Appendix F

Water Resources

APPROVED
Justus McGill
4/21/20

WATERS REPORT
INDIANA DEPARTMENT OF TRANSPORTATION (INDOT)
STATE ROUTE 234 IN MONTGOMERY COUNTY, INDIANA
SMALL STRUCTURE REPLACEMENT
DES. NO.: 1800155
ASSET ID #: CV 234-054-46.50

Prepared by:
Mathew Aldridge
Mathew.Aldridge@burgessniple.com
614-459-7272 ext. 1022
Burgess & Niple Inc.

Completed Date: 4/6/2020

Date of Field Reconnaissance: 10/16/2019

Location:
Section 16, Township 17N, Range 3W
Ladoga, Indiana Quadrangle
Montgomery County, Indiana
HUC 12: 0512 0108 1206 (Little Raccoon Creek-Big Raccoon Creek)
39.915737, -86.752866

1.0 PROJECT DESCRIPTION

The proposed project is located 6.55 miles west of State Route (SR) 75 in Montgomery County, Indiana. The existing structures are triple 24 in. diameter corrugated metal pipes that are 30 ft. in length on a 30° skew. The proposed project will be to replace the structures with a 6 ft. by 3 ft. reinforced concrete box.

2.0 DESKTOP RECONNAISSANCE

The literature review for this report included review of proposed project plans, U.S. Geological Survey (USGS) topographic maps, current aerial photography, National Hydrography Database (NHD), National Wetlands Inventory (NWI) maps, soils maps and soil survey information, Federal Emergency Management Agency (FEMA) flood hazard mapping, and Indiana Department of Environmental Management (IDEM) water quality and use designation information, as applicable. Findings of the literature review are summarized below.

2.1 USGS Topographic Mapping and Aerial Photography

The project location is depicted on the Ladoga, Indiana 7.5-Minute Series USGS topographic quadrangle. Aerial photography was evaluated from imagery obtained from Indiana Map (*https://maps.indiana.edu*).

The study area is approximately 0.517 acres located in a rural setting along State Route (SR) 234 and approximately 2.5 miles east of Ladoga. There are no streams located within the project area depicted on the USGS topographic map. The elevation of the surrounding area is approximately 890 ft. above mean sea level (AMSL). Aerial photography shows the entirety of the area surrounding the study area as active farmland. NHD shows one stream flowing from north to south through the study area.

2.2 Soils

According to the Soil Survey Geographic (SSURGO) Database for Montgomery County, Indiana, the study area does contain soil areas with nationally listed hydric soils.

Two soil units are mapped within the study area. Crosby silt loam, fine loamy subsoil, 0 to 2 percent slopes (CwA) and Treaty silty clay loam, 0 to 1 percent slopes. Both are rated as hydric soils.

Review results for soil mapping and unit descriptions obtained from the NRCS Web Soil Survey *(http://websoilsurvey.nrcs.usda.gov)* are summarized in **Table 1** below.

Table 1
Soil Survey

Soil Name	Map Abbreviation	Hydric Range
Crosby silt loam, fine loamy subsoil, 0 to 2 percent slopes	CwA	1-32%
Treaty silty clay loam, 0 to 1 percent slopes	Ty	66-99%

2.3 National Wetland Inventory (NWI) Information

No stream, wetlands, ponds or other mapped NWI features are depicted in the study area.

One NWI mapped riverine feature is located adjacent to the south of the study area (R4SBC).

NWI map review results obtained from the U.S. Fish & Wildlife Service's Wetlands Mapper application (*https://www.fws.gov/wetlands/Data/Mapper.html*), are summarized in **Table 2** below.

Table 2
NWI Mapped Features

Abbreviation	Classification	Description	Location
R4SBC	Riverine/Intermittent/ Streambed/Seasonally Flooded	Stream	Adjacent to the South of Study Area

2.4 Flood Hazard Mapping

The project location appears on Flood Insurance Rate Map (FIRM) panel 18107C0270C (effective 2/2/2012). It is shown located entirely within Zone X, indicating that it is in an Area of Minimal Flood Hazard.

3.0 FIELD RECONNAISSANCE

The study area was visited by Mathew Aldridge & Matthew Kestner, Environmental Scientists of B&N on October 16, 2019 to observe and document existing conditions, and to identify and evaluate potentially jurisdictional "waters of the U.S." (WOTUS) and other aquatic resources Weather conditions were a high of 62°F and 0.03 inches of precipitation had been recorded in the previous 72 hours. Findings of the field investigation are summarized below.

3.1 Streams

No stream was observed in the study area.

3.2 Wetlands

One data collection point was established in the study area to characterize and delineate potential wetland resources, and adjacent upland communities. Vegetation, hydrology, and soil data were collected at each sample point in accordance with applicable U.S. Army Corps of Engineers (USACE) Regional Supplement delineation protocols (*Midwest Regional Supplement*). Data collection results for each sample plot are discussed below:

Soil Point (SP) 1: SP-1 was taken at the culvert ingress north of SR 234. This soil exhibited hydric soil indicators, Depleted Matrix and Redox Depressions with a 10YR 4/1 matrix and 7.5 YR 4/6 redox features. A restrictive layer of hardpan was discovered 16 inches below ground surface. This point had a dominance of *Carex grayi* and *Setaria faberi*. Hydrophytic vegetation was neither dominant nor prevalent. This point exhibited geomorphic position, drainage patterns, and surface soil cracks, all of which are secondary wetland hydrology indicators. While wetland hydrology and hydric soils were present, this point did not pass wetland vegetation criteria to be classified as a wetland.

Wetland and Data Point characteristics are summarized in **Table 4.**

Table 4
Data Point Summary Table

Data Point	Vegetation	Soils	Hydrology	Wetland
SP 1	No	Yes	Yes	No

3.3 Open Waters

No ponds, lakes, or other open water features were observed in the study area.

3.4 Other Features

No roadside ditches or other linear water features were observed in the study area.

4.0 CONCLUSION

Based on the findings of this investigation, B&N concludes that there are no potentially jurisdictional streams or wetlands located within the study area. No ponds, lakes, ditches or other water features were observed in the study area.

These waterways are likely Waters of the U.S. Every effort should be taken to avoid and minimize impacts to the waterway and wetlands. If impacts are necessary, then mitigation may be required. The INDOT Environmental Services Division should be contacted immediately if impacts will occur. The final determination of jurisdictional waters is ultimately made by the U.S. Army Corps of Engineers. This report is our best judgement based on the guidelines set forth by the Corps.

5.0 ACKNOWLEDGEMENT

The waters determination has been prepared based on the best available information interpreted in the light of the investigator's training, experience, and professional judgement in conformance with the 1987 Corps of Engineers Wetlands Delineation Manual, the appropriate regional supplement, the USACE Jurisdictional Determination Form Instructional Guidebook, and other appropriate agency guidelines

