Elwood Wilson Drain, E.M. Hare Arm Hydraulic Study

Hamilton County, Indiana

Submitted by: Clark Dietz, Inc.
8900 Keystone Crossing, Suite 900
Indianapolis, IN 46240
317.844.8900

December 2016

Clark Dietz
ENGINEERS

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION 3
1.1 Project Background and Purpose 3
1.2 Data Collection and Review 4
CHAPTER 2 HYDROLOGIC ANALYSIS 6
2.1 Hydrologic Model Development 6
2.2 Watershed Delineation 6
2.3 Subbasin Parameters 6
2.4 Design Storm Events 7
2.5 Existing Model Results 7
2.6 Future Development Analysis 8
2.7 Existing and Future System Problems 9
CHAPTER 3 SOLUTION DEVELOPMENT 11
3.1 Introduction 11
3.2 Drainage Culvert Evaluation 11
3.3 Channel Improvements 13
3.4 Wetland Investigation 15
3.5 Regional Detention Basin Options 17
3.6 Utility Conflicts 18
3.7 Property Access Solutions 18
3.8 Future Development Accessibility 19
3.9 Potential Funding Source 20
3.10 Cost Estimate 20
CHAPTER 4 RECOMMENDATION 21
4.1 Recommendation 21

TABLES

2-1 Subbasin Hydraulic Parameters 7
2-2 Existing Peak Discharges 8
2-3 Developed Peak Discharges with Hamilton County Detention Policy Implemented 9
3-1 Culvert Table 13

FIGURES

1-1 Project Area Map 3
2-1 Discharge Location Map 8
3-1 Mallery Road Culvert 11
3-2 Promise Road Upstream 12
3-3 Promise Road Downstream 12
3-4 Harger Farm Drive 12
3-5 Wetland 1 Realignment 15
3-6 Wetland 2 and 3 Realignment 16
3-7 Wetland 4 Realignment 16
3-8 Potential Regional Detention 17
3-9 Property Access 19

ATTACHMENTS

Attachment 1 Watershed Delineation Map
Attachment 2 Lag Time Calculation
Attachment 3 Rainfall Distribution Table
Attachment 4 HY-8 Output
Attachment 5 Profile Figure
Attachment 6 Capacity Calculations
Attachment 7 Channel Cross Section – Home Depot
Attachment 8 Natural Resource Assessment
Attachment 9 Wetland Map
Attachment 10 Cost Estimate
Attachment 11 Project Alternative

1.0 INTRODUCTION

1.1 Project Background and Purpose

Clark Dietz was retained by the Hamilton County Drainage Board to prepare a hydraulic study for the E.M. Hare Arm of the Elwood Wilson Drain. The E.M. Hare Arm of the Elwood Wilson was originally constructed in 1908. The watershed is located northeast of the intersection of SR 37 and US 32 (Conner Street). The watershed drains approximately 1.05 square miles and discharges into the Elwood Wilson Drain, which flows downstream into Stony Creek. The E.M.Hare Arm is shown in Figure 1-1 with a light blue line. The watershed is outlined in red.

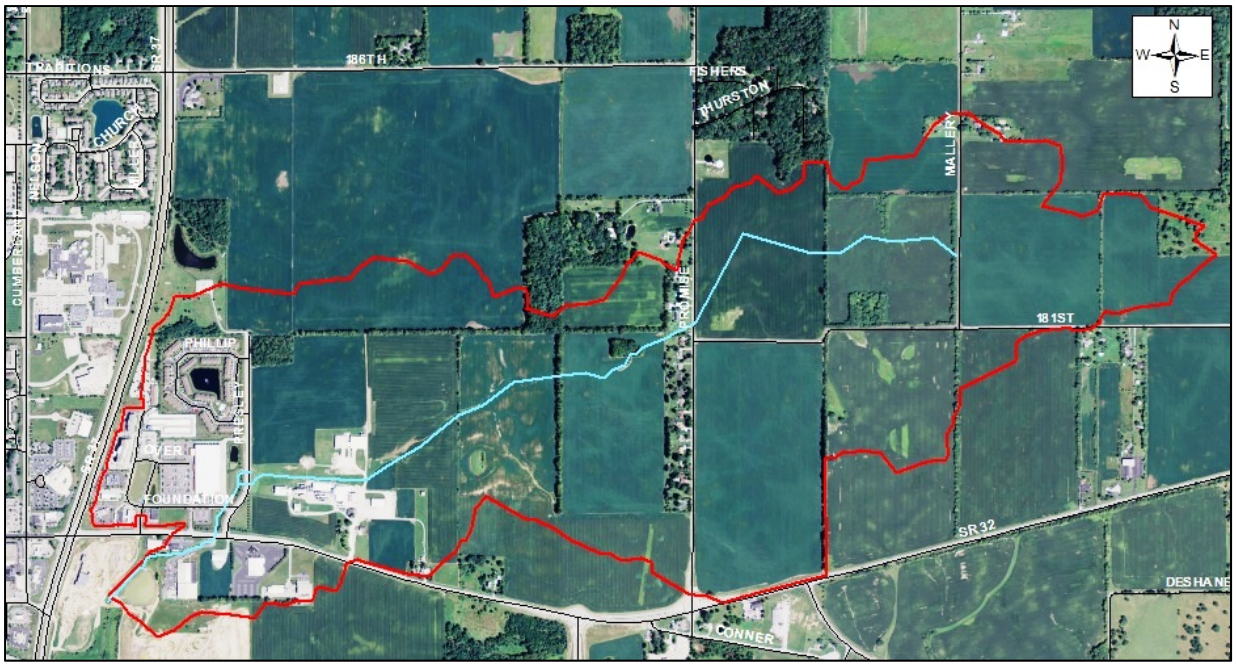


Figure 1-1 – Project Area Map

The downstream portion of the E.M. Hare Arm watershed has several existing developments, including Terry Lee Hyundai, Home Depot, Noblesville Commons shopping area, and several other smaller businesses. The Terry Lee Crossing was a major development that had significant floodplain compensatory storage and drainage issues that were resolved prior to the development.

A roundabout at the intersection of Presley Drive and SR 32 is planned for construction in 2016 and Presley Drive will be extended south to Pleasant Street. At the new SR 32 roundabout, the culvert crossing of the E.M. Hare Arm Drain will be replaced and reconstructed. The culvert has been designed to allow the upstream channel to be lowered by 5 feet to provide a better outlet for future development in the upper watershed.

Deepening the channel will create a challenge immediately downstream of the new Presley Drive /SR 32 roundabout as a building is located directly adjacent to the drain on one side, and a parking lot on the other side.

The upper watershed is currently agricultural but is expected to develop, especially in light of the planned roadway and future sanitary sewer service extensions planned by the City of Noblesville. It will be critical to have an improved

outlet for upstream development, as the current enclosed drain and overland flow path are undersized and/or in poor condition, resulting in roadway overtopping and related flooding. In addition, the culverts at Promise Road and Mallery Road are silted in, damaged, and undersized.

The objectives of this project were to:

- Develop a stormwater runoff model to simulate existing runoff and flooding potential and estimate possible increases in runoff that may be caused by future development.
- Define existing and potential future flooding problems in the watershed.
- Evaluate possible regional detention basins and their effectiveness in controlling future flood peaks. Also review possible multi-use application of regional detention sites.
- Develop a set of solutions to existing and potential future flooding problems under existing and future development conditions. These solutions may include system capacity increases, roadway crossing improvements, surface or underground detention, two stage ditch, cut off channels and/or rerouting runoff to other drainage watersheds.
- Identify wetland areas.
- Obtain public input and incorporate into the study.
- Develop engineering construction plans for the Elwood Wilson Drain, E.M. Hare Arm based on results of the hydraulic study (under future addendum or separate contract).
- Identify financing mechanisms for implementation of needed improvements.

1.2 Data Collection and Review

ESRI Shape Files were downloaded from the Hamilton County Geographic Information System Data Download Server. This included building footprints, regulated drains, soil types, roads, and 1 foot contours. These files were loaded into the program Esri® ArcMap™ 10.1 and used to determine the boundary of the E.M. Hare Arm watershed and the sub-watersheds. Aerial photography was added to identify land use types in the project area. The city of Noblesville provided a map with the location and inverts of the sanitary sewer that crosses the regulated drain on Presley Road. The City of Noblesville's website includes a zoning map that was used to identify the future land use of undeveloped parcels of land.

A field visit was conducted on April 13, 2016. The existing culverts in the system were inspected and photographed. The team walked the length of the E.M. Hare Arm taking notes and recording photographs. Williams Creek Consulting was sub-contracted to perform a wetland investigation of the project area.

Previously conducted plans and studies in the watershed were collected and reviewed. DLZ Indiana, LLC prepared the Elwood Wilson Drainage Basin Study, in December of 2002. The report evaluated the hydrology and hydraulics of the drainage basin and investigated potential detention options. Current regulations are different than when this report was published but a lot of the science in the evaluation is still relevant.

Design reports for the Princeton Lake Apartments were used to verify the hydrology and hydraulics of this development and how it interacts with the watershed as a whole.

Plans for the Home Depot development were obtained and used to evaluate culverts under Presley Drive and an access drive to Home Depot. These plans also provided detailed geometry of the existing channel between Presley Drive and SR 32.

Road Plans were obtained for the INDOT SR 32 & Presley Drive roundabout project. These plans provided the size and location of the new culvert planned under SR 32.

Design plans of SR 37, prepared in 1979, were used to verify the culvert downstream of the E.M. Hare that crosses under the highway. Elevations in these plans were converted from NGVD 29 to NAVD 88 by applying a datum correction of -0.423 feet.

2.0 HYDROLOGIC ANALYSIS

2.1 Hydrologic Model Development

The hydrologic analysis of the watershed was performed using HEC-HMS, version 3.5. HEC-HMS is a computer model developed by the U.S. Army Corp of Engineers capable of simulating runoff from various land uses and soil types, combining subbasin hydrographs, and routing flow.

2.2 Watershed Delineation

The Hamilton County GIS 1-foot interval contour data was used to delineate the overall watershed and subbasins of the E.M Hare Arm. A map with the delineation including the 10 subbasins can be found in Attachment 1. The total watershed area is approximately 1.05 square miles. Subbasins 1 through 8 are primarily agricultural land with a few single family residences. Subbasin 9 is a mix of commercial property and high density residential. Subbasin 10 is located downstream of SR 32 and is a commercial property. The watershed upstream of SR 32 includes an area of just under 1 square mile (0.99 sq mi). Drainage areas less than 1 square mile are not within the jurisdiction of the Indiana Department of Natural Resources (IDNR). The drainage area for the entire basin at the downstream end of subbasin 10 does exceed 1 square mile.

2.3 Subbasin Parameters

Per the Hamilton County Stormwater Management Technical Standards Manual, the runoff rates and contributing drainage areas were determined based on the Natural Resource Conservation Service (NRCS) Technical Release 55 (TR-55) time of concentration and curve number calculation methodologies. Attachment 1 shows the delineation of subbasins, time of concentration paths, and basins labels. Attachment 2 includes the time of concentration and lag time calculation worksheets for each of the subbasins and reaches.

Subbasin curve numbers were determined using the weighted average of curve numbers assigned to individual sub-areas of homogeneous land use and soil types. Existing condition land use was identified with aerial photography through the county's GIS and a site visit. The hydrologic soil types in the area are mainly type B or D. The individual curve numbers for each land use and soil type were selected from tables in SCS TR-55, Urban Hydrology for Small Watersheds, 1986. Subbasin parameters are summarized in Table 2-1.

Table 2-1 – Subbasin Hydrologic Parameters

Subbasin	Area (sq mi)	Lag Time (min)	Curve Number
1	0.120	54.7	76.1
2	0.054	31.9	75.4
3	0.157	40.8	76.5
4	0.051	31.6	75.6
5	0.021	29.5	78.2
6	0.063	42.8	76.1
7	0.202	37.9	76.0
8	0.229	50.0	75.6
9	0.102	18.7	88.8
10	0.052	21.5	93.8

Future development of the watershed was determined using the zoning map available on the City of Noblesville's website. Subbasins 9 and 10 have already been developed and their land use is expected to remain unchanged. Subbasins 1 through 8 currently are agricultural lands which could be developed into single family residences.

2.4 Design Storm Events

Per the Hamilton County Stormwater Management Technical Standards Manual, the entire system has been evaluated for the 100-year flow condition to ensure that all building are properly located outside the 100-year flood boundary and that flow paths are confined to designated areas with sufficient regulated drain easement.

A design storm event is defined by precipitation depth, duration, and the time distribution. Precipitation depths were taken from the Rainfall Frequency Atlas of the Midwest, Bulletin 71. The storm durations ranging between 1 and 24 hours were modeled to determine the controlling storm event at recurrence intervals of 100 and 10 years. The precipitation distribution curve for the storm events was developed using the Huff Curves. The rainfall distribution tables are included in Attachment 3.

2.5 Existing Model Results

The hydrologic model was constructed to simulate the 10 and 100-year storm events. Storm durations of 1, 3, 6, 12, and 24 hours were evaluated to determine the critical storm duration. The 6 hour storm was the critical storm for the E.M. Hare Arm.

The peak discharge was determined at locations along the drain where the subbasins were divided. Table 2-2 below lists the peak discharges along the drain. Figure 2-1 shows the locations where the flows were applied. In the figure the overall watershed is outlined in red, the subbasins are outlined in yellow, and the regulated drain is a light blue line.

Table 2-2 – Existing Peak Discharges

	Mallery Road	Promise Road	Mid Point	Presley Drive	SR 32
Existing Q10 (CFS)	30.2	78.7	158.3	214.0	244.6
Existing Q100 (CFS)	70.4	188.2	388.8	523.3	583.4

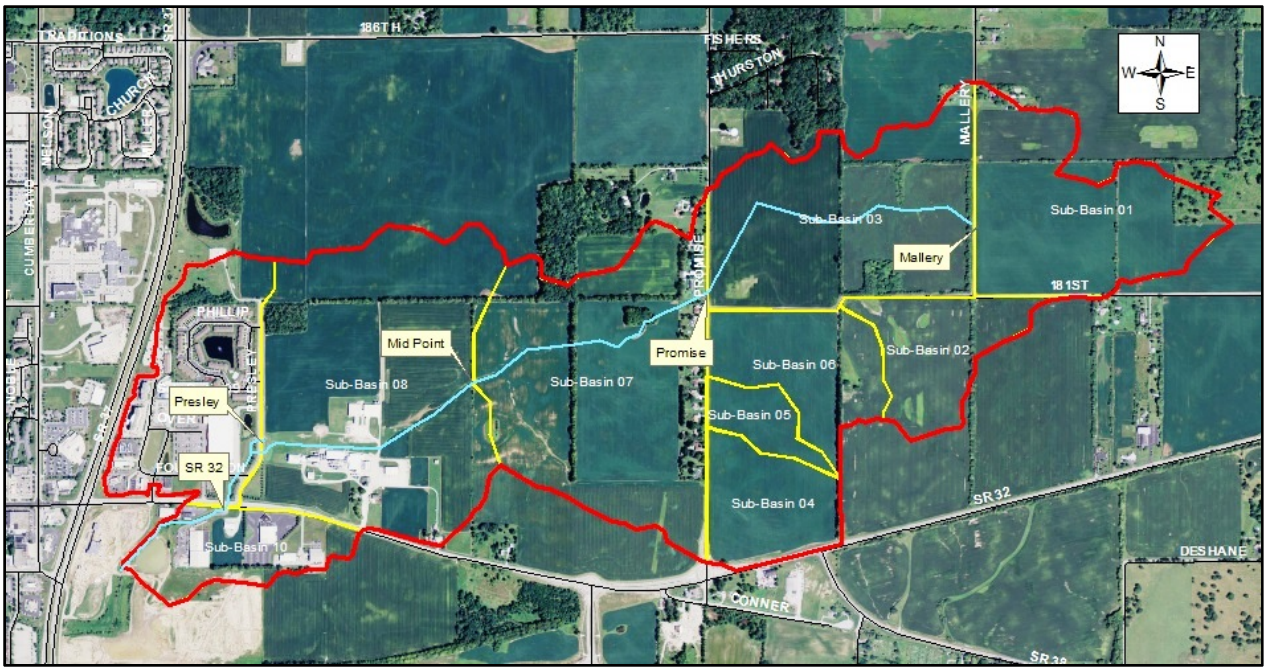


Figure 2-1 – Discharge Location Map

2.6 Future Development Results

Per the Hamilton County Stormwater Management Technical Standards Manual the allowable release rate for a newly developed property is 0.1 cfs per acre for a 10-year storm event and 0.3 cfs per acre for a 100-year storm event. Subbasins 9 and 10 have already been developed and their land use is not anticipated to change in the near future. Subbasins 1 through 8 are currently agricultural land and are zoned such that they could become single family residences in the future. Table 2-3 lists the acreage and allowable release rates for each of the sub sections of the regulated drain identified in Figure 2-1.

Table 2-3 – Post-Development Peak Discharges with Hamilton County Detention Policy Implemented

	Mallery Road	Promise Road	Mid Point	Presley Drive	SR 32
Area (acres)	76.6	34.8	427.6	574.3	639.8
Developed Q10 (CFS)	7.7	21.2	42.8	57.4	64.0
Developed Q100 (CFS)	23.0	63.6	128.3	172.3	191.9

2.7 Existing and Future System Problems

The existing drain from Mallery Road to Presley Drive is the original clay field tile. The size of the tile ranges from 8 inches to 20 inches. The tile was not sized to contain the peak discharge of a 100 year storm event. When the tile reaches its flow capacity the stormwater flows downstream overland. From field observations, the drain is sufficient for agricultural drainage of the adjacent farm field. On the west side of Presley Drive the drain becomes an open channel with culvert structures at Presley Drive, the Home Depot access Drive, and State Route 32.

Following rain events it is common for ponding to occur in several of the fields within the watershed. The property south of 181st Street and west of Mallery Road regularly hold water, as does the property north of 181st Street and east of Promise Road. Additional storage above and beyond the regulatory required stormwater detention should be considered for future development to ensure that the flow detained by these depression areas continues to be detained after development.

An investigation was conducted into locations within the watershed where drainage issues have been reported. Hamilton County's POSSE work order system was reviewed to identify a list of "Roads That Frequently Flood" in the E.M. Hare Arm Watershed. Four drainage investigations were filed in POSSE on Promise Road between SR 32 and 186th street. The investigations included a failed culvert, road overtopping, and ponding in yards.

At the intersection of the E. M. Hare Arm and Mallery Road a 12 inch corrugated pipe crosses under the pavement. The pipe is filled with debris and the ends are bent reducing the effectiveness of the pipe. During large storm events this pipe has insufficient capacity and stormwater overtops the road.

On Promise Road at the intersection with the regulated drain, a surface water culvert passes under the road. Downstream of the culvert the drainage path is not properly graded to flow and ponding occurs at several locations. During a field visit, over 24 hours after a rain event, a 3 foot deep pool was measured next to Promise Road. During large storm events stormwater has been observed to overtop the road at this location. This was the site of a fatal car accident in June of 2015.

In an agricultural field south of 181st Street and about 1700 feet east of Promise Road, water ponds after heavy rains. It is common for these ponding areas to hold water for over 24 hours following a rain.

At Presley Drive the E.M. Hare transitions from a closed tile to an open ditch. Upstream of the road crossing a steep grade change occurs that connects to the open channel. Evidence of heavy erosion was visible at this location and the steep drop is armored with large stone gabions.

The existing path of the E.M. Hare crosses through the Harger Farm property. A drive used by large farm equipment crosses this path and will need to be maintained for access in the final plans for the drain improvements.

Downstream of SR 32 the existing channel has steep side slopes, at some locations close to a 2:1 side slope. Approximately 350 feet downstream of the road crossing, a building is located on the bank of the channel. The building will limit improvements that can be made to the channel at this location. Retaining walls supporting the embankment may be required.

3.0 SOLUTION DEVELOPMENT

3.1 Introduction

In this chapter solutions are evaluated to remedy existing stormwater problems identified as part of this study within the watershed and to accommodate future development. Culvert structures are recommended at locations where the drain intersects road ways. Channel routing improvements are discussed which will improve conveyance. Potential regional detention sites were identified. Conflicts with existing utilities and wetlands are discussed. The accessibility of future development to connect to the drain has been investigated. An estimated cost to complete this work was prepared.

3.2 Drainage Culvert Evaluation

The existing 100 year flow rates and the projected future development flow rates both identify that several of the existing drainage culverts within the watershed are vastly undersized. Inspection of the facilities during storm events has confirmed that stormwater overtops the road at multiple locations.

Drainage culverts for the E.M. Hare Arm were evaluated at Mallery Road, Promise Road, the future access drive on the Harger Farm Property, Presley Drive, the Home Depot access road, and State Route 32. The hydraulic modeling software HY-8 version 7.30, developed by the Federal Highway Administration in 2013, was used to evaluate the culverts.

The culvert at Mallery Road is undersized and has not been maintained to maximize its full capacity. Figure 3-1 shows the vegetative growth that has accumulated around the upstream end of the culvert. Sediment and debris are present in the culvert and a defined channel does not exist upstream or downstream of the culvert.

Figure 3-1 – Mallery Road Culvert

Scour areas on either side of Promise Road are connected by an undersized culvert. These depressions fill with water after rain events and do not have a way to drain. Figures 3-2 and 3-3 show the ponding effect that remains 24 hours after a rain event. A defined channel is needed to help route this water downstream.

Figure 3-2 – Promise Road, Upstream

Figure 3-3 – Promise Road, Downstream

The E.M. Hare Arm crosses an access drive at the Harger Farm in a closed tile. If the tile is replaced with an open channel a culvert will be needed at this location. The Red Line in Figure 3-4 shows the location where this culvert would be located.

Figure 3-4 – Harger Farm Drive

The existing culverts at Presley Drive and the Home Depot drive are 12' x 5' and 12' x 6' box culverts respectively. Both of these culverts have been sized with adequate capacity, for the existing Q100 peak discharge, to prevent road overtopping. The culvert at SR 32 is currently an undersized 5' x 4' box culvert. The INDOT SR 32 project will replace this culvert with a 16' x 10' 3-sided box. The new culvert will have adequate capacity to convey the existing Q100 peak discharge and prevent road overtopping.

The existing and the developed Q100 flow rates for the watershed along with the culvert size corresponding to the flow rates are listed in Table 3-1 for each of the identified crossings. The HY-8 model outputs for each of these culverts are located in Attachment 4.

Table 3-1 – Culvert Table

	Mallery Road	Promise Road	Harger Farm Drive	Presley Drive	Home Depot Drive	SR 32
Existing Q100 (cfs)	70	188	389	523	583	583
Proposed Culvert (Existing Q100)	5' x 2' Box	7' x 4' Box	12' x 5' Box	12' x 5' Box	12' x 6' Box	16' x 10' Box
Developed Q100 (cfs)	23	64	128	172	192	192
Proposed Culvert (Developed Q100)	36" RCP	5' x 3' Box	6' x 4' Box	6' x 4' Box	6' x 4' Box	16' x 10' Box

The time table for full development of the watershed is uncertain. The County anticipates that it will be at least 15 years before this development would be complete. Therefore it is recommended that the culverts along the E.M. Hare Arm be designed for the existing Q100 discharges.

3.3 Channel Improvements

The majority of the land within the E.M. Hare Arm watershed is currently agricultural fields. In anticipation of the future development of this land, conveyance improvements are needed. The existing and future conveyance needs of this watershed can be met by lowering the existing profile of the drain, removing the closed field tile system, and constructing an open channel upstream to Mallery Road. In this section we evaluate the required size, depth, and slope of a trapezoidal channel to fully contain a 100 year storm event. The benefits of a channel are that they are easier to install and maintain and the cost to install is much less than a closed pipe system. Per the Hamilton County Stormwater Technical Standards Manual the side slopes of the channel should be graded at a slope of 3:1. The grassy swale and rip rap lined channels would have a manning roughness coefficient of 0.035. The channel slope will be designed such that the channel velocities stay between a minimum of 2 ft/s and a maximum of 4 ft/s in vegetated swales. A figure comparing the existing profile of the E.M. Hare Arm to the proposed profile is included as Attachment 5. The figure defines the stationing along the alignment, proposed depth changes to the drain, and identifies key crossing locations. The capacity of the channel in each of the channel segments was verified using the Manning's equation. The channel capacity calculations are included as Attachment 6. A detailed explanation of the proposed channel improvements follows.

The new channel will begin on the east side of Mallery Road 4 feet below existing ground. This 4 foot drop in the profile is necessary to accommodate the installation of the proposed 5' x 2' box under the road. The channel will be sloped at a grade of 0.49% between stations 115+00 and 134+00 with a channel bottom width of 4 feet. The channel depth ranges between 3 and 4 feet in this segment. At a 3 foot depth this channel has a flow capacity of 111 cfs which is sufficient to contain the Q100 flow of 70 cfs.

Between Station 102+00 and 115+00 the channel slope flattens out to 0.32% as it approaches Promise Road. The 4 foot channel bottom width is maintained and the depth increases from 4 feet to 6 feet. At a 4 foot depth, this channel has a flow capacity of 174 cfs which is able to contain the Q100 flow of 70 cfs. The channel depth at Promise Road was set at 6 feet deep to ensure the 7' x 4' box culvert under the road would have sufficient cover.

The channel segment downstream of Promise Road between stations 73+90 and 102+00 has a slope of 0.34%. The 4 foot channel bottom width is maintained and the depth ranges from 6 feet to 5 feet. At a 5 foot depth, this channel has a flow capacity of 304 cfs which is able to contain the Q100 flow of 188 cfs.

Between Station 65+00 and 73+90 the channel slope flattens to 0.26%. The 4 foot channel bottom width is maintained and the depth increases from 5 feet to 6 feet. At a 6 foot depth, the channel has a flow capacity of 413 cfs which is able to contain the Q100 flow of 389 cfs.

Between Station 51+50 and 65+00 the channel slope increases to 0.65%. The 4 foot channel bottom width is maintained and the depth is reduced from 6 feet to 5 feet. At a 5 foot depth, this channel has a flow capacity of 421 cfs which is able to contain the Q100 flow of 389 cfs. The channel velocity in this segment reaches 4.4 ft/s which exceeds the allowable limit for a grass swale. This segment will require rip rap or other lining to protect against erosion. The slope could not be flattened in this segment to reduce the velocities because this would result in a deeper channel with a wider trench. A wetland is located adjacent to this segment which must be avoided without shifting the channel outside the limits of the existing regulated drain easement. To satisfy this requirement a maximum trench width of 40 feet must be maintained.

Between Stations 50+50 and 51+50 the profile of the channel will drop 5 feet which is an average slope of 4.00%. A similar rock chute can be found at this location just upstream of Presley Road in the existing channel. Heavy armoring with a drop structure or stone gabions will be required to prevent bank erosion and head cutting. Channel velocities during a 100-year event could reach 11.4 ft/s, at this location.

Stations 42+50 to 50+50 are located between Presley Road and SR 32. The culvert at SR 32 will be replaced with the INDOT road project and the culvert has been designed to lower the channel 5 feet. The entire channel segment between Presley Drive and SR 32 will be lowered 5 feet to match its current slope of 0.30%. The existing channel has side slopes graded at 3:1. The new lower channel will have a bottom width of 5 feet and graded side slopes at 2:1 to meet the existing ground. A cross section of the new channel is included in Attachment 7. The existing culverts at Presley Drive and the Home Depot Drive can be lowered and remain in service.

Between Station 30+00 and 42+50 the channel be lowered 5 feet at SR 32 and transition back to the existing channel profile at the confluence of the Library Arm 1,200 feet downstream at a slope of 0.10%. The existing channel has side slopes as steep as 2:1 in this segment and buildings near the top of the bank that cannot be affected by the improvements. Three potential options for protecting the bank would include sheet pile, H-pile with lagging, and a steeper slope with benching and rip rap.

If sheet pile is used a length of 600 feet on each side of the channel will need to be protected. This would allow for the channel bottom to be lowered without compromising the stability of the existing bank in the vicinity of existing businesses. H-pile and lagging could be used if a more decorative finished product is desired. Aesthetic concrete plates could be set within the H-piles to give the channel a nice finished look. Finally the bank slope could be steepened to a 1:1 slope with benching added. This would require a large amount of rip rap to stabilize the bank. These options will need to be explored in more detail during final design when more detailed survey and geotechnical information are available.

3.4 Wetland Investigation

A Natural Resource Assessment was performed along the E.M. Hare Arm by the subconsultant Williams Creek Consulting to identify wetlands in the project area. Four (4) wetlands were identified, each located at least partially within the regulated drain easement. These areas are considered "Waters of the U.S." and potential impacts would likely be considered subject to regulation by the Indiana Department of Environmental Management (IDEM) and United States Army Corp of Engineers (USACE). Three (3) additional potential wetland areas were identified within the watershed boundary but are far enough away from the drain as to not be disturbed during channel improvements. The complete Natural Resource Assessment is included in Attachment 8 of this report.

Avoiding the wetland areas with the construction activity of the flood control improvements is a priority to avoid a lengthy permitting process, mitigation, and increased project costs. The proposed horizontal alignment of the E. M. Hare Arm has been shifted in the vicinity of the designated wetland areas to avoid them while still remaining within the regulated drain easement. Attachment 9 shows the full alignment with the proposed revisions to the alignment in Orange. The four wetland areas are shown on Attachment 9 and further discussed below.

Wetland 1 is located along the alignment at station 66+00 and has an area of 0.6 acres. The proposed alignment change will divert the channel south of the wetland. At this location the channel has a depth of about 6 feet and a total width of 40 feet. The revised alignment has been offset 55 feet, which is as far from the existing alignment that it can be while remaining within the regulated drain easement. At the proposed channel alignment location, 0.08 acres of wetland will be disturbed during construction. Figure 3-5 shows a zoomed in view of the proposed alignment in relation to the hatched wetland area.

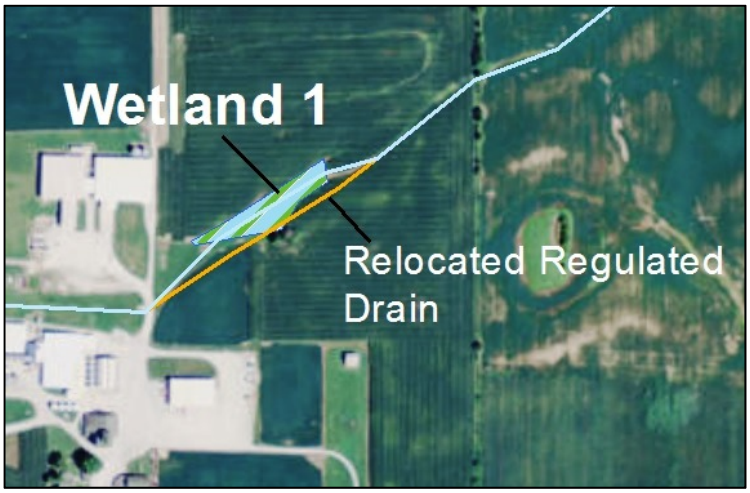


Figure 3-5 – Wetland 1 Realignment

Wetland 2 is located along the alignment at station 92+00 and has an area of 0.2 acres. The proposed alignment change will divert the channel north of the wetland. At this location the channel has a depth of about 6 feet and a total width of 40 feet. The revised alignment has been offset 45 feet. The proposed alignment will avoid the wetland area and keep the channel entirely within the regulated drain easement. Figure 3-6 shows a zoomed in view of the proposed alignment in relation to the hatched wetland area.

Wetland 3 is located along the alignment at station 98+00 and has an area of 0.3 acres. The proposed alignment change will divert the channel south of the wetland. At this location the channel has a depth of about 6 feet and a total width of 40 feet. The revised alignment has been offset 45 feet. The proposed alignment will avoid the wetland area and keep the channel entirely within the regulated drain easement. Figure 3-6 shows a zoomed in view of the proposed alignment in relation to the hatched wetland area.

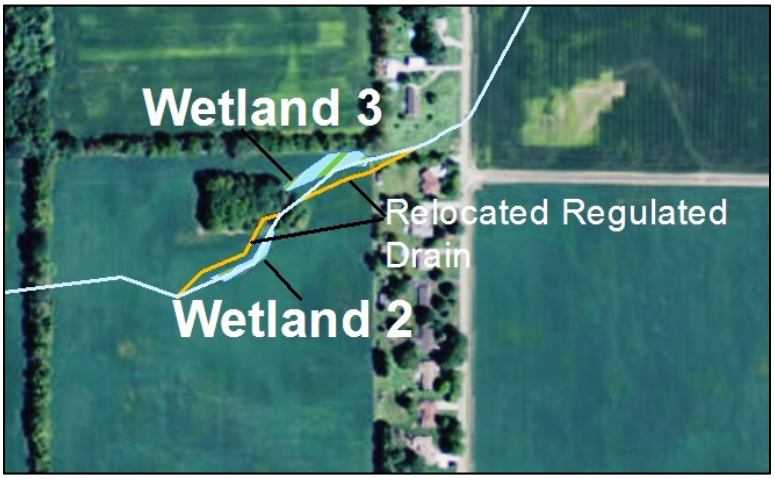


Figure 3-6 – Wetland 2 and 3 Realignment

Wetland 4 is located along the alignment at station 117+00 and has an area of 0.7 acres. The proposed alignment change will divert the channel south of the wetland. At this location the channel has a depth of about 4 feet and a total width of 28 feet. The revised alignment has been offset 15 feet. The proposed alignment will increase the distance between the channel and the wetland area and keep the channel entirely within the regulated drain easement. Figure 3-7 shows a zoomed in view of the proposed alignment in relation to the hatched wetland area.

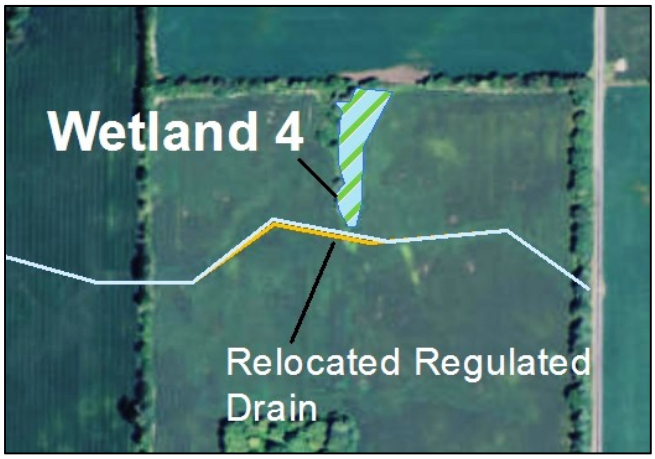


Figure 3-7 – Wetland 4 Realignment

3.5 Regional Detention Basin Options

Part of this study included the evaluation of potential regional detention basins. Regional detention basins could be useful in the future to reduce discharges. The locations with the greatest potential to locate these basins are areas of depressed topography. Three areas have been identified as potential locations for regional detention and can be seen in Figure 3-8, with blue and white polygons and white Basin labels.

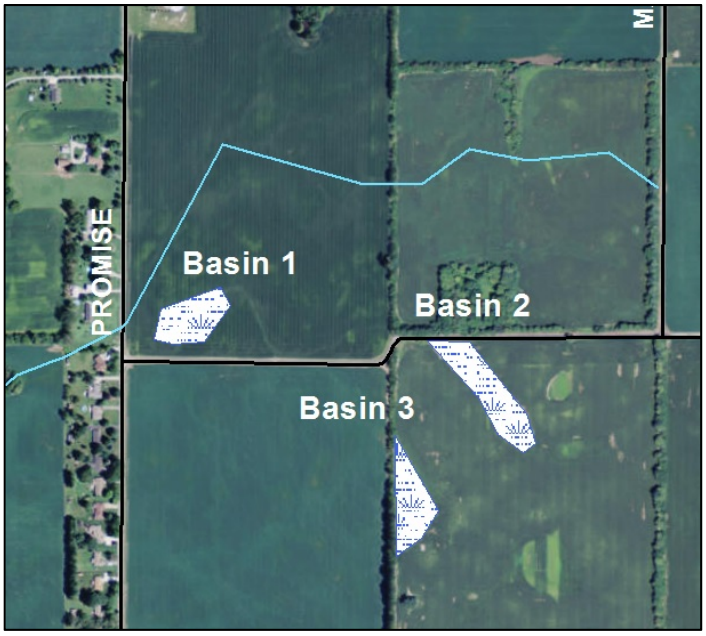


Figure 3-8 – Potential Regional Detention

Basin 1 is located northeast of the intersection of Promise Road and 181st Street. The existing depression is about 1.5 acres and is ideally located within 100 feet of the E.M. Hare Arm. Flow during large storm events could be diverted to this location to trim peak discharges downstream.

Basin 2 is located south of 181st Street between Mallery Road and Promise Road. The existing depression is about 2.3 acres and located at the outlet of Subbasin 2. The total discharge which can be reduced by this basin is limited as it will only receive flow from a single subbasin. During large storm events a basin at this location could reduce the risk of flow overtopping 181st street.

Basin 3 is located south of 181st Street between Mallery Road and Promise Road, about 500 feet south west of Basin 2. The existing depression is about 1.4 acres. The total discharge which can be reduced by this basin is limited as it will only receive flow from a single subbasin and is located in the upstream half of the subbasin.

3.6 Utility Conflicts

Construction of the new channel for the E. M. Hare Arm will conflict with several existing utilities. Proper coordination with the utilities will be necessary to prevent service interruptions to local customers. Indiana Code IC 36-9-27-48 states that public utilities which must be relocated to accommodate the construction or reconstruction of a regulated drain will be paid for by the public utility. Some of the utilities that could be impacted included the following.

A water distribution line is located next to Promise Road and runs perpendicular to the proposed channel alignment. The center of the channel will be 6 feet deep at this location and the waterline must have a minimum cover of 5 feet under the channel.

On the east side of Presley Drive a 10 inch sanitary sewer line crosses the proposed channel path. The top of the pipe is about 2 feet lower than the bottom of the proposed channel. The sewer pipe can be lowered up to 4 feet and still flow by gravity. A minimum 5 feet of separation is required between sanitary and storm facilities.

The Harger Farm property is serviced by a septic system. The septic field is located to the north of the main office building on the property. Special care will need to be taken during construction not to disturb or damage the existing septic tank and drain field.

3.7 Property Access Solutions

Converting the existing drain from a field tile to an open channel will result in accessibility issues for several property owners. Potential new access locations have been identified and are discussed in this section.

Property (1) is owned by the Scottish Rite of Indianapolis Foundation Inc. and is located north of SR 32. The new channel will cut off access to the northern portion of this property. Figure 3-9 shows the property outlined in yellow, with the drain represented with a light blue line. A proposed access crossing is shown with a purple line in the figure. The location of the access point needs to be agreed upon with the property owner and will need to be wide enough to support farming equipment. A 7 foot by 4 foot box culvert would be used under this crossing.

