed 3D 1.771 100 ye PR3F Raised 10120.00 482.60 501.01 501.65 0.003783 6.87 1786.72 329.15 0.36 each-1 1.742 179.78 Reach-1 100 year 10120.00 482.50 499.44 500.72 0.008586 9.08 1148.85 0.53 Existing Prelim Proposed 3B Reach-1 1.742 100 year 10120.00 482.50 499.44 500.72 0.008586 9.08 1148.85 179.78 0.53 Reach-1 1.742 100 year Proposed 3C 10120.00 482.50 499.53 500.77 0.008346 8.99 1164.36 183.78 0.52 Reach-1 1.742 100 year Proposed 3D 10120.00 482.50 499.45 500.72 0.008562 9.08 1150.40 180.19 0.53 Reach-1 1.742 100 year PR3E Raised 10120.00 482.50 499.45 500.72 0.008563 9.08 1150.35 180.17 0.53 Reach-1 1.7256\* 100 year Existing Prelim 10120.00 482 34 498 75 499 98 0.008149 8 98 1198 80 223 91 0.52 Reach-1 1.7256\* 100 year Proposed 3B 10120.00 482.34 498.75 499.98 0.008149 8.98 1198.80 223.91 0.52 Proposed 3C Reach-1 1.7256 100 year 10120.00 482.34 498.88 500.06 0.007732 8.83 1227.57 228.10 0.50 10120.00 482.34 498.76 0.008106 Reach-1 1.7256\* 100 year Proposed 3D 499.99 8.97 1201.71 224.33 0.51 100 year 1201.62 Reach-1 1.7256\* PR3E Raised 10120.00 482.34 498.76 499.99 0.008107 8.97 224.32 0.51 Reach-1 1.7092\* 100 year Existing Prelim 10120.00 482.18 498.17 499.29 0.007142 8.68 1300.76 267.61 0.49 Reach-1 1.7092\* 100 year Proposed 3B 10120.00 482.18 498.17 499 29 0.007142 8.68 1300.76 267.61 0.49 Proposed 3C Reach-1 1.7092\* 100 year 10120.00 482.18 498.34 499.40 0.006678 8.49 1348.79 294.46 0.47 482.18 Reach-1 1.7092\* 100 year Proposed 3D 10120.00 498.18 499.30 0.007095 8.66 1305.40 270.32 0.49 100 year 498.18 499.30 8.66 Reach-1 10120.00 482.02 497.87 0.005072 7.66 295.19 1.6928\* 100 year Existing Prelim 498.68 1558.10 0.42 Reach-1 Proposed 3B 10120.00 482.02 497.87 498.68 0.005072 7.66 1558.10 295.19 0.42 1.6928\* 100 year 498.09 0.004559 Reach-1.6928 00 year Proposed 3C 10120.00 482.0 498.83 7.36 1624.71 295.78 0.40 100 year Reach-1 1.6928\* Proposed 3D 10120.00 482.02 497.89 498.69 0.005015 7.63 1565.05 295.25 0.41 Reach-1 1.6928 100 year PR3E Raised 10120.00 482.02 497.89 498.69 0.005017 7.63 1564.86 295.25 0.41 Reach-1 1.6764\* 100 year Existing Prelim 10120.00 481 86 497 67 498.25 0.003435 6.60 1768.11 263.95 0.35 Reach-1 1.6764\* 100 year Proposed 3B 10120.00 481.86 497.67 498.25 0.003435 6.60 1768.11 263.95 0.35 481.86 Reach-1 1.6764 10120.00 497.92 498.45 0.003096 6.35 1832.46 264.48 0.33 100 year Proposed 3C Reach-1 1.6764\* 481.86 100 year Proposed 3D 10120.00 497.70 498.27 0.003397 6.57 1774.87 264.01 0.34 Reach-1 1.6764\* 100 year PR3E Raised 10120.00 481.86 497.70 498.27 0.003399 6.57 1774.68 264.00 0.34 481.70 Reach-1 1.66 100 year Existing Prelim 10120.00 497.49 497.96 0.002545 5.92 1880.69 232.26 0.30 1.66 100 year 10120.00 481.70 497.49 497 96 0.002545 5.92 1880.69 232.26 0.30 100 year Reach-1 1.66 Proposed 3C 10120.00 481.70 497.75 498.19 0.002310 5.72 1940.68 232.74 0.29 Reach-1 481.70 5.89 1.66 100 year Proposed 3D 10120.00 497.52 497.99 0.002519 1887.03 232.31 0.30 Reach-1 1.66 PR3E Raised 10120.00 481.70 497.52 497.99 0.002520 5.89 1886.85 232.31 0.30 100 year 10120.00 481.53 497.31 5.79 0.30 Reach-1 1.6450\* 100 year Existing Prelim 497.76 0.002448 1924.94 240.74 1.6450\* 10120.00 481.53 497.31 0.002448 Reach-1 100 year Proposed 3B 497.76 5.79 1924.94 240.74 0.30 1.6450\* 10120.00 481.53 497.58 498.00 0.002201 5.58 1991.94 241.26 0.28 100 year Proposed 3C Proposed 3D Reach-1 1 6450\* 100 year 10120.00 481.53 497 34 497 78 0.002420 5.77 1932.05 240.80 0.29 Reach-1 1.6450\* 100 year PR3E Raised 10120.00 481.53 497.34 497.78 0.002421 5.77 1931.86 240.80 0.29 Reach-1 1.6300\* 10120.00 481.35 497.13 497.56 0.002346 5.67 1972.17 249.25 0.29 100 year Existing Prelim Reach-1 1.6300\* 100 year Proposed 3B 10120.00 481.35 497.13 497.56 0.002346 5.67 1972.17 249.25 0.29 Reach-1 481.35 1.6300\* 100 vear Proposed 3C 10120.00 497.43 497.83 0.002090 5.44 2046.65 249.80 0.27 10120.00 481.35 497.16 497.59 0.002317 5.64 1980.11 249.31 Reach-1 1.6300\* 100 year Proposed 3D 0.29 481.35 Reach-1 1.6300\* PR3F Raised 10120.00 497.16 497.59 5.64 1979.88 249.31 0.29 100 year 0.002318 Reach-1 1.6150\* 100 year Existing Prelim 10120.00 481.17 496.97 497.37 0.002239 5.53 2022.79 257.76 0.28 Reach-1 1.6150\* 100 year Proposed 3B 10120.00 481.17 496.97 497.37 0.002239 5.53 2022.79 257.76 0.28 0.001976 1.6150\* 10120.00 481.17 497.28 497.66 5.29 2105.30 258.35 0.27 Reach-1 100 year Proposed 3C Reach-1 1.6150\* 100 year Proposed 3D 10120.00 481.17 497.00 497.40 0.002209 5.50 2031.62 257.82 0.28 481.17 497.00 497.40 Reach-1 1.6150 PR3E Raised 10120.00 0.002210 5.50 2031.37 257.82 0.28 100 year Reach-1 1.6 100 year Existing Prelim 9890.00 481.00 496.82 497.19 0.002018 5.25 2082.01 266.33 0.27 Reach-1 1.6 100 year Proposed 3B 9890.00 481.00 496.82 497.19 0.002018 5.25 2082.01 266.33 0.27 Reach-1 1.6 100 year 9890.00 481.00 497.16 497.50 0.001765 5.00 2172.54 266.96 0.25 Proposed 3C 266.40 497.22 0.001988 2091.85 1.6 100 year Proposed 3D 9890.00 481.00 496.86 5.22 0.27 Reach-1 1.6 100 year PR3E Raised 9890.00 481.00 496.86 497.22 0.001989 5.22 2091.57 266.40 0.27 Reach-1 Existing Prelim 1.5814\* 100 year 9890.00 480.64 496.61 496.98 0.002140 5.37 2065.95 276.69 0.27 Reach-1 1 5814\* 100 year Proposed 3B 9890 00 480 64 496 61 496 98 0.002140 5.37 2065 95 276 69 0.27 480.64 496.98 5.08 Reach-1 1.5814\* 100 year Proposed 3C 9890.00 497.32 0.001838 2169.29 277.41 0.26 Reach-1 100 year Proposed 3D 9890.00 480.64 496.65 497.02 0.002104 5.34 2077.29 276.77 0.27 9890.00 Reach-1 1.5814\* 100 year PR3E Raised 480.6 496.65 497.02 0.002105 5.34 2076.96 276.76 0.27 Reach-1 5.54 1.5629 9890.00 496.37 0.002316 2034.94 287.02 0.28 100 year Existing Prelim 480.29 496.76 Reach-1 1.5629 100 year Proposed 3B 9890.00 480.29 496.37 496.76 0.002316 5.54 2034.94 287.02 0.28 Reach-1 1.5629\* 100 year Proposed 3C 9890 00 480 29 496 79 497 13 0.001942 5.19 2154 32 287 86 0.26 Reach-1 1.5629\* 100 year Proposed 3D 9890.00 480.29 496.42 496.80 0.002270 5.50 2048.20 287.11 0.28

Approximate limit of Little Miami Backwater

Bridge 3B

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: 100 year (Continued) W.S. Elev E.G. Slope Crit W.S. E.G. Elev Vel Chnl Froude # Chl Reach River Sta Profile Plan Q Total Min Ch El Flow Area Top Width (cfs) (ft) (ft) (ft) (ft) (ft/ft) (ft/s) (sq ft) (ft) Reach-1 1.5629\* PR3E Raised 9890.00 480.29 496.42 496.80 0.002271 5.50 2047.83 287.11 0.28 100 year Reach-1 1.5443\* 100 year Existing Prelim 9890.00 479.93 496.10 496.52 0.002560 5.76 1988.21 297.33 0.30 Reach-1 1.5443\* Proposed 3B 9890.00 479.93 496.10 496.52 0.002560 5.76 1988.21 297.33 0.30 100 year 2128.48 298.34 1.5443\* 100 year Proposed 3C 9890.00 479.9 496.58 496.94 0.002079 5.33 0.27 Reach-1 1.5443\* 100 year Proposed 3D 9890.00 479.93 496.16 496.57 0.002498 5.71 2004.09 297.44 0.29 Reach-1 1.5443\* 100 year PR3E Raised 9890.00 479.93 496.16 496.57 0.002500 5.71 2003.64 297.44 0.29 Reach-1 1 5257\* 100 year Existing Prelim 9890 00 479 57 495 79 496 25 0.002925 6.08 1918 03 307 57 0.32 Reach-1 1.5257\* 100 year Proposed 3B 9890.00 479.57 495.79 496.25 0.002925 6.08 1918.03 307.57 0.32 Reach-1 9890.00 479.57 496.34 496.72 5.53 2087.36 308.84 0.28 1.5257\* 100 year 0.002270 Proposed 3C 100 year Reach-1 1.5257\* Proposed 3D 9890.00 479.57 495.85 496.30 0.002837 6.01 1937.75 307.72 0.31 0.002840 9890.00 495.85 6.01 0.31 Reach-1 1.5257\* 100 year PR3E Raised 479.5 496.30 1937.20 307.72 Reach-1 1.5071\* 9890.00 479.2° 0.00351 6.54 1814.95 317.67 0.34 100 year 495.93 Existing Prelim Reach-1 1.5071\* 100 year 9890.00 479.2 495.40 495 93 0.003511 6.54 1814.95 317.67 0.34 Proposed 3B Reach-1 1.5071\* 100 year Proposed 3C 9890.00 479.21 496.07 496.48 0.002534 5.78 2029.01 319.37 0.30 Reach-1 1.5071\* 100 year Proposed 3D 9890.00 479.2 495.48 495.99 0.003368 6.44 1841.26 317.88 0.34 PR3E Raised 0.003372 1840.53 Reach-1 1.5071\* 100 year 9890.00 479.21 495.48 495.99 6.44 317.87 0.34 9890.00 7.35 327.31 0.39 Reach-1 1.4886\* 100 year 478.86 494.84 495.52 0.004696 1644.30 Existing Prelim 1.4886\* 9890.00 494.84 0.004696 1644.30 Reach-1 100 year Proposed 3B 478.86 495.52 7.35 327.31 0.39 Reach-1 Proposed 3C 100 year 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Bridge 3C

Bridge 3D

Bridge 3E

ued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	1.26	100 year	Proposed 3B	8690.00	475.00	488.66		489.37	0.003332	7.11	1450.26	287.14	0.3
Reach-1	1.26	100 year	Proposed 3C	8690.00	475.00	488.66		489.37	0.003332	7.11	1450.26	287.14	0.3
Reach-1	1.26	100 year	Proposed 3D	8690.00	475.00	488.66		489.37	0.003332	7.11	1450.26	287.14	0.3
Reach-1	1.26	100 year	PR3E Raised	8690.00	475.00	488.66		489.37	0.003332	7.11	1450.26	287.14	0.3
Reach-1	1.201	100 year	Existing Prelim	8690.00	474.50	488.68		488.80	0.000631	3.59	3404.12	558.49	0.1
Reach-1	1.201	100 year	Proposed 3B	8690.00	474.50	488.68		488.80	0.000631	3.59	3404.12	558.49	0.1
Reach-1	1.201	100 year	Proposed 3C	8690.00	474.50	488.68		488.80	0.000631	3.59	3404.12 3404.12	558.49	0.
Reach-1	1.201	100 year	Proposed 3D PR3E Raised	8690.00	474.50 474.50	488.68 488.68		488.80 488.80	0.000631	3.59 3.59	3404.12	558.49 558.49	0.
Reach-1	1.201	100 year	PR3E Raised	8690.00	474.50	488.08		488.80	0.000631	3.59	3404.12	558.49	0.
Reach-1	1.2	100 year	Existing Prelim	8690.00	474.50	488.69		488.79	0.000710	2.99	3408.08	558.61	0.
Reach-1	1.2	100 year	Proposed 3B	8690.00	474.50	488.69		488.79	0.000710	2.99	3408.08	558.61	0.
Reach-1	1.2	100 year	Proposed 3C	8690.00	474.50	488.69		488.79	0.000710	2.99	3408.08	558.61	0.
Reach-1	1.2	100 year	Proposed 3D	8690.00	474.50	488.69		488.79	0.000710	2.99	3408.08	558.61	0.
Reach-1	1.2	100 year	PR3E Raised	8690.00	474.50	488.69		488.79	0.000710	2.99	3408.08	558.61	0.
Reach-1	1.018	100 year	Existing Prelim	8690.00	471.20	487.80		487.97	0.000873	3.51	2647.24	311.80	0.
Reach-1	1.018	100 year	Proposed 3B	8690.00	471.20	487.80		487.97	0.000873	3.51	2647.24	311.80	0.
Reach-1	1.018	100 year	Proposed 3C	8690.00	471.20	487.80		487.97	0.000873	3.51	2647.24	311.80	0.
Reach-1	1.018	100 year	Proposed 3D	8690.00	471.20	487.80		487.97	0.000873	3.51	2647.24	311.80	0.
Reach-1	1.018	100 year	PR3E Raised	8690.00	471.20	487.80		487.97	0.000873	3.51	2647.24	311.80	0.
Reach-1	0.998	100 year	Existing Prelim	8690.00	471.10	486.87	481.77	487.71	0.005444	7.34	1183.88	125.40	0
Reach-1	0.998	100 year	Proposed 3B	8690.00	471.10	486.87	481.77	487.71	0.005444	7.34	1183.88	125.40	0
Reach-1	0.998	100 year	Proposed 3C	8690.00	471.10	486.87	481.77	487.71	0.005444	7.34	1183.88	125.40	0
Reach-1	0.998	100 year	Proposed 3D	8690.00	471.10	486.87	481.77	487.71	0.005444	7.34	1183.88	125.40	0.
Reach-1	0.998	100 year	PR3E Raised	8690.00	471.10	486.87	481.77	487.71	0.005444	7.34	1183.88	125.40	0.
Reach-1	0.9945			Bridge									
Reach-1	0.991	100 year	Existing Prelim	8690.00	471.10	486.32	481.78	487.26	0.006456	7.80	1114.82	122.73	0.
Reach-1	0.991	100 year	Proposed 3B	8690.00	471.10	486.32	481.78	487.26	0.006456	7.80	1114.82	122.73	0
Reach-1	0.991	100 year	Proposed 3C	8690.00	471.10	486.32	481.78	487.26	0.006456	7.80	1114.82	122.73	0
Reach-1	0.991	100 year	Proposed 3D	8690.00	471.10	486.32	481.78	487.26	0.006456	7.80	1114.82	122.73	0.
Reach-1	0.991	100 year	PR3E Raised	8690.00	471.10	486.32	481.78	487.26	0.006456	7.80	1114.82	122.73	0
Reach-1	0.922	100 year	Existing Prelim	8690.00	469.30	483.16		484.44	0.009607	9.68	1036.95	185.43	0.
Reach-1	0.922	100 year	Proposed 3B	8690.00	469.30	483.16		484.44	0.009607	9.68	1036.95	185.43	0.
Reach-1	0.922	100 year	Proposed 3C	8690.00	469.30	483.16		484.44	0.009607	9.68	1036.95	185.43	0.
Reach-1	0.922	100 year	Proposed 3D	8690.00	469.30	483.16		484.44	0.009607	9.68	1036.95	185.43	0.
Reach-1	0.922	100 year	PR3E Raised	8690.00	469.30	483.16		484.44	0.009607	9.68	1036.95	185.43	0
Reach-1	0.79	100 year	Existing Prelim	8690.00	466.50	480.66		481.01	0.002916	5.57	2015.53	481.71	0
Reach-1	0.79	100 year	Proposed 3B	8690.00	466.50	480.66		481.01	0.002916	5.57	2015.53	481.71	0.
Reach-1	0.79	100 year	Proposed 3C	8690.00	466.50	480.66		481.01	0.002916	5.57	2015.53	481.71	0
Reach-1	0.79	100 year	Proposed 3D	8690.00	466.50	480.66		481.01	0.002916	5.57	2015.53	481.71	0
Reach-1	0.79	100 year	PR3E Raised	8690.00	466.50	480.66		481.01	0.002916	5.57	2015.53	481.71	0
Dh 4	0.50	400	Eviation Postin	0000.00	400.00	477.04		470.40	0.000400	4.70	2005 74	4050 74	
Reach-1	0.56	100 year	Existing Prelim	8690.00	463.00	477.91		478.10	0.002409	4.76	3205.71	1356.71	0
Reach-1	0.56	100 year	Proposed 3B	8690.00	463.00	477.91		478.10	0.002409	4.76	3205.71	1356.71	0
Reach-1	0.56	100 year	Proposed 3C	8690.00	463.00	477.91		478.10	0.002409	4.76	3205.71	1356.71	0
Reach-1	0.56	100 year	Proposed 3D	8690.00	463.00	477.91		478.10	0.002409	4.76	3205.71	1356.71	0
Reach-1	0.56	100 year	PR3E Raised	8690.00	463.00	477.91		478.10	0.002409	4.76	3205.71	1356.71	0
Reach-1	0.34	100 year	Existing Prelim	8690.00	460.00	475.30	468.86	475.58	0.002136	4.90	2894.23	1371.85	С
Reach-1	0.34	100 year	Proposed 3B	8690.00	460.00	475.30	468.86	475.58	0.002136	4.90	2894.23	1371.85	0
Reach-1	0.34	100 year	Proposed 3C	8690.00	460.00	475.30	468.86	475.58	0.002136	4.90	2894.23	1371.85	0
Reach-1	0.34	100 year	Proposed 3D	8690.00	460.00	475.30	468.86	475.58	0.002136	4.90	2894.23	1371.85	0
Reach-1	0.34	100 year	PR3E Raised	8690.00	460.00	475.30	468.86	475.58	0.002136	4.90	2894.23	1371.85	0

### **Attachment F**

Conceptual BMP Memo

HAM-Wasson Way to Otto Armleder

Preliminary BMP Memo (PID# 113603)



Prepared for: ODOT District 8

Prepared by: Stantec Consulting Services Inc.

February 28, 2024

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- 1.0 BMP Summary
- 2.0 Segment 1 Conceptual BMP Calculations
- 3.0 Segment 2 Conceptual BMP Calculations
- 4.0 Segment 3 Conceptual BMP Calculations

#### 1.0 BMP Summary

As a part of the feasibility study for the HAM-Wasson Way to Otto Armleder project, Stantec performed some preliminary post construction stormwater best management practice (BMP) calculations. These calculations we performed to identify challenges associated with BMP installation and ensure construction limits for each alternative incorporated the construction of BMP's. These calculations were conducted in accordance with the Ohio department of Transportation, Location and Design Manual, Volume 2. Stantec also utilized several other ODOT BMP resources including the BMP calculation spreadsheet and the ODOT BMP tool.

BMPs are provided for two reasons, to treat stormwater quality and stormwater quantity. Water quality treatment is providing for reduction of pollutants from storm water runoff before leaving the project site. Water quantity treatment is reducing the volume or peak flow rate of storm water runoff to protect the receiving stream's physical characteristics. Most projects, require water quality and quantity treatment. For segments of this project where greater than 1 acre of impervious area (pavement) is being added in new permanent right of way, quantity treatment will be required. Some segments will require quantity treatment, some segments will not.

It is anticipated that several different BMP treatments will be needed for the various alternatives. These include vegetated filter strips, enhanced bankful width ditches, bioretention cells, and manufactured systems. Vegetative based BMPs do not treat water quantity, but bioretention cells and manufactured systems do.

The calculations shown on subsequent pages are preliminary in nature and may change as the project progresses.

The following information should be kept in mind as the project moves forward:

- Earth disturbed areas where stormwater flows outside of the project right-ofway should not be channelized for the sole purpose of BMP construction. These areas can be eliminated from the calculations.
- Narrow vegetated filter strips may be utilized for areas only draining shared-use path pavement.
- There may be additional untreated roadway areas, not associated with the project earth disturbed area, within the existing right of way that can count towards bmp credit if treated.
- Off-site mitigation could be used as a BMP treatment if there are nearby untreated areas, such as parking lots or trailheads, owned by the City of

Cincinnati. This may be easier than constructing manufactured systems or other quantity treatment BMPs in Segment 3.

- Project requirements for shared-use path project can sometimes be quite high. While road construction projects often have treatment requirements between 20% and 30%, shared-use path projects can require nearly up to 100% depending on the setting. ODOT and the Ohio EPA recognize that there are some perimeter fringe areas with any development project that will be difficult to treat. Discussions should be have with these agencies if treatment percentages are above 90%.
- For the purposes of this analysis, each Segment and Alternative has been looked at individually. When constructed, the treatment requirements and types may change based on the configuration of the built phases. For example, if multiple segments are construction together, that will change the overall calculations.

#### 2.0 Segment 1 Conceptual BMP Calculations

#### Post Construction Stormwater BMP Overview

Segment 1 consists of two alternatives, Alternative A and Alternative C.

**Alternative A:** The total project earth disturbed area for post construction storm water BMP is 1.29 acres, however, 1.12 acres of earth disturbed area sheet flows out of the project area and should not be collected for the sole purposes of stormwater treatment according to Location & Design Manual Section 1112.1. Because the earth disturbed area is less than the 1 acre threshold, BMP will be not be required and a NOI will not need to be submitted to Ohio EPA. The preliminary BMP calculations are shown on the following pages.

Alternative C: The total project earth disturbed area for post construction storm water BMP is 2.49 acres, however, 0.50 acres of earth disturbed area sheet flows out of the project area and should not be collected for the sole purposes of stormwater treatment according to Location & Design Manual Section 1112.1. Because the earth disturbed area is greater than the 1 acre threshold, BMP will be required and a NOI will need to be submitted to Ohio EPA. The overall required treatment percentage for Alternative 1C is 23.31% of the remaining 1.99 acres. This alternative will therefore be required to treat 0.46 acres for quality. Quantity treatment will not be required because less than 1 acre of new impervious area is being added in new right of way. This alternative will utilize vegetated filter strips and enhanced bankful width ditches to treat stormwater runoff. It is anticipated that a combination of these can be used along Colbank Rd. Narrow vegetated filter strips can be used in some areas since all improvements are pedestrian related. The preliminary BMP calculations are shown on the following pages.

Post Construction Stormwater BMPs should not be a differentiator between the Segment 1 alternatives. BMPs will not be required for Alternative A, however, BMP credit will be relatively easy and inexpensive to obtain for Alternative C.

#### 3.0 Segment 2 Conceptual BMP Calculations

#### Post Construction Stormwater BMP Overview

Segment 2 consists of two alternatives, Alternative B and Alternative C.

Alternative B: The total project earth disturbed area for post construction storm water BMP is 2.52 acres, however, 0.70 acres of earth disturbed area sheet flows out of the project area and should not be collected for the sole purposes of stormwater treatment according to Location & Design Manual Section 1112.1. Because the earth disturbed area is greater than the 1 acre threshold, BMP will be required and a NOI will need to be submitted to Ohio EPA. The overall required treatment percentage for Alternative 2B is 38.87% of the remaining 1.82 acres. This alternative will therefore be required to treat 0.71 acres for quality. Quantity treatment will not be required because less than 1 acre of new impervious area is being added in new right of way. This alternative will utilize vegetated filter strips, enhanced bankful width ditches (vegetated biofilters), and potentially a manufactured system to treat stormwater runoff. It is anticipated that vegetated filter strips can be used inside the loop between Sta. 325+00 and Sta. 329+00 and towards the Segment 3 termini on the abandoned rail line. Narrow vegetated filter strips can be used where all improvements are pedestrian related. Where filter strips cannot be used, vegetated biofilters can be used, potentially on the east side of Wooster Rd. If additional treatment area is needed, a manufactured system will be installed where proposed curb is present, along Wooster Pike. The preliminary BMP calculations are shown on the following pages.

Alternative C: The total project earth disturbed area for post construction storm water BMP is 3.53 acres, however, 0.64 acres of earth disturbed area sheet flows out of the project area and should not be collected for the sole purposes of stormwater treatment according to Location & Design Manual Section 1112.1. Because the earth disturbed area is greater than the 1 acre threshold, BMP will be required and a NOI will need to be submitted to Ohio EPA. The overall required treatment percentage for Alternative 2C is 32.63% of the remaining 2.89 acres. This alternative will therefore be required to treat 0.94 acres for quality. Quantity treatment will not be required because less than 1 acre of new impervious area is being added in new right of way. This alternative will utilize vegetated filter strips, enhanced bankful width ditches, and potentially a manufactured system to treat stormwater runoff. It is anticipated that vegetated filter strips can be used inside the loop between Sta. 325+00 and Sta. 329+00 and towards the Segment 3 termini on the abandoned rail line. Narrow vegetated filter strips can be used where all improvements are pedestrian related. Where filter strips cannot be used, vegetated biofilters can be used,

potentially on the east side of Wooster Rd. If additional treatment area is needed, a manufactured system will be installed where proposed curb is present, along Wooster Pike. The preliminary BMP calculations are shown on the following pages.

Post Construction Stormwater BMPs should not be a differentiator between the Segment 2 alternatives. It will be challenging to achieve all BMP credits through vegetative options with either alternative. A manufactured system will most likely be required in both alternative because of the steep slopes, anticipated walls, and proposed curb.

#### 4.0 Segment 3 Conceptual BMP Calculations

#### Post Construction Stormwater BMP Overview

Segment 3 consists of four alternatives, Alternative B, Alternative C, Alternative D, and Alternative E.