Respectfully,

Mathew Aldridge

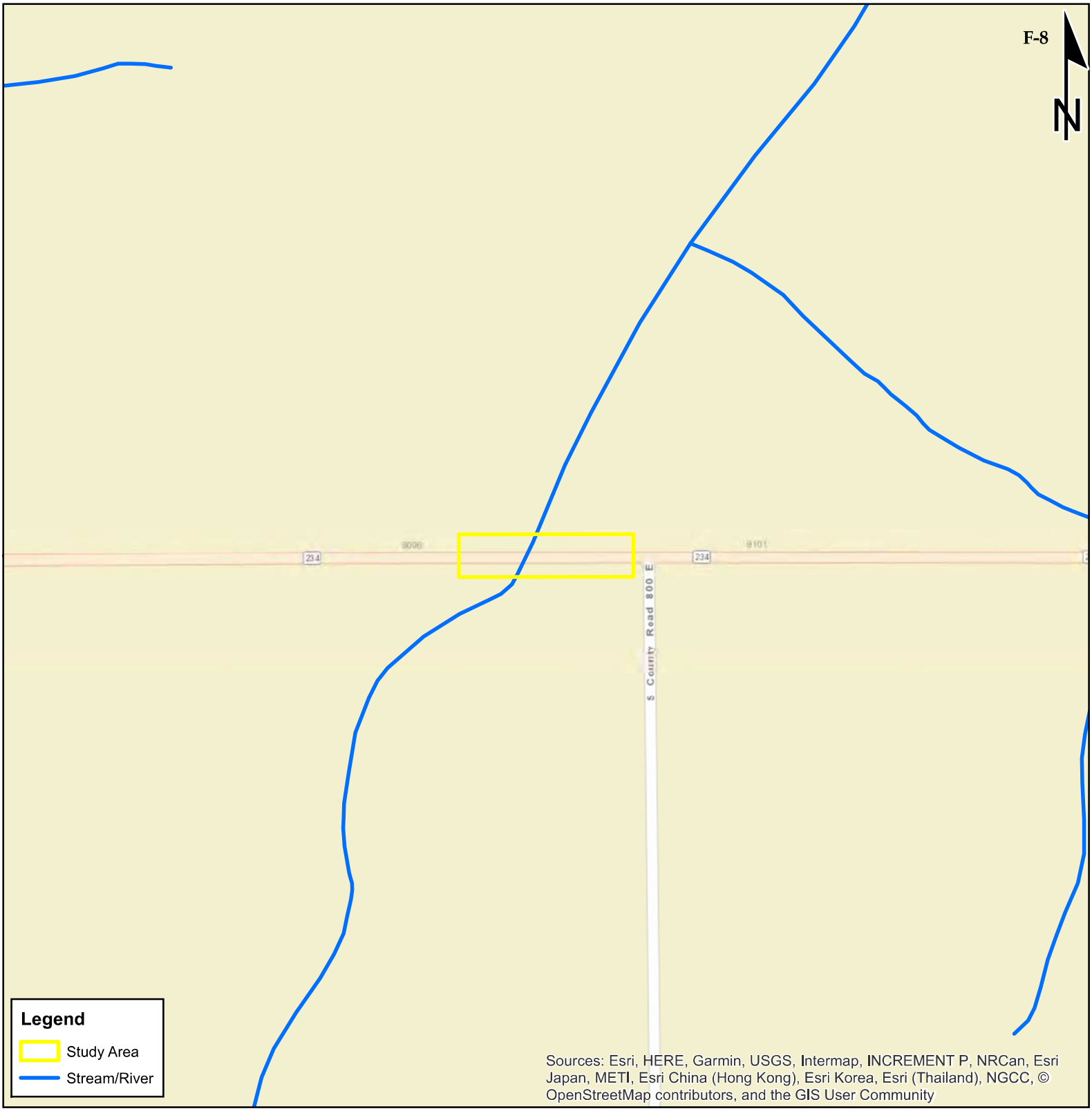
4/6/2020

Environmental Scientist
Burgess & Niple, Inc. / Crawfordsville District

ATTACHMENTS

Attachment 1	Project Location Map
Attachment 2	USGS Topographic Map
Attachment 3	Aerial Map
Attachment 4	National Hydrography Dataset (NHD) Map
Attachment 5	NRCS Hydric Soil Map
Attachment 6	NWI Features Map
Attachment 7	FEMA Flood Hazard Map
Attachment 8	Delineation Map
Attachment 9	Photo Orientation Map & Site Photographs
Attachment 10	Water Resources Data Forms

Highlighted attachments removed to avoid duplication within the CE. Refer to Appendix B for excluded Attachments.



0 125 250 500 Feet

Attachment 4

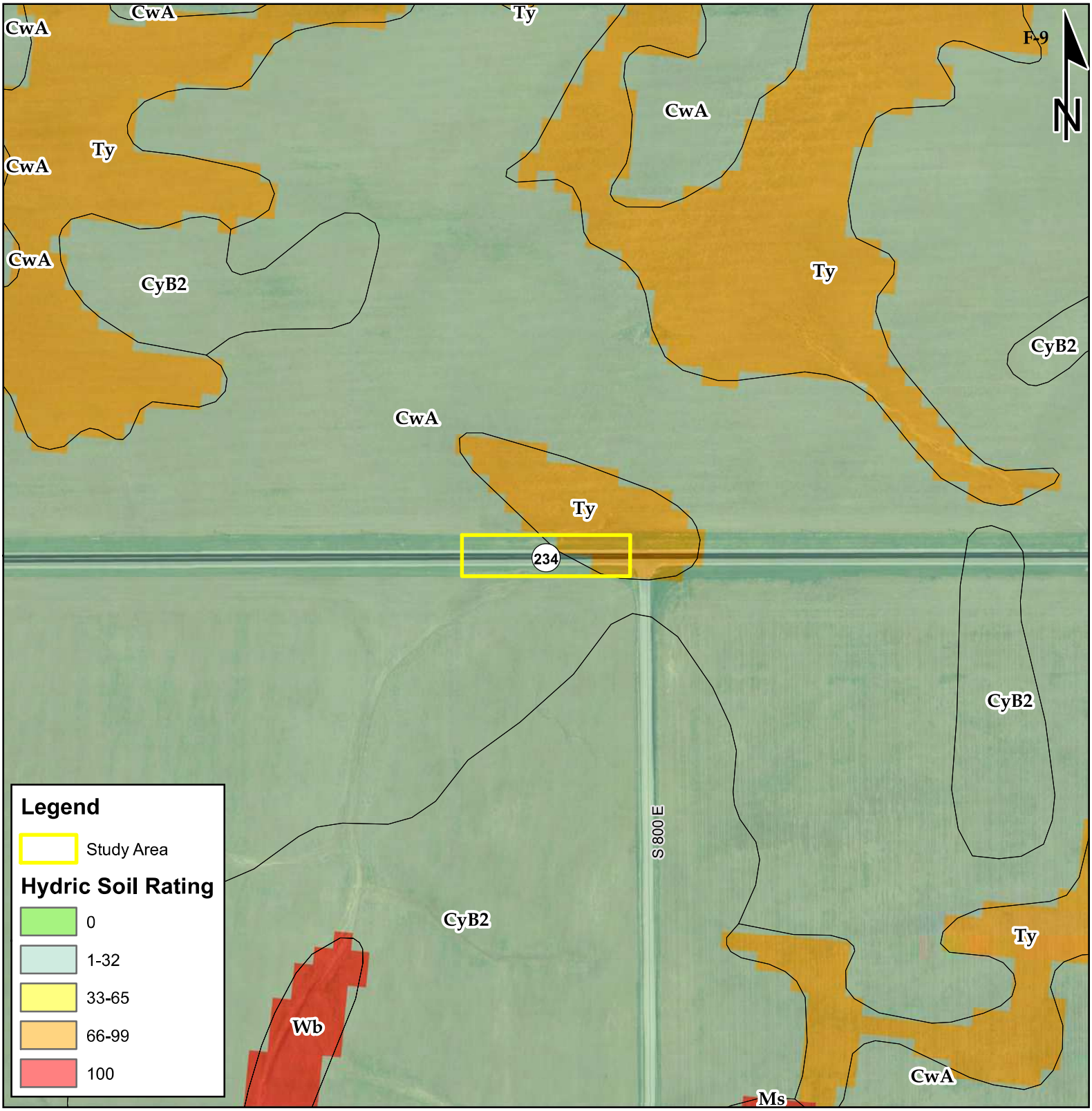
Indiana Dept. of Transportation (INDOT)
SR 234 - Culvert Replacement
Des. No.: 1800155
Montgomery County

NHD Map

Sources:
Non Orthophotography
Data - Obtained from the State of Indiana Geographical Information Office Library
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83

Prepared By: Burgess & Niple

October 2019



0 125 250 500 Feet

Attachment 5

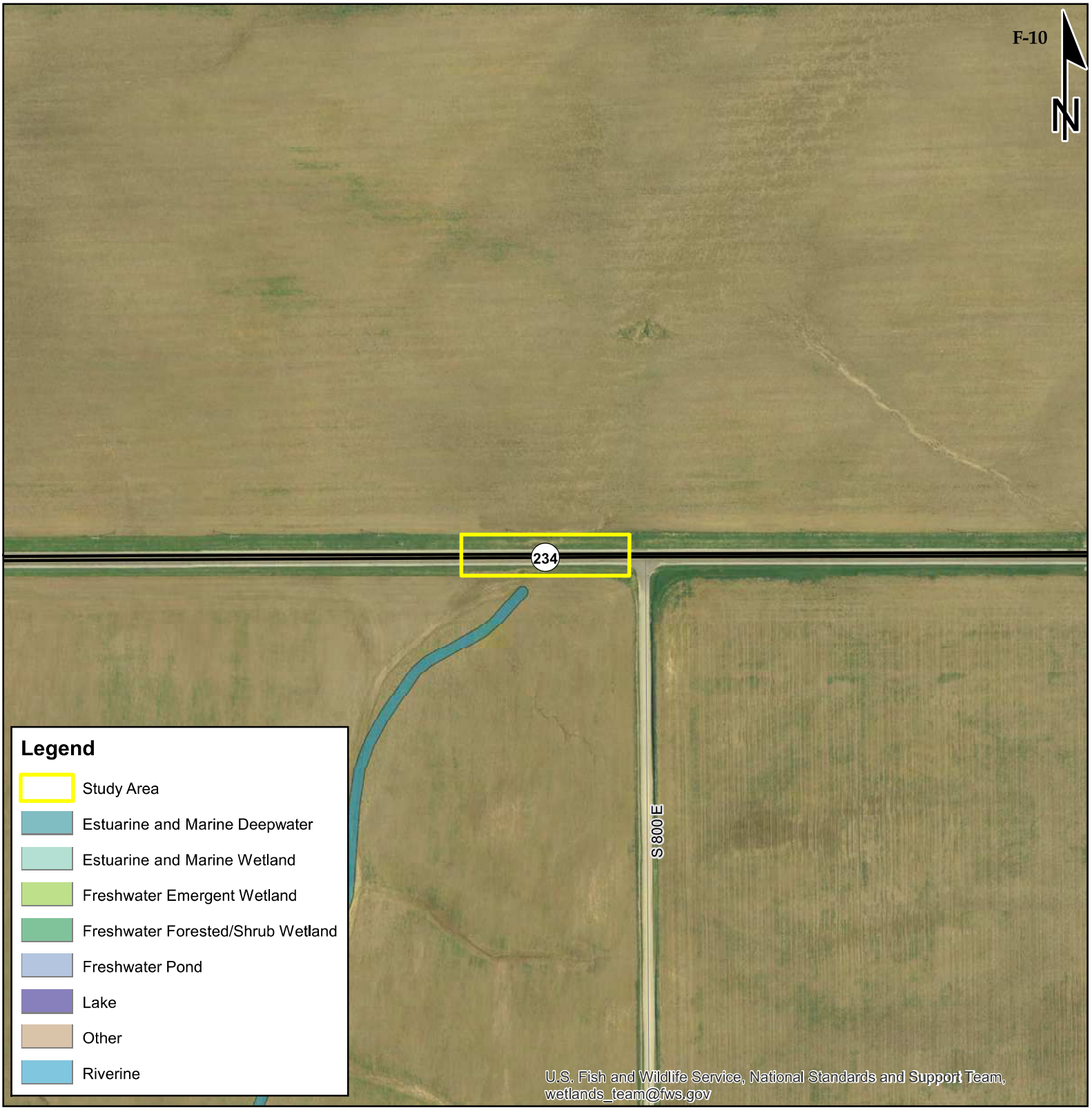
Indiana Dept. of Transportation (INDOT)
SR 234 - Culvert Replacement
Des. No.: 1800155
Montgomery County