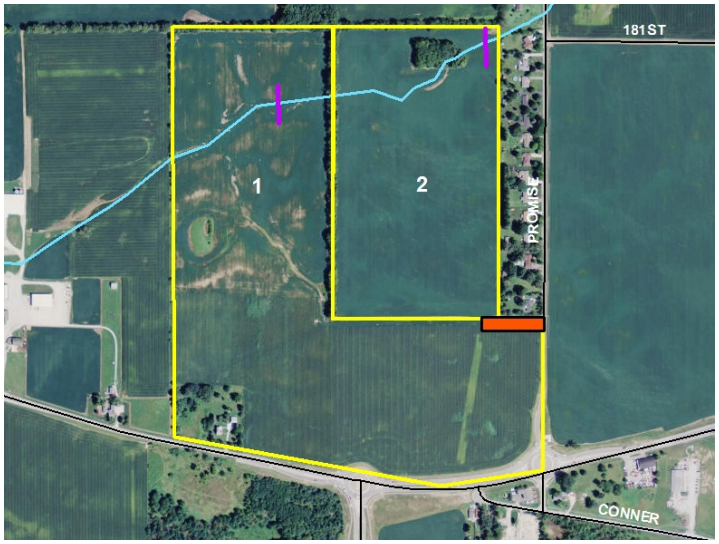


Figure 3-9 – Property Access

Property (2) is owned by the Fleck Family, and is located west of Promise Road. Currently the field access is located over the exiting drain tile in the northeast corner of the property. When the drain becomes an open channel this access drive will have to be removed. It is recommended that a new access drive be purchased from the Scottish Rite to connect the southeast corner of property (2) to Promise Road, illustrated with the orange rectangle in Figure 3-9. Access to the northern portion of this property will also be lost as a result of the channel. An access drive will need to be added and is proposed in the northeast quadrant of the property. A 7 foot by 4 foot box culvert would be used under this crossing. Discussion and approval from the property owner stakeholders will need to take place prior to moving forward with this option.

A potential alternative to using the 7 foot by 4 foot box culverts for the drive crossings would be to use refurbished tanker car as culverts. Hamilton County has connections to a supplier of these units and has used them in the past as a replacement for traditional culverts.

3.8 Future Development Accessibility

Based on current zoning, it is anticipated that the agricultural land in this watershed will be developed into residential communities in the future. One of the goals of this project is to identify a system that will allow these future developments to outlet their stormwater to the E. M. Hare Arm by gravity flow. Elevations were evaluated for the furthest reaches of the watershed and verify that a storm drain 3.5 feet deep could connect to the system from any point in the watershed at an appropriate slope. Below is a list of the 6 furthest reaches, the subbasin they are located in, their distance to connect to the drain, and the required slope.

- Subbasin 1 – Distance 2500 feet, at a slope of 0.3%
- Subbasin 2 – Distance 3150 feet, at a slope of 0.6%
- Subbasin 3 – Distance 1500 feet, at a slope of 0.8%
- Subbasin 4 – Distance 3100 feet, at a slope of 0.7%
- Subbasin 7 – Distance 2300 feet, at a slope of 0.9%
- Subbasin 8 – Distance 2200 feet, at a slope of 0.4%

3.9 Potential Funding Source

Adequate local funding sources will be required to implement the recommendations in this study. Primary funding sources include regulated drain funds, tax supported funds, special assessments, and user fees. Many Indiana communities use general funds, supported by property taxes, to fund stormwater improvement projects. General obligation, revenue, or special assessment bonds are often issued to finance large capital improvement programs. Repayment is normally through the general fund, special assessment district income and utility revenues.

Indiana Code (IC 36-9-27) governs regulated drains and the requirements for construction and reconstruction. The costs for the construction or reconstruction are divided among the parcels of property within the watershed and directly associated with regulated drain being (re)constructed. Reconstructing a regulated drain is the only way to: covert from an open drain to a tiled drain (or vice versa), increase the size of the drain, add and extension to the drain, change the alignment of the drain, construct drainage detention basins or provide for erosion control and for grade stabilization, or lower the drain per Section 34 of the above-referenced Code.

Another potential revenue source would be Tax Increment Financing (TIF). The Stoney Creek TIF is located south of SR 32 and east of SR 37. This boundary does not overlap with the majority of the E.M. Hare Drain but could provide a supplement for development of the downstream end of the drain.

The Hamilton County Drainage Board may transfer an amount up to 75% of the maintenance fund balance to a reconstruction fund that covers the same watershed as the maintenance fund.

3.10 Cost Estimate

A cost estimate was prepared based on the recommended improvements. The estimated construction cost is $2,560,600 with a total project cost of $3,151,600 (including non-construction costs). A detailed breakdown of the cost estimated with individual pay items is included in Attachment 10. Per the AACE Cost Estimating Classes this project would be considered a Class 3 Estimate. This means the level of design is at approximately 10% - 40% complete. Class 3 project have an expected cost accuracy range that could be 10% - 20% lower to 10% - 30% higher.

The average annual maintenance cost of the recommended option is about $1,150 per year. This was estimated based on historical maintenance records from Hamilton County.

An alternative was investigated to construct a drainage tile under the drain channel. The drainage tile would be sized for a 10 year storm event, and the channel would be sized to take additional flow up to the 100 year storm event. This alternative would add additional cost for the drain tile, and provide a cost savings by reducing the size of the channel. This option includes a cost saving of $272,000 for excavated material and a cost increase of $1,121,000 for new drainage tile. This results in an overall net increase in project cost of about $849,000, see Attachment 11. The average annual maintenance cost of this alternative is about $1,150 per year. The recommended improvements and this alternative both have the same maintenance requirements.

It is assumed that there will be a 3% increase in maintenance cost per year over a 50-year period. Over that same time period it would be expected that 2 major maintenance events would occur each costing approximately $10,000. The total maintenance cost of the improvements would be approximately $185,000 over a 50 year period.

4.0 RECOMMENDATION

4.1 Recommendation

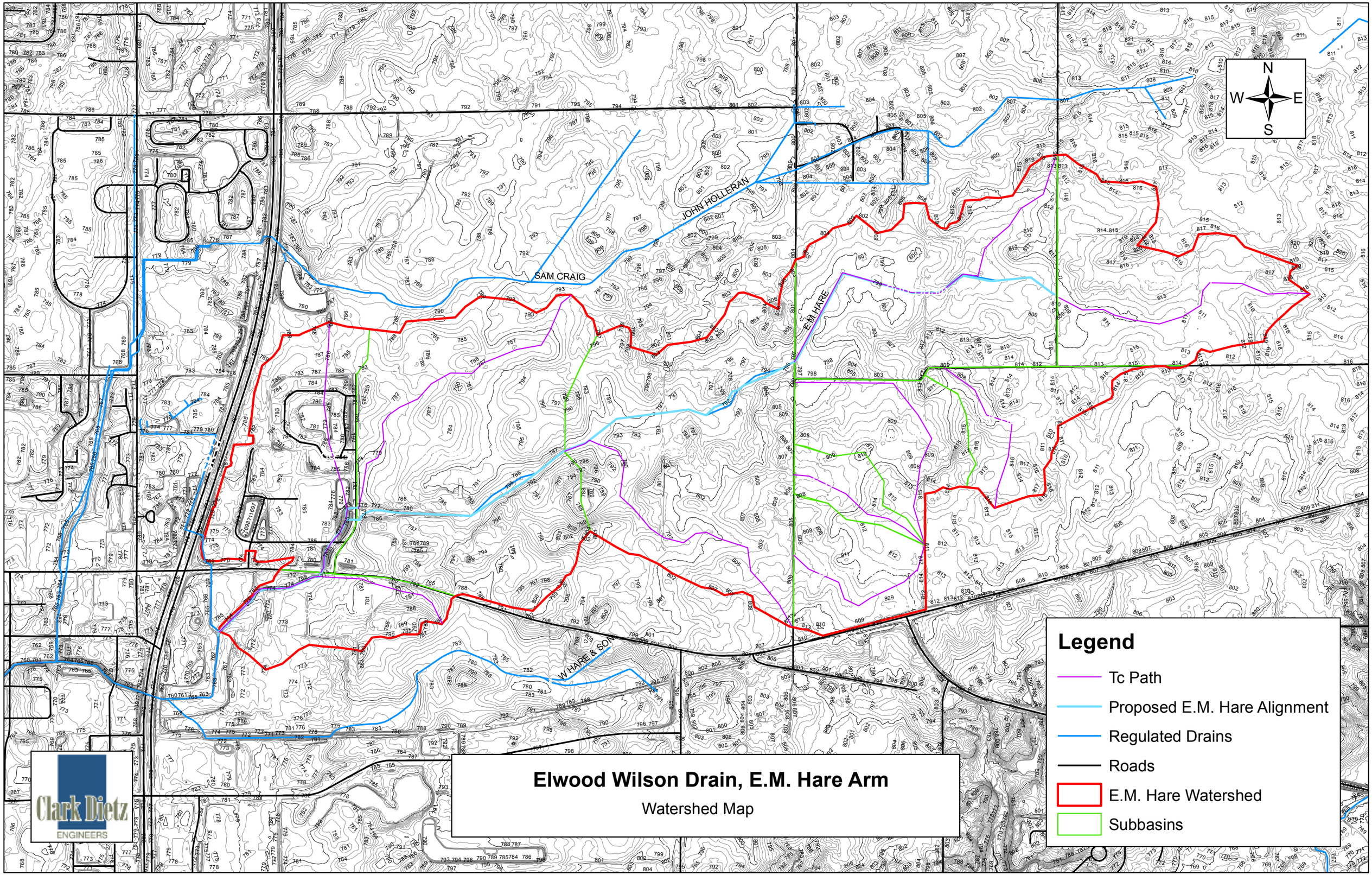
The capacity and alignment enhancements to the E. M. Hare Arm detailed in this study are recommended. The existing drain does not have adequate capacity to convey the current or future development discharges for a 100 year storm event without overtopping roads. Full development of the watershed is not expected for at least 15 years; therefore the channel should be designed with adequate capacity to contain the existing peak discharges within the regulated drain without overtopping any roads.

The culverts at Mallery Road and Promise Road are undersized and should be replaced to prevent future flow overtopping the road. A new culvert will be needed for the drive on Harger's Farm to provide continued access to the northern half of their property once the channel is constructed. The culverts at Presley Drive and Home Depot Drive are sized appropriately but will need to be lowered 5 feet to conform to the proposed vertical alignment of the channel. The new culvert at SR 32 is designed at the correct elevation and is properly sized. Access drive culverts are needed on the Scottish Rite and Fleck family properties for sections of their land which will be separated by the new channel.

The total estimated project cost of these improvements (including non-construction costs) is approximately $3.2 million.

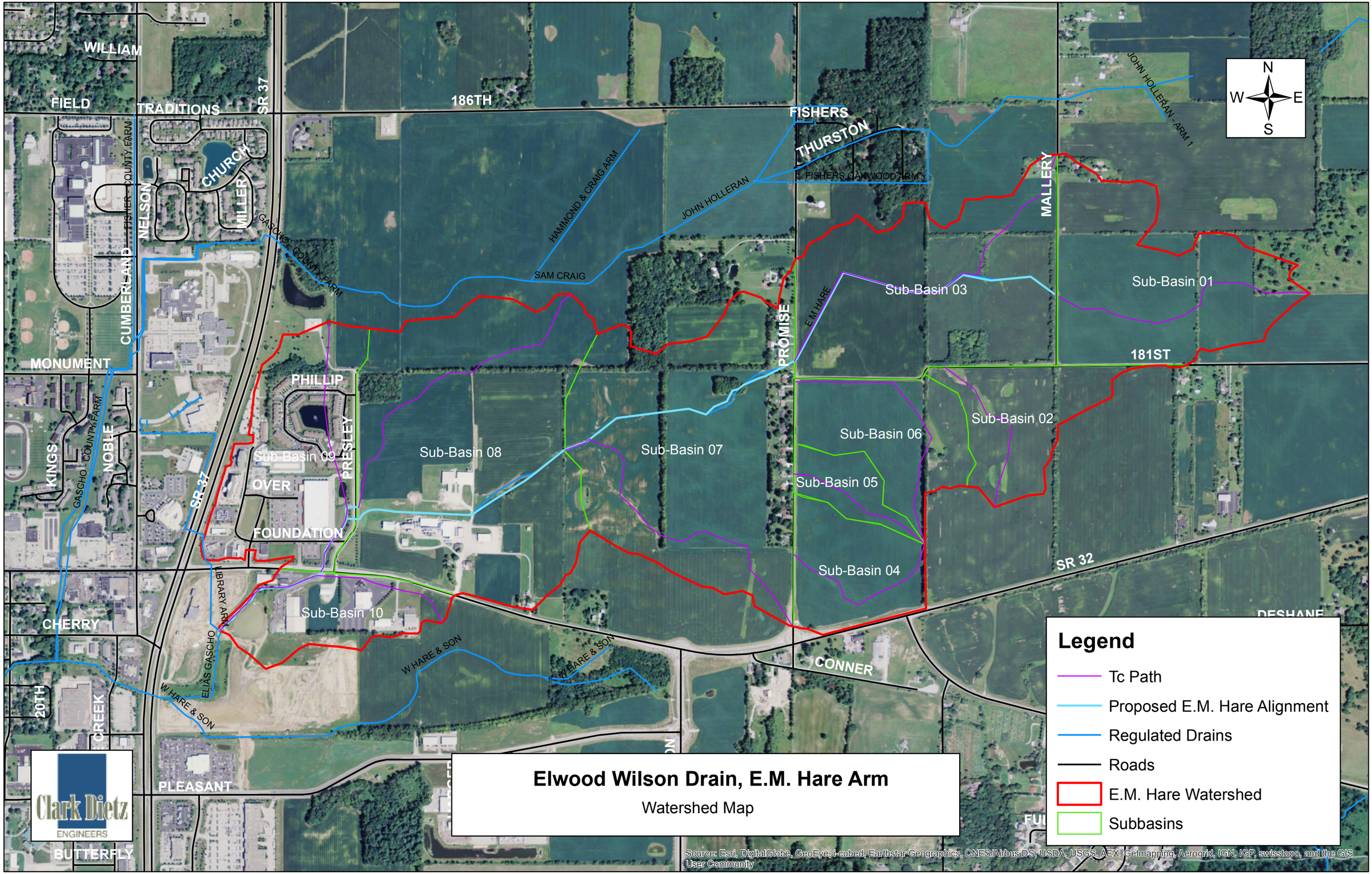
Attachment 1

Watershed Delineation Map



Elwood Wilson Drain, E.M. Hare Arm

Watershed Map


Elwood Wilson Drain, E.M. Hare Arm
Watershed Map
Legend
Tc Path
Proposed E.M. Hare Alignment
Regulated Drains
Roads
E.M. Hare Watershed
Subbasins
N
S
E
W
WILLIAM
FIELD
TRADITIONS
SR 37
186TH
FISHERS
THURSTON
CHURCH
NELSON
MILLER
CUMBERLAND
MONUMENT
KINGS
NOBLE
PHILLIP
PRESLEY
OVER
FOUNDATION
CHERRY
20TH
CREEK
PLEASANT
BUTTERFLY
PROMISE
MALLERY
181ST
SR 32
CONNER
DESHANE
GASCHO COUNTY FARM
HAMMOND & CRAIG ARM
JOHN HOLLERAN
SAM CRAIG
FISHERS OAKWOOD ARM
JOHN HOLLERAN - ARM 1
E M HARE
W HARE & SON
ELIAS GASCHO
LIBRARY ARM
Sub-Basin 01
Sub-Basin 02
Sub-Basin 03
Sub-Basin 04
Sub-Basin 05
Sub-Basin 06
Sub-Basin 07
Sub-Basin 08
Sub-Basin 09
Sub-Basin 10
Clark Dietz
ENGINEERS
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Attachment 2

Lag Time Calculation

Elwood Wilson Drain, E. M. Hare Arm
Lag Time Calculations
By: BEP
Date 5/5/2016

Subbasin 1

	Length (ft)	K	Upper El. (ft)	Lower El. (ft)	Vert. dis. (ft)	Slope (%)	Vel. (ft/s)	Tc (min)	Tl (min)
Sheet Flow	300	0.48	816	814.2	1.80	0.60	0.37	13.45	
Waterway	2,533	1.2	814.2	809	5.20	0.21	0.54	77.65	
Total	2,833		214	199.5	7.00	0.25		91.09	54.66

Subbasin 2

	Length (ft)	K	Upper El. (m)	Lower El. (m)	Vert. dis. (ft)	Slope (%)	Vel. (ft/s)	Tc (min)	Tl (min)
Sheet Flow	300	0.48	816.2	814	2.20	0.73	0.41	12.16	
Waterway	1,516	1.2	814	810	4.00	0.26	0.62	40.99	
Total	1,816		212	204	6.20	0.34		53.15	31.89

Subbasin 3

	Length (ft)	K	Upper El. (m)	Lower El. (m)	Vert. dis. (ft)	Slope (%)	Vel. (ft/s)	Tc (min)	Tl (min)
Sheet Flow	300	0.48	815.3	811	4.30	1.43	0.57	8.70	
Waterway	1,196	1.2	811	803.9	7.10	0.59	0.92	21.56	
Small Tributary	2,495	2.1	803.9	797	6.90	0.28	1.10	37.65	
Total	3,991				18.30	0.46		67.91	40.75

Subbasin 4

	Length (ft)	K	Upper El. (m)	Lower El. (m)	Vert. dis. (ft)	Slope (%)	Vel. (ft/s)	Tc (min)	Tl (min)
Sheet Flow	300	0.48	811.8	811.1	0.70	0.23	0.23	21.56	
Waterway	1,527	1.2	811.1	804	7.10	0.46	0.82	31.10	
Total	1,827				7.80	0.43		52.67	31.60

	Dis. (ft)	Vel. (ft/s)	Lag time (min)	Upper El. (m)	Lower El. (m)	Slope (%)
Reach 1	3,350	1	55.83	809	797.00	0.0036

Elwood Wilson Drain, E. M. Hare Arm
Lag Time Calculations
By: BEP
Date 5/5/2016

Subbasin 5

	Length (ft)	K	Upper El. (m)	Lower El. (m)	Vert. dis. (ft)	Slope (%)	Vel. (ft/s)	Tc (min)	Tl (min)
Sheet Flow	300	0.48	811.8	811.3	0.50	0.17	0.20	25.52	
Waterway	1,225	1.2	811.3	805	6.30	0.51	0.86	23.72	
Total	1,525				6.80	0.45		49.24	29.54

Subbasin 6

	Length (ft)	K	Upper El. (m)	Lower El. (m)	Vert. dis. (ft)	Slope (%)	Vel. (ft/s)	Tc (min)	Tl (min)
Sheet Flow	300	0.48	811.8	811	0.80	0.27	0.25	20.17	
Waterway	2,460	1.2	811	800	11.00	0.45	0.80	51.09	
Total	2,760				11.80	0.43		71.27	42.76

	Dis. (ft)	Vel. (ft/s)	Lag time (min)	Upper El. (ft)	Lower El. (ft)	Slope (%)
Reach 2	2,627	1.1	39.80	797.00	787.00	0.0038

Subbasin 7

	Length (ft)	K	Upper El. (m)	Lower El. (m)	Vert. dis. (ft)	Slope (%)	Vel. (ft/s)	Tc (min)	Tl (min)
Sheet Flow	300	0.48	811.3	807.5	3.80	1.27	0.54	9.26	
Waterway	2,946	1.2	807.5	788.3	19.20	0.65	0.97	50.68	
Small Tributary	280	2.1	788.3	787	1.30	0.46	1.43	3.26	
Total	3,526				24.30	0.69		63.20	37.92

	Dis. (ft)	Vel. (ft/s)	Lag time (min)	Upper El. (ft)	Lower El. (ft)	Slope (%)
Reach 3	2,383	1.3	30.55	787.00	771.96	0.0063

Elwood Wilson Drain, E. M. Hare Arm
Lag Time Calculations
By: BEP
Date 5/5/2016

Subbasin 8

	Length (ft)	K	Upper El. (m)	Lower El. (m)	Vert. dis. (ft)	Slope (%)	Vel. (ft/s)	Tc (min)	Tl (min)
Sheet Flow	300	0.48	793	792.5	0.50	0.17	0.20	25.52	
Waterway	3,120	1.2	792.5	775	17.50	0.56	0.90	57.86	
Total	3,420				18.00	0.53		83.38	50.03

Subbasin 9

	Length (ft)	K	Upper El. (m)	Lower El. (m)	Vert. dis. (ft)	Slope (%)	Vel. (ft/s)	Tc (min)	Tl (min)
Sheet Flow	300	0.48	794	786.7	7.30	2.43	0.75	6.68	
Waterway	520	1.2	786.7	780	6.70	1.29	1.36	6.36	
Small Tributary	1,793	2.1	780	769	11.00	0.61	1.64	18.17	
Total	2,613				25.00	0.96		31.21	18.72

	Dis. (ft)	Vel. (ft/s)	Lag time (min)	Upper El. (ft)	Lower El. (ft)	Slope (%)
Reach 4	829	1.3	10.63	771.96	768.80	0.0038

Subbasin 10

	Length (ft)	K	Upper El. (m)	Lower El. (m)	Vert. dis. (ft)	Slope (%)	Vel. (ft/s)	Tc (min)	Tl (min)
Sheet Flow	300	0.48	786.2	782	4.20	1.40	0.57	8.80	
Waterway	1,123	1.2	782	772	10.00	0.89	1.13	16.53	
Small Tributary	1,218	2.1	772	761.7	10.30	0.85	1.93	10.51	
Total	2,641				24.50	0.93		35.84	21.51

	Dis. (ft)	Vel. (ft/s)	Lag time (min)	Upper El. (ft)	Lower El. (ft)	Slope (%)
Reach 5	1,261	1.3	16.17	768.80	762.00	0.0054

Attachment 3

Rainfall Distribution Table

Table 10. Median Time Distributions of Heavy Storm Rainfall at a Point

	Cumulative storm rainfall (percent) for given storm type			
Cumulative storm time (percent)	*First-quartile*	*Second-quartile*	*Third-quartile*	*Fourth-quartile*
5	16	3	3	2
10	33	8	6	5
15	43	12	9	8
20	52	16	12	10
25	60	22	15	13
30	66	29	19	16
35	71	39	23	19
40	75	51	27	22
45	79	62	32	25
50	82	70	38	28
55	84	76	45	32
60	86	81	57	35
65	88	85	70	39
70	90	88	79	45
75	92	91	85	51
80	94	93	89	59
85	96	95	92	72
90	97	97	95	84
95	98	98	97	92

Attachment 4

HY-8 Output

HY-8 Culvert Analysis Report

Project Notes

Project Title: E.M. Hare Arm

Designer: Brian Powers

Project Date: Thursday, May 19, 2016

Notes:

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

Exit Loss Option: Standard Method

Crossing Notes: Mallery (Existing) (2)

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

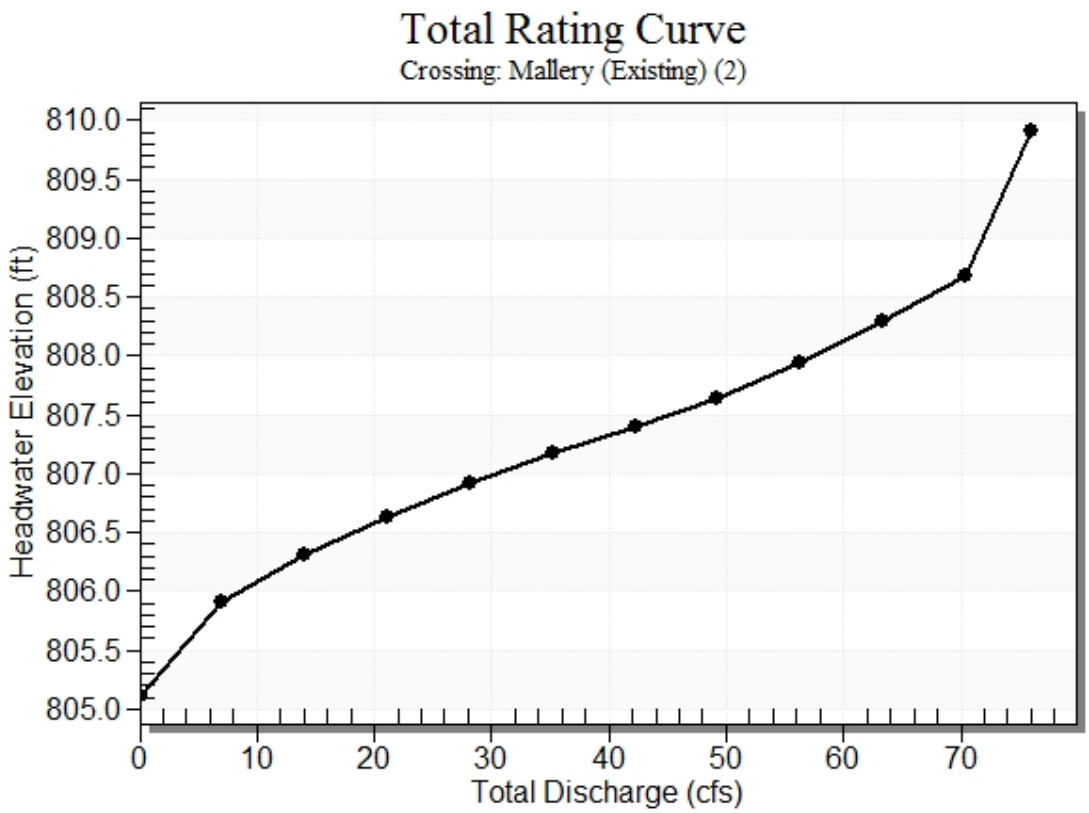
Design Flow: 70.4 cfs

Maximum Flow: 70.4 cfs

Table 1 - Summary of Culvert Flows at Crossing: Mallery (Existing) (2)

Headwater Elevation (ft)	Total Discharge (cfs)	5x2 Box Discharge (cfs)	Roadway Discharge (cfs)	Iterations
805.12	0.00	0.00	0.00	1
805.92	7.04	7.04	0.00	1
806.32	14.08	14.08	0.00	1
806.63	21.12	21.12	0.00	1
806.91	28.16	28.16	0.00	1
807.17	35.20	35.20	0.00	1
807.41	42.24	42.24	0.00	1
807.64	49.28	49.28	0.00	1
807.95	56.32	56.32	0.00	1
808.29	63.36	63.36	0.00	1
808.67	70.40	70.40	0.00	1
809.00	75.99	75.99	0.00	Overtopping

Rating Curve Plot for Crossing: Mallery (Existing) (2)



Culvert Notes: 5x2 Box

Table 2 - Culvert Summary Table: 5x2 Box

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	805.12	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
7.04	7.04	805.92	0.675	0.799	1-S1t	0.374	0.395	0.830	0.830	1.696	1.888
14.08	14.08	806.32	1.069	1.198	1-S1t	0.582	0.627	1.146	1.146	2.458	2.261
21.12	21.12	806.63	1.390	1.515	1-S1t	0.761	0.821	1.375	1.375	3.072	2.508
28.16	28.16	806.91	1.679	1.793	1-S1t	0.923	0.995	1.561	1.561	3.607	2.699
35.20	35.20	807.17	1.953	2.048	1-S1t	1.073	1.155	1.721	1.721	4.091	2.856
42.24	42.24	807.41	2.228	2.287	1-S1t	1.216	1.304	1.862	1.862	4.537	2.991
49.28	49.28	807.64	2.516	2.514	5-S1t	1.353	1.445	1.989	1.989	4.955	3.109
56.32	56.32	807.95	2.828	2.819	4-FFf	1.487	1.579	2.000	2.106	5.632	3.216
63.36	63.36	808.29	3.171	3.148	5-FFf	1.616	1.708	2.000	2.213	6.336	3.313
70.40	70.40	808.67	3.550	3.496	5-FFf	1.742	1.833	2.000	2.314	7.040	3.402

****

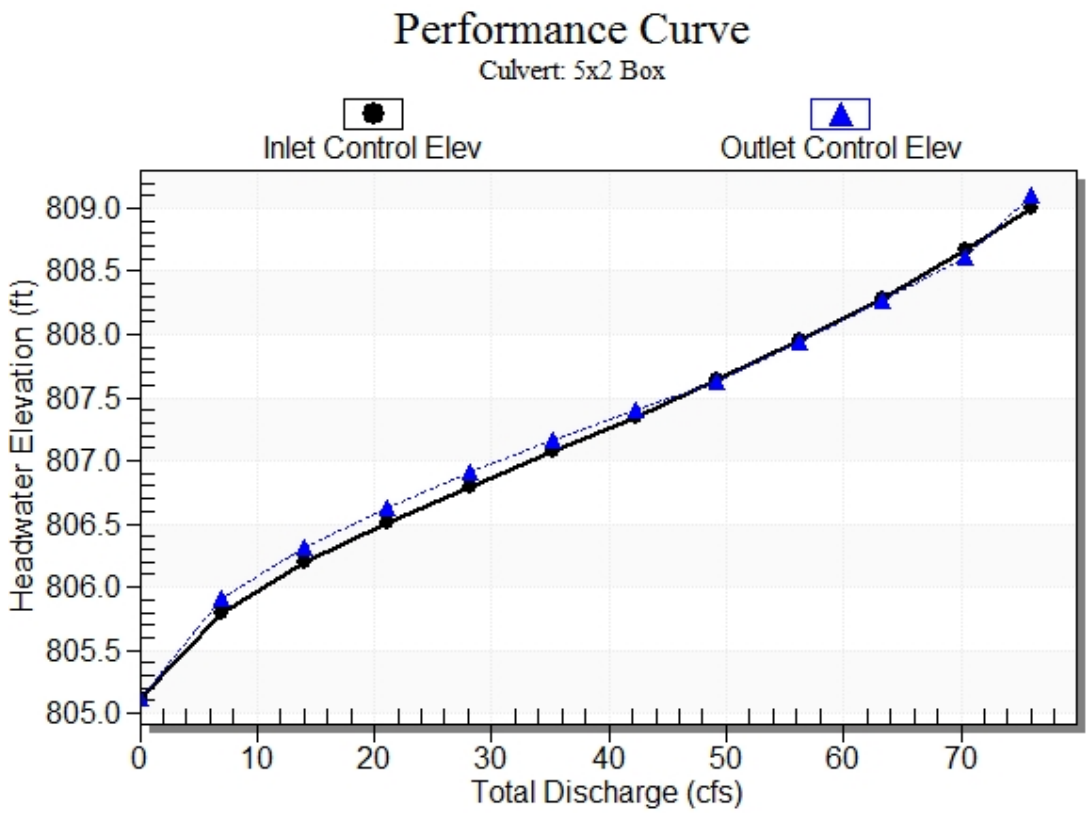
Straight Culvert

Inlet Elevation (invert): 805.12 ft, Outlet Elevation (invert): 805.00 ft

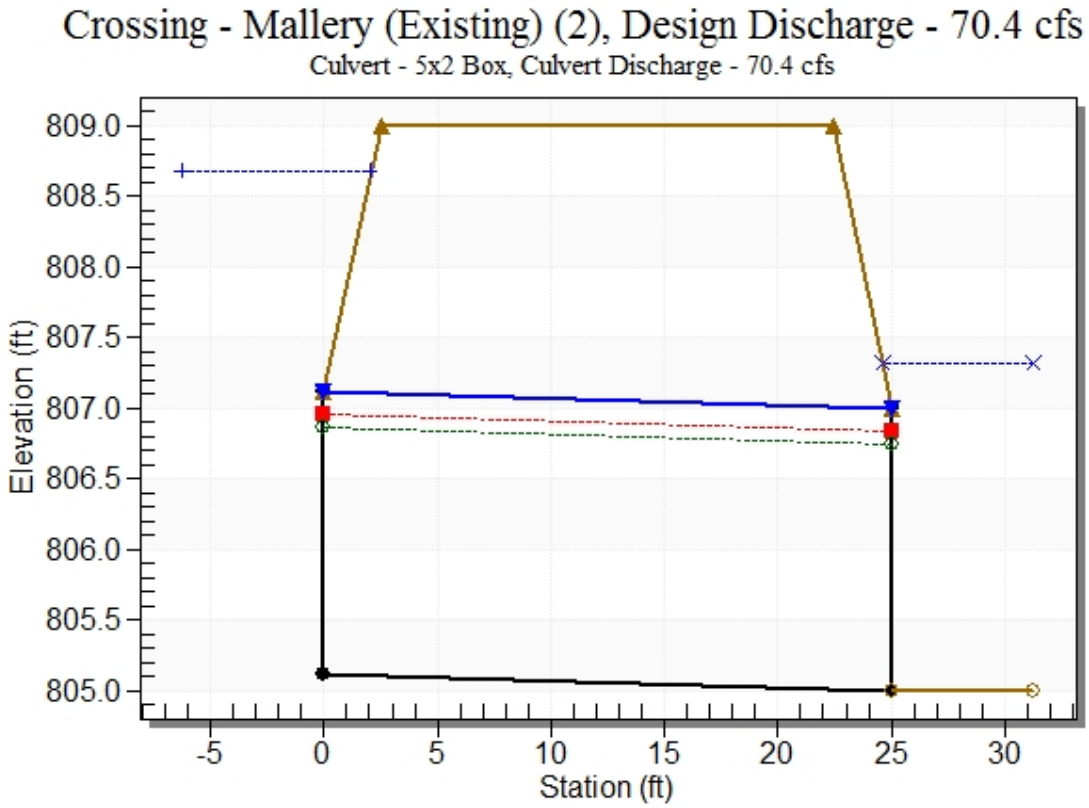
Culvert Length: 25.00 ft, Culvert Slope: 0.0048

****

Culvert Performance Curve Plot: 5x2 Box



Water Surface Profile Plot for Culvert: 5x2 Box



Site Data - 5x2 Box

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 805.12 ft

Outlet Station: 25.00 ft

Outlet Elevation: 805.00 ft

Number of Barrels: 1

Culvert Data Summary - 5x2 Box

Barrel Shape: Concrete Box

Barrel Span: 5.00 ft

Barrel Rise: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Mallery (Existing) (2))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	805.00	0.00	0.00	0.00	0.00
7.04	805.83	0.83	1.89	0.25	0.46
14.08	806.15	1.15	2.26	0.34	0.48
21.12	806.37	1.37	2.51	0.41	0.49
28.16	806.56	1.56	2.70	0.47	0.50
35.20	806.72	1.72	2.86	0.52	0.50
42.24	806.86	1.86	2.99	0.56	0.51
49.28	806.99	1.99	3.11	0.60	0.51
56.32	807.11	2.11	3.22	0.63	0.52
63.36	807.21	2.21	3.31	0.66	0.52
70.40	807.31	2.31	3.40	0.69	0.53

Tailwater Channel Data - Mallery (Existing) (2)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

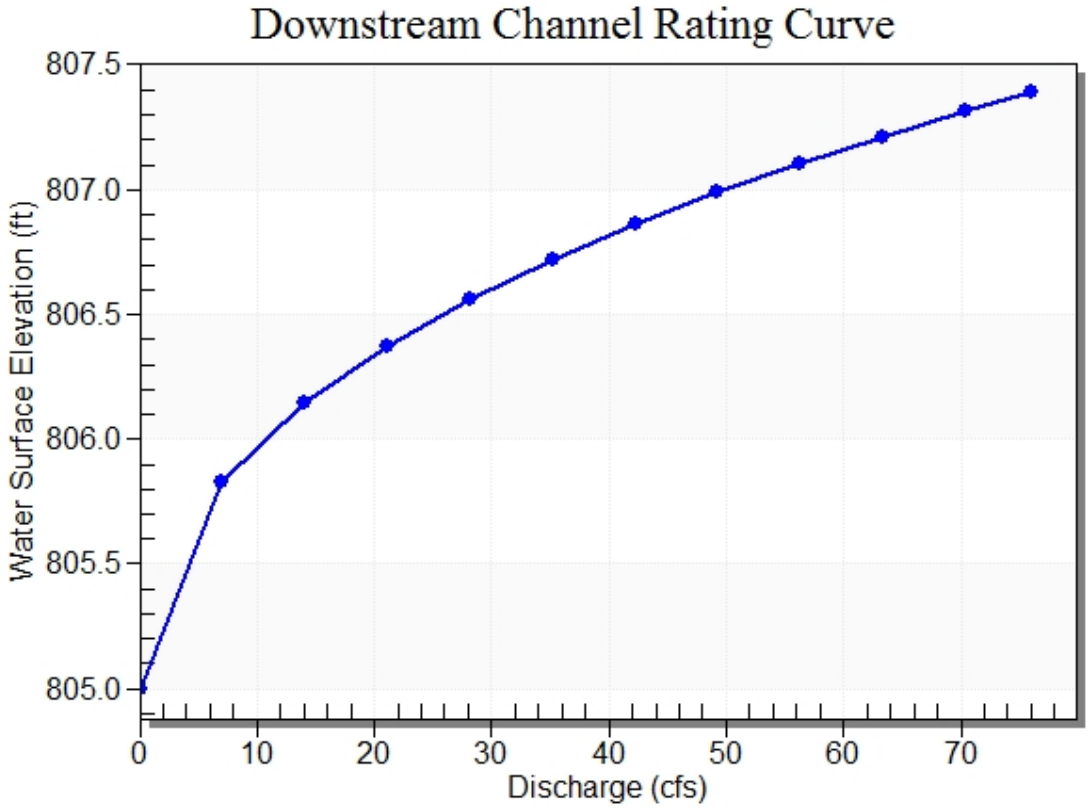
Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0048

Channel Manning's n: 0.0350

Channel Invert Elevation: 805.00 ft

Tailwater Rating Curve Plot for Crossing: Mallery (Existing) (2)



Roadway Data for Crossing: Mallery (Existing) (2)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 809.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

HY-8 Culvert Analysis Report

Project Notes

Project Title: E.M. Hare Arm

Designer: Brian Powers

Project Date: Thursday, May 19, 2016

Notes:

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

Exit Loss Option: Standard Method

Crossing Notes: Promise Rd (Existing) (2)

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

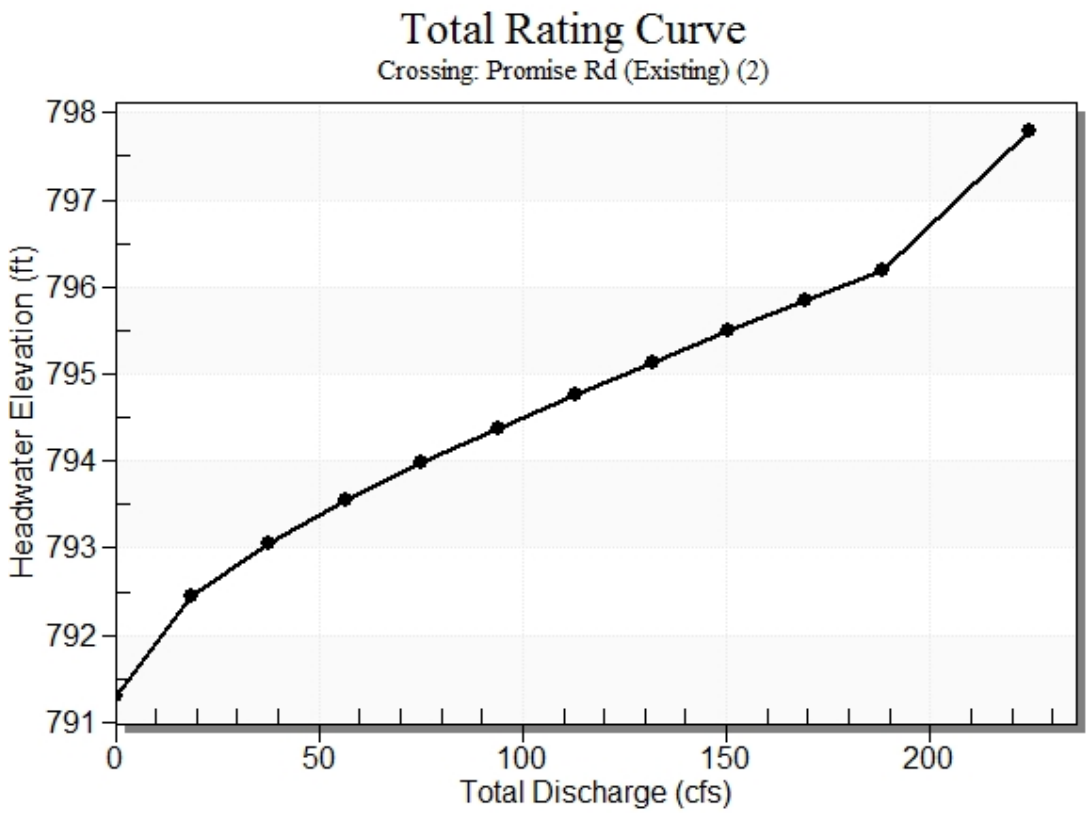
Design Flow: 188.2 cfs

Maximum Flow: 188.2 cfs

Table 1 - Summary of Culvert Flows at Crossing: Promise Rd (Existing) (2)