Alternative B: The total project earth disturbed area for post construction storm water BMP is 6.02 acres, however, 2.16 acres of earth disturbed area sheet flows out of the project area and should not be collected for the sole purposes of stormwater treatment according to Location & Design Manual Section 1112.1. Because the earth disturbed area is greater than the 1 acre threshold, BMP will be required and a NOI will need to be submitted to Ohio EPA. The overall required treatment percentage for Alternative 3B is 100% of the remaining 3.86 acres. This alternative will therefore be required to treat 3.86 acres. In addition to quality treatment, quantity treatment will be required because more than 1 acre of new impervious area is being added in new right of way. This alternative will need to use bioretention cells, detention basins, or permeable pavement to treat stormwater runoff. The listed BMPS are the most common options when quantity and quality treatment are needed. Additional discussions should be had with ODOT and OEPA to discuss reducing the treatment percent on this alternative as noted in the general discussion above. Discussions should also be had with the City of Cincinnati to determine if there are any untreated right of way areas that could be utilized for offsite mitigation such as at Otto Armleder Park or along Armleder Rd. Further refinement of the vertical profile of the shared use path could also be to potentially increase the sheet flow runoff, thereby reducing the required treatment amount. It is anticipated that after these options are explored, linear bioretention cells could be utilized in trail side ditches along the alignment. The preliminary BMP calculations are shown on the following pages.

Alternative C: The total project earth disturbed area for post construction storm water BMP is 6.01 acres, however, 2.1 acres of earth disturbed area sheet flows out of the project area and should not be collected for the sole purposes of stormwater treatment according to Location & Design Manual Section 1112.1. Because the earth disturbed area is greater than the 1 acre threshold, BMP will be required and a NOI will need to be submitted to Ohio EPA. The overall required treatment percentage for Alternative 3C is 76.21% of the remaining 3.91 acres. This alternative will therefore be required to treat 2.98 acres. In addition to quality treatment, quantity treatment will be required because more than 1 acre of new impervious area is being added in new right of way. This alternative will need to use bioretention cells, detention basins, or permeable pavement to treat stormwater runoff. The listed BMPS are the most common options when quantity and quality treatment are needed. Discussions should be had with the

City of Cincinnati to determine if there are any untreated right of way areas that could be utilized for offsite mitigation such as at Otto Armleder Park or along Armleder Rd. Further refinement of the vertical profile of the shared use path could also be done to potentially increase the sheet flow runoff, thereby reducing the required treatment amount. It is anticipated that after these options are explored, linear bioretention cells could be utilized in trail side ditches along the alignment. Permeable pavement may also be a good option for quantity treatment for this alternative. The preliminary BMP calculations are shown on the following pages.

Alternative D: The total project earth disturbed area for post construction storm water BMP is 5.90 acres, however, 2.07 acres of earth disturbed area sheet flows out of the project area and should not be collected for the sole purposes of stormwater treatment according to Location & Design Manual Section 1112.1. Because the earth disturbed area is greater than the 1 acre threshold, BMP will be required and a NOI will need to be submitted to Ohio EPA. The overall required treatment percentage for Alternative 3D is 86.31% of the remaining 3.83 acres. This alternative will therefore be required to treat 3.31 acres. In addition to quality treatment, quantity treatment will be required because more than 1 acre of new impervious area is being added in new right of way. This alternative will need to use bioretention cells, detention basins, manufactured systems, or permeable pavement to treat stormwater runoff. The listed BMPS are the most common options when quantity and quality treatment are needed. Discussions should be had with the City of Cincinnati to determine if there are any untreated right of way areas that could be utilized for offsite mitigation such as at Otto Armleder Park or along Armleder Rd. Further refinement of the vertical profile of the shared use path could also be done to potentially increase the sheet flow runoff, thereby reducing the required treatment amount. It is anticipated that after these options are explored, linear bioretention cells could be utilized in trail side ditches along the alignment. Permeable pavement may also be a good option for quantity treatment for this alternative. The preliminary BMP calculations are shown on the following pages.

Alternative E: The total project earth disturbed area for post construction storm water BMP is 6.01 acres, however, 1.92 acres of earth disturbed area sheet flows out of the project area and should not be collected for the sole purposes of stormwater treatment according to Location & Design Manual Section 1112.1. Because the earth disturbed area is greater than the 1 acre threshold, BMP will be required and a NOI will need to be submitted to Ohio EPA. The overall required treatment percentage for Alternative 3E is 71.13% of the remaining 4.09 acres. This alternative will therefore be required to treat 2.91 acres. In addition to quality treatment, quantity treatment will be required because more than 1 acre of new impervious area is being added in new right of way. This alternative will need to use bioretention cells, detention basins, or permeable pavement to treat stormwater runoff. The listed BMPS are the most common options when quantity and quality treatment are needed. Discussions should be had with the

City of Cincinnati to determine if there are any untreated right of way areas that could be utilized for offsite mitigation such as at Otto Armleder Park or along Armleder Rd. Further refinement of the vertical profile of the shared use path could also be done to potentially increase the sheet flow runoff, thereby reducing the required treatment amount. It is anticipated that after these options are explored, linear bioretention cells could be utilized in trail side ditches along the alignment. Permeable pavement may also be a good option for quantity treatment for this alternative. The preliminary BMP calculations are shown on the following pages.

Post Construction Stormwater BMPs should not be a differentiator between the Segment 3 alternatives. Providing the required BMPs will be challenging for all four alternatives since several acres quantity treatment is required. It is possible that construction phasing of the project will provide opportunities for extrea treatment in Segments 1 or 2 to be used for segment 3. As the project is developed, additional coordination should be conducted with project stakeholders to find creative and efficient ways to obtain the required treatment credit.



### Post-Construction BMP Calculation Spreadsheet

### Post Construction - Project Summary Segment 1A

Project Data Units

	011110
1.29	acres
No	
1.12	acres
BMPs and NOI	
not required	NA
0	acres
No	
No	
No	
	No 1.12  BMPs and NOI not required 0 No No



#### **Post-Construction BMP Calculation Spreadsheet**

# Post Construction - Project Summary Segment 1C

Project Data		Units
Project EDA	2.49	acres
Is the Project Routine Maintenance per L&D Vol. 2, Sec.		
1112.2	No	
Sheet Flow (outside of right of way)	0.5	acres
BMPs Required?	BMPs Required	NA
Ain (New Impervious Area in New Permanent R/W	0.1	acres
Does Entire Site Drain to Large River (>100 sq. miles)?	No	
Water Quality Treatment Required	Yes	
Water Quantity Treatment Required	No	
Treatment Percent and Treatment Requirement		
Aix (Project EDA that is inside the existing right-of-way)	2.32	acres
Ain (New Impervious Area in New Permanent R/W)	0.1	acres
T% (Treatment Percent)	23.31	%
Treatment Requirement	0.46	acres



#### **Post-Construction BMP Calculation Spreadsheet**

# Post Construction - Project Summary Segment 2B

Project Data		Units	
Project EDA		2.52	acres
Is the Project Routir	ne Maintenance per L&D Vol. 2, Sec.		
1112.2		No	
Sheet Flow (outside	of right of way)	0.7	acres
BMPs Required?		<b>BMPs Required</b>	NA
Ain (New Imperviou	s Area in New Permanent R/W	0.25	acres
Does Entire Site Dra	ain to Large River (>100 sq. miles)?	No	
Water Quality Treat	ment Required	Yes	
Water Quantity Trea	atment Required	No	
Treatment Percent and Treat	ment Requirement		
Aix (Project EDA that	at is inside the existing right-of-way)	0.81	acres
Ain (New Imperviou	s Area in New Permanent R/W)	0.25	acres
T% (Treatment Per	cent)	38.87	%
Treatment Require	ment	0.71	acres



#### **Post-Construction BMP Calculation Spreadsheet**

# Post Construction - Project Summary Segment 2C

Project Data		Units
Project EDA	3.53	acres
Is the Project Routine Maintenance per L&D Vol. 2	Sec.	
1112.2	No	
Sheet Flow (outside of right of way)	0.64	acres
BMPs Required?	BMPs Required	NA
Ain (New Impervious Area in New Permanent R/W	0.3	acres
Does Entire Site Drain to Large River (>100 sq. mil	es)? No	
Water Quality Treatment Required	Yes	
Water Quantity Treatment Required	No	
Treatment Percent and Treatment Requirement		
Aix (Project EDA that is inside the existing right-of-	way) 1.6	acres
Ain (New Impervious Area in New Permanent R/W	0.3	acres
T% (Treatment Percent)	32.63	%
Treatment Requirement	0.94	acres



#### **Post-Construction BMP Calculation Spreadsheet**

# Post Construction - Project Summary Segment 3B

Project Data		Units
Project EDA	6.02	acres
Is the Project Routine Maintenance per L&D Vol. 2, Sec.		
1112.2	No	
Sheet Flow (outside of right of way)	2.16	acres
BMPs Required?	BMPs Required	NA
Ain (New Impervious Area in New Permanent R/W	1.53	acres
Does Entire Site Drain to Large River (>100 sq. miles)?	No	
Water Quality Treatment Required	Yes	
Water Quantity Treatment Required	Yes	
Treatment Percent and Treatment Requirement		
Aix (Project EDA that is inside the existing right-of-way)	0	acres
Ain (New Impervious Area in New Permanent R/W)	1.53	acres
T% (Treatment Percent)	100.00	%
Treatment Requirement	3.86	acres



#### **Post-Construction BMP Calculation Spreadsheet**

# Post Construction - Project Summary Segment 3C

Project Data		Units	
Project EDA		6.01	acres
Is the Project Routine Maintenance per	L&D Vol. 2, Sec.		
1112.2		No	
Sheet Flow (outside of right of way)		2.1	acres
BMPs Required?		<b>BMPs Required</b>	NA
Ain (New Impervious Area in New Perm	nanent R/W	1.63	acres
Does Entire Site Drain to Large River (>	100 sq. miles)?	No	
Water Quality Treatment Required		Yes	
Water Quantity Treatment Required		Yes	
Treatment Percent and Treatment Requirement			
Aix (Project EDA that is inside the exist	ing right-of-way)	0.69	acres
Ain (New Impervious Area in New Perm	nanent R/W)	1.63	acres
T% (Treatment Percent)		76.21	%
Treatment Requirement		2.98	acres



#### **Post-Construction BMP Calculation Spreadsheet**

# Post Construction - Project Summary Segment 3D

Project Data	Units	
Project EDA	5.9	acres
Is the Project Routine Maintenance per L&D Vol. 2, Sec.		
1112.2	No	
Sheet Flow (outside of right of way)	2.07	acres
BMPs Required?	BMPs Required	NA
Ain (New Impervious Area in New Permanent R/W	1.55	acres
Does Entire Site Drain to Large River (>100 sq. miles)?	No	
Water Quality Treatment Required	Yes	
Water Quantity Treatment Required	Yes	
Treatment Percent and Treatment Requirement		
Aix (Project EDA that is inside the existing right-of-way)	0.32	acres
Ain (New Impervious Area in New Permanent R/W)	1.55	acres
T% (Treatment Percent)	86.31	%
Treatment Requirement	3.31	acres



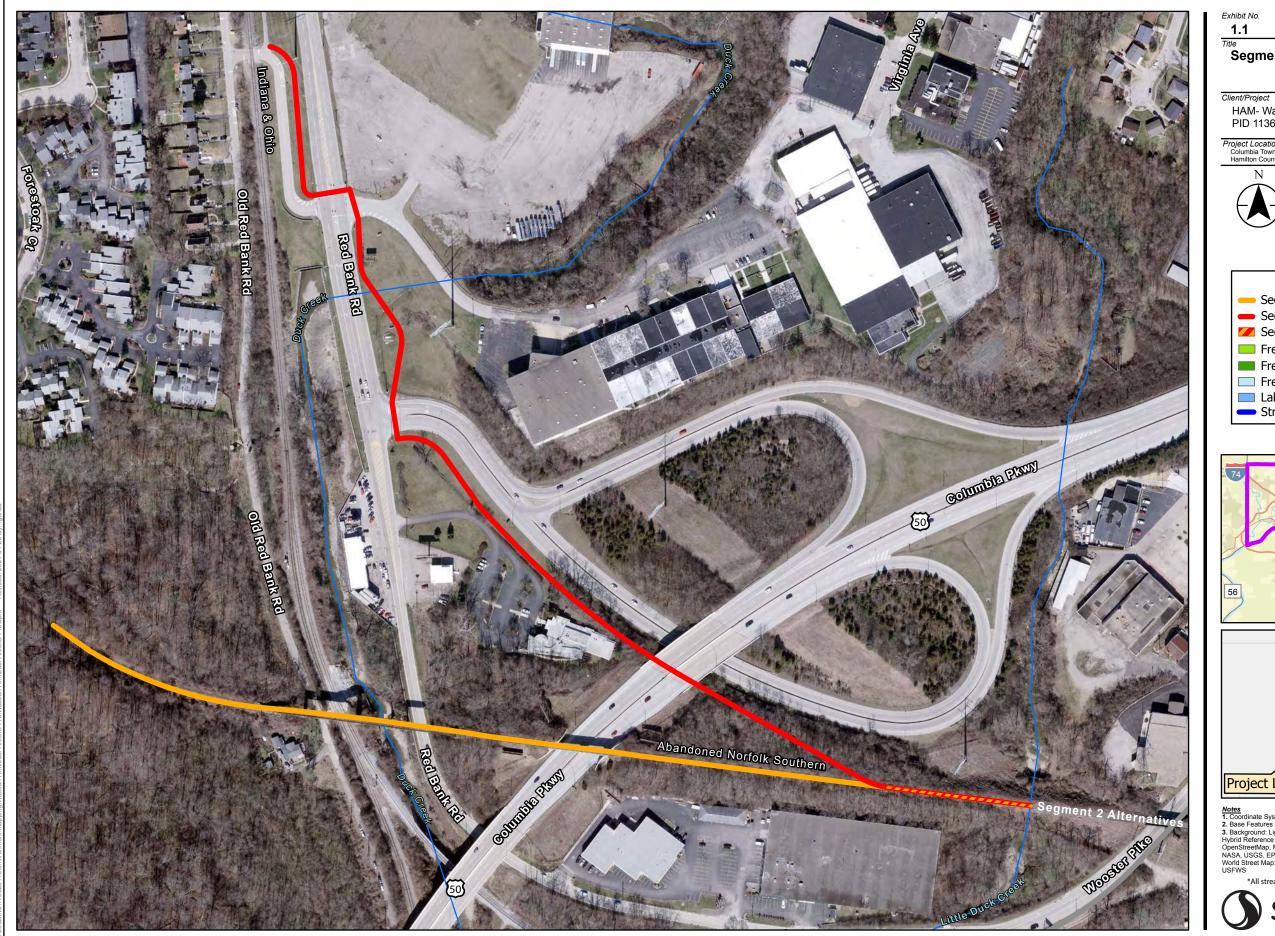
#### **Post-Construction BMP Calculation Spreadsheet**

# Post Construction - Project Summary Segment 3E

Project Data			Units
Project EDA		6.01	acres
Is the Project Routine Maintenance	per L&D Vol. 2, Sec.		
1112.2		No	
Sheet Flow (outside of right of way		1.92	acres
BMPs Required?		<b>BMPs Required</b>	NA
Ain (New Impervious Area in New I	Permanent R/W	1.47	acres
Does Entire Site Drain to Large Riv	er (>100 sq. miles)?	No	
Water Quality Treatment Required		Yes	
Water Quantity Treatment Require	d	Yes	
Treatment Percent and Treatment Requirer	nent		
Aix (Project EDA that is inside the	existing right-of-way)	0.83	acres
Ain (New Impervious Area in New I	Permanent R/W)	1.47	acres
T% (Treatment Percent)		71.13	%
Treatment Requirement		2.91	acres

### **Attachment G**

**Environmental Mapping** 



**Segment 1- Streams and Wetlands Map** 

HAM- Wasson Way to Otto Armleder PID 113603

Project Location Columbia Township Hamilton County, Oh Prepared by RG on 2023-12-11



(At original document size of 11x17) 1:2,700

173620146

#### Legend

- Segment 1-Alternative A
- Segment 1-Alternative C
- Segment 1- Alternatives A & C
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Streams\*

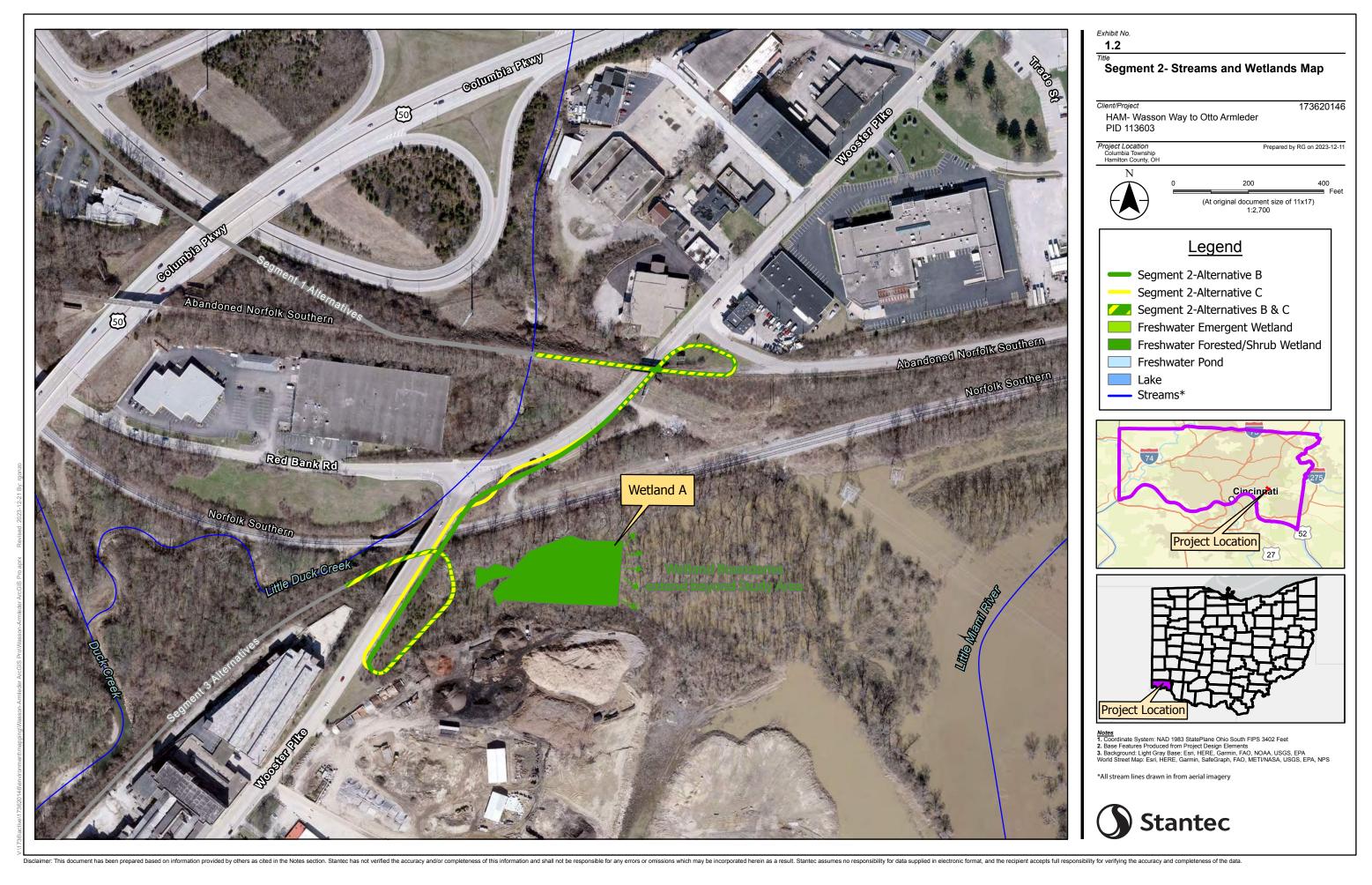




Notes
1. Coordinate System: NAD 1983 StatePlane Ohio South FIPS 3402 Feet
2. Base Features Produced from Project Design Elements
3. Background: Light Gray Base: Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS Hybrid Reference Layer: Esri Community Maps Contributors, City of Cincinnati. © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS World Street Map: Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, USFWS

\*All stream lines drawn in from aerial imagery

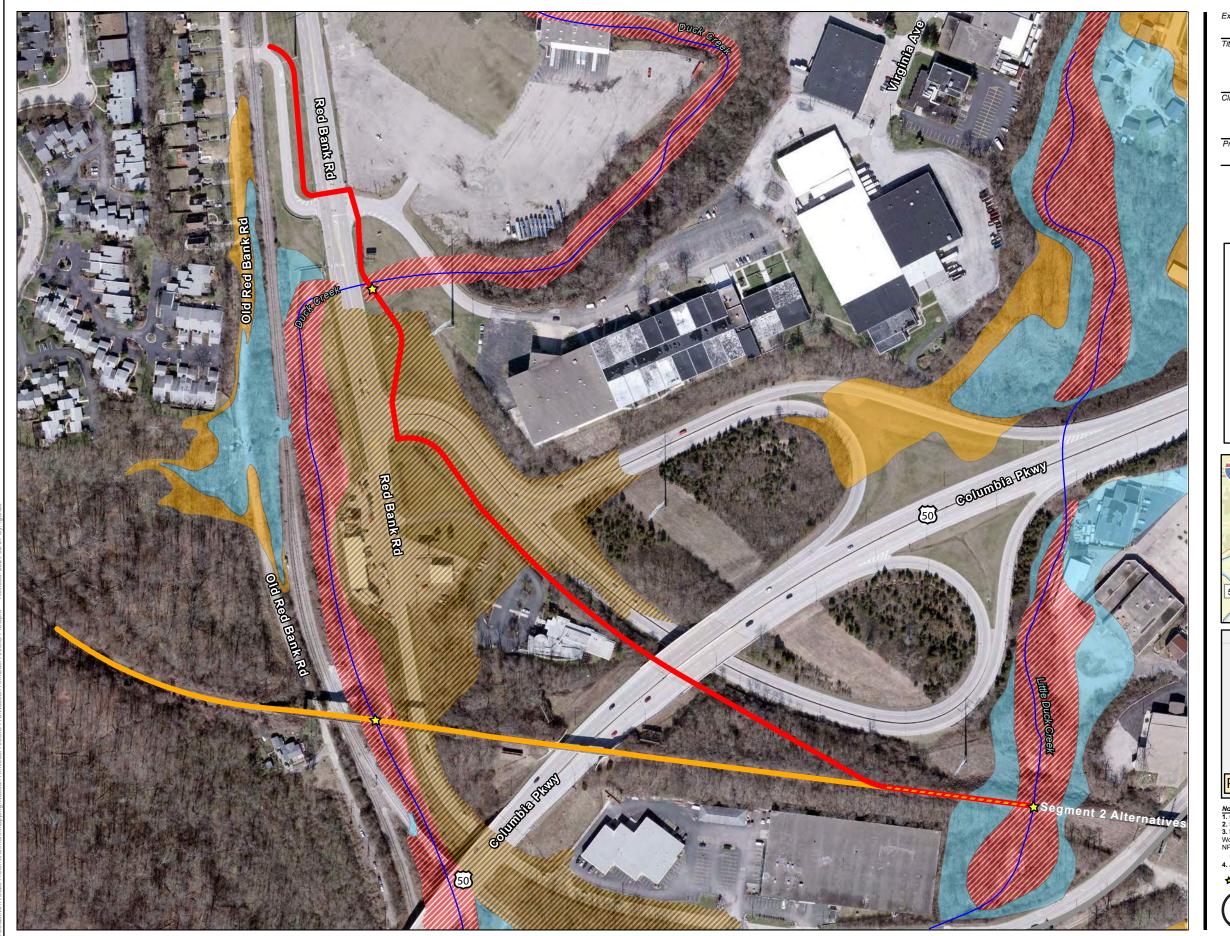




G-2



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2.1

Segment 1- FEMA Floodplains Map

Client/Project HAM- Wasson Way to Otto Armleder PID 113603

Project Location Columbia Township Hamilton County, Oh Prepared by RG on 2023-12-11



(At original document size of 11x17) 1:2,700

173620146

#### Legend

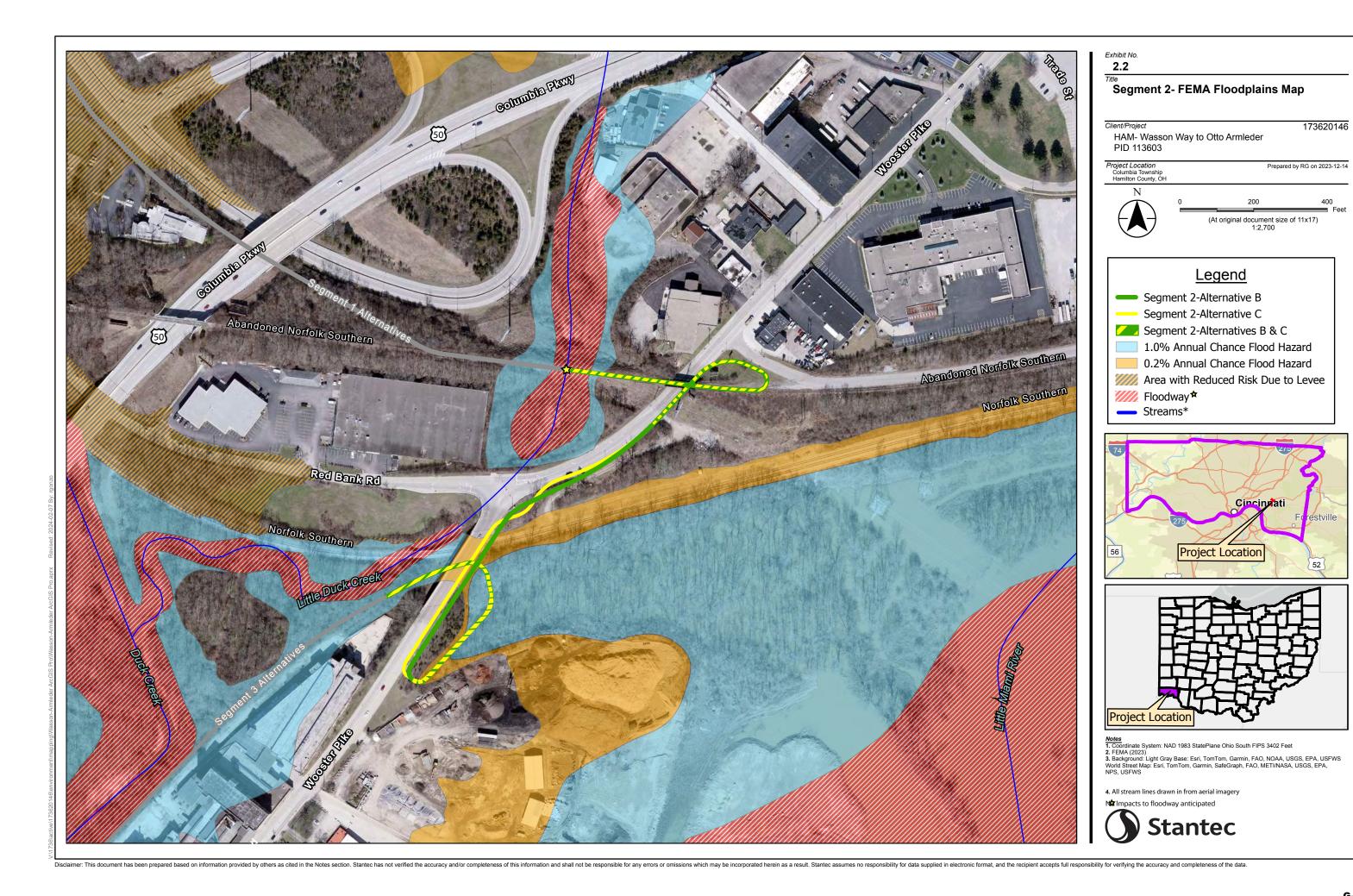
- Segment 1-Alternative A
- Segment 1-Alternative C
- Segment 1- Alternatives A & C
- 1.0% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard
- Area with Reduced Risk Due to Levee
- **I** Floodway ★
- Streams\*