NRCS Hydric Soil Map

October 2019

Sources:
Non Orthophotography Data - Obtained from the State of Indiana Geographical Information Office Library
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83

Prepared By: Burgess & Niple



0 125 250 500 Feet

Attachment 6

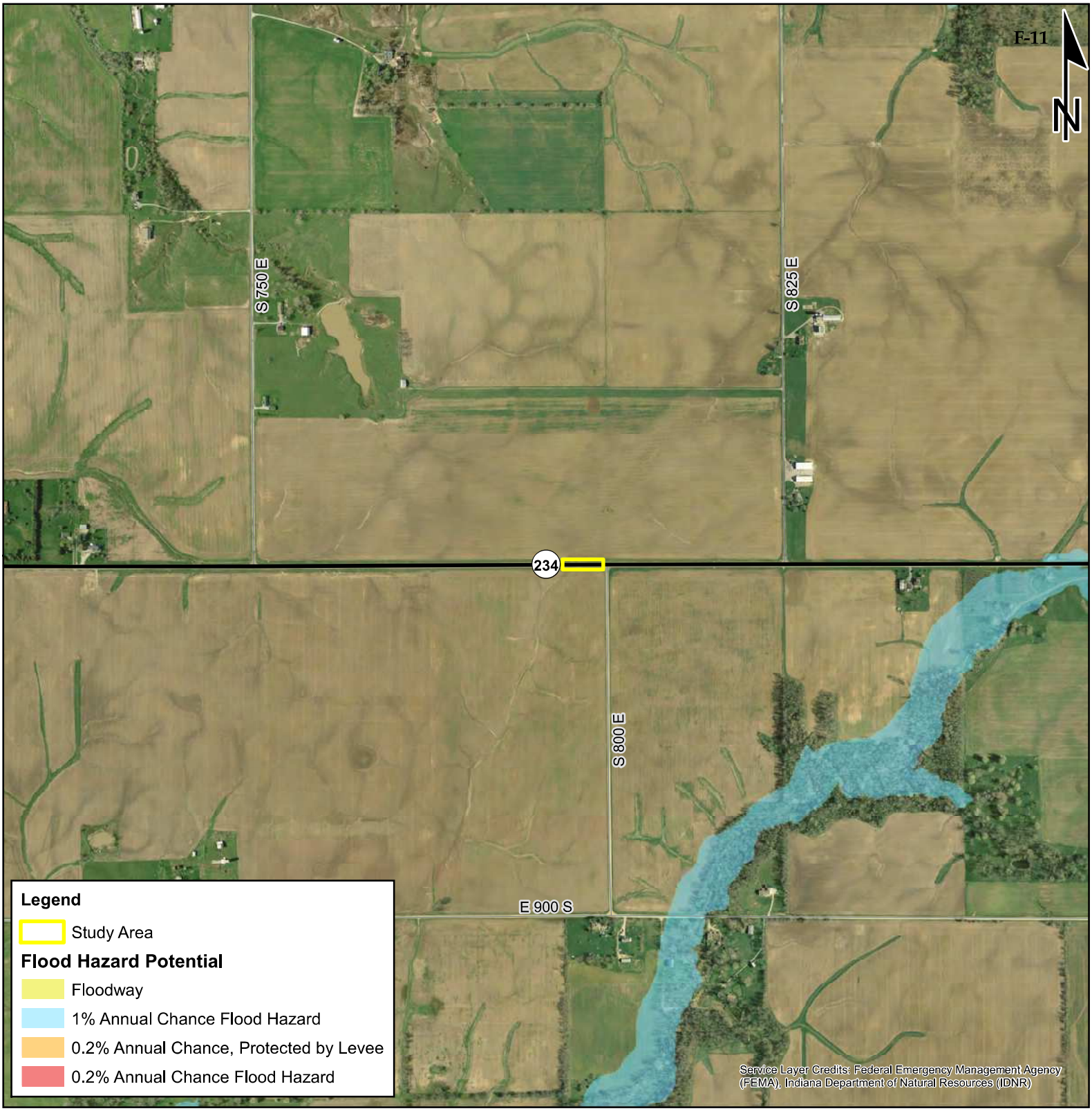
Indiana Dept. of Transportation (INDOT)
S.R. 234 - Culvert Replacement
Des. No.: 1800155
Montgomery County

NWI Map

Sources:
Non Orthophotography
Data - Obtained from the State of Indiana Geographical Information Office Library
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83

Prepared By: Burgess & Niple

October 2019



0 500 1,000 2,000 Feet

Attachment 7

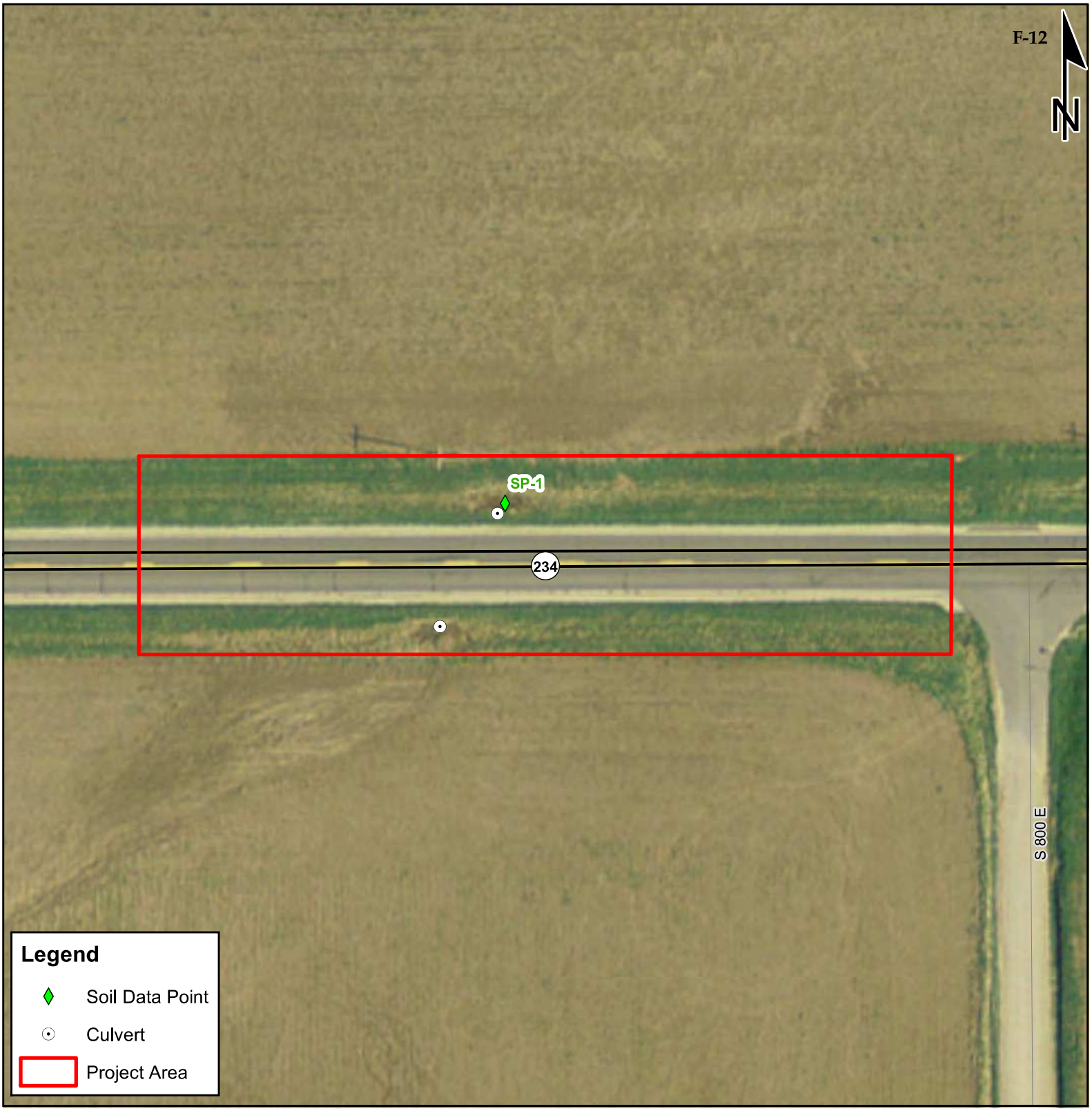
Indiana Dept. of Transportation (INDOT)
SR 234 - Culvert Replacement
Des. No.: 1800155
Montgomery County