Headwater Elevation (ft)	Total Discharge (cfs)	Box 7x4 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
791.31	0.00	0.00	0.00	1
792.45	18.82	18.82	0.00	1
793.05	37.64	37.64	0.00	1
793.54	56.46	56.46	0.00	1
793.98	75.28	75.28	0.00	1
794.38	94.10	94.10	0.00	1
794.76	112.92	112.92	0.00	1
795.13	131.74	131.74	0.00	1
795.49	150.56	150.56	0.00	1
795.84	169.38	169.38	0.00	1
796.20	188.20	188.20	0.00	1
797.00	224.46	224.46	0.00	Overtopping

Rating Curve Plot for Crossing: Promise Rd (Existing) (2)



Culvert Notes: Box 7x4

Table 2 - Culvert Summary Table: Box 7x4

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	791.31	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
18.82	18.82	792.45	1.039	1.143	1-S1t	0.538	0.608	1.089	1.089	2.469	2.378
37.64	37.64	793.05	1.649	1.742	1-S1t	0.857	0.965	1.530	1.530	3.515	2.864
56.46	56.46	793.54	2.155	2.231	1-S1t	1.127	1.264	1.854	1.854	4.351	3.186
75.28	75.28	793.98	2.597	2.666	1-S1t	1.366	1.531	2.118	2.118	5.077	3.433
94.10	94.10	794.38	3.003	3.070	1-S1t	1.591	1.777	2.345	2.345	5.732	3.636
112.92	112.92	794.76	3.386	3.452	1-S1t	1.808	2.007	2.546	2.546	6.335	3.810
131.74	131.74	795.13	3.756	3.820	1-S1t	2.011	2.224	2.728	2.728	6.899	3.963
150.56	150.56	795.49	4.125	4.177	1-S1t	2.212	2.431	2.895	2.895	7.430	4.101
169.38	169.38	795.84	4.499	4.526	1-S1t	2.405	2.630	3.049	3.049	7.936	4.225
188.20	188.20	796.20	4.885	4.871	5-S1t	2.596	2.821	3.193	3.193	8.420	4.340

****

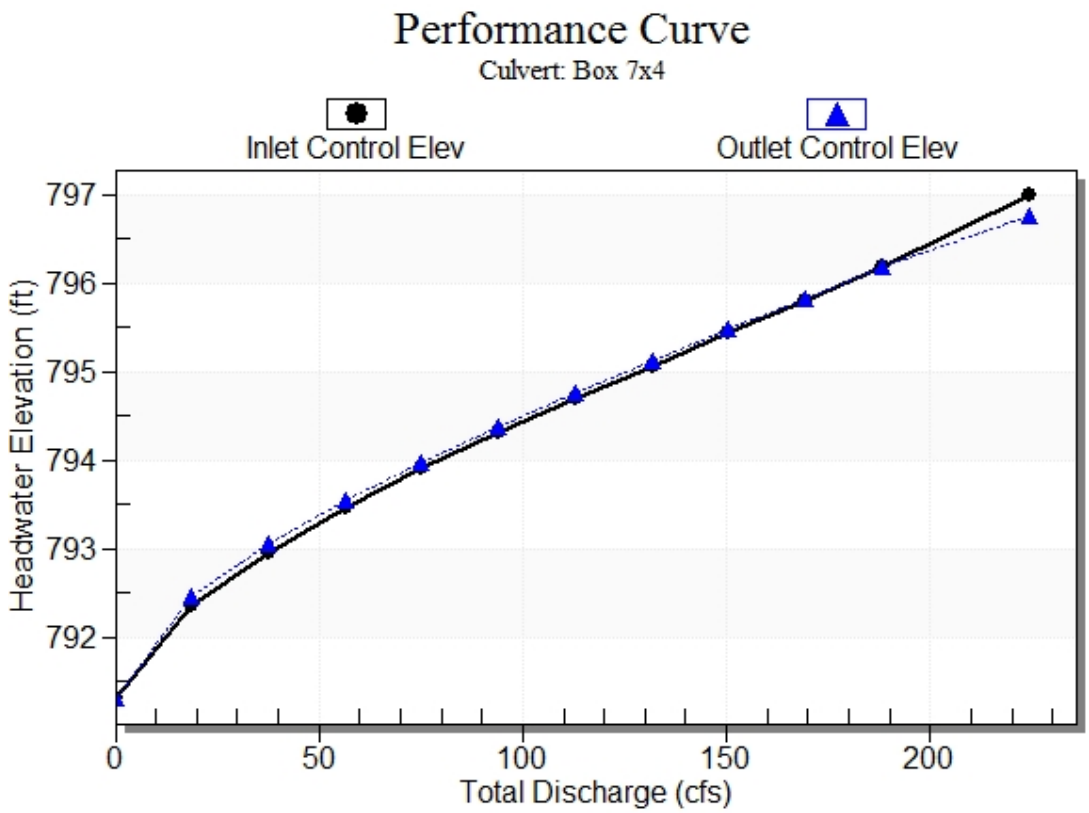
Straight Culvert

Inlet Elevation (invert): 791.31 ft, Outlet Elevation (invert): 791.19 ft

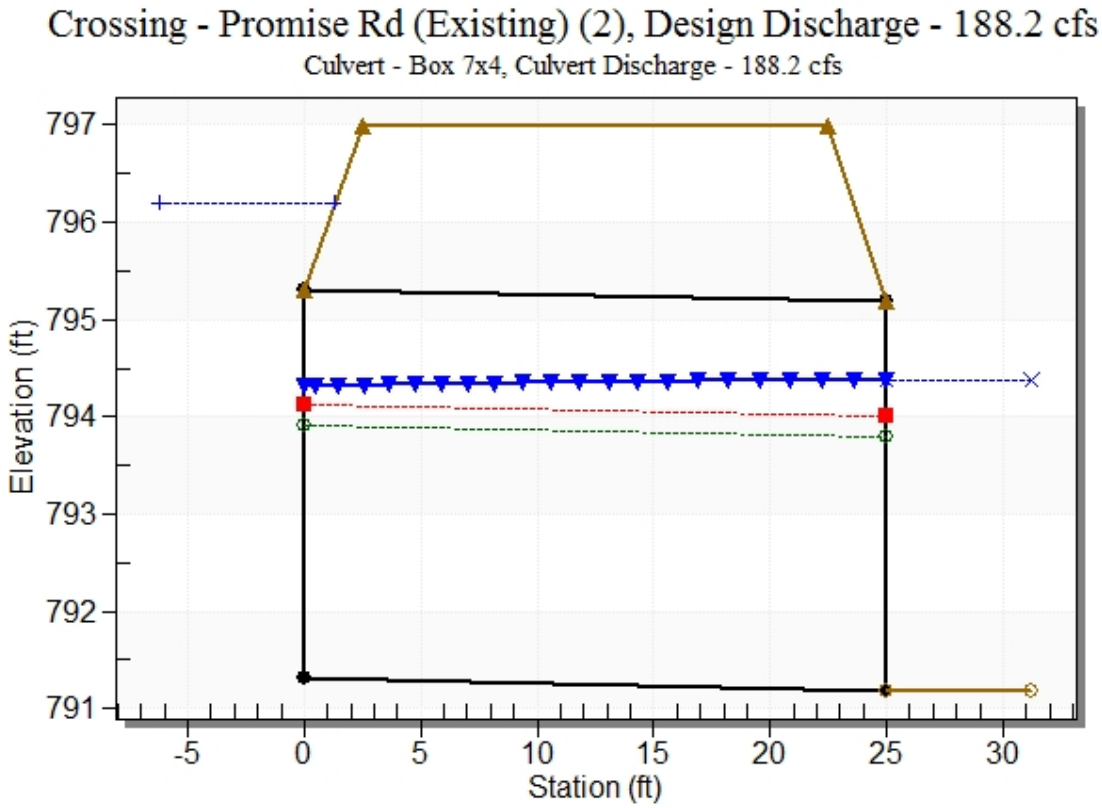
Culvert Length: 25.00 ft, Culvert Slope: 0.0048

****

Culvert Performance Curve Plot: Box 7x4



Water Surface Profile Plot for Culvert: Box 7x4



Site Data - Box 7x4

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 791.31 ft

Outlet Station: 25.00 ft

Outlet Elevation: 791.19 ft

Number of Barrels: 1

Culvert Data Summary - Box 7x4

Barrel Shape: Concrete Box

Barrel Span: 7.00 ft

Barrel Rise: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Promise Rd (Existing) (2))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	791.19	0.00	0.00	0.00	0.00
18.82	792.28	1.09	2.38	0.33	0.48
37.64	792.72	1.53	2.86	0.46	0.51
56.46	793.04	1.85	3.19	0.56	0.52
75.28	793.31	2.12	3.43	0.63	0.53
94.10	793.54	2.35	3.64	0.70	0.54
112.92	793.74	2.55	3.81	0.76	0.54
131.74	793.92	2.73	3.96	0.82	0.55
150.56	794.08	2.89	4.10	0.87	0.55
169.38	794.24	3.05	4.23	0.91	0.56
188.20	794.38	3.19	4.34	0.96	0.56

Tailwater Channel Data - Promise Rd (Existing) (2)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

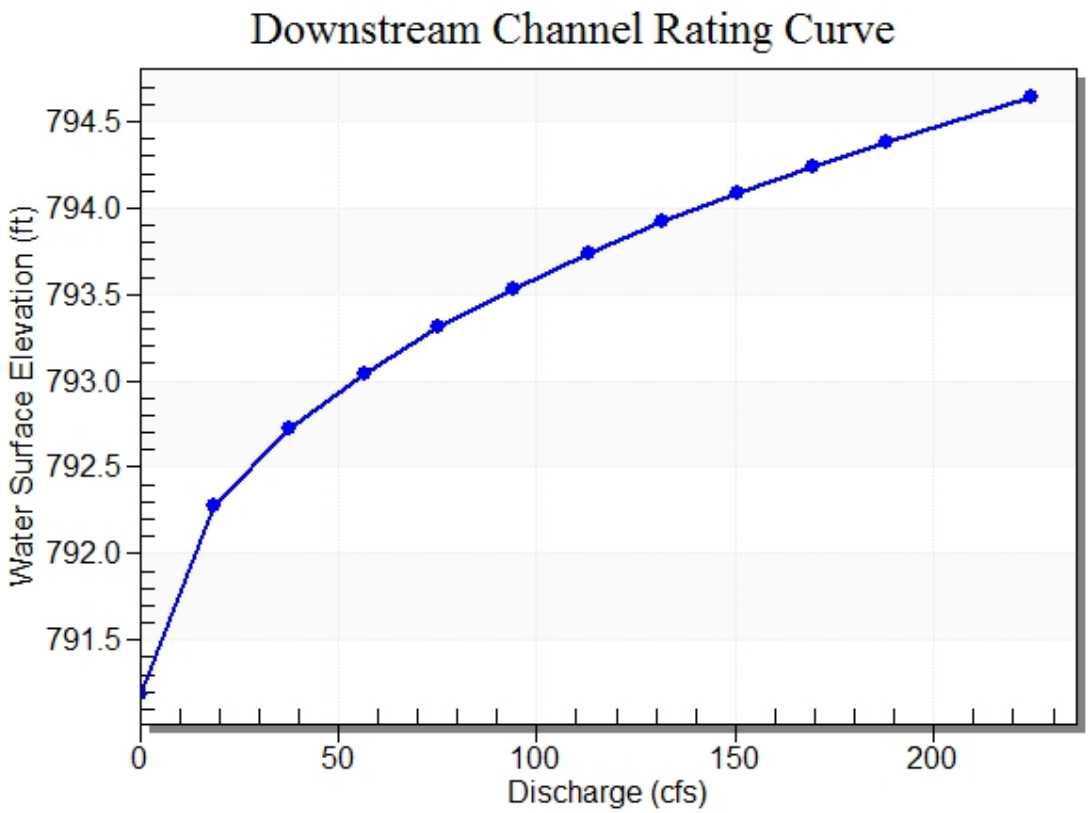
Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0048

Channel Manning's n: 0.0350

Channel Invert Elevation: 791.19 ft

Tailwater Rating Curve Plot for Crossing: Promise Rd (Existing) (2)



Roadway Data for Crossing: Promise Rd (Existing) (2)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 797.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

HY-8 Culvert Analysis Report

Project Notes

Project Title: E.M Hare Arm

Designer: Brian Powers

Project Date: Thursday, May 19, 2016

Notes:

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

Exit Loss Option: Standard Method

Crossing Notes: Harger Farm (Existing)

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

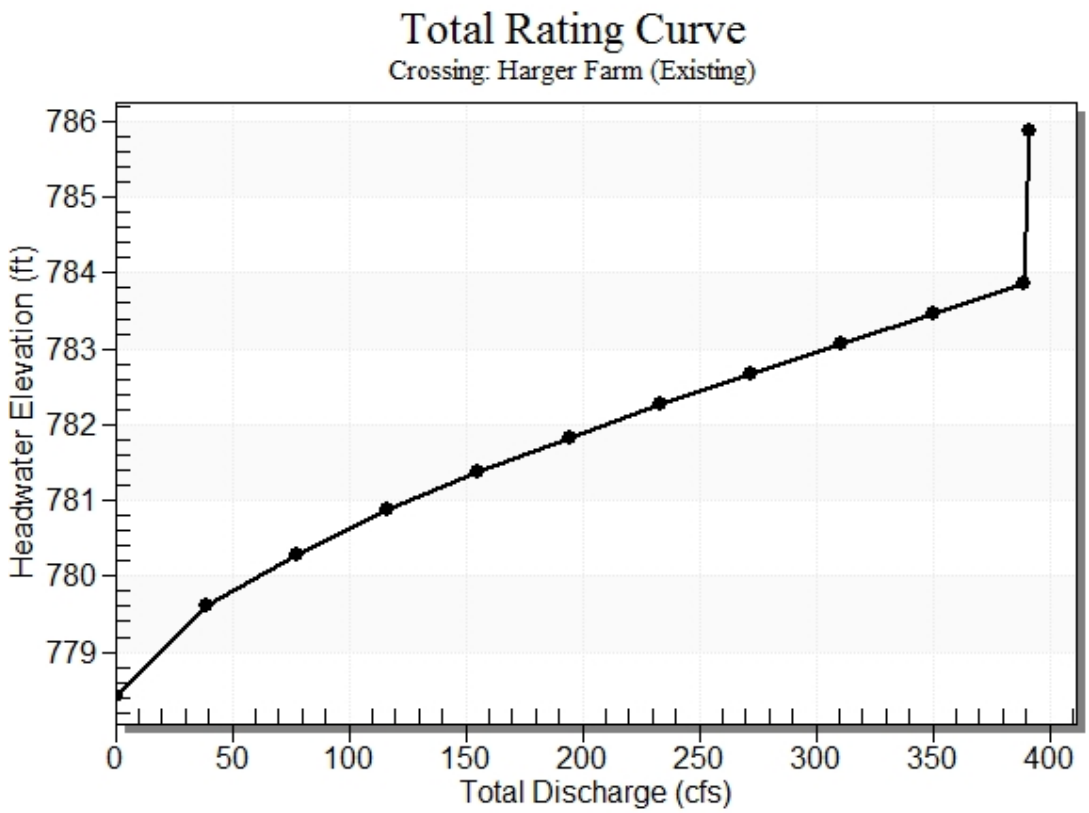
Design Flow: 388.8 cfs

Maximum Flow: 388.8 cfs

Table 1 - Summary of Culvert Flows at Crossing: Harger Farm (Existing)

Headwater Elevation (ft)	Total Discharge (cfs)	12x5 Box Discharge (cfs)	Roadway Discharge (cfs)	Iterations
778.43	0.00	0.00	0.00	1
779.60	38.88	38.88	0.00	1
780.29	77.76	77.76	0.00	1
780.87	116.64	116.64	0.00	1
781.37	155.52	155.52	0.00	1
781.83	194.40	194.40	0.00	1
782.26	233.28	233.28	0.00	1
782.67	272.16	272.16	0.00	1
783.07	311.04	311.04	0.00	1
783.47	349.92	349.92	0.00	1
783.87	388.80	388.80	0.00	1
783.90	391.54	391.54	0.00	Overtopping

Rating Curve Plot for Crossing: Harger Farm (Existing)



Culvert Notes: 12x5 Box

Table 2 - Culvert Summary Table: 12x5 Box

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	778.43	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
38.88	38.88	779.60	1.174	0.753	1-S2n	0.561	0.688	0.582	1.261	5.564	3.150
77.76	77.76	780.29	1.864	1.317	1-JS1t	0.891	1.093	1.792	1.792	3.616	3.814
116.64	116.64	780.87	2.442	1.766	1-JS1t	1.146	1.432	2.185	2.185	4.448	4.251
155.52	155.52	781.37	2.944	2.166	1-JS1t	1.391	1.734	2.507	2.507	5.169	4.587
194.40	194.40	781.83	3.404	2.544	1-JS1t	1.604	2.012	2.785	2.785	5.817	4.862
233.28	233.28	782.26	3.834	2.914	1-JS1t	1.816	2.273	3.031	3.031	6.413	5.098
272.16	272.16	782.67	4.245	3.282	1-JS1t	2.007	2.519	3.254	3.254	6.969	5.306
311.04	311.04	783.07	4.645	3.654	1-JS1t	2.198	2.753	3.459	3.459	7.494	5.491
349.92	349.92	783.47	5.041	4.033	5-JS1t	2.380	2.978	3.648	3.648	7.993	5.660
388.80	388.80	783.87	5.441	4.423	5-JS1t	2.556	3.195	3.826	3.826	8.469	5.815

****

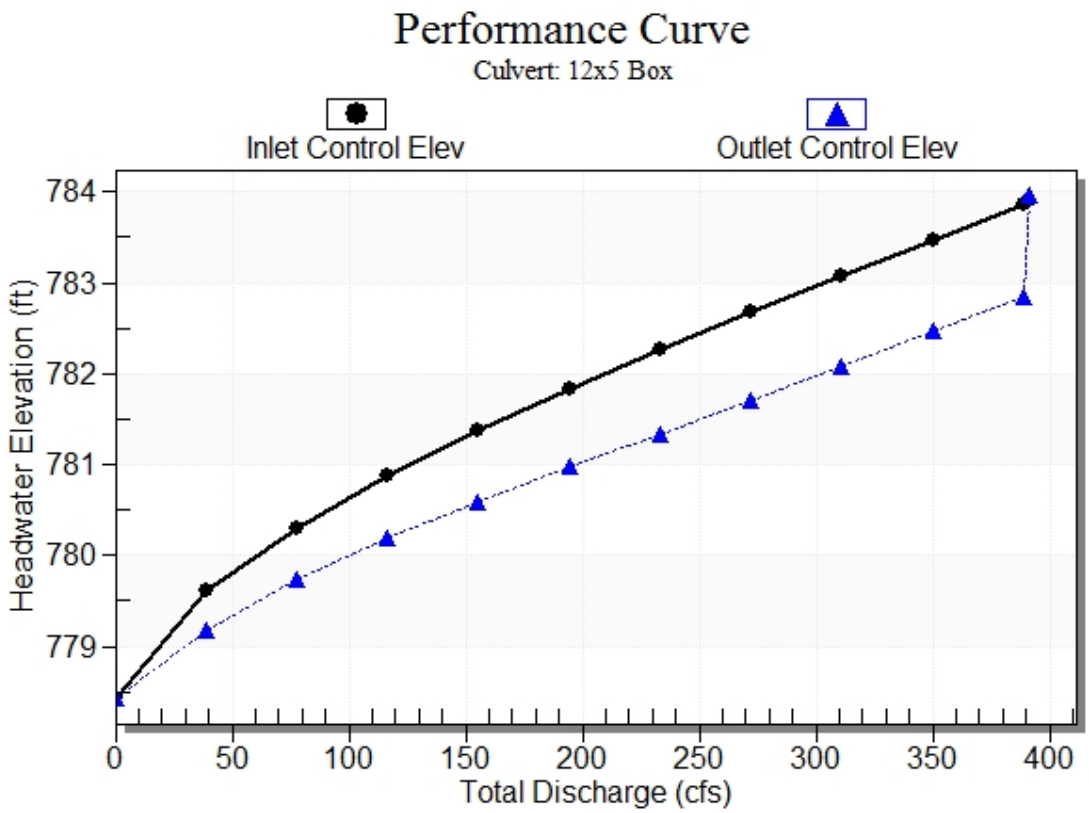
Straight Culvert

Inlet Elevation (invert): 778.43 ft, Outlet Elevation (invert): 777.91 ft

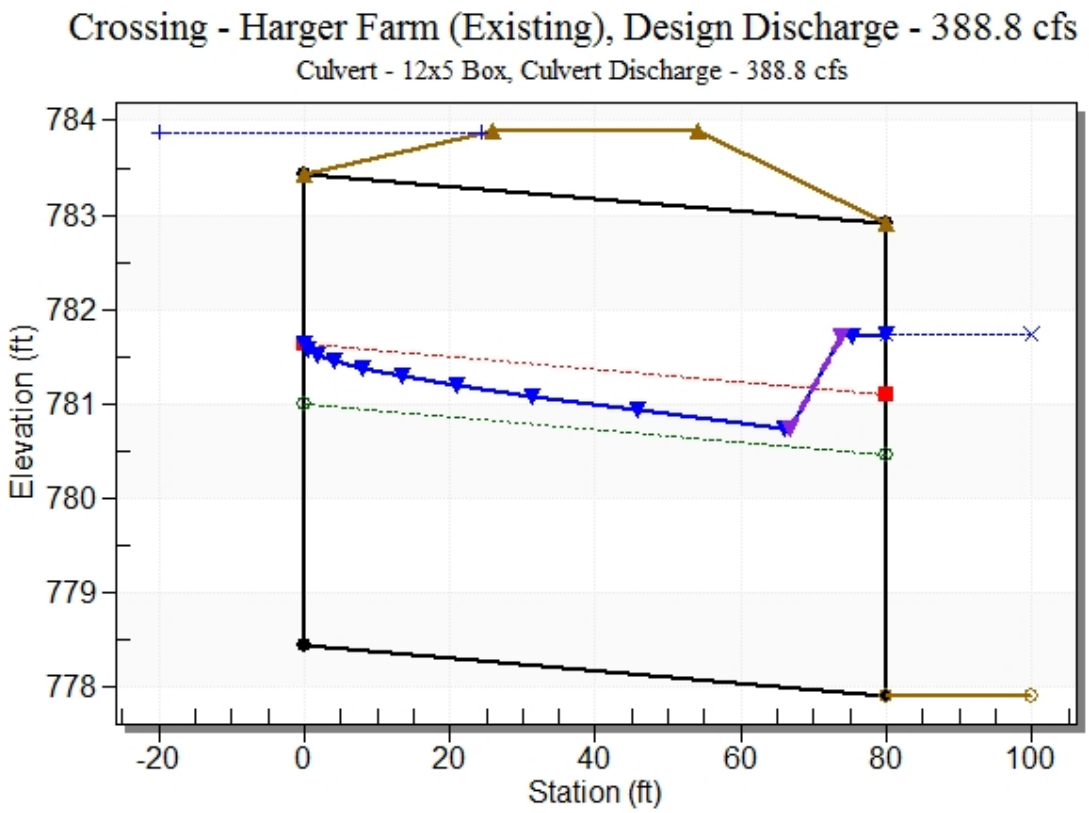
Culvert Length: 80.00 ft, Culvert Slope: 0.0065

****

Culvert Performance Curve Plot: 12x5 Box



Water Surface Profile Plot for Culvert: 12x5 Box



Site Data - 12x5 Box

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 778.43 ft

Outlet Station: 80.00 ft

Outlet Elevation: 777.91 ft

Number of Barrels: 1

Culvert Data Summary - 12x5 Box

Barrel Shape: Concrete Box

Barrel Span: 12.00 ft

Barrel Rise: 5.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0140

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Harger Farm (Existing))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	777.91	0.00	0.00	0.00	0.00
38.88	779.17	1.26	3.15	0.51	0.58
77.76	779.70	1.79	3.81	0.73	0.61
116.64	780.10	2.19	4.25	0.89	0.63
155.52	780.42	2.51	4.59	1.02	0.64
194.40	780.70	2.79	4.86	1.13	0.65
233.28	780.94	3.03	5.10	1.23	0.65
272.16	781.16	3.25	5.31	1.32	0.66
311.04	781.37	3.46	5.49	1.40	0.67
349.92	781.56	3.65	5.66	1.48	0.67
388.80	781.74	3.83	5.82	1.55	0.67

Tailwater Channel Data - Harger Farm (Existing)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 6.00 ft

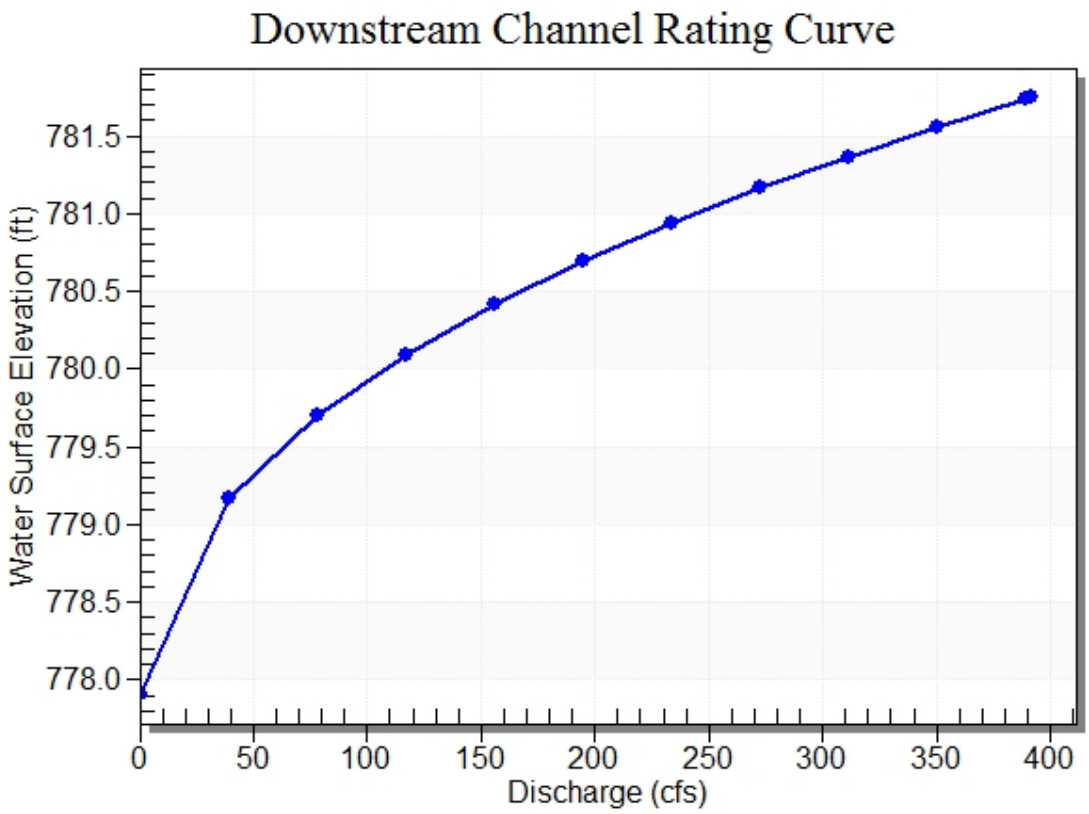
Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0065

Channel Manning's n: 0.0350

Channel Invert Elevation: 777.91 ft

Tailwater Rating Curve Plot for Crossing: Harger Farm (Existing)



Roadway Data for Crossing: Harger Farm (Existing)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 783.90 ft

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

HY-8 Culvert Analysis Report

Project Notes

Project Title: E. M. Hare Arm

Designer: Brian Powers

Project Date: Thursday, May 19, 2016

Notes:

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

Exit Loss Option: Standard Method

Crossing Notes: Presley (Existing)

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

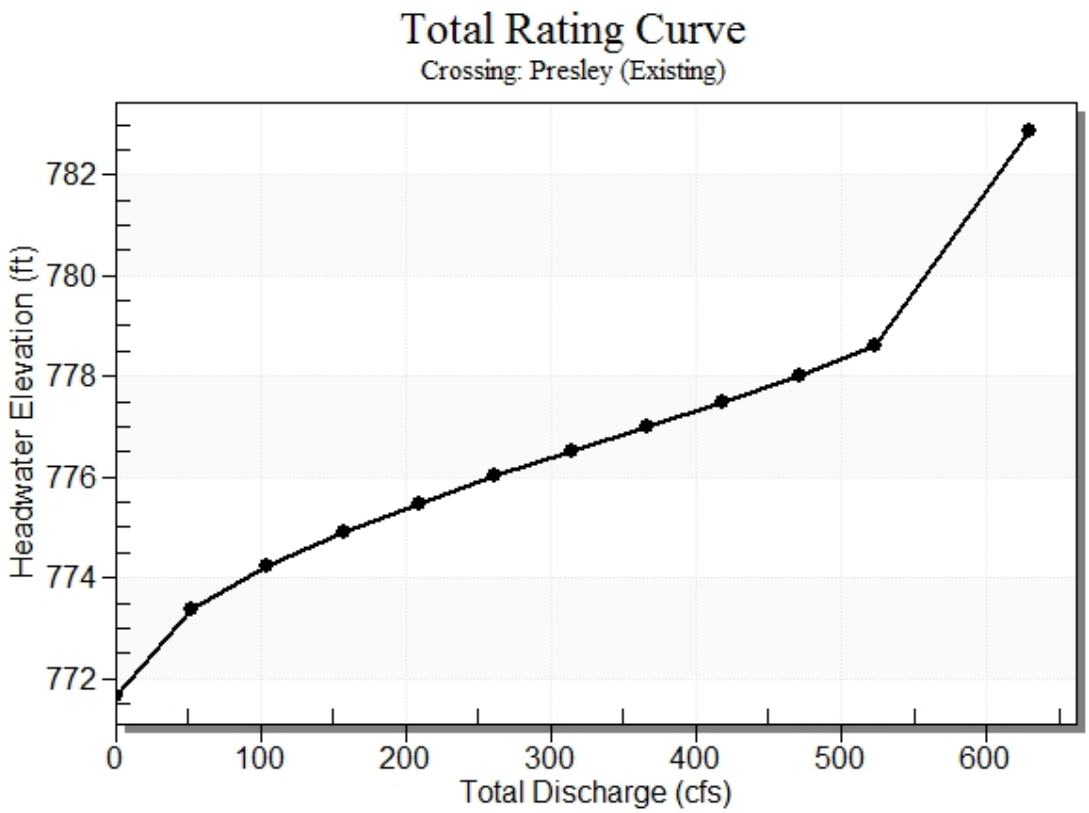
Design Flow: 523.3 cfs

Maximum Flow: 523.3 cfs

Table 1 - Summary of Culvert Flows at Crossing: Presley (Existing)

Headwater Elevation (ft)	Total Discharge (cfs)	12x5 Box Discharge (cfs)	Roadway Discharge (cfs)	Iterations
771.67	0.00	0.00	0.00	1
773.37	52.33	52.33	0.00	1
774.22	104.66	104.66	0.00	1
774.89	156.99	156.99	0.00	1
775.48	209.32	209.32	0.00	1
776.02	261.65	261.65	0.00	1
776.53	313.98	313.98	0.00	1
777.01	366.31	366.31	0.00	1
777.48	418.64	418.64	0.00	1
778.00	470.97	470.97	0.00	1
778.61	523.30	523.30	0.00	1
780.00	630.00	630.00	0.00	Overtopping

Rating Curve Plot for Crossing: Presley (Existing)



Culvert Notes: 12x5 Box

Table 2 - Culvert Summary Table: 12x5 Box

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	771.67	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
52.33	52.33	773.37	1.437	1.705	1-S1t	0.834	0.839	1.682	1.682	2.593	3.097
104.66	104.66	774.22	2.280	2.546	1-S1t	1.310	1.332	2.341	2.341	3.725	3.718
156.99	156.99	774.89	2.971	3.218	1-S1t	1.707	1.745	2.823	2.823	4.635	4.130
209.32	209.32	775.48	3.580	3.809	1-S1t	2.067	2.114	3.215	3.215	5.426	4.446
261.65	261.65	776.02	4.144	4.350	1-S1t	2.405	2.453	3.551	3.551	6.140	4.707
313.98	313.98	776.53	4.683	4.858	1-S1t	2.727	2.770	3.849	3.849	6.799	4.931
366.31	366.31	777.01	5.218	5.342	1-S1t	3.030	3.070	4.117	4.117	7.414	5.128
418.64	418.64	777.48	5.763	5.808	1-S1t	3.326	3.356	4.363	4.363	7.996	5.304
470.97	470.97	778.00	6.334	6.259	5-S1t	3.615	3.630	4.591	4.591	8.549	5.465
523.30	523.30	778.61	6.941	6.699	5-S1t	3.894	3.894	4.804	4.804	9.078	5.612

****

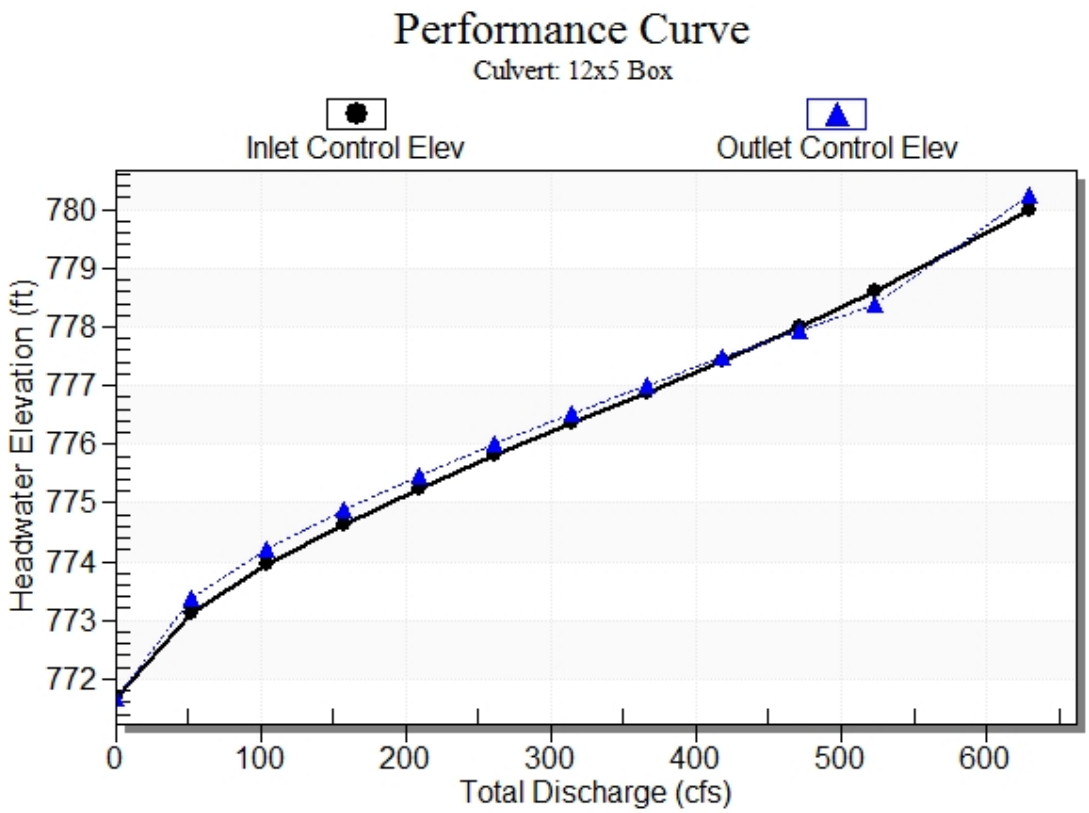
Straight Culvert

Inlet Elevation (invert): 771.67 ft, Outlet Elevation (invert): 771.50 ft

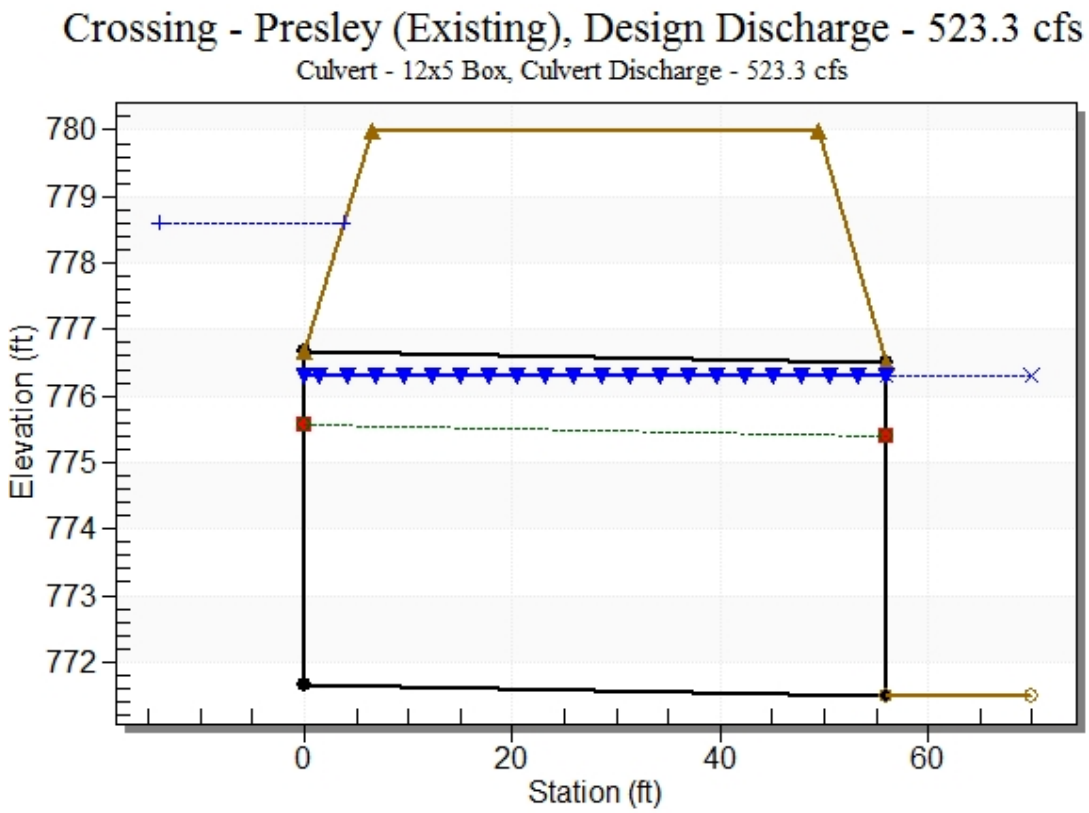
Culvert Length: 56.00 ft, Culvert Slope: 0.0030

