Storm Water Drainage
Preliminary Engineering Report

Prepared for the

City of Linton, Indiana

Greene County, Indiana

Prepared by:

HWC ENGINEERING

First Group ENGINEERING, INC.

135 N. Pennsylvania Street, Suite 2800
Indianapolis, Indiana 46204
317-347-3663

TABLE OF CONTENTS

Section Five – Alternatives Considered

Section Six – Selection of an Alternative

Section Seven – Proposed Project

Section Eight – Conclusions and Recommendations

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

Section One – Executive Summary

1.1 Introduction

The City of Linton, located in Greene County, Indiana, is geographically located approximately 32 miles southeast of Terre Haute. The City of Linton has authorized First Group and its subconsultant HWC Engineering to prepare a Preliminary Engineering Report to assess the condition of the City's storm water drainage facilities. This study is being undertaken to address the drainage needs in the City, and to identify other system needs over a twenty year planning period. This report will document the need for projects to address the issues identified in the study, the evaluation of several alternatives, and the justification of selected plans considering factors such as cost, benefit, and feasibility.

The report is funded with a Stormwater Improvement Programs grant from the Indiana Office of Community and Rural Affairs (OCRA). It has been prepared and formatted in accordance with guidelines provided by OCRA, which shall be the basis for future potential funding applications for the proposed projects. The report includes supporting documentation for the selected project recommendation with regard to information on the planning area, need for design, financial considerations, and environmental aspects of the project. An overall area map and a contour map are provided in Figure 1.0 and Figure 1.1.

1.2 Summary of Existing Conditions

1.2.1 Stormwater Drainage

The City of Linton's stormwater drainage facilities consists of storm sewers, drainage ditches and swales to convey water away from the City. The system has deteriorated due to the progressive closure of existing ditches over the past 50 years. Since very few storm sewers or

drainage tiles existed, ditches were the primary method of conveying stormwater throughout the City.

The underground storm sewers that did exist connected ditches under City streets, and many of these pipes have been disturbed during past utility projects, or have fallen into disrepair. The overall reduction in capacity of the City's limited drainage facilities causes ponding and standing water throughout the City. Existing City facilities are shown in Figure 1.2.

1.3 Proposed Improvements

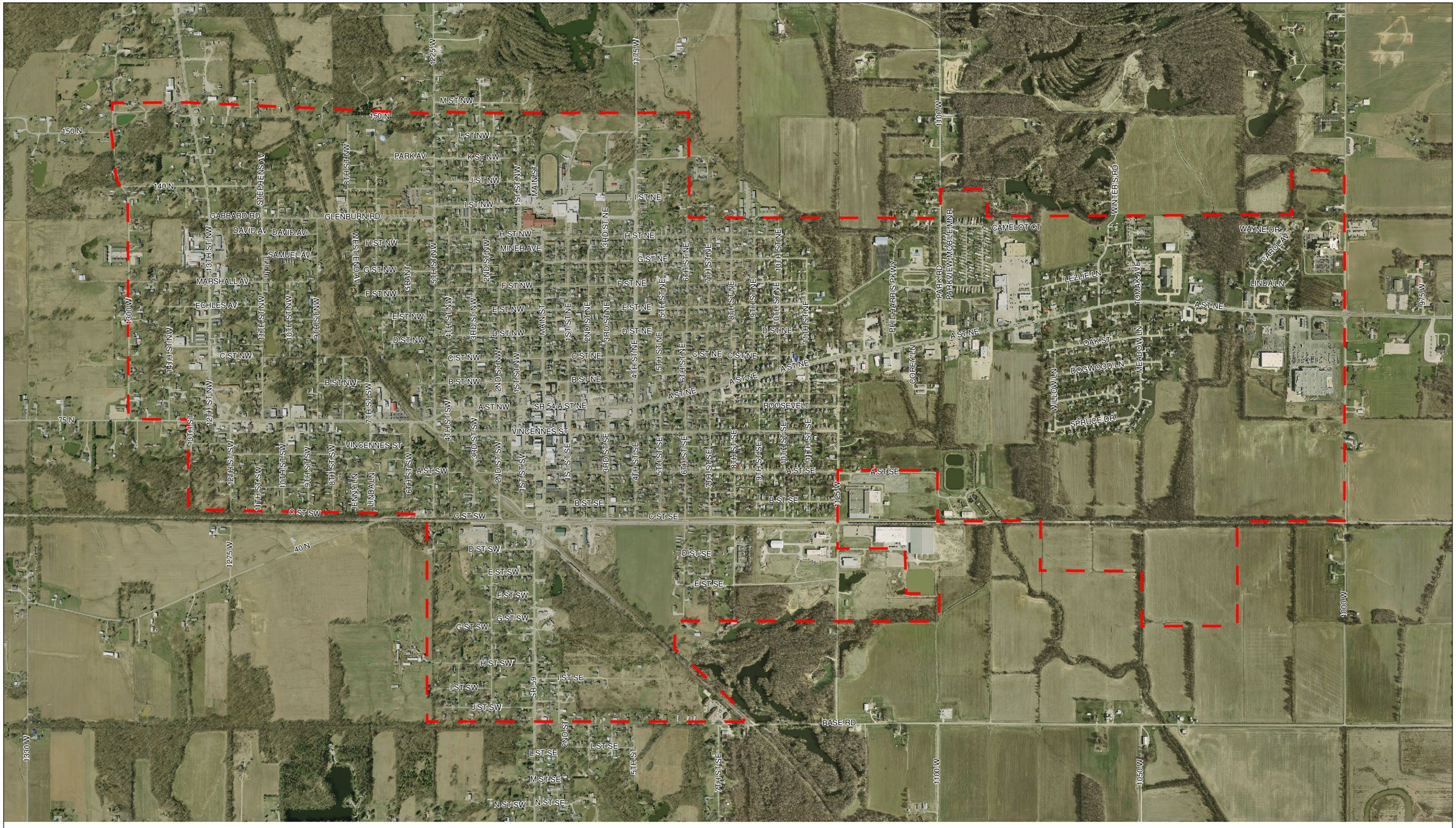
1.3.1 Stormwater Drainage

Proposed stormwater improvements include addressing areas of ponding water within the City, roadside ditches that need attention, and upgrading of major drainage ways that convey stormwater through the City. The staff of the City of Linton identified several existing areas of concern, which then led to the development of a number of alternatives for stormwater improvements within the City. Stormwater improvements should convey water away from areas of ponding and into major stormwater drainage ways. Increasing existing capacity in ditches, adding inlets to collect locations of ponding water, rerouting deteriorated trunklines, and adding regional detention are all suitable options to improve the City's drainage infrastructure system.

1.4 Financial Considerations

The preliminary cost estimate for the improvements recommended is shown in Section Seven. The City of Linton may pursue funding sources that include State Revolving Fund Loans, a Community Focus Fund Grant from the Office of Community and Rural Affairs, and Rural Development grants and loans from the United States Department of Agriculture. The City is also pursuing the creation of a stormwater utility and user fee to provide revenue for facilities,

operation and maintenance, funds for infrastructure improvements, and debt service for loans or bonds used to make capital improvements.



Graphic Scale (Feet)

0 1,200 2,400 3,600

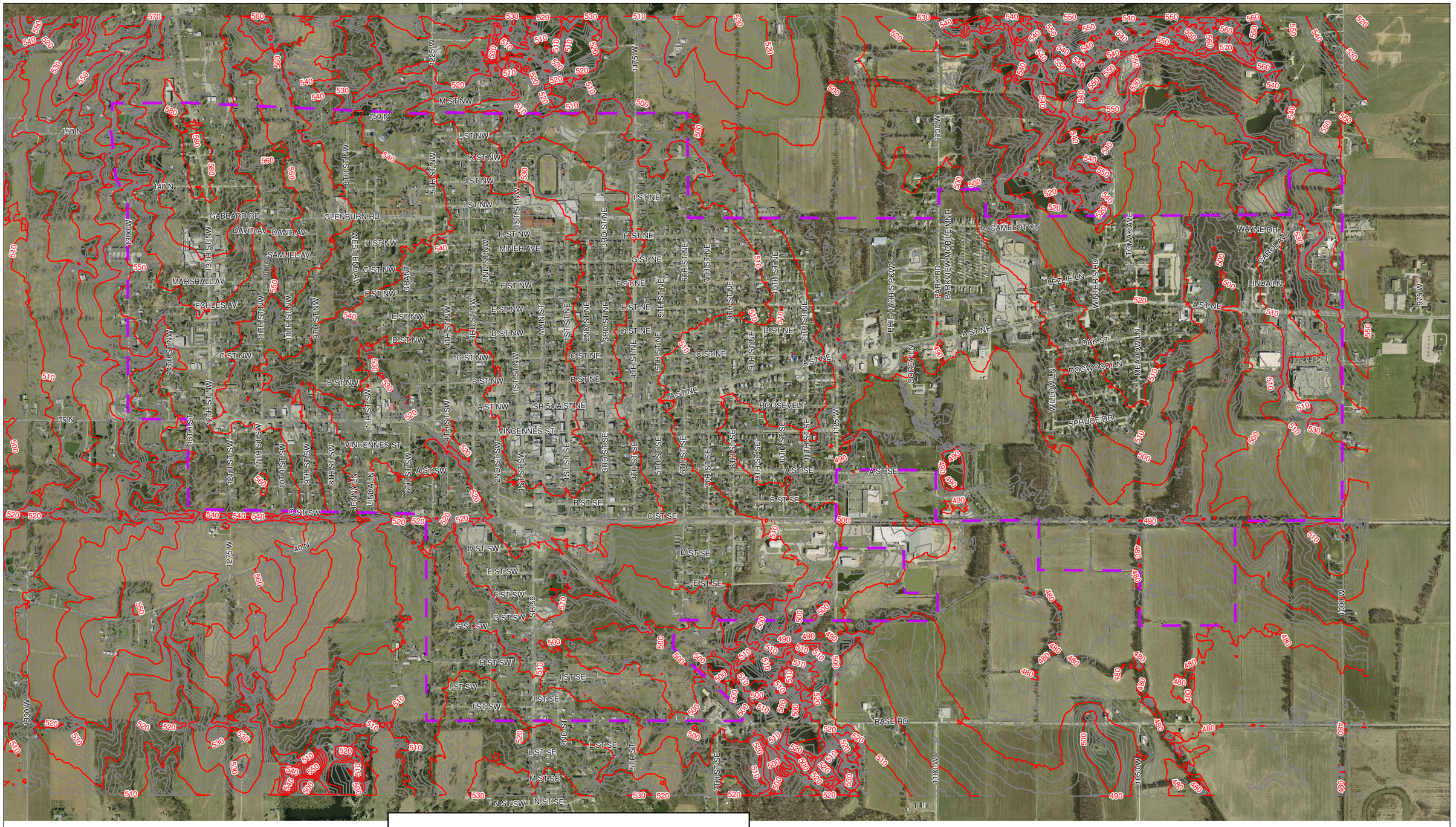
1 inch = 1,200 feet

Legend

Corporate Limits

Figure 1.0
Stormwater Drainage
Master Plan
Overall Aerial Map
Linton, Indiana
June 2016

HWC ENGINEERING



Graphic Scale (Feet)

0 1,200 2,400 3,600

1 inch = 1,200 feet

Legend

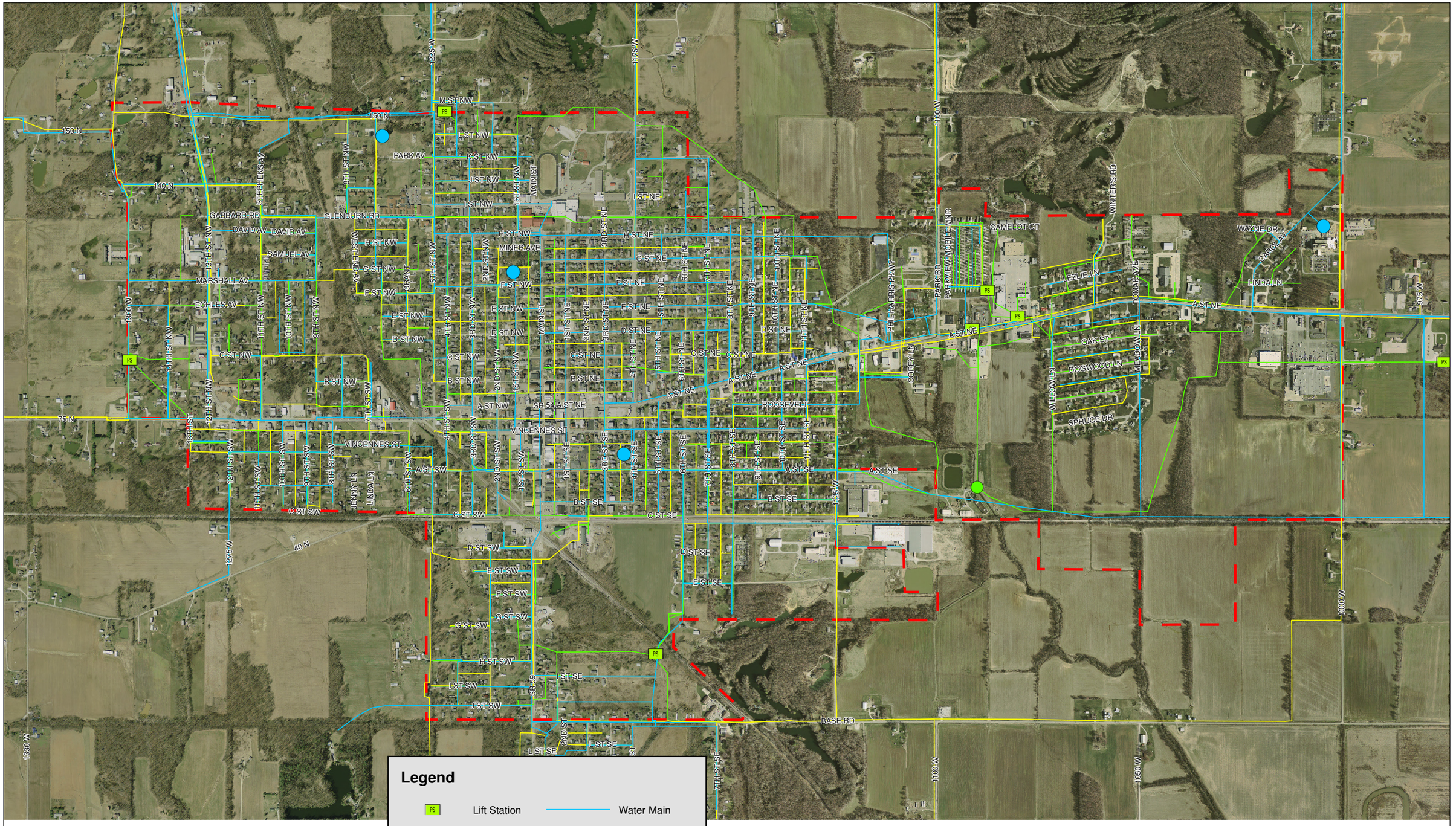
Corporate Limits

10' Index Contour

2' Intermediate Contour

HWC ENGINEERING

Figure 1.1
Stormwater Drainage
Master Plan
Overall Contour Map
Linton, Indiana
August 2016



Legend

- Lift Station
- Wet Well
- Elevated Tank
- Reservoir
- Water Main
- Gas Main
- Sanitary Sewer
- Corporate Limits

Graphic Scale (Feet)

0 1,200 2,400 3,600

1 inch = 1,200 feet

HWC ENGINEERING

Figure 1.2
Stormwater Drainage
Master Plan
Overall Utility Map
Linton, Indiana
August 2016

Section Two - Project Planning Area

2.1 Project Location

The City of Linton, located in Greene County, Indiana, is geographically located approximately 32 miles southeast of Terre Haute. See the project location map in Figure 1.1. U.S. Highways 54 and 59 intersect in downtown Linton. Linton is located within Sections 13, 14, 15, 22, 23, and 24, in Township 7 North, Range 7 West on the Linton USGS Quadrangle map as shown on the study area map (displaying the City's corporate limits) in Figure 2.1.

2.1.1 Study Area

The study area is generally comprised of the corporate limits of the City of Linton. The study area is within Stockton Township in Greene County. Refer to Figure 1.0 for a Study Area Map.

2.1.2 Service Area

The existing service area is the same as the study area. For the purposes of this study, the existing service area and the future service area will be considered the same as no significant growth is anticipated within the next twenty years.

2.2 Environmental Resources Present

The City of Linton lies within 3 watershed basins; Black Creek Ditch, Beehunter Ditch, and Buck Creek basins.

The Beehunter Ditch stream, located on the southeast side of the City, and Black Creek Ditch stream, located on the southwest side of the City, serve to drain approximately 85% of the City of Linton.

The service area of the project is primarily an urban area with a school corporation, retail trade, commercial, and industrial businesses throughout the City of Linton.

The land use pattern within the incorporated City of Linton is predominantly residential with concentrated areas of commercial lands in the downtown area and adjacent to SR 59.

A soils index, legend, and map for the City and surrounding areas are shown in Figure 2.2-A. In general, these soils in Linton, IN are in hydrologic soil group D, which means they are poorly draining soils.

As stated previously, the City of Linton lies in between the Black Creek Ditch, Beehunter Ditch, and Buck Creek watershed basins; the eastern edge of Critical Area 5 (described later) lies in the 100 year floodplain which runs along the stream. A Floodplain Map of the area around Linton is shown in Figure 2.2-B. A wetlands map for the area around Linton is included in Figure 2.2-C. As shown on Figure 2.2-C, there are a few wetlands within the City limits and area of concern for this study.

2.3 Growth Areas and Population Trends

2.3.1 Population

The City of Linton's population in 2010 was 5,413 as provided by the 2010 Census data. This represents a 6.95% decrease over the 10 years since the 2000 census population of 5,817. The population of Greene County was 33,199 in 2000 and decreased slightly to 33,190 in 2010.

2.3.2 Growth Areas

Based on discussions with the City there are limited expectations for growth. For the purposes of this study, no significant growth shall be planned for the service area.