FEMA Flood Hazard Map

Sources:
Non Orthophotography
Data - Obtained from the State of Indiana Geographical Information Office Library
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83

Prepared By: Burgess & Niple

October 2019



0 25 50 100 Feet

Attachment 9

Indiana Dept. of Transportation (INDOT)
SR 234 - Culvert Replacement
Des. No.: 1800155
Montgomery County

Delineation Map

Sources:
Non Orthophotography Data - Obtained from the State of Indiana Geographical Information Office Library
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83

Prepared By: Burgess & Niple

October 2019

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Des. No.: 1800155 - SR 234 City/County: Montgomery County Sampling Date: 10/16/2019

Applicant/Owner: Indiana Department of Transportation (INDOT) State: IN Sampling Point: SP 1

Investigator(s): M. Aldridge & M. Kestner Section, Township, Range: S16/T17N/R3W

Landform (hillside, terrace, etc.): Roadside Depression Local relief (concave, convex, none): Concave

Slope (%): 0-2 Lat: 39.915793 Long: -86.752798 Datum: NAD 83

Soil Map Unit Name: Crosby silt loam, fine loamy subsoil (CwA) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation X , Soil ____ , or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____ , Soil ____ , or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:
Soil Point (SP) 1 was taken to the north of SR 234 within a depression adjacent to the culvert.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 15 ft.)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5 ft.)			
1. *Carex grayi*	50	Yes	FACW
2. *Setaria faberi*	50	Yes	FACU
3. *Glechoma hederacea*	10	No	FACU
4. *Digitaria sanguinalis*	5	No	FACU
5.			
6.			
7.			
8.			
9.			
10.			
	115 =Total Cover		
Woody Vine Stratum (Plot size: 5 ft.)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	50	x 2 =	100
FAC species	0	x 3 =	0
FACU species	65	x 4 =	260
UPL species	0	x 5 =	0
Column Totals:	115 (A)		360 (B)

Prevalence Index = B/A = 3.13

Hydrophytic Vegetation Indicators:

____ 1 - Rapid Test for Hydrophytic Vegetation

____ 2 - Dominance Test is >50%

____ 3 - Prevalence Index is ≤3.0[1]

____ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)
Vegetation is regularly mowed

SOIL

Sampling Point: SP 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 4/1	90	7.5YR 4/6	10	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ? Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Hardpan

Depth (inches): 16

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- X Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Hydrology disturbed by the culvert and impoundment caused by the roadway

Appendix G

Public Involvement

Notice of Survey

Date: 7/18/2019

SUBJECT: SR 234 Small Structure Replacement
DES No. 1800155, Montgomery County, Indiana

Dear Property Owner:

CECon, on behalf of Infrastructure Engineering, Inc., will perform a survey for the replacement of the SR 234 Small Structure over Unnamed Tributary to Little Raccoon Creek, Montgomery County, Indiana. This work is associated with Indiana Department of Transportation (INDOT) Des No. 1800155. Our information indicates that you own or occupy property near the above referenced project. Our employees will be performing a survey of the project area in the near future. It may be necessary for them to come onto your property to complete this work. This is permitted by law per Indiana Code IC 8-23-7-26. They will show you their identification, if you are available, before coming onto your property. If you have sold this property, or it is occupied by someone else, please let us know the name and address of the new owner or current occupant so we can contact them about the survey.

At this stage, we generally do not know what effect, if any, our project may eventually have on your property. If we determine later that your property is involved, you will be contacted with additional information.

The survey work will include mapping the location of features such as trees, buildings, fences and drives, and obtaining ground elevations. The survey is needed for the proper planning and design of this project. Please be assured of our sincere desire to cause you as little inconvenience as possible during this survey. If any problems do occur, please contact our field crew or contact me at the telephone number or address shown above for our office. The Infrastructure Engineering, Inc. Project Manager is also available for questions concerning this project. His contact information is as follows:

Nick Bergman, PE
201 South Capitol Avenue, Suite 490
Indianapolis, IN 46225
(317) 243-9800

Sincerely,

Kurt M. Vonderheide

Kurt M. Vonderheide, PS
Senior Survey Project Manager

Owner Name	Owner Address	City, State and Zip Code
BradleyFarms Inc II	6161 E. SR 234	Ladoga, IN 47954-7204
Ellen Louise Smullen GST Exempt Trust c/o Soy Capital Bank & Trust Co ATTN: Farm Department	455 N. Main St.	Decatur, IL 62523-1180

Appendix H

Air Quality

tructure ement	7.28 mi W of SR 75	Crawfordsville	0	STBG	$411,752.00	Bridge ROW	RW	$3,200.00	$800.00			$4
tructure ement	6.55 mi W of SR 75	Crawfordsville	0	STBG	$377,041.00	Bridge ROW	RW	$6,400.00	$1,600.00			$8
Painting	5.77 mi N of I-74, over CSX RR	Crawfordsville	0	STBG	$297,783.00	Bridge Construction	CN	$238,226.40	$59,556.60			
						Bridge Consulting	PE	$16,000.00	$4,000.00	$20,000.00		
$297,783, No MPO												
Painting	0.32 mi N of US 136, over Sugar Creek	Crawfordsville	0	STBG	$1,191,133.00	Bridge Construction	CN	$952,906.40	$238,226.60			
						Bridge Consulting	PE	$96,000.00	$24,000.00	$120,000.00		
,191,133. No MPO												
Thin Deck	3.38 mi E of SR 47, over I-74 EB/WB	Crawfordsville	0	STBG	$269,080.00	Bridge Construction	CN	$215,264.00	$53,816.00			
						Bridge Consulting	PE	$16,000.00	$4,000.00	$20,000.00		
9,080. No MPO												
Thin Deck	3.17 mi S of SR 32, over Offield Creek	Crawfordsville	0	STBG	$176,066.00	Bridge Construction	CN	$124,852.80	$31,213.20			
						Bridge Consulting	PE	$16,000.00	$4,000.00	$20,000.00		
6,066. No MPO												
t. Improv. W/ Turn Lanes	0.93 mi S of US-136, Durham Dr. intersection	Crawfordsville	0	STBG	$688,643.00	Safety Consulting	PE	$52,000.00	$13,000.00			$65
t. Improv. W/ Turn Lanes	0.93 mi S of US-136, Durham Dr. intersection	Crawfordsville	0	STBG	$853,643.00	Safety ROW	RW	$80,000.00	$20,000.00			$100
Maintenance pair	4.52 mi E of I-74, over Muskrat Creek	Crawfordsville	0	STBG	$119,227.00	Bridge Consulting	PE	$12,000.00	$3,000.00	$15,000.00		
						Bridge Construction	CN	$83,381.60	$20,845.40			$104

Appendix I

Additional Studies

Land and Water Conservation Fund (LWCF) County Property List for Indiana (Last Updated July 2020)			
ProjectNumber	SubProjectCode	County	Property
1800133	1800133	Montgomery	Lincoln Activity Area (Lincoln Recreation Center)
1800161	1800161E	Montgomery	Shades State Park
1800171	1800171L	Montgomery	Shades State Park
1800211	1800211	Montgomery	Lake Waveland Park
1800308	1800308	Montgomery	Shades State Park
1800312	1800312N	Montgomery	Shades State Park
1800327	1800327I	Montgomery	Shades State Park
1800363	1800363BB	Montgomery	Shades State Park
1800405	1800405A	Montgomery	Calvert and Porter Woods
1800413	1800413R	Montgomery	Shades State Park
1800456	1800456	Montgomery	Shades State Park
1800480	1800480	Montgomery	Darlington Old School Park

*Park names may have changed. If acquisition of publically owned land or impacts to publically owned land is anticipated, coordination with IDNR, Division of Outdoor Recreation, should occur.

Calculations

Montgomery County Percent Population Below Poverty Level
Income in the past 12 months below poverty level: 3,693
Total Population: 36,581

3,693/36,581 = **10.09%**

Census Tract 9575 Percent Population Below Poverty Level
Income in the past 12 months below poverty level: 438
Total Population: 3,616

438/ 3,616 = **12.11%**

125% of COC: 10.09% x 125% = **12.61%**

12.11% < 12.61%

Montgomery County Percent Minority Population
Total Population White Alone: 37,430
Total Population: 38,276