****

Culvert Performance Curve Plot: 12x5 Box



Water Surface Profile Plot for Culvert: 12x5 Box



Site Data - 12x5 Box

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 771.67 ft

Outlet Station: 56.00 ft

Outlet Elevation: 771.50 ft

Number of Barrels: 1

Culvert Data Summary - 12x5 Box

Barrel Shape: Concrete Box

Barrel Span: 12.00 ft

Barrel Rise: 5.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Presley (Existing))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	771.50	0.00	0.00	0.00	0.00
52.33	773.18	1.68	3.10	0.50	0.52
104.66	773.84	2.34	3.72	0.70	0.54
156.99	774.32	2.82	4.13	0.85	0.55
209.32	774.71	3.21	4.45	0.96	0.56
261.65	775.05	3.55	4.71	1.06	0.57
313.98	775.35	3.85	4.93	1.15	0.58
366.31	775.62	4.12	5.13	1.23	0.58
418.64	775.86	4.36	5.30	1.31	0.59
470.97	776.09	4.59	5.46	1.38	0.59
523.30	776.30	4.80	5.61	1.44	0.60

Tailwater Channel Data - Presley (Existing)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

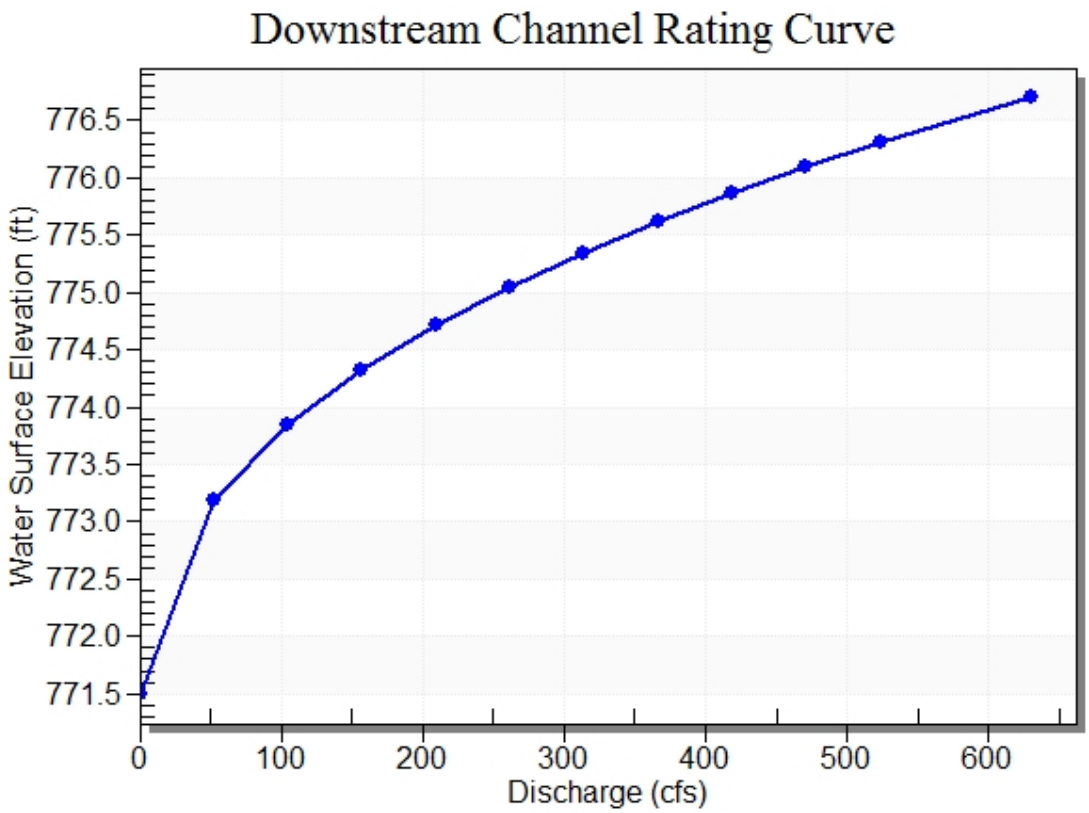
Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0048

Channel Manning's n: 0.0350

Channel Invert Elevation: 771.50 ft

Tailwater Rating Curve Plot for Crossing: Presley (Existing)



Roadway Data for Crossing: Presley (Existing)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 780.00 ft

Roadway Surface: Paved

Roadway Top Width: 43.00 ft

HY-8 Culvert Analysis Report

Project Notes

Project Title: E.M. Hare Arm

Designer: Brian Powers

Project Date: Thursday, May 19, 2016

Notes:

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

Exit Loss Option: Standard Method

Crossing Notes: Home D (Existing)

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

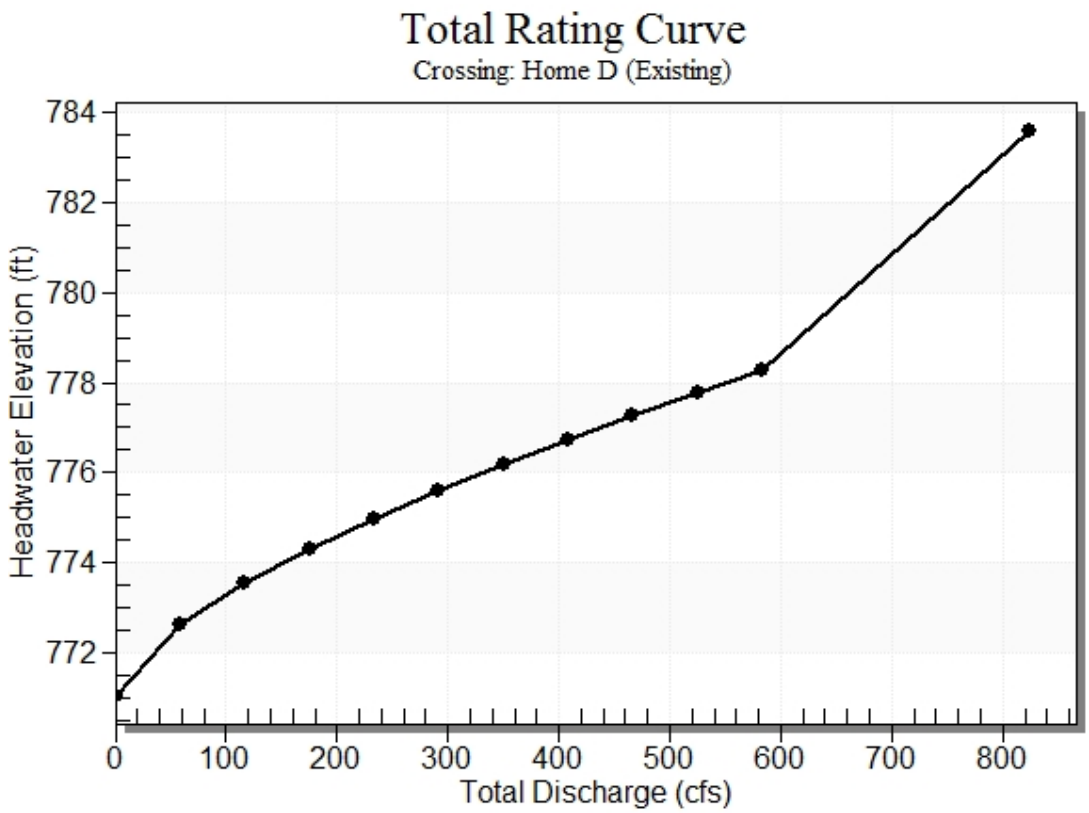
Design Flow: 583.4 cfs

Maximum Flow: 583.4 cfs

Table 1 - Summary of Culvert Flows at Crossing: Home D (Existing)

Headwater Elevation (ft)	Total Discharge (cfs)	12x6 Box Discharge (cfs)	Roadway Discharge (cfs)	Iterations
771.05	0.00	0.00	0.00	1
772.64	58.34	58.34	0.00	1
773.56	116.68	116.68	0.00	1
774.31	175.02	175.02	0.00	1
774.98	233.36	233.36	0.00	1
775.59	291.70	291.70	0.00	1
776.17	350.04	350.04	0.00	1
776.72	408.38	408.38	0.00	1
777.25	466.72	466.72	0.00	1
777.76	525.06	525.06	0.00	1
778.29	583.40	583.40	0.00	1
781.00	824.58	824.58	0.00	Overtopping

Rating Curve Plot for Crossing: Home D (Existing)



Culvert Notes: 12x6 Box

Table 2 - Culvert Summary Table: 12x6 Box

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	771.05	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
58.34	58.34	772.64	1.545	1.590	1-S1t	0.887	0.902	1.773	1.773	2.742	3.189
116.68	116.68	773.56	2.452	2.512	1-S1t	1.405	1.432	2.463	2.463	3.948	3.825
175.02	175.02	774.31	3.206	3.263	1-S1t	1.841	1.876	2.966	2.966	4.918	4.247
233.36	233.36	774.98	3.861	3.928	1-S1t	2.238	2.273	3.375	3.375	5.762	4.572
291.70	291.70	775.59	4.463	4.541	1-S1t	2.603	2.638	3.726	3.726	6.524	4.839
350.04	350.04	776.17	5.031	5.119	1-S1t	2.950	2.979	4.036	4.036	7.227	5.069
408.38	408.38	776.72	5.579	5.669	1-S1t	3.288	3.301	4.316	4.316	7.884	5.271
466.72	466.72	777.25	6.123	6.199	7-M1t	3.609	3.608	4.573	4.573	8.505	5.452
525.06	525.06	777.76	6.673	6.712	7-M1t	3.925	3.903	4.811	4.811	9.096	5.617
583.40	583.40	778.29	7.241	7.210	7-M1t	4.233	4.187	5.032	5.032	9.661	5.769

****

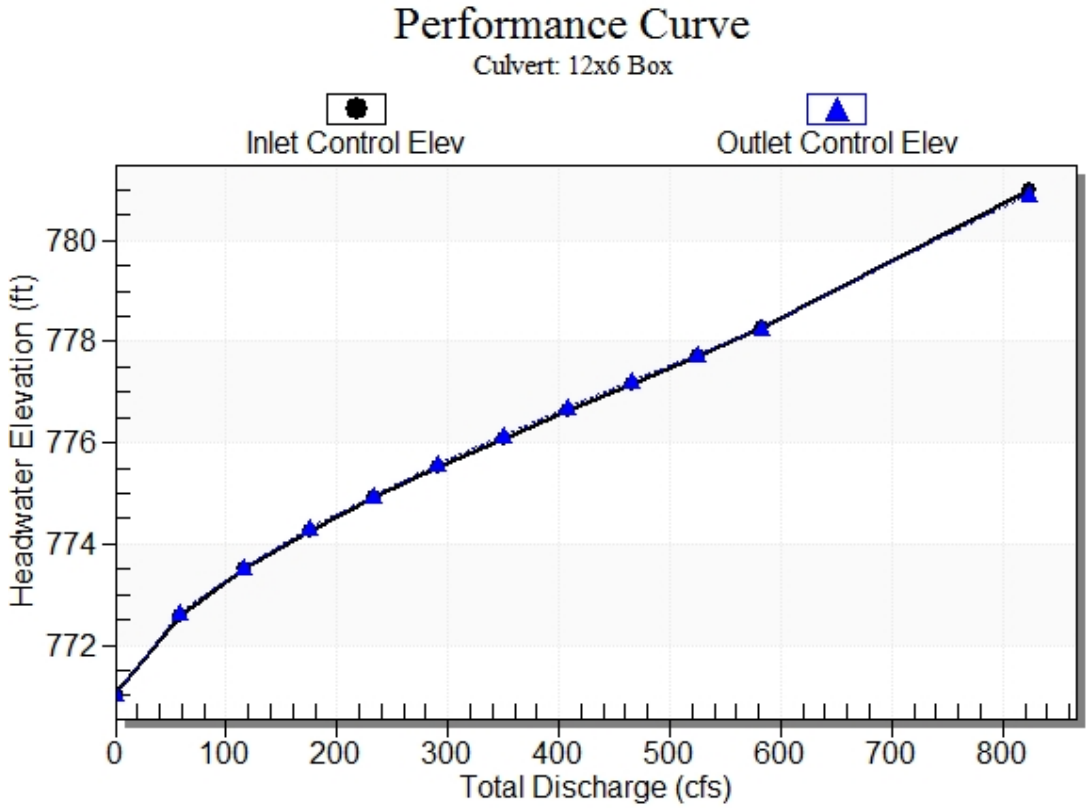
Straight Culvert

Inlet Elevation (invert): 771.05 ft, Outlet Elevation (invert): 770.50 ft

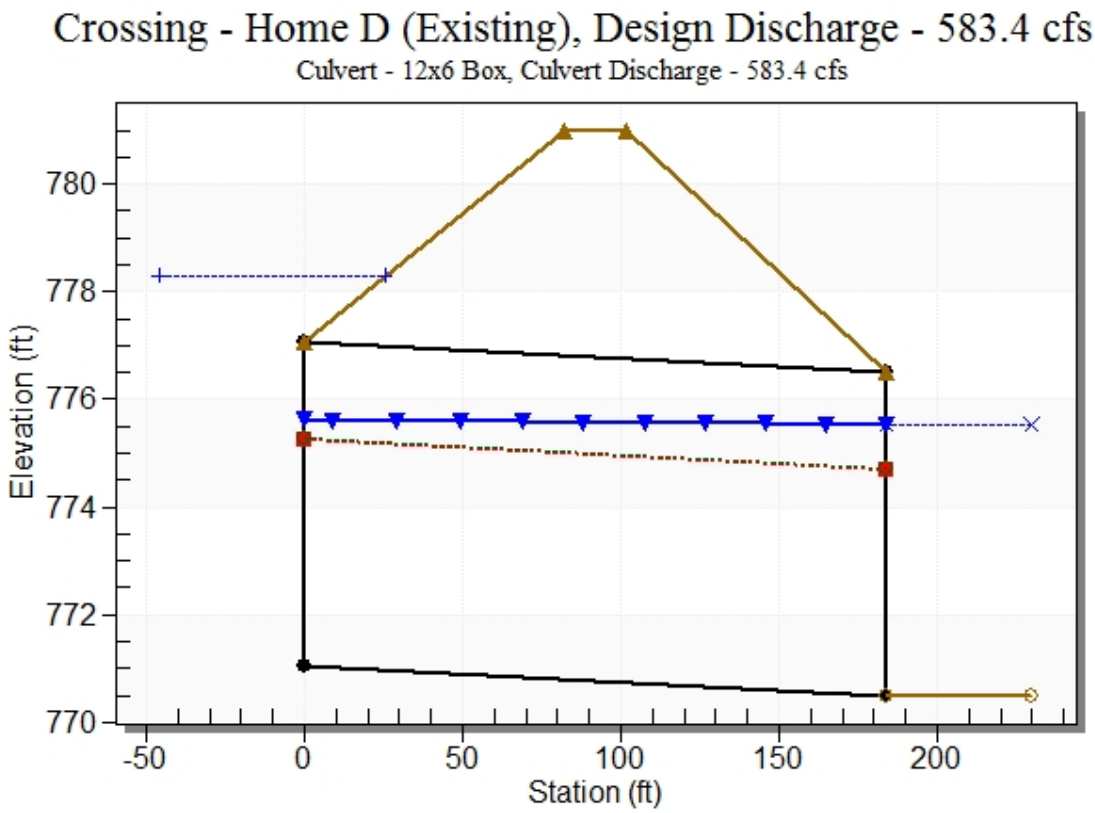
Culvert Length: 184.00 ft, Culvert Slope: 0.0030

****

Culvert Performance Curve Plot: 12x6 Box



Water Surface Profile Plot for Culvert: 12x6 Box



Site Data - 12x6 Box

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 771.05 ft

Outlet Station: 184.00 ft

Outlet Elevation: 770.50 ft

Number of Barrels: 1

Culvert Data Summary - 12x6 Box

Barrel Shape: Concrete Box

Barrel Span: 12.00 ft

Barrel Rise: 6.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Home D (Existing))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	770.50	0.00	0.00	0.00	0.00
58.34	772.27	1.77	3.19	0.53	0.52
116.68	772.96	2.46	3.82	0.74	0.54
175.02	773.47	2.97	4.25	0.89	0.56
233.36	773.87	3.37	4.57	1.01	0.57
291.70	774.23	3.73	4.84	1.12	0.57
350.04	774.54	4.04	5.07	1.21	0.58
408.38	774.82	4.32	5.27	1.29	0.59
466.72	775.07	4.57	5.45	1.37	0.59
525.06	775.31	4.81	5.62	1.44	0.60
583.40	775.53	5.03	5.77	1.51	0.60

Tailwater Channel Data - Home D (Existing)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

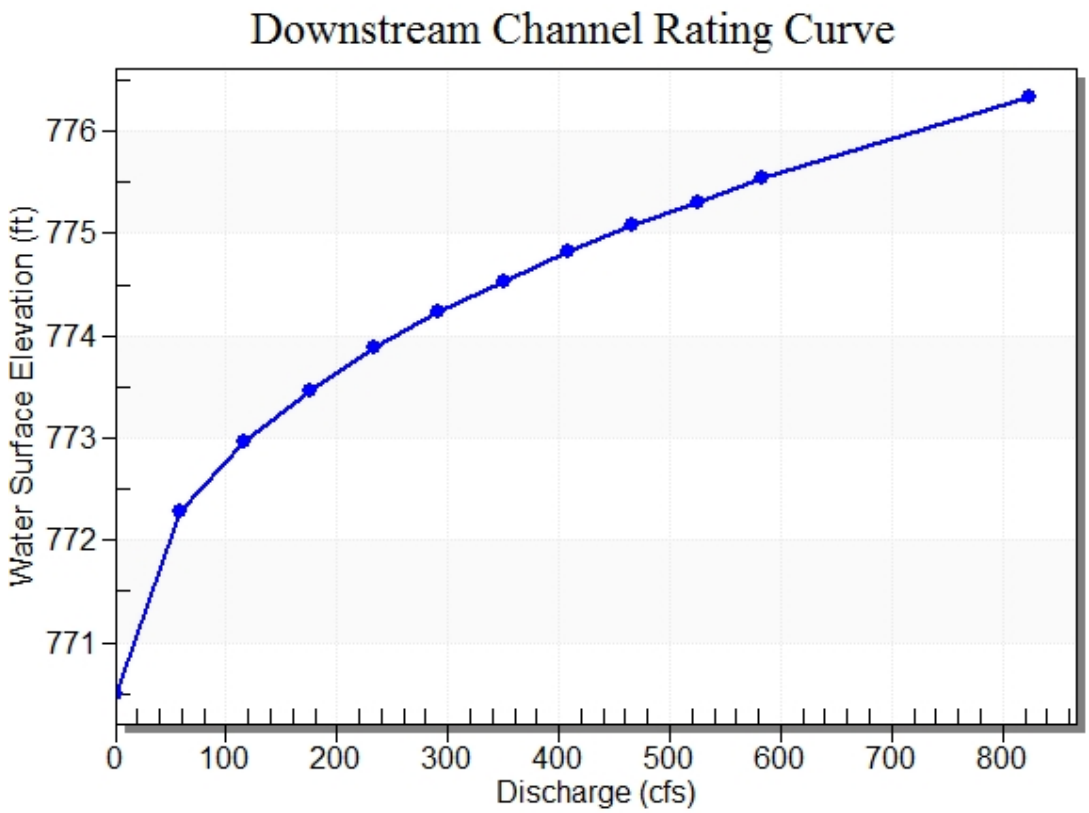
Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0048

Channel Manning's n: 0.0350

Channel Invert Elevation: 770.50 ft

Tailwater Rating Curve Plot for Crossing: Home D (Existing)



Roadway Data for Crossing: Home D (Existing)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 781.00 ft

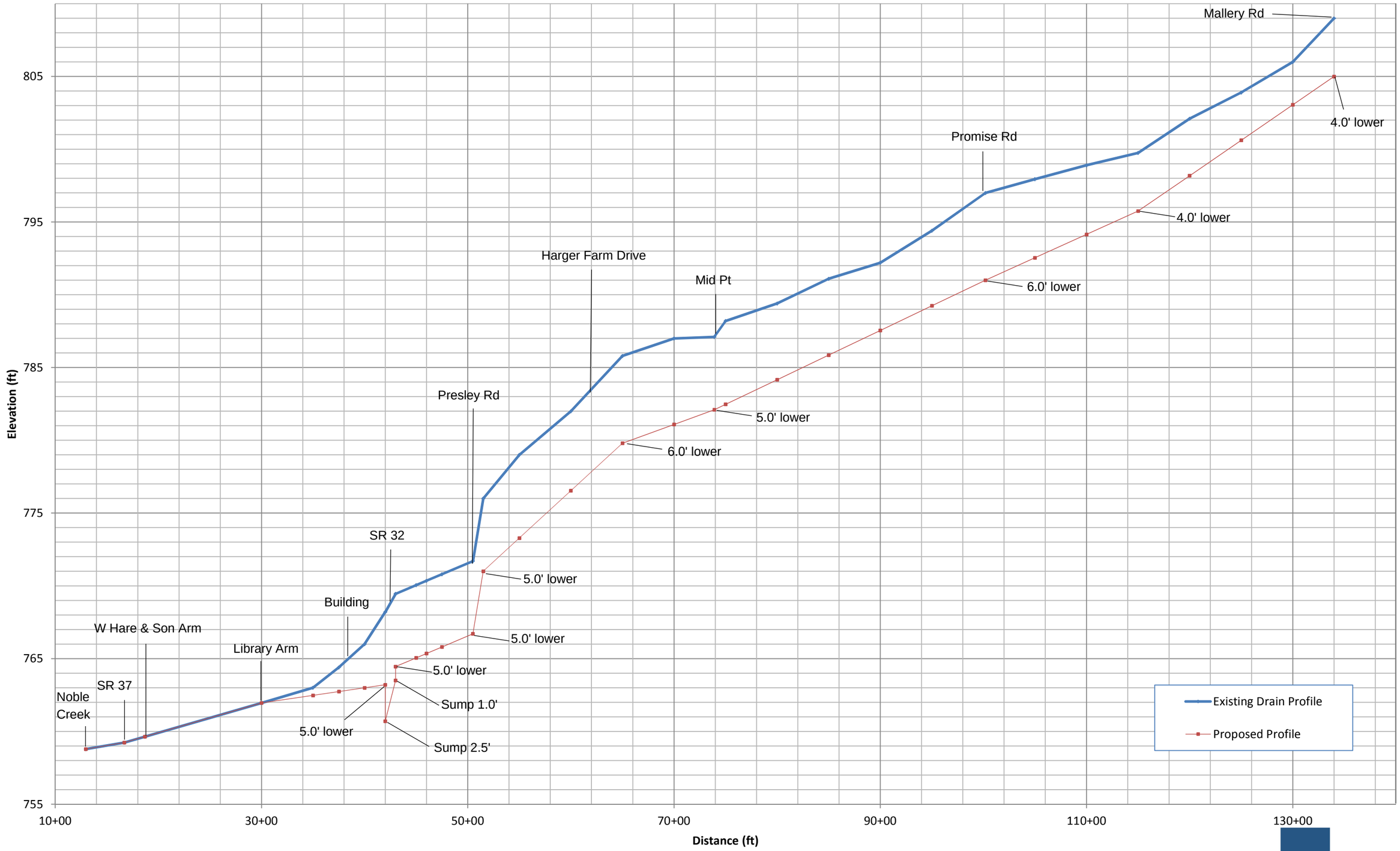
Roadway Surface: Paved

Roadway Top Width: 20.00 ft

Attachment 5

Profile Figure

E.M. Hare Arm Profiles



Elwood Wilson Drain, E.M. Hare Arm Hydraulic Study
7/22/2016

Clark Dietz
ENGINEERS

Attachment 6

Capacity Calculations

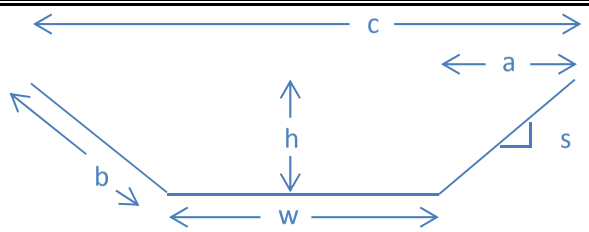
Max Flow, Mannings Equation

Project: E.M. Hare Arm, Elwood Wilson Drain Hydrauilc Study

Made By: BEP

Date: 5/25/2016

Trapazoidal Ditch



Q = (1.00 / n)*A*R^(2/3) * S^(1/2)

n =	0.035	(manning's roughness coefficient)	
A =	64	(Area, square feet)	
P =	29.30	(Wet Perimeter, feet)	
R =	2.18	(Hydraulic Radius, feet)	R = A / P
S =	0.0049	(Slope, ft/ft)	
Q =	**215.5**	**CFS**	
V =	3.37	ft/s	

h =	4	feet	(height)
w =	4	feet	(width)
s =	3 : 1		(side slope)
a =	12	feet	
b =	12.65	feet	
c =	28	feet	

Station 115+00 - 134+00

Upstream end of channel at Mallery Road

Area =	53200	sq ft	1.22	acres
Volume =	121,600	cu ft	4504	cu yd

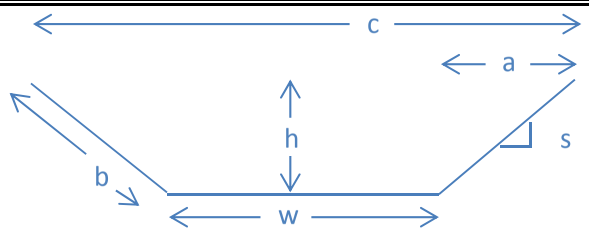
Max Flow, Mannings Equation

Project: E.M. Hare Arm, Elwood Wilson Drain Hydrauilc Study

Made By: BEP

Date: 5/25/2016

Trapazoidal Ditch



Q = (1.00 / n)*A*R^(2/3) * S^(1/2)

n =	0.035	(manning's roughness coefficient)	
A =	64	(Area, square feet)	
P =	29.30	(Wet Perimeter, feet)	
R =	2.18	(Hydraulic Radius, feet)	R = A / P
S =	0.0032	(Slope, ft/ft)	
Q =	**174.1**	**CFS**	
V =	2.72	ft/s	

h =	4	feet	(height)
w =	4	feet	(width)
s =	3 : 1		(side slope)
a =	12	feet	
b =	12.65	feet	
c =	28	feet	

Station 102+00 - 115+00

Downstream ends at Promise Road

Area =	36400	sq ft	0.84	acres
Volume =	83,200	cu ft	3081	cu yd

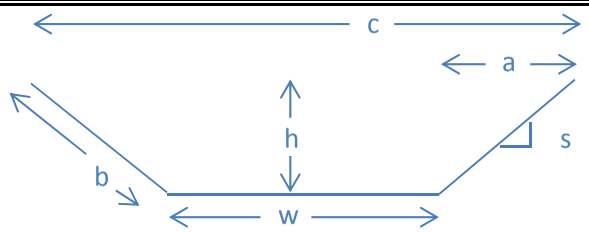
Max Flow, Mannings Equation

Project: E.M. Hare Arm, Elwood Wilson Drain Hydrauilc Study

Made By: BEP

Date: 5/25/2016

Trapazoidal Ditch



Q = (1.00 / n)*A*R^(2/3) * S^(1/2)

n =	0.035	(manning's roughness coefficient)	
A =	132	(Area, square feet)	
P =	41.95	(Wet Perimeter, feet)	
R =	3.15	(Hydraulic Radius, feet)	R = A / P
S =	0.0034	(Slope, ft/ft)	
Q =	**472.2**	**CFS**	
V =	3.58	ft/s	

h =	6	feet	(height)
w =	4	feet	(width)
s =	3 : 1		(side slope)
a =	18	feet	
b =	18.97	feet	
c =	40	feet	

Station 73+90 - 102+00

Mid Point to Promise Rd

Area =	112400	sq ft	2.58	acres
Volume =	370,920	cu ft	13,738	cu yd

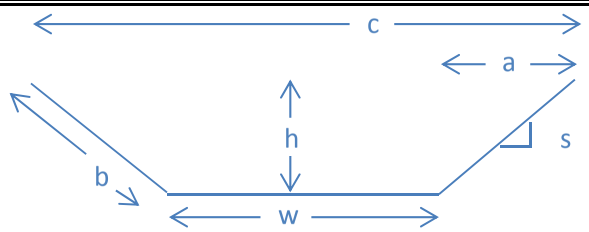
Max Flow, Mannings Equation

Project: E.M. Hare Arm, Elwood Wilson Drain Hydrauilc Study

Made By: BEP

Date: 5/25/2016

Trapazoidal Ditch



Q = (1.00 / n)*A*R^(2/3) * S^(1/2)

n =	0.035	(manning's roughness coefficient)	
A =	132	(Area, square feet)	
P =	41.95	(Wet Perimeter, feet)	
R =	3.15	(Hydraulic Radius, feet)	R = A / P
S =	0.0026	(Slope, ft/ft)	
Q =	**413.0**	**CFS**	
V =	3.13	ft/s	

h =	6	feet	(height)
w =	4	feet	(width)
s =	3 : 1		(side slope)
a =	18	feet	
b =	18.97	feet	
c =	40	feet	

Station 65+00 - 73+90

Downstream from Mid Point

Area =	35600	sq ft	0.82	acres
Volume =	117,480	cu ft	4,351	cu yd

***Can't go deeper to reduce downstream slope because the channel must avoid a wetland in this section.

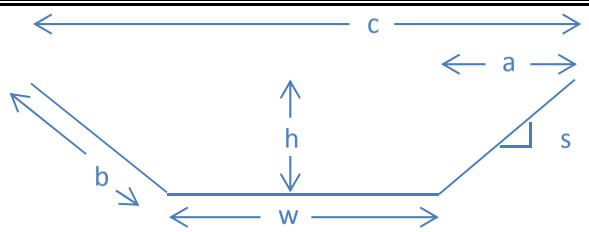
Max Flow, Mannings Equation

Project: E.M. Hare Arm, Elwood Wilson Drain Hydrauilc Study

Made By: BEP

Date: 5/25/2016

Trapazoidal Ditch



Q = (1.00 / n)*A*R^(2/3) * S^(1/2)

n =	0.035	(manning's roughness coefficient)	
A =	95	(Area, square feet)	
P =	35.62	(Wet Perimeter, feet)	
R =	2.67	(Hydraulic Radius, feet)	R = A / P
S =	0.0065	(Slope, ft/ft)	
Q =	**420.8**	**CFS**	
V =	**4.43**	ft/s	

h =	5	feet	(height)
w =	4	feet	(width)
s =	3 : 1		(side slope)
a =	15	feet	
b =	15.81	feet	
c =	34	feet	

Station 51+50 - 65+00

Upsteam of Presley Drive

Velocity is greater than 4 ft/s. Grass Swale has a max V=4ft/s. Must line the channel with Rip Rap, max V=10ft/s.

Area =	45900	sq ft	1.05	acres
Volume =	128,250	cu ft	4,750	cu yd

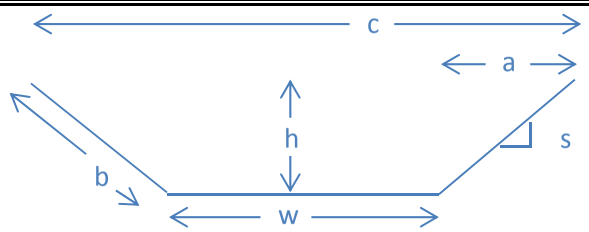
Max Flow, Mannings Equation

Project: E.M. Hare Arm, Elwood Wilson Drain Hydrauilc Study

Made By: BEP

Date: 5/25/2016

Trapazoidal Ditch



Q = (1.00 / n)*A*R^(2/3) * S^(1/2)

n =	0.035	(manning's roughness coefficient)	
A =	95	(Area, square feet)	
P =	35.62	(Wet Perimeter, feet)	
R =	2.67	(Hydraulic Radius, feet)	R = A / P
S =	0.043	(Slope, ft/ft)	
Q =	**1082.4**	**CFS**	
V =	**11.39**	ft/s	

h =	5	feet	(height)
w =	4	feet	(width)
s =	3 : 1		(side slope)
a =	15	feet	
b =	15.81	feet	
c =	34	feet	

Station 50+50 - 51+50

Upsteam of Presley Drive

Velocity is greater than 10 ft/s. Channel Armoring is required.

Area =	3400	sq ft	0.08	acres
Volume =	9,500	cu ft	352	cu yd

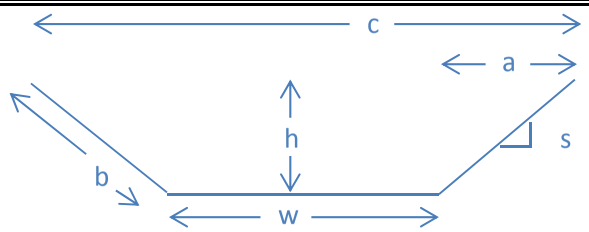
Max Flow, Mannings Equation

Project: E.M. Hare Arm, Elwood Wilson Drain Hydrauilc Study

Made By: BEP

Date: 5/25/2016

Trapazoidal Ditch



Q = (1.00 / n)*A*R^(2/3) * S^(1/2)

n =	0.035	(manning's roughness coefficient)	
A =	153.52	(Area, square feet)	
P =	38.99	(Wet Perimeter, feet)	
R =	3.94	(Hydraulic Radius, feet)	R = A / P
S =	0.003	(Slope, ft/ft)	
Q =	**599.1**	**CFS**	
V =	3.90	ft/s	

h =	7.6	feet	(height)
w =	5	feet	(width)
s =	2 : 1		(side slope)
a =	15.2	feet	
b =	16.99	feet	
c =	35.4	feet	

Station 42+50 - 50+50

SR 32 to Presley DR

Area =	20000	sq ft	0.46	acres
Volume =	60,000	cu ft	2,222	cu yd

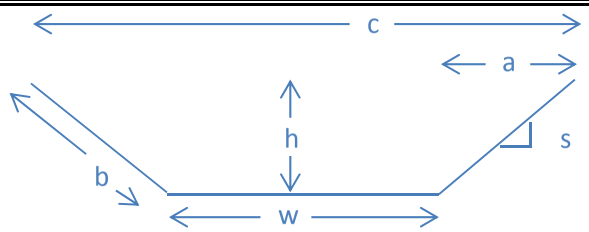
Max Flow, Mannings Equation

Project: E.M. Hare Arm, Elwood Wilson Drain Hydrauilc Study

Made By: BEP

Date: 5/25/2016

Trapazoidal Ditch



Q = (1.00 / n)*A*R^(2/3) * S^(1/2)

n =	0.035	(manning's roughness coefficient)					
A =	232	(Area, square feet)					
P =	55.60	(Wet Perimeter, feet)					
R =	4.17	(Hydraulic Radius, feet)	R = A / P	h =	8	feet	(height)
S =	0.0019	(Slope, ft/ft)		w =	5	feet	(width)
				s =	3 : 1		(side slope)
Q =	**748.9**	**CFS**		a =	24	feet	
				b =	25.30	feet	
V =	3.23	ft/s		c =	53	feet	

Station 30+00 - 42+50

SR 32 to Library Arm

Area =	25000	sq ft	0.57	acres
Volume =	39,063	cu ft	1,447	cu yd

The Existing channel has enough capacity to contain the Q100 discharge.

For the section of the stream that need to be lowered sheet pile could be driven to create a lower channel center.

Attachment 7

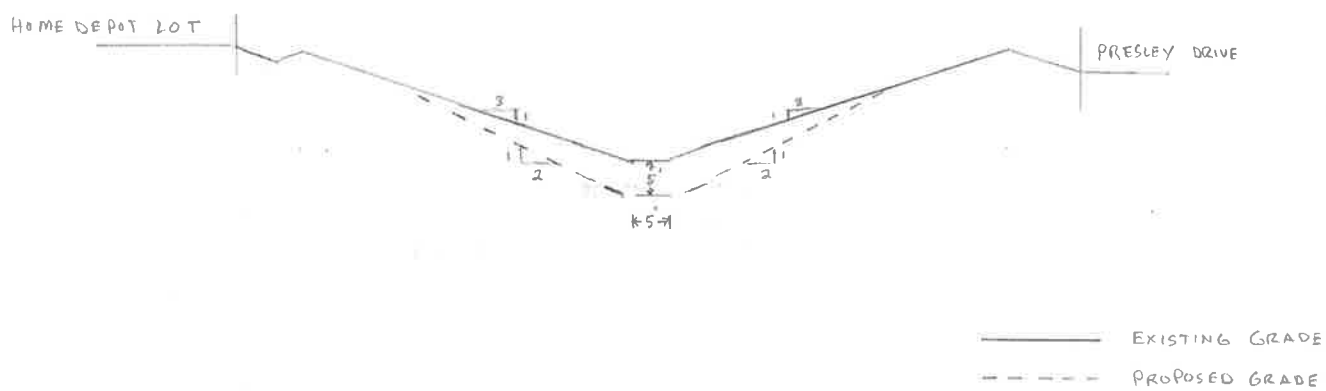
Channel Crossing Section – Home Depot

Project Name: E. M. HARE ARM **No.**

CROSS SECTION - CHANNEL ADJACENT TO HOME DEPOT

Made by: BP **Date:** 5/25/16 **Checked by:** **Date:**

CROSS SECTION OF CHANNEL BETWEEN PRESLEY DR AND HOME DEPOT
LOOKING UPSTREAM



CLARK DIETZ

COMPUTATIONS

Attachment 8

Natural Resource Assessment

WILLIAMS CREEK
CONSULTING

Natural Resource Assessment — Elwood Wilson Drain

Indianapolis, Marion County, Indiana

Prepared For:

Clark Dietz, Inc.