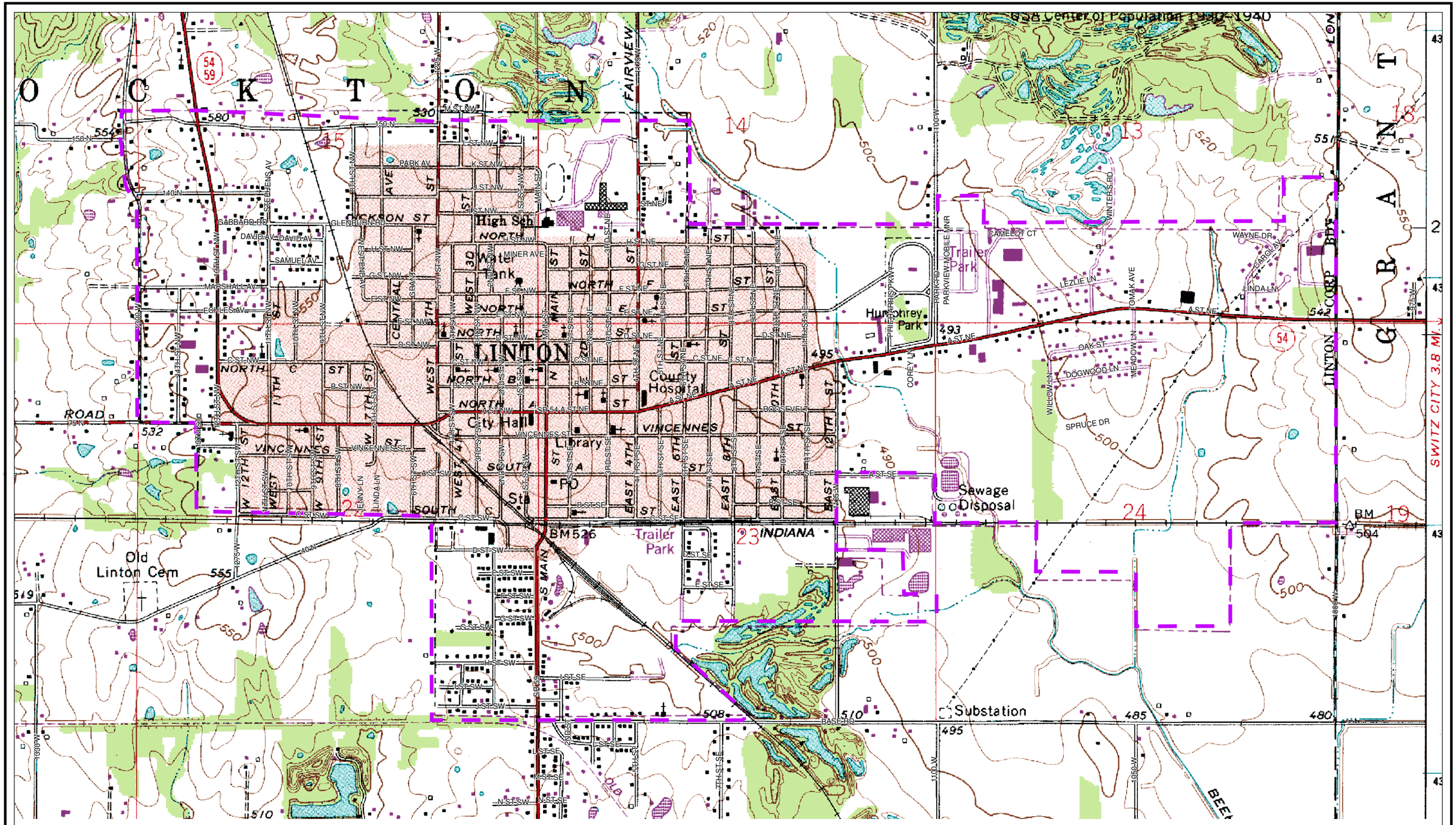
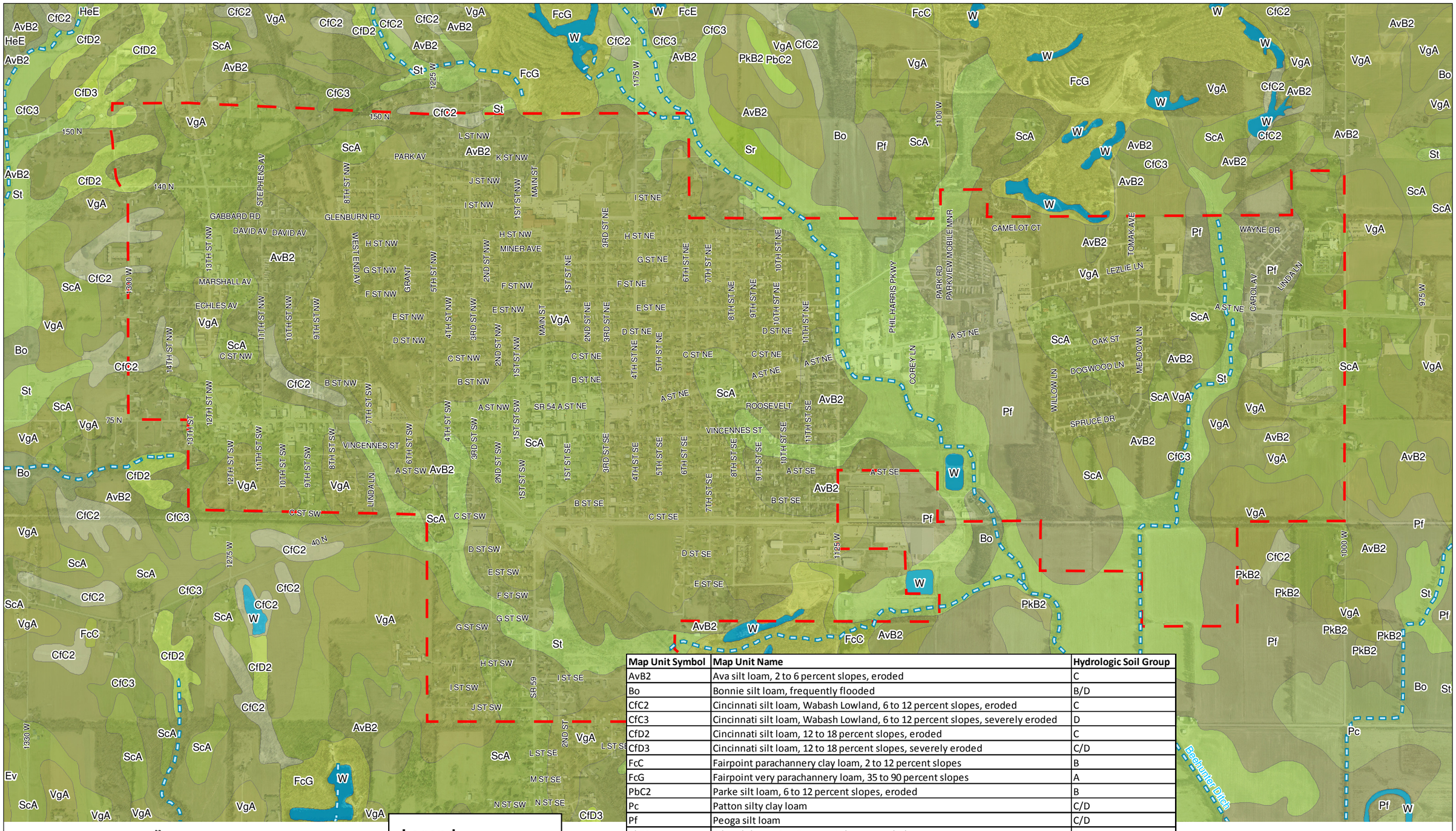


Figure 2.1
Stormwater Drainage
Master Plan
Overall USGS Topographical Map
Linton, Indiana
August 2016

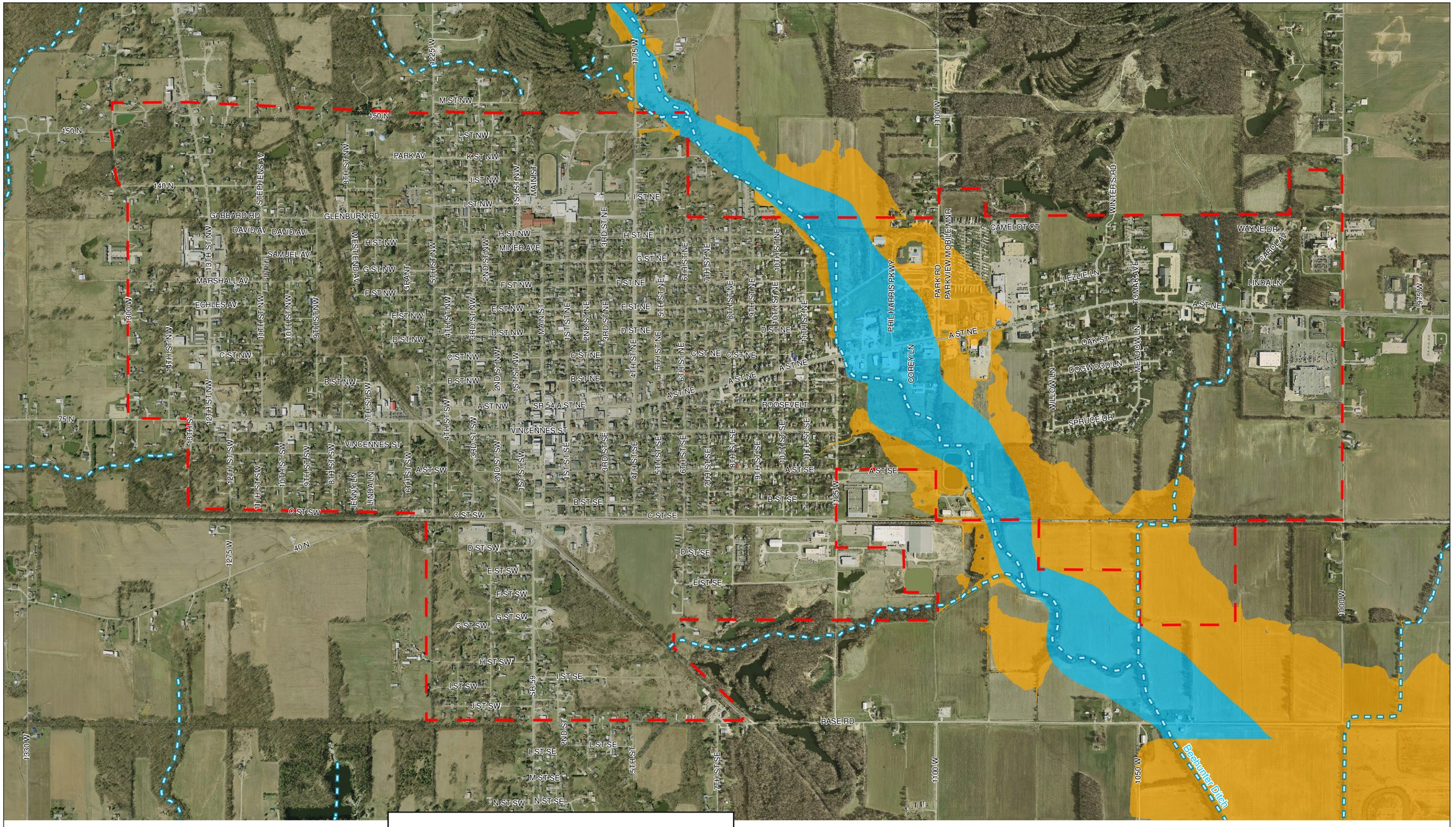
HWC ENGINEERING



Map Unit Symbol	Map Unit Name	Hydrologic Soil Group
AvB2	Ava silt loam, 2 to 6 percent slopes, eroded	C
Bo	Bonnie silt loam, frequently flooded	B/D
CfC2	Cincinnati silt loam, Wabash Lowland, 6 to 12 percent slopes, eroded	C
CfC3	Cincinnati silt loam, Wabash Lowland, 6 to 12 percent slopes, severely eroded	D
CfD2	Cincinnati silt loam, 12 to 18 percent slopes, eroded	C
CfD3	Cincinnati silt loam, 12 to 18 percent slopes, severely eroded	C/D
FcC	Fairpoint parachannery clay loam, 2 to 12 percent slopes	B
FcG	Fairpoint very parachannery loam, 35 to 90 percent slopes	A
PbC2	Parke silt loam, 6 to 12 percent slopes, eroded	B
Pc	Patton silty clay loam	C/D
Pf	Peoga silt loam	C/D
PkB2	Pike silt loam, 2 to 6 percent slopes, eroded	B
ScA	Shakamak silt loam, 1 to 3 percent slopes	C/D
Sr	Steff silt loam, frequently flooded	B/D
St	Stendal silt loam, frequently flooded	B/D
VgA	Vigo silt loam, 0 to 2 percent slopes	C/D
W	Water	

Figure 2.2-A
Stormwater Drainage
Master Plan
Soils Map
Linton, Indiana
August 2016

HWC ENGINEERING



Graphic Scale (Feet)

0 1,200 2,400 3,600

1 inch = 1,200 feet

Legend

- River/Stream
- Corporate Limits
- Floodway
- 100-Year Floodplain

Figure 2.2-B
Stormwater Drainage
Master Plan
Overall Floodplain Map
Linton, Indiana
August 2016

HWC ENGINEERING

Legend

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- Corporate Limits

Graphic Scale (Feet)

0 1,200 2,400 3,600

1 inch = 1,200 feet

HWC ENGINEERING

Figure 2.2-C
Stormwater Drainage
Master Plan
Overall Wetlands Map
Linton, Indiana
June 2016

Section Three – Existing Facilities

3.1 Location

The stormwater drainage facilities are generally located within the City limits with the exception of primary drainage ditches that extend outside of the City. A general location/service area map showing the existing utilities in the City shown in Figure 1.2.

3.2 History

The City of Linton has an old and failing infrastructure system with many instances of sinkholes and pipe collapses, which are repaired and patched per occurrence. These pipes are the primary method of conveying storm water out of the City, along with roadside swales and a network of ditches and streams. There are no plans or reports available for the existing stormwater drainage facilities. Therefore, City correspondence, aerial assessments, topographical assessments, and field inspection are the only ways to gather information and address the existing stormwater issues in Linton.

3.3 Condition of Facilities

3.3.1 Stormwater Drainage

Existing infrastructure passes underneath buildings and often times does not adequately collect runoff from ponding areas. Many of the existing swales in the City are filled in and do not convey flow.

Staff of the City of Linton have identified critical areas that pose the largest problems within the City including:

- Willow Lane in the subdivision of Green Acres just east of downtown,
- 12th Street SW south of State Road 54,

- North and west of the intersection of 5th Street NW and K Street,
- North and south on 4th Street NW from the intersection of 4th Street NW and State Road 54,
- On E Street NE between 4th Street NW and 5th Street NE,
- On E Street NE between 5th Street NE and 11th Street NE,
- The area surrounding the intersection of B Street NE and 6th Street NE,
- Along A Street SE between 3rd Street SE and 11th Street SE.
- Along E Vincennes Street between 1st Street SE and 9th Street SE,

See Figure 3.3 for an overall problem areas map for drainage storm sewer locations.

Other areas also identified as drainage concerns within the City, included several stretches of ditches that provide conveyance of stormwater and outfalls for storm sewers throughout the City. This includes the following:

- Black Creek Ditch and its tributary
- Beehunter Ditch and its tributary

See Figure 3.4 for an overall map identifying areas of concern for ditches integral to the City's conveyance of storm water.

3.4 Financial Status of Existing Facilities

Currently, facility maintenance and improvements are paid through the existing sanitary sewer budget. In order for the City of Linton submit a competitive grant application to OCRA, they will need to set up a stormwater funding system to be paid by homeowners and other community land owners. The stormwater funding system will also help fund ongoing projects, O&M costs with existing stormwater facilities, and other utilities.

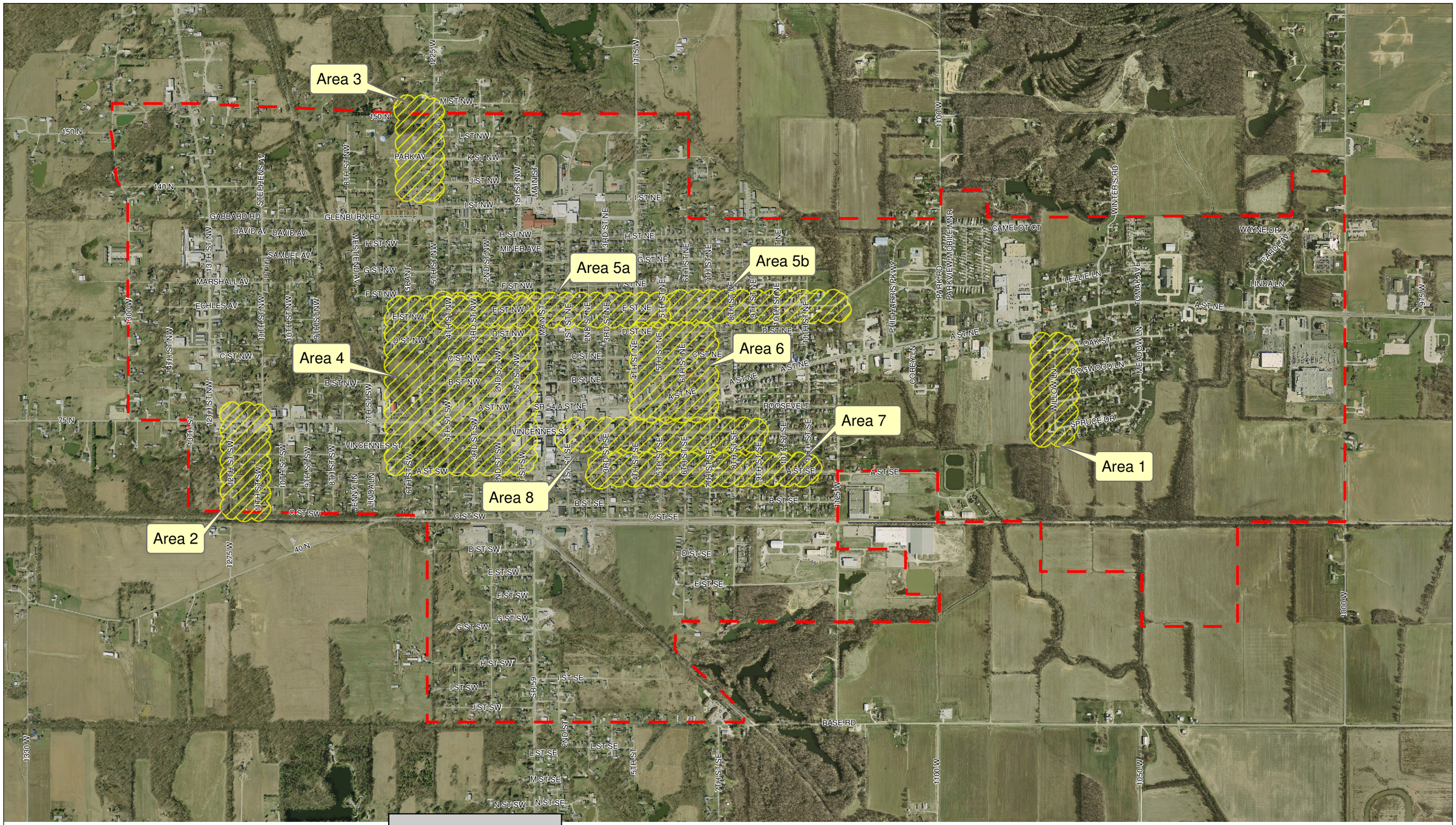


Figure 3.3
Stormwater Drainage
Master Plan
Overall Problem Areas Map
Linton, Indiana
August 2016

HWC ENGINEERING

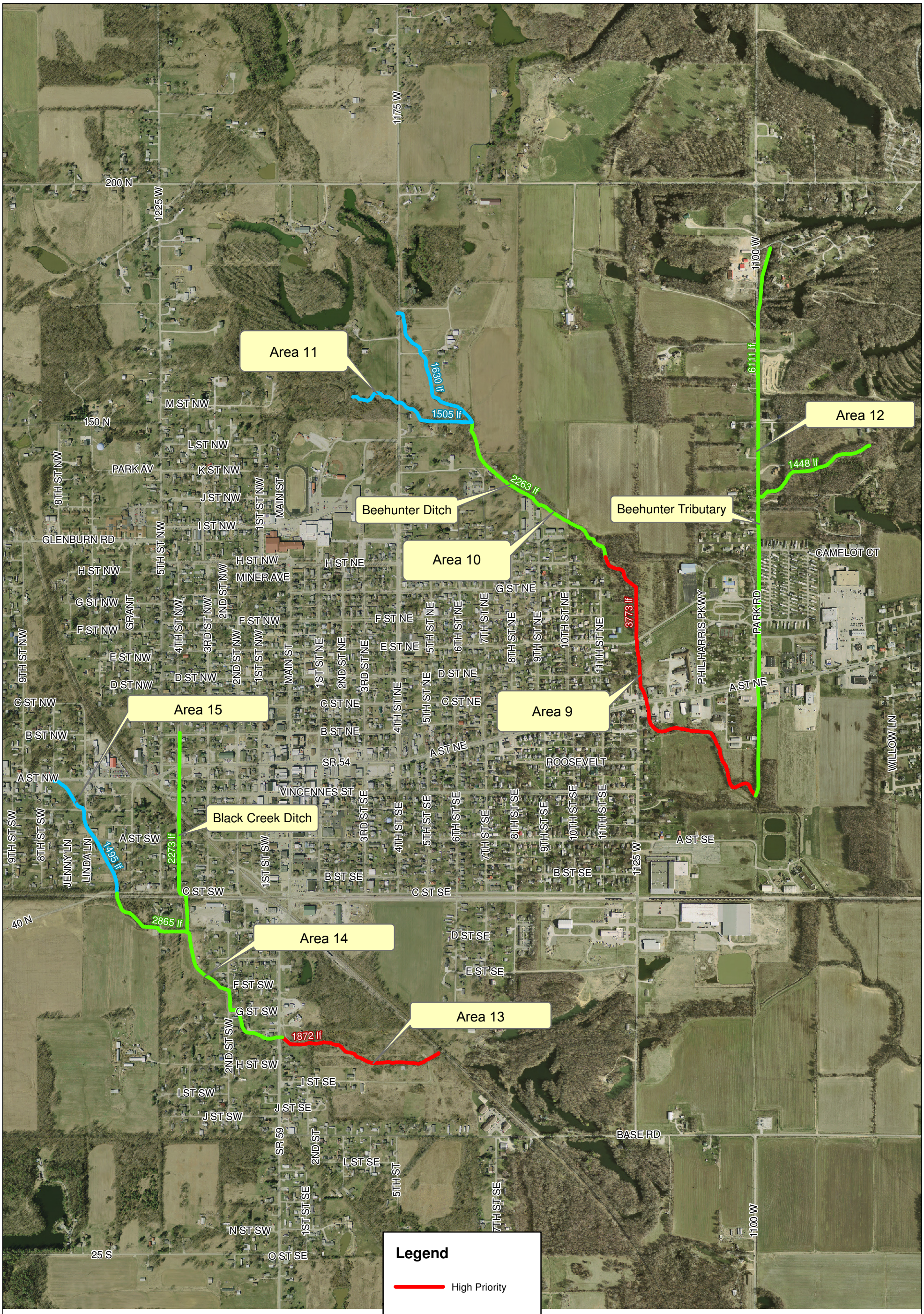


Figure 3.4
Ditch Area of Concern
Linton, Indiana September 2016

HWC ENGINEERING

Section Four – Need for Project

4.1 Stormwater Drainage

The purpose of this PER is to develop the most economical and feasible solution to address the stormwater drainage concerns in the City of Linton study area. Critical Areas of concern are shown in Figure 3.3.

4.2 Growth

Based on population trends (see Section 2.3.1), the City has experienced a decrease in growth at the rate of approximately 6.95% from 2000 to 2010. The population of Greene County has experienced no significant increase or decrease in population over the last 10 years. For the purposes of this study, no significant growth is anticipated for the service area.

4.3 Stormwater System

4.3.1 Critical Area 1

The Green Acres Subdivision is located on State Road 54 East of downtown Linton. The houses on Oak St., Dogwood St., Chris Schenkel Dr., and Spruce Dr. all flow from east to west toward Willow Lane, which provides a roadside swale for the subdivision and flows south.

The flow from Willow Lane then drains to an existing ditch south of the subdivision. This road would convey flow away from the subdivision more efficiently if a storm sewer, with inlets, were installed along Willow Lane, flowing south to the existing ditch.