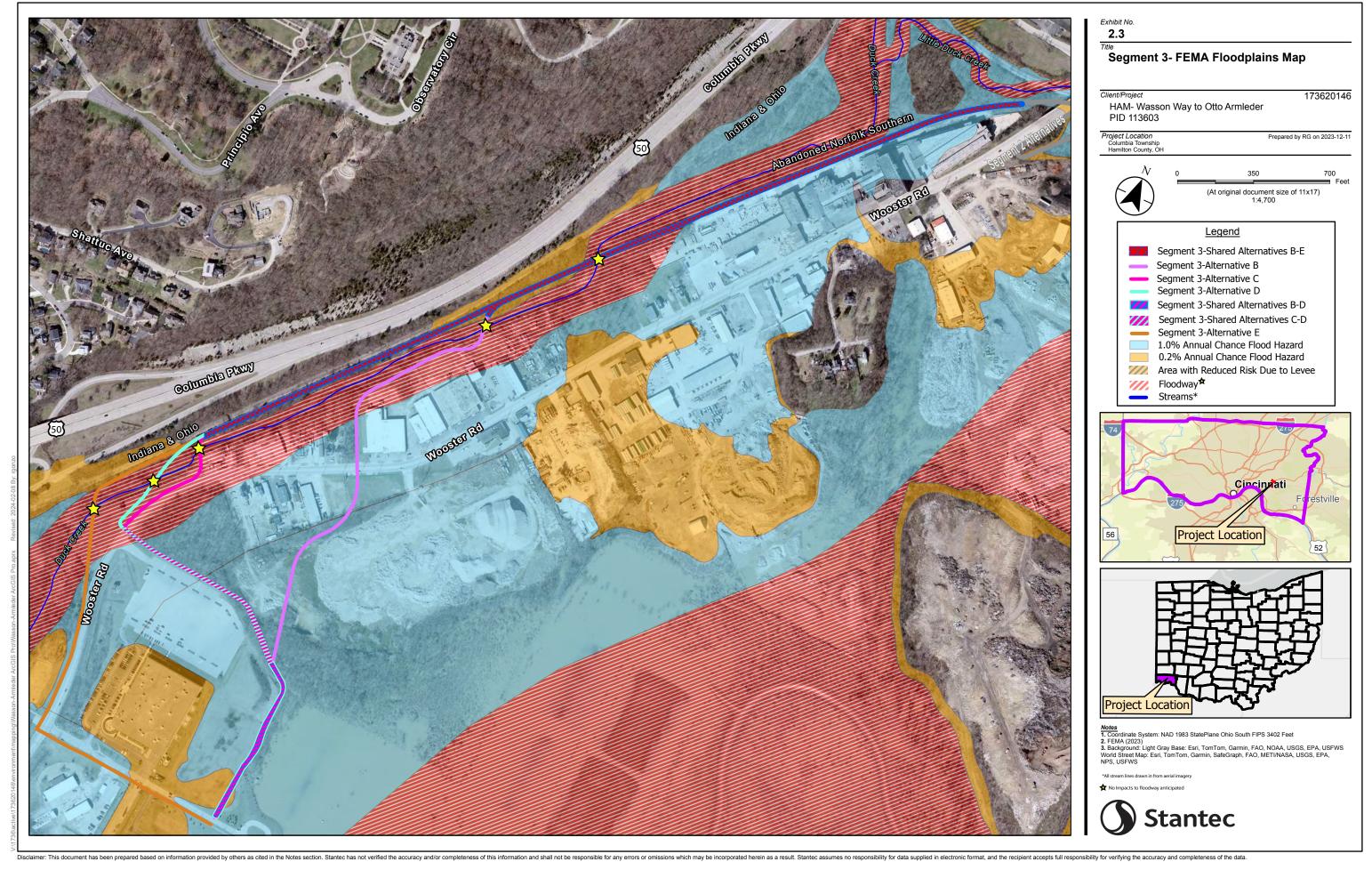


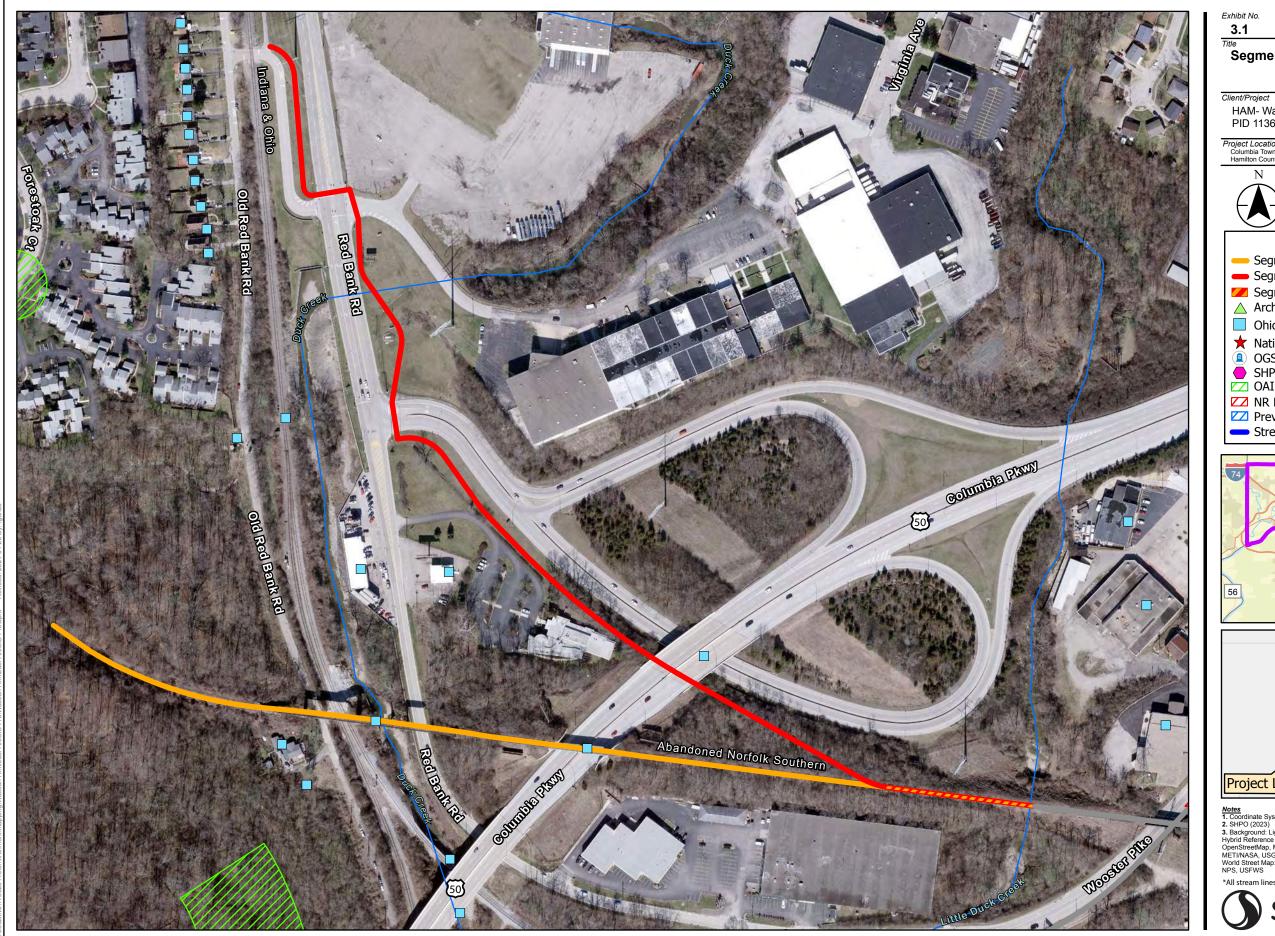


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G-5





3.1

**Segment 1- Cultural Resources Map** 

HAM- Wasson Way to Otto Armleder PID 113603

Project Location Columbia Township Hamilton County, O Prepared by RG on 2023-12-11

(At original document size of 11x17) 1:2,700

173620146

### <u>Legend</u>

- Segment 1-Alternative A
- Segment 1-Alternative C
- Segment 1- Alternatives A & C
- △ Archaeological Inventory
- Ohio Historic Inventory
- ★ National Register Listings
- OGS Cemeteries
- SHPO Determinations
- OAI Boundaries
- NR Boundaries
- Previously Surveyed Areas
- Streams\*

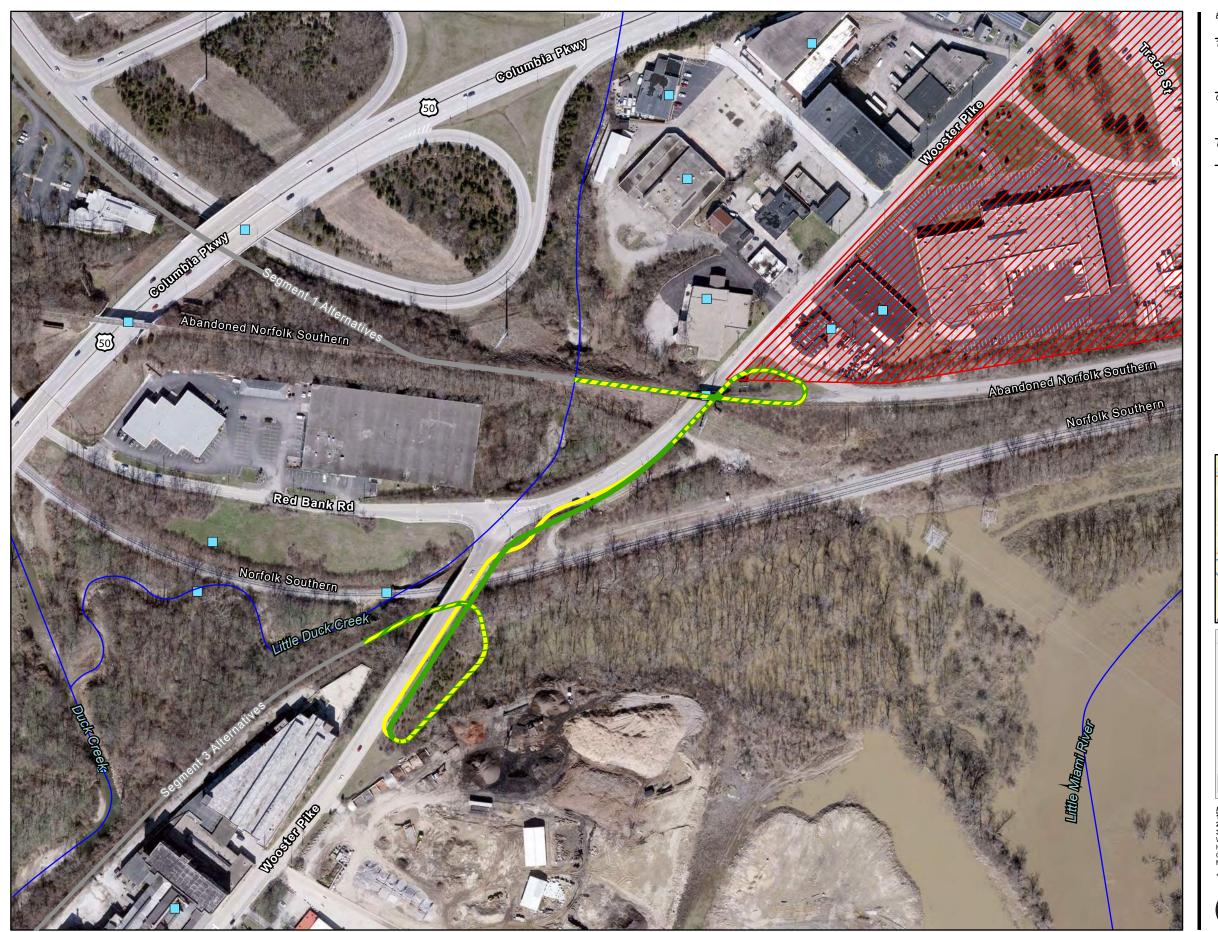




Notes
1. Coordinate System: NAD 1983 StatePlane Ohio South FIPS 3402 Feet
2. SHPO (2023)
3. Background: Light Gray Base: Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS Hybrid Reference Layer: Esri Community Maps Contributors, City of Cincinnati, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS World Street Map: Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, USFWS

\*All stream lines drawn in from aerial imagery





3.2

**Segment 2- Cultural Resources Map** 

Client/Project HAM- Wasson Way to Otto Armleder PID 113603

Project Location Columbia Township Hamilton County, O Prepared by RG on 2023-12-11

(At original document size of 11x17) 1:2,700

173620146

# Legend

Segment 2-Alternative B

Segment 2-Alternative C Segment 2-Alternatives B & C

△ Archaeological Inventory

Ohio Historic Inventory ★ National Register Listings

OGS Cemeteries

SHPO Determinations

OAI Boundaries NR Boundaries

Previously Surveyed Areas

Streams\*





Notes
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3. Background: Light Gray Base: Esri, HERE, Garmin, FAO, NOAA, USGS, EPA
World Street Map: Esri, HERE, Garmin, SafeGraph, FAO, METINASA, USGS, EPA, NPS
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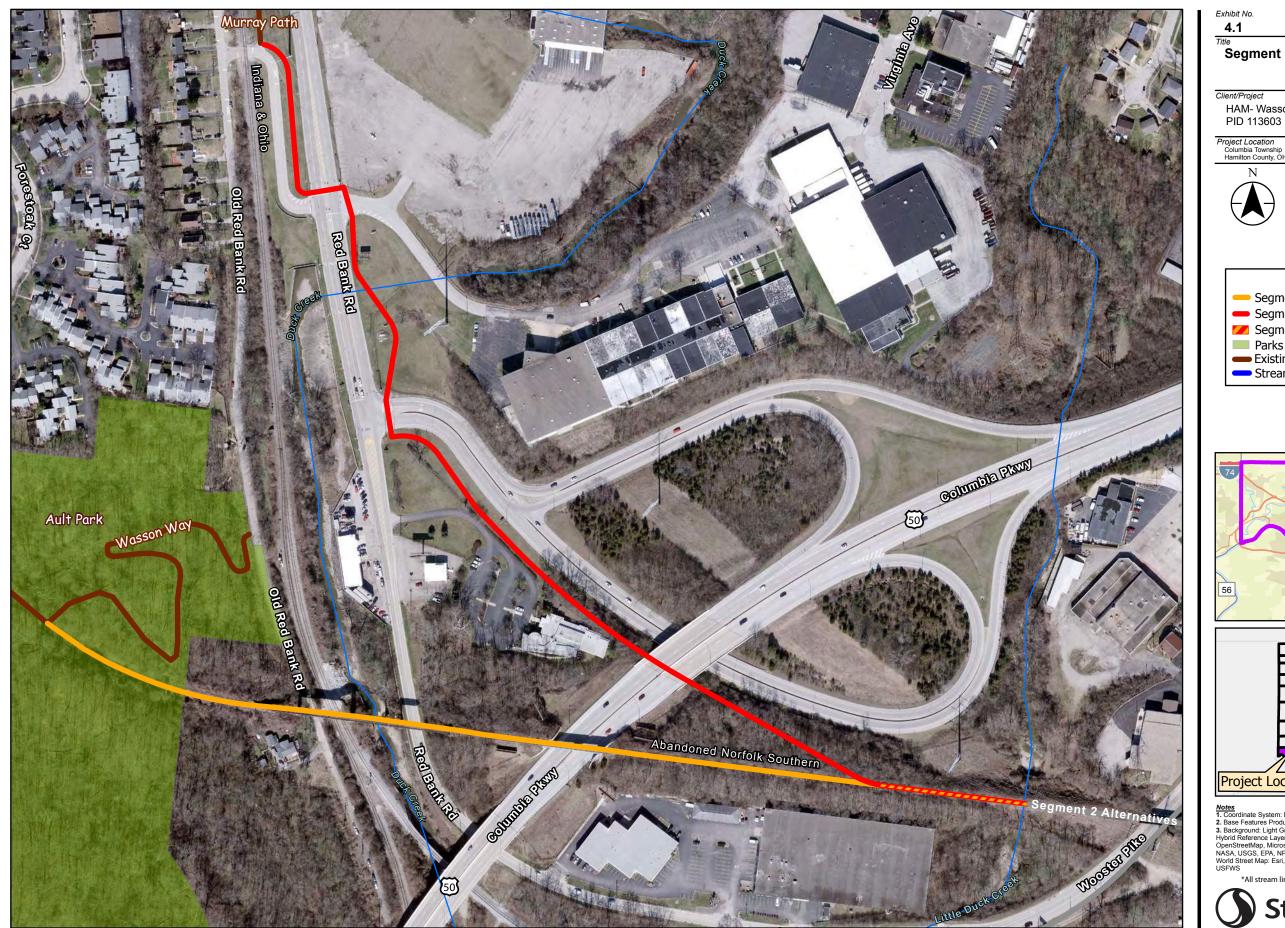
\*All stream lines drawn in from aerial imagery



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G-9



**DRAFT** 

Segment 1- Section 4(f) Properties Map

Client/Project 173620146 HAM- Wasson Way to Otto Armleder

Project Location Columbia Township Hamilton County, O Prepared by RG on 2023-12-11

(At original document size of 11x17) 1:2,700

## Legend

- Segment 1-Alternative A
- Segment 1-Alternative C
- Segment 1- Alternatives A & C
- Parks Existing Trail
- Streams\*





Notes
1. Coordinate System: NAD 1983 StatePlane Ohio South FIPS 3402 Feet
2. Base Features Produced from Project Design Elements
3. Background: Light Gray Base: Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS Hybrid Reference Layer: Esri Community Maps Contributors, City of Cincinnati, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/ NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS World Street Map: Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, USFWS

\*All stream lines drawn in from aerial imagery





Segment 2- Section 4(f) Properties Map

HAM- Wasson Way to Otto Armleder PID 113603

Project Location Columbia Township Hamilton County, O Prepared by RG on 2023-12-11

(At original document size of 11x17) 1:2,700

173620146

# Legend

Segment 2-Alternative B
Segment 2-Alternative C

Segment 2-Alternatives B & C

Parks Trails

Streams\*

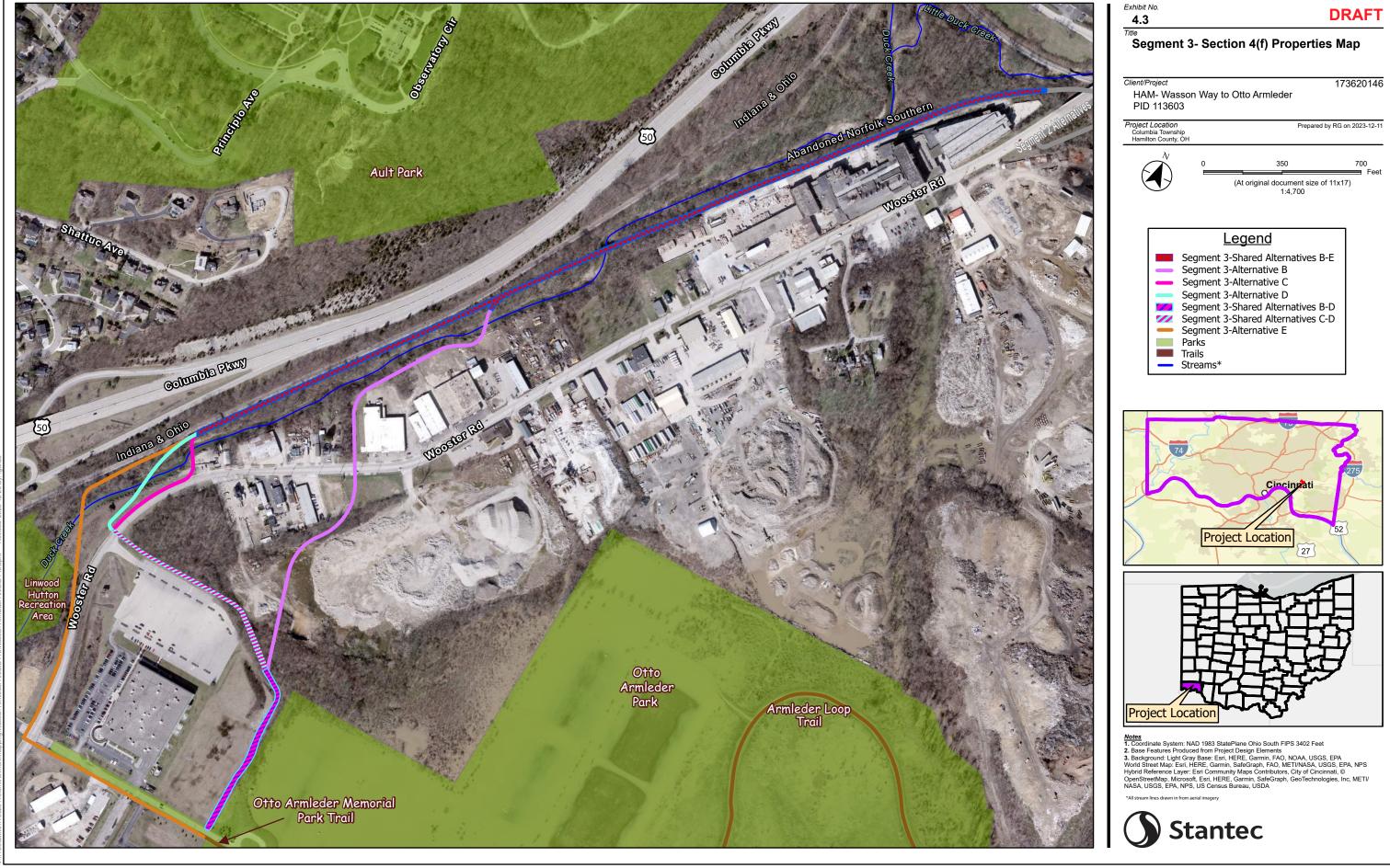


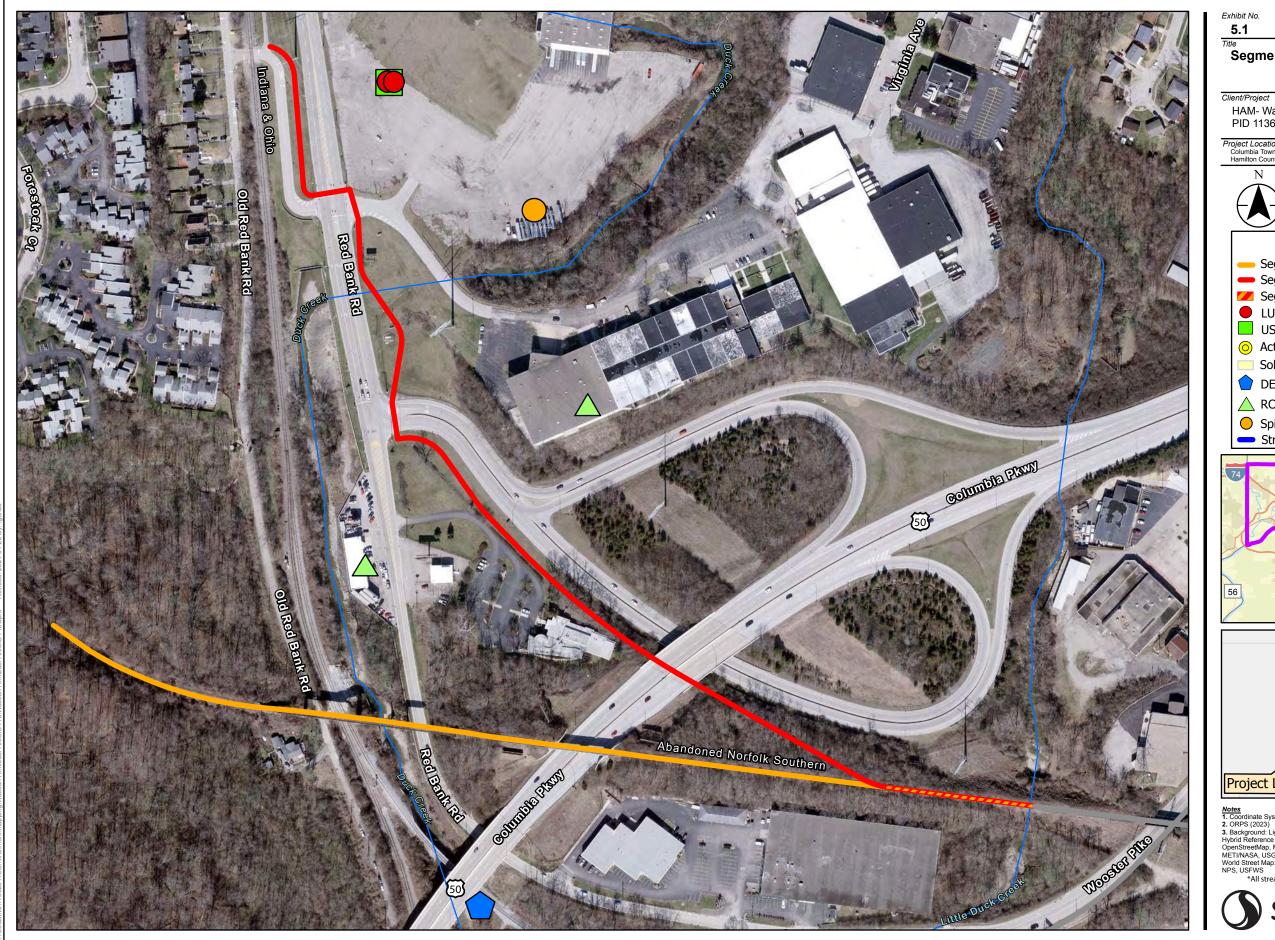


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OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/
NASA, USGS, EPA, NPS, US Census Bureau, USDA

\*All stream lines drawn in from aerial imagery







**Segment 1- Regulated Materials Map** 

HAM- Wasson Way to Otto Armleder PID 113603

Project Location Columbia Township Hamilton County, O Prepared by RG on 2023-12-11