8900 Keystone Crossing, Suite 900

Indianapolis, Indiana 46240

Clark Dietz
ENGINEERS

May 2016

Williams Creek Consulting, Inc.
Corporate Office
619 N. Pennsylvania
Indianapolis, Indiana 46204

Satellite Offices:
Columbus, Ohio
St. Louis, Missouri

+1.877.668.8848
info@williamscreek.net

TABLE OF CONTENTS

Natural Resource Assessment **Page**

EXECUTIVE SUMMARY 1

1.0 LIMITATION OF LIABILITY 3

2.0 INTRODUCTION 3

3.0 JURISDICTIONAL RESOURCES 3

3.1 U.S. ARMY CORPS OF ENGINEERS 3
3.1.1 Waters of the U.S. *5*
3.1.2 Wetlands *5*
3.1.3 Regional Supplement Manuals *6*
3.2 UNITED STATES FISH AND WILDLIFE SERVICE 7
3.3 INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT 8
3.4 INDIANA DEPARTMENT OF NATURAL RESOURCES 8
3.5 SOIL AND WATER CONSERVATION DISTRICT 9
3.6 HAMILTON COUNTY DRAINAGE BOARD 9

4.0 DESKTOP REVIEW 9

4.1 UNITED STATES GEOLOGICAL SURVEY 7.5-MINUTE QUADRANGLE MAP 9
4.2 NATIONAL WETLANDS INVENTORY MAP 10
4.3 UNITED STATES DEPARTMENT OF AGRICULTURE SOIL SURVEY 10
4.4 AERIAL PHOTOGRAPHY 11
4.5 FLOOD INSURANCE RATE MAP 11
4.6 ENDANGERED, THREATENED, AND RARE SPECIES EVALUATION 12

5.0 SITE RECONNAISSANCE 12

5.1 METHODOLOGY 12
5.2 SITE AND ADJACENT PROPERTY LAND USE 13
5.3 WETLAND SUMMARY 13
5.3.1 Wetland A – (~0.74 acre) *13*
5.3.2 Wetland B – (~0.17 acre) *14*
5.3.3 Wetland C – (~0.30 acre) *14*
5.3.4 Wetland D – (~0.62 acre) *15*
5.4 DATA POINT SUMMARY 15
5.5 DRAINAGE FEATURES, STREAMS, AND OTHER POTENTIAL "WATERS OF THE U.S." 16

6.0 CONCLUSIONS 17

FIGURES

Figure 1 – SITE Location Map
Figure 2 – National Wetlands Inventory Map
Figure 3 – Key to National Wetlands Inventory Map
Figure 4 – United States Department of Agriculture Soil Survey Map
Figure 5 – 2014 Aerial Photograph
Figure 6 – FEMA Flood Insurance Rate Map
Figure 7a – Data Point & Aquatic Feature Location Map
Figure 7b – Data Point & Aquatic Feature Location Map

APPENDICES

Appendix A – USFWS & IDNR Correspondence Letters
Appendix B – SITE Photographs
Appendix C – Data Forms

Executive Summary

Williams Creek Consulting, Inc. (Williams Creek) performed a natural resource assessment (NRA) and wetland delineation for Elwood Wilson Drain, E.M. Hare Arm and its contributing watershed upstream of State Road 37 in Noblesville, Hamilton County, Indiana (SITE) on 18 April 2016. Field inspection was limited to the regulated drainage easement of the Elwood Wilson Drain with visual inspection and desktop review of the contributing watershed.

Williams Creek reached the following conclusions based on review of available and reasonably ascertainable federal, state, and local resources, and a SITE inspection conducted on the date referenced above.

- Four (4) wetlands, Wetlands A, B, C, and D were identified on-SITE. Communally, all of the identified wetlands were located at least partially within a regulated drain easement. Due to this hydrologic connection with a "waters of the U.S.," any potential impacts would likely be considered subject to regulation by the IDEM and the USACE.
- Three (3) potential wetland areas were located on-SITE. Potential Wetlands 1 and 2 did not appear to have a hydrologic connection with any "waters of the U.S." and would likely be considered isolated wetlands subject to regulation by the IDEM alone. However, Potential Wetland 3 appeared to have a hydrologic connection to Elwood Wilson Drain, and therefore may be considered a jurisdictional "waters of the U.S." subject to USACE and IDEM jurisdiction.
- Two (2) drainage channels were located on-SITE. A regulated drain, Elwood Wilson Drain, bisected the SITE. Approximately 4,791 linear feet of Elwood Wilson Drain was open channel, and approximately 5,692 linear feet was encapsulated in drainage tiles. The second channel, approximately 859 linear feet in length, did not appear to have a hydrologic connection with any "waters of the U.S." and would not likely be considered jurisdictional and not subject to USACE regulation.
- A portion of the Elwood Wilson Drain consists of an open channel on western portion of the SITE. No other potential "waters of the U.S." were identified within the regulated drainage easement.
- Five (5) stormwater ponds, Ponds 1, 2, 3, 4, and 5, are located within the contributing watershed of the Elwood Wilson Drain on-SITE. All ponds appear to have been constructed in upland soils for the purpose of storing stormwater. As such, all ponds would not likely be considered jurisdictional "waters of the U.S." based on 40 CFR 230.3.
- Review of the Hamilton County FlexViewer website revealed that a regulated drain, Elwood Wilson Drain, E.M. Hare Arm, bisects the SITE, both as an open drain and as a closed tile drain.
- Correspondence with the U.S. Fish and Wildlife Service (USFWS) indicated that the SITE is within the range of the federally threatened northern long-eared bat (*Myotis septentrionalis*) and the federally endangered Indiana bat (*Myotis sodalis*). The USFWS does not have any records of the bats near the SITE and finds only minimal habitat for these species surrounding the SITE.

- Correspondence with the Indiana Department of Natural Resources (IDNR) indicated no special-status species within a 0.5 mile radius of the SITE area.
- A Rule 5 Stormwater Run-off Permit is required for land disturbance activities greater than one (1) acre.

If impacts to any wetlands or drainage features are proposed, the type of permit required will depend on the type and extent of impacts proposed. If less than 300 lf of stream impacts are proposed, then an IDEM Regional General Permit (RGP) Notification will likely be necessary. If more than 300 lf of impacts are proposed, a Regional General Permit (RGP) with Section 401 Water Quality Certification (WQC) will likely be necessary. If anticipated impacts exceed 300 lf of stream, then an Individual Permit (IP) may be necessary, dependent on the type of impacts proposed. Mitigation for impacts is required at a 1:1 ratio for drainage features and open water.

Mitigation for impacts to federally jurisdictional "waters of the U.S." are required at a 1:1 ratio for drainage features and open water, 4:1 for forested wetlands, 3:1 for scrub/shrub wetlands, and 2:1 for emergent wetlands.

If development activities are proposed to impact any of these aquatic features, Williams Creek recommends that the final report and associated figures be submitted to the USACE for Jurisdictional Determination.

1.0 Limitation of Liability

This report has been prepared solely in accordance with an agreement between Mr. Hans Peterson of Clark Dietz, Inc. ("CLIENT"), and Williams Creek Consulting, Inc. ("Williams Creek").

The services performed by Williams Creek have been conducted in a manner consistent with the level of quality and skill generally exercised by members of its profession and consulting practices relating to this type of engagement.

This report is solely for the use of CLIENT, and was prepared based upon an understanding of CLIENT's specific objective(s), and based upon information obtained by Williams Creek in furtherance of CLIENT's specific objective(s). Any reliance of this report by third parties shall be at such third party's sole risk as this report may not contain, or be based upon, sufficient information for purposes of other parties, for their objectives, or for other uses. This report shall only be presented in full and may not be used to support any other objectives than those for CLIENT as set out in the report, except where written approval and consent are expressly provided by CLIENT and Williams Creek.

2.0 INTRODUCTION

The purpose of this investigation was to conduct an NRA and wetland delineation of the SITE to evaluate potential land development permitting requirements regarding natural resources. Due to access restrictions, fieldwork was only completed within the regulated drain easement. Evaluation of potential natural resources within the remainder of the watershed was completed through desktop review. In this report, Williams Creek provides a detailed description of the information reviewed and collected as part of the scope of work for this project. Williams Creek summarizes the jurisdictional framework applicable to this project, provides a desktop review of relevant and publicly available documents, and details information collected during the SITE reconnaissance including a wetlands determination, an evaluation of the potential presence of other natural resources within the SITE boundary, and a discussion of endangered, threatened, and rare (ETR) species and habitat. The Conclusions section summarizes Williams Creek's findings, addresses potential concern areas and permitting, regulatory, and other relevant issues.

The SITE is located in the Riverwood, Indiana USGS 7.5-Minute Quadrangle Map, Sections 32 and 33, Township 19 North, Range 5 East and Section 5, Township 18 North, Range 5 East (**Figure 1**).

3.0 JURISDICTIONAL RESOURCES

3.1 U.S. Army Corps of Engineers

Through the Clean Water Act (CWA) of 1972, Section 404, the USACE maintains authority over "waters of the U.S." as defined in the Code of Federal Regulations (33 CFR 328.3). The limit of jurisdiction described in 33 CFR 328.4 for non-tidal waters is the "ordinary high water mark" if no adjacent wetlands are present. If wetlands are present, the limit of jurisdiction applies to the boundary of the adjacent wetland. Any wetland that has a hydrological connection to a "waters of the U.S." is also included. Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) also serves as a base of federal authority over certain waters. Definitions and permitting requirements for jurisdictional waters under Section 10 can be found in 33 CFR Parts 322 and 329.

A Section 404 permit must be obtained from the USACE before any fill or dredging activities are conducted within the boundary of a "waters of the U.S." including federal jurisdictional

wetlands. The USACE uses three (3) types of permits: nationwide permits, regional general permits for Indiana, and individual permits. Furthermore, a Section 401 WQC must be filed with the IDEM concurrently with the Section 404 permit(s). Each permit is discussed in the following paragraphs.

Nationwide Permits have been developed for projects that meet a specific criterion and are deemed to have minimal impacts to the aquatic environment. There are 44 Nationwide Permits created to streamline the permit process for smaller, repetitive, low impact projects including, but not limited to Aids to Navigation, Fish and Wildlife Harvesting, Outfall Structures and Maintenance, Utility Line Activities, Stream and Wetland Restoration, Maintenance Dredging of Existing Basins, Agriculture Activities, and Mining Activities.

Regional General Permits (RGP) for Indiana authorizes proposed impacts associated with any construction activities including agriculture and mining activities. Wetland impacts must be less than one (1) acre to qualify for this type of permit.

RGP Notification to IDEM may be used for impacts that are less than 0.1 acre of wetland or 300 linear feet of stream, and are deemed to have minimal impacts to the aquatic environment.

Individual Permits (IP) are required for proposed wetland impacts of one (1) acre and greater. The review process for this type of permit may take up to one (1) year due to the higher level of scrutiny by the regulatory agencies.

The Louisville District of the USACE developed new mitigation guidelines in September 2004 for the federal jurisdictional wetlands and "waters of the U.S." The guidelines require stream and wetland characterizations for all drainage features and wetlands proposed to be impacted. The document required for permitting must contain extensive detail of the proposed impact sites, the proposed mitigation sites, and information regarding the construction and monitoring of the mitigation sites.

Impacts to USACE jurisdictional wetlands or other "waters of the U.S." will require in-kind mitigation. The USACE and the IDEM prefer the mitigation to be on-site, but may allow off-site mitigation in some cases due to certain constraints of a property. The typical mitigation ratios for impacts to federally jurisdictional wetlands and other "waters of the U.S." are as follows:

Impact Type	**Replacement**
Emergent Wetland	2:1 Acres
Scrub-Shrub Wetland	3:1 Acres
Forested Wetland	4:1 Acres
Stream/Drainage Ways	1:1 Linear feet
Open Water	1:1 Acres

3.1.1 Waters of the U.S.

A "waters of the U.S." can be described as any waterway that appears to have a "clear, natural line impressed on the bank"[1] that is caused by variations in water levels over a period of time. The USACE is the final authority on the determination of whether a waterway qualifies for jurisdiction under the Clean Water Act, but jurisdictional "waters of the U.S." can include ephemeral streams and drainage ditches, as well as large rivers. Several indicators that may be considered in determining an ordinary high water mark include, but are not limited to, changes in soil character, destruction of terrestrial vegetation, historical or recorded data, presence of litter and/or debris, scour, and water staining.

3.1.2 Wetlands

Wetlands offer a variety of functions and values that may include, but are not limited to, groundwater recharge/discharge, flood flow alteration, sediment/toxicant retention, and fish and wildlife habitat. Because of the perceived functions and values of wetlands, the USACE developed the Wetlands Delineation Manual, (*1987 Manual*)[2] to identify wetlands.

Wetlands are defined in the *1987 Manual* as, "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."[2] The *1987 Manual* outlines the protocol for distinguishing wetland areas from "upland" areas. Wetland areas are delineated according to three (3) primary criteria: vegetation, soil, and hydrology. An area is determined to qualify as a wetland if it meets the following "general diagnostic environmental characteristics:"

- Hydrophytic vegetation
- Hydrology
- Hydric Soil

<u>Hydrophytic Vegetation</u>

The <u>1987 Manual</u> defines hydrophytic vegetation as, "…the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present…"

The USFWS and the National Plant List Panel developed the following categories to establish the relative probability of species occurring within the ranges between upland and wetland. The list was updated by the USACE with cooperation with other federal agencies in 2012. The following list is the categories for plant species:

Obligate Wetland Plants (OBL) – Probability of >99% occurrence in wetlands with a 1% probability of occurrence in upland areas.

Facultative Wetland Plants (FACW) – Probability of 67% - 99% occurrence in wetlands with a 1% - 33% probability of occurrence in upland areas.

---

[1] U.S. Army Corps of Engineers, *Regulatory Guidance Letter*, No. 05-05, date 7-12-05
[2] U.S. Army Corps of Engineers, Wetlands Delineation Manual, (*1987 Manual*).

Facultative Plants (FAC) - Probability of 34% - 66% occurrence in either wetlands or upland areas.

Facultative Upland Plants (FACU) - Probability of 67% - 99% occurrence in upland areas with a 1% - 33% probability of occurrence in wetland areas.

Obligate Upland Plants (UPL) - Probability of >99% occurrence in upland areas with a 1% probability of occurrence in wetland areas.

The hydrophytic vegetation criterion is met if greater than 50% of dominant species are FAC, FACW, or OBL.

Hydrology

Areas which are inundated or saturated to the surface for a significant time during the growing season will typically exhibit characteristics of wetland hydrology. Careful examination of the site conditions is needed to adequately identify wetland areas. The anaerobic and reducing conditions in inundated or saturated soils influence the plant community and may favor a dominance of hydrophytic species. It should be noted that the *1987 Manual* further defines the growing season and methodology for determining evidence of hydrology.

There are two (2) types of hydrologic indicators: primary and secondary. Primary indicators of hydrology are discussed in the *1987 Manual* and include, but are not limited to, inundation, and saturation within the upper 12 inches of soil, water marks, drift lines, sediment deposits, and drainage patterns. Secondary indicators may include, but are not limited to, oxidized root channels, water stained leaves, local soil survey data, FAC-Neutral test, etc. One (1) primary or two (2) secondary indicators are required to meet this criterion.

Hydric Soil

"A hydric soil is formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part." [3] All organic soils (except Folists) are considered hydric, while mineral soils must be carefully examined to qualify as hydric. There are several indicators that suggest a soil is hydric. An inspection of the soil profile to a minimum depth of 16 inches below ground surface is required in order to make this determination. The soil data used is the horizon of soil immediately below the A-horizon, or at 10 inches below the soil surface. Hydric soils may be present in an upland position; however, there may be insufficient evidence of hydrology or vegetation for the area to qualify as wetland.

3.1.3 Regional Supplement Manuals

A series of regional supplements[4] to the 1987 manual are developed by the Army Engineer Research and Development Center (ERDC) to be more specific to regionally geographical conditions. Each supplement manual is developed to account for regional differences in climate, geology, soils, hydrology, plant and animal communities, etc. The intent of the regional supplements is to update the 1987 Manual with current information and technology rather than change the definition or manner that wetlands were delineated. The

[3] USDA-NRCS, HYDRIC SOIL TECH. NOTE 1: Proper use of Hydric Soil Terminology,

[4] U. S. Army Corps of Engineers. 2008. *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region,* ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-08-27.Vicksburg, MS: U.S. Army Engineer Research and Development Center

procedures for completing a wetland delineation is to use a combination of the 1987 Manual and the correct regional supplement manual.

Sections that replace the 1987 Manual for the Midwest supplement are summarized in the following table:

Item	Replaced Portions of the 1987 Manual	Replacement Guidance
Hydrophytic Vegetation Indicators	Paragraph 35, all subparts, and all reference to specific indicators in Part IV.	Chapter 2
Hydric Soil Indicators	Paragraphs 44 and 45, all subparts, and all references to specific indicators in Park IV.	Chapter 3
Wetland Hydrology Indicators	Paragraph 49(b), all subparts, and all references to specific indicators in Part IV.	Chapter 4
Growing Season Definition	Glossary	Chapter 4, Growing Season; Glossary
Hydrology Standard for Highly Disturbed or Problematic Wetland Situations	Paragraph 48, including Table 5 and the accompanying User note in the online version of the Manual.	Chapter 5, Wetlands that Periodically Lack Indicators of Wetland Hydrology, Procedure item 3(g).

Regional Supplement Manuals will continue to be developed and revised electronically with the improvement of technology and procedures.

3.2 United States Fish and Wildlife Service

The Endangered Species Act (ESA) of 1973 intends to conserve the habitats of federally endangered or threatened species and to assist in the recovery of species listed. The USFWS is the regulating authority for this act and works with the states to provide additional conservation measures. The USFWS[5] defines two (2) classifications of protected species, endangered and threatened. An endangered species is an organism that is in danger of extinction throughout all or a significant portion of its range. A threatened species is an organism that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. All species of plants and animals are eligible for listing.

Any activity that may incidentally harm federally threatened or endangered species is prohibited by the ESA. For proposed development areas that contain listed species, private landowners may create a Habitat Conservation Plan to minimize the impact on the listed species. This plan should include the protection of breeding, foraging, and shelter requirements for the listed species. The USFWS may then grant an Incidental Take Permit for the project. In the event that any person knowingly violates any provision of the Act or Permit, the person may be assessed penalties.

[5] U.S. Fish and Wildlife Service, ESA Basics, 2004

Projects that involve federal funding or permitting on a site where endangered or threatened species are known to occur or where significant habitat is present will require an alternatives analysis and extensive documentation of agency coordination.

3.3 Indiana Department of Environmental Management

The IDEM is the State agency that reviews and issues permits regarding isolated wetlands (IAC 13-18). The law recognizes three (3) types of wetlands: Class I, Class II, and Class III. Class I isolated wetlands occur in areas that have been disturbed by human activity/development, have low species diversity or greater than 50% nonnative species, do not provide critical habitat for the support of significant wildlife or aquatic vegetation, or do not possess significant hydrologic function. Class III isolated wetlands are located in areas that are undisturbed or minimally disturbed by human activity/development, are composed of rare or important ecological types, and support more than minimal wildlife or aquatic habitat and hydrologic function. Class II isolated wetlands are those that do not fit the criteria set for either Class I or Class III isolated wetlands.

Exemptions are in place to allow impacts to Class I and Class II wetlands without requiring permitting and mitigation. Class I wetlands qualify for the exemption if the entire wetland does not exceed 0.5 acre. Any Class I wetland exceeding 0.5 acre will require mitigation. Class II wetlands qualify for the exemption if the entire wetland acreage does not exceed 0.25 acre. Any Class II wetland exceeding 0.25 acre will require mitigation. Any proposed impacts to Class III or nonexempt Class I or Class II wetlands will require an isolated wetlands and/or "waters of the State" permit through IDEM. Such isolated wetland permit applications will be submitted concurrently with any USACE Section 404 jurisdictional wetland permits and IDEM Section 401 WQC if necessary.

According to IAC 13-18, impacts to isolated wetlands will require some form of compensatory mitigation. The law specifically states the amount of mitigation that must be created to offset impacts to isolated wetlands. **These mitigation ratios do not apply to USACE jurisdictional wetlands.** The mitigation ratios for impacts to state regulated wetlands (isolated) are as follows:

Impact Type	Replacement	On Site Ratio	Off -Site Ratio
Class I	Class I	1.5:1 Acres	1.5:1 Acres
Class I	Class II or III	1:1 Acres	1:1 Acres
Class II	Class II or III	Non-forested	Non-forested
		1.5:1 Acres	2:1 Acres
		Forested	Forested
		2:1 Acres	2.5:1 Acres
Class III	Class III	Non-forested	Non-forested
		2:1 Acres	2.5:1 Acres
		Forested	Forested
		2.5:1 Acres	3:1 Acres

3.4 Indiana Department of Natural Resources

The IDNR Division of Water has authority over the floodways of waterways that have a watershed greater than one (1) square mile. If construction activities are proposed in a regulated floodway then a Construction in a Floodway permit would be required. A watershed analysis would be required to determine the actual drainage for each waterway

proposed to be impacted. In addition, trees cleared within a regulated floodway will require compensatory mitigation.

The IDNR Division of Nature Preserves provides a Natural Heritage Data center for the documentation of state and federally listed endangered, threatened, and rare species and high quality natural communities. The IDNR serves to identify, protect, and manage significant natural areas and ETR species through coordination with the land owner. Currently over 23,000 acres of dedicated Nature Preserves are located throughout the state. The preservation of natural communities supports species diversity and provides examples of historic conditions for recreational, educational, and scientific opportunities.

3.5 Soil and Water Conservation District

A Rule 5 Stormwater Run-off Permit is required for construction related activities that will disturb one (1) or more acres of land that is not within a designated Municipal Separate Storm Sewer System (MS4) entity or is in a MS4 entity that does not have a stormwater ordinance established. The purpose of Rule 5 is to reduce pollutants, mainly sediment from soil erosion, in stormwater discharges into surface waters of the State for the protection of public health, existing water uses, and aquatic biota.

A Construction Plan, including a Storm Water Pollution Prevention Plan, must be reviewed and approved by the Hamilton County Soil and Water Conservation District (SWCD) as part of the Rule 5 permit process. A public notice of the intent to operate under Rule 5 must be submitted in a newspaper of general circulation. A Notice of Intent (NOI) letter must then be submitted to IDEM including a $100 application fee, proof of the public notice, and the Construction Plan Review Approval Verification Form as received from the SWCD. A Rule 5 Stormwater Run-off Permit will be issued by IDEM if all materials are approved.

3.6 Hamilton County Drainage Board

The Hamilton County Drainage Board has authority over designated regulated drains. Drains could include subdivision drains, field tiles, or open ditches and creeks, within Hamilton County. Authorization from the Hamilton County Drainage Board would be required for any work conducted within the easement of a regulated drain. Any construction affecting a regulated drain in Hamilton County, and/or the corresponding easement on either side of such a drain, must be reviewed and approved by the Hamilton County Drainage Board prior to disturbance.

4.0 DESKTOP REVIEW

Williams Creek reviewed applicable, readily available and accessible historical information for the potential presence of wetlands, “waters of the U.S.”, and natural resources. The findings are presented below.

4.1 United States Geological Survey 7.5-Minute Quadrangle Map

A USGS 7.5-Minute Quadrangle map displays contour lines to portray the shape and elevation of the land surface. Quadrangle maps render the three-dimensional changes in elevation of the terrain on a two-dimensional surface. The maps usually portray both manmade and natural topographic features. Although they show lakes, rivers, various surface water drainage trends, vegetation, etc., they typically do not provide the level of

detail needed for accurate evaluation of wetlands. However, the existence of these features may suggest the potential presence of wetlands.

The SITE is located in the Riverwood, Indiana USGS 7.5-Minute Quadrangle Map, Sections 32 and 33, Township 19 North, Range 5 East and Section 5, Township 18 North, Range 5 East. Williams Creek evaluated the topography of the SITE and concluded that the elevation ranges from approximately 810 to 780 feet above mean sea level across the SITE. The topographic map depicts one (1) unnamed blue line aquatic feature, a tributary to Stony Creek, in the southwest corner of the SITE (**Figure 1**). The topographic survey also indicates the presence of several depressions within the watershed of the Elwood Wilson Drain as indicated by closed contours. The presence of closed contours suggests the increased potential for wetlands.

4.2 National Wetlands Inventory Map

National Wetlands Inventory (NWI) maps were developed to meet a USFWS mandate to map the wetland and deepwater habitats of the U.S. These maps were developed using high altitude aerial photographs and USGS Quadrangle maps as a topographic base. Indicators that exhibited pre-determined wetland characteristics, visible in the photographs, were identified according to a detailed classification system. The NWI map retains some of the detail of the Quadrangle map; however, it is used primarily for demonstration of wetland areas identified by the agency. The maps are accurate to a scale of 1:24,000. In general, the NWI information requires field verification.

NWI data is shown projected over the Riverwood, Indiana topographic map in **Figure 2**, and the associated key is shown in **Figure 3**. There are eight (8) NWI wetlands mapped within the SITE boundary, indicating the increased potential for wetlands in these areas. Three (3) palustrine, forested (PFO) wetlands are mapped in the northwestern portion of the SITE. These features are longer discernable due to commercial development over that area. Two (2) other PFO wetlands and a ponded feature (PUBF) are mapped over the northcentral portion of the SITE. These three (3) features are a part of an existing homestead and surrounding farm land. One (1) PFO is mapped just south of this homestead and within the drainage easement of Elwood Wilson Drain. This feature is still clearly apparent, and was confirmed during Williams Creek's field investigation of the SITE. A palustrine, emergent wetland (PEMC) was also mapped near the southeast portion of the SITE. This feature is no longer discernable on SITE due to residential construction over that portion of the property.

4.3 United States Department of Agriculture Soil Survey

Williams Creek reviewed the soils mapped on-SITE in the Natural Resource Conservation Service (NRCS) digital soil survey data for Hamilton County, Indiana. This data is projected over aerial photography, illustrating distinct soil map unit boundaries (**Figure 4**).

Fifteen (15) soil units are classified on-SITE:

Soil Map Unit	Description	Hydric within Hamilton County
Br	Brookston silty clay loam	Yes
CrA	Crosby silt loam, 0 to 3 percent slopes	Yes
FnA	Fox loam 0 to 2 percent slopes	No
FxC3	Fox clay loam, 8 to 18 percent slopes, severely eroded	No

Ho	Houghton muck	Yes
MmA	Miami silt loam, 0 to 2 percent slopes	No
MmB2	Miami silt loam, 2 to 6 percent slopes, eroded	Yes
MmC2	Miami silt loam, 6 to 12 percent slopes, eroded	Yes
MmD2	Miami silt loam, 12 to 18 percent slopes, eroded	No
MoC3	Miami clay loam, 6 to 12 percent slopes, severely eroded	No
MoD3	Miami clay loam, 12 to 18 percent slopes, severely eroded	No
OcA	Ockley silt loam, 0 to 2 percent slopes	No
OcB2	Ockley silt loam, 2 to 6 percent slopes, eroded	No
Or	Orthents	No
Pn	Patton silty clay loam	Yes

Of the fifteen (15) soil units situated within the SITE area, six (6) are considered hydric[6] within Hamilton County. The presence of hydric soil units within these areas suggests the potential presence of wetlands on-SITE.

4.4 Aerial Photography

Aerial photography provides a visual overview of the SITE and can provide information to assist in identifying land use practices, terrain, drainage, vegetated areas, wetlands, habitats, etc. Certain features, such as variegated soil patterns, may suggest the presence of wetlands.

Williams Creek reviewed a 2014 aerial photograph of the SITE from the NRCS Geospatial Data Gateway website (**Figure 5**). The SITE consists of Elwood Wilson Drain, E.M. Hare Arm and its contributing watershed upstream of State Road 37. The SITE consists primarily of active agricultural land with single family residential lots located along Promise Road. Land use in the western portion of the SITE consists of commercial and multifamily residential buildings. Four (4) ponds are visible within the western portion of the SITE in the commercial and multifamily residential development, and one (1) pond is visible in the north central portion of the SITE on a single family residential lot. One (1) stream is visible on the southwest corner of the SITE, which appears to consist of the open portion of the Elwood Wilson Drain. Wet signatures, indicating the potential presence of wetlands can be seen in the southcentral and southeast portions of the SITE in areas utilized as agricultural row crop. Wet signatures indicate an increased potential for the presence of wetlands.

4.5 Flood Insurance Rate Map

The Federal Emergency Management Agency (FEMA) was developed in 1979 to reform disaster relief and recovery, civil defense, and to prepare and mitigate for natural hazards. The Mitigation Division of FEMA manages the National Flood Insurance Program which provides guidance on how to lessen the impact of disasters on communities through flood insurance, floodplain management, and flood hazard mapping. Proper floodplain management has the ability to minimize the extent of flooding and flood damage and improve stormwater quality by reducing stormwater velocities and erosion. The one (1) percent annual chance flood (100 year flood) boundary must be kept free of encroachment as the national standard for the program.

---

[6] USDA-NRCS, Lists of Hydric Soils; National List; all states (December 2015)

Williams Creek reviewed digital Flood Insurance Rate Map (FIRM) data from the FEMA Flood Map Service Center. The open channel portion of the Elwood Wilson Drain is partially located within the area mapped as Flood Zone A within the southwest corner, along the regulated drain easement. (**Figure 6**).

4.6 Endangered, Threatened, and Rare Species Evaluation

Williams Creek filed a request with the USFWS and IDNR for documentation of any ETR species on SITE. Correspondence with the USFWS indicated that the SITE is within the range of the federally endangered Indiana bat (*Myotis sodalis*) and the federally threatened northern long-eared bat (*Myotis septentrionalis*). The USFWS has no records of bats near the SITE, although the SITE has not been surveyed, and there does appear to be minimal suitable bat habitat surrounding the SITE.

Correspondence with the IDNR indicated that no other ETR species or significant areas have been documented within a 0.5 mile radius of the SITE.

Based on the correspondence referenced above, additional correspondence with the agencies does not appear to be warranted at this time. If federal permitting or federal financing will be used in future development, additional coordination may be necessary.

5.0 SITE RECONNAISSANCE

5.1 Methodology

Williams Creek conducted a field investigation at the SITE on 18 April 2016. During this investigation, Williams Creek noted the presumed land use of the SITE and surrounding area, and evaluated the SITE for the potential presence of wetlands, "waters of the U.S.," and natural resources using the findings of the desktop review and field observations. Photographs were taken during the field investigation and are provided in **Appendix B**.

Williams Creek used the Routine Determination Method (RDM) with an established baseline and transects as described in the *1987 Manual* for typical sites over five (5) acres. Williams Creek recorded data from a number of data points (DP) along the transect as a function of diversity of vegetation, property size, soil types, habitat variability, and other SITE features as deemed appropriate by Williams Creek. Where evidence of a wetland was suspected, three (3) wetland criteria were applied to determine if the area in question was representative of a wetland using the methodology set forth by the USACE. More specifically, Williams Creek visually examined and recorded the dominant vegetation, recorded soil properties such as texture and color using the Munsell Soil Color Chart (Munsell Color Chart), excavated soil pits, and evaluated the primary and secondary hydrologic indicators as discussed in Section 2.1.2.

If all three (3) criteria were met, i.e. vegetation, soil properties, and hydrologic indicators, a second DP was established adjacent to the wetland DP in an area outside of the presumed wetland boundary for the purpose of delineating between the wetland and non-wetland areas. Once delineated, Williams Creek continued the RDM to evaluate the remainder of the SITE.

5.2 SITE and Adjacent Property Land Use

The area of the SITE subject to this assessment was approximately 765 acres in area, and consisted primarily of active agricultural land with commercial and multifamily residential land use in the western portion of the SITE and single family residential lots located along Promise Road. Adjacent land use was primarily commercial and residential to the west and agriculture surrounding the remainder of the SITE (**Figure 5**).

5.3 Wetland Summary

Four (4) wetland areas were identified within the regulated drainage easement during this investigation based upon methodology set forth in the *1987 Manual* and the *Midwest Regional Supplement.* All identified wetlands were located at least partially within the regulated drain easement. Due to access restrictions of the surrounding watershed, a complete wetland delineation was only completed within the regulated drain easement. The remainder of the SITE outside of the regulated drain easement was evaluated only through a desktop review. Information collected at each DP on 18 April 2016 is described in the following sections. This information is summarized on the forms provided in **Appendix C**. The DP locations are depicted on **Figure 7a** and **Figure 7b**.

Wetland DP locations and boundaries were recorded at the time of the SITE investigation using a TopCon GRS-1 hand held data collector. The calculated area of the wetland was based on the surveyed wetland boundary locations. A discussion of the wetland and associated DPs is provided below.

5.3.1 Wetland A – (~0.74 acre)

Wetland A was classified as a palustrine, forested wetland (PFO) of approximately 0.74 acre, and was situated in the SITE's northeastern corner. The limits of Wetland A extended beyond the regulated drainage limits. Wetland A appeared to have a hydrologic connected to Elwood Wilson Drain via the closed drain, and therefore may be considered a jurisdictional "waters of the U.S." subject to USACE and IDEM jurisdiction.

A-1

This DP was collected in the southern portion of Wetland A. The dominant vegetation present consisted of box elder (*Acer negundo*, FAC), common hackberry (*Celtis occidentalis*, FAC), bush honeysuckle (*Lonicera maackii*, UPL) and tall goldenrod (*Solidago altissima*, FACU), meeting the hydrophytic vegetation criterion. Examination of the soil profile using the Munsell Color Chart revealed a matrix color of 10YR 3/1 to a depth of 18 inches, meeting the hydric soil criterion. Evidence of hydrologic features observed included surface water to a depth of two (2) inches, saturation to a depth of 18 inches, and drainage patterns, meeting the hydrology criterion. Since all three (3) criteria were met, this area qualified as a wetland.

A-2

This DP was collected west of Wetland A. The dominant vegetation present consisted of black cherry (*Prunus serotina*, FACU), common hackberry, and bush honeysuckle, which did not meet the hydrophytic vegetation criterion. Examination of the soil profile using the Munsell Color Chart revealed a matrix color of 10YR 3/2 to a depth of 18 inches, which did not meet the hydric soil criterion. No evidence of hydrologic features was observed. Since all three (3) criteria were not met, this area did not qualify as a wetland.

5.3.2 Wetland B – (~0.17 acre)

Wetland B was classified as a palustrine, forested wetland (PFO) of approximately 0.17 acre, and was situated in the east central portion of the SITE. Wetland B appeared to be situated above the Elwood Wilson Drain; therefore, Wetland B may have a hydrologic connection to Elwood Wilson Drain, and therefore may be considered a jurisdictional "waters of the U.S." subject to USACE and IDEM jurisdiction.

B-1

This DP was collected in the eastern portion of Wetland B. The dominant vegetation present consisted of green ash (*Fraxinus pennsylvanica*, FACW), common hackberry, bush honeysuckle, and an unknown forb (assumed to be FAC), meeting the hydrophytic vegetation criterion. Examination of the soil profile using the Munsell Color Chart revealed a matrix color of 10YR 4/1 with 10YR 4/6 mottles to a depth of 18 inches, meeting the hydric soil criterion. Evidence of hydrologic features observed included surface water to a depth of two (2) inches, saturation to a depth of 18 inches, water stained leaves, and drainage patterns, meeting the hydrology criterion. Since all three (3) criteria were met, this area qualified as a wetland.

B-2

This DP was collected south of Wetland B. The dominant vegetation present consisted of common hackberry, bush honeysuckle, corn (*Zea mays*, UPL), and sleepydick (*Ornithogalum umbellatum*, FACU), which did not meet the hydrophytic vegetation criterion. Examination of the soil profile using the Munsell Color Chart revealed a matrix color of 10YR 4/3 with to a depth of 18 inches, which did not meet the hydric soil criterion. No evidence of hydrologic features was observed. Since all three (3) criteria were not met, this area did not qualify as a wetland.

5.3.3 Wetland C – (~0.30 acre)

Wetland C was classified as a palustrine, forested wetland (PFO) of approximately 0.30 acre, and was situated northeast of Wetland B. Wetland C appeared to have a hydrologic connection to Elwood Wilson Drain via the closed regulated drain, and therefore may be considered a jurisdictional "waters of the U.S." subject to USACE and IDEM jurisdiction.

C-1

This DP was collected in the eastern portion of Wetland C. The dominant vegetation present consisted of box elder and common hackberry, meeting the hydrophytic vegetation criterion. Examination of the soil profile using the Munsell Color Chart revealed a matrix color of 10YR 4/1 with 10YR 4/6 mottles to a depth of 18 inches, meeting the hydric soil criterion. Evidence of hydrologic features observed included surface water to a depth of two (2) inches, saturation to a depth of 18 inches, and drainage patterns, meeting the hydrology criterion. Since all three (3) criteria were met, this area qualified as a wetland.

C-2

This DP was collected south of Wetland C. The dominant vegetation present consisted of corn and sleepydick, which did not meet the hydrophytic vegetation criterion. Examination of the soil profile using the Munsell Color Chart revealed a matrix color of 10YR 4/2 to a depth of four (4) inches and a matrix color of 10YR 4/3 to a depth of 18 inches, which did not meet the hydric soil criterion. No evidence of hydrologic features was observed. Since all three (3) criteria were not met, this area did not qualify as a wetland.

5.3.4 Wetland D – (~0.62 acre)

Wetland D was classified as a palustrine, emergent wetland (PEM) of approximately 0.62 acre, and was situated in the west central portion of the SITE. Wetland D appeared to have a hydrologic connection to Elwood Wilson Drain via the closed drain, and therefore may be considered a jurisdictional "waters of the U.S." subject to USACE and IDEM jurisdiction.

D-1

This DP was collected in the eastern portion of Wetland D. The wetland area was located in an active agricultural area, and all vegetation was cleared through disking. Examination of the soil profile using the Munsell Color Chart revealed a matrix color of 10YR 4/1 to a depth of 18 inches, meeting the hydric soil criterion. Evidence of hydrologic features observed included surface water to a depth of two (2) inches, saturation to a depth of 18 inches, and drainage patterns, meeting the hydrology criterion. Since all three (3) criteria were met, this area qualified as a wetland.

D-2

This DP was collected south of Wetland D. The dominant vegetation present consisted of corn and sleepydick, meeting the hydrophytic vegetation criterion. Examination of the soil profile using the Munsell Color Chart revealed a matrix color of 10YR 4/3 to a depth of 18 inches, which did not meet the hydric soil criterion. No evidence of hydrologic features was observed. Since all three (3) criteria were not met, this area did not qualify as a wetland.

5.4 Data Point Summary

Below is a description of the information collected at each DP during the 18 April 2016 field investigation within the regulated drainage easement that was not associated with a wetland. The purpose of collecting these DPs was to describe the characteristics of the SITE. Information that was collected at each DP is summarized on the forms provided in **Appendix C**. Their locations are depicted on **Figure 7a** and **Figure 7b**.

DP-1

This DP was located in the northeast portion of the SITE, just east of Promise Road. The dominant vegetation present consisted of corn and sleepydick, which did not meet the hydrophytic vegetation criterion. Examination of the soil profile using the Munsell Color Chart revealed a matrix color of 10YR 4/3 to a depth of 18 inches, which did not meet the hydric soil criterion. No evidence of hydrologic features was observed. Since all three (3) criteria were not met, this area did not qualify as a wetland.

DP-2

This DP was located in the northeast portion of the SITE, just west of East 115th Street. The dominant vegetation present consisted of bush honeysuckle, common hackberry, tall goldenrod, common dandelion (*Taraxacum* officinale, FACU), and fox grape (*Vitis* labrusca, FACU), which did not meet the hydrophytic vegetation criterion. Examination of the soil profile using the Munsell Color Chart revealed a matrix color of 10YR 3/2 to a depth of 18 inches, which did not meet the hydric soil criterion. No evidence of hydrologic features was observed. Since all three (3) criteria were not met, this area did not qualify as a wetland.

DP-3

This DP was located in the center of the SITE. The dominant vegetation present consisted of corn and sleepydick, which did not meet the hydrophytic vegetation criterion. Examination of the soil profile using the Munsell Color Chart revealed a matrix color of 10YR 4/3 to a depth of 18 inches, which did not meet the hydric soil criterion. No evidence of hydrologic features was observed. Since all three (3) criteria were not met, this area did not qualify as a wetland.

DP-4

This DP was located near the center of the SITE, west of DP-3. The dominant vegetation present consisted of corn and sleepydick, which did not meet the hydrophytic vegetation criterion. Examination of the soil profile using the Munsell Color Chart revealed a matrix color of 10YR 4/3 to a depth of 18 inches, which did not meet the hydric soil criterion. No evidence of hydrologic features was observed. Since all three (3) criteria were not met, this area did not qualify as a wetland.