The ditches around the houses, as well as Willow Lane, drain approximately 30 acres, which mostly flows from the west edge of Mellow Lane towards Willow Lane.

4.3.2 Critical Area 2

The stretch of road on 12th St. NW, south of State Road 59 accumulates standing water during storm events. There is a high point, approximately 0.25 miles south of State Road 59, from which water splits north toward State Road 59 and south to an existing ditch. The area contains roadside ditches for drainage. However, the road side ditches have been filled in, leading to ponding in and adjacent to the road. North of the intersection with Vincennes St., there is an existing 36" storm sewer that is partially collapsed and needs replaced. There are three catch basins connecting to this trunk line along 12th St. NW that are filled in and need replaced. This area receives about 16 acres of runoff from the surrounding area.

4.3.3 Critical Area 3

There is a highly eroded ditch located on the south edge of K St. NW west of 5th St. NW. Runoff from the surrounding area flows north toward K St. NW and then drains into an existing swale that flows from south to north through the area. A detention pond redirected to the existing swale would reduce and control the peak runoff rates through the ditch and decrease the needed capacity of downstream infrastructure. Along with pond grading, swale regrading would also be completed to repair eroded ditch conditions. Along 5th St. NW water overtops the roadway during storm events. There are drive culverts that need replacing to convey flow from the area. This area receives about 24.5 acres of runoff.

4.3.4 Critical Area 4

At the intersection of State Road 59 and 6th St. SW, there are two catch basins that are failing and need replaced. Runoff

flows southeast from the catch basins through an existing, failing, 36" storm pipe that carries flow through the middle of a lot to an existing ditch that needs clearing, grubbing, and regrading. The existing storm sewer needs to be rerouted to take flow around the edge of the property. Just to the northeast of this area, there are existing storm pipes along 5th and 4th St. NW that are failing and need replaced. Runoff flows south along these roads and floods the road during storm events.

4.3.5 Critical Area 5

This area consists of E St. NE from 5th St. NW to 11th St. NE. During storm events, many of the intersections in this area have standing water due to failing inlets. A 3' x 4' concrete box running under the roadway is in fair condition and serves as the storm sewer trunk line for this area. Runoff flows south from the side roads and is not being collected into the sewer efficiently. Adding and replacing inlets would allow storm water to be collected into the sewer system which then outfalls to Beehunter Ditch east of the area. This area receives about 100 acres of drainage.

4.3.6 Critical Area 6

This area is between 5th St. NE and 7th St. NE just north of State Road 54. There is an existing storm pipe that runs through the area that is in fair condition but there is standing water at the intersection of B St. NE and 6th St. NE during and after storm events. Adding two additional inlets would collect water into the existing pipe which needs to be relocated to be located within the roadway. The existing pipe along 5th St. NE would be rerouted along the roadway.

4.3.7 Critical Area 7

This area consists of E Vincennes St. from 7th St. SE to 9th St. SE and A St. SE from 7th St. SE to 11th St. SE. The existing storm pipes on each road are failing and need replaced. This area also lacks sufficient inlets, which results in local ponding. To the east of the area, there is an existing ditch where the pipes outfall. The runoff flows east to this ditch. This area receives about 76 acres of runoff.

4.3.8 Critical Area 8

This area consists of E Vincennes St. from 1st St. SE to 7th St. SE and A St. SE from 3rd St. SE to 7th St. SE. The existing storm pipes on each road are failing and need replaced. This area also lacks sufficient inlets, which results in local ponding. To the east of the area, there is an existing ditch where the pipes outfall. The runoff flows east to this ditch. This area receives about 76 acres of runoff.

4.3.9 Critical Area 9

This area consists of a 3773 LF section of Beehunter Ditch east of 11th St NE and 12th St NE. The ditch requires maintenance that includes grinding stumps and clearing out trees.

4.3.10 Critical Area 10

This area consists of a 2263 LF section of Beehunter Ditch east of 11th St NE and 7th St NE continuing north where critical area 9 began. This part of the ditch requires maintenance that includes the clearing of trees and shaping.

4.3.11 Critical Area 11

This area consists of a 1505 LF and a 1630 LF section of Beehunter Ditch continuing west and north respectively from where critical area 10 began. These parts of the ditch require maintenance that includes the clearing of trees and shaping.

4.3.12 Critical Area 12

This area consists of a 6111 LF and a 1448 LF section of Beehunter Tributary adjacent to Park Road from approximately 1300 LF south of A St NE to the north at Cottenwood Estates. These parts of the tributary require clearing and shaping.

4.3.13 Critical Area 13

This area consists of an 1872 LF section of the Black Creek Ditch that runs from the approximate intersection of S Main St and G St SW east towards the railroad tracks. This part of the ditch requires cleaning, clearing, and shaping.

4.3.14 Critical Area 14

This area consists of a 4123 LF and a 1015 LF section of Black Creek Ditch that runs from the approximate intersection of S Main St and G St SW northwest to the intersection of 4th St NW and B St NW and from D St SW northwest 1015 LF to C St SW. These parts of the ditch require cleaning, clearing, and shaping

4.3.15 Critical Area 15

This area consists of a 1495 LF section of the Black Creek Ditch that continues northwest from the critical area 14 1015 LF section to the intersection of A St NW and 9th St NW. This part of the ditch requires cleaning, clearing, and shaping.

Section Five –Alternatives Considered

5.1 Introduction of Alternatives

This section will establish alternatives to address the stormwater drainage issues within the City.

The main concerns for the City are addressing and evaluating stormwater drainage issues related to standing water and damaged, existing stormwater facilities within the City. The following sections discuss the alternatives developed for Storm Sewer Infrastructure Improvements and Improvements to Major Drainageways.

5.2 Storm Sewer Infrastructure Improvements

5.2.1 Area 1 - Storm Sewer Installation along Willow Lane

This first drainage improvement involves installing a storm sewer with eight inlets and four manholes that would convey runoff south along Willow Lane located in the Green Acres subdivision in Linton, IN. This flow would outfall to an existing ditch south of the subdivision and prevent Willow Lane from acting as the primary conveyance for subdivision runoff.

5.2.1.1 Design Criteria

To design the storm sewer system, topographical survey of the area is necessary in order to confirm inlet locations and the area collected by each inlet. Storm sewers would be analyzed to convey the 10 year storm event within the pipe and keep the 100 year storm event below the finished grade. The peak runoff flow for design would also be needed. The pipes from inlets to the trunk line and along the trunk line must be able to convey the peak runoff without causing ponding or overtopping of the roadway.

Preliminary design shows that the road collects approximately 30 acres of drainage for a 10-year, 1-hour flow of 49 cfs and a 100-year, 1-hour flow of 66 cfs, requiring a pipe sized to include 345 linear feet of 24", 350 linear feet of 30", and 500 linear feet of 36" RCP. This is assuming a flowline slope of 0.50%.

5.2.1.2 Map

Figure 5.2.1 shows the proposed location and layout of this alternative.

5.2.1.3 Environmental Impacts

The environmental impacts of installing a new storm sewer are increased sediment in runoff during construction until newly graded areas have been stabilized.

An erosion and sediment control plan is required for the proposed work on Willow Lane.

Indiana Department of Environmental Management (IDEM)/United States Army Corps of Engineers (USACE) permits 401 and 404 will be required due to the outfall to the open stream south of the subdivision.

5.2.1.4 Construction Problems

Construction problems associated with a storm sewer system are the need of larger excavating equipment and longer construction time with additional costs when compared to ditches. The alternative to sewer lines are ditches and drive culverts, but these are often times filled-in and not well maintained.

To place a storm system underground, utilities would have to be located so that utilities can maintain required separation and continued function during construction.

5.2.1.5 Cost Estimate

Table 5.2.1 presents the capital costs for this alternative.

City of Linton - Storm Water Study

Storm Sewer System Installation along Willow Lane

Table 5.2.1

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
1	Pipe, Type 2, Circular, 24 inch, RCP	LF	345	$ 65.00	$ 22,425.00
2	Pipe, Type 2, Circular, 30 inch, RCP	LF	350	$ 83.00	$ 29,050.00
3	Pipe, Type 2, Circular, 36 inch, RCP	LF	500	$ 100.00	$ 50,000.00
4	6 ft Manhole	EA	4	$ 5,000.00	$ 20,000.00
5	Inlet	EA	8	$ 2,700.00	$ 21,600.00
6	End Section	EA	1	$ 750.00	$ 750.00
7	Drive Repair	LF	200	$ 25.00	$ 5,000.00
8	Structural Backfill	CY	300.00	$ 35.00	$ 10,500.00
9	Compacted Aggregate, No. 53 Stone	TON	200.00	$ 30.00	$ 6,000.00
10	HMA Surface	TON	30.00	$ 125.00	$ 3,750.00
11	HMA Base	TON	60.00	$ 100.00	$ 6,000.00
12	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 5,000.00	$ 5,000.00
13	Allowance for Utility Relocation	LS	1	$ 15,000.00	$ 15,000.00
14	Erosion Control	LS	1	$ 5,000.00	$ 5,000.00
15	Maintenance of Traffic	LS	1	$ 5,000.00	$ 5,000.00
16	Construction Engineering/Staking	LS	1	$ 7,200.00	$ 7,200.00
17	Mobilization/Demobilization/Bond	LS	1	$ 10,300.00	$ 10,300.00
				Sub Total	**$ 222,575.00**
				Construction Contingencies (15%)	$ 33,390.00
				Total Construction Costs	**$ 255,970.00**
II. NON-CONSTRUCTION COSTS					
				Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%	**$ 64,000.00**
				Total Capital Costs	**$ 319,970.00**

5.2.1.6 Advantages

The advantages of installing a storm sewer along Willow Lane are:

- Elimination of Willow Lane serving as a storm drain
- Elimination of runoff overtopping the road and local ponding and flooding adjacent to the roadway

5.2.1.7 Disadvantages

The disadvantages of installing a storm sewer along Willow Lane are:

- Higher cost for storm sewer
- Easements may need to be acquired
- Potential utility conflicts

5.2.2 Area 2 - Ditch Re-grading/Cleaning and Pipe Replacement along 12th St. NW

This drainage improvement includes re-grading/cleaning of the open ditch south of State Road 59 and replacing a damaged storm sewer as well as four catch basins. Water accumulates during storm events between the intersections of 12th St. NW with Vincennes St. and Price Rd. These catch basins will collect runoff into the storm sewer which flows northeast away from the high point on 12th St. SW.

5.2.2.1 Design Criteria

To design ditch re-grading, topographical survey of the area is necessary in order to determine where the ditch needs re-grading in order to maintain a positive slope allowing water to drain toward the northeast. The ditch must be able to convey the peak runoff without allowing water to overtop the roadway. Ditches will be sized to convey a 50 year event, dependent on the classification of adjacent roadways.

To design the storm sewer system, topographical survey of the area will also be necessary in order to confirm where the inlets should be placed and the area contributing to each inlet. Storm sewers would be

analyzed to convey the 10 year storm event within the pipe and keep the 100 year storm event below the finished grade. The peak runoff flow for design would also be needed. The pipes from inlets to the trunk line and along the trunk line must be able to convey the peak runoff without causing ponding or overtopping of the roadway.

For a preliminary estimate, the pipes were sized using the 10-year, 1-hour rainfall event. This rainfall event has the highest peak flow for the ditch and storm sewer at 27 cfs collected from approximately 16 acres of land. The 100-year, 1 hour rainfall event has a peak flow of 37 cfs. The pipe receiving flow from the 850 foot long ditch would need to be 310 linear feet of 18" RCP and then increased to 600 linear feet of 24" RCP as the trunk line approaches State Road 59 to the south. This analysis assumes the slope of the pipe to be 1.5%, matching the existing topography above ground.

5.2.2.2 Map

Figure 5.2.2 shows the proposed location and layout of this alternative.

5.2.2.3 Environmental Impacts

The environmental impacts of re-grading a ditch are increased sediment in runoff during construction until newly graded areas have been stabilized.

An erosion and sediment control plan is required for the proposed work in this project area.

No permits are required for this area.

5.2.2.4 Construction Problems

Construction problems with re-grading a ditch involve the threat of rain events preventing excavation of the earth in the ditch.

Construction problems associated with a storm sewer system are the need of larger excavating equipment and longer construction time with

additional costs when compared to ditches. The alternative to sewer lines are ditches and drive culverts, but these are often times filled-in and not well maintained. Where watershed areas are smaller, the grading of roadside ditches is being proposed in an effort to minimize costs and over designed infrastructure improvements.

To place a storm system underground, utilities would have to be located so that utilities can maintain required separation and continued function during construction. Where watershed areas are smaller, the grading of

5.2.2.5 Cost Estimate

Table 5.2.2 presents the capital costs for this alternative.

City of Linton - Storm Water Study
Ditch Rehabilitation and Pipe Replacement along 12th St. NW

Table 5.2.2

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
1	Pipe, Type 2, Circular, 12 inch, RCP	LF	40	$ 45.00	$ 1,800.00
2	Pipe, Type 2, Circular, 18 inch, RCP	LF	310	$ 55.00	$ 17,050.00
3	Pipe, Type 2, Circular, 24 inch, RCP	LF	600	$ 65.00	$ 39,000.00
4	Ditch Rehabilitation	LF	850	$ 10.00	$ 8,500.00
5	6 ft Manhole	EA	2	$ 5,000.00	$ 10,000.00
6	Inlet	EA	3	$ 2,700.00	$ 8,100.00
7	Drive Repair	LF	40	$ 25.00	$ 1,000.00
8	Structural Backfill	CY	200.00	$ 35.00	$ 7,000.00
9	Compacted Aggregate, No. 53 Stone	TON	100.00	$ 30.00	$ 3,000.00
10	HMA Surface	TON	20.00	$ 100.00	$ 2,000.00
11	HMA Base	TON	60.00	$ 90.00	$ 5,400.00
12	Parking Lot Repair	LF	120	$ 40.00	$ 4,800.00
13	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 5,000.00	$ 5,000.00
14	Allowance for Utility Relocation	LS	1	$ 15,000.00	$ 15,000.00
15	Erosion Control	LS	1	$ 5,000.00	$ 5,000.00
16	Maintenance of Traffic	LS	1	$ 5,000.00	$ 5,000.00
17	Construction Engineering/Staking	LS	1	$ 4,900.00	$ 4,900.00
18	Mobilization/Demobilization/Bond	LS	1	$ 6,900.00	$ 6,900.00
				Sub Total	**$ 149,450.00**
				Construction Contingencies (15%)	$ 22,420.00
				Total Construction Costs	**$ 171,870.00**
II. NON-CONSTRUCTION COSTS					
	Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%				**$ 43,000.00**
	Easements	**EA**	**12**	**$2,000.00**	**$ 24,000.00**
				Total Capital Costs	**$ 238,870.00**

5.2.2.6 Advantages

The advantages of this alternative are:

- Elimination of the ponding on 12th St. NW south of State Road 59
- Cleaning of open ditch on 12 St. NW
- Ease of maintenance for the ditch

5.2.2.7 Disadvantages

The disadvantages of this alternative are:

- Potential filling in as has happened in many ditches in Linton
- Higher cost for the storm sewer
- Easements may be needed
- Potential utility conflicts

5.2.3 Area 3 - Detention Pond, Ditch Re-Grading, and Pipe Replacement at K St. NW and 5th St. NW

The next drainage improvement alternative is the construction of a detention pond with a storm sewer outlet from the pond to an existing swale. A detention pond redirected to an existing swale would reduce and control peak runoff rates. This in turn will decrease the needed capacity of downstream infrastructure. There is also a highly eroded ditch in this project area on K St. NW just west of 5th St. NW. This will most likely need re-graded, cleaned, and grubbed. The flow from this ditch will be directed into a proposed roadside swale with three drive culverts.

5.2.3.1 Design Criteria

To design the detention pond and the ditch re-grading, a topographical survey of the area is necessary in order to size the pond and to determine proposed ditch grades in order to maintain a positive slope allowing water to drain toward the northeast. The peak runoff flow for design would also be needed. The ditch must be able to convey the peak runoff without allowing water to overtop the roadway.

To design the storm sewer system, topographical survey of the area is also necessary in order to confirm inlet locations and the area collected by each inlet. Storm sewers would be analyzed to convey the 10 year storm event within the pipe. The pipes from inlets to the trunk line and along the trunk line must be able to convey the peak runoff without causing ponding or overtopping of the roadway.

As a preliminary design, sizing for the storm sewer system in this alternative was done using a 10-year, 1 hour rainfall event. This stormwater drainage system would drain approximately 24 acres of land. The outfall from this system would convey 30 cfs that the system receives from a 10-year, 1-hour rainfall event and a 100-year, 1-hour flow of 41 cfs. The sections of this system would be made up of approximately 60 linear feet of 12" RCP, 80 linear feet of 18" RCP, 80 linear feet of 24" RCP, and 50 linear feet of 30" RCP. This analysis assumes a 1.5% slope on the pipes, with the trunk line conveying flow from the problem intersection. Preliminary pond sizing includes 670 cubic yards of grading, and an outlet structure containing a 15" flared end section, 8 linear feet of 15" pipe, and riprap.

5.2.3.2 Map

Figure 5.2.3 shows the proposed location and layout of this alternative.

5.2.3.3 Environmental Impacts

The environmental impacts of re-grading a ditch are increased sediment in runoff during construction until newly graded areas have been stabilized.

The construction of a storm sewer system would require the excavation of a large amount of earth. This storm sewer system would also deliver greater flow to a ditch with established historical flow patterns.

The construction of a pond would also require the excavation of a large amount of earth, but would reduce the peak flows.

An erosion and sediment control plan is required for the proposed work in this project area.

IDEM/USACE permits 401 and 404 will be required due to the outfall to the open ditch north of County Road 150 N.

5.2.3.4 Construction Problems

Construction problems with re-grading a ditch and grading a pond involve the threat of rain events preventing excavation of the earth in the ditch and pond areas. It should be assumed that the ditch would be classified as waters of the US and be under the jurisdiction of the Army Corp of Engineering and IDEM. Therefore, one-step removal techniques should be used during construction to operate within the allowed construction methods for clearing a ditch according to the USACE and IDEM. Additionally, if any tree clearing is to be done, it should be completed between October 1 and March 30 (due to possible endangered bat species) and should leave all tree root balls in place.

Construction problems associated with a storm sewer system are the need of larger excavating equipment and longer construction time with additional costs when compared to ditches. The alternative to sewer lines are ditches, but they cannot go across town as easily as underground sewer systems can.

To place a storm system underground, utilities would have to be located so that utility coordination can be done in order to maintain required separation and continued function of utilities.

5.2.3.5 Cost Estimate

Table 5.2.3 presents the capital costs for this alternative.

City of Linton - Storm Water Study

Proposed Dentention Pond, Ditch Regrading, and Pipe Replacement at NW K St. and 5th St. NW

Table 5.2.3

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
1	Pipe, Type 2, Circular, 12 inch, RCP	LF	60	$ 45.00	$ 2,700.00
2	Pipe, Type 2, Circular, 15 inch, RCP	LF	8	$ 50.00	$ 400.00
3	Pipe, Type 2, Circular, 18 inch, RCP	LF	80	$ 55.00	$ 4,400.00
4	Pipe, Type 2, Circular, 24 inch, RCP	LF	80	$ 65.00	$ 5,200.00
5	Pipe, Type 2, Circular, 30 inch, RCP	LF	50	$ 83.00	$ 4,150.00
6	Pond Grading	CY	670	$ 25.00	$ 16,750.00
7	Flared End Section, 15 inch w/ trash rack	EA	1	$ 1,200.00	$ 1,200.00
8	Outlet Structure	EA	1	$ 4,000.00	$ 4,000.00
9	Riprap	TON	6	$ 60.00	$ 360.00
10	Drive Repair	LF	80	$ 25.00	$ 2,000.00
11	Structural Backfill	CY	200	$ 35.00	$ 7,000.00
12	Compacted Aggregate, No. 53 Stone	TON	100	$ 30.00	$ 3,000.00
13	HMA Surface	TON	30	$ 125.00	$ 3,750.00
14	HMA Base	TON	50	$ 100.00	$ 5,000.00
15	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 20,000.00	$ 20,000.00
16	Allowance for Utility Relocation	LS	1	$ 15,000.00	$ 15,000.00
17	Erosion Control	LS	1	$ 10,000.00	$ 10,000.00
18	Maintenance of Traffic	LS	1	$ 2,000.00	$ 2,000.00
19	Construction Engineering/Staking	LS	1	$ 3,800.00	$ 3,800.00
20	Mobilization/Demobilization/Bond	LS	1	$ 5,600.00	$ 5,600.00
				Sub Total	**$ 116,310.00**
				Construction Contingencies (15%)	$ 17,450.00
				Total Construction Costs	**$ 133,760.00**
II. NON-CONSTRUCTION COSTS					
	Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%				**$ 33,000.00**
	Easements	**EA**	**1**	**$2,000.00**	**$ 2,000.00**
				Total Capital Costs	**$ 168,760.00**

5.2.3.6 Advantages

The major advantages of this alternative are:

- Allows for property owners within the proposed storm system construction limits to maintain their property once construction is done.
- Eliminates ponding at the intersection of NW K St. and 5th St. NW.
- Cleans out existing ditch for runoff to flow

5.2.3.7 Disadvantages

Disadvantages also exist with this alternative:

- Potential land acquisition
- A need to demolish and repair sections of property owners driveways
- Potential utility conflicts

5.2.4 Area 4 - Ditch Rehabilitation, Re-Grading, and Pipe Replacement along State Road 54 at 4th St. NW and 5th St. NW

This drainage improvement alternative involves clearing and re-grading of the ditch between 5th and 4th St. NW, and rerouting and replacing storm sewer with six inlets and four manholes in the project area.