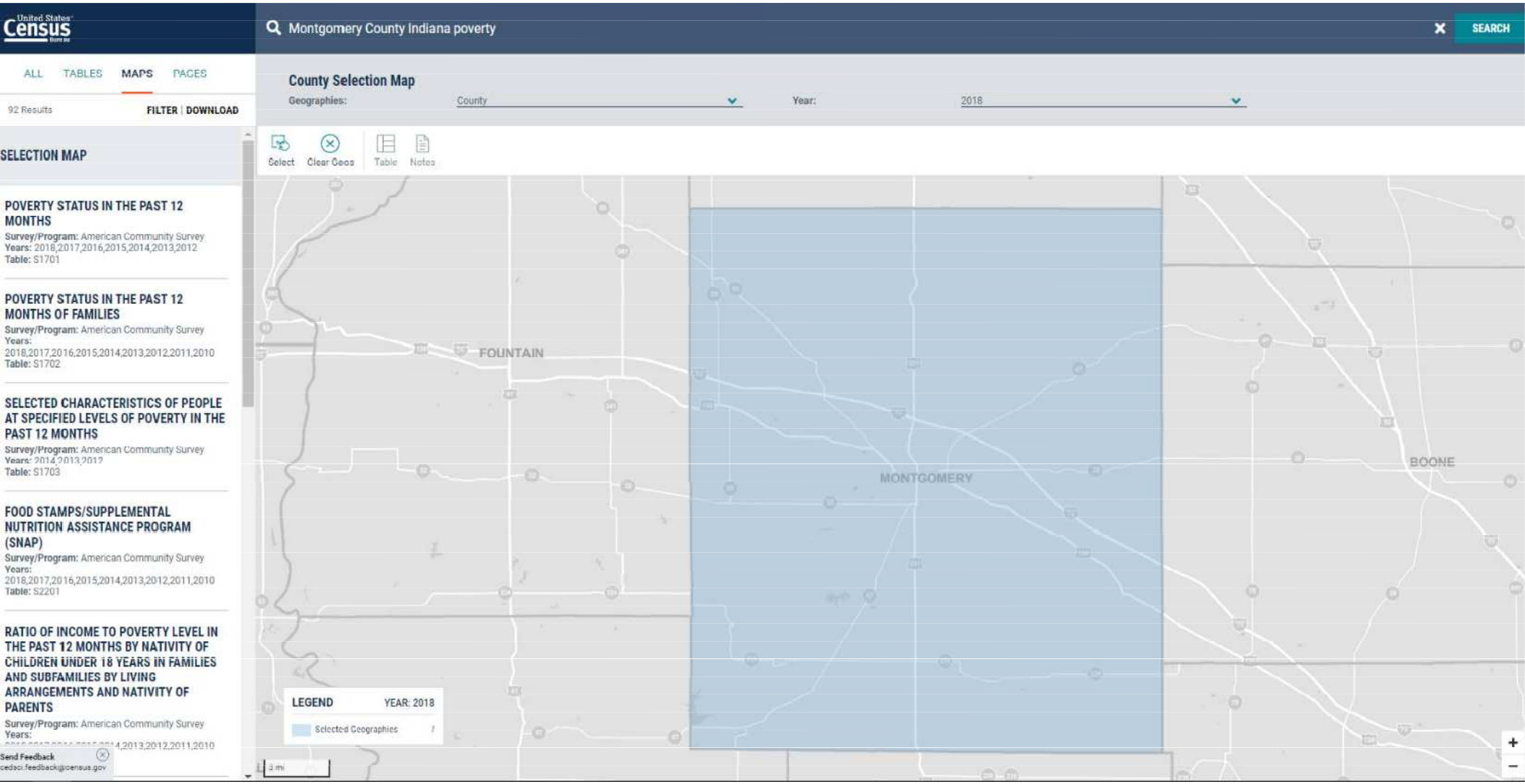
38,276– 37,430 = **846**
846 / 38,276 = **2.21%**

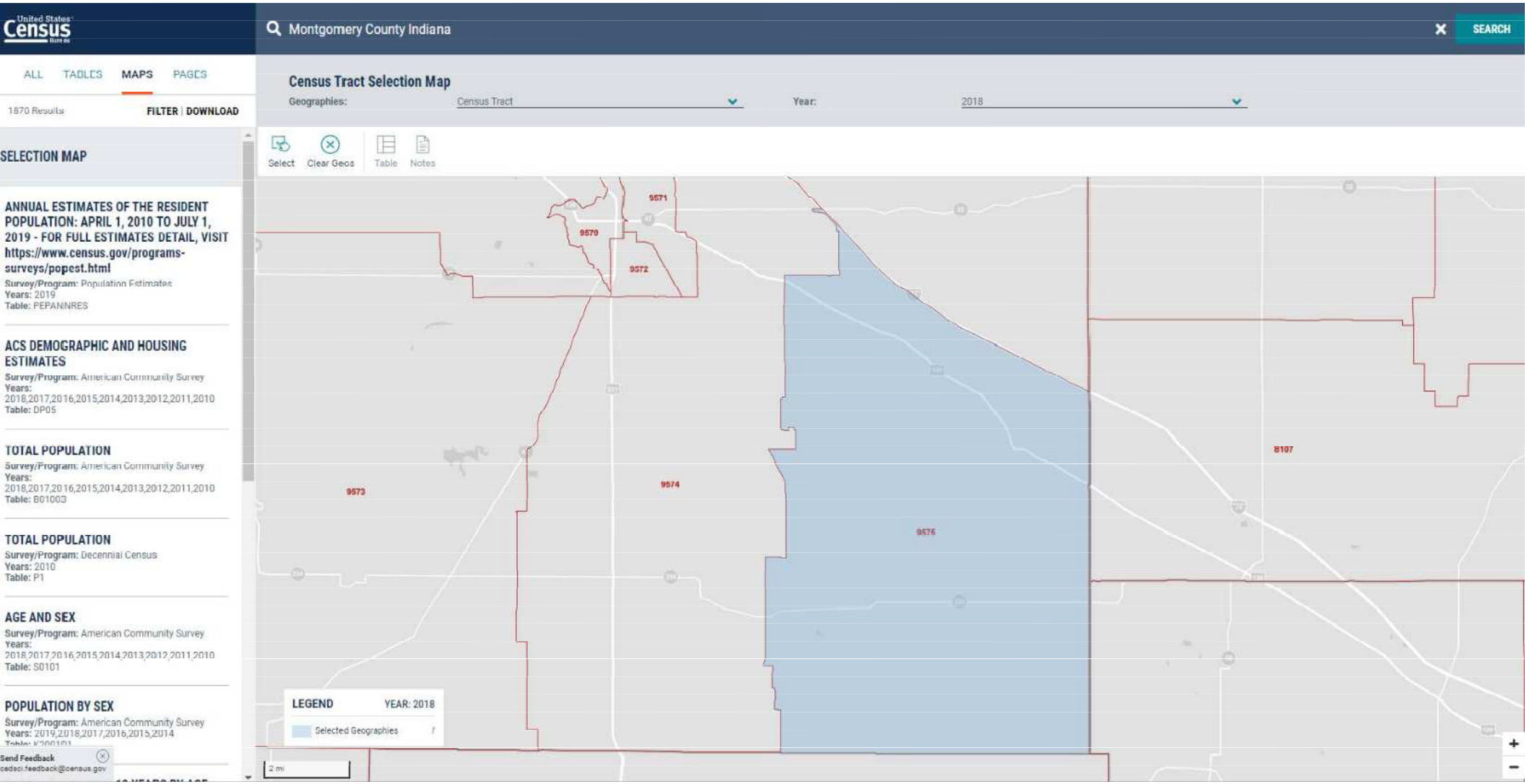
Census Tract 9575 Percent Minority Population
Total Population White Alone: 3,619
Total Population: 3,638

3,638 – 3,619 = **19**
19 / 3,638 = **0.52%**

125% of COC: 2.21% x 125% = **2.76%**

0.52% < 2.76%





Indiana Floodplain Information Portal Report

Point of Interest

Effective Flood Zone:
X
Preliminary Flood Zone:
N/A
Best Available Flood Zone:
X
Approximate Flood Elevation:
863ft NAVD88
Source:
Zone A Model Delineation
Nearest Stream:
LITTLE RACCOON CREEK