DP-5

This DP was located in the southwest portion of the SITE. The dominant vegetation present consisted of Bermuda grass (*Cynodon dactylon*, FACU), sleepydick, and white clover (*Trifolium repens*, FACU), which did not meet the hydrophytic vegetation criterion. Examination of the soil profile using the Munsell Color Chart revealed a matrix color of 10YR 3/3 to a depth of 18 inches, which did not meet the hydric soil criterion. No evidence of hydrologic features was observed. Since all three (3) criteria were not met, this area did not qualify as a wetland.

5.5 Drainage Features, Streams, and Other Potential "Waters of the U.S."

A portion of the Elwood Wilson Drain consists of an open channel on western portion of the SITE. No other potential "waters of the U.S." were identified within the regulated drainage easement.

Five (5) stormwater ponds, Ponds 1, 2, 3, 4, and 5, are located within the contributing watershed of the Elwood Wilson Drain on-SITE (**Figure 7a** and **Figure 7b**). All ponds were located based on desktop review and sizes are based on aerial photographs. All ponds appear to have been constructed in upland soils for the purpose of storing stormwater. As such, all ponds would not likely be considered jurisdictional "waters of the U.S." based on 40 CFR 230.3.

Two (2) drainage channels were located on-SITE. A regulated drain, Elwood Wilson Drain, bisected the SITE. Approximately 4,791 linear feet of Elwood Wilson Drain was open channel, and approximately 5,692 linear feet was encapsulated in drainage tiles. Portions of the tile drain appear to have failed and are now visible as an open channel drain as indicated on **Figure 7a** and **7b**.

Drainage Feature 1 was located in the south central portion of the SITE, outside of the regulated drainage easement, and was approximately 859 linear feet in length. Drainage Feature 1 appeared to consist of an erosional swale feature that flowed into a potential wetland area. Drainage Feature 1 did not appear to have a hydrologic connection with any "waters of the U.S." and would not likely be considered jurisdictional and not subject to USACE regulation.

Three (3) potential wetland areas were located on-SITE. Due to access restrictions being limited to the regulated drain easement, only a desktop review could be completed to determine these likely wetland areas as well as their size. Review of the 2014 aerial photograph shown in the figures included in this report show several potential wetland areas. However; review of aerials during multiple growing seasons does not show a consistent wet signature and subsequent lack of farming in these areas. The potential wetland Areas shown in **Figure 7a** and **Figure 7b** were determined through the review of multiple years of aerial photography and other resources described within the desktop review portion of this report.

Potential Wetland 1 is located is the southeast portion of the SITE, south of East 181st Street. This feature has not been previously mapped as a wetland area and is most likely due to poor drainage related to active agriculture in the area. Potential Wetland 2 is located in the southern portion of the SITE, just east of Harger Farms Inc., This isolated feature provides drainage for the surrounding agricultural fields as well as an outflow for Drainage Feature 1. Potential Wetland 3 was observed in the southwest corner of the SITE. This feature was part of a commercial development in 2006, where the complete area was cleared and graded. Poor economic conditions and lapse in construction activities left this portion of the SITE unattended for a number of years and led to poor drainage and ponding. None of the potential wetland areas have ever been mapped as aquatic features (Figure 7a and 7b) and are the result of commercial development and agricultural activities. Potential Wetlands 1 and 2 did not appear to have a hydrologic connection with any "waters of the U.S." and would likely be considered isolated wetlands subject to regulation by the IDEM alone. However, Potential Wetland 3 appeared to have a hydrologic connection to Elwood Wilson Drain, and therefore may be considered a jurisdictional "waters of the U.S." subject to USACE and IDEM jurisdiction.

6.0 Conclusions

Williams Creek performed an NRA and wetland delineation of the SITE located in the Riverwood, Indiana USGS 7.5-Minute Quadrangle Map, Sections 32 and 33, Township 19 North, Range 5 East, and Section 5, Township 18 North, Range 5 East on 18 April 2016.

One (1) stream, Elwood Wilson Drain, four (4) wetlands, five (5) ponds, and three (3) potential wetland areas were identified on-SITE.

Water Body	Size	Habitat Type	Anticipated Regulatory Status
Wetland A	0.74 acre	PFO	USCAE/IDEM/Hamilton County Drainage Board
Wetland B	0.17 acre	PFO	USCAE/IDEM/Hamilton County Drainage Board
Wetland C	0.30 acre	PFO	USACE/IDEM/Hamilton County Drainage Board
Wetland D	0.62 acre	PEM	USACE/IDEM/Hamilton County Drainage Board
Elwood Wilson Drain	10,663 lf	Perennial	USACE/IDEM/Hamilton County Drainage Board
Drainage Feature 1	859 lf	Ephemeral	N/A

Water Body	Size	Habitat Type	Anticipated Regulatory Status
Storm Pond 1	0.25 acre	Pond	N/A
Storm Pond 2	1.49 acres	Pond	N/A
Storm Pond 3	0.55 acre	Pond	N/A
Storm Pond 4	0.23 acre	Pond	N/A
Storm Pond 5	0.91 acre	Pond	N/A
Potential Wetland 1	1.38 acres	PEM	IDEM
Potential Wetland 2	1.23 acres	PEM	IDEM
Potential Wetland 3	10.67 acres	PEM	USACE/IDEM

Any impacts to Elwood Wilson Drain may require permitting through the USACE, IDEM, and the Hamilton County Drainage Board. Mitigation, if required, is required at a 1:1 ration for impacts to drainage features. Drainage Feature 1 would likely be considered an isolated feature and would not require permitting.

An RGP and WQC will likely be required for impacts to Wetland A, B, C, and/or D if proposed cumulative impacts are greater than 0.1 acre and below 1.0 acre. Mitigation for impacts is required at a 4:1 ratio for forested wetlands and 2:1 for emergent wetlands. If cumulative impacts are less than 0.1 acre, then an RGP Notification to IDEM may be necessary. Impacts that total less than 0.1 acre typically do not require mitigation.

Based on review of the Hamilton County FlexViewer website, the Elwood Wilson Drain, E.M. Hare Arm, bisects the SITE both as an open drain and a closed tile drain. Activities within the regulated drainage easement and the floodplain would require coordination with the Hamilton County Surveyor and the Hamilton County Drainage Board.

Correspondence with the USFWS indicated that the SITE is within the range of the federally-endangered Indiana bat and the federally-threatened northern long-eared bat. There are no records of the bats near the project SITE, but the SITE has not been surveyed and there is minimal suitable habitat surrounding the SITE.

Correspondence with the IDNR indicated that no other ETR species or significant areas documented within a 0.5 mile radius of the SITE.

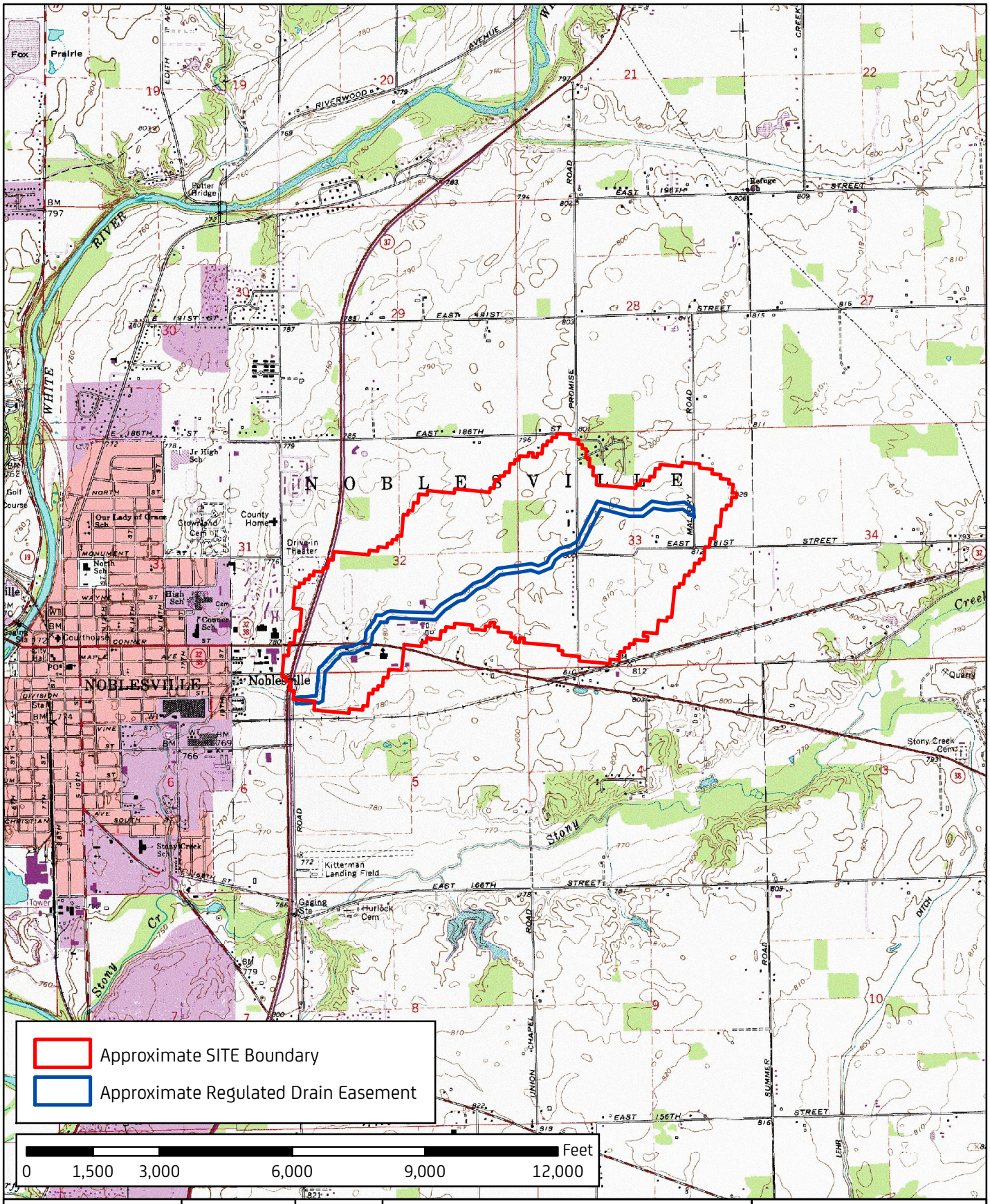
If proposed development activities will disturb one (1) or more acres of land, then a Rule 5 Stormwater Run-off Permit may be required.

If development activities are proposed to impact Wetland A, B, C, and/ or D or Elwood Wilson Drain, Williams Creek recommends that the final report and associated figures be submitted to the appropriate agencies for recommended coordination. If development

activities are proposed in or near the potential aquatic features identified in the desktop review, additional fieldwork is recommended to determine the presence and limits of these features.

Figures

WILLIAMS CREEK
CONSULTING



WILLIAMS CREEK CONSULTING

619 N. Pennsylvania St.
Indianapolis, IN 46204

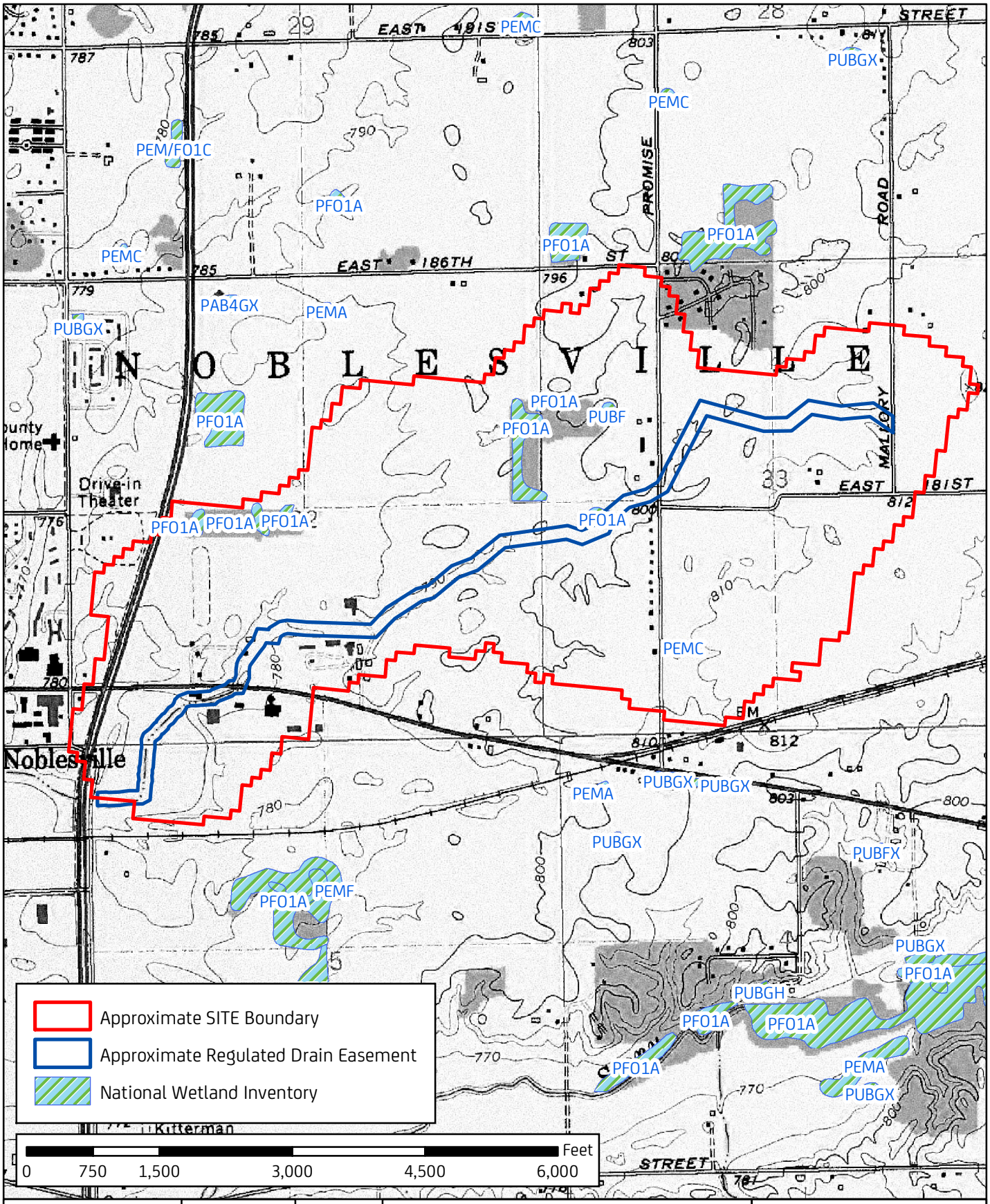
P: 317-423-0690
F: 317-423-0696

N

Figure 1
USGS Topographic Map
Riverwood Quadrangle
Elwood Wilson Drain
Noblesville, Hamilton County, Indiana

Prepared for:
Clark Dietz, Inc.

Date:
May 2016



WILLIAMS CREEK CONSULTING

619 N. Pennsylvania St.
Indianapolis, IN 46204

P: 317-423-0690
F: 317-423-0696

N

Figure 2
National Wetlands Inventory Map
Riverwood Quadrangle
Elwood Wilson Drain
Noblesville, Hamilton County, Indiana

Prepared for:
Clark Dietz, Inc.

Date:
May 2016

SYSTEM

P-PALUSTRINE

CLASS	RB-ROCK BOTTOM	UB-UNCONSOLIDATED BOTTOM	AB-AQUATIC BED	US-UNCONSOLIDATED SHORE	ML-MOSS-LICHEN	EM-EMERGENT	SS-SCRUB-SHRUB	FO-FORESTED	OW-OPEN WATER/ *UNKNOWN BOTTOM*
Subclass	1 Bedrock 2 Rubble 3 Mud 4 Organic	1 Cobble-Gravel 2 Sand	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular 5 *Unknown Submergent* 6 *Unknown Surface*	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	1 Moss 2 Lichen	1 Persistent 2 Nonpersistent	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 *Deciduous* 7 *Evergreen*	1 Broad-Leaved Deciduous 2 Needle –Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 *Deciduous* 7 *Evergreen*	

MODIFIERS

In order to more adequately describe wetland and deepwater habitats one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied to the ecological system.

WATER REGIME				WATER CHEMISTRY			SOIL	SPECIAL MODIFIERS
Non-Tidal		**Tidal**		**Coastal Halinity**	**Inland Salinity**	**pH Modifiers for All Fresh Water**		
A Temporarily Flooded	H Permanently Flooded	K *Artificially Flooded*	*S Temporary-Tidal	1 Hyperhaline	7 Hypersaline		g Organic	b Beaver
B Saturated	J Intermittently Flooded	L Subtidal	*R Seasonal-Tidal	2 Euhaline	8 Eusaline	a Acid	n Mineral	d *Partially Drained/Ditched*
C Seasonally Flooded	L Artificially Flooded	M Irregularly Exposed	*T Semipermanent-Tidal	3 Mixohaline *(Brackish)*	9 Mixosaline	t Circumneutral		f Farmed
D Seasonally Flooded/ *Well Drained*	W Intermittently Flooded/Temporary	N Regularly Flooded	V Permanent-Tidal	4 Polyhaline	0 Fresh	i Alkaline		h Diked/Impounded
E *Seasonally Flooded/ Saturated*	Y Saturated/Semipermanent/ Seasonal	P Irregularly Flooded	U *Unknown*	5 Mesohaline				r Artificial Substrate
F Semipermanently Flooded	Z Intermittently Exposed/ Permanent			6 Oligohaline				s Spoil
G Intermittently Exposed	U *Unknown*	*These water regimes are only used in tidally influenced, freshwater systems.		0 Fresh				x Excavated

NOTE: Italicized items were added for mapping by National Wetlands Inventory program.

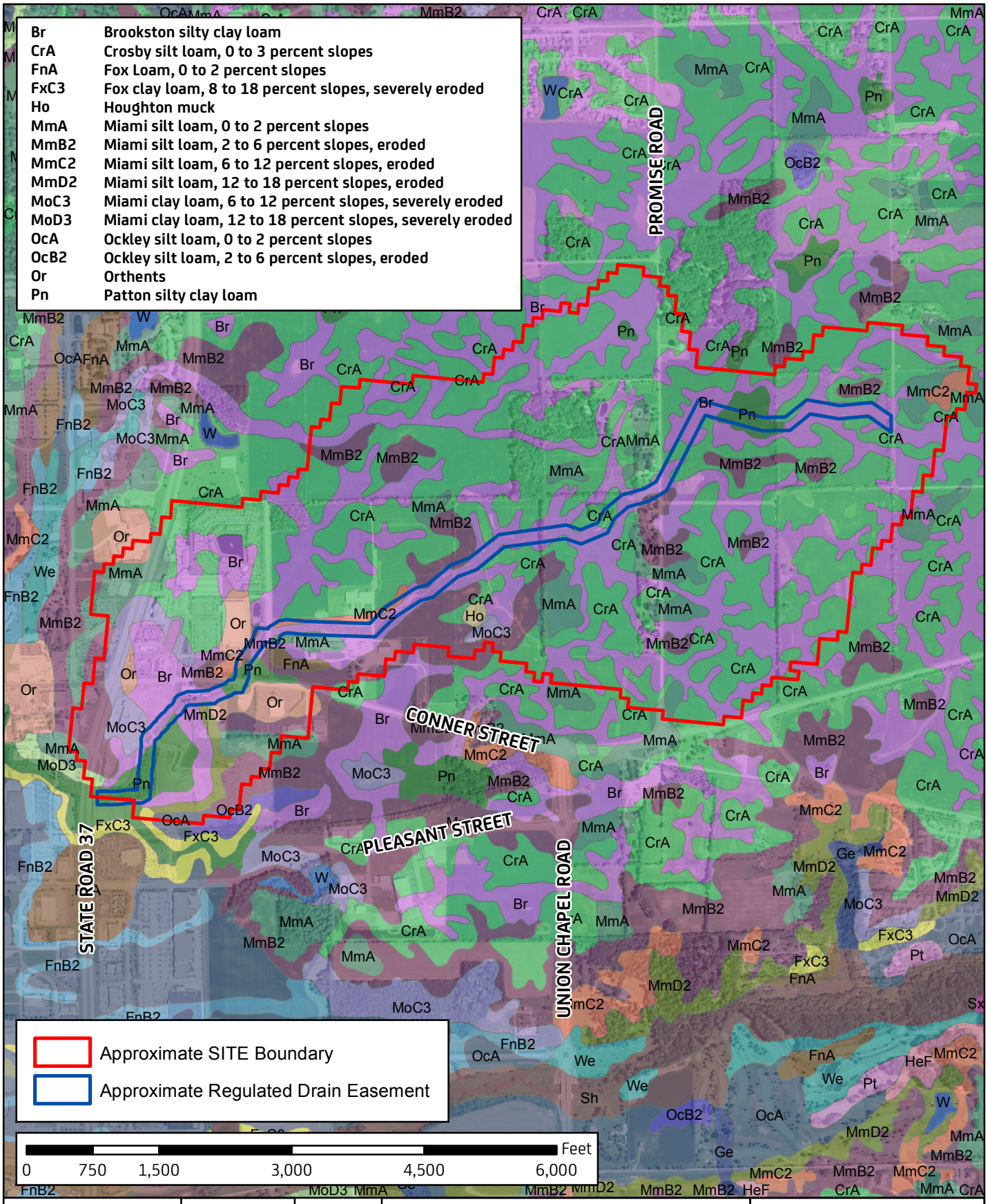
WILLIAMS CREEK CONSULTING
619 N. Pennsylvania St.
Indianapolis, IN 46204
P: 317-423-0690
F: 317-423-0696

N

Figure 3
Key to National Wetlands Inventory Map
Elwood Wilson Drain
Noblesville, Hamilton County, Indiana

Prepared for:
Clark Dietz, Inc.

Date:
May 2016



WILLIAMS CREEK CONSULTING

619 N. Pennsylvania St.
Indianapolis, IN 46204

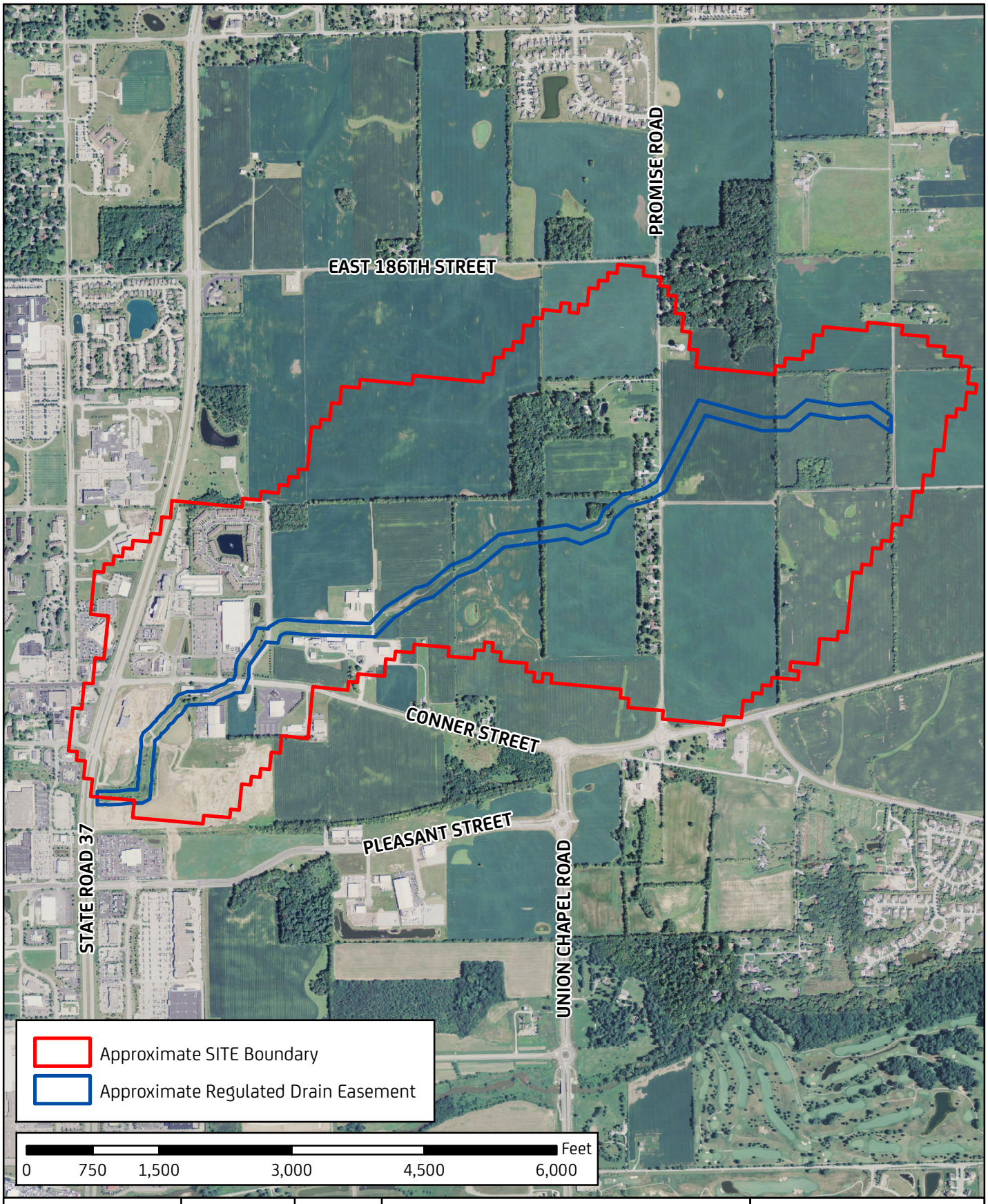
P: 317-423-0690
F: 317-423-0696

N

Figure 4
NRCS Soil Survey for Hamilton County
NRCS Web Soil Survey
Elwood Wilson Drain
Noblesville, Hamilton County, Indiana

Prepared for:
Clark Dietz, Inc.

Date:
May 2016



WILLIAMS CREEK CONSULTING

619 N. Pennsylvania St.
Indianapolis, IN 46204

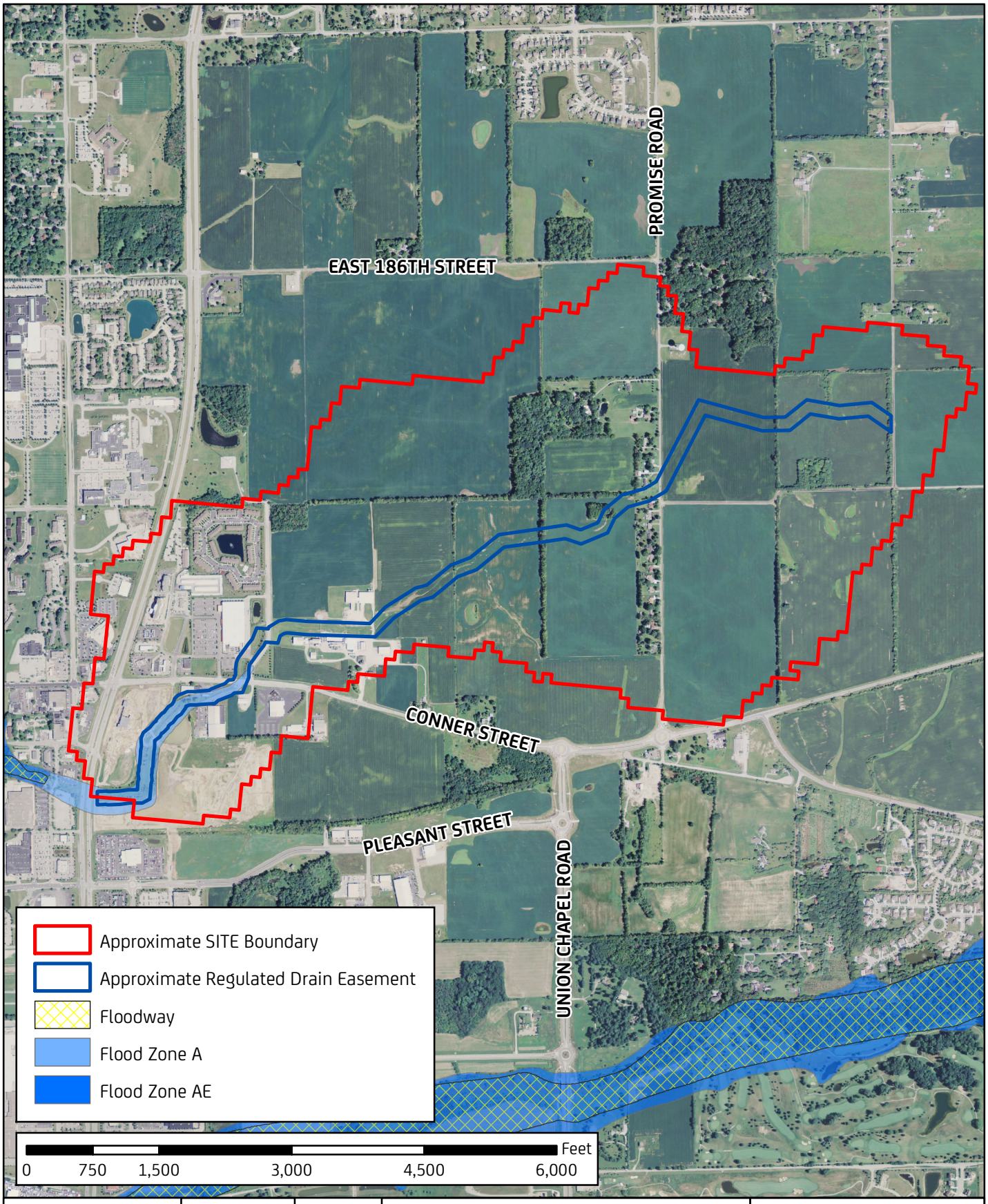
P: 317-423-0690
F: 317-423-0696

N

Figure 5
2014 Aerial Photograph
NRCS Geospatial Data Gateway
Elwood Wilson Drain
Noblesville, Hamilton County, Indiana

Prepared for:
Clark Dietz, Inc.

Date:
May 2016



WILLIAMS CREEK CONSULTING

619 N. Pennsylvania St.
Indianapolis, IN 46204

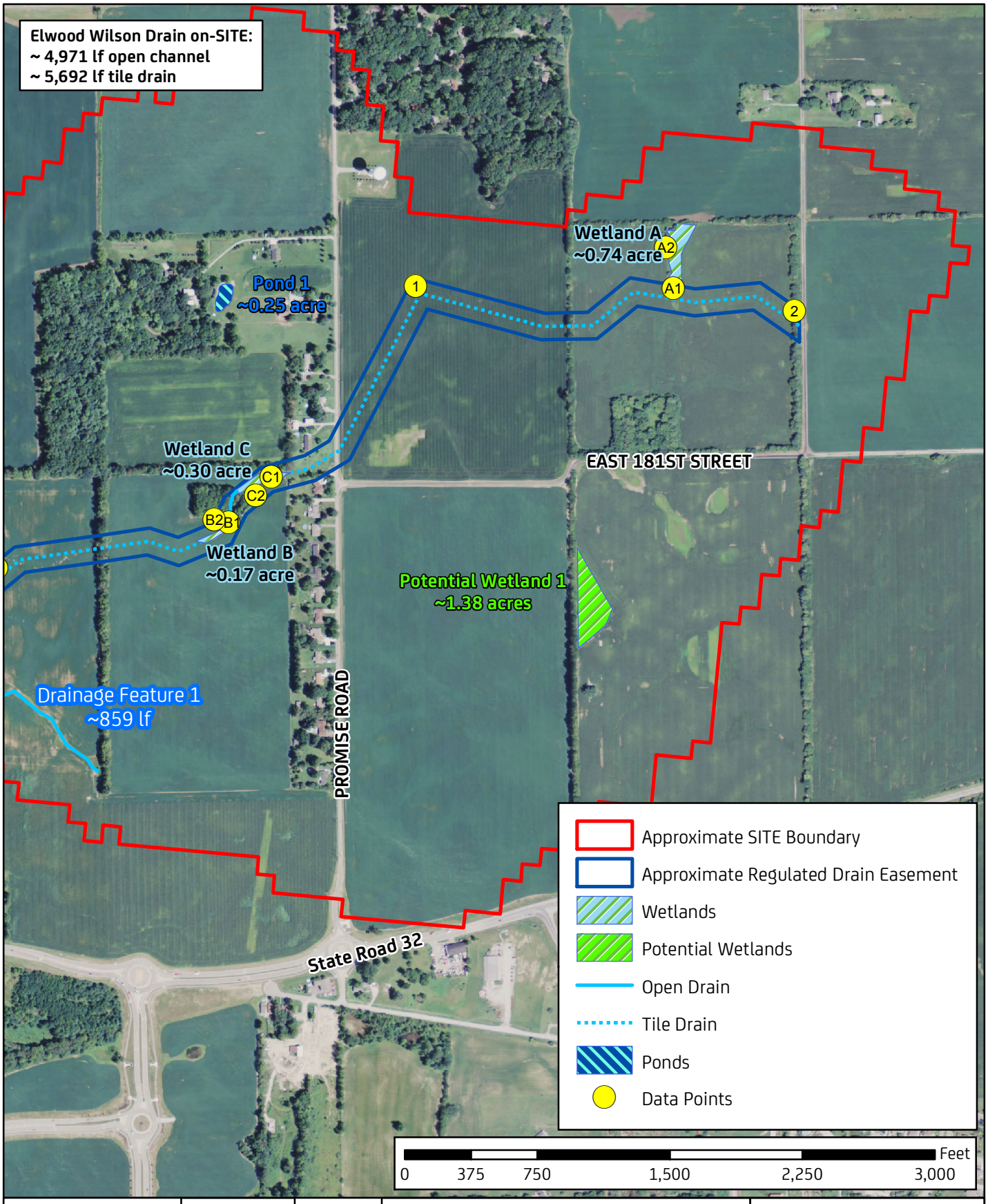
P: 317-423-0690
F: 317-423-0696

N

Figure 6
FEMA Flood Insurance Rate Map
Indiana GIS Atlas
Elwood Wilson Drain
Noblesville, Hamilton County, Indiana

Prepared for:
Clark Dietz, Inc.

Date:
May 2016



WILLIAMS CREEK CONSULTING

619 N. Pennsylvania St.
Indianapolis, IN 46204

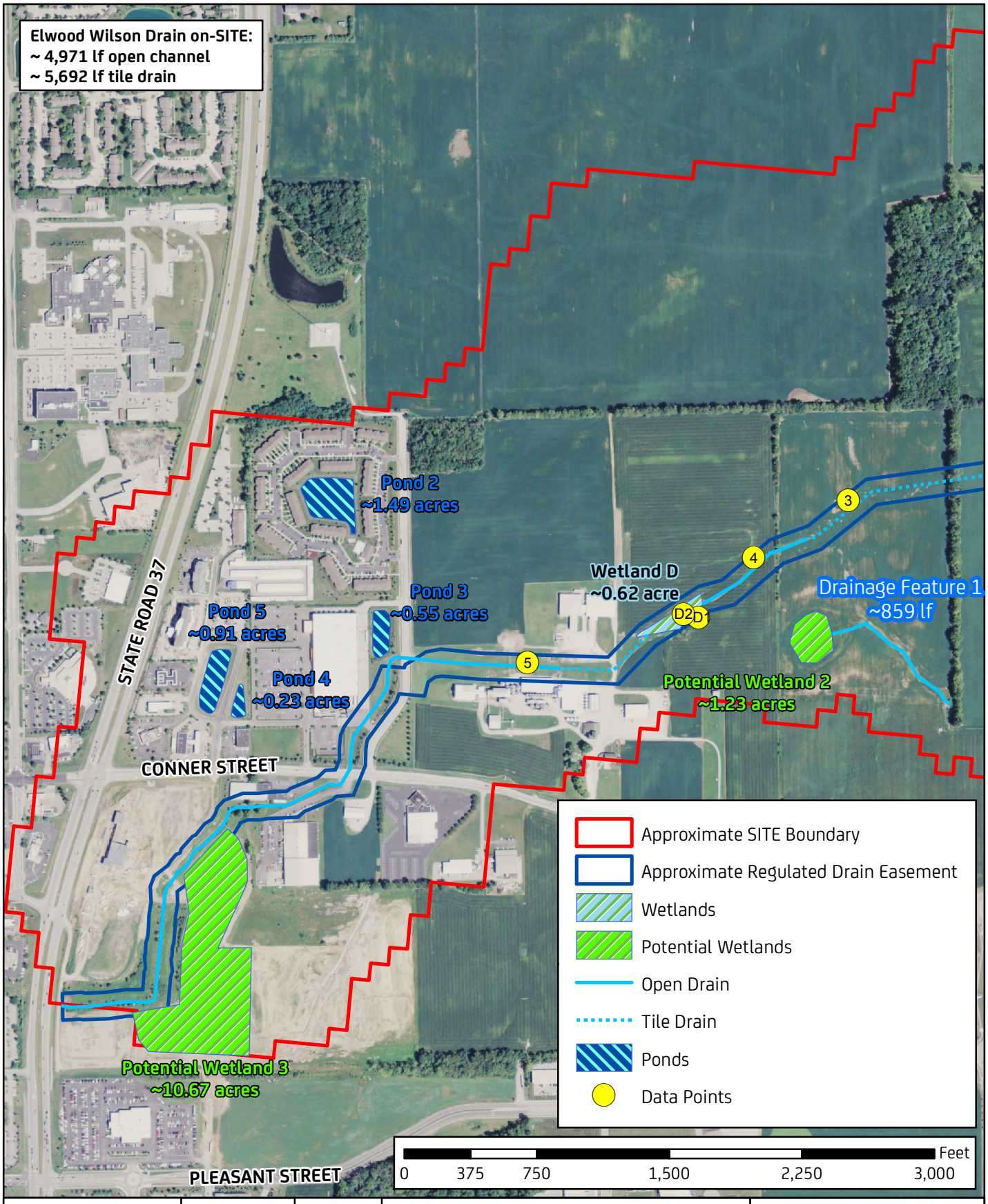
P: 317-423-0690
F: 317-423-0696

N

Figure 7a
Aquatic Feature and Data Point Map
Elwood Wilson Drain
Noblesville, Hamilton County, Indiana

Prepared for:
Clark Dietz, Inc.

Date:
May 2016



WILLIAMS CREEK CONSULTING

619 N. Pennsylvania St.
Indianapolis, IN 46204

P: 317-423-0690
F: 317-423-0696

N

Figure 7b
Aquatic Feature and Data Point Map
Elwood Wilson Drain
Noblesville, Hamilton County, Indiana

Prepared for:
Clark Dietz, Inc.

Date:
May 2016

Appendix A

USFWS & IDNR Correspondence Letters

WILLIAMS CREEK
CONSULTING

Eric Blake

From: Reed, Marissa <marissa_reed@fws.gov>
Sent: Tuesday, April 12, 2016 9:14 AM
To: Eric Blake
Subject: Re: Request for ETR - Elwood Wilson Drain

Eric,

Hamilton County is within the range of the federally endangered Indiana bat (*Myotis sodalis*) and the federally threatened northern long-eared bat (*Myotis septentrionalis*). We have no records of bats near the project site, but to our knowledge the area has not been surveyed. There is minimal suitable habitat for these species surrounding the site.