(At original document size of 11x17) 1:2,700

173620146

### Legend

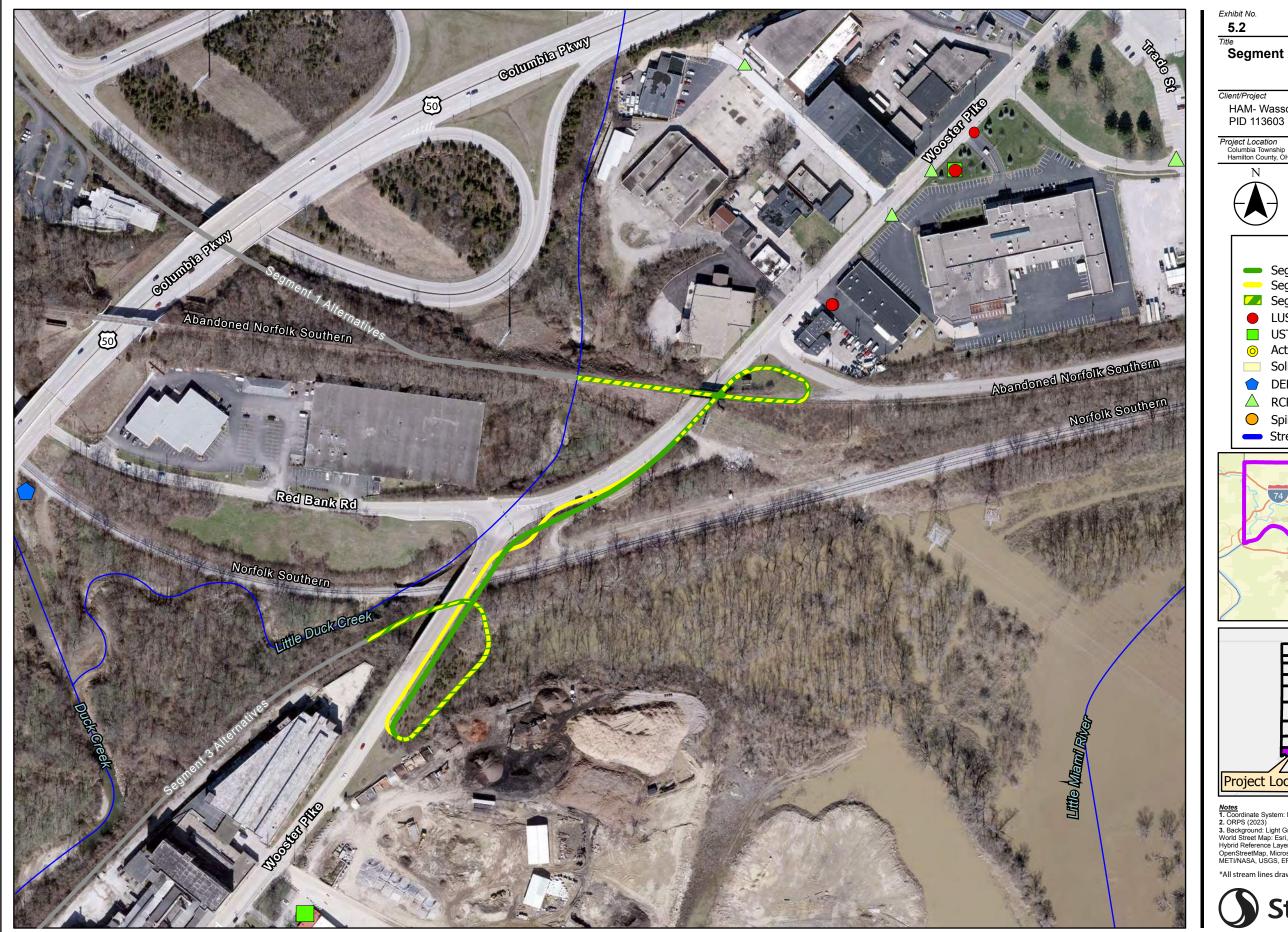
- Segment 1-Alternative A
- Segment 1-Alternative C
- Segment 1- Alternatives A & C
- LUST sites
- UST sites
- Active Solid Waste Site
- Solid Waste Site-1/4 mile buffer
- DERR sites
- A RCRA sites
- Spill sites
- Streams\*





Notes
1. Coordinate System: NAD 1983 StatePlane Ohio South FIPS 3402 Feet
2. ORPS (2023)
3. Background: Light Gray Base: Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS
Hybrid Reference Layer: Esri Community Maps Contributors, City of Cincinnati, ©
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METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS
World Street Map: Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA,
NPS, USFWS
\*All stream lines drawn in from aerial imagery





**Segment 2- Regulated Materials Map** 

173620146 HAM- Wasson Way to Otto Armleder

Project Location Columbia Township Hamilton County, O Prepared by RG on 2023-12-11

(At original document size of 11x17) 1:2,700

# Legend

- Segment 2-Alternative B
- Segment 2-Alternative C
- Segment 2-Alternatives B & C
- LUST Sites
- UST Sites
- Active Solid Waste Site
- Solid Waste Site-1/4 mile buffer
- DERR Sites
- **RCRA Sites**
- Spill Sites
- Streams\*

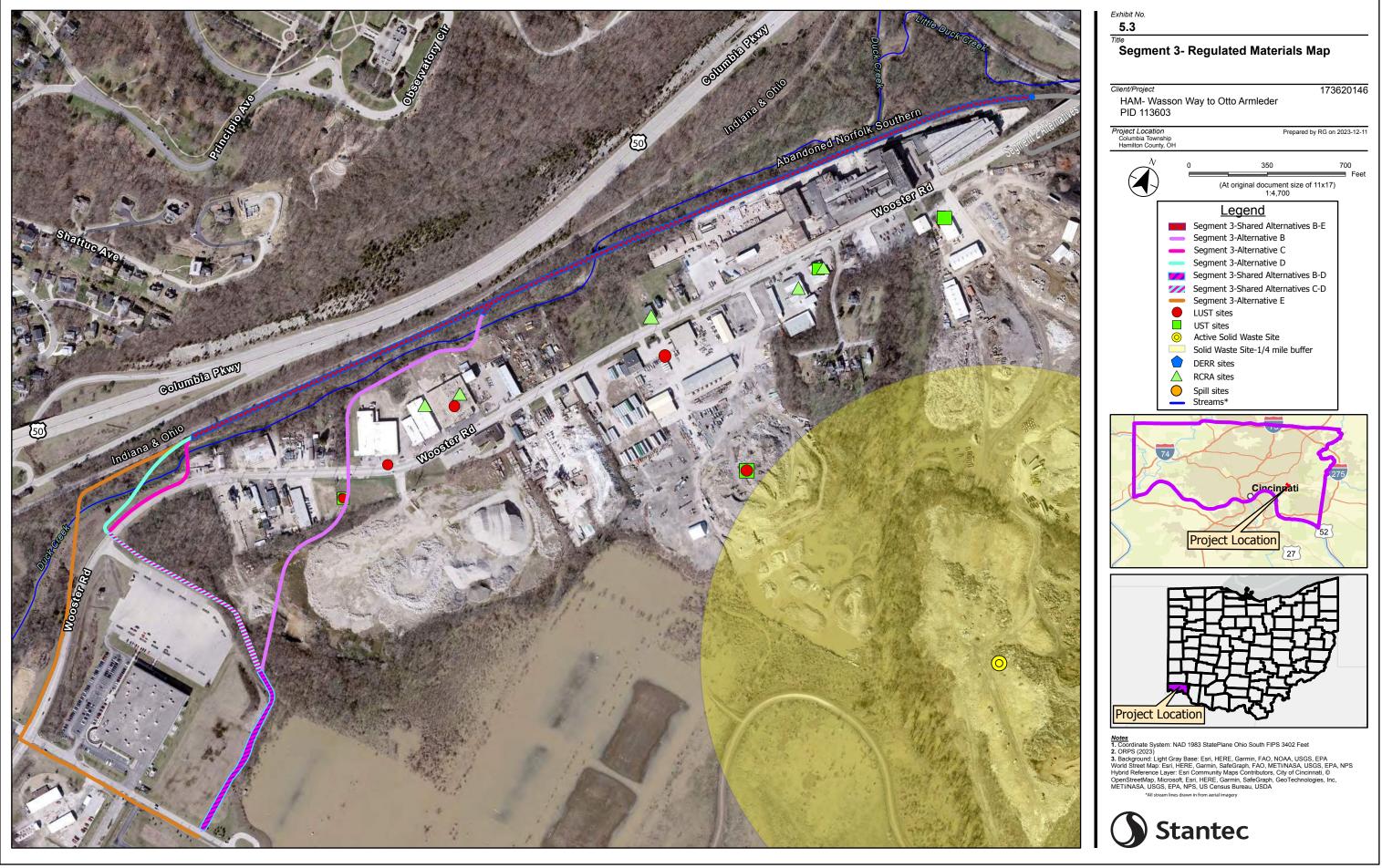




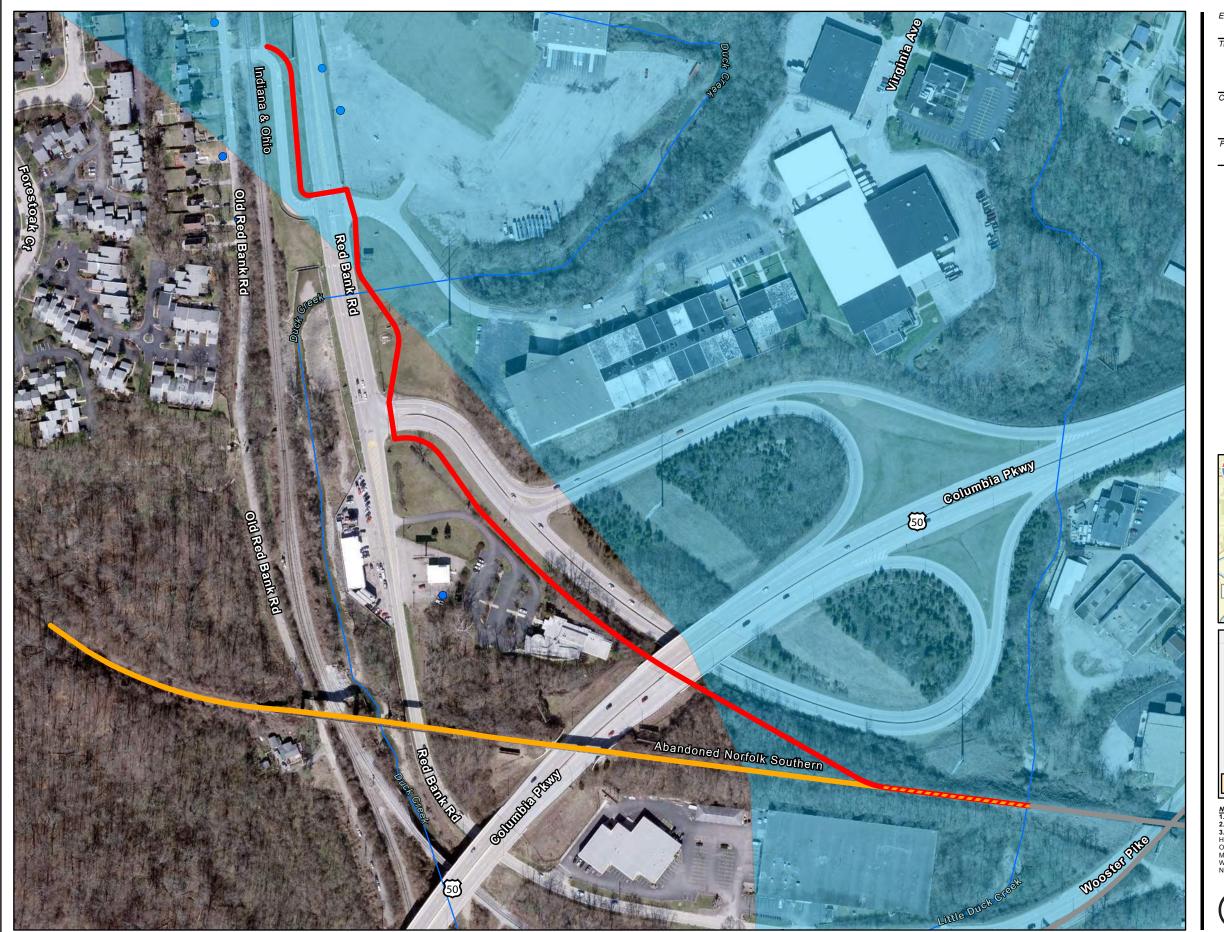
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3. Background: Light Gray Base: Esri, HERE, Garmin, FAO, NOAA, USGS, EPA
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METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

\*All stream lines drawn in from aerial imagery





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6.1

Segment 1- Drinking Water Source **Protection Map** 

Client/Project HAM- Wasson Way to Otto Armleder PID 113603

Project Location Columbia Township Hamilton County, Oh Prepared by RG on 2023-12-11



(At original document size of 11x17) 1:2,700

173620146

### Legend

- Segment 1-Alternative A
- Segment 1-Alternative C
- Segment 1- Alternatives A & C
- Greater Miami Sole Source Aquifer
- Water Wells
- Streams\*

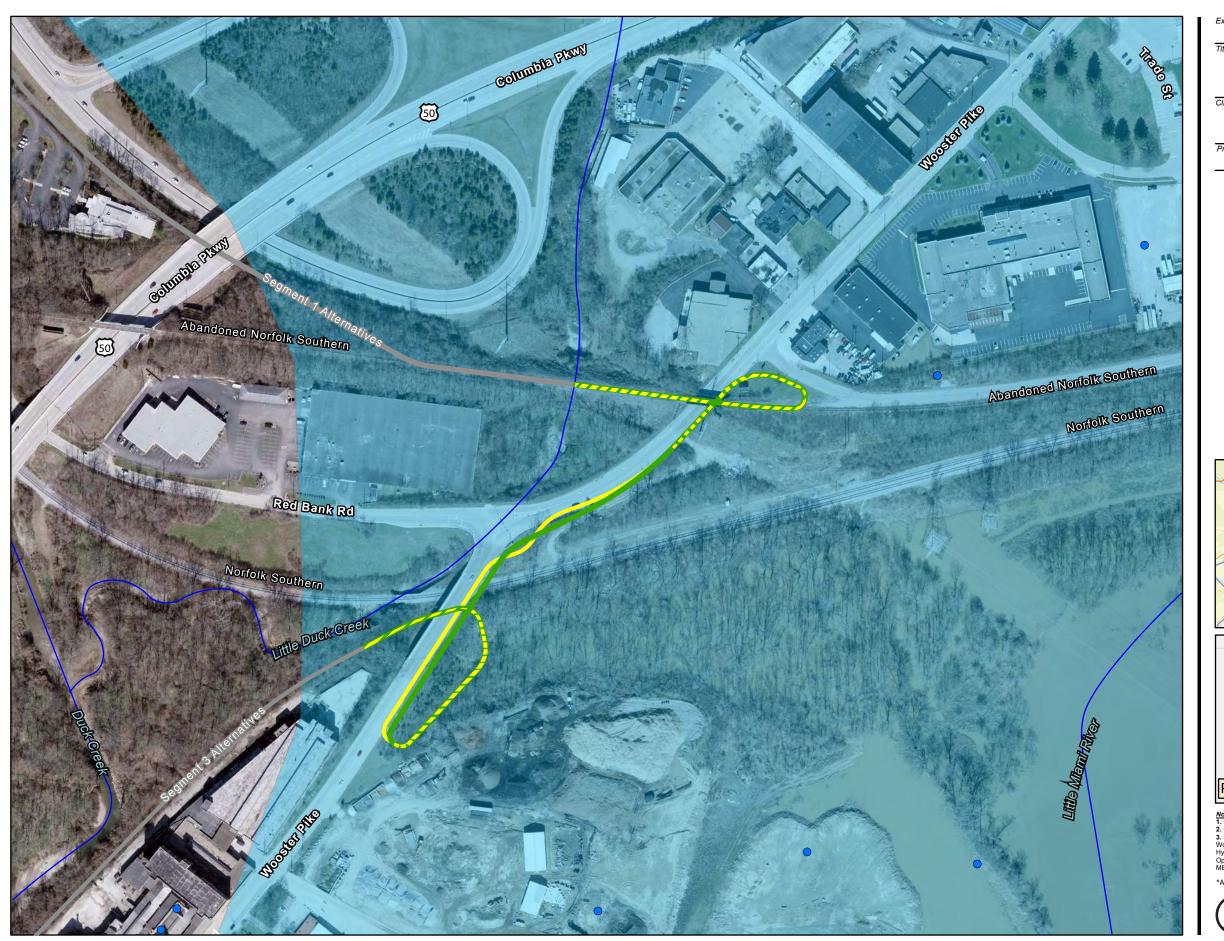




Notes
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2. ODNR (2023), OEPA (2023)
3. Background: Light Gray Base: Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS Hybrid Reference Layer: Esri Community Maps Contributors, City of Cincinnati, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS World Street Map: Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, USFWS

\*All stream lines drawn in from aerial imagery





6.2

Segment 2- Drinking Water Source **Protection Map** 

Client/Project HAM- Wasson Way to Otto Armleder

PID 113603

Project Location Columbia Township Hamilton County, Oh Prepared by RG on 2023-12-11

(At original document size of 11x17) 1:2,700

173620146

# Legend

Segment 2-Alternative B

Segment 2-Alternative C

Segment 2-Alternatives B & C

Greater Miami Sole Source Aquifer Water Wells

Streams\*



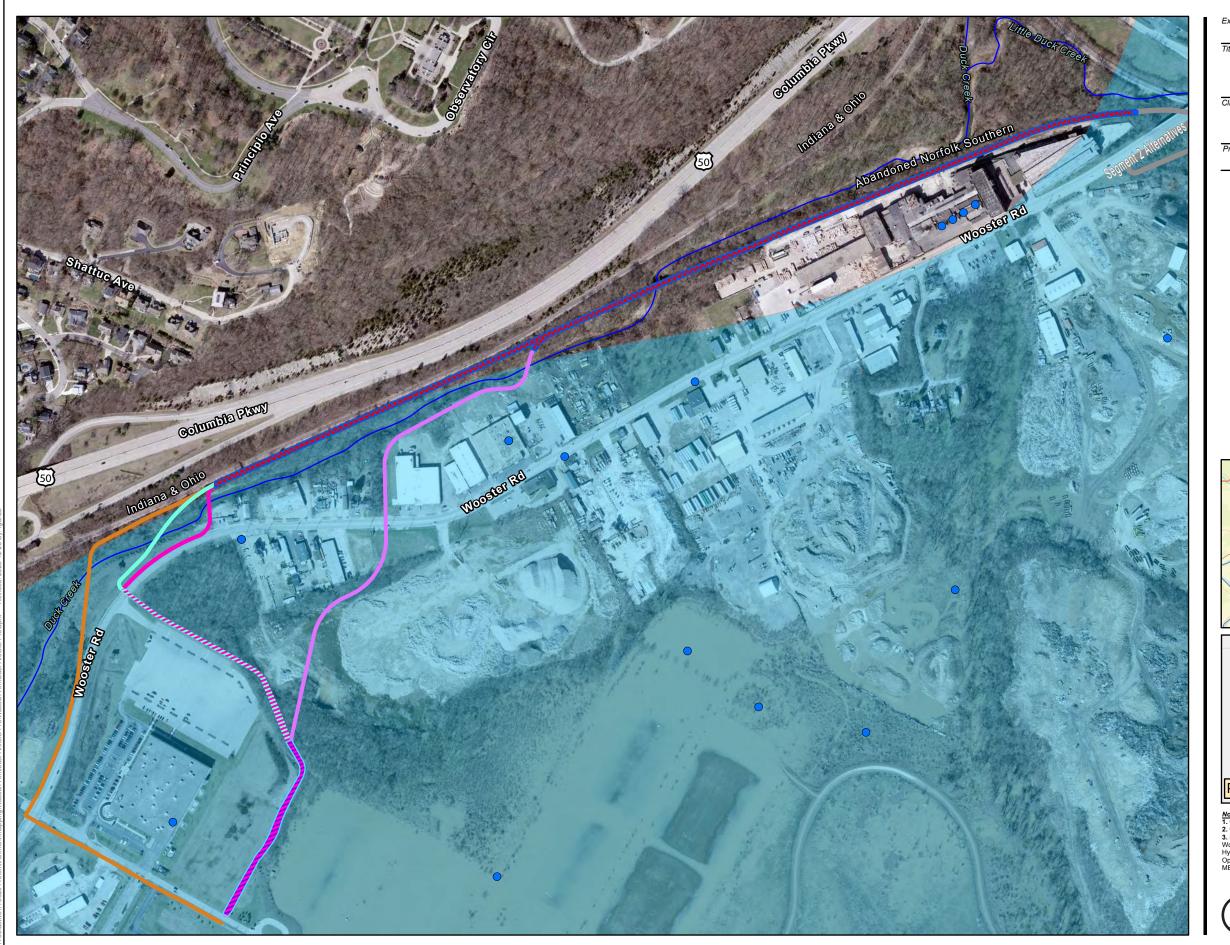


Notes
1. Coordinate System: NAD 1983 StatePlane Ohio South FIPS 3402 Feet
2. ODNR (2023). Ohio EPA (2023)
3. Background: Light Gray Base: Esri, HERE, Garmin, FAO, NOAA, USGS, EPA
World Street Map: Esri, HERE, Garmin, SafeGraph, FAO, METINASA, USGS, EPA, NPS
Hybrid Reference Layer: Esri Community Maps Contributors, City of Cincinnati, ⊚
OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc,
METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

\*All stream lines drawn in from aerial imagery



Englistration and the recipient as been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



6.3

Segment 3- Drinking Water Source **Protection Map** 

Client/Project HAM- Wasson Way to Otto Armleder PID 113603

Project Location Columbia Township Hamilton County, Oh Prepared by RG on 2023-12-11



(At original document size of 11x17) 1:4,700

173620146

# **Legend**

Segment 3-Shared Alternatives B-E
Segment 3-Alternative B

Segment 3-Alternative C

Segment 3-Alternative D Segment 3-Shared Alternatives B-D

Segment 3-Shared Alternatives C-D Segment 3-Alternative E

Water Wells

Greater Miami Sole Source Aquifer

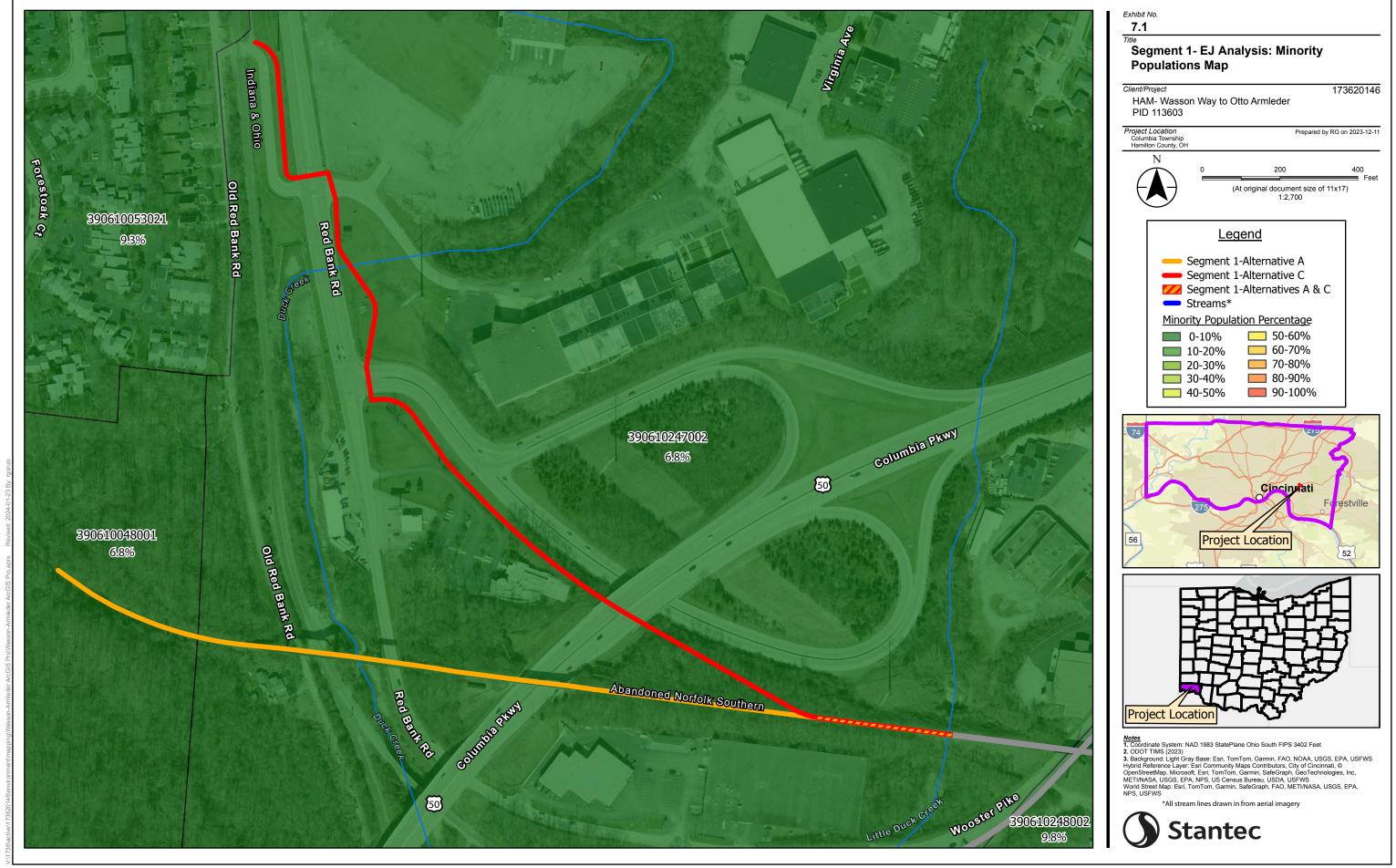
Streams\*





Notes
1. Coordinate System: NAD 1983 StatePlane Ohio South FIPS 3402 Feet
2. ODNR (2023), Ohio EPA (2023)
3. Background: Light Gray Base: Esri, HERE, Garmin, FAO, NOAA, USGS, EPA
World Street Map: Esri, HERE, Garmin, SafeGraph, FAO, METINASA, USGS, EPA, NPS
Hybrid Reference Layer: Esri Community Maps Contributors, City of Cincinnati, ©
OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc,
METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