Map Legend

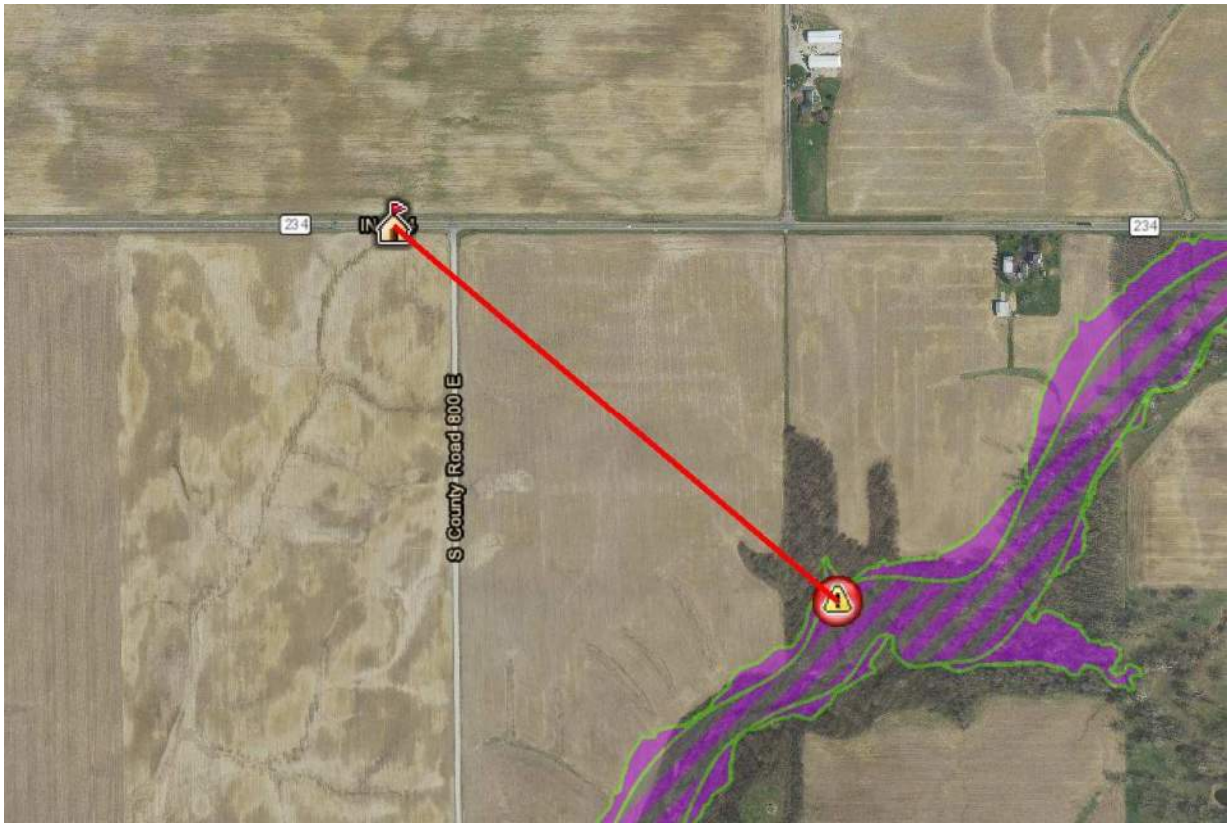
Point of Interest

Nearest Point on Stream

Best Available Flood Zone

- FEMA Zone AE Floodway
- DNR Detailed Floodway
- DNR Approximate Floodway
- FEMA Zone A
- FEMA Zone AE
- DNR Detailed Fringe
- DNR Approximate Fringe
- Additional Floodplain Area
- FEMA Protected by Levee
- FEMA Floodplain - Ponding (Depth)
- FEMA Floodplain - Sheet Flow (Depth)

Site Map with Best Available Flood Zone



Approximate scale 1:12,000

Disclaimer

Generated on Monday December 28th 2020 at 08:32:56am

The data shown on this map represents FEMA floodplain data enhanced with additional studies that have been reviewed and approved by the Division of Water. While this data has not yet been submitted to FEMA for inclusion in the Flood Insurance Rate

Abbreviated Engineer's Report

SR 234 over UNT to Little Raccoon Creek
Small Structure Project

CV 234-054-46.50
Des. No. 1800155

April 2020

Prepared For

Indiana Department of Transportation

TABLE OF CONTENTS

Highlighted appendix removed to reduce size.

PURPOSE OF REPORT

The purpose of this report is to document the engineering assessment phase of project development, including all coordination that has been completed in preparation for this small structure replacement project. This document outlines the proposal and is intended to serve as a guide for subsequent survey, design, environmental, right of way and other project activities leading to construction. The preferred alternative identified in this document is considered pre-decisional, pending the outcome of environmental studies.

PROJECT LOCATION

This project is located on SR 234, 6.55 miles west of SR 75 at reference post 46+50 in Montgomery County within the Indiana Department of Transportation's (INDOT) Crawfordsville District, Crawfordsville Sub-District. The GPS coordinates at the project are 39° 54′ 56.6″ North and 86° 45′ 11.0″ West. The project is located within Section 16 of Township 17 North, Range 3 West in the Ladoga Quadrangle Map. The project is not in a Regional Planning Organization. The project location map is in Appendix A.

PROJECT PURPOSE AND NEED

The existing small structure is exhibiting severe signs of deterioration with a potential for localized failures. The structure does not meet current design standards and is hydraulically undersized to handle the design flow. Therefore, the project need is to address the deteriorated condition of the existing substandard small structure.

The project purpose is to improve the safety, condition, and performance of this crossing.

EXISTING FACILITY

ROADWAY

The existing roadway facility is classified as a major collector. The roadway is not part of the US National Highway System (NHS) nor the National Truck Network. The posted speed limit at the project location is 55 mph. Table 1 shows the roadway information for SR 234.

The existing roadway typical section has two 11.5-foot lanes and 2-foot usable shoulder with no paved shoulders. The side slope from the edge of pavement on either side of the culvert consists of an approximate 4(H):1(V) to 6(H):1(V) slope to the roadside ditch.

Table 1: Roadway Information for SR 234

Geometric Criteria			
Design Speed	55 MPH	***Functional Class***	Major Collector
Design Criteria	3R, Non-Freeway	***Rural/Urban***	Rural
Terrain	Level	***Access Control***	None
Approach Cross Section			
IDM Figure Reference	IDM 55-3B		
Travel Lane Count	2	***Travel Lane Width***	11.5′ (Existing) 11′ (Minimum Req'd.)
Shoulder Width (Usable)	2′ (Existing) 3′ (Minimum Req'd.)	***Shoulder Width (paved)***	0′ (Existing) 2′ (Minimum Req'd.)
Mainline Pavement	HMA	***Shoulder Pavement***	Aggregate (Existing)
Alignment			
Horizontal	Tangent	***Vertical***	Sag Curve

VERTICAL ALIGNMENT

Based on the survey data for this project, the existing sag vertical curve has an approximate incoming grade of -0.90%, an outgoing grade of +1.33%, and a 300-foot curve length. The required curve length for a curve with these grades and speeds is 260 feet, which appears to be met. No design exception is required to retain the existing vertical alignment.

SMALL STRUCTURE

The existing culvert, CV 234-054-46.50, carries SR 234 over an Unnamed Tributary (UNT) to Little Raccoon Creek, which flows generally from northeast to southwest. The existing structure consists of triple 24-inch diameter corrugated metal pipes with a length of 30 feet at a skew of 30° to the roadway. The existing culvert has approximately 2 feet cover. The maximum horizontal opening between the three 24-inch barrels is 8 feet with a maximum vertical opening of 2 feet. The headwall exists at both ends of structure and has spalling with exposed rebar at both ends. The year built is unknown and there are no known rehabilitations to the structure. See Appendix B for site photographs of the small structure.

The small structure was last inspected on May 10, 2019. According to the 2019 Culvert Inspection Report, the culvert has a condition rating of 4 (poor) and is recommended for replacement. There is heavy rusting throughout the structure from the spring line to the invert with portions of invert failure. The headwalls have heavy spalling with exposed rebar at both ends of the structure. The culvert has a channel protection rating of 8 (good). The structure does not have a clearly defined channel on the upstream side and the downstream channel is a farmed swale. The culvert inspection frequency is 12 months. See Appendix C for the 2019 Culvert Inspection Report.

TRAFFIC DATA

Per the Traffic Count Database System (TCDS), INDOT conducted traffic counts approximately 1.1 miles west of the project in May of 2018. INDOT provided traffic forecast information for build year. A growth rate of 0.72% was used to forecast the traffic. Table 2 shows the annual daily traffic (ADT) for the count year (2018), current year (2020), build year (2022), and the design year (2042).

Table 2: Traffic Data

Year	ADT
2018 – Count Year	1,775
2020 – Current Year	1,800
2022 – Build Year	1,826
2042 – Design Year	2,109

From the INDOT traffic forecast report, the design hourly volume (DHV) is 8.73%, the directional split is 49.97%, and the percentage of trucks is 9.01%. The traffic data from the traffic forecast report can be found in Appendix D.

CRASH DATA

Crash data from 2017 to 2020 was analyzed within a half mile of the project location. three crashes were identified in the area. Table 3 shows the location, manner of collision, severity level: fatality, injury, or property damage only (PDO), and any other contributing factors.

Table 3: Crash History

Year	Approximate Location	Manner of Collision	Severity Level	Other Contributing Factors
2018	SR 234E & CR750E	Insecure Load	PDO	Daytime
2018	SR 234E & CR825E	Collision with deer	PDO	Daytime
2019	SR 234E & CR750E	Collision with deer	PDO	Dark (Not Lighted)

The first incident occurred at or near the intersection of SR 234 E and CR 750 E due to an insecure load of gravel on the front vehicle's trailer. Gravel fell from the front vehicle trailer causing damage on rear vehicle. Only minor paint and windshield chipping occurred.

The second collision within the area was with deer during the daytime with clear weather and dry pavement and the third collision was with deer during the night with dry pavement.

Based on the above information, the reported incidents do not appear to be due to the culvert, lack of sight distance provided by the roadway, nor narrow shoulders.

ALTERNATIVES

Per the INDOT provided Hydraulic Design Memorandum dated March 20, 2020, there are two approved options. The first approved option consists of installing a Cured-in-Place-Pipe liner through the existing barrels and adding a Class I Riprap apron for scour protection. The second option includes replacing the existing structure with a 6 ft span by 3 ft rise reinforced concrete box (RCB) sumped 18 inches. The RCB option requires a Class 1 riprap apron at the outlet and a revetment riprap apron at the inlet to protect the structure from scour. See Appendix E for the INDOT Hydraulic Design Memorandum.

It was expressed during the initial field check meeting that the reinforced concrete box without guardrail is preferred, but its selection is contingent on if the construction costs are within the current budget and if the life-cycle analysis shows it to be the most cost-effective solution.

The existing headwall is within the clear zone and represents a safety hazard for vehicles departing the roadway. Due to the safety concerns and the short length of the hazard, providing increased safety through the project area was evaluated as part of this assessment. Extending the length of the replacement culvert to eliminate the need for a headwall and guardrail protection was evaluated.