5.2.4.1 Design Criteria

To design ditch re-grading, topographical survey of the area is necessary in order to determine where the ditch needs re-grading in order to maintain a positive slope allowing water to drain away from the road. The peak runoff flow for design would also be needed. Ditches will be sized to convey a 50 year event, dependent on the classification of adjacent roadways.

To design the storm sewer system, topographical survey of the area will also be necessary in order to confirm inlet locations and the area collected by each inlet.

For a preliminary design, no hydrology was done because the existing pipe needs to be replaced and reconnected into the existing system. This replacement involves 1010 linear feet of 36" RCP and 410 linear feet of 24" RCP.

5.2.4.2 Map

Figure 5.2.4 shows the proposed location and layout of this alternative.

5.2.4.3 Environmental Impacts

The environmental impacts of re-grading a ditch are increased sediment in runoff during construction until newly graded areas have been stabilized. Additional bank stabilization of the downstream system may be required.

The construction of a storm sewer system would require the excavation of a large amount of earth. This storm sewer system may deliver greater flow to a ditch with established historical flow patterns.

An erosion and sediment control plan is required for the proposed work in this project area.

IDEM/USACE permits 401 and 404 will be required due to the outfall to the open ditch south of the project area.

5.2.4.4 Construction Problems

Construction problems with re-grading a ditch involve the threat of rain events preventing excavation of the earth in the ditch. It should be assumed that the ditch would be classified as waters of the US and be under the jurisdiction of the Army Corp of Engineering and IDEM. Therefore, one-step removal techniques should be used during construction to operate within the allowed construction methods for

clearing a ditch according to the USACE and IDEM. Additionally, if any tree clearing is to be done, it should be completed between October 1 and March 30 (due to possible endangered bat species) and should leave all tree root balls in place.

Construction problems associated with a storm sewer system are the need of larger excavating equipment and longer construction time with additional costs when compared to ditches. The alternative to sewer lines are ditches and culverts, but they cannot go across town as easily as underground sewer systems can.

To place a storm system underground, utilities would have to be located so that utility coordination can be done in order to maintain required separation and continued function of utilities.

Problems could also include abandoning existing pipes, while making sure existing drains and connections are not removed or no longer functional. Because of this projects proximity to the railroad, care would need to be taken to avoid any excavation within the railroad's right-of-way.

5.2.4.5 Cost Estimate

Table 5.2.4 presents the capital costs for this alternative.

City of Linton - Storm Water Study

Ditch Clearing/Regrading and Pipe Replacement along State Road 54 at 4th St. NW and 5th St. NW

Table 5.2.4

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
1	Pipe, Type 2, Circular, 24 inch, RCP	LF	410	$ 80.00	$ 32,800.00
2	Pipe, Type 2, Circular, 36 inch, RCP	LF	1010	$ 120.00	$ 121,200.00
3	Ditch Grading	LF	180	$ 25.00	$ 4,500.00
4	6 ft Manhole	EA	4	$ 5,000.00	$ 20,000.00
5	Inlet	EA	6	$ 2,700.00	$ 16,200.00
6	Structural Backfill	CY	750	$ 35.00	$ 26,250.00
7	Compacted Aggregate, No. 53 Stone	TON	350	$ 30.00	$ 10,500.00
8	HMA Surface	TON	100	$ 100.00	$ 10,000.00
9	HMA Base	TON	180	$ 90.00	$ 16,200.00
10	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 5,000.00	$ 5,000.00
11	Allowance for Utility Relocation	LS	1	$ 30,000.00	$ 30,000.00
12	Erosion Control	LS	1	$ 5,000.00	$ 5,000.00
13	Maintenance of Traffic	LS	1	$ 7,500.00	$ 7,500.00
14	Construction Engineering/Staking	LS	1	$ 10,700.00	$ 10,700.00
15	Mobilization/Demobilization/Bond	LS	1	$ 15,300.00	$ 15,300.00
				Sub Total	$ 331,150.00
				Construction Contingencies (15%)	$ 49,670.00
				Total Construction Costs	$ 380,820.00
II. NON-CONSTRUCTION COSTS					
	Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%				$ 95,000.00
	Easements	EA	1	$2,000.00	$ 2,000.00
				Total Capital Costs	$ 477,820.00

5.2.4.6 Advantages

The advantages of this alternative are

- Ease of maintenance
- Improves poor existing conditions

5.2.4.7 Disadvantages

The disadvantages of this alternative are:

- Potential erosion of existing downstream ditches due to potentially increased flows and/or velocities after new storm sewer has been added and ditches have been cleared
- Potential easement obtainment
- Potential higher cost

5.2.5 Area 5 - Adding Inlets and Manholes along E St. NE from 5th St. NW to 11th St. NE

This drainage improvement alternative involves adding approximately thirty-four inlets and seventeen manholes that would be connected into the existing 3' x 4' concrete box trunk line currently serving this area. Many of the intersections in this project area have standing water during and following storm events due to the failing of old inlets and lack of sufficient collection points.

5.2.5.1 Design Criteria

The proposed inlets in this project aim to address failing, old inlets and unserved low points. New area is not being added to the existing trunk line, therefore the effects of the area's hydrology on the existing trunk line was not analyzed. The addition of inlets, storm laterals, restoration of impacted road, and sidewalk infrastructures are the primary emphasis for this project location. The work involves the installation of approximately 850 linear feet of 12" RCP. Additionally several ADA ramps adjacent to the new inlet locations will need to be replaced.

5.2.5.2 Map

Figures 5.2.5a and 5.2.5b show the proposed location and layout of this alternative.

5.2.5.3 Environmental Impacts

The inlet installation will involve the removal and replacement of sections of roadway and excavation of the earth under that roadway in order to install the inlet and maintain a positive slope into the pipe to the outfall at the ditch.

An erosion and sediment control plan is required for the proposed work on E St. NW.

An IDEM Rule 5 Permit will be required due to the affected area being larger than 1 acre.

5.2.5.4 Construction Problems

To install inlets in this project area, sections of road will have to be demolished and repaired. The location of other utilities could be a concern during construction if the inlet or pipe is in conflict with these locations.

5.2.5.5 Cost Estimate

Table 5.2.5 presents the capital costs for this alternative.

City of Linton - Storm Water Study
Adding Inlets and Manholes along NE E. St. from 5th St. NW to 11th St. NE
Table 5.2.5

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
1	Pipe, Type 2, Circular, 12 inch, RCP	LF	850	$ 45.00	$ 38,250.00
2	6 ft Manhole	EA	17	$ 5,000.00	$ 85,000.00
3	Inlet	EA	34	$ 2,700.00	$ 91,800.00
4	Structural Backfill	CY	600	$ 35.00	$ 21,000.00
5	Compacted Aggregate, No. 53 Stone	TON	300	$ 30.00	$ 9,000.00
6	HMA Surface	TON	75	$ 100.00	$ 7,500.00
7	HMA Base	TON	150	$ 90.00	$ 13,500.00
8	Hydrodynamic Separator	EA	1	$ 30,000.00	$ 30,000.00
9	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 5,000.00	$ 5,000.00
10	Allowance for Utility Relocation	LS	1	$ 30,000.00	$ 30,000.00
11	Erosion Control	LS	1	$ 5,000.00	$ 5,000.00
12	Maintenance of Traffic	LS	1	$ 10,000.00	$ 10,000.00
13	Construction Engineering/Staking	LS	1	$ 12,200.00	$ 12,200.00
14	Mobilization/Demobilization/Bond	LS	1	$ 17,400.00	$ 17,400.00
				Sub Total	**$ 375,650.00**
				Construction Contingencies (15%)	$ 56,350.00
				Total Construction Costs	**$ 432,000.00**
II. NON-CONSTRUCTION COSTS					
				Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%	**$ 108,000.00**
				Total Capital Costs	**$ 540,000.00**

5.2.5.6 Advantages

The advantages of this alternative are:

- Reduction of the ponding at many of the intersections in the project area and at currently unserved low points
- Ease of maintenance
- Low cost compared to installation of a storm sewer trunk line

5.2.5.7 Disadvantages

The disadvantages of this alternative are:

- Potential utility conflicts
- A need to demolish and repair sections of roadways, causing that roadway to be temporarily out of service

5.2.6 Area 6 - Pipe Rerouting along 5th St. NE and B St. NE

The next drainage improvement is to reroute an existing 18" storm sewer that is in fair condition. The current route goes through the middle of a property and the proposed route would relocate the storm sewer to be within the City's right-of-way. The intersection of 6th St. NE and B St. NE floods during and after storm events. Therefore, it is proposed that two inlets and four manholes be added at this location in order to convey the runoff into the existing 18" pipe.

5.2.6.1 Design Criteria

To design the storm sewer system, topographical survey of the area is necessary in order to confirm inlet locations and the area collected by each inlet. The pipes from inlets to the trunk line and along the trunk line must be able to convey the peak runoff without causing ponding or overtopping of the roadway.

Therefore, topographical survey of the area is also necessary in order to determine the necessary slopes of pipes in the storm sewer system.

Hydrology was not calculated for this area because only a section of the existing storm sewer would be replaced and rerouted. Because the downstream pipe size is remaining at 18" in diameter, changes in pipe size are not feasible for this particular location. The proposed pipe would consist of 360 linear feet of 18" RCP.

5.2.6.2 Map

Figure 5.2.6 shows the proposed location and layout of this alternative.

5.2.6.3 Environmental Impacts

The construction of a storm sewer system would require the excavation of a large amount of earth. This storm sewer system could also deliver greater flow to a ditch with established historical flow patterns.

The inlet installation will involve the removal and replacement of sections of roadway and excavation of the earth under that roadway in order to install the inlet and maintain a positive slope into the pipe.

An erosion and sediment control plan is required for the proposed work in this project area.

No permits are required for this area.

5.2.6.4 Construction Problems

Construction problems associated with a storm sewer system are the need of larger excavating equipment and longer construction time.

To place a storm system underground, utilities would have to be located so that utility coordination can be done in order to maintain required separation and continued function of utilities.

To install an inlets in this project area, sections of road will have to be demolished and repaired. The location of other utilities could be a concern during construction.

5.2.6.5 Cost Estimate

Table 5.2.6 presents the capital costs for this alternative.

City of Linton - Storm Water Study
Pipe Rerouting along 5th St. NE and NE B St.

Table 5.2.6

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
1	Pipe, Type 2, Circular, 18 inch, RCP	LF	360	$ 55.00	$ 19,800.00
2	6 ft Manhole	EA	4	$ 3,500.00	$ 14,000.00
3	Inlet	EA	2	$ 2,700.00	$ 5,400.00
4	Drive Repair	LF	170	$ 25.00	$ 4,250.00
5	Structural Backfill	CY	250	$ 35.00	$ 8,750.00
6	Compacted Aggregate, No. 53 Stone	TON	110	$ 30.00	$ 3,300.00
7	HMA Surface	TON	30	$ 125.00	$ 3,750.00
8	HMA Base	TON	60	$ 100.00	$ 6,000.00
9	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 5,000.00	$ 5,000.00
10	Allowance for Utility Relocation	LS	1	$ 15,000.00	$ 15,000.00
11	Erosion Control	LS	1	$ 2,000.00	$ 2,000.00
12	Maintenance of Traffic	LS	1	$ 2,000.00	$ 2,000.00
13	Construction Engineering/Staking	LS	1	$ 3,200.00	$ 3,200.00
14	Mobilization/Demobilization/Bond	LS	1	$ 4,500.00	$ 4,500.00
				Sub Total	**$ 96,950.00**
				Construction Contingencies (15%)	$ 14,540.00
				Total Construction Costs	**$ 111,490.00**
II. NON-CONSTRUCTION COSTS					
				Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%	**$ 28,000.00**
				Total Capital Costs	**$ 139,490.00**

5.2.6.6 Advantages

The advantages of this alternative are:

- Reduction of the ponding at the 6th St, NE and B St. NE intersection
- Ease of maintenance as the proposed sewer will be within the City's right-of-way
- Low cost compared to a storm sewer trunk line

5.2.6.7 Disadvantages

The disadvantages of this alternative are:

- A need to demolish and repair a section of street, causing that street to be temporarily out of service.
- Potential utility conflicts

5.2.7 Area 7 - Pipe Replacement on E Vincennes St. and A St. SE East of 7th St. SE

The next drainage improvement is to replace failing storm sewers on E Vincennes St. and A St. SE East of 7th St. Se. This involves approximately four new inlets and two new manholes on E Vincennes St, and approximately ten new inlets and five new manholes on A St. SE. These would be added in order to efficiently convey runoff into the new storm sewer which outfalls to an existing stream that runs through the eastern edge of the project area.

5.2.7.1 Design Criteria

To design the storm sewer system, topographical survey of the area is necessary in order to determine where the inlets should be placed, how much runoff is getting to each inlet, and to determine the allowable slope of the pipe. Storm sewers would be analyzed to convey the 10 year storm event within the pipe and keep the 100 year storm event below the finished grade. The pipes from inlets to the trunk line and along the trunk line must be able to convey the peak runoff without causing ponding or overtopping of the roadway. The amount of runoff will need to be determined as well. With the slope and the amount of runoff needed to be conveyed, the size of the pipe can be determined.

As a preliminary design, sizing for the storm sewer system in this alternative was calculated. This stormwater drainage system would drain approximately 76 acres of land. The outfall from this system would convey 54 cfs for the section along Vincennes St. and 86 cfs for the section along A St. SE from a 10-year, 1-hour rainfall event. For the

100 year, 1 hour rainfall event, the system would convey 73 cfs for the Vincennes St. section and 118 cfs for the A St. SE section. Both sections of this system would be made up of approximately 570 linear feet of 30" RCP, 1,350 linear feet of 36" RCP, and 250 linear feet of 42" RCP. This analysis assumes a 1.5% slope for the trunk line.

5.2.7.2 Map

Figures 5.2.7 show the proposed location and layout of this alternative.

5.2.7.3 Environmental Impacts

The construction of a storm sewer system would require the excavation of a large amount of earth. This storm sewer system would also deliver greater flow to a stream with established historical flow patterns.

The structure and pipe installation will involve the removal and replacement of sections of roadway and excavation of the earth under that roadway in order to install the inlet and maintain a positive slope into the pipe to the outfall at the stream

.

An erosion and sediment control plan is required for the proposed work on Vincennes St. and A St. SE.

An IDEM Rule 5 Permit will be required due to the affected area being larger than 1 acre. IDEM/USACE permits 401 and 404 will also be required due to the outfall to the open stream east of the project area.

5.2.7.4 Construction Problems

Construction problems associated with a storm sewer system are the need of larger excavating equipment and longer construction time.

To place a storm system underground, utilities would have to be located so that utility coordination can be done in order to maintain required separation and continued function of utilities.

To install inlets, manholes, and a new storm sewer in this project area, sections of road will have to be demolished and repaired. The location of other utilities could be a concern during construction.

5.2.7.5 Cost Estimate

Table 5.2.7 presents the capital costs for this alternative.

City of Linton - Storm Water Study
Pipe Replacement on E Vincennes St. and A St. SE East of 7th St. SE
Table 5.2.7

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
2	Pipe, Type 2, Circular, 30 inch, RCP	LF	570	$ 83.00	$ 47,310.00
3	Pipe, Type 2, Circular, 36 inch, RCP	LF	1350	$ 120.00	$ 162,000.00
4	Pipe, Type 2, Circular, 42 inch, RCP	LF	250	$ 150.00	$ 37,500.00
5	6 ft Manhole	EA	7	$ 5,000.00	$ 35,000.00
6	Inlet	EA	14	$ 2,700.00	$ 37,800.00
7	Flared End Section	EA	2	$ 1,000.00	$ 2,000.00
8	Riprap	TON	24	$ 60.00	$ 1,440.00
9	Drive Repair	LF	100	$ 25.00	$ 2,500.00
10	Structural Backfill	CY	1500	$ 35.00	$ 52,500.00
11	Compacted Aggregate, No. 53 Stone	TON	700	$ 30.00	$ 21,000.00
12	HMA Surface	TON	175	$ 100.00	$ 17,500.00
13	HMA Base	TON	325	$ 90.00	$ 29,250.00
14	Hydrodynamic Separator	LS	1	$ 80,000.00	$ 80,000.00
15	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 2,000.00	$ 2,000.00
16	Allowance for Utility Relocation	LS	1	$ 12,000.00	$ 12,000.00
17	Erosion Control	LS	1	$ 3,000.00	$ 3,000.00
18	Maintenance of Traffic	LS	1	$ 2,000.00	$ 2,000.00
19	Construction Engineering/Staking	LS	1	$ 19,100.00	$ 19,100.00
20	Mobilization/Demobilization/Bond	LS	1	$ 27,300.00	$ 27,300.00
				Sub Total	**$ 591,200.00**
				Construction Contingencies (15%)	$ 88,680.00
				Total Construction Costs	**$ 679,880.00**
II. NON-CONSTRUCTION COSTS					
	Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%				**$ 170,000.00**
	Easements	**EA**	**1**	**$2,000.00**	**$ 2,000.00**
				Total Capital Costs	**$ 851,880.00**

5.2.7.6 Advantages

The advantages of this alternative are:

- Runoff will drain from the roadways in the project area and reduce ponding
- Ease of maintenance

5.2.7.7 Disadvantages

The disadvantages of this alternative are:

- Potential easement acquisition
- A need to demolish and repair sections of street, causing streets to be temporarily out of service.
- Potential of utility conflicts

5.2.8 Area 8 - Pipe Replacement on E Vincennes St. and A St. SE West of 7th St. SE

The last drainage improvement is to replace failing storm sewers on E Vincennes St. and A St. SE west of 7th St. SE. This alternative involves the construction of approximately eight new inlets and four new manholes on E Vincennes St, and approximately eight new inlets and four new manholes on A St. SE. These would be added in order to efficiently convey runoff into the proposed storm sewer, which would have an outfall at an existing stream that runs through the eastern edge of the project area.

5.2.8.1 Design Criteria

To design the storm sewer system, topographical survey of the area is necessary in order to determine where the inlets should be placed, how much runoff is getting to each inlet, and to determine the allowable slope of the pipe. Storm sewers would be analyzed to convey the 10 year storm event within the pipe and keep the 100 year storm event below the finished grade. The pipes from inlets to the trunk line and along the trunk line must be able to convey the peak runoff without causing ponding or overtopping of the roadway. The amount of runoff will need to be determined as well. With the slope and the

amount of runoff needed to be conveyed, the size of the pipe can be determined.

As a preliminary design, sizing for the storm sewer system in this alternative was calculated. This stormwater drainage system would drain approximately 76 acres of land. The outfall from this system would convey 54 cfs for the section along Vincennes St. and 86 cfs for the section along A St. SE from a 10-year, 1-hour rainfall event. For the 100 year, 1 hour rainfall event, the system would convey 73 cfs for the Vincennes St. section and 118 cfs for the A St. SE section. Both sections of this system would be made up of approximately 1,600 linear feet of 24" RCP and 1,430 linear feet of 30" RCP. This analysis assumes a 1.5% slope for the trunk line conveying flow from the problem intersection.

5.2.8.2 Map

Figures 5.2.8 show the proposed location and layout of this alternative.

5.2.8.3 Environmental Impacts

The construction of a storm sewer system would require the excavation of a large amount of earth. This storm sewer system would also deliver greater flow to a ditch with established historical flow patterns.

The structure and pipe installation will involve the removal and replacement of a section of roadway and excavation of the earth under that roadway in order to install the inlet and maintain a positive slope into the pipe to the outfall at the ditch.

An erosion and sediment control plan is required for the proposed work on Vincennes St. and A St. SE.

An IDEM Rule 5 Permit will be required due to the affected area being larger than 1 acre. IDEM/USACE permits 401 and 404 will also be required due to the outfall to the open stream east of the project area.

5.2.8.4 Construction Problems

Construction problems associated with a storm sewer system are the need of larger excavating equipment and longer construction time.

To place a storm system underground, utilities would have to be located so that utility coordination can be done in order to maintain required separation and continued function of utilities.

To install inlets in this project area, a section of road will have to be demolished and repaired. The location of other utilities could be a concern during construction.

5.2.8.5 Cost Estimate

Table 5.2.8 presents the capital costs for this alternative.