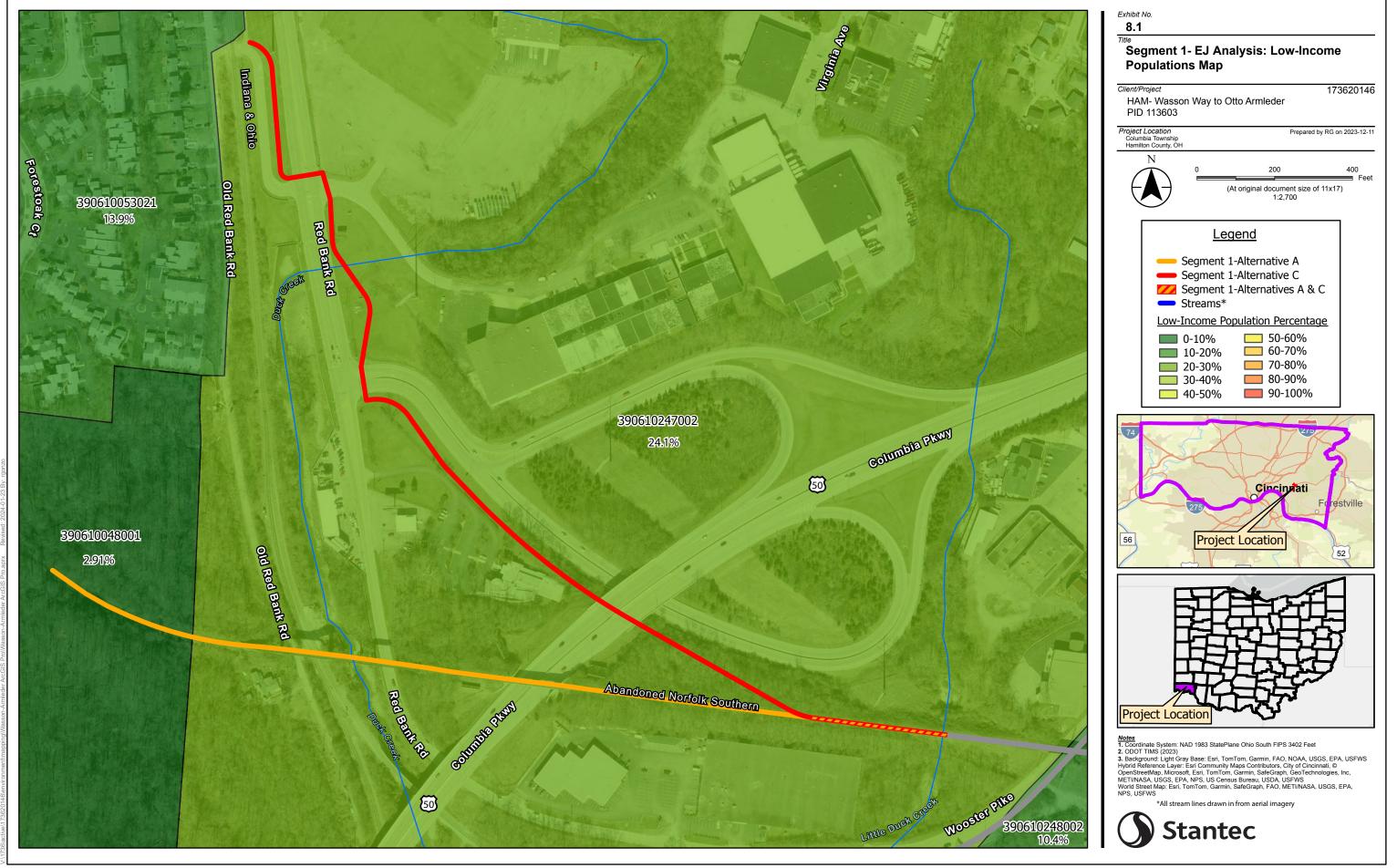


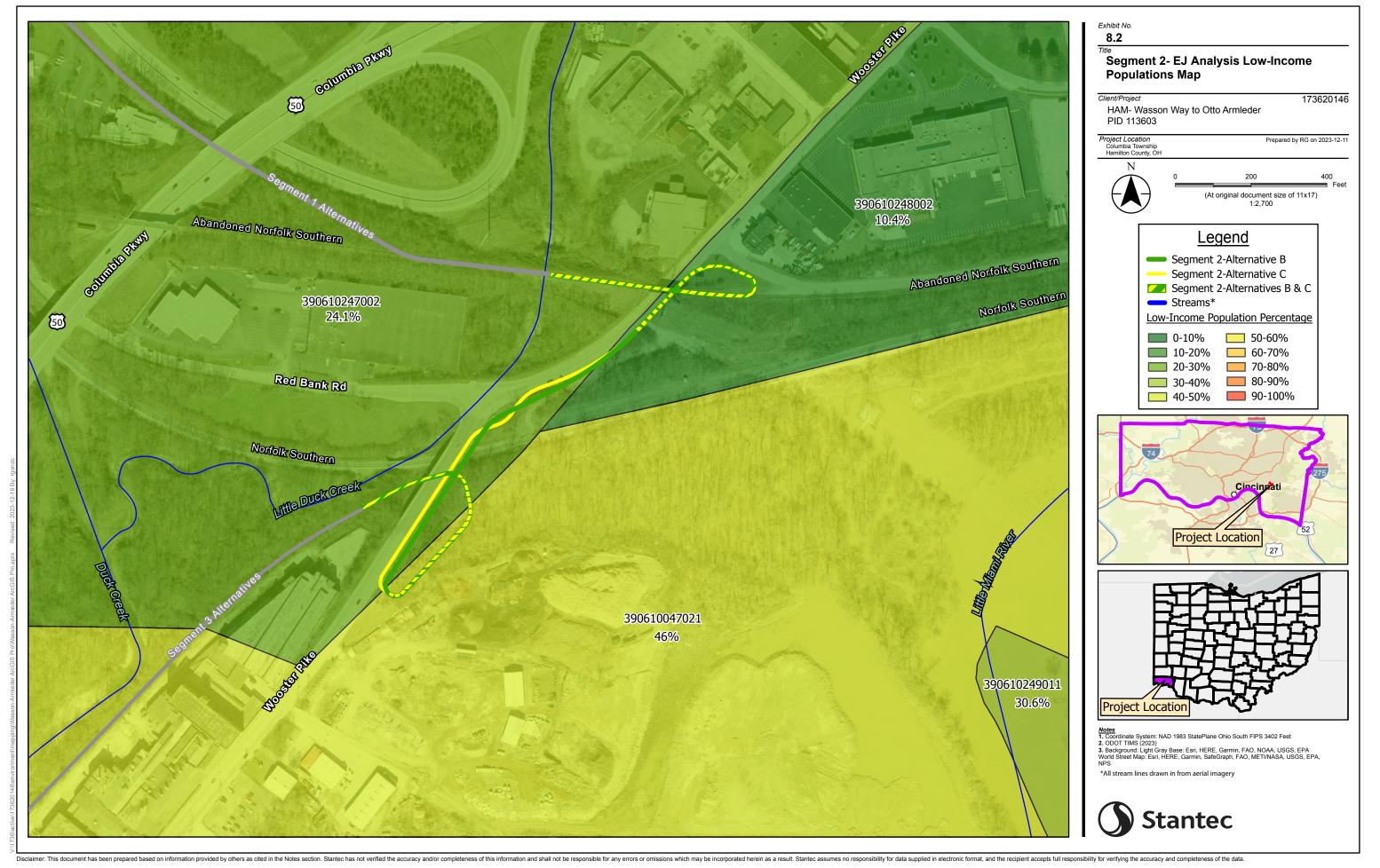


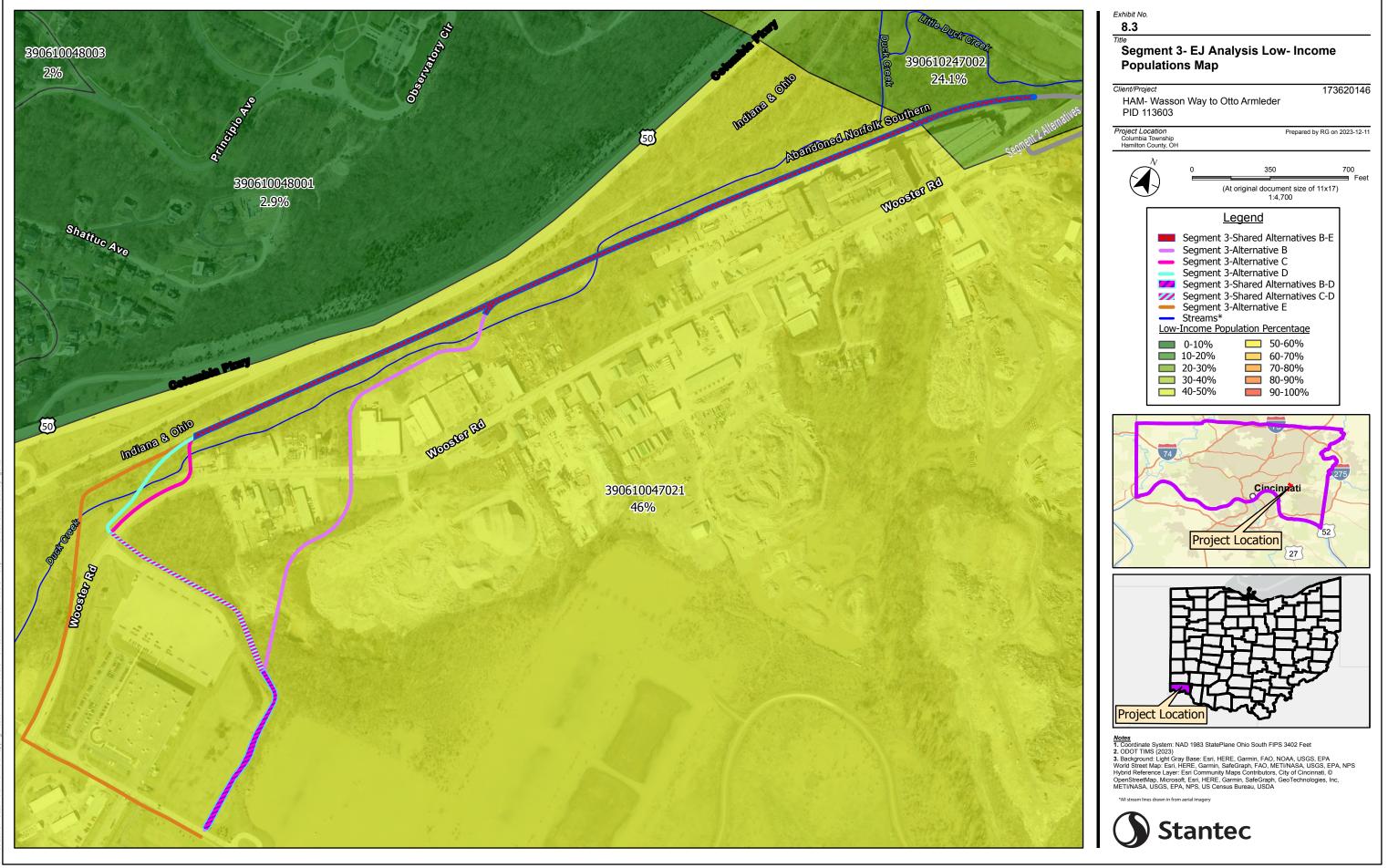


Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verifying the accuracy and/or completeness of this information and shall not be responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.









# **Attachment H**

Ecological Resources Technical Memorandum

Memo



To: Steve Shadix From: Michael de Villiers

Cincinnati

Project/File: 173620146 Date: January 2, 2024

Reference: HAM-Wasson Way to Otto Armleder; PID 113603

#### **Introduction**

The proposed trail extension project is in the Village of Fairfax, Columbia Township, Hamilton County, Ohio (See **Figures 1.1** and **1.2**). Great Parks of Hamilton County (Great Parks) and the Village of Fairfax, in cooperation with the Ohio Department of Transportation (ODOT) District 8 are proposing a new shared-use path connection from the end of US 50 at Wasson Way to the entrance to Otto Armleder Park at Wooster Road. This project is divided into three contiguous segments. The eastern section (Segment 1) begins at the existing Wasson Way near US 50 in Ault Park and continues to the intersection of Wooster Road and Red Bank Road. The middle portion of the study area (Segment 2) crosses the existing railroad at the intersection of Wooster Road and Red Bank Road. The southern section (Segment 3) continues from the south side of the existing railroad at the intersection of Wooster Road and Red Bank Road south to Armleder Road near the entrance to Otto Armleder Park. The project is needed to address safety and connectivity for pedestrians and bicyclists between Beechmont Circle and Red Bank Road and between Wasson Way and the Little Miami Scenic Trail at Otto Armleder Memorial Park. The study area is approximately 93.5 acres.

Ecological field surveys for the proposed project were conducted on September 8-9, 2022, and October 16-18, 2023. These surveys included wetland and stream delineations, a freshwater mussel reconnaissance survey, and documentation of vegetative communities within the study area. A total of two (2) streams and four (4) wetlands were found within the study area (See **Figure 2**). Ecological resources found within the study area are described below.

#### <u>Streams</u>

Two (2) streams were found within the study area including one perennial stream (Duck Creek) and one intermittent stream (Little Duck Creek). Both streams are in an area mapped by the Ohio Environmental Protection Agency (OEPA) as "Eligible" for Nationwide permitting. Table 1 below summarizes streams within the study area:

**Table 1. Summary of Streams** 

Stream ID	Drainage Area (mi²)	Stream Hydrology Type	Habitat Assessment	OEPA Aquatic Life Use Designation	Length in Study Area (LF)
Duck Creek	14.4	Perennial	QHEI 65.5	Warmwater Habitat	4,884
Little Duck Creek	1.71	Intermittent	QHEI 61.0	Warmwater Habitat	1,410

Reference: HAM-Wasson Way to Otto Armleder; PID 113603

#### **Wetlands**

Four (4) wetlands were found within the study area including two palustrine forested wetlands and two palustrine emergent wetlands. Table 2 summarizes wetlands within the study area:

Table 2. Summary of wetlands.

Wetland ID	Hydrologic Connection	ORAM Score (Category)	Wetland Type (Cowardin)	Estimated Total Size (Acre)*	Estimated Size in Study Area (Acre)
Wetland A	Adjacent	50 (Category 2)	Palustrine – Forested	4.97	0.21
Wetland B	Adjacent	29 (Category 1)	Palustrine – Emergent	0.10	0.10
Wetland C	Adjacent	21 (Category 1)	Palustrine – Emergent	0.02	0.02
Wetland D	Adjacent	48.5 (Category 2)	Palustrine – Forested	3.52	0.68

<sup>\*</sup> Total size estimate using aerial imagery

#### **Threatened and Endangered Species**

#### Federally Listed Species

The Ohio Department of Natural Resources, Division of Wildlife (ODNR-DOW) conducted a Natural Heritage Database (NHDB) records check on December 8, 2023. This check found no records of Indiana bat (*Myotis sodalis*), Northern long-eared bat (*Myotis septentrionalis*), or tricolored bat (*Perimyotis subflavus*) captures or hibernacula within a 1-mile radius of the study area. According to a United States Fish and Wildlife Service (USFWS) email information request response on November 1, 2023, the project is not located within a bat buffer. Three potential maternity roost trees were identified within the study area 100 feet past edge of pavement. No portals, openings, cracks, or crevices in rock outcrops that may be an entrance to a cave or mine that would be considered suitable winter hibernacula for Indiana bat or northern long-eared bat were found within the study area. Approximately 32 acres of suitable wooded habitat is found within the study area.

The ODNR-DOW NHDB records check found no records of bald eagle (*Haliaeetus leucocephalus*) nests within a 1-mile radius of the study area and no nests were observed within the study area. Five federally listed mussel species have been found within Hamilton County: fanshell (*Cyprogenia stegaria*), pink mucket pearly mussel (*Lampsilis orbiculata*), rayed bean (*Villosa fabalis*), sheepnose (*Plethobasus cyphyus*), and snuffbox (*Epioblasma triquetra*). A mussel reconnaissance survey conducted on September 8, 2022, in Duck Creek found no live mussels or mussel shells.

#### State Listed Species

The ODNR-DOW NHDB records check found seven additional records of state-listed species within a 1-mile radius of the study area: state potentially threatened running buffalo clover (*Trifolium stoloniferum*), state endangered loggerhead shrike (*Lanius ludovicianus*), state threatened mountain madtom (*Noturus eleutherus*) and blue sucker (*Cycleptus elongatus*), and state species of concern fawnsfoot mussel (*Truncilla* 

January 2, 2024 Steve Shadix Page 3 of 4

Reference: HAM-Wasson Way to Otto Armleder; PID 113603

donaciformis), black sandshell mussel (Ligumia recta), and eastern ringtail dragonfly (Erpetogomphus designatus).

Running buffalo clover requires periodic disturbance and a somewhat open habitat to successfully flourish, but it cannot tolerate full-sun, full-shade, or severe disturbance. Historically running buffalo clover was found in rich soils in the ecotone between open forest and prairie. Those areas were probably maintained by the disturbance caused by bison. Today, the species is found in partially shaded woodlots, mowed areas (lawns, parks, cemeteries), and along streams and trails (USFWS, July 2020). The loggerhead shrike is found in semi-open grasslands, shrublands, grazed pastures, and agricultural areas with scrubby vegetation and lookout posts or perches. Their diet includes bugs, small animals, and other small birds, which they store on barbs, thorns, or forks between branches. The mountain madtom is found in the deep, rocky riffles of fastflowing streams with gravel or cobble substrate and is very sensitive to pollution and siltation. The blue sucker is found in deep, swift, large rivers with cobble substrate and are bottom feeders. The fawnsfoot mussel occurs in both large and medium-sized rivers at normal depths varying from less than three feet up to 15 to 18 feet in big rivers such as the Tennessee. A substrate of either sand or mud is suitable and although it is typically found in moderate current, it can adapt to a lake or embayment environment lacking current. The black sandshell mussel is typically found in medium-sized to large rivers in locations with strong current and substrates of coarse sand and gravel with cobbles in water depths from several inches to six feet or more. It can be found in sand, gravel, or silt. The eastern ringtail dragonfly is found in rivers and streams with gravel bottoms.

Suitable habitat for the running buffalo clover, loggerhead shrike (in semi-open scrub/shrub habitat), fawnsfoot mussel and black sandshell mussel (Duck Creek), and the eastern ringtail dragonfly (Duck Creek) is found within the study area. There is no suitable habitat for the mountain madtom and blue sucker within the study area.

#### **Mussels**

A mussel reconnaissance survey was conducted on September 8, 2022, in Duck Creek. Duck Creek is an unlisted stream with a drainage area > 5 mi<sup>2</sup> as indicated by ODNR-DOW's *Ohio Mussel Survey Protocol* (meaning the stream has potential for mussels, but federally listed mussels not expected). No evidence of mussels was observed, including living mussels or dead mussel shells.

#### Land Cover

The study area was surveyed for vegetative communities on October 16, 17, and 18, 2023 (See Figure 2). Developed High Intensity (DH) and Developed Open Space (DS) vegetative communities account for approximately 27 percent and 17 percent of land cover within the study area, respectively. Approximately 14 percent of the land cover within the study area is Upland Forest (UF), which consists primarily of black locust (Robinia pseudoacacia), black cherry (Prunus serotina), hackberry (Celtis occidentalis), sugar maple (Acer saccharum), boxelder (Acer negundo), black walnut (Juglans nigra), white oak (Quercus alba), shagbark hickory (Carya ovata), American elm (Ulmus americana), redbud (Cercis canadensis), and Amur honeysuckle (Lonicera maackii). Approximately 20 percent of the land cover within the study area is Floodplain Forest (FF), which consists primarily of boxelder, silver maple (Acer saccharinum), red maple (Acer rubrum), cottonwood (Populus deltoides), sycamore (Platanus occidentalis), green ash (Fraxinus pennsylvanica), and black willow (Salix nigra). Approximately 15 percent of the land cover within the study area is Scrub/Shrub (SS), which consists of Amur honeysuckle, eastern red cedar (Juniperus virginiana), Callery pear (Pyrus

January 2, 2024 Steve Shadix Page 4 of 4

Reference: HAM-Wasson Way to Otto Armleder; PID 113603

calleryana), flowering dogwood (*Cornus florida*), multiflora rose (*Rosa multiflora*), and sandbar willow (*Salix interior*). The remaining 7 percent of land cover within the study area is made up of streams and wetlands, of which approximately 6 percent is Open Water (OW), approximately 0.9 percent is Forested Wetland (FW), and approximately 0.1 percent is Marsh (MA).

Respectfully,

STANTEC CONSULTING SERVICES INC.

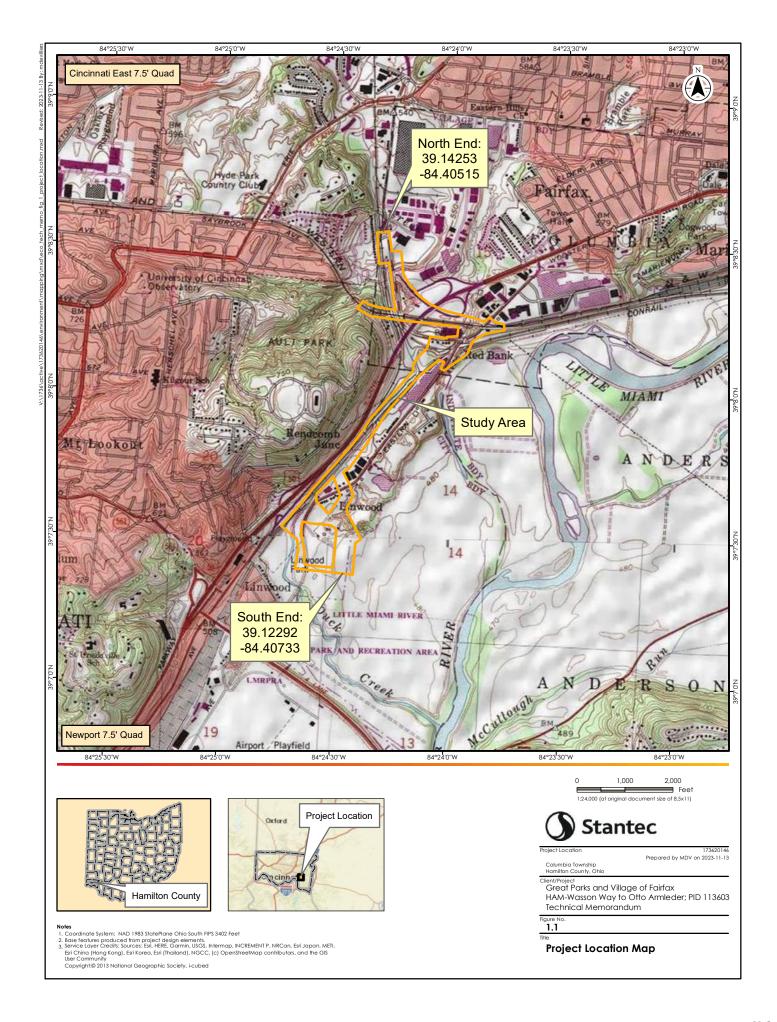
Michael de Villiers

Senior Environmental Specialist Phone: (513) 619-6463 michael.devilliers@stantec.com