ALTERNATE NO. 1 – 6' (SPAN) X 3' (RISE) RCB (NO GUARDRAIL)

This alternate uses an 84 feet long 6-foot (span) by 3-foot (rise) reinforced concrete box structure sumped 18 inches. A Class 1 riprap apron at the outlet and a revetment riprap apron at the inlet to protect the structure from scour.

The roadway typical section will remain as existing through the project limits with 2 – 11.5-foot lanes and a 2' usable shoulder. A Level 1 Design Exception required for the shoulder width. The structure will be of sufficient length to have the end of the structure be outside of the clear zone and eliminate the need for protection. The side slopes are proposed to be graded at 4(H):1(V) to tie back into existing ground or ditch. Refer to the Typical Sections in Appendix F.

The traversable sideslope is required to be maintained at least the guardrail runout length of 185 ft in front of the structure. Therefore, the project limits will need to be approximately 188 feet on either side of the centerline of the structure (376' total). However, only approximately 20' of this will be full depth pavement replacement. The remainder of the project limits will be limited to HMA overlay and slope grading. The existing vertical profile provides adequate cover over the structure.

ALTERNATE NO. 2 – 6′ (SPAN) X 3′ (RISE) RCB (GUARDRAIL)

This alternative uses the same structure as Alternate No. 1, but adds guardrail to both sides of SR 234 and shortens the structure length to 64-ft. The sideslope will be graded to a 2(H):1(V) to tie into the existing ground and will be protected by guardrail. The guardrail will be offset 4 ft from the travelway. Shoulders will be paved to front face of the guardrail. No Design Exception will be needed. Refer to the Typical Sections in Appendix F.

The total project limits will be approximately twice the length of the guardrail runout length of 185 ft for the installation of the guardrail. Therefore, the project limits will need to be approximately 188 feet on either side of the centerline of the structure (376′ total). However, only approximately 20′ of this will be full depth pavement replacement. The remainder of the project limits will be limited to HMA overlay and slope grading. The existing vertical profile provides adequate cover over the structure.

ALTERNATE NO. 3 – 1.92′ CIPP LINERS

This alternative will rehabilitate the existing structure using a 1.92′ diameter Cured-In-Place Pipe Liner, installation of a Class I Riprap apron for scour protection, and reconstruct the headwalls.

Since this alternate is considered a Partial 3R project, no other work will be required.

This alternate only addresses the condition of the structure and does not correct the hydraulic and safety deficiencies.

ALTERNATE NO. 4 – NO ACTION

If the structure remains in its existing state, the small structure will continue to deteriorate and could eventually fail creating unsafe roadway conditions and emergency repairs.

MAINTENANCE OF TRAFFIC CONCEPT

This project is not considered a mobility significant project per IDM Section 503-2.02. The following is the temporary traffic control plan concept that shall be used for the project:

A full closure of SR 234 with detour is anticipated for the project due to the type of work for Alternate Number 1 and 2. The proposed detour will utilize US 231, SR 236, and SR 75. The detour length is approximately 23.7 miles with 8.4 miles of additional travel. No local detour has been coordinated for this project. Due to the overall length of the detour and the rural setting, it is anticipated that locals will use county roads as a detour. An unofficial detour will be discussed with INDOT and the local agencies will be involved in the discussion regarding the potential damage to county roads due to the unofficial detour. Access to adjoining properties shall be maintained during construction.

For Alternate No. 3, only flagging operations will be required since all of the work will be off of the roadway.

ENVIRONMENTAL IMPACTS

Per the Indiana Geological & Water Survey, wetlands are not present near the structure. The stream is possibly considered Waters of the U.S. The stream does show up as a blue line on the latest USGS Quad Map.

The total impacts to the stream are anticipated to remain under the 300-foot threshold for both alternates. Therefore, if the stream is determined to be a Waters of the U.S. by the U.S. Army Corps of Engineers, the IDEM 401 and USACE 404 permits will not need to be elevated from the anticipated regional general permits to individual permits.

A Categorical Exclusion (CE) Level 1 was originally anticipated for this project. A CE Level 2 is anticipated for Alternate No. 1 and 2 since 0.5 acres of right of way is anticipated.

PERMITS REQUIRED

There are two anticipated permits required. The USACE 404 – Regional General Permit and the IDEM 401 – Regional General Permit are anticipated. An IDEM Rule 5 Application may be required if the limits of disturbance exceed one acre in the final design. No other permits are anticipated for the project.

RIGHT-OF-WAY IMPACTS

Per the as-built plans, the existing apparent right of way is a constant 30' offset from the roadway centerline to the north and a constant 40' offset from the roadway centerline to the south within the project limits. Parcel data indicates that the southern right of way was a land grant.

However, for this project the existing right of way is assumed to be taken at the existing edge of pavement since the parcel documentation shows that the land grants were not filed in a timely manner (approximately 25 years later).

It is anticipated that approximately 0.5 acres of right of way will be reacquired for this project. Of the right of way being acquired, approximately 0.45 acres will be requiring apparent right of way.

Table 4: Right of Way

Alternate No.	Apparent Right of Way Reacquisition	Permanent Right of Way Acquisition	Temporary Right of Way Acquisition
1	0.45	0.05	0.00
2	0.45	0.05	0.00
3	0.11	0.00	0.17

RAILROAD IMPACTS

There are no railroads in the vicinity of the project, so there are no anticipated impacts to railroads.

UTILITY IMPACTS

Per an 811 Design Ticket, there are two utilities within the area: AT&T - Distribution and Hendricks Power Cooperative. During the site visit, overhead utilities are observed on the north side of the road. The poles are approximately 28 feet off of the existing edge of pavement. Permanent impact or relocation of the overhead utility north of the roadway are subject to final design and the alternate chosen.

The proposed construction may have a temporary impact on the overhead facilities. The crane required for installation may be too close to the overhead lines and would have a high probability of arcing. The overhead electric lines will likely need to be de-energized while the culvert is installed.

SURVEY REQUIREMENTS

The survey requirements include the culvert inlets, edge of roadway, existing headwalls, and topographic features.

INITIAL FIELD CHECK MEETING

The initial field check meeting was held at the project site on July 19, 2019. The meeting minutes can be found in Appendix H.

PRELIMINARY COST ESTIMATE

The preliminary construction cost estimate for each of the alternatives can be found in Table 3. See Appendix F for the quantity calculations, full cost estimate, and the Life Cycle Cost Analysis.

The life cycle cost analysis only includes the cost of guardrail replacement due to damage or safety upgrades. The life cycle cost analysis does not include the pavement resurfacing, pavement replacement, pavement markings, or any other incidentals that would be considered similar for all options. The life of Alternate No. 1 and 2 is 75 years and the life of Alternate No. 3 is 50 years. At 50 years for Alternate No.3, the structure will have to be replaced.

Table 5: Preliminary Cost Estimates for the Alternatives

Alternate No.	Alternative Description	Preliminary Cost Estimate	Preliminary R/W Costs	Life Cycle Additional Costs	Total Initial Cost	Total Life Time Costs
1	Reinforced Concrete Box	$245,000	$5,000	$0	$225,000	$225,000
2	Reinforced Concrete Box with guardrail	$316,000	$5,000	$73,000	$297,000	$365,000
3	CIPP Liner	$99,000	$2,800	$0	$101,800	$101,800

Based on the initial investment at construction and when the Total Life Time Cost are accounted for, Alternate No. 3 is least expensive though it has a shorter design life than the other alternates.

The recommended alternate is Alternate No. 1, the Reinforced Concrete Box without guardrail since this alternate provides the lowest cost in a 75 year period.

PHASE COSTS FOR CN/PE/RR/RW/UT

The current SPMS indicates $120,000 for PE, $10,000 for RW, and $223,561 for CN. The recommended alternate is below the programmed cost in the SPMS.

CONCURRENCE

This document was prepared by:

_____ [Date] 04/27/2020
Nicholas Bergman, P.E.
Project Manager – Infrastructure Engineering, Inc.

Reviewed by:
Asset Engineer Review

Chris Wheeler, P.E. 5/1/2020 [Date]
[Name]
[Title]

Reviewed by:
Scope Manager Review

Michael L. Eubank [Date] 5/6/2020
[Name] Mike Eubank
[Title] District Scoping Manager

Reviewed by:
~~*District Traffic Engineer*~~ System Asset Manager

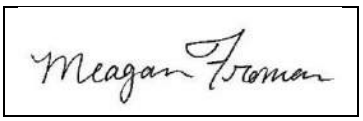
Scott J. Chandler [Date]
[Name] 5-6-2020
[Title

APPENDIX E – INDOT HYDRAULICS APPROVAL LETTERS

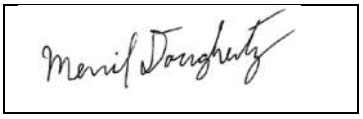
March 20, 2020

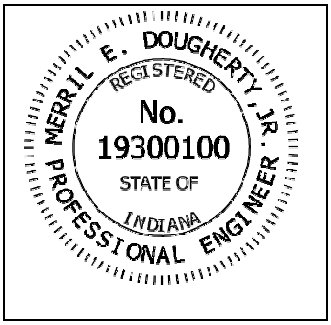
TO: Tamara Montgomery
INDOT Project Manager

FROM: Meagan Froman, E.I.T.
Hydraulics Engineer



THROUGH: Merril Dougherty, P.E.
Hydraulics Engineer





SUBJECT: Hydraulic Review
Des. #: 1800155
Asset Name: CV 234-054-46.50
County: Montgomery
Location: 6.55 miles W of SR 75
Crossing: UNT to Little Raccoon Creek
DNR CIF Permit Required (Y/N): No
Legal Drain (Y/N): No

Site Parameters		
Drainage Area	123.98	acres
Q_{100} Discharge	167.78	cfs
Q_{25} Discharge	132.16	cfs
Q_{100} Water Surface Elevation	97.49	ft.
Design Roadway Serviceability Elevation	100.00	ft.