City of Linton - Storm Water Study
Pipe Replacement on E Vincennes St. and A St. SE West of 7th St. SE

Table 5.2.8

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
1	Pipe, Type 2, Circular, 24 inch, RCP	LF	1600	$ 65.00	$ 104,000.00
2	Pipe, Type 2, Circular, 30 inch, RCP	LF	1430	$ 83.00	$ 118,690.00
5	6 ft Manhole	EA	8	$ 5,000.00	$ 40,000.00
6	Inlet	EA	16	$ 2,700.00	$ 43,200.00
9	Drive Repair	LF	150	$ 25.00	$ 3,750.00
10	Structural Backfill	CY	2100	$ 35.00	$ 73,500.00
11	Compacted Aggregate, No. 53 Stone	TON	950	$ 30.00	$ 28,500.00
12	HMA Surface	TON	250	$ 100.00	$ 25,000.00
13	HMA Base	TON	480	$ 90.00	$ 43,200.00
15	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 3,000.00	$ 3,000.00
16	Allowance for Utility Relocation	LS	1	$ 18,000.00	$ 18,000.00
17	Erosion Control	LS	1	$ 7,000.00	$ 7,000.00
18	Maintenance of Traffic	LS	1	$ 3,000.00	$ 3,000.00
19	Construction Engineering/Staking	LS	1	$ 17,900.00	$ 17,900.00
20	Mobilization/Demobilization/Bond	LS	1	$ 25,600.00	$ 25,600.00
				Sub Total	**$ 554,340.00**
				Construction Contingencies (15%)	$ 83,160.00
				Total Construction Costs	**$ 637,500.00**
II. NON-CONSTRUCTION COSTS					
				Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%	**$ 159,000.00**
				Total Capital Costs	**$ 796,500.00**

5.2.8.6 Advantages

The advantages of this alternative are:

- Runoff will drain from the side roads and reduce ponding
- Ease of maintenance

5.2.8.7 Disadvantages

The disadvantages of this alternative are:

- Potential easement acquisition
- A need to demolish and repair a section of street, causing that street to be temporarily out of service.
- Potential of utility conflicts

5.2.9 Summary of Storm Sewer Infrastructure Improvements

The preceding sections have evaluated the storm sewer drainage system alternatives consisting of varying systems of storm sewers, culverts, ditches, and a detention pond. The proposed alternatives are intended to provide an assessment and recommendation to the City of Linton in planning for future stormwater drainage improvements.

This study gives guidance as to how the overall drainage in the City could be structured to address the problem areas noted by the City. The next steps to prepare a stormwater drainage design plan would include prioritization of identified projects, which is provided in Section 6 of this study, more detailed field survey, updating the plan based on more detailed topography and survey findings, and preparations of construction documents and permitting needed to construct the desired facility improvements.

5.3 Improvements to Major Drainageways

Projects identified in this section address the concerns regarding conveyance of stormwater via major drainageways through and around the City of Linton. In several locations, historic conditions of agricultural drainage ditches or streams that have experienced development along the banks, have not been well maintained and have seen an increase in runoff rates and frequency of runoff. This study has identified areas of particular concern that need to establish safe conveyance paths for stormwater from pipe networks to natural drainageways.

5.3.1 Area 9 - Ditch Rehabilitation Along Beehunter Ditch East of 11th St NE

This first ditch drainage improvement alternative includes the clearing out of trees and grinding of stumps on the open Beehunter Ditch east of 11th St NE

and 12th ST NE. This section of the ditch collects runoff and drains south towards A St SE.

5.3.1.1 Design Criteria

To design ditch re-grading, topographical survey of the area is necessary in order to determine where the ditch needs re-grading in order to maintain a positive slope allowing water to drain toward the southeast. The ditch must be able to convey the peak runoff without allowing water to overtop the roadway. Ditches will be sized to convey a 50 year event, dependent on the classification of adjacent roadways.

5.3.1.2 Map

Figure 5.3.1 shows the proposed location and layout of this alternative.

5.3.1.3 Environmental Impacts

The environmental impacts of re-grading a ditch are increased sediment in runoff during construction until newly graded areas have been stabilized.

An erosion and sediment control plan is required for the proposed work in this project area.

IDEM/USACE permits 401 and 404 will be required due to work occurring below the ordinary high water mark of the ditch.

An IDEM Rule 5 Permit will be required due to the affected area being larger than 1 acre.

5.3.1.4 Construction Problems

Construction problems with re-grading a ditch involve the threat of rain events preventing excavation of the earth in the ditch.

5.3.1.5 Cost Estimates

Table 5.3.1 presents the capital costs for this alternative.

City of Linton - Storm Water Study
Ditch Rehabilitation Along Beehunter Ditch East of 11th St NE
Table 5.3.1

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
1	Ditch Rehabilitation	LF	3773	$ 10.00	$ 37,730.00
2	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 13,000.00	$ 13,000.00
3	Erosion Control	LS	1	$ 15,000.00	$ 15,000.00
4	Maintenance of Traffic	LS	1	$ 5,000.00	$ 5,000.00
5	Construction Engineering/Staking	LS	1	$ 1,500.00	$ 1,500.00
6	Mobilization/Demobilization/Bond	LS	1	$ 3,600.00	$ 3,600.00
				Sub Total	**$ 75,830.00**
				Construction Contingencies (15%)	$ 11,370.00
				Total Construction Costs	**$ 87,200.00**
II. NON-CONSTRUCTION COSTS					
				Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%	**$ 22,000.00**
				Total Capital Costs	**$ 109,200.00**

5.3.1.6 Advantages

The advantages of this alternative are:

- Ease of maintenance for the ditch
- Lower cost compared to storm sewer trunk line installation

5.3.1.7 Disadvantages

The disadvantages of this alternative are:

- Potential filling in as has happened in many ditches in Linton if ditch maintenance is not performed
- Easements may be needed to complete work

5.3.2 Area 10 - Ditch Rehabilitation Along Beehunter Ditch East of 7th St NE

This next ditch drainage improvement alternative includes the clearing and cleaning out of trees and debris on the open Beehunter Ditch west of 11th St NE and east of 7th ST NE. This section of the ditch collects runoff and drains southeast towards Area 9.

5.3.2.1 Design Criteria

To design ditch re-grading, topographical survey of the area is necessary in order to determine where the ditch needs re-grading in order to maintain a positive slope allowing water to drain toward the southeast. The ditch must be able to convey the peak runoff without allowing water to overtop the roadway. Ditches will be sized to convey a 50 year event, dependent on the classification of adjacent roadways.

5.3.2.2 Map

Figure 5.3.1 shows the proposed location and layout of this alternative.

5.3.2.3 Environmental Impacts

The environmental impacts of re-grading a ditch are increased sediment in runoff during construction until newly graded areas have been stabilized.

IDEM/USACE permits 401 and 404 will be required due to work occurring below the ordinary high water mark of the ditch.

An IDEM Rule 5 Permit will be required due to the affected area being larger than 1 acre.

An erosion and sediment control plan is required for the proposed work in this project area.

5.3.2.4 Construction Problems

Construction problems with re-grading a ditch involve the threat of rain events preventing excavation of the earth in the ditch.

5.3.2.5 Cost Estimates

Table 5.3.2 presents the capital costs for this alternative.

City of Linton - Storm Water Study
Ditch Rehabilitation Along Beehunter Ditch East of 7th St NE
Table 5.3.2

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
1	Ditch Rehabilitation	LF	2263	$ 10.00	$ 22,630.00
2	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 8,000.00	$ 8,000.00
3	Erosion Control	LS	1	$ 15,000.00	$ 15,000.00
4	Maintenance of Traffic	LS	1	$ 5,000.00	$ 5,000.00
5	Construction Engineering/Staking	LS	1	$ 1,500.00	$ 1,500.00
6	Mobilization/Demobilization/Bond	LS	1	$ 2,600.00	$ 2,600.00
				Sub Total	**$ 54,730.00**
				Construction Contingencies (15%)	$ 8,210.00
				Total Construction Costs	**$ 62,940.00**
II. NON-CONSTRUCTION COSTS					
				Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%	**$ 16,000.00**
				Total Capital Costs	**$ 78,940.00**

5.3.2.6 Advantages

The advantages of this alternative are:

- Ease of maintenance for the ditch
- Lower cost compared to storm sewer trunk line installation

5.3.2.7 Disadvantages

The disadvantages of this alternative are:

- Potential filling in as has happened in many ditches in Linton if ditch maintenance is not performed
- Easements may be needed to complete work

5.3.3 Area 11 - Ditch Rehabilitation Along Beehunter Ditch East of 4th St NE

This ditch drainage alternative includes the clearing and cleaning out of trees and debris in two sections on the open Beehunter Ditch west and north from where Area 10 began. Both sections of ditches cross 4th St NE before connecting at the beginning of Area 10. This section of the ditch collects runoff and drains southeast towards Area 10.

5.3.3.1 Design Criteria

To design ditch re-grading, topographical survey of the area is necessary in order to determine where the ditch needs re-grading in order to maintain a positive slope allowing water to drain toward the southeast. The ditch must be able to convey the peak runoff without allowing water to overtop the roadway. Ditches will be sized to convey a 50 year event, dependent on the classification of adjacent roadways.

5.3.3.2 Map

Figure 5.3.1 shows the proposed location and layout of this alternative.

5.3.3.3 Environmental Impacts

The environmental impacts of re-grading a ditch are increased sediment in runoff during construction until newly graded areas have been stabilized.

An erosion and sediment control plan is required for the proposed work in this project area.

An IDEM Rule 5 Permit will be required due to the affected area being larger than 1 acre.

5.3.3.4 Construction Problems

Construction problems with re-grading a ditch involve the threat of rain events preventing excavation of the earth in the ditch. In addition, ditches are often times filled in and not well maintained.

5.3.3.5 Cost Estimates

Table 5.3.3 presents the capital costs for this alternative.

City of Linton - Storm Water Study
Ditch Rehabilitation Along Beehunter Ditch East of 4th St NE
Table 5.3.3

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
1	Ditch Rehabilitation	LF	3135	$ 10.00	$ 31,350.00
2	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 11,000.00	$ 11,000.00
3	Erosion Control	LS	1	$ 15,000.00	$ 15,000.00
4	Maintenance of Traffic	LS	1	$ 1,500.00	$ 1,500.00
5	Construction Engineering/Staking	LS	1	$ 1,500.00	$ 1,500.00
6	Mobilization/Demobilization/Bond	LS	1	$ 3,000.00	$ 3,000.00
				Sub Total	**$ 63,350.00**
				Construction Contingencies (15%)	$ 9,500.00
				Total Construction Costs	**$ 72,850.00**
II. NON-CONSTRUCTION COSTS					
				Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%	**$ 18,000.00**
				Total Capital Costs	**$ 90,850.00**

5.3.3.6 Advantages

The advantages of this alternative are:

- Ease of maintenance for the ditch
- Lower cost compared to storm sewer trunk line installation

5.3.3.7 Disadvantages

The disadvantages of this alternative are:

- Potential filling in as has happened in many ditches in Linton if ditch maintenance is not performed
- Easements may be needed to complete work

5.3.4 Area 12 - Ditch Rehabilitation Along Beehunter Tributary

The next ditch drainage improvement alternative includes the clearing and cleaning out of trees and debris on the open Beehunter Tributary adjacent to Park Road from Cottenwood Estates to the south towards A St NE. Area 12 and Area 9 outfall at the same discharge point. This section of the ditch collects runoff and drains southeast towards the outfall at Area 9.

5.3.4.1 Design Criteria

To design ditch re-grading, topographical survey of the area is necessary in order to determine where the ditch needs re-grading in order to maintain a positive slope allowing water to drain toward the south. The ditch must be able to convey the peak runoff without allowing water to overtop the roadway. Ditches will be sized to convey a 50 year event, dependent on the classification of adjacent roadways.

5.3.4.2 Map

Figure 5.3.1 shows the proposed location and layout of this alternative.

5.3.4.3 Environmental Impacts

The environmental impacts of re-grading a ditch are increased sediment in runoff during construction until newly graded areas have been stabilized.

An erosion and sediment control plan is required for the proposed work in this project area.

An IDEM Rule 5 Permit will be required due to the affected area being larger than 1 acre.

5.3.4.4 Construction Problems

Construction problems with re-grading a ditch involve the threat of rain events preventing excavation of the earth in the ditch. In addition, ditches are often times filled in and not well maintained.

5.3.4.5 Cost Estimates

Table 5.3.4 presents the capital costs for this alternative.

City of Linton - Storm Water Study
Ditch Rehabilitation Along Beehunter Tributary

Table 5.3.4

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
1	Ditch Rehabilitation	LF	7559	$ 10.00	$ 75,590.00
2	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 26,000.00	$ 26,000.00
3	Erosion Control	LS	1	$ 20,000.00	$ 20,000.00
4	Maintenance of Traffic	LS	1	$ 5,000.00	$ 5,000.00
5	Construction Engineering/Staking	LS	1	$ 1,500.00	$ 1,500.00
6	Mobilization/Demobilization/Bond	LS	1	$ 6,400.00	$ 6,400.00
				Sub Total	**$ 134,490.00**
				Construction Contingencies (15%)	$ 20,170.00
				Total Construction Costs	**$ 154,660.00**
II. NON-CONSTRUCTION COSTS					
				Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%	**$ 39,000.00**
				Total Capital Costs	**$ 193,660.00**

5.3.4.6 Advantages

The advantages of this alternative are:

- Ease of maintenance for the ditch
- Lower cost compared to storm sewer trunk line installation

5.3.4.7 Disadvantages

The disadvantages of this alternative are:

- Potential filling in as has happened in many ditches in Linton if ditch maintenance is not performed
- Easements may be needed to complete work

5.3.5 Area 13 - Ditch Rehabilitation Along Black Creek Ditch Near S Main St

This ditch drainage improvement alternative includes the clearing and cleaning out of trees and debris on the open Black Creek Ditch from the intersection of S Main St and G St SW east towards the railroad tracks. This section of the ditch collects runoff and drains east towards the railroad tracks.

5.3.5.1 Design Criteria

To design ditch re-grading, topographical survey of the area is necessary in order to determine where the ditch needs re-grading in order to maintain a positive slope allowing water to drain toward the east. The ditch must be able to convey the peak runoff without allowing water to overtop the roadway. Ditches will be sized to convey a 50 year event, dependent on the classification of adjacent roadways.

5.3.5.2 Map

Figure 5.3.1 shows the proposed location and layout of this alternative.

5.3.5.3 Environmental Impacts

The environmental impacts of re-grading a ditch are increased sediment in runoff during construction until newly graded areas have been stabilized.

An erosion and sediment control plan is required for the proposed work in this project area.

5.3.5.4 Construction Problems

Construction problems with re-grading a ditch involve the threat of rain events preventing excavation of the earth in the ditch. In addition, ditches are often times filled in and not well maintained.

5.3.5.5 Cost Estimates

Table 5.3.5 presents the capital costs for this alternative.

City of Linton - Storm Water Study
Ditch Rehabilitation Along Black Creek Ditch Near S Main St

Table 5.3.5

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
1	Ditch Rehabilitation	LF	1872	$ 10.00	$ 18,720.00
2	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 7,000.00	$ 7,000.00
3	Erosion Control	LS	1	$ 15,000.00	$ 15,000.00
4	Maintenance of Traffic	LS	1	$ 1,500.00	$ 1,500.00
5	Construction Engineering/Staking	LS	1	$ 1,500.00	$ 1,500.00
6	Mobilization/Demobilization/Bond	LS	1	$ 2,200.00	$ 2,200.00
				Sub Total	**$ 45,920.00**
				Construction Contingencies (15%)	$ 6,890.00
				Total Construction Costs	**$ 52,810.00**
II. NON-CONSTRUCTION COSTS					
				Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%	**$ 13,000.00**
				Total Capital Costs	**$ 65,810.00**

5.3.5.6 Advantages

The advantages of this alternative are:

- Ease of maintenance for the ditch
- Lower cost compared to storm sewer trunk line installation

5.3.5.7 Disadvantages

The disadvantages of this alternative are:

- Potential filling in as has happened in many ditches in Linton if ditch maintenance is not performed
- Easements may be needed to complete work

5.3.6 Area 14 - Ditch Rehabilitation Along Black Creek Ditch Near C St SW

This next ditch drainage improvement alternative includes the clearing and cleaning out of trees and debris in two sections on the open Black Creek Ditch. The first section runs from C St SW southeast towards the connection point at Area 13 near the intersection of S Main St and G St SW. The other section of ditch included in this alternative begins at the intersection of B St NW and 4th St NW and flows south to meet with the first section of ditch, just south of C St SW. These sections of the ditch collect runoff and drain southeast towards Area 13.

5.3.6.1 Design Criteria

To design ditch re-grading, topographical survey of the area is necessary in order to determine where the ditch needs re-grading in order to maintain a positive slope allowing water to drain toward the south. The ditch must be able to convey the peak runoff without allowing water to overtop the roadway. Ditches will be sized to convey a 50 year event, dependent on the classification of adjacent roadways.

5.3.6.2 Map

Figure 5.3.1 shows the proposed location and layout of this alternative.

5.3.6.3 Environmental Impacts

The environmental impacts of re-grading a ditch are increased sediment in runoff during construction until newly graded areas have been stabilized.

An erosion and sediment control plan is required for the proposed work in this project area.

An IDEM Rule 5 Permit will be required due to the affected area being larger than 1 acre.

5.3.6.4 Construction Problems

Construction problems with re-grading a ditch involve the threat of rain events preventing excavation of the earth in the ditch. In addition, ditches are often times filled in and not well maintained.

5.3.6.5 Cost Estimates

Table 5.3.6 presents the capital costs for this alternative.

City of Linton - Storm Water Study
Ditch Rehabilitation Along Black Creek Ditch Near C St SW
Table 5.3.6

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
1	Ditch Rehabilitation	LF	5138	$ 10.00	$ 51,380.00
2	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 18,000.00	$ 18,000.00
3	Erosion Control	LS	1	$ 20,000.00	$ 20,000.00
4	Maintenance of Traffic	LS	1	$ 5,000.00	$ 5,000.00
5	Construction Engineering/Staking	LS	1	$ 1,500.00	$ 1,500.00
6	Mobilization/Demobilization/Bond	LS	1	$ 4,800.00	$ 4,800.00
				Sub Total	**$ 100,680.00**
				Construction Contingencies (15%)	$ 15,110.00
				Total Construction Costs	**$ 115,790.00**
II. NON-CONSTRUCTION COSTS					
				Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%	**$ 29,000.00**
				Total Capital Costs	**$ 144,790.00**

5.3.6.6 Advantages

The advantages of this alternative are:

- Ease of maintenance for the ditch
- Lower cost compared to storm sewer trunk line installation

5.3.6.7 Disadvantages

The disadvantages of this alternative are:

- Potential filling in as has happened in many ditches in Linton if ditch maintenance is not performed
- Easements may be needed to complete work

5.3.7 Area 15 - Ditch Rehabilitation Along Black Creek Ditch Near A St NW

The final ditch drainage improvement alternative includes the clearing and cleaning out of trees and debris on the open Black Creek Ditch beginning at the intersection of A St NW and 9th St NW. This section of the ditch collects runoff and drains southeast towards C St SW connection with Area 14.

5.3.7.1 Design Criteria

To design ditch re-grading, topographical survey of the area is necessary in order to determine where the ditch needs re-grading in order to maintain a positive slope allowing water to drain toward the south. The ditch must be able to convey the peak runoff without allowing water to overtop the roadway. Ditches will be sized to convey a 50 year event, dependent on the classification of adjacent roadways.

5.3.7.2 Map

Figure 5.3.1 shows the proposed location and layout of this alternative.

5.3.7.3 Environmental Impacts

The environmental impacts of re-grading a ditch are increased sediment in runoff during construction until newly graded areas have been stabilized.

An erosion and sediment control plan is required for the proposed work in this project area.

5.3.7.4 Construction Problems

Construction problems with re-grading a ditch involve the threat of rain events preventing excavation of the earth in the ditch. In addition, ditches are often times filled in and not well maintained.

5.3.7.5 Cost Estimates

Table 5.3.7 presents the capital costs for this alternative.