Michael D de Willies

Attachment: Figures 1.1, 1.2, 2; Attachment A Ecological Resources Photolog

**Figures** 







- Notes

  1. Coordinate System: NAD 1983 StatePlane Ohio South FIPS 3402 Feet

  2. Base features produced from project design elements.

  3. Service Layer Credits: ODOT Mapping Services (2014)

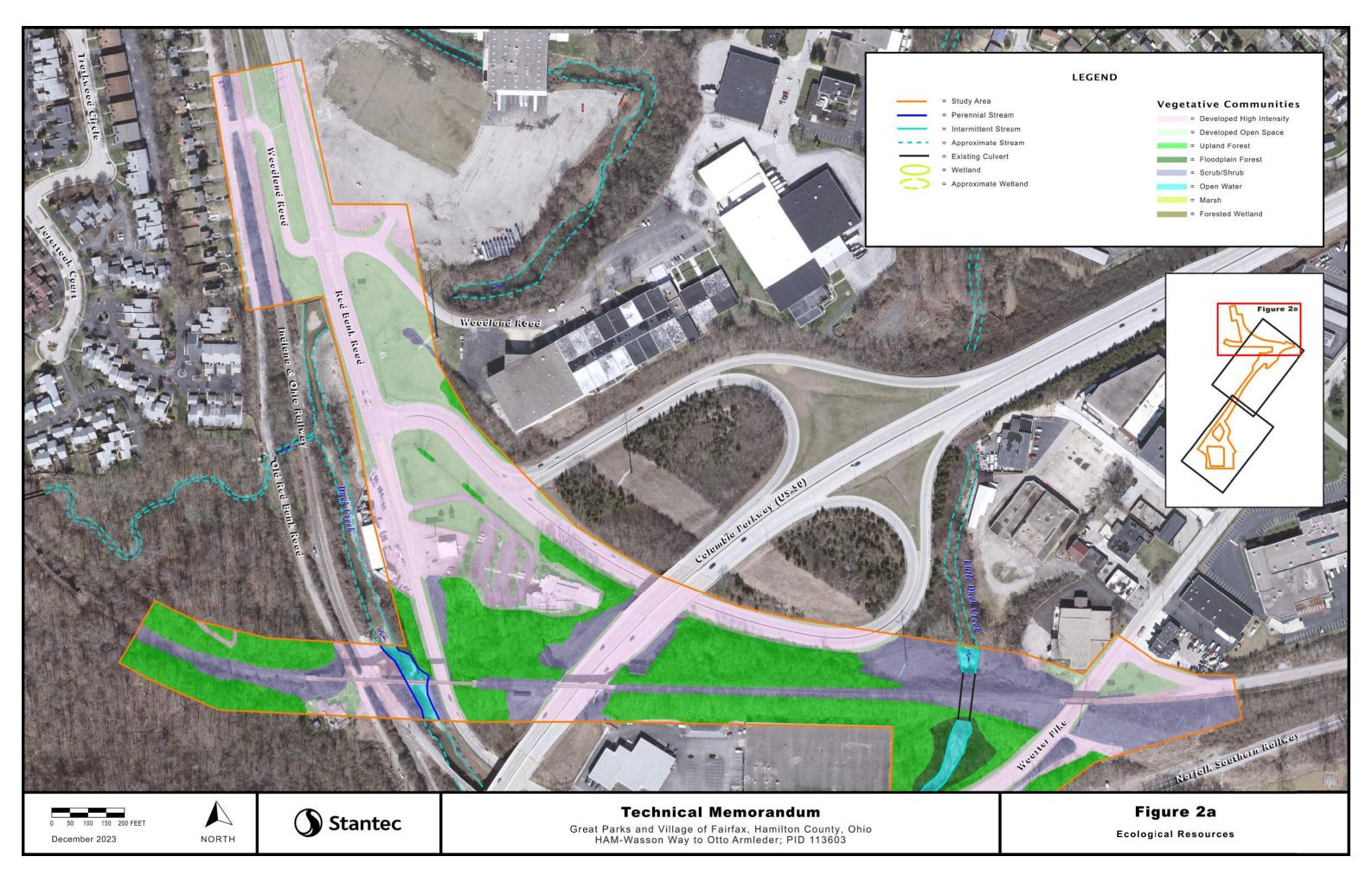


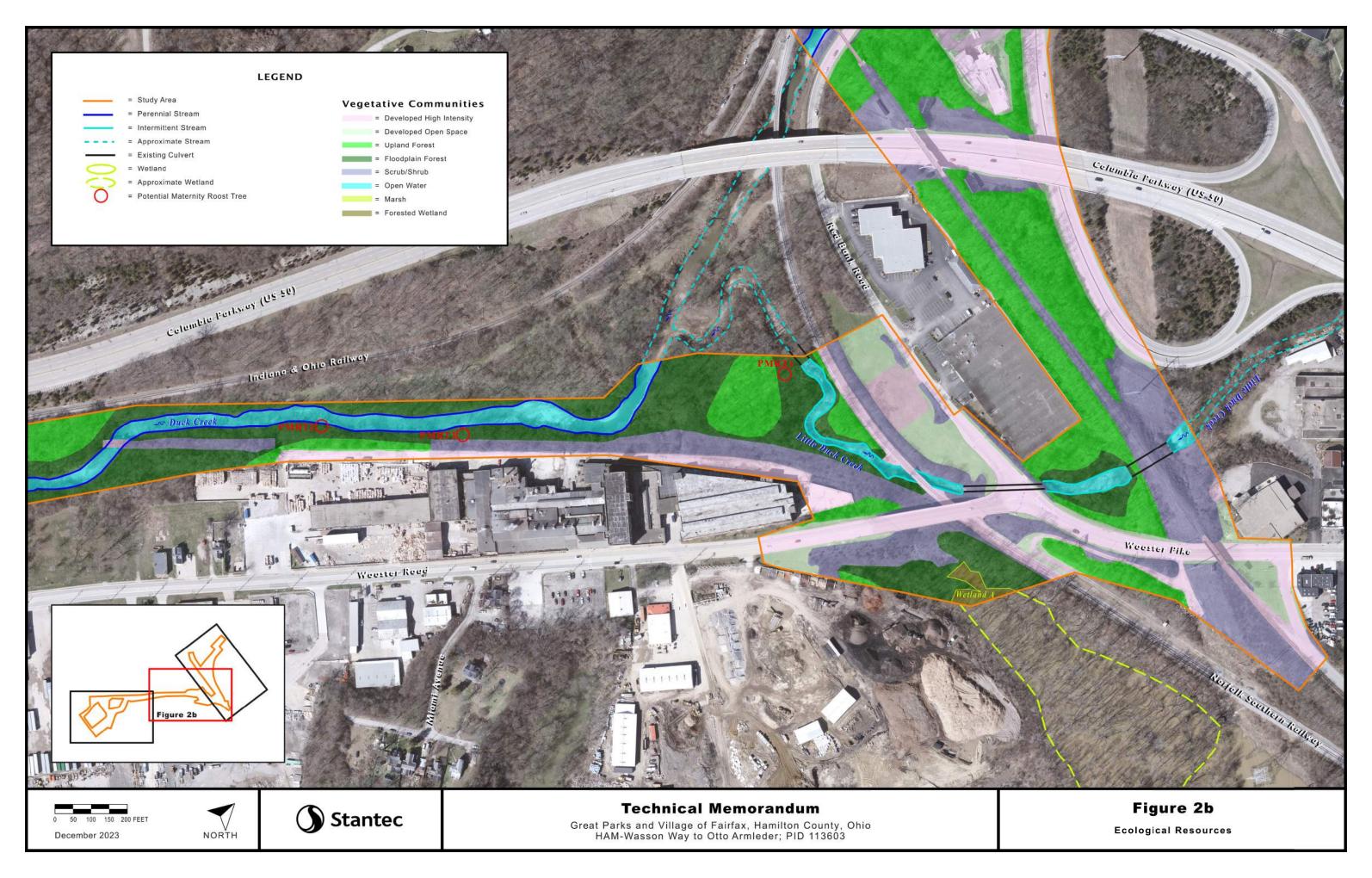


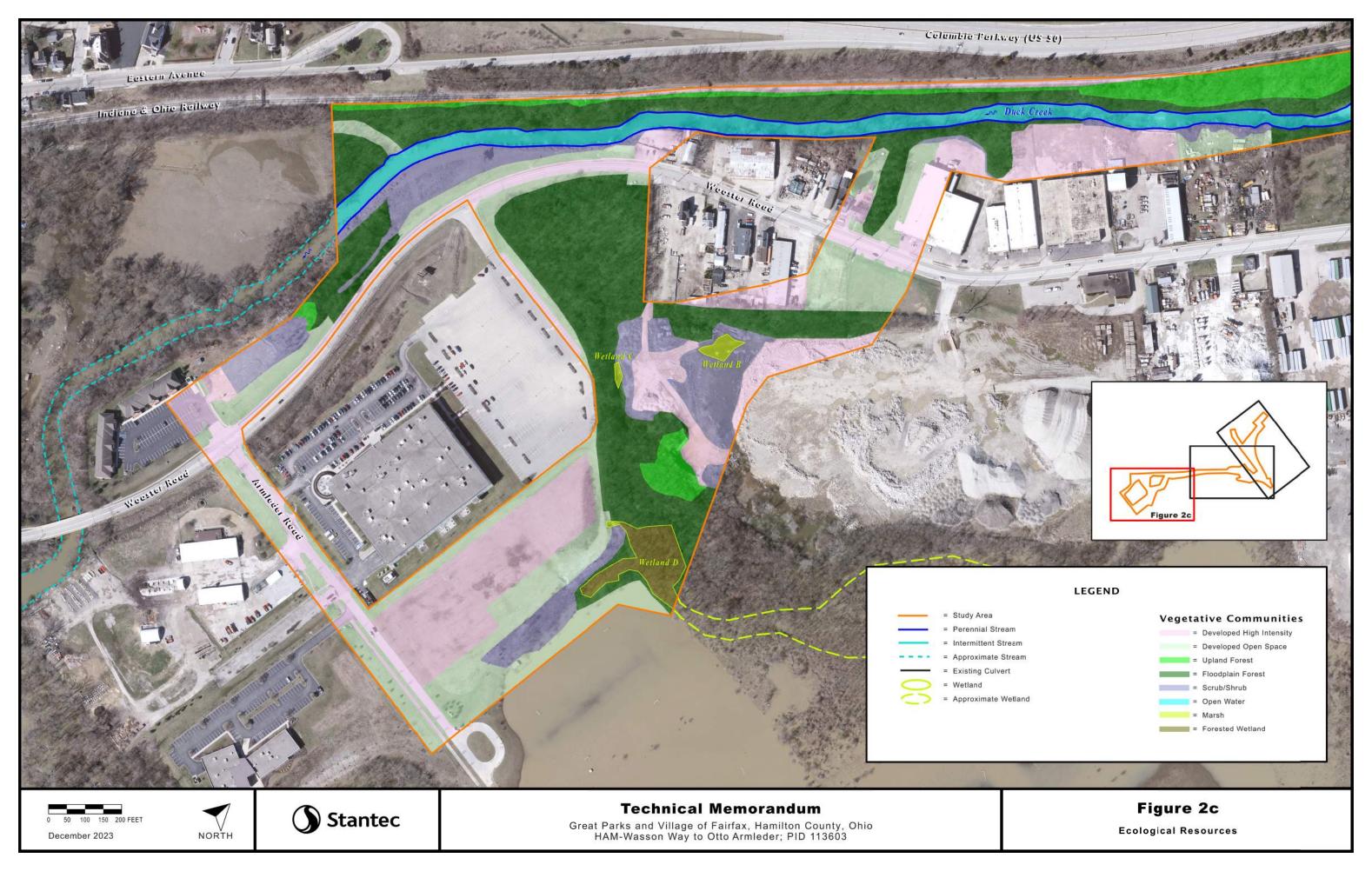
173620146 Prepared by MDV on 2023-11-13

Gent/Project
Great Parks and Village of Fairfax
HAM-Wasson Way to Otto Armleder; PID 113603
Techincal Memorandum

Project Location Map County Roadway Map Base

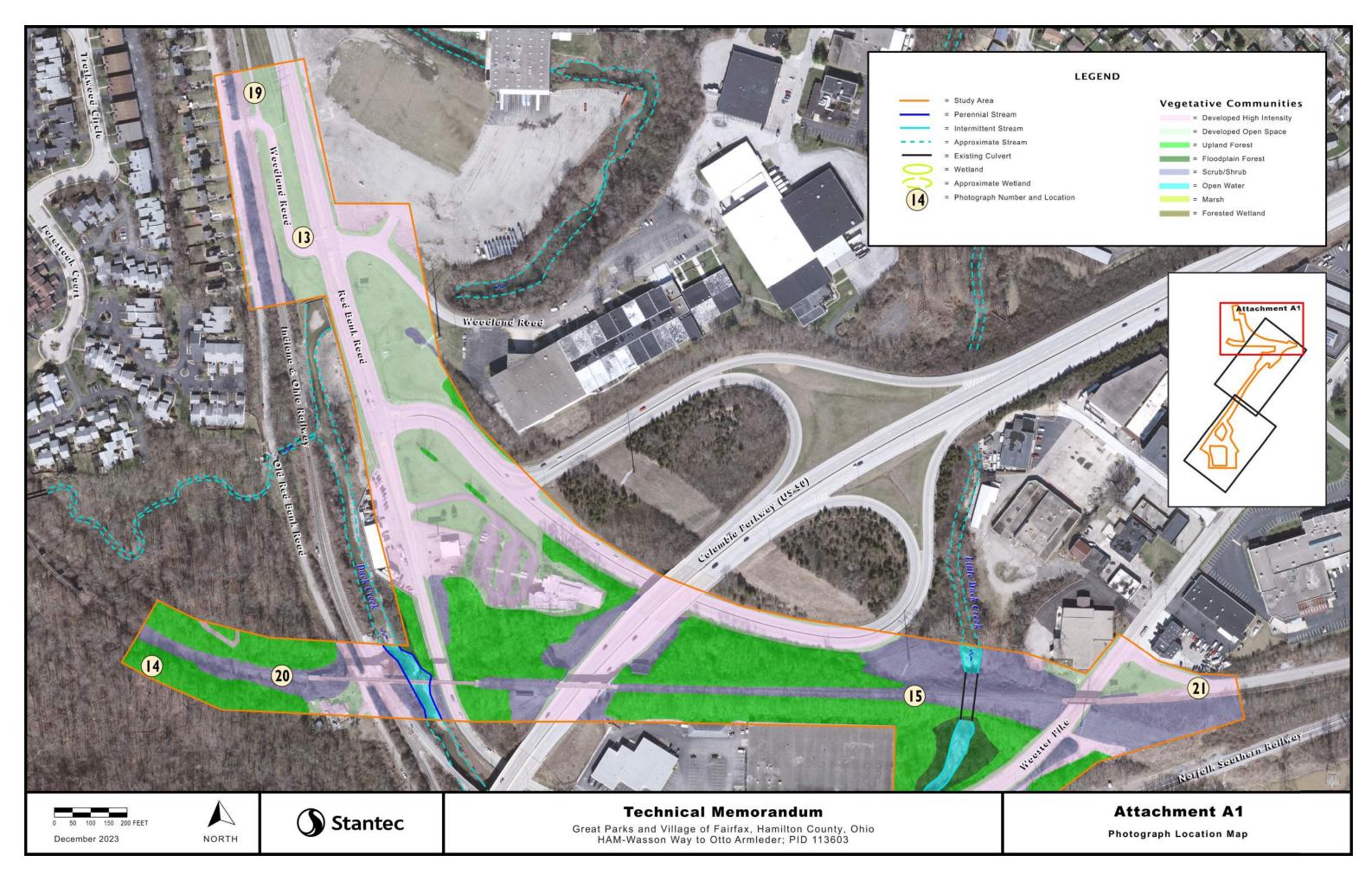


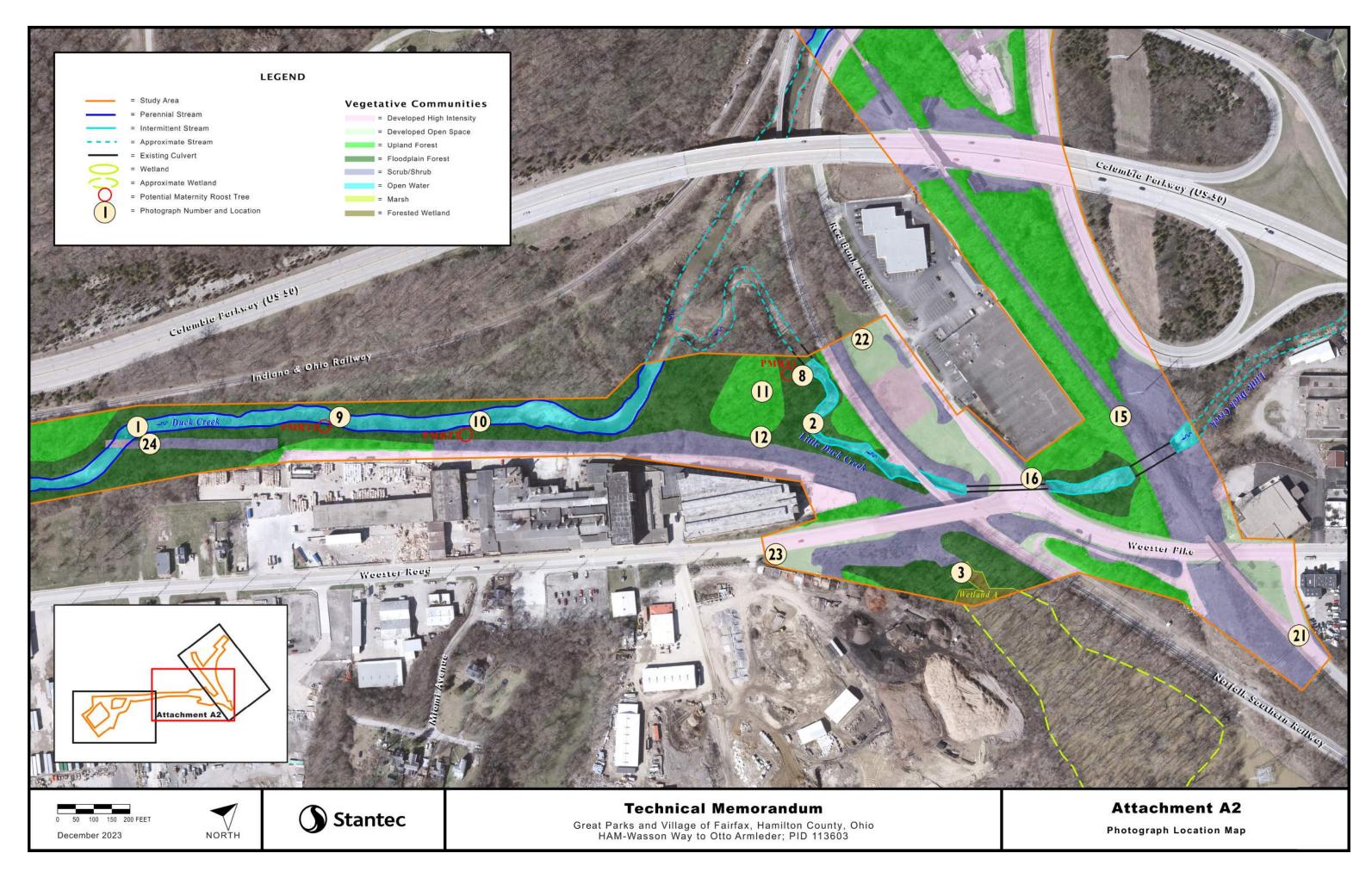


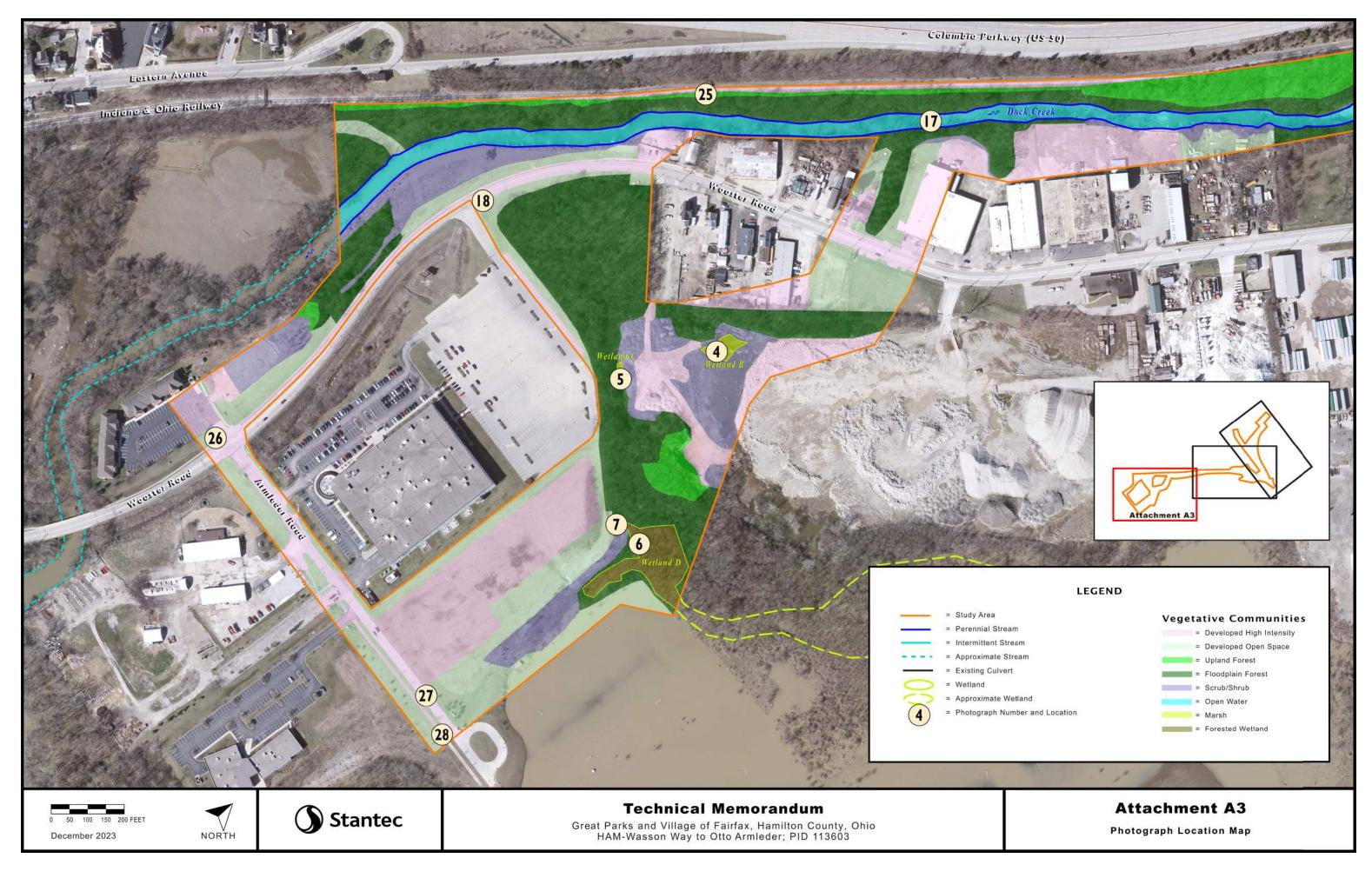


**Attachment A** 

**Photo Log** 









# HAM-Wasson Way to Otto Armleder; PID 113603 Technical Memorandum; Hamilton County, Ohio



Photo Location 1: Duck Creek, perennial, facing upstream, northeast.



Photo Location 1: Duck Creek, perennial, facing downstream, south.



HAM-Wasson Way to Otto Armleder; PID 113603 Technical Memorandum; Hamilton County, Ohio



Photo Location 1: Duck Creek, perennial, typical substrates.



Photo Location 2: Little Duck Creek, intermittent, facing upstream, northeast.



HAM-Wasson Way to Otto Armleder; PID 113603 Technical Memorandum; Hamilton County, Ohio



Photo Location 2: Little Duck Creek, intermittent, facing downstream, north.



Photo Location 2: Little Duck Creek, intermittent, typical substrates.





Photo Location 3: Wetland A, Sample Point P1, facing east.



Photo Location 4: Wetland B, Sample Point P3, facing east.





Photo Location 5: Wetland C, Sample Point P7, facing south.



Photo Location 6: Wetland D (PFO), Sample Point P9, facing south.





Photo Location 7: Wetland D (PEM), Sample Point P10, facing east.



Photo Location 8: Potential Maternity Roost Tree 1, close-up.



HAM-Wasson Way to Otto Armleder; PID 113603 Technical Memorandum; Hamilton County, Ohio



Photo Location 8: Potential Maternity Roost Tree 1, overview, facing southwest.



Photo Location 9: Potential Maternity Roost Tree 2, close-up.





Photo Location 9: Potential Maternity Roost Tree 2, overview, facing south.



Photo Location 10: Potential Maternity Roost Tree 3, close-up.



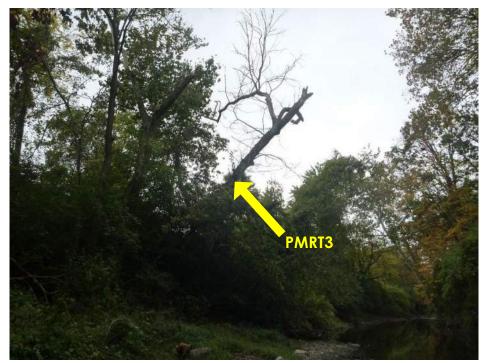


Photo Location 10: Potential Maternity Roost Tree 3, overview, facing south.



Photo Location 11: Abandoned structure foundation, facing southeast.



HAM-Wasson Way to Otto Armleder; PID 113603 Technical Memorandum; Hamilton County, Ohio



Photo Location 12: Abandoned well, facing northwest.



Photo Location 13: Developed High Intensity (DH), Developed Open Space (DS), and Scrub/Shrub (SS) vegetative communities, facing north.





Photo Location 14: Upland Forest (UF) vegetative community, facing east.



Photo Location 15: Upland Forest (UF) and Scrub/Shrub (SS) vegetative communities, facing west.





Photo Location 15: Upland Forest (UF) and Scrub/Shrub (SS) vegetative communities, facing east.

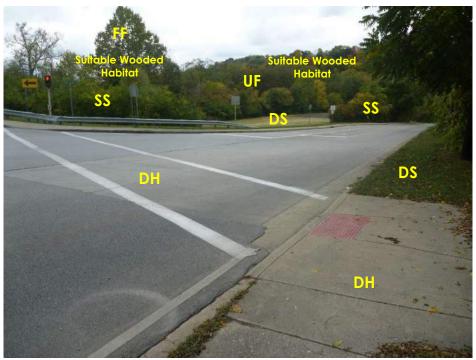


Photo Location 16: Developed High Intensity (DH), Developed Open Space (DS), Upland Forest (UF), Floodplain Forest (FF), and Scrub/Shrub (SS) vegetative communities, facing southwest.



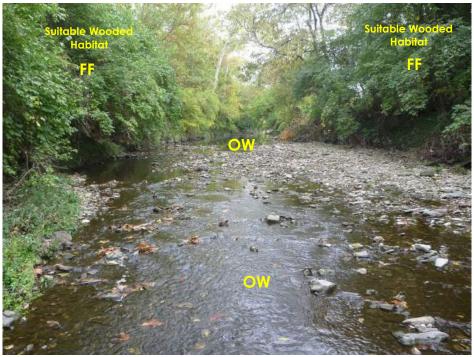


Photo Location 17: Floodplain Forest (FF) and Open Water (OW) vegetative communities, facing northeast.

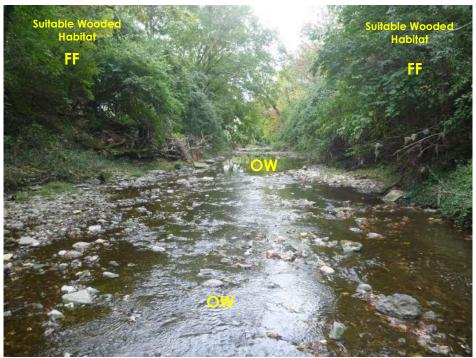


Photo Location 17: Floodplain Forest (FF) and Open Water (OW) vegetative communities, facing southwest.





Photo Location 18: Developed High Intensity (DH), Developed Open Space (DS), Upland Forest (UF), and Scrub/Shrub (SS) vegetative communities, facing north.



Photo Location 18: Floodplain Forest (FF) and Developed Open Space (DS) vegetative communities, facing east.





Photo Location 19: View along Woodland Road and Red Bank Road at north end of study area, facing south.



Photo Location 20: View along abandoned rail bridge crossing over Indiana & Ohio Railway, Duck Creek, and Red Bank Road at northwest end of study area, facing east.





Photo Location 21: View of study area adjacent to abandoned rail line at northeast end of study area, facing west.



Photo Location 22: View of study area between Red Bank Road and Norfolk Southern Railway, facing east.



HAM-Wasson Way to Otto Armleder; PID 113603 Technical Memorandum; Hamilton County, Ohio



Photo Location 23: View of study area adjacent to Wooster Road, facing northeast.



Photo Location 24: View along abandoned rail line bridge over Duck Creek, facing southwest.





Photo Location 25: View along Indiana & Ohio Railway near the southwest end of the study area, facing northeast.



Photo Location 26: View of intersection of Wooster Road and Armleder Road at south end of study area, facing east.





Photo Location 26: View along Wooster Road at south end of study area, facing north.



Photo Location 27: View of study area on the north side of Armleder Road at south end of study area, facing north.



HAM-Wasson Way to Otto Armleder; PID 113603 Technical Memorandum; Hamilton County, Ohio



Photo Location 28: View along Armleder Road at southeast end of study area, facing west.

# **Attachment I**

**Preliminary Cost Estimates** 

Wasson - Armleder	Alterna	te	1-A Cos	t Estimate	<del></del>	
ITEM	UNIT	ι	JNIT PRICE			
				QTY		COST
ROADWAY						
Clearning & Grubbing	ACRE	\$	20,000	1.40	\$	28,000.00
Excavation	CY	\$	25.00	2,100	\$	52,490.25
Embankment	CY	\$	25.00	473	\$	11,828.00
Seeding & Mulching	SY	\$	5.00	2,872	\$	14,359.50
Guardrail, Type MGS	FT	\$	35.00	-	\$	-
Fence, Misc.: Wood	FT	\$	75.00	681	\$	51,092.25
5'- 7' Sidewalk	SF	\$	8.00	-	\$	-
10' or 12' Shared Use Path	SY	\$	70.00	3,130	\$	219,126.13
Concrete Barrier, Type D	FT	\$	150.00		_	
Curb	FT	\$	25.00	-	\$	-
Curb Ramp	SF	\$	20.00	-	\$	-
4" Concrete Traffic Island	SY	\$	120.00	-	\$	-
Subgrade Stabilization	SY	\$	45.00	-	\$	-
DRAINAGE & ERCOION CONTROL		_		-	_	
DRAINAGE & EROSION CONTROL		φ.	45.00	-	φ.	
Underdrains	FT	\$	15.00	-	\$	-
Culvert Type A, <5'	FT FT	\$	200 100	-	\$	-
Culvert Type D, 12"	FT	\$	375	-	\$	-
Closed Storm System Erosion Control	FT	\$	20	2,350	\$	47,000,00
Post Construction Stormwater BMPs	LUMP	Þ	3%	2,350	\$	47,000.00 128,313.07
Post Construction Stormwater Bivies	LOWIF	$\vdash$	370	_	Ψ	120,313.07
PAVEMENT		$\vdash$			$\vdash$	
Pavement, Mainline	SY	\$	120		\$	
Pavement, Salvage	SY	\$	60	_	\$	_
. aremem, carrage	<u> </u>	Ť		_	Ť	
UTILITIES				-		
Electric Transmission Line Relocation	FT	\$	500	-	\$	-
Electric Distribution Line Relocation	FT	\$	100	-	\$	-
Water Line Relocation	FT	\$	500	-	\$	-
Sanitary Sewer Relocation	FT	\$	300	-	\$	-
				-		
TRAFFIC CONTROL				-		
Signs, Ground Mounted	MILE	\$	25,000	0.50	\$	12,500.00
Traffic Signals	EA	\$	200,000	-	\$	-
Pavement Markings	FT	\$	5	2,141	\$	10,706.19
Lighting	LUMP			-	\$	-
				-		
STRUCTURES				-	Ļ	
Segmental Block Wall	LUMP	<u> </u>		-	\$	-
Cast In Place Concrete Wall	LUMP	_	050 000		_	
Precast Box Culvert	EA	\$	250,000	-	\$	-
Precast Arch Culvert	EA	\$	750,000	-	\$	- 2 000 000 00
Rehabilitate Red Bank Road/Duck Creek Bridge	LUMP	\$	3,000,000	1	\$	3,000,000.00
Rehabilitate Columbia Parkway Bridge	LUMP	\$	600,000	1_	\$	600,000.00
INCIDENTALS		$\vdash$			$\vdash$	
Field Office	MONTH	\$	2,500.00	12	\$	30,000.00
Mobilization	LUMP	\$	200,000.00	12	\$	200,000.00
Construction Layout & Stakes	LUMP	۳	0.50%	4,405,415	\$	22,027.08
Maintaining Traffic	LUMP	$\vdash$	3%	4,405,415	\$	132,162.46
Contingency	LUMP	$\vdash$	30%	4,559,605	\$	1,367,881.48
Inflation Factor	LUMP		19%	5,927,486	\$	1,135,113.65
TOTAL	1 201111		1070	\$	, Ψ	7,062,600.05
101AL \$ 1,002,000.05						