Parameter	Existing		Proposal 1		Proposal 2	
Structure Size & Type	Triple 2' ID CMP's		Triple 1.92' ID CIPP Liners		8' x 4' RCB with 18" Sump	
Q_{100} Headwater Elevation	100.59	ft.	100.58	ft.	100.31	ft.
Q_{25} Headwater Elevation	100.50	ft.	100.48	ft.	99.83	ft.
Meets Roadway Serviceability @ Q_{25} (Y/N)	No		No		Yes	
Backwater	3.10	ft.	3.09	ft.	2.82	ft.
Assumed Flowline Elevation	95.79 ft.					
Sump Depth	0	in.	0	in.	18	in.

ID = inside pipe diameter

Existing Conditions and Analysis

The existing structure is approximately 48’ long and has a mostly rural watershed of crops with pavement and small residential and industrial areas. Flow through the structure runs north to south, and the downstream channel consists of crops.

Hydrology was performed using the Rational Method, and hydraulic analysis was performed with HY-8 Version 7.2. The tailwater elevation was determined using LiDAR data, and the cross-section was located about 100’ downstream of the existing culvert. The elevations in the table are based on the downstream existing invert and proposed flowline elevation of 95.79 ft. This datum was determined from using field survey and should only be used for hydraulic purposes. The Q_{100} water surface elevation is based on the existing outlet depth.

Review of Proposals

Liners proposals:

Proposal 1: 1.92’ ID CIPP Liners

Replacement proposals:

Proposal 2: 8’ x 4’ RCB with 18” Sump

This replacement proposal may require a grade raise; the designer should ensure cover requirements are met.

Riprap Design Recommendations

Parameter	Proposal 1		Proposal 2	
Q_{25} Outlet Velocity	8.75	ft/s	8.46	ft/s
Minimal Outlet Riprap Size	Class 1		Class 1	
Inlet Riprap Needed (Y/N)	No		Yes	
Q_{25} Natural Channel Velocity	2.07 ft/s			
Minimal Inlet Riprap Size	Revetment			

Class 1 riprap on geotextiles should be used at the outlet and placed according to IDM Figure 203-2J regardless of which proposal is selected. Revetment riprap should also be placed at the inlet according to IDM Figure 203-2J if Proposal 2 is selected. There was no evidence of scour observed at the inlet during the site visit, but if Proposal 1 is selected and the designer determines a need for inlet protection, revetment riprap or larger may be used.

Alternative scour protection designs should be submitted to the INDOT Office of Hydraulics for review and approval.

If you have any questions or comments, please contact me at (317) 233-7755 or MFroman@indot.IN.gov.

Culvert Inspection Report

CV 234-054-46.50

SR 234
over

Inspection Date: 05/12/2020

Inspected By: Daniel W. Bewley

Inspection Type(s): Culvert

TABLE OF CONTENTS

Inspector: Daniel W. Bewley
Asset Name: CV 234-054-46.50
Inspection Date: 05/12/2020
Facility Carried: SR 234

Culvert Inspection Report

Latitude: 39.91573

Longitude: -86.75280

Executive Summary

5/12/2020. Culvert is in overall poor condition. SPMS shows Des# 1800155, Contract# R-41588, Letting Date 9/14/2022, Work Type Replacement & Project Status Active

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

The structure is in poor overall condition. This structure is programmed for replacement in 2020 (Matt Ference, 05-10-2019).

Structure Number: *CV 234-054-46.50* **Inspector:** Bewley,Daniel W.

Large Culvert Inspection Report

(8) Asset Code:	*93000817*	(27) Year Built:	*0000*
Asset Name:	*CV 234-054-46.50*	(90) Inspection Date:	*05/12/2020*
OLD Culvert ID:	*234-54-46.50*	(91) Inspection Frequency:	*12*
Team Assignment:	*01*	☐ Additional Treatment Exists	

Identification

(2) Highway Agency District:	*01*	(3) County Code:	*054*
Sub District:	*1200*	Ramp ID:	
(42B) Type of Service (Under):	*5*	☐ Adjacent to Roadway	

(7) Facility Carried: *SR 234* (6) Features Intersected:

(9) Location: *6.55 W SR 75* (9.01) Location Additional Description:

(11) Milepoint: *46.50* (16) Latitude: *39.91573* (17) Longitude: *-86.75280*

Classification:

(104) Highway System of the Inventory Route: *0* (26) Functional Classification of Inventory Route: *02*

Geometric Data

Culvert: Kind of Material: *3. Steel* Culvert: Type of Structure: *3. Pipe* Min Est Fill Cover (ft): *1.00*

Culvert: Max. Horizontal Opening (ft.): *9.00* Culvert: Max. Vertical Opening (ft.): *02.00* (34) Skew: *30*

Barrel Length (ft.): *30.00* Original Culvert Shape: *Round*

Measurement Remarks: *From CV Chart*

Structure Additional Description: *Corrugated Metal Pipe 2' x 2' Three pipes*

Openings:

Direction	Opening Latitude	Opening Longitude	Direction	Opening Latitude	Opening Longitude
1.			3.		
2.			4.		

Openings Comments:

☐ **Follow Up Required:**

**If checked, please describe for follow up: *Too small to enter.*

Endangered Species

Bats: seen or heard under structure? * *N*

Birds/swallows/nests seen? Empty nests present? *N*

* If yes, add one photo to the dropdown field

General Condition Ratings

(36A) Bridge Railings:	*N*	(36C) Approach Guardrail:	*N*
(36B) Transitions:	*N*	(36D) Approach Guardrail Ends:	*N*

Culvert:

(62) Culvert - Rating: *4*

(62) Culvert Rating Comments: *There is severe rusting throughout the structure. The head walls have severe spalling with exposed rebar at both ends of the structure. All three pipes have rust holes along the water line. All pipes are still maintaining their shape. No obvious changes since last inspection.*

Deck:

(58) Deck: *N*

(58a) Deck Comments:

Superstructure:

(59) Superstructure: *N*

(59.01) Superstructure Comments:

Substructure:

(60) Substructure: *N*

(60.01) Substructure Comments:

CV-Headwall/Anchor Rating *4*

CV-Wingwalls Rating *N*

Channel:

(61) Channel and Channel Protection: *8*

(61.01) Channel and Channel Protection Comments: *The water flows from the north to the south. The channel is an equalizer between two farm fields and does not have much of a channel.*

Bank Erosion Rating: *7*

Drift/Sediment Rating *7*

Channel Alignment Rating *7*

☐ **Check this box if culvert has OBSTRUCTED flow**

Describe Obstruction:

Overtopping Frequency: *1*

Overtopping Frequency Comments:

Inspector: Daniel W. Bewley
Structure Number: 93000817
Inspection Date: 05/12/2020
Facility Carried: SR 234

Culvert Inspection Report

Pictures

PHOTO 1 Condition

Description Road alignment looking east

PHOTO 2 Condition

Description Road alignment looking west

Inspector: Daniel W. Bewley
Structure Number: 93000817
Inspection Date: 05/12/2020
Facility Carried: SR 234

Culvert Inspection Report

Pictures

PHOTO 3 Condition

Description Pavement condition above culvert

PHOTO 4 Elevation, Condition

Description Profile looking North

Inspector: Daniel W. Bewley
Structure Number: 93000817
Inspection Date: 05/12/2020
Facility Carried: SR 234

Culvert Inspection Report

Pictures

PHOTO 5 Elevation, Condition

Description Profile looking south

PHOTO 6 Condition

Description Looking South through middle pipe showing no bottom

Inspector: Daniel W. Bewley
Structure Number: 93000817
Inspection Date: 05/12/2020
Facility Carried: SR 234

Culvert Inspection Report

Pictures

PHOTO 7 Condition

Description Looking south through west pipe

PHOTO 8 Condition

Description Looking South through East pipe

Inspector: Daniel W. Bewley
Structure Number: 93000817
Inspection Date: 05/12/2020
Facility Carried: SR 234

Culvert Inspection Report

Pictures

PHOTO 9 Condition

Description Looking North through middle pipe showing rusted through areas

PHOTO 10 Condition

Description Looking North through West pipe

Inspector: Daniel W. Bewley
Structure Number: 93000817
Inspection Date: 05/12/2020
Facility Carried: SR 234

Culvert Inspection Report

Pictures

PHOTO 11 Condition

Description Looking North through East pipe

PHOTO 12 Condition

Description Channel alignment on North side of road

Inspector: Daniel W. Bewley
Structure Number: 93000817
Inspection Date: 05/12/2020
Facility Carried: SR 234

Culvert Inspection Report

Pictures

PHOTO 13 Condition

Description Channel alignment on South side of road