City of Linton - Storm Water Study
Ditch Rehabilitation Along Black Creek Ditch Near A St NW
Table 5.3.7

I. CONSTRUCTION COSTS					
Item #	Description	Unit	Qty	Unit Price	Total
1	Ditch Rehabilitation	LF	1495	$ 10.00	$ 14,950.00
2	Site Restoration (Seed/Straw/Fertilizer)	LS	1	$ 5,000.00	$ 5,000.00
3	Erosion Control	LS	1	$ 15,000.00	$ 15,000.00
4	Maintenance of Traffic	LS	1	$ 5,000.00	$ 5,000.00
5	Construction Engineering/Staking	LS	1	$ 1,500.00	$ 1,500.00
6	Mobilization/Demobilization/Bond	LS	1	$ 2,000.00	$ 2,000.00
				Sub Total	**$ 43,450.00**
				Construction Contingencies (15%)	$ 6,520.00
				Total Construction Costs	**$ 49,970.00**
II. NON-CONSTRUCTION COSTS					
				Non-Construction (Engineering, Accounting, Legal, Administrative) - 25%	**$ 12,000.00**
				Total Capital Costs	**$ 61,970.00**

5.3.7.6 Advantages

The advantages of this alternative are:

- Ease of maintenance for the ditch
- Lower cost compared to storm sewer trunk line installation

5.3.7.7 Disadvantages

The disadvantages of this alternative are:

- Potential filling in as has happened in many ditches in Linton if ditch maintenance is not performed
- Easements may be needed to complete work

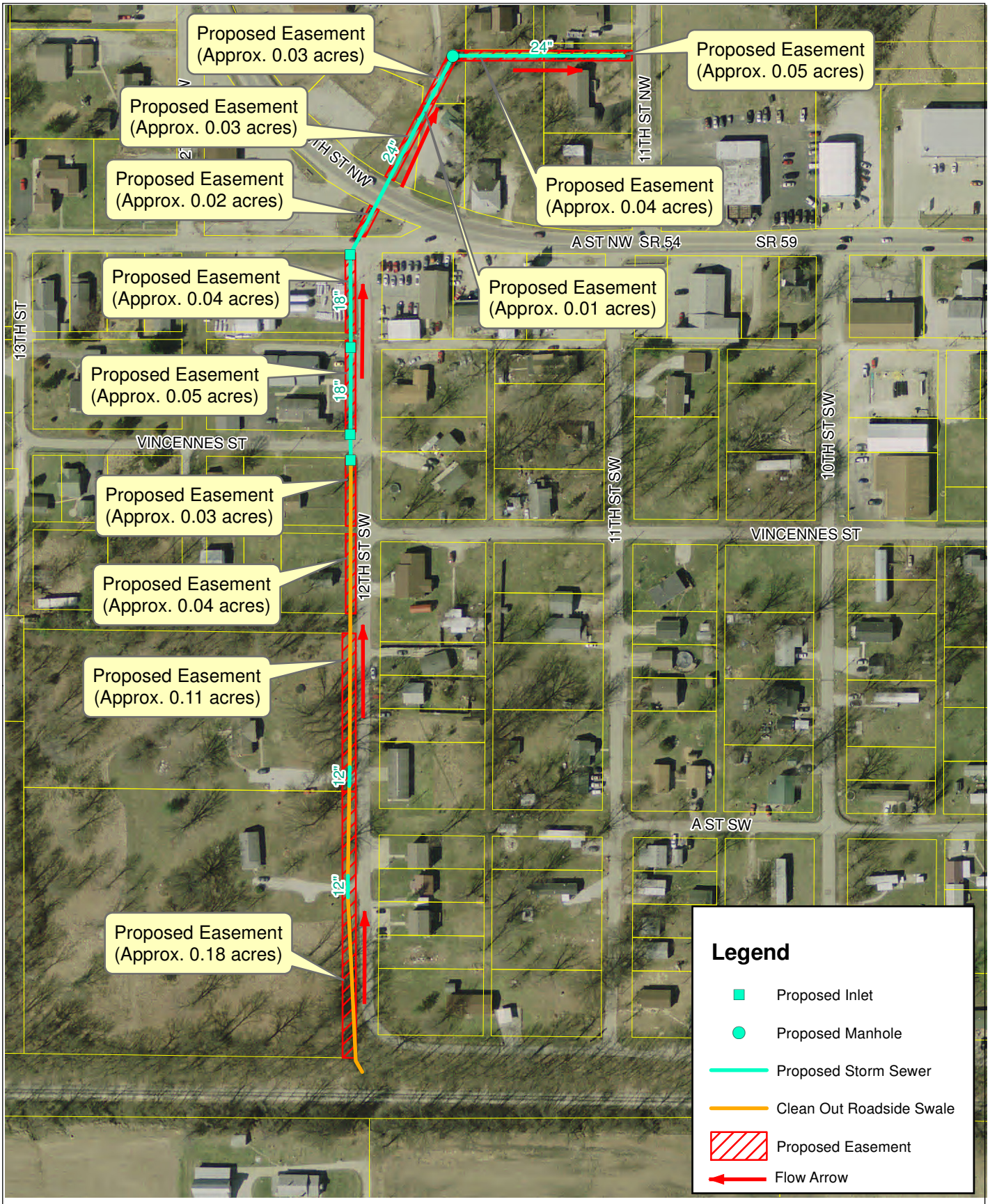
5.3.8 Summary of Improvements to Major Drainageways

The preceding sections have evaluated the design alternatives for major drainageways that serve the community of Linton in conveying significant upstream runoff as well as significant increases in developed runoff through and around the City limits. The proposed alternatives are intended to provide improvements that re-establish drainageways capable of safely conveying significant flows with measures to protect against erosion, prevent damage to public infrastructure, and can be easily accessed by the City for future maintenance.

The next steps to prepare a stormwater drainage design plan would include prioritization of identified projects, which is provided in Section 6 of this study, more detailed field survey, updating the plan based on more detailed topography and survey findings, and preparations of construction documents and permitting needed to construct the desired facility improvements.

Figure 5.2.1
Stormwater Drainage Master Plan
Problem Area 1
Linton, Indiana
August 2016

HWC ENGINEERING



N

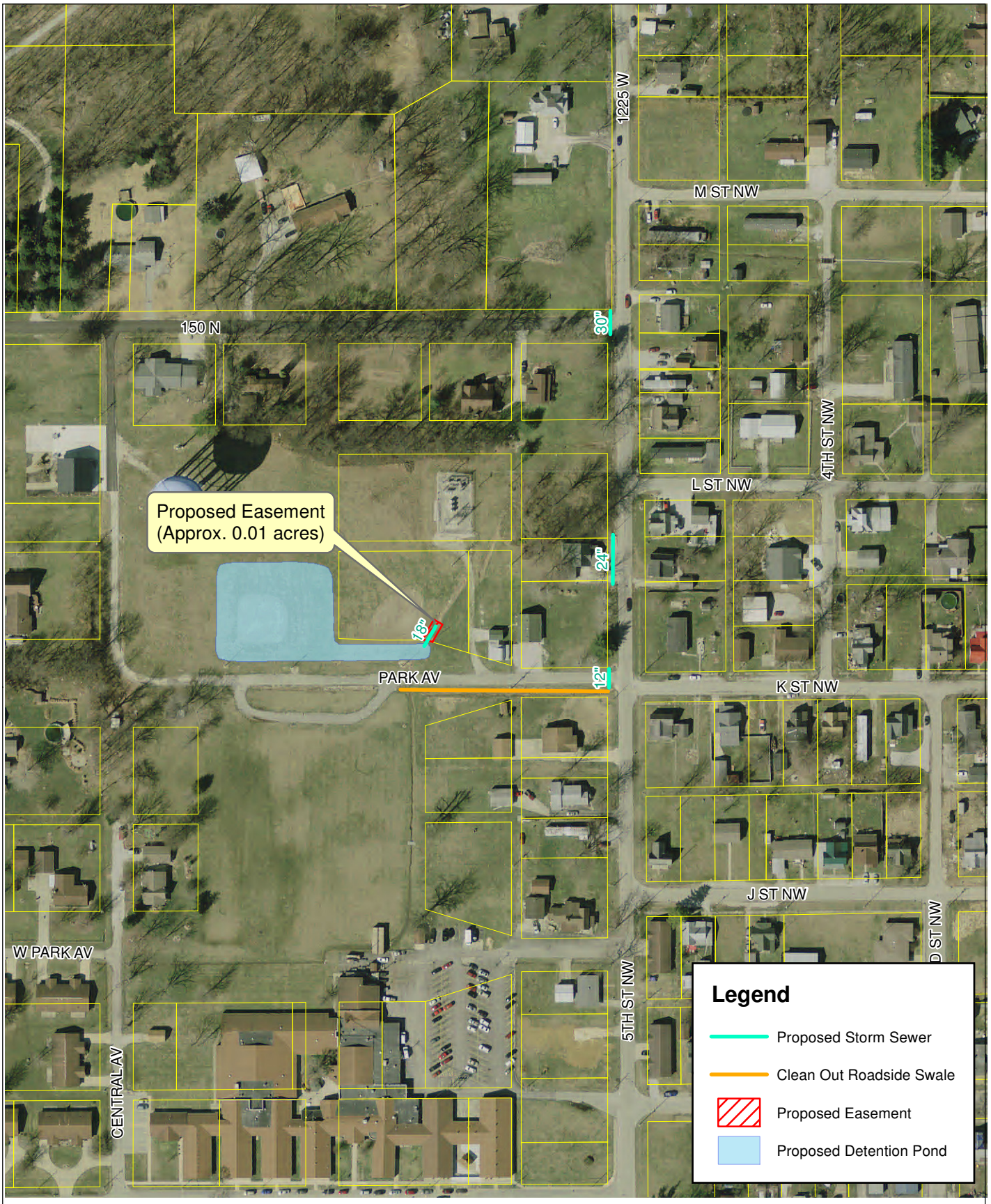
Graphic Scale (Feet)

0 200 400

1 inch = 200 feet

Figure 5.2.2
Stormwater Drainage Master Plan
Problem Area 2
Linton, Indiana
August 2016

HWC ENGINEERING



N

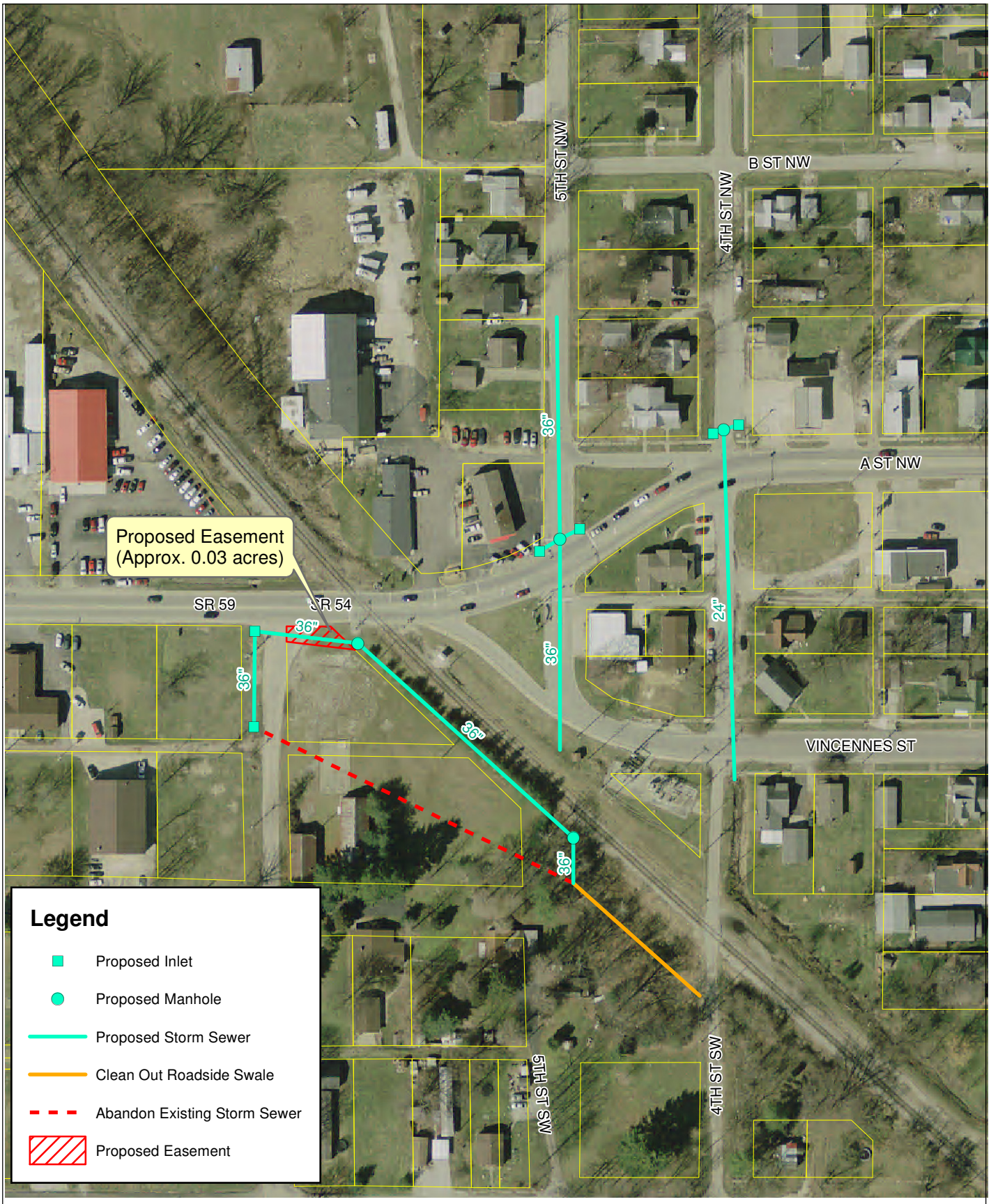
Graphic Scale (Feet)

0 200 400

1 inch = 200 feet

Figure 5.2.3
Stormwater Drainage Master Plan
Problem Area 3
Linton, Indiana
August 2016

HWC ENGINEERING



N

Graphic Scale (Feet)

0 150 300

1 inch = 150 feet

Figure 5.2.4
Stormwater Drainage Master Plan
Problem Area 4
Linton, Indiana
August 2016

HWC ENGINEERING

Legend

- Proposed Inlet
- Existing Storm Sewer
- Proposed Manhole
- Flow Arrow
- Proposed Storm Sewer

Graphic Scale (Feet)

0 300 600

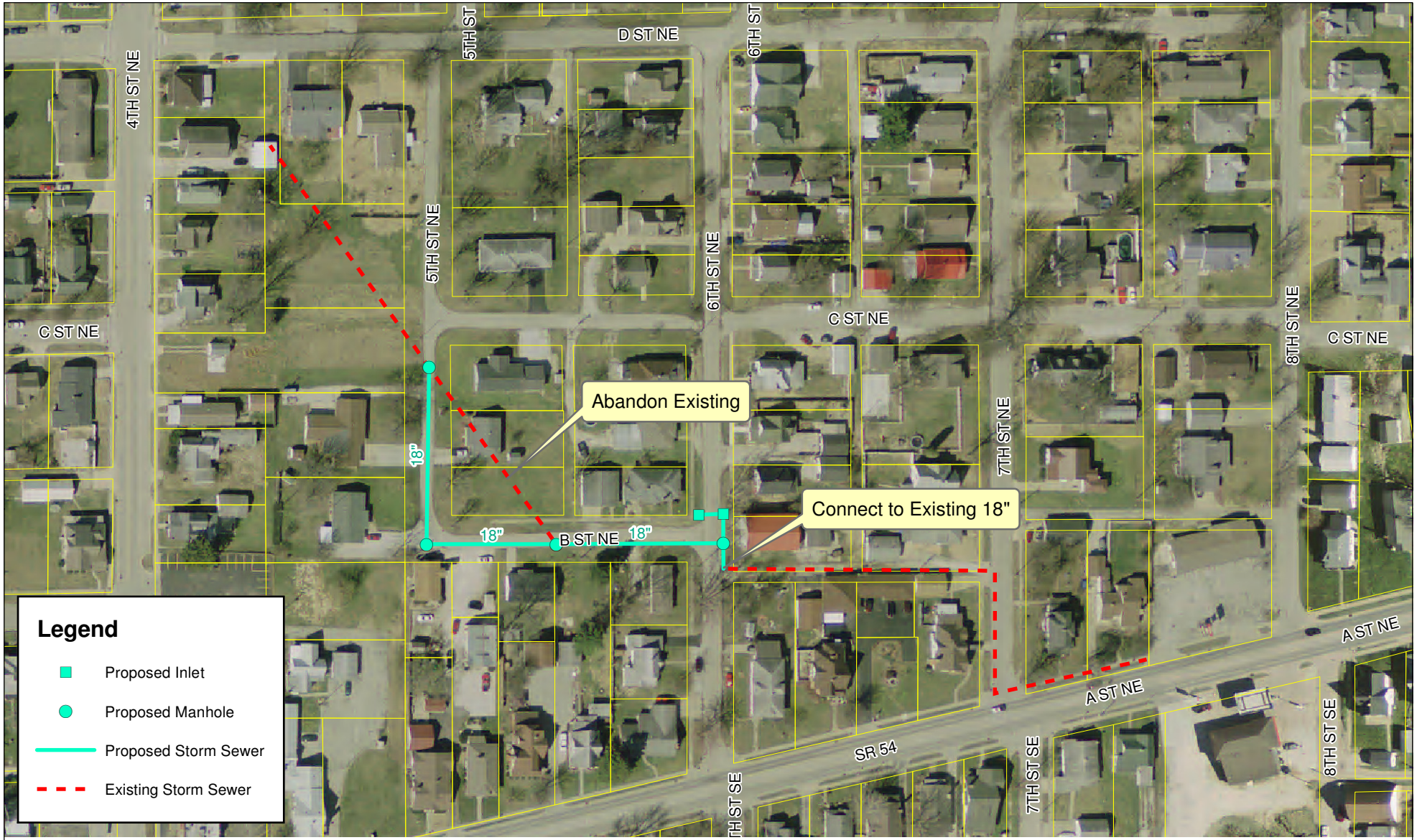
1 inch = 300 feet

Figure 5.2.5-A
Stormwater Drainage Master Plan
Problem Area 5a
Linton, Indiana
August 2016

HWC ENGINEERING

Figure 5.2.5-B
Stormwater Drainage Master Plan
Problem Area 5b
Linton, Indiana
August 2016

HWC ENGINEERING



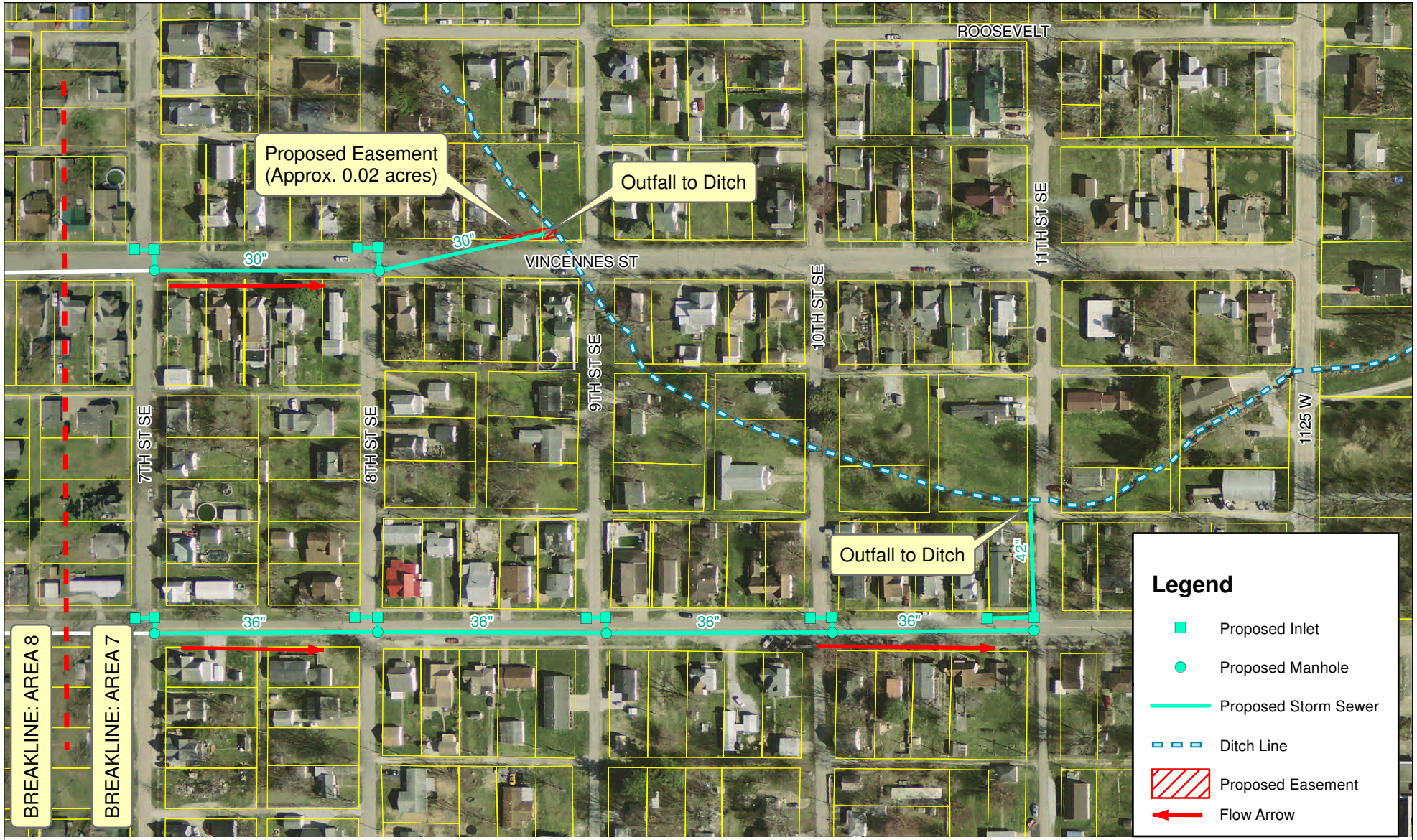
Graphic Scale (Feet)

0 150 300

1 inch = 150 feet

Figure 5.2.6
Stormwater Drainage Master Plan
Problem Area 6
Linton, Indiana
August 2016