This endangered species information is provided for technical assistance only, and does not fulfill the requirements of Section 7 of the Endangered Species Act.

Regards,
Marissa

Marissa Reed
Wildlife Biologist
U.S. Fish & Wildlife Service
Ecological Services Field Office
620 S. Walker Street
Bloomington, IN 47403
Phone - 812-334-4261 ext. 1215
Fax - 812-334-4273

On Mon, Apr 11, 2016 at 2:17 PM, Eric Blake <eblake@williamscreek.net> wrote:

> Ms. Reed,
>
> Attached, please find a site location map and a request for information for a proposed project in Noblesville, Hamilton County, Indiana (CDI).
>
> Thank you,
>
> **Eric Blake**
>
> Project Engineer
>
> eblake@williamscreek.net

Williams Creek Consulting

www.williamscreek.net

619 N. Pennsylvania Street | Indianapolis, IN 46204

+1.317.423.0690 **office** | +1.877.668.8848 **toll free**

LinkedIn | Twitter | Facebook | Instagram | I YouTube

This message is intended solely for the above addressee. If the reader of this message is not the addressee or the employee intended or agent responsible for delivering the message to the recipient, you are hereby notified that this transmission may contain privileged or confidential information and dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us by phone and destroy the original.

Division of Nature Preserves
402 W. Washington St., Rm W267
Indianapolis, IN 46204-2739

April 11, 2016

Dear: Eric Blake,

I am responding to your request for information on the endangered, threatened, or rare (ETR) species, high quality natural communities, and natural areas documented from a project area, Indiana. The Indiana Natural Heritage Data Center has been checked and there are no ETR species and significant areas documented within 0.5 mile of the project area for the Elwood Wilson Drain, Noblesville, Indiana.

The information I am providing does not preclude the requirement for further consultation with the U.S. Fish and Wildlife Service as required under Section 7 of the Endangered Species Act of 1973. If you have concerns about potential Endangered Species Act issues you should contact the Service at their Bloomington, Indiana office.

U.S. Fish and Wildlife Service
620 South Walker St.
Bloomington, Indiana 47403-2121
(812)334-4261

At some point, you may need to contact the Department of Natural Resources' Environmental Review Coordinator so that other divisions within the department have the opportunity to review your proposal. For more information, please contact:

Department of Natural Resources
Attn: Christie Stanifer
Environmental Coordinator
Division of Fish and Wildlife
402 W. Washington Street, Room W273
Indianapolis, IN 46204
(317)232-8163

Please note that the Indiana Natural Heritage Data Center relies on the observations of many individuals for our data. In most cases, the information is not the result of comprehensive field surveys conducted at particular sites. Therefore, our statement that there are no documented significant natural features at a site should not be interpreted to mean that the site does not support special plants or animals.

Due to the dynamic nature and sensitivity of the data, this information should not be used for any project other than that for which it was originally intended. It may be necessary for you to request updated material from us in order to base your planning decisions on the most current information.

Thank you for contacting the Indiana Natural Heritage Data Center. You may reach me at (317)232-3517 you have any questions or need additional information.

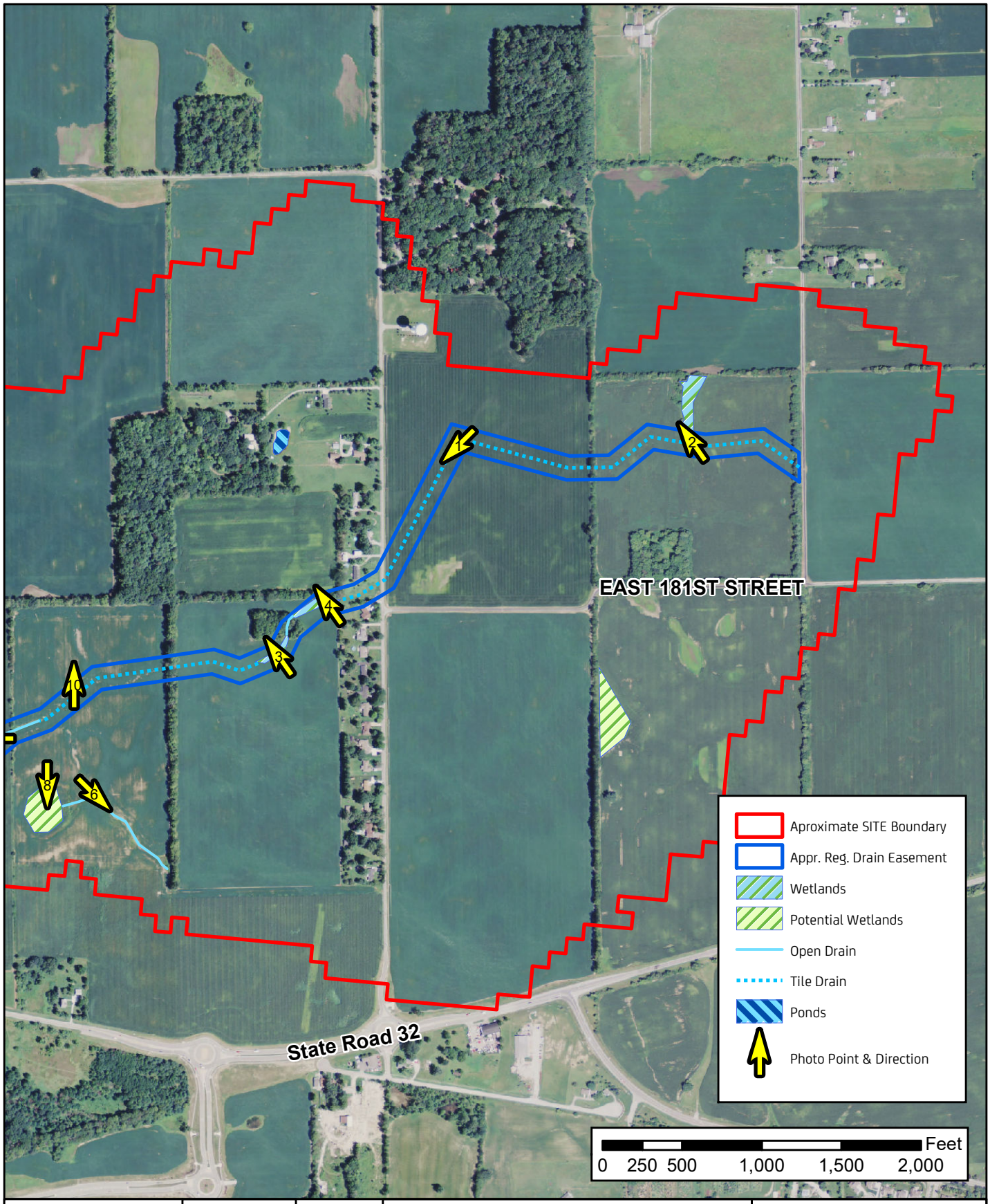
Sincerely,

Robin M. Wilson
Indiana Natural Heritage Data Center

Appendix B

SITE Photographs

WILLIAMS CREEK
CONSULTING



WILLIAMS CREEK CONSULTING

619 N. Pennsylvania St.
Indianapolis, IN 46204

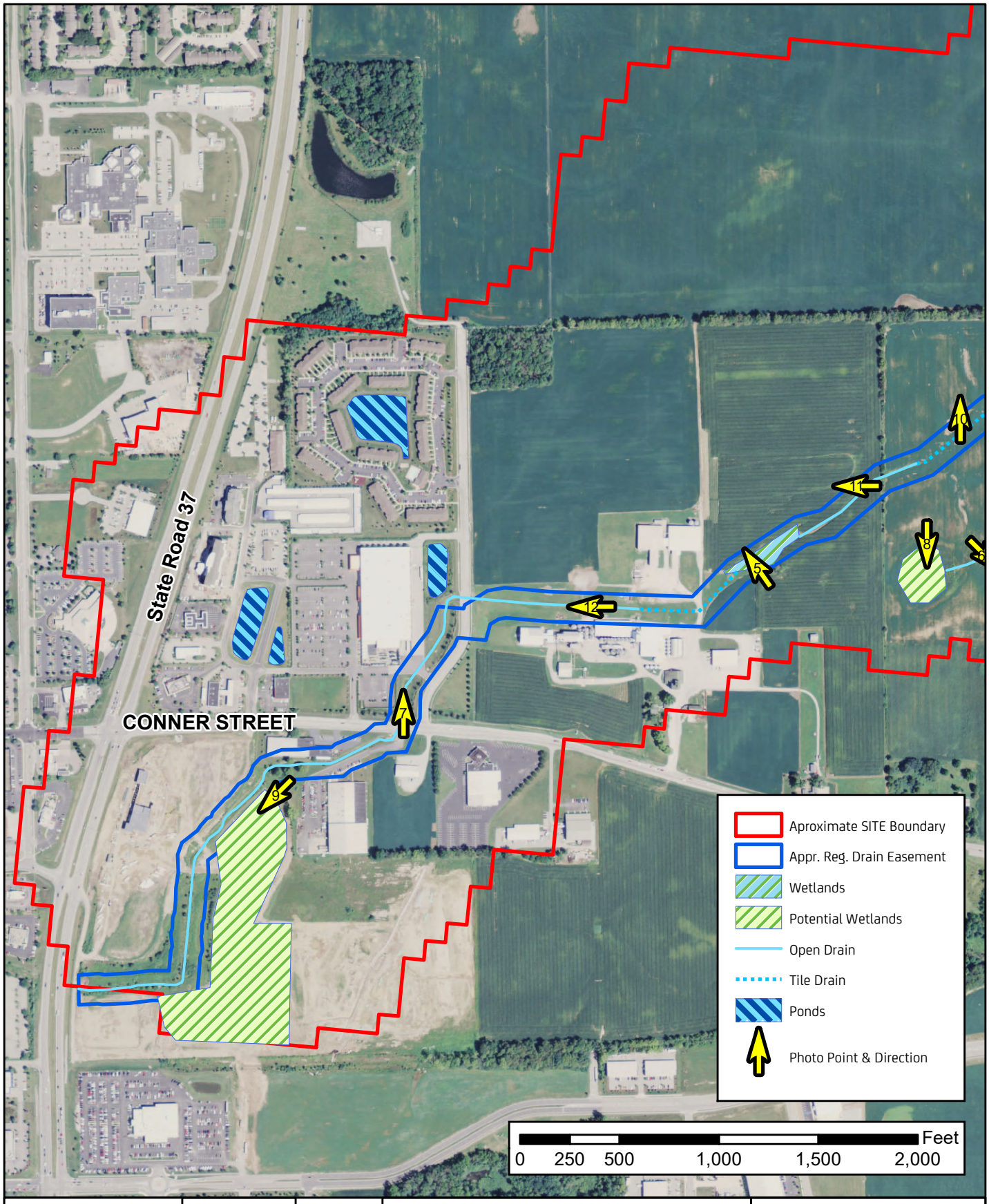
P: 317-423-0690
F: 317-423-0696

N

Figure 8a
Photo Points
Elwood Wilson Drain
Noblesville, Hamilton County, Indiana

Prepared for:
Clark Dietz, Inc.

Date:
August 2016



WILLIAMS CREEK CONSULTING

619 N. Pennsylvania St.
Indianapolis, IN 46204

P: 317-423-0690
F: 317-423-0696

N

Figure 8b
Photo Points
Elwood Wilson Drain
Noblesville, Hamilton County, Indiana

Prepared for:
Clark Dietz, Inc.

Date:
August 2016

Photo Point 1: Area in vicinity of DP 1
View: Looking southwest over agricultural field

Photo Point 2: Wetland A
View: Looking north

Photo Point 3: Wetland B
View: Looking northwest

Photo Point 4: Wetland C
View: Looking west

Photo Point 5: Wetland D
View: Looking northwest

Photo Point 6: Drainage Feature 1
View: Looking southeast

Photo Point 7: Elwood Wilson Drain
View: Looking north

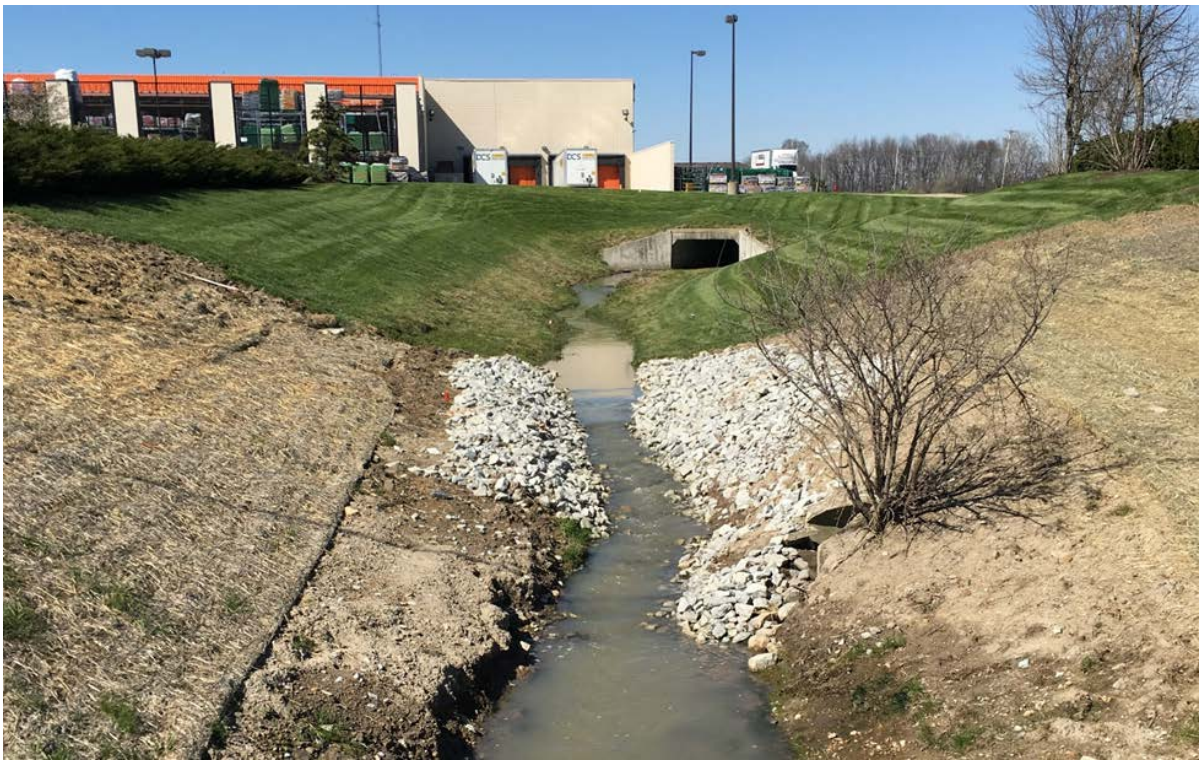


Photo Point 8: Potential Wetland 2
View: Looking south

Photo Point 9: Potential Wetland 3
View: Looking southwest

Photo Point 10: Data Point 3
View: Looking north

Photo Point 11: Data Point 4
View: Looking west

Photo Point 12: Data Point 5
View: Looking west

Appendix C

Data Forms

WILLIAMS CREEK
CONSULTING

Site: Elwood Wilson Drain City/County: Noblesville / Hamilton Date: 4.13.16 Data Point: A1
Client: Clark Dietz, Inc. State: IN Section, Township, Range: S32 T19N R5E
Investigator(s): B. Owens
Slope (%): 0-2 Nor. 4433617.95 Eas. 586877.56 Datum: UTM NWI Class: NA
Soil Map Unit Name:
Climatic/hydrologic conditions typical for time of year? Y/N Y
Vegetation ____, Soil ____ or Hydrology ____ significantly disturbed
Vegetation ____, Soil ____ or Hydrology ____ naturally problematic
Are Normal Circumstances Present? Yes x No ____

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present? Yes ____ No x
Hydric Soil Present? Yes x No ____ **Is the DP within a Wetland?**
Wetland Hydrology Present? Yes x No **Yes** x **No**

Remarks:

VEGETATION

Tree Stratum	Plot size:	Absolute %	Dominant	Indicator Status	
1.	*Acer negundo*	50	Y	FAC	3
2.	*Celtis occidentalis*	25	Y	FAC	3
3.					
4.					
5.					
		75	Total Cover		
Shrub Stratum	Plot size:				
1.	*Lonicera maackii*	15	Y	UPL	5
2.					
3.					
4.					
5.					
		15	Total Cover		
Herb Stratum	Plot size:				
1.	*Solidago altissima*	5		FACU	4
2.					
3.					
4.					
5.					
6.					
7.					
8.					
		5	Total Cover		
Woody Vine Stratum	Plot size:				
1.					
2.					
		0	Total Cover		

Remarks:

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 2
Total number of dominant species across all strata: 3
Percent of dominant species that are OBL, FACW, or FAC: 66.67

Prevalence Index Worksheet

Total % cover of:

OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	75	x 3	225
FACU species	5	x 4	20
UPL species	15	x 5	75
Total	95		320

Prevalence Index: 3.36842105

Hydrophytic Vegetation Indicators:

____ Rapid Test for Hydrophytic Veg.
x Dominance Test is >50%
____ Prevalence Index is ≤3.0*
____ Morphological Adaptations*
____ Problematic Hydrophytic Vegetation*

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present?
Yes x **No** ____

SOIL

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

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-18	10 YR 3/1	100					SL	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Coated Sand grains **Location: PL=Pore Lining, M=Matrix

	Hydric Soil Indicators:				Indicators for Problematic Soils
	Histosol (A1)		Sandy Gleyed Matrix (S4)		Coast Prairie Redox (A16)
	Histic Epipedon (A2)		Sandy Redox (S5)		Iron-Manganese Masses (F12)
	Black Histic (A3)		Stripped Matrix (S6)		Other
	Hydrogen Sulfide (A4)		Loamy Mucky Mineral (F1)		
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)		
	2 cm Muck (A10)	x	Depleted Matrix (F3)		
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)		
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)		
	Sandy Mucky Mineral (S1)		Redox Depressions (F8)		
	5cm Mucky Peat or Peat				

Restrictive Layer (if observed)
Type:
Depth (inches):
Remarks:

Hydric Soil Present? **Yes** x **No** ____

HYDROLOGY

Wetland Hydrology Indicators:

	Primary Indicators (check all that apply)				Secondary Indicators
x	Surface Water (A1)		Water Stained Leaves (B9)		Surface Soil Cracks (B6)
	High Water Table (A2)		Aquatic Fauna (B13)	x	Drainage Patterns (B10)
x	Saturation (A3)		True Aquatic Plants (B14)		Dry-Season Water Table (C2)
	Water Marks (B1)		Hydrogen Sulfide Odor (C1)		Crayfish Burrows (C8)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)		Saturation Visible on Aerial Imagery (C9)
	Drift Deposits (B3)				Stunted or Stressed Plants (D1)
	Algal Mat or Crust (B4)		Presence of Reduced Iron (C4)		Geomorphic Position (D2)
	Iron Deposits (B5)		Recent Iron Reduction in Tilled Soil (C6)		FAC-Neutral Test (D5)
	Inundation Visible on Aerial Imagery (B7)		Thin Muck Surface (C7)		
	Sparsely Vegetated Concave Surface (B8)		Guage or Well Data (D9)		
			Other		

Field Observations:

Surface Water Present?	Yes	x	No	____	Depth (inches)	2
Water Table Present?	Yes	____	No	x	Depth (inches)	____
Saturation Present?	Yes	x	No	____	Depth (inches)	0-18

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

Remarks: Wetland A

Site: Elwood Wilson Drain City/County: Noblesville / Hamilton Date: 4.13.16 Data Point: A2
Client: Clark Dietz, Inc. State: IN Section, Township, Range: S32 T19N R5E
Investigator(s): B. Owens
Slope (%): 0-2 Nor. 4433617.95 Eas. 586877.56 Datum: UTM NWI Class: NA
Soil Map Unit Name:
Climatic/hydrologic conditions typical for time of year? Y/N Y
Vegetation ____, Soil ____ or Hydrology ____ significantly disturbed
Vegetation ____, Soil ____ or Hydrology ____ naturally problematic
Are Normal Circumstances Present? Yes x No ____

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present? Yes x No ____
Hydric Soil Present? Yes x No ____
Wetland Hydrology Present? Yes x No ____

Is the DP within a Wetland?
Yes x **No**

Remarks:

VEGETATION

Tree Stratum	Plot size:	Cover	Species	Indicator Status	
1.	*Prunus serotina*	50	Y	FACU	4
2.	*Celtis occidentalis*	20	Y	FAC	3
3.					
4.					
5.					
		70	Total Cover		
Shrub Stratum	**Plot size:**				
1.	*Lonicera maackii*	30	Y	UPL	5
2.					
3.					
4.					
5.					
		30	Total Cover		
Herb Stratum	**Plot size:**				
1.	*Solidago altissima*	60	Y	FACU	4
2.	*Rubus pergratus*	10		FACU	4
3.	*Taraxacum officinale*	15		FACU	4
4.					
5.					
6.					
7.					
8.					
		85	Total Cover		
Woody Vine Stratum	**Plot size:**				
1.					
2.					
		0	Total Cover		

Remarks:

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 1
Total number of dominant species across all strata: 4
Percent of dominant species that are OBL, FACW, or FAC: 25.00

Prevalence Index Worksheet

Total % cover of:			
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	20	x 3	60
FACU species	135	x 4	540
UPL species	30	x 5	150
Total	185		750

Prevalence Index: 4.05405405

Hydrophytic Vegetation Indicators:

- ____ Rapid Test for Hydrophytic Veg.
- ____ Dominance Test is >50%
- ____ Prevalence Index is ≤3.0*
- ____ Morphological Adaptations*
- ____ Problematic Hydrophytic Vegetation*

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present?
Yes ____ **No** x

SOIL

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

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-18	10 YR 3/2	100					SL	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Coated Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators:				Indicators for Problematic Soils	
	Histosol (A1)		Sandy Gleyed Matrix (S4)		Coast Prairie Redox (A16)
	Histic Epipedon (A2)		Sandy Redox (S5)		Iron-Manganese Masses (F12)
	Black Histic (A3)		Stripped Matrix (S6)		Other
	Hydrogen Sulfide (A4)		Loamy Mucky Mineral (F1)		
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)		
	2 cm Muck (A10)		Depleted Matrix (F3)		
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)		
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)		
	Sandy Mucky Mineral (S1)		Redox Depressions (F8)		
	5cm Mucky Peat or Peat				

Restrictive Layer (if observed)
Type:
Depth (inches):
Remarks:

Hydric Soil Present? **Yes** ____ **No** x

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (check all that apply)				Secondary Indicators	
	Surface Water (A1)		Water Stained Leaves (B9)		Surface Soil Cracks (B6)
	High Water Table (A2)		Aquatic Fauna (B13)		Drainage Patterns (B10)
	Saturation (A3)		True Aquatic Plants (B14)		Dry-Season Water Table (C2)
	Water Marks (B1)		Hydrogen Sulfide Odor (C1)		Crayfish Burrows (C8)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)		Saturation Visible on Aerial Imagery (C9)
	Drift Deposits (B3)				Stunted or Stressed Plants (D1)
	Algal Mat or Crust (B4)		Presence of Reduced Iron (C4)		Geomorphic Position (D2)
	Iron Deposits (B5)		Recent Iron Reduction in Tilled Soil (C6)		FAC-Neutral Test (D5)
	Inundation Visible on Aerial Imagery (B7)		Thin Muck Surface (C7)		
	Sparsely Vegetated Concave Surface (B8)		Guage or Well Data (D9)		
			Other		

Field Observations:

Surface Water Present? Yes ____ No x Depth (inches) ____
Water Table Present? Yes ____ No x Depth (inches) ____
Saturation Present? Yes ____ No x Depth (inches) ____

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

Site: Elwood Wilson Drain City/County: Noblesville / Hamilton Date: 4.13.16 Data Point: B1
Client: Clark Dietz, Inc. State: IN Section, Township, Range: S32 T19N R5E
Investigator(s): B. Owens
Slope (%): 0-2 Nor. 4433617.95 Eas. 586877.56 Datum: UTM NWI Class: NA
Soil Map Unit Name:
Climatic/hydrologic conditions typical for time of year? Y/N Y
Vegetation ____, Soil ____ or Hydrology ____ significantly disturbed
Vegetation ____, Soil ____ or Hydrology ____ naturally problematic
Are Normal Circumstances Present? Yes x No ____

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present? Yes x No ____
Hydric Soil Present? Yes x No ____
Wetland Hydrology Present? Yes x No ____

Is the DP within a Wetland?
Yes x **No**

Remarks:

VEGETATION

Tree Stratum	Plot size:	Cover	Species	Indicator Status	
1.	*Fraxinus pennsylvanica*	15	Y	FACW	2
2.	*Celtis occidentalis*	15	Y	FAC	3
3.					
4.					
5.					
		30	Total Cover		
Shrub Stratum	**Plot size:**				
1.	*Lonicera maackii*	10	Y	UPL	5
2.					
3.					
4.					
5.					
		10	Total Cover		
Herb Stratum	**Plot size:**				
1.	*unknown forb*	10	Y	FAC	3
2.					
3.					
4.					
5.					
6.					
7.					
8.					
		10	Total Cover		
Woody Vine Stratum	**Plot size:**				
1.					
2.					
		0	Total Cover		

Remarks:

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 3
Total number of dominant species across all strata: 4
Percent of dominant species that are OBL, FACW, or FAC: 75.00

Prevalence Index Worksheet

Total % cover of:			
OBL species	0	x 1	0
FACW species	15	x 2	30
FAC species	25	x 3	75
FACU species	0	x 4	0
UPL species	10	x 5	50
Total	50		155

Prevalence Index: 3.1

Hydrophytic Vegetation Indicators:

- ____ Rapid Test for Hydrophytic Veg.
- x Dominance Test is >50%
- ____ Prevalence Index is ≤3.0*
- ____ Morphological Adaptations*
- ____ Problematic Hydrophytic Vegetation*

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present?
Yes x **No** ____

SOIL

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

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-18	10 YR 4/1	100	10YR 4/6	25	D	M	SL	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Coated Sand grains **Location: PL=Pore Lining, M=Matrix

	Hydric Soil Indicators:				Indicators for Problematic Soils
	Histosol (A1)		Sandy Gleyed Matrix (S4)		Coast Prairie Redox (A16)
	Histic Epipedon (A2)		Sandy Redox (S5)		Iron-Manganese Masses (F12)
	Black Histic (A3)		Stripped Matrix (S6)		Other
	Hydrogen Sulfide (A4)		Loamy Mucky Mineral (F1)		
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)		
	2 cm Muck (A10)	x	Depleted Matrix (F3)		
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)		
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)		
	Sandy Mucky Mineral (S1)		Redox Depressions (F8)		
	5cm Mucky Peat or Peat				

Restrictive Layer (if observed)
Type:
Depth (inches):
Remarks:

Hydric Soil Present? **Yes** x **No** ____

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (check all that apply)				Secondary Indicators	
x	Surface Water (A1)	x	Water Stained Leaves (B9)		Surface Soil Cracks (B6)
	High Water Table (A2)		Aquatic Fauna (B13)	x	Drainage Patterns (B10)
x	Saturation (A3)		True Aquatic Plants (B14)		Dry-Season Water Table (C2)
	Water Marks (B1)		Hydrogen Sulfide Odor (C1)		Crayfish Burrows (C8)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)		Saturation Visible on Aerial Imagery (C9)
	Drift Deposits (B3)				Stunted or Stressed Plants (D1)
	Algal Mat or Crust (B4)		Presence of Reduced Iron (C4)		Geomorphic Position (D2)
	Iron Deposits (B5)		Recent Iron Reduction in Tilled Soil (C6)		FAC-Neutral Test (D5)
	Inundation Visible on Aerial Imagery (B7)		Thin Muck Surface (C7)		
	Sparsely Vegetated Concave Surface (B8)		Guage or Well Data (D9)		
			Other		

Field Observations:

Surface Water Present?	Yes	x	No		Depth (inches)	2
Water Table Present?	Yes		No	x	Depth (inches)	
Saturation Present?	Yes	x	No		Depth (inches)	0-18

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

Remarks: Wetland B

Site: Elwood Wilson Drain City/County: Noblesville / Hamilton Date: 4.13.16 Data Point: B2
Client: Clark Dietz, Inc. State: IN Section, Township, Range: S32 T19N R5E
Investigator(s): B. Owens
Slope (%): 0-2 Nor. 4433617.95 Eas. 586877.56 Datum: UTM NWI Class: NA
Soil Map Unit Name:
Climatic/hydrologic conditions typical for time of year? Y/N Y
Vegetation x , Soil ____ or Hydrology ____ significantly disturbed
Vegetation ____ , Soil ____ or Hydrology ____ naturally problematic
Are Normal Circumstances Present? Yes x No ____

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes ____	No	x
Hydric Soil Present?	Yes ____	No	x
Wetland Hydrology Present?	Yes	No	x

Is the DP within a Wetland? **Yes** **No** x

Remarks:
Freshly plowed agricultural field (Zea mays)

VEGETATION

Tree Stratum	Plot size:	Cover	Species	Indicator Status	
1.	*Celtis occidentalis*	10	Y	FAC	3
2.					
3.					
4.					
5.					
		10	Total Cover		
Shrub Stratum	**Plot size:**				
1.	*Lonicera maackii*	15	Y	UPL	5
2.					
3.					
4.					
5.					
		15	Total Cover		
Herb Stratum	**Plot size:**				
1.	*Zea mays*	80	Y	UPL	5
2.	*Ornithogalum umbellatum*	20	Y	FACU	4
3.					
4.					
5.					
6.					
7.					
8.					
		100	Total Cover		
Woody Vine Stratum	**Plot size:**				
1.					
2.					
		0	Total Cover		

Remarks: Freshly plowed agricultural field (Zea mays)

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC:	1
Total number of dominant species across all strata:	4
Percent of dominant species that are OBL, FACW, or FAC:	25.00

Prevalence Index Worksheet

Total % cover of:			
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	10	x 3	30
FACU species	20	x 4	80
UPL species	95	x 5	475
Total	125		585

Prevalence Index: 4.68

Hydrophytic Vegetation Indicators:
____ Rapid Test for Hydrophytic Veg.
____ Dominance Test is >50%
____ Prevalence Index is ≤3.0*
____ Morphological Adaptations*
____ Problematic Hydrophytic Vegetation*

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present?
Yes ____ **No** x

SOIL

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

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-18	10 YR 4/3	100					SL	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Coated Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators:				Indicators for Problematic Soils	
	Histosol (A1)		Sandy Gleyed Matrix (S4)		Coast Prairie Redox (A16)
	Histic Epipedon (A2)		Sandy Redox (S5)		Iron-Manganese Masses (F12)
	Black Histic (A3)		Stripped Matrix (S6)		Other
	Hydrogen Sulfide (A4)		Loamy Mucky Mineral (F1)		
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)		
	2 cm Muck (A10)		Depleted Matrix (F3)		
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)		
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)		
	Sandy Mucky Mineral (S1)		Redox Depressions (F8)		
	5cm Mucky Peat or Peat				

Restrictive Layer (if observed)
Type:
Depth (inches):
Remarks:

Hydric Soil Present? **Yes** ____ **No** x

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (check all that apply)				Secondary Indicators	
	Surface Water (A1)		Water Stained Leaves (B9)		Surface Soil Cracks (B6)
	High Water Table (A2)		Aquatic Fauna (B13)		Drainage Patterns (B10)
	Saturation (A3)		True Aquatic Plants (B14)		Dry-Season Water Table (C2)
	Water Marks (B1)		Hydrogen Sulfide Odor (C1)		Crayfish Burrows (C8)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)		Saturation Visible on Aerial Imagery (C9)
	Drift Deposits (B3)				Stunted or Stressed Plants (D1)
	Algal Mat or Crust (B4)		Presence of Reduced Iron (C4)		Geomorphic Position (D2)
	Iron Deposits (B5)		Recent Iron Reduction in Tilled Soil (C6)		FAC-Neutral Test (D5)
	Inundation Visible on Aerial Imagery (B7)		Thin Muck Surface (C7)		
	Sparsely Vegetated Concave Surface (B8)		Guage or Well Data (D9)		
			Other		

Field Observations:

Surface Water Present?	Yes	____	No	x	Depth (inches) ____
Water Table Present?	Yes	____	No	x	Depth (inches) ____
Saturation Present?	Yes		No	x	Depth (inches)

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

Remarks: Freshly plowed agricultural field (Zea mays), upland area near Wetland B

Site: Elwood Wilson Drain City/County: Noblesville / Hamilton Date: 4.13.16 Data Point: C1
Client: Clark Dietz, Inc. State: IN Section, Township, Range: S32 T19N R5E
Investigator(s): B. Owens
Slope (%): 0-2 Nor. 4433617.95 Eas. 586877.56 Datum: UTM NWI Class: NA
Soil Map Unit Name:
Climatic/hydrologic conditions typical for time of year? Y/N Y
Vegetation ____, Soil ____ or Hydrology ____ significantly disturbed
Vegetation ____, Soil ____ or Hydrology ____ naturally problematic
Are Normal Circumstances Present? Yes x No ____

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present? Yes x No ____
Hydric Soil Present? Yes x No ____
Wetland Hydrology Present? Yes x No

Is the DP within a Wetland?
Yes x **No**

Remarks:

VEGETATION

Tree Stratum	Plot size:	Cover	Species	Indicator Status	
1.	*Acer negundo*	15	Y	FAC	3
2.	*Celtis occidentalis*	15	Y	FAC	3
3.					
4.					
5.					
		30	Total Cover		
Shrub Stratum	Plot size:				
1.					
2.					
3.					
4.					
5.					
		0	Total Cover		
Herb Stratum	Plot size:				
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
		0	Total Cover		
Woody Vine Stratum	Plot size:				
1.					
2.					
		0	Total Cover		

Remarks:

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 2
Total number of dominant species across all strata: 2
Percent of dominant species that are OBL, FACW, or FAC: 100.00

Prevalence Index Worksheet

Total % cover of:			
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	30	x 3	90
FACU species	0	x 4	0
UPL species	0	x 5	0
Total	30		90

Prevalence Index: 3

Hydrophytic Vegetation Indicators:

- ____ Rapid Test for Hydrophytic Veg.
- x Dominance Test is >50%
- x Prevalence Index is ≤3.0*
- ____ Morphological Adaptations*
- ____ Problematic Hydrophytic Vegetation*

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present?
Yes x **No** ____

SOIL

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

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-18	10 YR 4/1	100	10YR 4/6	25	D	M	SL	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Coated Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators:				Indicators for Problematic Soils	
	Histosol (A1)		Sandy Gleyed Matrix (S4)		Coast Prairie Redox (A16)
	Histic Epipedon (A2)		Sandy Redox (S5)		Iron-Manganese Masses (F12)
	Black Histic (A3)		Stripped Matrix (S6)		Other
	Hydrogen Sulfide (A4)		Loamy Mucky Mineral (F1)		
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)		
	2 cm Muck (A10)	x	Depleted Matrix (F3)		
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)		
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)		
	Sandy Mucky Mineral (S1)		Redox Depressions (F8)		
	5cm Mucky Peat or Peat				

Restrictive Layer (if observed)
Type:
Depth (inches):
Remarks:

Hydric Soil Present? **Yes** x **No** ____

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (check all that apply)				Secondary Indicators	
x	Surface Water (A1)		Water Stained Leaves (B9)		Surface Soil Cracks (B6)
	High Water Table (A2)		Aquatic Fauna (B13)	x	Drainage Patterns (B10)
x	Saturation (A3)		True Aquatic Plants (B14)		Dry-Season Water Table (C2)
	Water Marks (B1)		Hydrogen Sulfide Odor (C1)		Crayfish Burrows (C8)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)		Saturation Visible on Aerial Imagery (C9)
	Drift Deposits (B3)				Stunted or Stressed Plants (D1)
	Algal Mat or Crust (B4)		Presence of Reduced Iron (C4)		Geomorphic Position (D2)
	Iron Deposits (B5)		Recent Iron Reduction in Tilled Soil (C6)		FAC-Neutral Test (D5)
	Inundation Visible on Aerial Imagery (B7)		Thin Muck Surface (C7)		
	Sparsely Vegetated Concave Surface (B8)		Guage or Well Data (D9)		
			Other		

Field Observations:

Surface Water Present?	Yes	x	No		Depth (inches)	2
Water Table Present?	Yes		No	x	Depth (inches)	
Saturation Present?	Yes	x	No		Depth (inches)	0-18

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

Remarks: Wetland C

Site: Elwood Wilson Drain City/County: Noblesville / Hamilton Date: 4.13.16 Data Point: C2
Client: Clark Dietz, Inc. State: IN Section, Township, Range: S32 T19N R5E
Investigator(s): B. Owens
Slope (%): 0-2 Nor. 4433617.95 Eas. 586877.56 Datum: UTM NWI Class: NA
Soil Map Unit Name:
Climatic/hydrologic conditions typical for time of year? Y/N Y
Vegetation x , Soil ____ or Hydrology ____ significantly disturbed
Vegetation ____ , Soil ____ or Hydrology ____ naturally problematic
Are Normal Circumstances Present? Yes x No ____

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes ____	No x	
Hydric Soil Present?	Yes ____	No x	**Is the DP within a Wetland?**
Wetland Hydrology Present?	Yes	No x	**Yes** **No** x

Remarks:
Freshly plowed agricultural field (Zea mays)

VEGETATION

Tree Stratum	Plot size:	Cover	Species	Indicator Status	
1.					
2.					
3.					
4.					
5.					
		0	Total Cover		
Shrub Stratum	**Plot size:**				
1.					
2.					
3.					
4.					
5.					
		0	Total Cover		
Herb Stratum	**Plot size:**				
1.	*Zea mays*	50	Y	UPL	5
2.	*Ornithogalum umbellatum*	10		FACU	4
3.					
4.					
5.					
6.					
7.					
8.					
		60	Total Cover		
Woody Vine Stratum	**Plot size:**				
1.					
2.					
		0	Total Cover		

Remarks: Freshly plowed agricultural field (Zea mays)

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC:	0
Total number of dominant species across all strata:	1
Percent of dominant species that are OBL, FACW, or FAC:	0.00

Prevalence Index Worksheet

Total % cover of:			
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	0	x 3	0
FACU species	10	x 4	40
UPL species	50	x 5	250
Total	60		290

Prevalence Index: 4.83333333

Hydrophytic Vegetation Indicators:
____ Rapid Test for Hydrophytic Veg.
____ Dominance Test is >50%
____ Prevalence Index is ≤3.0*
____ Morphological Adaptations*
____ Problematic Hydrophytic Vegetation*

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present?
Yes ____ **No** x

SOIL

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

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-4	10 YR 4/2	100					SL	
4-18	10 YR 4/3	100					SL	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Coated Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators:				**Indicators for Problematic Soils**	
	Histosol (A1)		Sandy Gleyed Matrix (S4)		Coast Prairie Redox (A16)
	Histic Epipedon (A2)		Sandy Redox (S5)		Iron-Manganese Masses (F12)
	Black Histic (A3)		Stripped Matrix (S6)		Other
	Hydrogen Sulfide (A4)		Loamy Mucky Mineral (F1)		
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)		
	2 cm Muck (A10)		Depleted Matrix (F3)		
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)		
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)		
	Sandy Mucky Mineral (S1)		Redox Depressions (F8)		
	5cm Mucky Peat or Peat				

Restrictive Layer (if observed)
Type:
Depth (inches):
Remarks:

Hydric Soil Present? **Yes** ____ **No** x

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (check all that apply)				Secondary Indicators	
	Surface Water (A1)		Water Stained Leaves (B9)		Surface Soil Cracks (B6)
	High Water Table (A2)		Aquatic Fauna (B13)		Drainage Patterns (B10)
	Saturation (A3)		True Aquatic Plants (B14)		Dry-Season Water Table (C2)
	Water Marks (B1)		Hydrogen Sulfide Odor (C1)		Crayfish Burrows (C8)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)		Saturation Visible on Aerial Imagery (C9)
	Drift Deposits (B3)				Stunted or Stressed Plants (D1)
	Algal Mat or Crust (B4)		Presence of Reduced Iron (C4)		Geomorphic Position (D2)
	Iron Deposits (B5)		Recent Iron Reduction in Tilled Soil (C6)		FAC-Neutral Test (D5)
	Inundation Visible on Aerial Imagery (B7)		Thin Muck Surface (C7)		
	Sparsely Vegetated Concave Surface (B8)		Guage or Well Data (D9)		
			Other		

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches)	____	
Water Table Present?	Yes ____	No x	Depth (inches)	____	
Saturation Present?	Yes	No x	Depth (inches)		

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

Remarks: Freshly plowed agricultural field (Zea mays), upland area near Wetland C

Site: Elwood Wilson Drain City/County: Noblesville / Hamilton Date: 4.13.16 Data Point: D1
Client: Clark Dietz, Inc. State: IN Section, Township, Range: S32 T19N R5E
Investigator(s): B. Owens
Slope (%): 0-2 Nor. 4433617.95 Eas. 586877.56 Datum: UTM NWI Class: NA
Soil Map Unit Name:
Climatic/hydrologic conditions typical for time of year? Y/N Y
Vegetation x , Soil ____ or Hydrology ____ significantly disturbed
Vegetation ____ , Soil ____ or Hydrology ____ naturally problematic
Are Normal Circumstances Present? Yes x No ____

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present? Yes x No ____
Hydric Soil Present? Yes x No ____
Wetland Hydrology Present? Yes x No ____

Is the DP within a Wetland?
Yes x **No**

Remarks:
Wetland area within a cleared agricultural field, void of vegetation

VEGETATION

Tree Stratum	Plot size:	Cover	Species	Indicator Status
1.				
2.				
3.				
4.				
5.				
		0	Total Cover	
Shrub Stratum	**Plot size:**			
1.				
2.				
3.				
4.				
5.				
		0	Total Cover	
Herb Stratum	**Plot size:**			
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
		0	Total Cover	
Woody Vine Stratum	**Plot size:**			
1.				
2.				
		0	Total Cover	

Remarks:
Wetland area within a cleared agricultural field, void of vegetation

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 0
Total number of dominant species across all strata: 0
Percent of dominant species that are OBL, FACW, or FAC:

Prevalence Index Worksheet

Total % cover of:

OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	0	x 3	0
FACU species	0	x 4	0
UPL species	0	x 5	0
Total	0		0

Prevalence Index:

Hydrophytic Vegetation Indicators:

____ Rapid Test for Hydrophytic Veg.
____ Dominance Test is >50%
____ Prevalence Index is $\leq$3.0*
____ Morphological Adaptations*
____ Problematic Hydrophytic Vegetation*

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present?
Yes x **No** ____

SOIL

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

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-18	10 YR 4/1	100					SL	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Coated Sand grains **Location: PL=Pore Lining, M=Matrix

	Hydric Soil Indicators:				Indicators for Problematic Soils
	Histosol (A1)		Sandy Gleyed Matrix (S4)		Coast Prairie Redox (A16)
	Histic Epipedon (A2)		Sandy Redox (S5)		Iron-Manganese Masses (F12)
	Black Histic (A3)		Stripped Matrix (S6)		Other
	Hydrogen Sulfide (A4)		Loamy Mucky Mineral (F1)		
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)		
	2 cm Muck (A10)	x	Depleted Matrix (F3)		
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)		
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)		
	Sandy Mucky Mineral (S1)		Redox Depressions (F8)		
	5cm Mucky Peat or Peat				

Restrictive Layer (if observed)
Type:
Depth (inches):
Remarks:

Hydric Soil Present? **Yes** x **No** ____

HYDROLOGY

Wetland Hydrology Indicators:

	Primary Indicators (check all that apply)				Secondary Indicators
x	Surface Water (A1)		Water Stained Leaves (B9)		Surface Soil Cracks (B6)
	High Water Table (A2)		Aquatic Fauna (B13)	x	Drainage Patterns (B10)
x	Saturation (A3)		True Aquatic Plants (B14)		Dry-Season Water Table (C2)
	Water Marks (B1)		Hydrogen Sulfide Odor (C1)		Crayfish Burrows (C8)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)		Saturation Visible on Aerial Imagery (C9)
	Drift Deposits (B3)				Stunted or Stressed Plants (D1)
	Algal Mat or Crust (B4)		Presence of Reduced Iron (C4)		Geomorphic Position (D2)
	Iron Deposits (B5)		Recent Iron Reduction in Tilled Soil (C6)		FAC-Neutral Test (D5)
	Inundation Visible on Aerial Imagery (B7)		Thin Muck Surface (C7)		
	Sparsely Vegetated Concave Surface (B8)		Guage or Well Data (D9)		
			Other		

Field Observations:

Surface Water Present?	Yes	x	No		Depth (inches)	2
Water Table Present?	Yes		No	x	Depth (inches)	
Saturation Present?	Yes	x	No		Depth (inches)	0-18

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

Remarks: Wetland area within a cleared agricultural field, void of vegetation (Wetland D)

Site: Elwood Wilson Drain City/County: Noblesville / Hamilton Date: 4.13.16 Data Point: D2
Client: Clark Dietz, Inc. State: IN Section, Township, Range: S32 T19N R5E
Investigator(s): B. Owens
Slope (%): 0-2 Nor. 4433617.95 Eas. 586877.56 Datum: UTM NWI Class: NA
Soil Map Unit Name:
Climatic/hydrologic conditions typical for time of year? Y/N Y
Vegetation x , Soil ____ or Hydrology ____ significantly disturbed
Vegetation ____ , Soil ____ or Hydrology ____ naturally problematic
Are Normal Circumstances Present? Yes x No ____

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes ____	No x	
Hydric Soil Present?	Yes ____	No x	**Is the DP within a Wetland?**
Wetland Hydrology Present?	Yes	No x	**Yes** **No** x

Remarks:
Freshly plowed agricultural field (Zea mays)

VEGETATION

Tree Stratum	Plot size:	Cover	Species	Indicator Status	
1.					
2.					
3.					
4.					
5.					
		0	Total Cover		
Shrub Stratum	**Plot size:**				
1.					
2.					
3.					
4.					
5.					
		0	Total Cover		
Herb Stratum	**Plot size:**				
1.	*Zea mays*	50	Y	UPL	5
2.	*Ornithogalum umbellatum*	10		FACU	4
3.					
4.					
5.					
6.					
7.					
8.					
		60	Total Cover		
Woody Vine Stratum	**Plot size:**				
1.					
2.					
		0	Total Cover		

Remarks: Freshly plowed agricultural field (Zea mays)

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC:	0
Total number of dominant species across all strata:	1
Percent of dominant species that are OBL, FACW, or FAC:	0.00

Prevalence Index Worksheet

Total % cover of:			
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	0	x 3	0
FACU species	10	x 4	40
UPL species	50	x 5	250
Total	60		290

Prevalence Index: 4.83333333

Hydrophytic Vegetation Indicators:
____ Rapid Test for Hydrophytic Veg.
____ Dominance Test is >50%
____ Prevalence Index is ≤3.0*
____ Morphological Adaptations*
____ Problematic Hydrophytic Vegetation*

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present?
Yes ____ **No** x

SOIL

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

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-18	10 YR 4/3	100					SL	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Coated Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators:				Indicators for Problematic Soils	
	Histosol (A1)		Sandy Gleyed Matrix (S4)		Coast Prairie Redox (A16)
	Histic Epipedon (A2)		Sandy Redox (S5)		Iron-Manganese Masses (F12)
	Black Histic (A3)		Stripped Matrix (S6)		Other
	Hydrogen Sulfide (A4)		Loamy Mucky Mineral (F1)		
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)		
	2 cm Muck (A10)		Depleted Matrix (F3)		
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)		
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)		
	Sandy Mucky Mineral (S1)		Redox Depressions (F8)		
	5cm Mucky Peat or Peat				

Restrictive Layer (if observed)
Type:
Depth (inches):
Remarks:

Hydric Soil Present? **Yes** ____ **No** x

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (check all that apply)				Secondary Indicators	
	Surface Water (A1)		Water Stained Leaves (B9)		Surface Soil Cracks (B6)
	High Water Table (A2)		Aquatic Fauna (B13)		Drainage Patterns (B10)
	Saturation (A3)		True Aquatic Plants (B14)		Dry-Season Water Table (C2)
	Water Marks (B1)		Hydrogen Sulfide Odor (C1)		Crayfish Burrows (C8)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)		Saturation Visible on Aerial Imagery (C9)
	Drift Deposits (B3)				Stunted or Stressed Plants (D1)
	Algal Mat or Crust (B4)		Presence of Reduced Iron (C4)		Geomorphic Position (D2)
	Iron Deposits (B5)		Recent Iron Reduction in Tilled Soil (C6)		FAC-Neutral Test (D5)
	Inundation Visible on Aerial Imagery (B7)		Thin Muck Surface (C7)		
	Sparsely Vegetated Concave Surface (B8)		Guage or Well Data (D9)		
			Other		

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches)	____	
Water Table Present?	Yes ____	No x	Depth (inches)	____	
Saturation Present?	Yes	No x	Depth (inches)		

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

Remarks: Freshly plowed agricultural field (Zea mays), outside of Wetland D

Site: Elwood Wilson Drain City/County: Noblesville / Hamilton Date: 4.13.16 Data Point: 1
Client: Clark Dietz, Inc. State: IN Section, Township, Range: S32 T19N R5E
Investigator(s): B. Owens
Slope (%): 0-2 Nor. 4433617.95 Eas. 586877.56 Datum: UTM NWI Class: NA
Soil Map Unit Name:
Climatic/hydrologic conditions typical for time of year? Y/N Y
Vegetation x , Soil ____ or Hydrology ____ significantly disturbed
Vegetation ____ , Soil ____ or Hydrology ____ naturally problematic
Are Normal Circumstances Present? Yes x No ____

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes ____	No x	
Hydric Soil Present?	Yes ____	No x	**Is the DP within a Wetland?**
Wetland Hydrology Present?	Yes	No x	**Yes** **No** x

Remarks:
Freshly plowed agricultural field (Zea mays)

VEGETATION

Tree Stratum	Plot size: ____	Cover	Species	Indicator Status	
1.					
2.					
3.					
4.					
5.					
		0	Total Cover		
Shrub Stratum	Plot size: ____				
1.					
2.					
3.					
4.					
5.					
		0	Total Cover		
Herb Stratum	Plot size: ____				
1.	*Zea mays*	50	Y	UPL	5
2.	*Ornithogalum umbellatum*	10		FACU	4
3.					
4.					
5.					
6.					
7.					
8.					
		60	Total Cover		
Woody Vine Stratum	Plot size: ____				
1.					
2.					
		0	Total Cover		

Remarks: Freshly plowed agricultural field (Zea mays)

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC:	0
Total number of dominant species across all strata:	1
Percent of dominant species that are OBL, FACW, or FAC:	0.00

Prevalence Index Worksheet

Total % cover of:			
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	0	x 3	0
FACU species	10	x 4	40
UPL species	50	x 5	250
Total	60		290

Prevalence Index: 4.83333333

Hydrophytic Vegetation Indicators:
____ Rapid Test for Hydrophytic Veg.
____ Dominance Test is >50%
____ Prevalence Index is ≤3.0*
____ Morphological Adaptations*
____ Problematic Hydrophytic Vegetation*

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present?
Yes ____ **No** x

SOIL

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

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-18	10 YR 4/3	100					SL	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Coated Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators:				Indicators for Problematic Soils	
	Histosol (A1)		Sandy Gleyed Matrix (S4)		Coast Prairie Redox (A16)
	Histic Epipedon (A2)		Sandy Redox (S5)		Iron-Manganese Masses (F12)
	Black Histic (A3)		Stripped Matrix (S6)		Other
	Hydrogen Sulfide (A4)		Loamy Mucky Mineral (F1)		
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)		
	2 cm Muck (A10)		Depleted Matrix (F3)		
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)		
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)		
	Sandy Mucky Mineral (S1)		Redox Depressions (F8)		
	5cm Mucky Peat or Peat				

Restrictive Layer (if observed)
Type:
Depth (inches):
Remarks:

Hydric Soil Present? **Yes** ____ **No** x

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (check all that apply)				Secondary Indicators	
	Surface Water (A1)		Water Stained Leaves (B9)		Surface Soil Cracks (B6)
	High Water Table (A2)		Aquatic Fauna (B13)		Drainage Patterns (B10)
	Saturation (A3)		True Aquatic Plants (B14)		Dry-Season Water Table (C2)
	Water Marks (B1)		Hydrogen Sulfide Odor (C1)		Crayfish Burrows (C8)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)		Saturation Visible on Aerial Imagery (C9)
	Drift Deposits (B3)				Stunted or Stressed Plants (D1)
	Algal Mat or Crust (B4)		Presence of Reduced Iron (C4)		Geomorphic Position (D2)
	Iron Deposits (B5)		Recent Iron Reduction in Tilled Soil (C6)		FAC-Neutral Test (D5)
	Inundation Visible on Aerial Imagery (B7)		Thin Muck Surface (C7)		
	Sparsely Vegetated Concave Surface (B8)		Guage or Well Data (D9)		
			Other		

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches)	____	
Water Table Present?	Yes ____	No x	Depth (inches)	____	
Saturation Present?	Yes	No x	Depth (inches)		

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

Remarks: Freshly plowed agricultural field (Zea mays)

Site: Elwood Wilson Drain City/County: Noblesville / Hamilton Date: 4.13.16 Data Point: 2
Client: Clark Dietz, Inc. State: IN Section, Township, Range: S32 T19N R5E
Investigator(s): B. Owens
Slope (%): 0-2 Nor. 4433617.95 Eas. 586877.56 Datum: UTM NWI Class: NA
Soil Map Unit Name:
Climatic/hydrologic conditions typical for time of year? Y/N Y
Vegetation ____, Soil ____ or Hydrology ____ significantly disturbed
Vegetation ____, Soil ____ or Hydrology ____ naturally problematic
Are Normal Circumstances Present? Yes x No ____

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes ____	No x	
Hydric Soil Present?	Yes ____	No x	**Is the DP within a Wetland?**
Wetland Hydrology Present?	Yes	No x	**Yes** **No** x

Remarks:

VEGETATION

Tree Stratum	Plot size:	Cover	Species	Indicator Status	
1.					
2.					
3.					
4.					
5.					
		0	Total Cover		
Shrub Stratum	**Plot size:**				
1.	*Lonicera maackii*	50	Y	UPL	5
2.	*Celtis occidentalis*	15	Y	FAC	3
3.					
4.					
5.					
		65	Total Cover		
Herb Stratum	**Plot size:**				
1.	*Solidago altissima*	30	Y	FACU	4
2.	*Taraxacum officinale*	15	Y	FACU	4
3.					
4.					
5.					
6.					
7.					
8.					
		45	Total Cover		
Woody Vine Stratum	**Plot size:**				
1.	*Vitis labrusca*	15	Y	FACU	4
2.					
		15	Total Cover		

Remarks:

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC:	1
Total number of dominant species across all strata:	5
Percent of dominant species that are OBL, FACW, or FAC:	20.00

Prevalence Index Worksheet

Total % cover of:			
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	15	x 3	45
FACU species	60	x 4	240
UPL species	50	x 5	250
Total	125		535
Prevalence Index:			4.28

Hydrophytic Vegetation Indicators:

- ____ Rapid Test for Hydrophytic Veg.
- ____ Dominance Test is >50%
- ____ Prevalence Index is ≤3.0*
- ____ Morphological Adaptations*
- ____ Problematic Hydrophytic Vegetation*

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present?
Yes ____ **No** x

SOIL

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

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-18	10 YR 3/2	100					SL	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Coated Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators:				Indicators for Problematic Soils	
	Histosol (A1)		Sandy Gleyed Matrix (S4)		Coast Prairie Redox (A16)
	Histic Epipedon (A2)		Sandy Redox (S5)		Iron-Manganese Masses (F12)
	Black Histic (A3)		Stripped Matrix (S6)		Other
	Hydrogen Sulfide (A4)		Loamy Mucky Mineral (F1)		
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)		
	2 cm Muck (A10)		Depleted Matrix (F3)		
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)		
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)		
	Sandy Mucky Mineral (S1)		Redox Depressions (F8)		
	5cm Mucky Peat or Peat				

Restrictive Layer (if observed)
Type:
Depth (inches):
Remarks:

Hydric Soil Present? **Yes** ____ **No** x

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (check all that apply)				Secondary Indicators	
	Surface Water (A1)		Water Stained Leaves (B9)		Surface Soil Cracks (B6)
	High Water Table (A2)		Aquatic Fauna (B13)		Drainage Patterns (B10)
	Saturation (A3)		True Aquatic Plants (B14)		Dry-Season Water Table (C2)
	Water Marks (B1)		Hydrogen Sulfide Odor (C1)		Crayfish Burrows (C8)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)		Saturation Visible on Aerial Imagery (C9)
	Drift Deposits (B3)				Stunted or Stressed Plants (D1)
	Algal Mat or Crust (B4)		Presence of Reduced Iron (C4)		Geomorphic Position (D2)
	Iron Deposits (B5)		Recent Iron Reduction in Tilled Soil (C6)		FAC-Neutral Test (D5)
	Inundation Visible on Aerial Imagery (B7)		Thin Muck Surface (C7)		
	Sparsely Vegetated Concave Surface (B8)		Guage or Well Data (D9)		
			Other		

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches)	____	
Water Table Present?	Yes ____	No x	Depth (inches)	____	
Saturation Present?	Yes	No x	Depth (inches)		

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

Remarks:

Site: Elwood Wilson Drain City/County: Noblesville / Hamilton Date: 4.13.16 Data Point: 3
Client: Clark Dietz, Inc. State: IN Section, Township, Range: S32 T19N R5E
Investigator(s): B. Owens
Slope (%): 0-2 Nor. 4433617.95 Eas. 586877.56 Datum: UTM NWI Class: NA
Soil Map Unit Name:
Climatic/hydrologic conditions typical for time of year? Y/N Y
Vegetation x , Soil ____ or Hydrology ____ significantly disturbed
Vegetation ____ , Soil ____ or Hydrology ____ naturally problematic
Are Normal Circumstances Present? Yes x No ____

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes ____	No x	
Hydric Soil Present?	Yes ____	No x	**Is the DP within a Wetland?**
Wetland Hydrology Present?	Yes	No x	**Yes** **No** x

Remarks:
Freshly plowed agricultural field (Zea mays)

VEGETATION

Tree Stratum	Plot size:	Cover	Species	Indicator Status	
1.					
2.					
3.					
4.					
5.					
		0	Total Cover		
Shrub Stratum	**Plot size:**				
1.					
2.					
3.					
4.					
5.					
		0	Total Cover		
Herb Stratum	**Plot size:**				
1.	*Zea mays*	50	Y	UPL	5
2.	*Ornithogalum umbellatum*	10		FACU	4
3.					
4.					
5.					
6.					
7.					
8.					
		60	Total Cover		
Woody Vine Stratum	**Plot size:**				
1.					
2.					
		0	Total Cover		

Remarks: Freshly plowed agricultural field (Zea mays)

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC:	0
Total number of dominant species across all strata:	1
Percent of dominant species that are OBL, FACW, or FAC:	0.00

Prevalence Index Worksheet

Total % cover of:			
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	0	x 3	0
FACU species	10	x 4	40
UPL species	50	x 5	250
Total	60		290

Prevalence Index: 4.83333333

Hydrophytic Vegetation Indicators:
____ Rapid Test for Hydrophytic Veg.
____ Dominance Test is >50%
____ Prevalence Index is ≤3.0*
____ Morphological Adaptations*
____ Problematic Hydrophytic Vegetation*

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present?
Yes ____ **No** x

SOIL

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

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-18	10 YR 4/3	100					SL	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Coated Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators:				Indicators for Problematic Soils	
	Histosol (A1)		Sandy Gleyed Matrix (S4)		Coast Prairie Redox (A16)
	Histic Epipedon (A2)		Sandy Redox (S5)		Iron-Manganese Masses (F12)
	Black Histic (A3)		Stripped Matrix (S6)		Other
	Hydrogen Sulfide (A4)		Loamy Mucky Mineral (F1)		
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)		
	2 cm Muck (A10)		Depleted Matrix (F3)		
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)		
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)		
	Sandy Mucky Mineral (S1)		Redox Depressions (F8)		
	5cm Mucky Peat or Peat				

Restrictive Layer (if observed)
Type:
Depth (inches):
Remarks:

Hydric Soil Present? **Yes** ____ **No** x

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (check all that apply)				Secondary Indicators	
	Surface Water (A1)		Water Stained Leaves (B9)		Surface Soil Cracks (B6)
	High Water Table (A2)		Aquatic Fauna (B13)		Drainage Patterns (B10)
	Saturation (A3)		True Aquatic Plants (B14)		Dry-Season Water Table (C2)
	Water Marks (B1)		Hydrogen Sulfide Odor (C1)		Crayfish Burrows (C8)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)		Saturation Visible on Aerial Imagery (C9)
	Drift Deposits (B3)				Stunted or Stressed Plants (D1)
	Algal Mat or Crust (B4)		Presence of Reduced Iron (C4)		Geomorphic Position (D2)
	Iron Deposits (B5)		Recent Iron Reduction in Tilled Soil (C6)		FAC-Neutral Test (D5)
	Inundation Visible on Aerial Imagery (B7)		Thin Muck Surface (C7)		
	Sparsely Vegetated Concave Surface (B8)		Guage or Well Data (D9)		
			Other		

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches)	____	
Water Table Present?	Yes ____	No x	Depth (inches)	____	
Saturation Present?	Yes	No x	Depth (inches)		

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

Remarks: Freshly plowed agricultural field (Zea mays)

Site: Elwood Wilson Drain City/County: Noblesville / Hamilton Date: 4.13.16 Data Point: 4
Client: Clark Dietz, Inc. State: IN Section, Township, Range: S32 T19N R5E
Investigator(s): B. Owens
Slope (%): 0-2 Nor. 4433617.95 Eas. 586877.56 Datum: UTM NWI Class: NA
Soil Map Unit Name:
Climatic/hydrologic conditions typical for time of year? Y/N Y
Vegetation x , Soil ____ or Hydrology ____ significantly disturbed
Vegetation ____ , Soil ____ or Hydrology ____ naturally problematic
Are Normal Circumstances Present? Yes x No ____

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes ____	No x	
Hydric Soil Present?	Yes ____	No x	**Is the DP within a Wetland?**
Wetland Hydrology Present?	Yes	No x	**Yes** **No** x

Remarks:
Freshly plowed agricultural field (Zea mays)

VEGETATION

Tree Stratum	Plot size:	Cover	Species	Indicator Status	
1.					
2.					
3.					
4.					
5.					
		0	Total Cover		
Shrub Stratum	**Plot size:**				
1.					
2.					
3.					
4.					
5.					
		0	Total Cover		
Herb Stratum	**Plot size:**				
1.	*Zea mays*	50	Y	UPL	5
2.	*Ornithogalum umbellatum*	10		FACU	4
3.					
4.					
5.					
6.					
7.					
8.					
		60	Total Cover		
Woody Vine Stratum	**Plot size:**				
1.					
2.					
		0	Total Cover		

Remarks: Freshly plowed agricultural field (Zea mays)

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC:	0
Total number of dominant species across all strata:	1
Percent of dominant species that are OBL, FACW, or FAC:	0.00

Prevalence Index Worksheet

Total % cover of:			
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	0	x 3	0
FACU species	10	x 4	40
UPL species	50	x 5	250
Total	60		290

Prevalence Index: 4.83333333

Hydrophytic Vegetation Indicators:
____ Rapid Test for Hydrophytic Veg.
____ Dominance Test is >50%
____ Prevalence Index is ≤3.0*
____ Morphological Adaptations*
____ Problematic Hydrophytic Vegetation*

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present?
Yes ____ **No** x

SOIL

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

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-18	10 YR 4/3	100					SL	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Coated Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators:				**Indicators for Problematic Soils**	
	Histosol (A1)		Sandy Gleyed Matrix (S4)		Coast Prairie Redox (A16)
	Histic Epipedon (A2)		Sandy Redox (S5)		Iron-Manganese Masses (F12)
	Black Histic (A3)		Stripped Matrix (S6)		Other
	Hydrogen Sulfide (A4)		Loamy Mucky Mineral (F1)		
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)		
	2 cm Muck (A10)		Depleted Matrix (F3)		
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)		
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)		
	Sandy Mucky Mineral (S1)		Redox Depressions (F8)		
	5cm Mucky Peat or Peat				

Restrictive Layer (if observed)
Type:
Depth (inches):
Remarks:

Hydric Soil Present? **Yes** ____ **No** x

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (check all that apply)				Secondary Indicators	
	Surface Water (A1)		Water Stained Leaves (B9)		Surface Soil Cracks (B6)
	High Water Table (A2)		Aquatic Fauna (B13)		Drainage Patterns (B10)
	Saturation (A3)		True Aquatic Plants (B14)		Dry-Season Water Table (C2)
	Water Marks (B1)		Hydrogen Sulfide Odor (C1)		Crayfish Burrows (C8)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)		Saturation Visible on Aerial Imagery (C9)
	Drift Deposits (B3)				Stunted or Stressed Plants (D1)
	Algal Mat or Crust (B4)		Presence of Reduced Iron (C4)		Geomorphic Position (D2)
	Iron Deposits (B5)		Recent Iron Reduction in Tilled Soil (C6)		FAC-Neutral Test (D5)
	Inundation Visible on Aerial Imagery (B7)		Thin Muck Surface (C7)		
	Sparsely Vegetated Concave Surface (B8)		Guage or Well Data (D9)		
			Other		

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches)	____	
Water Table Present?	Yes ____	No x	Depth (inches)	____	
Saturation Present?	Yes	No x	Depth (inches)		

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

Remarks: Freshly plowed agricultural field (Zea mays)

Site: Elwood Wilson Drain City/County: Noblesville / Hamilton Date: 4.13.16 Data Point: 5
Client: Clark Dietz, Inc. State: IN Section, Township, Range: S32 T19N R5E
Investigator(s): B. Owens
Slope (%): 0-2 Nor. 4433617.95 Eas. 586877.56 Datum: UTM NWI Class: NA
Soil Map Unit Name:
Climatic/hydrologic conditions typical for time of year? Y/N Y
Vegetation x , Soil ____ or Hydrology ____ significantly disturbed
Vegetation ____ , Soil ____ or Hydrology ____ naturally problematic
Are Normal Circumstances Present? Yes x No ____

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes ____	No x	
Hydric Soil Present?	Yes ____	No x	**Is the DP within a Wetland?**
Wetland Hydrology Present?	Yes	No x	**Yes** **No** x

Remarks:
Cleared and regularly maintained grassy area

VEGETATION

Tree Stratum	Plot size:	Cover	Species	Indicator Status	
1.					
2.					
3.					
4.					
5.					
		0	Total Cover		
Shrub Stratum	**Plot size:**				
1.					
2.					
3.					
4.					
5.					
		0	Total Cover		
Herb Stratum	**Plot size:**				
1.	*Cynodon dactylon*	95	Y	FACU	4
2.	*Ornithogalum umbellatum*	25		FACU	4
3.	*Trifolium repens*	25		FACU	4
4.					
5.					
6.					
7.					
8.					
		145	Total Cover		
Woody Vine Stratum	**Plot size:**				
1.					
2.					
		0	Total Cover		

Remarks: Cleared and regularly maintained grassy area

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC:	0
Total number of dominant species across all strata:	1
Percent of dominant species that are OBL, FACW, or FAC:	0.00

Prevalence Index Worksheet

Total % cover of:			
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	0	x 3	0
FACU species	145	x 4	580
UPL species	0	x 5	0
Total	145		580
Prevalence Index:			4

Hydrophytic Vegetation Indicators:
____ Rapid Test for Hydrophytic Veg.
____ Dominance Test is >50%
____ Prevalence Index is ≤3.0*
____ Morphological Adaptations*
____ Problematic Hydrophytic Vegetation*

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present?
Yes ____ **No** x

SOIL

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

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-18	10 YR 3/3	100					SL	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Coated Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators:				**Indicators for Problematic Soils**	
	Histosol (A1)		Sandy Gleyed Matrix (S4)		Coast Prairie Redox (A16)
	Histic Epipedon (A2)		Sandy Redox (S5)		Iron-Manganese Masses (F12)
	Black Histic (A3)		Stripped Matrix (S6)		Other
	Hydrogen Sulfide (A4)		Loamy Mucky Mineral (F1)		
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)		
	2 cm Muck (A10)		Depleted Matrix (F3)		
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)		
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)		
	Sandy Mucky Mineral (S1)		Redox Depressions (F8)		
	5cm Mucky Peat or Peat				

Restrictive Layer (if observed)
Type:
Depth (inches):
Remarks:

Hydric Soil Present? **Yes** ____ **No** x

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (check all that apply)				Secondary Indicators	
	Surface Water (A1)		Water Stained Leaves (B9)		Surface Soil Cracks (B6)
	High Water Table (A2)		Aquatic Fauna (B13)		Drainage Patterns (B10)
	Saturation (A3)		True Aquatic Plants (B14)		Dry-Season Water Table (C2)
	Water Marks (B1)		Hydrogen Sulfide Odor (C1)		Crayfish Burrows (C8)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)		Saturation Visible on Aerial Imagery (C9)
	Drift Deposits (B3)				Stunted or Stressed Plants (D1)
	Algal Mat or Crust (B4)		Presence of Reduced Iron (C4)		Geomorphic Position (D2)
	Iron Deposits (B5)		Recent Iron Reduction in Tilled Soil (C6)		FAC-Neutral Test (D5)
	Inundation Visible on Aerial Imagery (B7)		Thin Muck Surface (C7)		
	Sparsely Vegetated Concave Surface (B8)		Guage or Well Data (D9)		
			Other		

Field Observations:

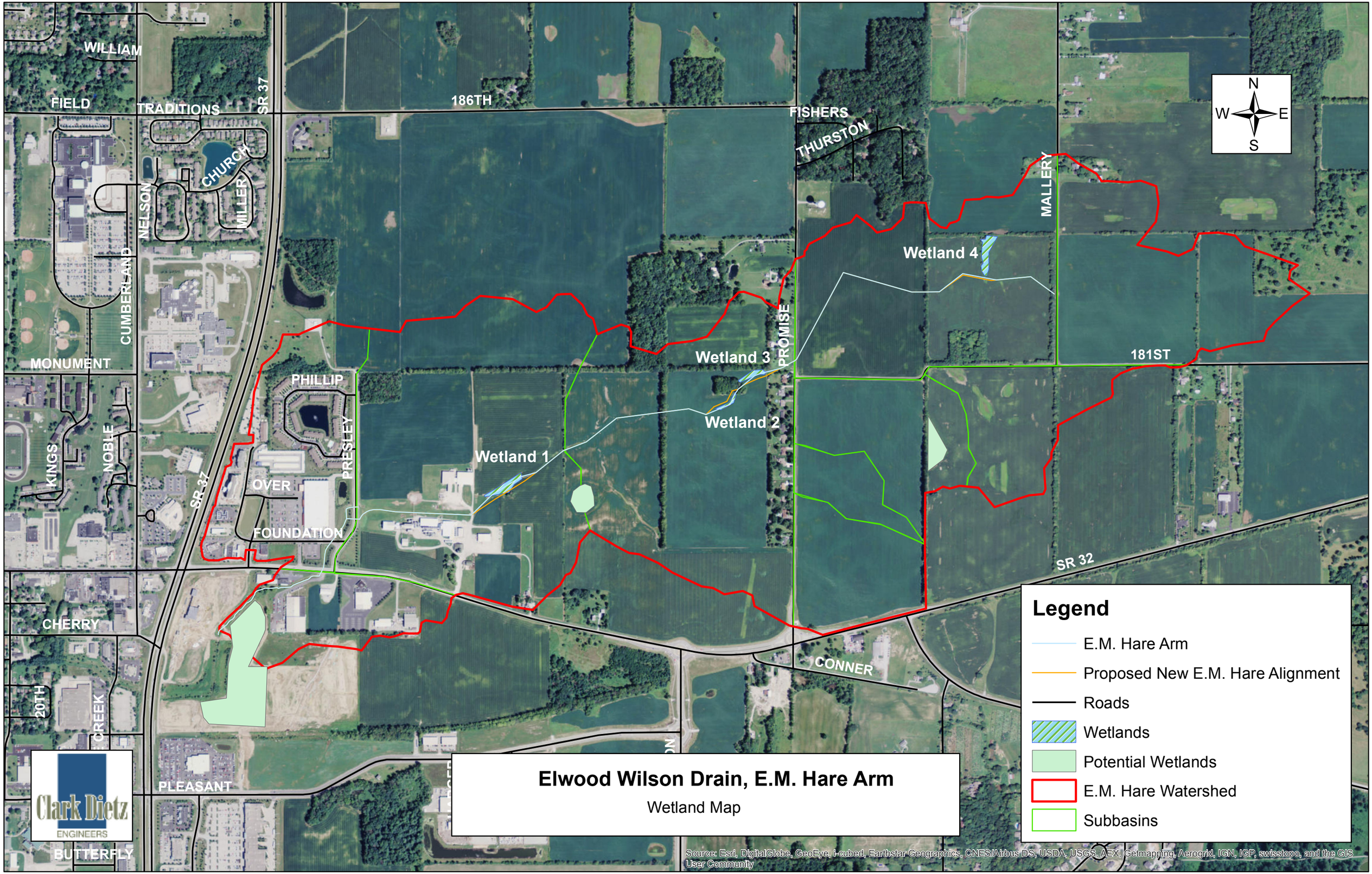
Surface Water Present?	Yes ____	No x	Depth (inches) ____		
Water Table Present?	Yes ____	No x	Depth (inches) ____		
Saturation Present?	Yes	No x	Depth (inches)		

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

Remarks: Cleared and regularly maintained grassy area

Attachment 9

Wetland Map



Elwood Wilson Drain, E.M. Hare Arm

Wetland Map

Attachment 10

Cost Estimate

Hamilton County - Elwood Wilson Drain, E.M. Hare Arm Hydraulic Study
Cost Estimate

Last Revised: August, 2016

Total Opinion of Probable Costs: **$3,151,600**

ITEM No.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL
	Site Work				
1	Clearing and Grubbing	1	LS	$15,000	$15,000
2	Temporary Silt Fence	20,000	LF	$0.50	$10,000
3	Tree Removal (4" and over)	10	EA	$900	$9,000
4	Common Excavation	34,500	CYS	$25	$862,500
	Structures				
5	5 x 2 Box Culvert (Mallery) including road repair	30	LF	$447	$13,400
6	7 x 4 Box Culvert (Promise) including road repair	30	LF	$1,130	$33,900
7	12 x 5 Box Culvert (Harger)	100	LF	$1,317	$131,700
8	7 x 4 Box Culvert (Scottish Rite)	30	LF	$1,100	$33,000
9	7 x 4 Box Culvert (Fleck)	30	LF	$1,100	$33,000
10	12 x 5 Box Culvert (Presley) including road repair	56	LF	$1,347	$75,400
11	12 x 6 Box Culvert (Home Depot) including road repair	184	LF	$1,347	$247,800
12	Sheet Pile	18,000	SFT	$15	$270,000
13	Stone Gabions	8	EA	$260	$2,100
14	Revetment Rip Rap	2,000	Ton	$50	$100,000
15	Tile Animal Guard - 6" connection	25	EA	$390	$9,800
16	Tile Animal Guard - 8" connection	25	EA	$438	$11,000
17	Tile Animal Guard - 10" connection	25	EA	$483	$12,100
18	Tile Animal Guard - 12" connection	25	EA	$525	$13,100
	Restoration				
19	Slope Stabilization Seed Mix (Filter Strip)	332,000	SFT	$0.45	$149,400
	General Costs				
20	Erosion Control Maintenance (1%)	1	LS	$20,300	$20,300
21	Contingency (25%)	1	LS	$508,100	$508,100
	Construction Subtotal				**$2,560,600**
				Legal Costs(3%) =	$77,000
				Design and Bidding Services(10%) =	$257,000
				Construction Engineering and Observation Services(10%)=	$257,000
				Total Project Cost =	**$3,151,600**

Notes

Clark Dietz ENGINEERS

Attachment 11

Project Alternative

Project Alternative

The recommended improvements to the E.M. Hare Arm include converting the existing undersized field tile between Mallery Road and Presley Road to an open channel. A project alternative was investigated that includes the installation of a new storm sewer along the regulated drain large enough to convey a 10-year storm event and an open channel on top of the sewer to convey the remainder of the flow up to a 100-year storm event. This would reduce the size of the channel required to convey the 100-year event (compared to having all of the flow in an open channel), but would require the installation of the pipe beneath the channel. All pipe and channel sizes were calculated using Manning's equation. Below is a table listing the peak discharges used to size the storm sewer and the overland channel. The Overland Q100 discharge is equal to the total Q100 discharge used for the recommended improvements minus the Q10 discharge which will be diverted to the storm sewer beneath the channel.

	Mallery Road	Promise Road	Mid Point	Presley Road	SR 32
Pipe Q10 (CFS)	7.7	21.2	42.8	57.4	64.0
Overland Q100 (CFS)	15.3	42.4	85.5	114.9	127.9

To convey the Q10 peak discharge the storm sewer from Mallery Road to Promise Road would need to be a 21-inch diameter RCP, 3,400 feet in length. To convey the flow from Promise road to the Mid Point between Presley Road the storm sewer would need to be a 30-inch diameter RCP, 2,600 feet in length. To convey the flow the remaining distance to Presley Road the storm sewer would need to be a 42-inch diameter RCP, 2,400 feet in length.

By diverting the Q10 peak discharge to the storm sewer the depth of the overland channel can be reduced by 1 foot between Mallery Road and Presley Road. This would reduce the channel excavation volume by 3,640 cubic yards through this reach. Between Promise Road and the Mid Point the channel excavation volume is reduced by 3,850 cubic yards. Between the Mid Point and Presley Road the channel excavation volume is reduced by 3,386 cubic yards. This results in a total reduction in channel excavation volume of 10,876 cubic yards.

Project Alternative

Cost Savings from reduction in Common Excavation:

(10,876 CYS) * ($25/CYS) = **$271,900**

Additional Cost to construct new Storm Sewer:

(3,400 feet) * ($100 21"RCP/ft) = $340,000

(2,600 feet) * ($135 30"RCP/ft) = $351,000

(2,400 feet) * ($179 42"RCP/ft) = $429,600

Total Additional Cost for Storm Sewer = **$1,120,600**

Net Additional Cost of Alternative:

$1,120,600 - $271,900 = **$848,700**

Clark Dietz
ENGINEERS
8900 Keystone Crossing, Suite 900
Indianapolis, IN 46240
317.844.8900
www.clarkdietz.com