Wasson - Armleder	Alterna	at	e 1-C Cos	t Estimate		
113333 / 111113431./						
ITEM	UNIT		UNIT PRICE			
				QTY		COST
ROADWAY		L				
Clearning & Grubbing	ACRE	\$	20,000	2.50	\$	50,000.00
Excavation	CY	\$	25.00	5,171	\$	129,266.00
Embankment	CY	\$	25.00	1,939	\$	48,463.50
Seeding & Mulching	SY	\$ \$	5.00 35.00	7,805	\$	39,025.55
Guardrail, Type MGS Fence, Misc.: Wood	FT	_	75.00	-	\$	<u> </u>
5'- 7' Sidewalk	SF	\$	8.00	-	\$	-
10' or 12' Shared Use Path	SY	\$	70.00	3.437	\$	240,611.17
Concrete Barrier, Type D	FT	\$	150.00	3,437	\$	240,011.17
Curb Ramp	SF	\$	25.00	1.733	\$	43,337.14
4" Concrete Traffic Island	SY	\$	120.00	1,133	\$	43,337.14
Subgrade Stabilization	SY	\$	45.00	-	\$	<u>-</u>
oubgrade diabilization	01	۳	45.00		Ψ	
DRAINAGE & EROSION CONTROL	1	$\vdash$				
Underdrains	FT	\$	15.00		\$	
Culvert Type A, <5'	FT	\$	200		\$	
Culvert Type D, 12"	FT	\$	100	85	\$	8.500.00
Closed Storm System	FT	\$	375	-	\$	30,000.00
Erosion Control	FT	\$	20	2,575	\$	51,500.00
Post Construction Stormwater BMPs	LUMP	۲	3%	2,010	\$	49,877.36
1 det deneu deuen eterminater Bini e	1 20.0	H	0,0	_	Ψ_	10,017.00
PAVEMENT		$\vdash$		_		
Pavement, Mainline	SY	\$	120	_	\$	_
Pavement, Salvage	SY	\$	60	_	\$	-
, 3		Ť		-	Ė	
UTILITIES				-		
Electric Transmission Line Relocation	FT	\$	500	-	\$	-
Electric Distribution Line Relocation	FT	\$	100	650	\$	65,000.00
Water Line Relocation	FT	\$	500	-	\$	-
Sanitary Sewer Relocation	FT	\$	300	-	\$	-
				-		
TRAFFIC CONTROL				-		
Signs, Ground Mounted	MILE	\$	25,000	0.50	\$	12,500.00
Traffic Signal Modifications for Crosswalk	EA	\$	50,000	2	\$	100,000.00
Pavement Markings	FT	\$	5	2,875	\$	14,375.32
Lighting	LUMP			•	\$	-
				-		
STRUCTURES				-		
Soldier Pile & Lagging Wall	LUMP			-	\$	-
Segmental Block Wall	LUMP	$oxed{oxed}$		-	\$	-
Sheetpiling Wall	LUMP	$\vdash$		-		
Cast In Place Concrete Wall	LUMP	<u> </u>	0=0.00=	-	_	
Precast Box Culvert	EA	\$	250,000	-	\$	-
Precast Arch Culvert	EA	\$	750,000	-	\$	-
Drilled Shaft Concrete Wall	LF	\$	2,000.00	350	\$	700,000.00
		$\vdash$				
INCIDENTALO	1	$\vdash$				
INCIDENTALS Field Office	MONTH	<u></u> φ	2 500 00	12	œ.	30 000 00
Mobilization	LUMP	_	2,500.00 100,000.00		\$	30,000.00
Construction Layout & Stakes	LUMP	\$	0.50%	1,712,456	\$	100,000.00 8,562.28
Maintaining Traffic	LUMP	┢	3%	1,712,456	\$	51,373.68
Contingency	LUMP	$\vdash$	30%	1,712,456	\$	51,373.68
Inflation Factor (From ODOT Calculator)	LUMP	$\vdash$	19%	2,286,129	\$	437,793.67
,	LOME	Щ	1970		_	723,922.47
TOTAL				\$	۷,	123,322.41

Wasson - Armleder	Alterna	ate	2-B Cos	t Estimate	<b>)</b>	
ITEM	UNIT	ι	JNIT PRICE			
				QTY		COST
ROADWAY Clearning & Grubbing	ACRE	¢.	20,000	2.58	\$	51,622.91
Excavation	CY	\$	25.00	1,485	\$	37,128.00
Embankment	CY	\$	25.00	3,896	\$	97,389.25
Seeding & Mulching	SY	\$	5.00	1,997	\$	9,986.33
Guardrail, Type MGS	FT	\$	35.00	-	\$	-
Fence, Misc.: Wood	FT	\$	75.00	243	\$	18,225.00
5'- 7' Sidewalk	SF	\$	8.00	-	\$	-
10' or 12' Shared Use Path	SY	\$	70.00	3,464	\$	242,506.73
Concrete Barrier, Type D	FT FT	\$	150.00	670	\$	100,500.00
Curb Curb Ramp	SF	\$	25.00 20.00	866	\$	21,640.40
4" Concrete Traffic Island	SF	\$	120.00	-	\$	
Subgrade Stabilization	SY	\$	45.00	-	\$	-
		Ė		-	Ė	
DRAINAGE & EROSION CONTROL				-		
Underdrains	FT	\$	15.00	-	\$	-
Culvert Type A, <5'	FT	\$	200	-	\$	-
Culvert Type D, 12"	FT	\$	100	-	\$	-
Closed Storm System	FT	\$	375	750	\$	281,250.00
Erosion Control Post Construction Stormwater BMPs	FT LUMP	\$	20 3%	2,600	\$	52,000.00 116,496.52
Post Construction Stormwater BMPs	LUMP		3%		<b>\$</b>	116,496.52
PAVEMENT				-		
Pavement, Mainline	SY	\$	120	-	\$	-
Pavement, Salvage	SY	\$	60	-	\$	-
, ,		Ė		-	Ė	
UTILITIES				-		
Electric Transmission Line Relocation	FT	\$	500	-	\$	-
Electric Distribution Line Relocation	FT	\$	100	-	\$	-
Water Line Relocation	FT	\$	500	-	\$	<u>-</u>
Sanitary Sewer Relocation	FT	\$	300	-	\$	-
TRAFFIC CONTROL				-		
Signs, Ground Mounted	MILE	\$	25,000	0.50	\$	12,559.14
Traffic Signals	EA	\$	200,000	- 0.00	\$	-
Pavement Markings	FT	\$	5	3.000	\$	15,002.45
Lighting	LUMP	\$	-	-	\$	-
				-		
STRUCTURES				-	_	
Segmental Block Wall	LUMP	_	107.05	-	\$	-
Cast In Place Concrete Wall	SF	\$	125.00	300	\$	37,500.00
Precast Box Culvert Precast Arch Culvert	EA EA	\$	250,000 750,000		\$	-
Drilled Shaft Concrete Wall	LF	\$	2,000.00	382	\$	764,000.00
Railroad Bridge Modifications	LUMP	\$	271,635.00	1	\$	271,635
Wooster Road Bridge Widening	LUMP		1,640,272.00	1	\$	1,640,272
	-	Ė			Ė	,, -
INCIDENTALS Field Office	MONTH	¢	2,500.00	12	\$	30,000.00
Mobilization	LUMP	\$	200,000.00	12	\$	200,000.00
Construction Layout & Stakes	LUMP	۳	0.50%	3,896,199	\$	19,998.57
Maintaining Traffic	LUMP		3%	3,896,199	\$	119,991.41
Contingency	LUMP	T	30%	4,032,566	\$	1,241,911.11
Inflation Factor	LUMP		19%	5,242,335	\$	1,030,579.24
TOTAL	•	-		\$		6,412,194.06
IVIAL				Ψ		5, <del>7</del> 12,137.00

Subgrade Stabilization	Wasson - Armleder	Alterna	te	2-C Cos	t Estimate	<del></del>	
Clearning & Grubbing	ITEM	UNIT	ι	JNIT PRICE			
Clearning & Grubbing					QTY		COST
Excavation							
Embankment			_			<u> </u>	
Seeding & Mulching						_	
Guardrail, Type MGS						,	
Fence, Misc.: Wood			_			_	
SF   S   8.00   -   \$ -						_	
10" or 12" Shared Use Path			_			,	29,370.75
Concrete Barrier, Type D						_	245 000 00
Curb						_	
SF   \$ 20.00   \$ 4" Concrete Traffic Island   SF   \$ 120.00   200   \$ 24,000.00						_	
A**Concrete Traffic Island			_		-	,	-
Subgrade Stabilization					200	,	24,000.00
Underdrains	Subgrade Stabilization	SY		45.00	3,044	_	136,985.36
Underdrains							
Culvert Type A, <5  FT \$ 200							
Culvert Type D, 12"	\$11.00 m				2,225		33,372.60
FT   \$ 375					-	,	-
FT   \$ 20	Culvert Type D, 12"		_		-	_	-
Pavement, Mainline			_			,	
PAVEMENT			Þ		2,025	_	
Pavement, Mainline	Post Construction Stormwater BiMPs	LUMP	_	3%		Ф	98,713.71
Pavement, Mainline	PAVEMENT						
DITILITIES		SY	\$	120	2 844	\$	341 280 00
UTILITIES						_	-
Electric Transmission Line Relocation			Ť			Ť	
Electric Distribution Line Relocation	UTILITIES						
Water Line Relocation         FT         \$ 500         450         \$ 225,000.00           Sanitary Sewer Relocation         FT         \$ 300         -         \$ -           TRAFFIC CONTROL           Signs, Ground Mounted         MILE         \$ 25,000         0.50         \$ 12,500.00           Traffic Signals         EA         \$ 200,000         -         \$ -           Pavement Markings         FT         \$ 5         2,780         \$ 13,898.37           Lighting         LUMP         \$ 120,000         1         \$ 120,000.00           STRUCTURES           Segmental Block Wall         LUMP         -         \$ -           Cast In Place Concrete Wall         LUMP         -         \$ -           Drilled Shaft Concrete Wall         LUMP         -         -         -           Precast Box Culvert         EA         \$ 250,000         -         \$ -           12' X 12' Box Culvert Extension         LF         \$ 3,500.00         54         \$ 189,000.00           Extended Culvert Headwall         LUMP         \$ 60,000.00         1         \$ 271,635.00         1         \$ 271,635.40           Wooster Road Bridge Modification         LUMP         \$ 585,400.00	Electric Transmission Line Relocation	FT	\$	500	-	\$	-
Sanitary Sewer Relocation		FT	\$			\$	45,000.00
TRAFFIC CONTROL   Signs, Ground Mounted   MILE   \$ 25,000   0.50   \$ 12,500.00     Traffic Signals   EA   \$ 200,000   -   \$     Pavement Markings   FT   \$ 5   2,780   \$ 13,898.37     Lighting   LUMP   \$ 120,000   1   \$ 120,000.00     STRUCTURES			_		450	_	225,000.00
Signs, Ground Mounted         MILE         \$ 25,000         0.50         \$ 12,500.00           Traffic Signals         EA         \$ 200,000         -         \$ -           Pavement Markings         FT         \$ 5         2,780         \$ 13,898.37           Lighting         LUMP         \$ 120,000         1         \$ 120,000.00           STRUCTURES           Segmental Block Wall         LUMP         -         \$ -           Cast In Place Concrete Wall         LUMP         -         \$ -           Drilled Shaft Concrete Wall         LF         \$ 2,000.00         121         \$ 242,000.00           Precast Box Culvert         EA         \$ 250,000         -         \$ -           12' X 12' Box Culvert Extension         LF         \$ 3,500.00         54         \$ 189,000.00           Extended Culvert Headwall         LUMP         \$ 60,000.00         \$ 60,000.00         \$ 60,000.00         \$ 1271,635           Wooster Road Bridge Modifications         LUMP         \$ 585,400.00         1         \$ 271,635           Wooster Road Bridge Modification         LUMP         \$ 585,400.00         1         \$ 30,000.00           Mobilization         LUMP         \$ 100,000.00         1         \$ 100,000.00	Sanitary Sewer Relocation	FT	\$	300	-	\$	-
Signs, Ground Mounted         MILE         \$ 25,000         0.50         \$ 12,500.00           Traffic Signals         EA         \$ 200,000         -         \$ -           Pavement Markings         FT         \$ 5         2,780         \$ 13,898.37           Lighting         LUMP         \$ 120,000         1         \$ 120,000.00           STRUCTURES           Segmental Block Wall         LUMP         -         \$ -           Cast In Place Concrete Wall         LUMP         -         \$ -           Drilled Shaft Concrete Wall         LF         \$ 2,000.00         121         \$ 242,000.00           Precast Box Culvert         EA         \$ 250,000         -         \$ -           12' X 12' Box Culvert Extension         LF         \$ 3,500.00         54         \$ 189,000.00           Extended Culvert Headwall         LUMP         \$ 60,000.00         \$ 60,000.00         \$ 60,000.00         \$ 1271,635           Wooster Road Bridge Modifications         LUMP         \$ 585,400.00         1         \$ 271,635           Wooster Road Bridge Modification         LUMP         \$ 585,400.00         1         \$ 30,000.00           Mobilization         LUMP         \$ 100,000.00         1         \$ 100,000.00	TRAFFIC CONTROL						
Traffic Signals         EA         \$ 200,000         -         \$ -           Pavement Markings         FT         \$ 5         2,780         \$ 13,898.37           Lighting         LUMP         \$ 120,000         1         \$ 120,000.00           STRUCTURES           Segmental Block Wall         LUMP         -         \$ -           Cast In Place Concrete Wall         LUMP         -         -           Drilled Shaft Concrete Wall         LF         \$ 2,000.00         121         \$ 242,000.00           Precast Box Culvert         EA         \$ 250,000         -         \$ -         -           12' X 12' Box Culvert Extension         LF         \$ 3,500.00         54         \$ 189,000.00         Extended Culvert Headwall         LUMP         \$ 60,000.00         \$ 60,000.00         1         \$ 271,635         \$ 60,000.00         1         \$ 271,635         \$ 60,000.00         1         \$ 271,635         \$ 60,000.00         1         \$ 271,635         \$ 60,000.00         \$ 60,000.00         \$ 60,000.00         \$ 60,000.00         \$ 60,000.00         \$ 60,000.00         \$ 60,000.00         \$ 60,000.00         \$ 60,000.00         \$ 60,000.00         \$ 60,000.00         \$ 60,000.00         \$ 60,000.00         \$ 60,000.00		NAIL E	φ.	25.000	0.50	Φ.	10 500 00
Pavement Markings					0.50		12,500.00
LUMP   \$ 120,000			_	,	2 780	,	13 808 37
STRUCTURES   Segmental Block Wall							
Cast In Place Concrete Wall	gg		┢	0,000		<b>–</b>	,,,,,,,,
Cast In Place Concrete Wall	STRUCTURES						
Drilled Shaft Concrete Wall		LUMP				\$	
Precast Box Culvert	Cast In Place Concrete Wall	LUMP			-		
12' X 12' Box Culvert Extension         LF         \$ 3,500.00         54         \$ 189,000.00           Extended Culvert Headwall         LUMP         \$ 60,000.00           Railroad Bridge Modifications         LUMP         \$ 271,635.00         1         \$ 271,635           Wooster Road Bridge Modification         LUMP         \$ 585,400.00         1         \$ 585,400           INCIDENTALS           Field Office         MONTH         \$ 2,500.00         12         \$ 30,000.00           Mobilization         LUMP         \$ 100,000.00         1         \$ 100,000.00           Construction Layout & Stakes         LUMP         0.50%         3,529,626         \$ 17,648.13           Maintaining Traffic         LUMP         30%         3,653,163         \$ 1,095,948.95           Contingency         LUMP         19%         4,749,112         \$ 909,454.97			_		121	_	242,000.00
Extended Culvert Headwall         LUMP         \$ 60,000.00           Railroad Bridge Modifications         LUMP         \$ 271,635.00         1         \$ 271,635           Wooster Road Bridge Modification         LUMP         \$ 585,400.00         1         \$ 585,400           INCIDENTALS           Field Office         MONTH         \$ 2,500.00         12         \$ 30,000.00           Mobilization         LUMP         \$ 100,000.00         1         \$ 100,000.00           Construction Layout & Stakes         LUMP         0.50%         3,529,626         \$ 17,648.13           Maintaining Traffic         LUMP         3%         3,529,626         \$ 105,888.79           Contingency         LUMP         30%         3,653,163         \$ 1,095,948.95           Inflation Factor         LUMP         19%         4,749,112         \$ 909,454.97					-	_	_
Railroad Bridge Modifications			\$	3,500.00	54	,	
Nooster Road Bridge Modification			_	074 005 05			
INCIDENTALS   Field Office   MONTH   \$ 2,500.00   12   \$ 30,000.00   Mobilization   LUMP   \$ 100,000.00   1   \$ 100,000.00   Construction Layout & Stakes   LUMP   0.50%   3,529,626   \$ 17,648.13   Maintaining Traffic   LUMP   3%   3,529,626   \$ 105,888.79   Contingency   LUMP   30%   3,653,163   \$ 1,095,948.95   Inflation Factor   LUMP   19%   4,749,112   \$ 909,454.97   Construction Layout & LUMP   19%			_			_	·
Field Office         MONTH         \$ 2,500.00         12         \$ 30,000.00           Mobilization         LUMP         \$ 100,000.00         1         \$ 100,000.00           Construction Layout & Stakes         LUMP         0.50%         3,529,626         \$ 17,648.13           Maintaining Traffic         LUMP         3%         3,529,626         \$ 105,888.79           Contingency         LUMP         30%         3,653,163         \$ 1,095,948.95           Inflation Factor         LUMP         19%         4,749,112         \$ 909,454.97	wooster Road Bridge Modification	LUMP	<b>5</b>	585,400.00	1	\$	585,400
Field Office         MONTH         \$ 2,500.00         12         \$ 30,000.00           Mobilization         LUMP         \$ 100,000.00         1         \$ 100,000.00           Construction Layout & Stakes         LUMP         0.50%         3,529,626         \$ 17,648.13           Maintaining Traffic         LUMP         3%         3,529,626         \$ 105,888.79           Contingency         LUMP         30%         3,653,163         \$ 1,095,948.95           Inflation Factor         LUMP         19%         4,749,112         \$ 909,454.97			$\vdash$				
Field Office         MONTH         \$ 2,500.00         12         \$ 30,000.00           Mobilization         LUMP         \$ 100,000.00         1         \$ 100,000.00           Construction Layout & Stakes         LUMP         0.50%         3,529,626         \$ 17,648.13           Maintaining Traffic         LUMP         3%         3,529,626         \$ 105,888.79           Contingency         LUMP         30%         3,653,163         \$ 1,095,948.95           Inflation Factor         LUMP         19%         4,749,112         \$ 909,454.97	INCIDENTALS		$\vdash$				
Mobilization         LUMP         \$ 100,000.00         1         \$ 100,000.00           Construction Layout & Stakes         LUMP         0.50%         3,529,626         \$ 17,648.13           Maintaining Traffic         LUMP         3%         3,529,626         \$ 105,888.79           Contingency         LUMP         30%         3,653,163         \$ 1,095,948.95           Inflation Factor         LUMP         19%         4,749,112         \$ 909,454.97		MONTH	\$	2.500.00	12	\$	30 000 00
Construction Layout & Stakes         LUMP         0.50%         3,529,626         \$ 17,648.13           Maintaining Traffic         LUMP         3%         3,529,626         \$ 105,888.79           Contingency         LUMP         30%         3,653,163         \$ 1,095,948.95           Inflation Factor         LUMP         19%         4,749,112         \$ 909,454.97			_			_	
Maintaining Traffic         LUMP         3%         3,529,626         \$ 105,888.79           Contingency         LUMP         30%         3,653,163         \$ 1,095,948.95           Inflation Factor         LUMP         19%         4,749,112         \$ 909,454.97			Ė			_	
Contingency         LUMP         30%         3,653,163         \$ 1,095,948.95           Inflation Factor         LUMP         19%         4,749,112         \$ 909,454.97	Maintaining Traffic					_	
Inflation Factor LUMP 19% 4,749,112 \$ 909,454.97	Contingency						1,095,948.95
TOTAL \$ 5.658.567.07	Inflation Factor	LUMP		19%			909,454.97
1 T	TOTAL				\$		5,658,567.07