HWC ENGINEERING



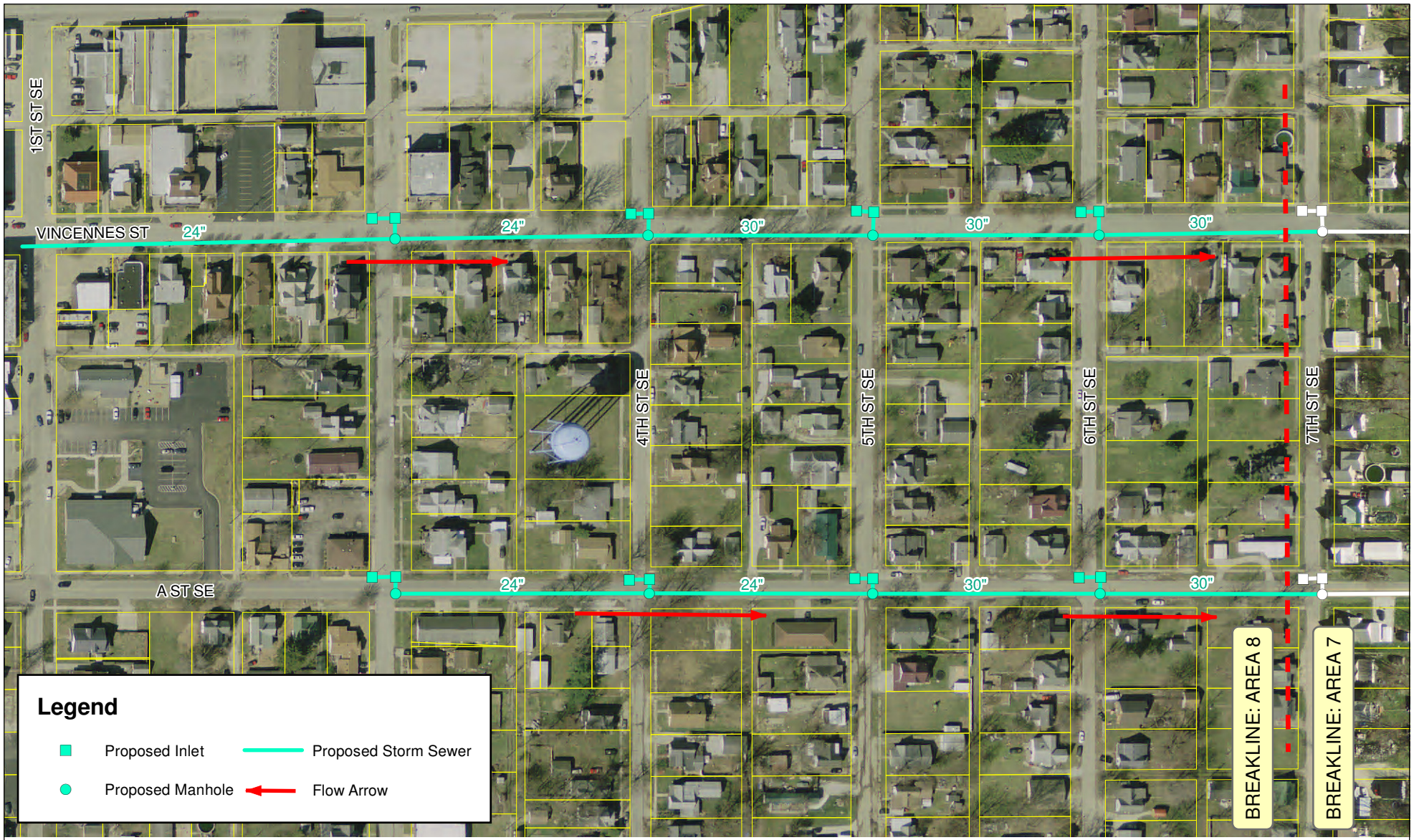
Graphic Scale (Feet)

0 200 400

1 inch = 200 feet

Figure 5.2.7
Stormwater Drainage Master Plan
Problem Area 7
Linton, Indiana
October 2016

HWC ENGINEERING



Graphic Scale (Feet)

0 200 400

1 inch = 200 feet

Figure 5.2.8
Stormwater Drainage Master Plan
Problem Area 8
Linton, Indiana
October 2016

HWC ENGINEERING

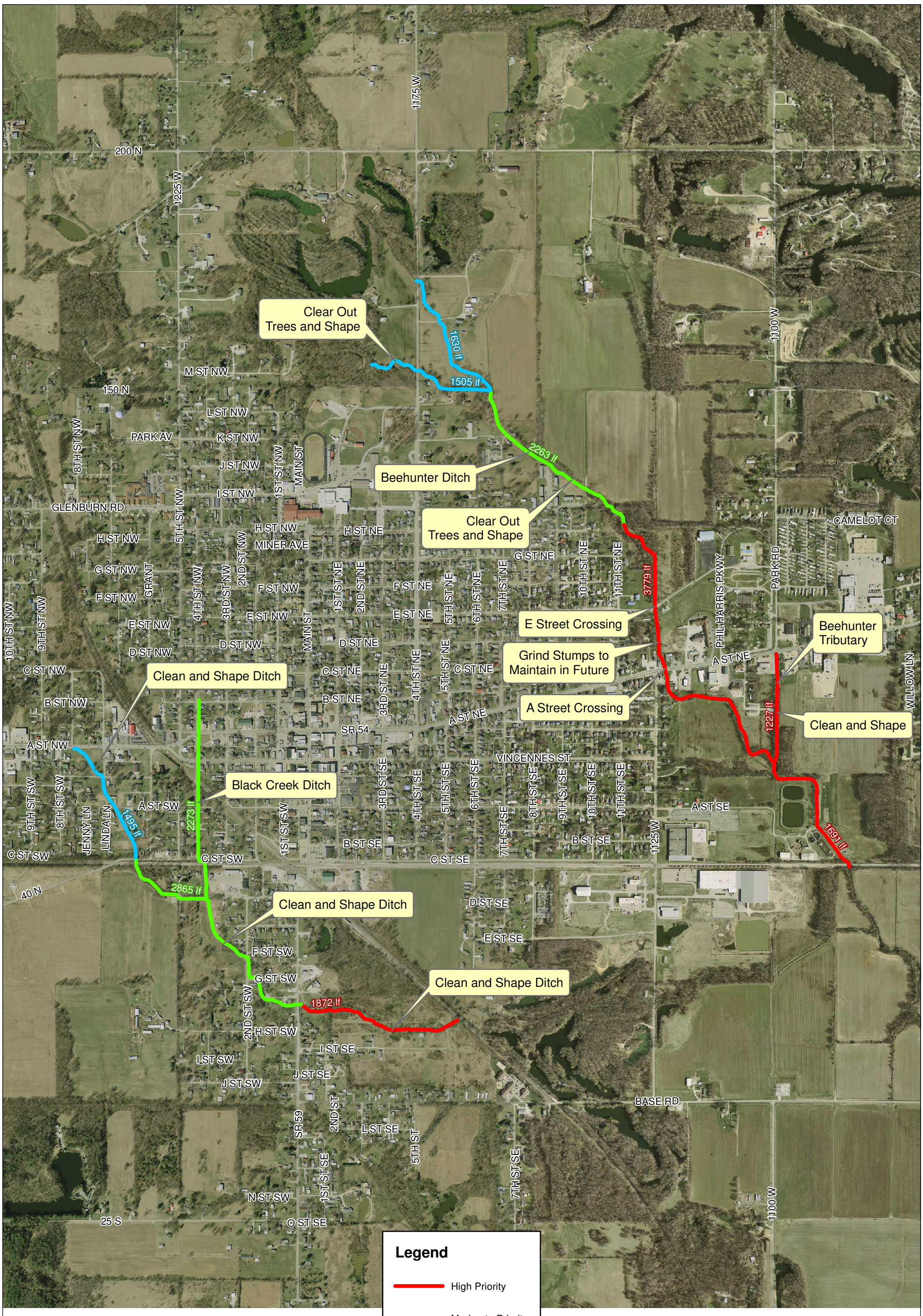


Figure 5.3.1
Ditch Project Map
Linton, Indiana
September 2016

HWC ENGINEERING

Section Six – Selection of an Alternative

6.1 Present Worth (Life Cycle) Cost Analysis

The present worth (life cycle) cost analysis for the Storm Sewer Drainage Alternatives and the Stormwater Ditch Drainage Alternatives are shown in Table 6.1 and 6.2.

6.2 Selected Alternative

Based on the evaluation included in Section 5, the present worth analysis included in this section, along with input from the City of Linton, the recommended plan for the City of Linton is to prioritize storm sewer drainage construction as followed:

1. Area 4 - Ditch Rehabilitation, Re-Grading, and Pipe Replacement along State Road 54 at 4th St. NW and 5th St. NW
2. Area 7 - Pipe Replacement on E Vincennes St. and A St. SE East of 7th St. SE
3. Area 6 - Pipe Rerouting along 5th St. NE and B St. NE
4. Area 1 - Storm Sewer Installation along Willow Lane
5. Area 3 - Detention Pond, Ditch Re-Grading, and Pipe Replacement at K St. NW and 5th St. NW
6. Area 8 - Pipe Replacement on E Vincennes St and A St. SE West of 7th St. SE
7. Area 2 - Ditch Re-Grading/Cleaning and Pipe Replacement along 12th St. NW
8. Area 5 - Adding Inlets and Manholes along E St. NE from 5th St. NW to 11th St. NE

Likewise based on the evaluation included in Section 5, the present worth analysis included in this section, along with input from the City of Linton, the

recommended plan for the City of Linton is to prioritize stormwater ditch drainage construction as followed:

1. Area 9 - Ditch Rehabilitation Along Beehunter Ditch East of 11th St NE
2. Area 13 - Ditch Rehabilitation Along Black Creek Ditch Near S Main St
3. Area 12 - Ditch Rehabilitation Along Beehunter Tributary
4. Area 10 - Ditch Rehabilitation Along Beehunter Ditch East of 7th St NE
5. Area 14 - Ditch Rehabilitation Along Black Creek Ditch Near C St SW
6. Area 11 - Ditch Rehabilitation Along Beehunter Ditch East of 4th St NE
7. Area 15 - Ditch Rehabilitation Along Black Creek Ditch Near A St NW

The City plans to complete some or all of the recommended improvements for the storm sewer networks and major drainage ways over time with both grant opportunities and their own resources as funding allows. These ongoing improvements will help address storm drainage concerns identified by the city's staff and residents.

The total recommended stormwater system improvements are evaluated in further detail in Section 7.

Table 6.1
City of Linton Stormwater Study
Present Worth Cost Summary of Storm Sewer Drainage Alternatives

Alternative Description	Construction Cost	Contingency (15%)	Non Construction Cost (25%)	Total Capital Cost	Annual Cost	Present Worth of Annual Cost	Total Present Worth
Area #1 - Storm Sewer System Installation along Willow Lane	$222,575.00	$33,390.00	$64,000.00	$319,970.00	$2,000.00	$40.00	$321,970.00
Area #2 - Ditch Rehabilitation and Pipe Replacement along 12th St. NW	$149,450.00	$22,420.00	$67,000.00	$238,870.00	$3,000.00	$60.00	$241,870.00
Area #3 - Proposed Detention Pond, Ditch Regrading, and Pipe Replacement at NW K St. and 5th St. NW	$116,310.00	$17,450.00	$35,000.00	$168,760.00	$5,000.00	$100.00	$173,760.00
Area #4 - Ditch Rehabilitation and Pipe Replacement along State Road 54 at 4th St. NW and 5th St. NW	$331,150.00	$49,670.00	$97,000.00	$477,820.00	$3,000.00	$60.00	$480,820.00
Area #5 - Adding Inlets and Manholes along NE E. St. from 5th St. NW to 11th St. NE	$375,650.00	$56,350.00	$108,000.00	$540,000.00	$2,000.00	$40.00	$542,000.00
Area #6 - Pipe Rerouting along 5th St. NE and NE B St.	$96,950.00	$14,540.00	$28,000.00	$139,490.00	$2,000.00	$40.00	$141,490.00
Area #7 - Pipe Replacement on E Vincennes St. and A St. SE (including 7th Street and East)	$591,200.00	$88,680.00	$172,000.00	$851,880.00	$2,000.00	$40.00	$853,880.00
Area #8 - Pipe Replacement on E Vincennes St. and A St. SE (West of 7th Street)	$554,340.00	$83,160.00	$159,000.00	$796,500.00	$2,000.00	$40.00	$798,500.00

*The interest rate used for determining the present worth is 2%, which is the "real" federal discount rate for 2012 as determined from Appendix C of the Office of Management and Budget (OMB) Circular A-94 as recommended by RUS Bulletin 1780-3. The term used is 40 years.

Table 6.2
City of Linton Stormwater Study
Present Worth Cost Summary of Stormwater Ditch Drainage Options

Alternative Description	Construction Cost	Contingency (15%)	Non Construction Cost (25%)	Total Capital Cost	Annual Cost	Present Worth of Annual Cost	Total Present Worth
Area #9 - Ditch Rehabilitation Along Beehunter Ditch East of 11th St NE	$75,830.00	$11,370.00	$22,000.00	$109,200.00	$2,500.00	$50.00	$111,700.00
Area #10 - Ditch Rehabilitation Along Beehunter Ditch East of 7th St NE	$54,730.00	$8,210.00	$16,000.00	$78,940.00	$2,000.00	$40.00	$80,940.00
Area #11 - Ditch Rehabilitation Along Beehunter Ditch East of 4th St NE	$63,350.00	$9,500.00	$18,000.00	$90,850.00	$2,000.00	$40.00	$92,850.00
Area #12 - Ditch Rehabilitation Along Beehunter Tributary	$134,490.00	$20,170.00	$39,000.00	$193,660.00	$4,000.00	$80.00	$197,660.00
Area #13 - Ditch Rehabilitation Along Black Creek Ditch Near S Main St	$45,920.00	$6,890.00	$13,000.00	$65,810.00	$2,000.00	$40.00	$67,810.00
Area #14 - Ditch Rehabilitation Along Black Creek Ditch Near C St SW	$100,680.00	$15,110.00	$29,000.00	$144,790.00	$3,000.00	$60.00	$147,790.00
Area #15 - Ditch Rehabilitation Along Black Creek Ditch Near A St NW	$43,450.00	$6,520.00	$12,000.00	$61,970.00	$2,000.00	$40.00	$63,970.00

*The interest rate used for determining the present worth is 2%, which is the "real" federal discount rate for 2012 as determined from Appendix C of the Office of Management and Budget (OMB) Circular A-94 as recommended by RUS Bulletin 1780-3. The term used is 40 years.

Section Seven – Proposed Project

7.1 Preliminary Project Design

7.1.1 Stormwater Drainage

The recommended projects in this study have been prioritized in Section 6. It is recommended that the City of Linton use this prioritization to phase the recommended projects based on grant funding and the timeline for city financing.

The first phase for stormwater drainage improvements recommended include ditch clearing, re-grading, and pipe replacement along State Road 54 and 4th St. NW and 5th St. NW as well as pipe replacement on E Vincennes St and A St SE east of 7th St SE.

The phase alternatives for major drainageway improvements recommended include ditch rehabilitation along Beehunter Ditch east of 11th St NE, along Beehunter Tributary, and along Black Creek Ditch near S Main St.

A schematic layout of the recommended first phase of stormwater drainage improvements is shown in Figure 7-1.

7.2 Total Project Cost Estimate

The phase 1 and subsequent total project cost estimates for the stormwater drainage improvement are shown in Table 7-1 and 7-2.

Table 7-1
City of Linton Stormwater Drainage PER
Phase 1 Proposed Recommended Project Cost Estimate

I. Construction (Including 15% Contingency)	
D. Area #4 - Ditch Clearing, Re-Grading, and Pipe Replacement along State Road 54 at 4th St. NW and 5th St. NW	$ 380,820.00
H. Area #7 - Pipe Replacement on E Vincennes St and A St. SE East of 7th St. SE	$ 679,880.00
I. Area #9 - Ditch Rehabilitation Along Beehunter Ditch East of 11th St NE	$ 87,200.00
L. Area #12 - Ditch Rehabilitation Along Beehunter Tributary	$ 154,660.00
M. Area #13 - Ditch Rehabilitation Along Black Creek Ditch Near S Main St	$ 52,810.00
Construction Cost:	**$ 1,355,370.00**
II. Non-Construction Costs (25% of Construction Costs)	
D. Area #4 - Engineering, Accounting, Legal, Administrative, Easement	$ 97,000.00
H. Area #7 - Engineering, Accounting, Legal, Administrative, Easement	$ 172,000.00
I. Area #9 - Engineering, Accounting, Legal, Administrative	$ 22,000.00
L. Area #12 - Engineering, Accounting, Legal, Administrative	$ 39,000.00
M. Area #13 - Engineering, Accounting, Legal, Administrative	$ 13,000.00
Non-Construction Cost:	**$ 343,000.00**
Total Capital Cost:	**$ 1,698,370.00**

Table 7-2
City of Linton Stormwater Drainage PER
Subsequent Proposed Recommended Project Cost Estimate

I. Construction (Including 15% Contingency)	
A. Area #1 - Storm Sewer Installation along Willow Lane	$ 255,970.00
B. Area #2 - Ditch Re-Grading/Cleaning and Pipe Replacement along 12th St. NW	$ 171,870.00
C. Area #3 - Detention Pond, Ditch Re-Grading, and Pipe Replacement at K St. NW and 5th St. NW	$ 133,760.00
E. Area #5 - Adding Inlets and Manholes along E St. NE from 5th St. NW to 11th St. NE	$ 432,000.00
F. Area #6 - Pipe Rerouting along 5th St. NE and B St. NE	$ 111,490.00
G. Area #8 - Pipe Replacement on E Vincennes St. and A St. SE West of 7th St. SE	$ 637,500.00
J. Area #10 - Ditch Rehabilitation Along Beehunter Ditch East of 7th St NE	$ 62,940.00
K. Area #11 - Ditch Rehabilitation Along Beehunter Ditch East of 4th St NE	$ 72,850.00
N. Area #14 - Ditch Rehabilitation Along Black Creek Ditch Near C St SW	$ 115,790.00
O. Area #15 - Ditch Rehabilitation Along Black Creek Ditch Near A St NW	$ 49,970.00
Construction Cost:	**$ 2,044,140.00**
II. Non-Construction Costs (25% of Construction Costs)	
A. Area #1 – Engineering, Accounting, Legal, Administrative	$ 64,000.00
B. Area #2 - Engineering, Accounting, Legal, Administrative, Easements	$ 67,000.00
C. Area #3 - Engineering, Accounting, Legal, Administrative, Easement	$ 35,000.00
E. Area #5 - Engineering, Accounting, Legal, Administrative	$ 108,000.00
F. Area #6 - Engineering, Accounting, Legal, Administrative	$ 28,000.00
G. Area #8 - Engineering, Accounting, Legal, Administrative	$ 159,000.00
J. Area #10 - Engineering, Accounting, Legal, Administrative	$ 16,000.00
K. Area #11 - Engineering, Accounting, Legal, Administrative	$ 18,000.00
N. Area #14 - Engineering, Accounting, Legal, Administrative	$ 29,000.00
O. Area #15 - Engineering, Accounting, Legal, Administrative	$ 12,000.00
Non-Construction Cost:	**$536,000.00**
Total Capital Cost:	**$ 2,580,140.00**

7.3 Annual Operating Budget

7.3.1 Income

To finance desired stormwater projects, the City of Linton is going to establish a stormwater utility and user fee as well as pursue available grant and low interest loan options. The City will also conduct a financial study and prepare a preliminary rate analysis to base stormwater user rates.

7.3.2 Operations and Maintenance Costs

From Table 6-1 and 6-2, the annual costs and present worth of the annual costs are shown to be $21,000 and $420 respectively for the stormwater drainage options and $17,500 and $350 respectively for the stormwater ditch drainage options. The annual costs include costs for mowing, maintenance of ditches and the pond area, supplies, and cleaning of inlets.

7.3.3 Debt Repayments

The proposed project is anticipated to be funded by the Office of Community and Rural Affairs (OCRA) grants, as well as possibly United States Department of Agriculture (USDA) Rural Development grants and loans, State Revolving Fund (SRF) loans, and local bonds issued.

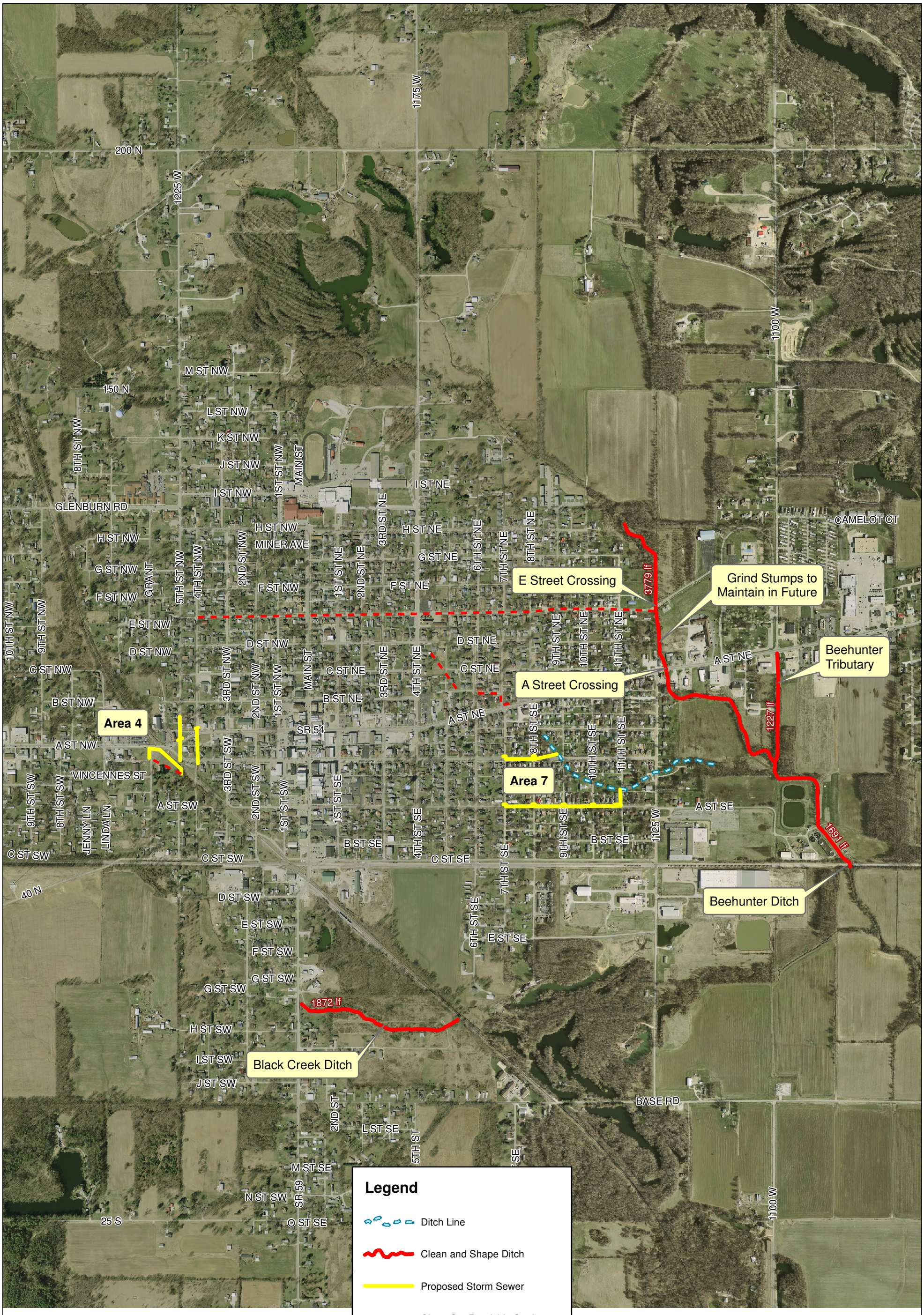
7.3.4 Reserves

7.3.4.1 Debt Service Reserve

Consideration in the annual cost requirements for the required reserve for any acquired Rural Development, SRF, or other type of loan shall be included in the City's final rate analysis.