Excavation	Cos	t Estimate	•	
Clearning & Grubbing	PRICE			
Clearning & Grubbing				
Clearning & Grubbing		QTY		COST
Excavation	20,000	5.98	\$	119,560.41
Embankment	25.00	10,328	\$	258,210.63
Seeding & Mulching	25.00	5,499	\$	137,484.82
Fence, Misc.: Wood	5.00	19,735	\$	98,673.67
5'- 7' Sidewalk         SF         \$           10' or 12' Shared Use Path         SY         \$           Concrete Barrier, Type D         FT         \$           Curb         FT         \$           Curb Ramp         SF         \$           4" Concrete Traffic Island         SY         \$           Subgrade Stabilization         SY         \$           DRAINAGE & EROSION CONTROL           Underdrains         FT         \$           Culvert Type A, <5'	35.00	-	\$	-
10' or 12' Shared Use Path	75.00	1,407	\$	105,525.00
Concrete Barrier, Type D Curb Curb FT \$ SF \$ 4" Concrete Traffic Island SY \$ Subgrade Stabilization SY \$ Subgrade Stabilization SY \$ Subgrade Stabilization FT \$ Culvert Type A, <5' FT \$ Culvert Type D, 12" FT \$ Culvert Type D, 12" FT \$ Colsed Storm System FT \$ Frosion Control Post Construction Stormwater BMPs LUMP  PAVEMENT Pavement, Mainline Pavement, Salvage SY \$  UTILITIES Electric Transmission Line Relocation FT \$ Sanitary Sewer Relocation FT \$ San	8.00	-	\$	-
Curb Ramp SF \$ 4" Concrete Traffic Island SY \$ Subgrade Stabilization SY \$  DRAINAGE & EROSION CONTROL  Underdrains FT \$ Culvert Type A, <5' FT \$ Culvert Type D, 12" FT \$ Closed Storm System FT \$ Erosion Control FT \$ Erosion Control FT \$ Pavement, Mainline SY \$ Pavement, Salvage SY \$  UTILITIES Electric Transmission Line Relocation FT \$ Electric Distribution Line Relocation FT \$ Sanitary Sewer Relocation FT \$ Sanitary Sewer Relocation FT \$ Signs, Ground Mounted MILE \$ Traffic Signals FA \$ Pavement Markings FT \$ Lighting LUMP  STRUCTURES Segmental Block Wall LUMP  STRUCTURES Segmental Block Wall SF \$ Precast Box Culvert EA \$ Precast Box Culvert EA \$ Precast Box Culvert EA \$ Precast Bord Concrete Wall SF \$ Precast Bord Concrete Wall SF \$ Precast Bord Concrete Wall SF \$ Modify Abandoned RR Bridge over Duck Creek LUMP \$ STRUCTURES Field Office MONTH \$ 2.5 MODITION SIGNATION SIG	70.00	7,364	\$	515,455.40
Curb Ramp 4" Concrete Traffic Island SY \$ Subgrade Stabilization SY \$  DRAINAGE & EROSION CONTROL Underdrains Culvert Type A, <5' FT \$ Culvert Type D, 12" FT \$ Closed Storm System FT \$ Erosion Control FT \$ Post Construction Stormwater BMPs LUMP  PAVEMENT Pavement, Mainline SY \$ Pavement, Salvage SY \$  UTILITIES Electric Transmission Line Relocation FT \$ Sanitary Sewer Relocation FT \$ Sany Severent Markings FT \$ Lighting LUMP  STRUCTURES Segmental Block Wall LUMP  STRUCTURES Segmental Block Wall LUMP Cast In Place Concrete Wall SF \$ Precast Box Culvert EA \$ Precast Arch Culvert EA \$ Segmental Bridge over Duck Creek LUMP \$ STRUCTURES Field Office MONTH \$ SINCIDENTALS Field Office Mobilization LUMP \$ SINCIDENTALS Field Office Mobilization LUMP \$ 100,10  MONTH \$ 2.5	150.00	-		
4" Concrete Traffic Island Subgrade Stabilization  PRAINAGE & EROSION CONTROL Underdrains Culvert Type A, <5' Culvert Type D, 12" Closed Storm System FT \$ Erosion Control Post Construction Stormwater BMPs  UTILITIES Electric Transmission Line Relocation Electric Distribution Line Relocation FT \$ Sanitary Sewer Relocation FT \$ Sanitary Sewer Relocation FT \$ Signs, Ground Mounted Traffic Signals Pavement Markings Lighting STRUCTURES Segmental Block Wall Cast In Place Concrete Wall Precast Box Culvert FEA \$ Signs, Ground R Bridge over Duck Creek LUMP  INCIDENTALS Field Office MONTH \$ 2,5 MO	22.00	-	\$	-
Subgrade Stabilization  DRAINAGE & EROSION CONTROL  Underdrains  Culvert Type A, <5'  Culvert Type D, 12"  Closed Storm System  FT \$  Erosion Control  Post Construction Stormwater BMPs  LUMP  PAVEMENT  Pavement, Mainline  Pavement, Salvage  SY \$  UTILITIES  Electric Transmission Line Relocation  FT \$  Electric Distribution Line Relocation  FT \$  Sanitary Sewer Relocation  FT \$  TRAFFIC CONTROL  Signs, Ground Mounted  Traffic Signals  Pavement Markings  Lighting  STRUCTURES  Segmental Block Wall  Cast In Place Concrete Wall  Precast Arch Culvert  Modify Abandoned RR Bridge over Duck Creek  LUMP \$ 237,3  LIGHENTALS  Field Office  MONTH \$ 2,5  INCIDENTALS  Field Office  MONTH \$ 2,5  MONTH \$ 100,6  MONTH \$ 2,5  MONTH \$ 100,6  MONT	8.00	316	\$	2,525.50
DRAINAGE & EROSION CONTROL  Underdrains  Culvert Type A, <5' Culvert Type D, 12" FT \$  Closed Storm System FT \$  Erosion Control FT \$  Post Construction Stormwater BMPs  LUMP  PAVEMENT  Pavement, Mainline Pavement, Salvage SY \$  UTILITIES  Electric Transmission Line Relocation FT \$  Electric Distribution Line Relocation FT \$  Water Line Relocation FT \$  Sanitary Sewer Relocation FT \$  TRAFFIC CONTROL  Signs, Ground Mounted Traffic Signals FT \$  Lighting  LUMP  STRUCTURES  Segmental Block Wall Precast In Place Concrete Wall Precast Arch Culvert Precast Arch Culvert Modify Abandoned RR Bridge over Duck Creek LUMP \$ 237,3  LIGHTOR STRUCTURES  INCIDENTALS  Field Office MONTH \$ 2,5  MONTH \$ 100,6  MONTH \$ 2,5  MONTH \$ 100,6	120.00	-	\$	-
Underdrains Culvert Type A, <5' Culvert Type D, 12" Closed Storm System FT \$ Erosion Control Fost Construction Stormwater BMPs  PAVEMENT Pavement, Mainline Pavement, Salvage SY \$  UTILITIES Electric Transmission Line Relocation Electric Distribution Line Relocation FT \$ Sanitary Sewer Relocation FT \$ Signs, Ground Mounted Traffic Signals FT \$ Lighting  STRUCTURES  Segmental Block Wall Cast In Place Concrete Wall Precast Box Culvert EA \$ 20 Precast Box Culvert Modify Abandoned RR Bridge over Duck Creek LUMP  INCIDENTALS Field Office MoNTH \$ 2,5 MONTH \$ 100,0 MONTH \$ 2,5 MONTH \$ 100,0 MONTH	45.00	-	\$	-
Underdrains Culvert Type A, <5' Culvert Type D, 12" Closed Storm System FT \$ Erosion Control Fost Construction Stormwater BMPs  PAVEMENT Pavement, Mainline Pavement, Salvage SY \$  UTILITIES Electric Transmission Line Relocation Electric Distribution Line Relocation FT \$ Sanitary Sewer Relocation FT \$ Signs, Ground Mounted Traffic Signals FT \$ Lighting  STRUCTURES Segmental Block Wall Cast In Place Concrete Wall Precast Box Culvert Modify Abandoned RR Bridge over Duck Creek INCIDENTALS Field Office Mobilization FT \$ STRUCTURES FILING INCIDENTALS Field Office MoNTH \$ 2,5 MONTH				
Culvert Type A, <5'	15.00		·	
Culvert Type D, 12"         FT         \$           Closed Storm System         FT         \$           Erosion Control         FT         \$           Post Construction Stormwater BMPs         LUMP           PAVEMENT           Pavement, Mainline         SY         \$           Pavement, Salvage         SY         \$           UTILITIES           Electric Transmission Line Relocation         FT         \$           Electric Distribution Line Relocation         FT         \$           Water Line Relocation         FT         \$           Sanitary Sewer Relocation         FT         \$           TRAFFIC CONTROL           Signs, Ground Mounted         MILE         \$           Traffic Signals         EA         \$           Pavement Markings         FT         \$           Lighting         LUMP           STRUCTURES           Segmental Block Wall         LUMP           Cast In Place Concrete Wall         SF         \$           Precast Box Culvert         EA         \$           Precast Arch Culvert         EA         \$           Modify Abandoned RR Bridge over Duck Creek         LUMP	15.00	-	\$	-
Closed Storm System Erosion Control Post Construction Stormwater BMPs  PAVEMENT Pavement, Mainline Pavement, Salvage  UTILITIES Electric Transmission Line Relocation Electric Distribution Line Relocation FT \$ Sanitary Sewer Relocation FT \$ Sanitary Sewer Relocation FT \$ Signs, Ground Mounted Traffic Signals EA \$ 20 Favement Markings Lighting  STRUCTURES Segmental Block Wall Cast In Place Concrete Wall Precast Arch Culvert Modify Abandoned RR Bridge over Duck Creek LUMP \$ 237,6 Concrete Slab Bridge over Duck Creek LUMP \$ 52 INCIDENTALS Field Office MONTH \$ 2,5 Mobilization  FT \$	200	-	\$	-
Erosion Control FT \$ Post Construction Stormwater BMPs LUMP  PAVEMENT Pavement, Mainline SY \$ Pavement, Salvage SY \$  UTILITIES Electric Transmission Line Relocation FT \$ Electric Distribution Line Relocation FT \$ Water Line Relocation FT \$ Sanitary Sewer Relocation FT \$  TRAFFIC CONTROL Signs, Ground Mounted MILE \$ Traffic Signals EA \$ Pavement Markings FT \$ Lighting LUMP  STRUCTURES Segmental Block Wall LUMP  Cast In Place Concrete Wall SF \$ Precast Box Culvert EA \$ Precast Arch Culvert EA \$ Modify Abandoned RR Bridge over Duck Creek LUMP \$ STRUCTURES INCIDENTALS Field Office MONTH \$ 2,5 Mobilization LUMP \$ 100,6  MONTH \$ 2,5 Mobilization LUMP \$ 100,6	100 375		\$	-
Post Construction Stormwater BMPs  Pavement, Mainline Pavement, Salvage  UTILITIES Electric Transmission Line Relocation Electric Distribution Line Relocation FT Sanitary Sewer Relocation FT Sanitary Sewer Relocation FT Signs, Ground Mounted Mille Signs, Ground Mounted Mille Signs, Ground Mounted FT Substituting Signals FT Substituting Sement Markings FT Substituting Sement Markings FT Substituting Semental Block Wall Cast In Place Concrete Wall Precast Box Culvert Precast Box Culvert Frecast Arch Culvert Modify Abandoned RR Bridge over Duck Creek LUMP Signs, Ground Mounted LUMP Signs, Ground Mounted Signs, Ground Mounted Signs, Ground Mounted Mille Signs, Ground Mounted Mille Signs, Ground Mounted Signs, Ground Moun		- E E D E	\$	110 500 00
PAVEMENT Pavement, Mainline Pavement, Salvage  UTILITIES Electric Transmission Line Relocation Electric Distribution Line Relocation FT Sanitary Sewer Relocation FT Sanitary Sewer Relocation FT Signs, Ground Mounted Traffic Signals FA EaA Favement Markings Lighting  STRUCTURES Segmental Block Wall Cast In Place Concrete Wall Precast Box Culvert Precast Box Culvert Modify Abandoned RR Bridge over Duck Creek LUMP  INCIDENTALS Field Office MONTH S 2,5 Mobilization  SY	20 3%	5,525	\$	110,500.00 71,034.22
Pavement, Mainline Pavement, Salvage  UTILITIES  Electric Transmission Line Relocation FI \$ Electric Distribution Line Relocation FT \$ Water Line Relocation FT \$ Sanitary Sewer Relocation FT \$  TRAFFIC CONTROL  Signs, Ground Mounted MILE \$ 2 Pavement Markings FT \$ Lighting  STRUCTURES  Segmental Block Wall Cast In Place Concrete Wall Precast Box Culvert Fecast Arch Culvert Modify Abandoned RR Bridge over Duck Creek LUMP \$ 237, Concrete Slab Bridge over Duck Creek LUMP \$ 52 INCIDENTALS  Field Office MONTH \$ 2,5 Mobilization LUMP \$ 100,6	370		φ	11,034.22
Pavement, Mainline Pavement, Salvage  UTILITIES  Electric Transmission Line Relocation FI \$ Electric Distribution Line Relocation FT \$ Water Line Relocation FT \$ Sanitary Sewer Relocation FT \$  TRAFFIC CONTROL  Signs, Ground Mounted MILE \$ 2 Pavement Markings FT \$ Lighting  STRUCTURES  Segmental Block Wall Cast In Place Concrete Wall Precast Box Culvert Fecast Arch Culvert Modify Abandoned RR Bridge over Duck Creek LUMP \$ 237, Concrete Slab Bridge over Duck Creek LUMP \$ 52 INCIDENTALS  Field Office MONTH \$ 2,5 Mobilization LUMP \$ 100,6				
Pavement, Salvage  UTILITIES  Electric Transmission Line Relocation FI \$ Electric Distribution Line Relocation FT \$ Water Line Relocation FT \$ Sanitary Sewer Relocation FT \$  TRAFFIC CONTROL  Signs, Ground Mounted MILE \$ 2 Traffic Signals FT \$ Lighting LUMP  STRUCTURES  Segmental Block Wall Cast In Place Concrete Wall Precast Box Culvert FEA \$ 29 Precast Arch Culvert Modify Abandoned RR Bridge over Duck Creek LUMP \$ 237,3 Concrete Slab Bridge over Duck Creek LUMP \$ 52 INCIDENTALS  Field Office MONTH \$ 2,5 Mobilization LUMP \$ 100,6	120	_	\$	_
UTILITIES  Electric Transmission Line Relocation FT \$ Electric Distribution Line Relocation FT \$ Water Line Relocation FT \$ Sanitary Sewer Relocation FT \$  TRAFFIC CONTROL  Signs, Ground Mounted MILE \$ 2 Traffic Signals FT \$  Lighting LUMP  STRUCTURES  Segmental Block Wall Cast In Place Concrete Wall Precast Box Culvert Precast Arch Culvert Modify Abandoned RR Bridge over Duck Creek LUMP \$ 237,3 Concrete Slab Bridge over Duck Creek LUMP \$ 52  INCIDENTALS Field Office MONTH \$ 2,5 Mobilization LUMP \$ 100,6	60	_	\$	_
Electric Transmission Line Relocation  Electric Distribution Line Relocation  Water Line Relocation  FT  Sanitary Sewer Relocation  FT  Sanitary Sewer Relocation  FT  Signs, Ground Mounted  Traffic Signals  EA  Pavement Markings  Lighting  STRUCTURES  Segmental Block Wall  Cast In Place Concrete Wall  Precast Box Culvert  Precast Arch Culvert  Modify Abandoned RR Bridge over Duck Creek  LUMP  STRUCTURES  Concrete Slab Bridge over Duck Creek  LUMP  STRUCTURES  Segmental Block Wall  LUMP  SF  SOUNT SAN STRUCTURES  Segmental Block Wall  LUMP  SF  SOUNT SAN SOUNT		-	Ť	
Electric Distribution Line Relocation Water Line Relocation FT Sanitary Sewer Relocation FT  TRAFFIC CONTROL Signs, Ground Mounted MILE Traffic Signals FT Superior Standard FT S		-	\$	-
Water Line Relocation FT \$ Sanitary Sewer Relocation FT \$  TRAFFIC CONTROL  Signs, Ground Mounted MILE \$ 20 Traffic Signals EA \$ 20 Pavement Markings FT \$  Lighting LUMP  STRUCTURES  Segmental Block Wall LUMP  Cast In Place Concrete Wall SF \$ 3 Precast Box Culvert EA \$ 25 Precast Arch Culvert EA \$ 75 Modify Abandoned RR Bridge over Duck Creek LUMP \$ 237,3 Concrete Slab Bridge over Duck Creek LUMP \$ 52  INCIDENTALS  Field Office MONTH \$ 2,5 Mobilization LUMP \$ 100,6	500	-	\$	-
Sanitary Sewer Relocation FT  TRAFFIC CONTROL  Signs, Ground Mounted MILE \$ .20 Traffic Signals EA \$ .20 Pavement Markings FT \$  Lighting LUMP  STRUCTURES  Segmental Block Wall LUMP  Cast In Place Concrete Wall SF \$ .30 Precast Box Culvert EA \$ .20 Precast Arch Culvert EA \$ .20 Modify Abandoned RR Bridge over Duck Creek LUMP \$ .237,3 Concrete Slab Bridge over Duck Creek LUMP \$ .237,3 Concrete Slab Bridge over Duck Creek LUMP \$ .237,3 Concrete Slab Bridge over Duck Creek LUMP \$ .25  INCIDENTALS  Field Office MONTH \$ .2,5 Mobilization LUMP \$ .100,6	100	-	\$	-
TRAFFIC CONTROL  Signs, Ground Mounted  Traffic Signals  Pavement Markings  Lighting  STRUCTURES  Segmental Block Wall  Cast In Place Concrete Wall  Precast Box Culvert  Precast Arch Culvert  Modify Abandoned RR Bridge over Duck Creek  LUMP  INCIDENTALS  Field Office  MONTH \$ 2,5  Mobilization	500	-	\$	-
Signs, Ground Mounted         MILE         \$ 20           Traffic Signals         EA         \$ 20           Pavement Markings         FT         \$           Lighting         LUMP         LUMP           Structures           Segmental Block Wall         LUMP         LUMP           Cast In Place Concrete Wall         SF         \$ 3           Precast Box Culvert         EA         \$ 25           Precast Arch Culvert         EA         \$ 75           Modify Abandoned RR Bridge over Duck Creek         LUMP         \$ 237,3           Concrete Slab Bridge over Duck Creek         LUMP         \$ 52           INCIDENTALS           Field Office         MONTH         \$ 2,5           Mobilization         LUMP         \$ 100,6	300	-	\$	-
Signs, Ground Mounted         MILE         \$ 20           Traffic Signals         EA         \$ 20           Pavement Markings         FT         \$           Lighting         LUMP         LUMP           Structures           Segmental Block Wall         LUMP         LUMP           Cast In Place Concrete Wall         SF         \$ 3           Precast Box Culvert         EA         \$ 25           Precast Arch Culvert         EA         \$ 75           Modify Abandoned RR Bridge over Duck Creek         LUMP         \$ 237,3           Concrete Slab Bridge over Duck Creek         LUMP         \$ 52           INCIDENTALS           Field Office         MONTH         \$ 2,5           Mobilization         LUMP         \$ 100,6		-		
Traffic Signals         EA         \$ 20           Pavement Markings         FT         \$           Lighting         LUMP           STRUCTURES           Segmental Block Wall         LUMP           Cast In Place Concrete Wall         SF         \$ 3           Precast Box Culvert         EA         \$ 25           Precast Arch Culvert         EA         \$ 75           Modify Abandoned RR Bridge over Duck Creek         LUMP         \$ 237,3           Concrete Slab Bridge over Duck Creek         LUMP         \$ 52           INCIDENTALS           Field Office         MONTH         \$ 2,5           Mobilization         LUMP         \$ 100,6				
Pavement Markings	25,000	1	\$	26,425.00
STRUCTURES  Segmental Block Wall Cast In Place Concrete Wall Precast Box Culvert Precast Arch Culvert Modify Abandoned RR Bridge over Duck Creek Concrete Slab Bridge over Duck Creek  INCIDENTALS Field Office MoNTH \$ 2,5	00,000	-	\$	-
STRUCTURES  Segmental Block Wall  Cast In Place Concrete Wall  Precast Box Culvert  Precast Arch Culvert  Modify Abandoned RR Bridge over Duck Creek  Concrete Slab Bridge over Duck Creek  INCIDENTALS  Field Office  MONTH \$ 2,5	5	5,581	\$	27,904.80
Segmental Block Wall Cast In Place Concrete Wall Precast Box Culvert Precast Arch Culvert Modify Abandoned RR Bridge over Duck Creek Concrete Slab Bridge over Duck Creek  INCIDENTALS Field Office MONTH \$ 2,5 Mobilization  LUMP  LUMP  LUMP  LUMP  100,6		-	\$	-
Segmental Block Wall Cast In Place Concrete Wall Precast Box Culvert Precast Arch Culvert Modify Abandoned RR Bridge over Duck Creek Concrete Slab Bridge over Duck Creek  INCIDENTALS Field Office MONTH \$ 2,5 Mobilization  LUMP  LUMP  LUMP  LUMP  100,6		-		
Cast In Place Concrete Wall Precast Box Culvert Precast Arch Culvert  Modify Abandoned RR Bridge over Duck Creek Concrete Slab Bridge over Duck Creek  INCIDENTALS Field Office MoNTH \$ 2,5 Mobilization  SF \$ 3.5 EA \$ 25 EA \$ 75 EA		-	φ.	
Precast Box Culvert EA \$ 25 Precast Arch Culvert EA \$ 75 Modify Abandoned RR Bridge over Duck Creek LUMP \$ 237,3 Concrete Slab Bridge over Duck Creek LUMP \$ 52  INCIDENTALS Field Office MONTH \$ 2,5 Mobilization LUMP \$ 100,6	350.00	- 200	\$	70,000,00
Precast Arch Culvert EA \$ 75  Modify Abandoned RR Bridge over Duck Creek LUMP \$ 237,3  Concrete Slab Bridge over Duck Creek LUMP \$ 52  INCIDENTALS  Field Office MONTH \$ 2,5  Mobilization LUMP \$ 100,0	350.00 50,000	200	\$	70,000.00
Modify Abandoned RR Bridge over Duck Creek  Concrete Slab Bridge over Duck Creek  LUMP \$ 237,7  LUMP \$ 52  INCIDENTALS  Field Office  MONTH \$ 2,5  Mobilization  LUMP \$ 100,0	50,000	<u>-</u>	\$	<del>-</del>
Concrete Slab Bridge over Duck Creek LUMP \$ 52  INCIDENTALS  Field Office MONTH \$ 2,5  Mobilization LUMP \$ 100,0		<u>-</u> 1	\$	237,363.20
INCIDENTALS Field Office MONTH \$ 2,5 Mobilization LUMP \$ 100,0	28,179	<u></u>	\$	528,179.00
Field Office MONTH \$ 2,5 Mobilization LUMP \$ 100,6	20,173	<u>'</u>	\$	-
Field Office MONTH \$ 2,5 Mobilization LUMP \$ 100,6			<del>                                     </del>	
Mobilization LUMP \$ 100,0	500.00	12	\$	30,000.00
	00.00	1	\$	100,000.00
Construction Layout & Stakes LUMP	0.50%	2,438,842	\$	12,194.21
Maintaining Traffic LUMP	3%	2,438,842	_	73,165.25
Contingency	30%	2,524,201	\$	757,260.33
Inflation Factor LUMP	19%	3,281,461	\$	628,399.87
TOTAL		\$		3,909,861.30

Wasson - Armleder A	Alterna	te	3-C Cos	t Estimate	)	
ITEM	UNIT	ι	JNIT PRICE			
				QTY		COST
ROADWAY						
Clearning & Grubbing	ACRE	\$	20,000	5.86	_	117,145
Excavation	CY	\$	25.00 25.00	4,621	\$	115,536.14
Embankment Seeding & Mulching	SY	\$	25.00 5.00	10,013 20,623	\$	250,314.62 103,113.68
Guardrail, Type MGS	FT	\$	35.00	20,023	\$	103,113.00
Fence, Misc.: Wood	FT	\$	75.00	1,230	\$	92,257.50
5'- 7' Sidewalk	SF	\$	8.00	-	\$	-
10' or 12' Shared Use Path	SY	\$	70.00	8,556	\$	598,914.40
Concrete Barrier, Type D	FT	\$	150.00	-	\$	-
Curb	FT	\$	25.00	-	\$	-
Curb Ramp	SF	\$	20.00	184	\$	3,684.22
4" Concrete Traffic Island	SY	\$	120.00	-		-
Subgrade Stabilization	SY	\$	45.00	-		-
				-		
DRAINAGE & EROSION CONTROL		L		-		
Underdrains	FT	\$	15.00	-		-
Culvert Type A, <5'	FT	\$	200	-		-
Culvert Type D, 12"	FT	\$	100	-		-
Closed Storm System	FT	\$	375	- 0.400	Φ.	-
Erosion Control	FT	\$	20	6,400	\$	128,000.00
Post Construction Stormwater BMPs	LUMP		3%		\$	73,664.91
PAVEMENT						
Pavement, Mainline	SY	\$	120	<u> </u>		
Pavement, Salvage	SY	\$	60	_		_
aramam, carrage	<del>  •</del>	Ť		_		
UTILITIES				-		-
Electric Transmission Line Relocation	FT	\$	500	-		-
Electric Distribution Line Relocation	FT	\$	100	200		20,000
Water Line Relocation	FT	\$	500	-		-
Sanitary Sewer Relocation	FT	\$	300	-		-
				-		
TRAFFIC CONTROL		<u> </u>		-		
Signs, Ground Mounted	MILE	\$	25,000	1	\$	30,238.97
Traffic Signals	EA	\$	200,000	-	\$	-
Pavement Markings	FT	\$	5	6,386	\$	31,932.35
Lighting	LUMP			-	\$	<u>-</u>
STRUCTURES				-		
Segmental Block Wall	LUMP	$\vdash$		-		
Cast In Place Concrete Wall	SF	$\vdash$		-		<u> </u>
Precast Box Culvert	EA	\$	250,000	-		-
Precast Arch Culvert	EA	\$	750,000	-		-
Modify Abandoned RR Bridge over Duck Creek	LUMP	\$	237,363.20	1	\$	237,363.20
Concrete Slab Bridge over Duck Creek	LUMP	\$	596,997	1	\$	596,997.00
·			·			
INCIDENTALS		L				
Field Office	MONTH	_	2,500.00	12	\$	30,000.00
Mobilization	LUMP	\$	100,000.00	1	\$	100,000.00
Construction Layout & Stakes	LUMP	<u> </u>	0.50%	2,529,162	\$	12,645.81
Maintaining Traffic	LUMP	<u> </u>	3%	2,529,162	\$	75,874.86
Contingency	LUMP	<u> </u>	30% 19%	2,617,683	\$ 6	785,304.77
Inflation Factor TOTAL	LUMP		19%	3,402,987	\$	651,672.08 <b>4,054,659.41</b>
				\$		A 115A 65Q A1

Wasson - Armleder A	Alterna	te	3-D Cos	t Estimate	)	
ITEM	UNIT	ι	JNIT PRICE			
				QTY		COST
ROADWAY	1005	_	00.000	5.04	_	440.070.00
Clearning & Grubbing	ACRE	\$	20,000	5.91	\$	118,276.39
Excavation Embankment	CY	\$	25.00 25.00	5,340 7,272	\$	133,507.55 181,805.78
Seeding & Mulching	SY	\$	5.00	23,729	\$	118,644.26
Guardrail, Type MGS	FT	\$	35.00	20,720	\$	-
Fence, Misc.: Wood	FT	\$	75.00	1,530	\$	114,750.00
5'- 7' Sidewalk	SF	\$	8.00	-	\$	-
10' or 12' Shared Use Path	SY	\$	70.00	8,583	\$	600,814.67
Concrete Barrier, Type D	FT	\$	150.00		\$	-
Curb	FT	\$	25.00	-	\$	-
Curb Ramp	SF	\$	20.00	184	\$	3,684.22
4" Concrete Traffic Island	SY	\$	120.00	-	\$	-
Subgrade Stabilization	SY	\$	45.00	-	\$	-
DRAINAGE & EROSION CONTROL	+	$\vdash$		-	_	
Underdrains	FT	\$	15.00		\$	
Culvert Type A, <5'	FT	\$	200	_	\$	-
Culvert Type D, 12"	FT	\$	100	_	\$	_
Closed Storm System	FT	\$	375	-	\$	-
Erosion Control	FT	\$	20	6,400	\$	128,000.00
Post Construction Stormwater BMPs	LUMP		3%		\$	78,812.30
				-		
PAVEMENT	0) (	_	100	-	_	
Pavement, Mainline	SY	\$	120	-	\$	-
Pavement, Salvage	SY	\$	60	-	\$	-
UTILITIES					\$	
Electric Transmission Line Relocation	FT	\$	500	-	\$	
Electric Distribution Line Relocation	FT	\$	100	-	\$	-
Water Line Relocation	FT	\$	500	-	\$	-
Sanitary Sewer Relocation	FT	\$	300	-	\$	-
Gas Line Relocation	FT	\$	300	200	\$	60,000.00
				-		
TRAFFIC CONTROL	1 1 1 1		05.000	- ,	_	00.440.44
Signs, Ground Mounted	MILE	\$	25,000	1	\$	30,440.44
Traffic Signals Pavement Markings	EA FT	\$	200,000	- 6,429	\$	32,145.10
Lighting	LUMP	Ψ	5	- 0,429	\$	JZ, 140. IU -
Lighting	LOWIN			-	۳	<u>-</u>
STRUCTURES				-		
Segmental Block Wall	LUMP			ı	\$	-
Sheetpiling Wall	LUMP					
Cast In Place Concrete Wall	LUMP	\$	125.00	445	\$	55,625.00
Precast Box Culvert	EA	\$	250,000	-	\$	-
Precast Arch Culvert	EA	\$	750,000	-	\$	-
Modify Abandoned RR Bridge over Duck Creek Concrete Slab Bridge over Duck Creek	LUMP	\$	237,363.20 682,020.00	1	\$	237,363.20 682,020.00
Concrete Stab Bridge over Duck Creek	LUMP	Ф	682,020.00	ı	Þ	682,020.00
	1					
INCIDENTALS						
Field Office	MONTH	\$	2,500.00	12	\$	30,000.00
Mobilization	LUMP	\$	100,000.00	1	\$	100,000.00
Construction Layout & Stakes	LUMP		0.50%	2,705,889	\$	13,529.44
Maintaining Traffic	LUMP	<u> </u>	3%	2,705,889	\$	81,176.67
Contingency	LUMP		30%	2,800,595	\$	840,178.50
Inflation Factor	LUMP		19%	3,640,774	\$	697,208.13
TOTAL				\$		4,337,981.63

Wasson - Armleder	 Alterna	ite	3-E Cos	t Estimate	<del></del>	
ITEM	UNIT	ı	UNIT PRICE			
BOADWAY	_			QTY		COST
ROADWAY Clearning & Grubbing	ACRE	\$	20,000	5.78	\$	115.672.24
Excavation	CY	\$	25.00	5,078	\$	126,954.97
Embankment	CY	\$	25.00	9,407	\$	235,169.87
Seeding & Mulching	SY	\$	5.00	19,423	\$	97,115.78
Guardrail, Type MGS	FT	\$	22.00	-	\$	-
Fence, Misc.: Wood	FT	\$	75.00	360	\$	27,000.00
5'- 7' Sidewalk	SF	\$	8.00	-	\$	-
10' or 12' Shared Use Path	SY	\$	70.00	8,570	\$	599,866.86
Concrete Barrier, Type D	FT FT	\$	150.00 22.00	-	\$	-
Curb Curb Ramp	SF	\$	8.00	381	\$	3,051.14
4" Concrete Traffic Island	SY	\$	120.00	- 301	\$	
Subgrade Stabilization	SY	\$	45.00	_	\$	_
	<del>                                     </del>	Ť	.0.00	-	Ť	
DRAINAGE & EROSION CONTROL				-		
Underdrains	FT	\$	15.00	-	\$	-
Culvert Type A, <5'	FT	\$	200	-	\$	-
Culvert Type D, 12"	FT	\$	100	-	\$	-
Closed Storm System	FT	\$	375	-	\$	-
Erosion Control Post Construction Stormwater BMPs	FT LUMP	\$	20 3%	6,425	\$	128,500.00
Post Construction Stormwater BMPs	LUMP		3%		\$	102,528.51
PAVEMENT						
Pavement, Mainline	SY	\$	120	_	\$	_
Pavement, Salvage	SY	\$	60	-	\$	-
•				-		
UTILITIES				-	\$	-
Electric Transmission Line Relocation	FT	\$	500	-	\$	-
Electric Distribution Line Relocation	FT	\$	100	-	\$	-
Water Line Relocation	FT	\$	500	-	\$	-
Sanitary Sewer Relocation	FT	\$	300	-	\$	-
TRAFFIC CONTROL	+	$\vdash$		-		
Signs, Ground Mounted	MILE	\$	25,000	1	\$	31,683.52
Traffic Signals	EA	\$	50,000	1	\$	50,000.00
Pavement Markings	FT	\$	5	5,594	\$	27,969.05
Lighting	LUMP			-	\$	-
				-		
STRUCTURES	1,,,,,,	_		-	_	
Segmental Block Wall Cast In Place Concrete Wall	LUMP	φ.	250.00	2.019	\$	1 004 045 00
Precast Box Culvert	SF EA	\$	350.00 250,000	2,918	\$	1,021,215.20
Precast Arch Culvert	EA	\$	750,000	-	\$	<del>-</del>
Modify Abandoned RR Bridge over Duck Creek	LUMP	\$	237,363.20	1	\$	237,363.20
Concrete Slab Bridge over Duck Creek	LUMP	\$	714,555.00	1	\$	714,555.00
		Ė	,	-	Ĺ	,
INCIDENTALS	1,40,17	_	0.500.00	4.5	_	22 222 22
Field Office	MONTH		2,500.00	12	\$	30,000.00
Mobilization Construction Layout & Stakes	LUMP LUMP	\$	100,000.00	3,648,645	\$ \$	100,000.00
Construction Layout & Stakes Maintaining Traffic	LUMP	$\vdash$	0.50% 3%	3,648,645	\$	18,243.23 109,459.36
Contingency	LUMP	$\vdash$	30%	3,648,645	\$	1,132,904.38
Inflation Factor	LUMP	$\vdash$	19%	4,909,252	\$	940,121.82
TOTAL	1 -0////	_	1070	\$	Ψ_	5,849,374.12
IOIAL				Ψ		U,UTU,U14.12

FY 2024-2028	Business	Plan Inflation Calculator:
Not sure if y	ou have the la	test calculator? Click here.
Last Modified: 7/20/2023  Please Enter Values in the Yellow	v Areas Only:	Today's Date: February 28, 2024
Estimation Start Date: Less than or Equal to Today's D (mm/dd/yyyy)	Pate	Enter Construction Mid-Point Date: (cannot exceed 02/28/2049) (mm/dd/yyyy)
<b>2/28/2024</b> Start Date:		1/1/2028 Construction Mid-Point Date:
\$3,000,000.00 Estimated Dollar Amount:	t:	
Estimate Start Date to Cons Inflation - Start to Mid-Poi		_
(compounded growth	rate)	Inflated Dollar Amount:
Business Plan	19.2%	\$3,574,574.05
Estimator's Name:		
County - Route - Section:	HAM-Wasson Way	to Otto Armleder
PID:	113603	
Estimator's Notes:	Feasibility Study Est	timates