7.3.4.2 Short-Lived Asset Reserve

There are no short-lived asset reserves anticipated in any of the alternatives stated in Table 7-1 and 7-2.



Legend

- Ditch Line
- Clean and Shape Ditch
- Proposed Storm Sewer
- Clean Out Roadside Swale
- Abandon Existing Storm Sewer

Graphic Scale (Feet)

0 1,000 2,000

1 inch = 1,000 feet

Figure 7.1
Recommended Project
Linton, Indiana
October 2016

HWC ENGINEERING

Section Eight – Conclusions and Recommendations

Based on the contents of this PER, it is recommended that the City of Linton implement the recommended stormwater system improvements as discussed in Section 7. The following section documents the steps required for this project.

8.1 Funding Applications

It is recommended that the City submit a grant application to OCRA (grant $500,000) as well as funding applications to SRF (loan of $250,000), which has recently added funding options for stormwater projects, and USDA Rural Development and select the funding agency with the lower local match requirement and best overall financing conditions. Seeking funding through Rural Development can prolong the anticipated timeline for initial projects to begin due to the internal agency review process and requirements. Another option for funding would be for the City of Linton to issue bonds backed by the stormwater utility and the revenue generated through City stormwater user rates.

8.2 Special Studies

Completion and approval of an Environmental Assessment (EA) is required by Rural Development and OCRA prior to funding approval. The purpose of the EA is to provide a detailed evaluation of the potential environmental impacts/concerns of the proposed project, which is reviewed by specific environmental agencies.

8.3 Special Coordination

As mentioned in Section 8.2, special coordination will be required with selected agencies to receive an approval of the EA.

Additionally, given the improvements recommended in this PER, special coordination will be required with the Indiana Department of Environmental Management, Indiana Department of Natural Resources, the Army Corp of Engineers, County Surveyor's Office, and other agencies in order to receive approval of the proposed project and to proceed to the construction phase.

8.4 Recommended Plan of Action

In accordance with the information presented in this PER, the following schedule is anticipated for the City of Linton to implement the project:

Table 8-1
Anticipated Phase 1 Project Schedule

	Milestone	Target Date
1	Authorize preparation of the Environmental Assessment (EA)	30 days following City's approval of PER
2	Submit the PER, EA, and funding applications to USDA Rural Development and SRF.	15 days following completion of the EA
3	Submit OCRA grant application	Spring 2017 (if matching funds are available)
4	Initiate preparation of design plans, specifications, and permit applications	Within 30 days of securing a funding commitment for the project
5	Submit construction permit applications to all local, state, and federal permitting agencies	Within 120 days of initiating a design contract
6	Bid Project	Within 60 days of receipt of authorization to bid from funding agencies*
7	Begin Construction	90 days following receipt of acceptable bids*
8	Complete Phase I Construction	240 days following award of construction*

*Timeframe is dependent upon when the City can apply and secure OCRA grant funding after commitment of matching funds.

It is anticipated that this plan of action, utilizing the recommendations in this PER, will allow construction of new stormwater drainage improvements within the planning area, and thus greatly reduce the problems that currently exist.

Hydraulic Design Analysis Summary

for the

Stormwater System Improvements

for

City of Linton

Greene County, Indiana

Appendix A

Prepared by:

HWC ENGINEERING

135 N. Pennsylvania St. Suite 2800
Indianapolis, IN 46204
Phone: (317) 347-3663
Fax: (317) 347-3664

City of Linton

Greene County, Indiana

Stormwater System Improvements

Peak Discharge Calculations

Calculated Using the Rational Method

Rational Method: Q_{peak} = I·Σ(C·A)·1.0083 cfs/(ac·in/hr) Designer(s): BASH

Design Return Period: 10 yr. Date: July-16

Structure Up	Structure Down	Structure Up Type	A [Acre]	C	C·A [Acre]	Inlet T_0 [min]	Max System t_f [min]	Max T_c [min]	I [in/hr]	Σ(C·A) [Acre]	Q_{peak} [cfs]	Pipe Flow Time, t_f [min]	Structure Up Location
1-A	1-B	CURB	5.62	0.40	2.25	18.3	0.0	18.3	4.44	2.25	**10.05**	1.1	
1-B	1-C	CURB	6.00	0.40	2.40	20.0	19.4	20.0	4.28	4.65	**20.04**	0.9	
1-C	1-D	CURB	9.38	0.40	3.75	18.8	20.9	20.9	4.19	8.40	**35.47**	0.8	
1-D	1-E	End	8.26	0.40	3.30	16.3	21.7	21.7	4.11	11.70	**48.52**	0.3	
2-A	2-B	Grate	4.82	0.40	1.93	17.7	0.0	17.7	4.49	1.93	**8.74**	0.7	
2-B	2-C	Grate	5.02	0.40	2.01	16.2	18.4	18.4	4.43	3.94	**17.58**	1.2	
2-C	2-D	Grate	3.12	0.40	1.25	11.9	19.5	19.5	4.32	5.18	**22.57**	0.5	
2-D	2-E	End	2.71	0.40	1.08	11.6	20.1	20.1	4.27	6.27	**26.98**		
3-A	3-B	CURB	16.51	0.20	3.30	24.7	0.0	24.7	3.82	3.30	**12.71**	0.2	
3-C	3-D	CURB	4.21	0.20	0.84	34.5	0.0	34.5	3.12	0.84	**2.65**	0.2	
3-D	3-E	CURB	0.57	0.40	0.23	10.2	34.6	34.6	3.11	1.07	**3.36**	0.2	
3-B	3-F	CURB	2.75	0.40	1.10	12.9	24.9	24.9	3.80	4.40	**16.87**	0.1	
		End											
7a-A	7a-B	CURB	10.75	0.40	4.30	15.6	0.0	15.6	4.70	4.30	**20.40**	1.5	
7a-B	7a-C	CURB	8.41	0.40	3.36	14.3	17.1	17.1	4.56	7.66	**35.21**	1.0	
7a-C	7a-D	End	10.40	0.40	4.16	14.8	18.1	18.1	4.46	11.82	**53.18**	0.9	
7b-A	7b-B	CURB	6.75	0.83	5.57	18.8	0.0	18.8	4.39	5.57	**24.68**	1.2	
7b-B	7b-C	CURB	9.66	0.40	3.86	19.6	19.9	19.9	4.28	9.43	**40.72**	0.9	
7b-C	7b-D	CURB	9.68	0.40	3.87	15.2	20.9	20.9	4.19	13.30	**56.20**	0.9	
7b-D	7b-E	CURB	9.74	0.40	3.90	14.2	21.7	21.7	4.10	17.20	**71.18**	0.8	
7b-E	7b-F	End	10.13	0.40	4.05	14.8	22.6	22.6	4.02	21.25	**86.22**	0.2	

City of Linton
Greene County, Indiana
Stormwater System Improvements

Time-of-Concentration Calculations

Calculated Using the SCS Time-of-Concentration Method

2 yr, 24 hr Peak Rainfall, P_2 = 3.15 in. Designer(s): BASH

Design Return Period = 10 yr. Date: July-16

Structure Up	Structure Down	Overland Sheet Flow #1				Overland Sheet Flow #2				Shallow Conc. Flow #1				Shallow Conc. Flow #2				Shallow Conc. Flow #3				T_o
		Length	Slope	Mannings n	T_f	Length	Slope	Mannings n	T_f	Length	Paved?	Slope	T_f	Length	Paved?	Slope	T_f	Length	Paved?	Slope	T_f	
		[ft]	[%]		[min]	[ft]	[%]		[min]	[ft]	[Y or N]	[%]	[min]	[ft]	[Y or N]	[%]	[min]	[ft]	[Y or N]	[%]	[min]	[min]
1-A	1-B	100	1.5	0.15	11.1					34	Y	1.5	0.2	1048	Y	1.5	7.0					**18.3**
1-B	1-C	100	1.30	0.15	11.7					63	Y	1.30	0.5	1122	Y	1.40	7.8					**20.0**
1-C	1-D	100	1.20	0.15	12.1					228	N	1.20	2.2	741	Y	1.80	4.5					**18.8**
1-D	1-E	100	2.10	0.15	9.7					42	Y	2.10	0.2	951	Y	1.50	6.4					**16.3**
2-A	2-B	100	1.10	0.15	12.5					134	N	1.10	1.3	420	Y	0.80	3.9					**17.7**
2-B	2-C	100	1.70	0.15	10.5					76	N	1.70	0.6	345	N	0.50	5.1					**16.2**
2-C	2-D	100	2.10	0.15	9.7					46	N	2.10	0.3	213	N	1.40	1.9					**11.9**
2-D	2-E	100	1.80	0.15	10.3					70	N	1.80	0.5	113	N	2.70	0.7					**11.6**
3-A	3-B	100	1.30	0.15	11.7					470	N	1.30	4.3	441	N	0.80	5.1	329.0	N	0.9	3.6	**24.7**
3-C	3-D	100	1.10	0.15	12.5					905	N	1.10	8.9	327	N	0.90	3.6	288.0	N	0.1	9.4	**34.5**
3-D	3-E	100	2.00	0.15	9.9					42	N	2.00	0.3									**10.2**
3-B	3-F	100	2.60	0.15	8.9					52	N	2.60	0.3	315	N	0.80	3.6					**12.9**
7a-A	7a-B	100	2.30	0.15	9.3					43	Y	2.30	0.2	925	Y	1.60	6.0					**15.6**
7a-B	7a-C	100	1.90	0.15	10.1					211	N	1.90	1.6	95	Y	1.70	0.6	324.0	Y	1.7	2.0	**14.3**
7a-C	7a-D	100	1.80	0.15	10.3					297	N	1.80	2.3	326	Y	1.50	2.2					**14.8**
7b-A	7b-B	100	0.90	0.15	13.6					160	Y	0.90	1.4	504	Y	1.20	3.8					**18.8**
7b-B	7b-C	100	1.00	0.15	13.0					168	N	1.00	1.7	289	Y	0.80	2.7	326.0	Y	1.5	2.2	**19.6**
7b-C	7b-D	100	1.80	0.15	10.3					184	N	1.80	1.4	167	Y	1.40	1.2	324.0	Y	1.3	2.3	**15.2**
7b-D	7b-E	100	2.60	0.15	8.9					235	N	2.60	1.5	243	Y	1.60	1.6	328.0	Y	1.5	2.2	**14.2**
7b-E	7b-F	100	2.60	0.15	8.9					100	N	2.60	0.6	383	Y	1.50	2.6	325.0	Y	1.0	2.7	**14.8**

HWC ENGINEERING

City of Linton

Greene County, Indiana

Stormwater System Improvements

Storm Structure Design

Calculated Using Manning's Equation

Manning's Equation: $Q_{full} = 1.49/n \cdot A \cdot R_h^{2/3} \cdot S^{1/2}$ Designer(s): BASH

Design Return Period: 10 yr. Date: July-16

Structure Up	Structure Down	Q_{peak} [cfs]	Pipe Length [ft]	Pipe Slope [%]	Pipe Size [in]	Pipe Material	Mannings n	Invert Out [ft]	Invert In [ft]	Q_{full} [cfs]	V_{full} [fps]	V_{peak} [fps]	Pipe Flow Time, t_f [min]	Top of Casting [ft]	Approx. Cover Up [ft]
1-A	1-B	10.05	341	0.50	24	RCP	0.013			16.04	5.11	5.36	1.1		
1-B	1-C	20.04	346	0.50	30	RCP	0.013			29.08	5.92	6.35	0.9		
1-C	1-D	35.47	345	0.50	36	RCP	0.013			47.29	6.69	7.29	0.8		
1-D	1-E	48.52	148	0.50	36	RCP	0.013			47.29 X	6.69	7.89	0.3		
2-A	2-B	8.74	307	1.50	18	RCP	0.013			12.90	7.30	7.80	0.7		
2-B	2-C	17.58	645	1.50	24	RCP	0.013			27.78	8.84	9.31	1.2		
2-C	2-D	22.57	303	1.50	24	RCP	0.013			27.78	8.84	9.82	0.5		
2-D	2-E	26.98													
3-A	3-B	12.71	80	1.50	18	RCP	0.013			12.90	7.30	8.38	0.2		
3-C	3-D	2.65	60	1.50	12	RCP	0.013			4.38	5.57	5.81	0.2		
3-D	3-E	3.36	80	1.50	24	RCP	0.013			27.78	8.84	5.95	0.2		
3-B	3-F	16.87	50	1.50	30	RCP	0.013			50.37	10.26 X	9.16	0.1		
7a-A	7a-B	20.40	876	1.50	24	RCP	0.013			27.78	8.84	9.60	1.5		
7a-B	7a-C	35.21	651	1.50	30	RCP	0.013			50.37	10.26 X	11.03	1.0		
7a-C	7a-D	53.18	649	1.50	30	RCP	0.013			50.37 X	10.26 X	12.46	0.9		
7b-A	7b-B	24.68	698	1.50	24	RCP	0.013			27.78	8.84	10.02	1.2		
7b-B	7b-C	40.72	648	1.50	30	RCP	0.013			50.37	10.26 X	11.37	0.9		
7b-C	7b-D	56.20	653	1.50	36	RCP	0.013			81.91	11.59 X	12.41	0.9		
7b-D	7b-E	71.18	650	1.50	36	RCP	0.013			81.91	11.59 X	13.08	0.8		
7b-E	7b-F	86.22	200	1.50	42	RCP	0.013			123.55	12.84 X	13.80	0.2		

HWC ENGINEERING

Detention Pond Grading

for the

Stormwater System Improvements

for

City of Linton

Greene County, Indiana

Appendix B

Prepared by:

HWC ENGINEERING

135 N. Pennsylvania St. Suite 2800
Indianapolis, IN 46204
Phone: (317) 347-3663
Fax: (317) 347-3664

DETENTION VOLUME APPROXIMATION USING THE HYDROGRAPH METHOD

Project: Linton Stormwater PER

Basin ID:

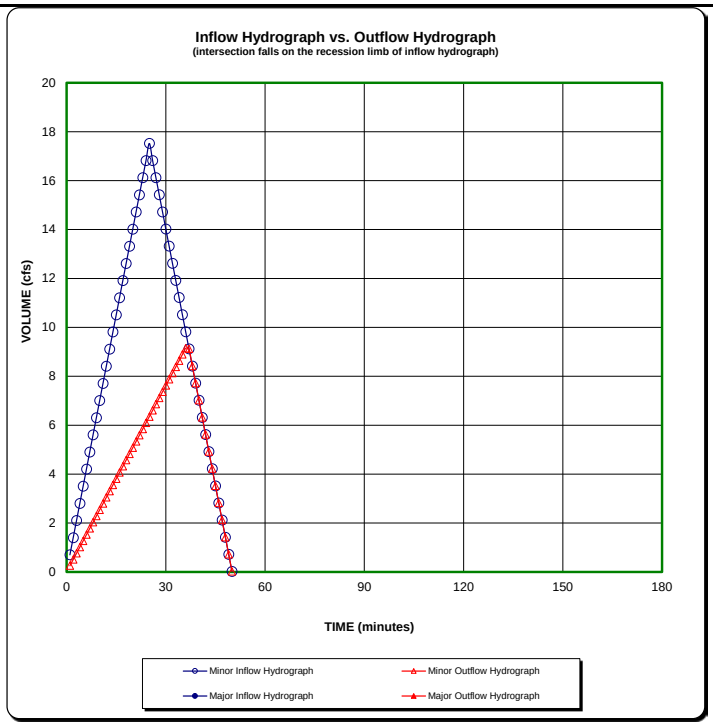
Design Information (Input): MINOR

Max. Allowable Peak Outflow	Qp-out =	12.70	cfs
Time to Peak Outflow	Tp-out =	50.00	minutes

Minor Storage Volume (cubic ft.): **12,306**

Minor Storage Volume (acre-ft.): **0.283**

1	MINOR (e.g. 2-, 5-, OR 10-year) EVENT			
Time	Inflow hydrograph	**Outflow** Rising Hy	Increm. Volume	**Storage** Volume
minutes (input)	cfs (input)	cfs (output)	acre-ft (output)	acre-ft (output)
		0.00	0.000	0.000
1.0	0.70	0.25	0.001	0.001
2.0	1.40	0.51	0.001	0.002
3.0	2.10	0.76	0.002	0.004
4.0	2.80	1.02	0.002	0.006
5.0	3.50	1.27	0.003	0.009
6.0	4.20	1.52	0.004	0.013
7.0	4.91	1.78	0.004	0.017
8.0	5.61	2.03	0.005	0.022
9.0	6.31	2.29	0.006	0.028
10.0	7.01	2.54	0.006	0.034
11.0	7.71	2.79	0.007	0.041
12.0	8.41	3.05	0.007	0.048
13.0	9.11	3.30	0.008	0.056
14.0	9.81	3.56	0.009	0.065
15.0	10.51	3.81	0.009	0.074
16.0	11.21	4.06	0.010	0.084
17.0	11.91	4.32	0.010	0.094
18.0	12.61	4.57	0.011	0.105
19.0	13.32	4.83	0.012	0.117
20.0	14.02	5.08	0.012	0.129
21.0	14.72	5.33	0.013	0.142
22.0	15.42	5.59	0.014	0.156
23.0	16.12	5.84	0.014	0.170
24.0	16.82	6.10	0.015	0.185
25.0	17.52	6.35	0.015	0.200
26.0	16.82	6.60	0.014	0.214
27.0	16.12	6.86	0.013	0.227
28.0	15.42	7.11	0.011	0.238
29.0	14.72	7.37	0.010	0.248
30.0	14.02	7.62	0.009	0.257
31.0	13.32	7.87	0.008	0.265
32.0	12.62	8.13	0.006	0.271
33.0	11.92	8.38	0.005	0.276
34.0	11.22	8.64	0.004	0.279
35.0	10.52	8.89	0.002	0.282
36.0	9.82	9.14	0.001	0.283
37.0	9.12	9.12	0.000	0.283
38.0	8.42	8.42	0.000	0.283
39.0	7.72	7.72	0.000	0.283
40.0	7.02	7.02	0.000	0.283
41.0	6.32	6.32	0.000	0.283
42.0	5.62	5.62	0.000	0.283
43.0	4.92	4.92	0.000	0.283
44.0	4.22	4.22	0.000	0.283
45.0	3.52	3.52	0.000	0.283
46.0	2.82	2.82	0.000	0.283
47.0	2.12	2.12	0.000	0.283
48.0	1.42	1.42	0.000	0.283
49.0	0.72	0.72	0.000	0.283
50.0	0.02	0.02	0.000	0.283



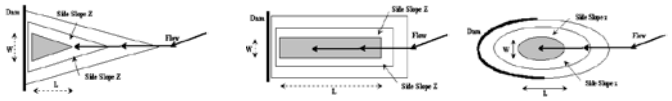
NOTE: THIS IS A FIRST APPROXIMATION ONLY

HWC ENGINEERING

Pond

STAGE-STORAGE SIZING FOR POLYGONAL, ELLIPTICAL, OR IRREGULAR PONDS

Project: Linton Stormwater PER
Basin ID:



Design Information (Input):

Width of Pond Bottom, W =	31.44	ft
Length of Pond Bottom, L =	47.16	ft
Dam Side-slope (H:V), Z_a =	4.00	ft/ft

Check Pond Shape

Right Triangle		OR...
Isosceles Triangle		OR...
Rectangle	X	OR...
Circle / Ellipse		OR...
Irregular		(Use Overide values in cells G32:G52)

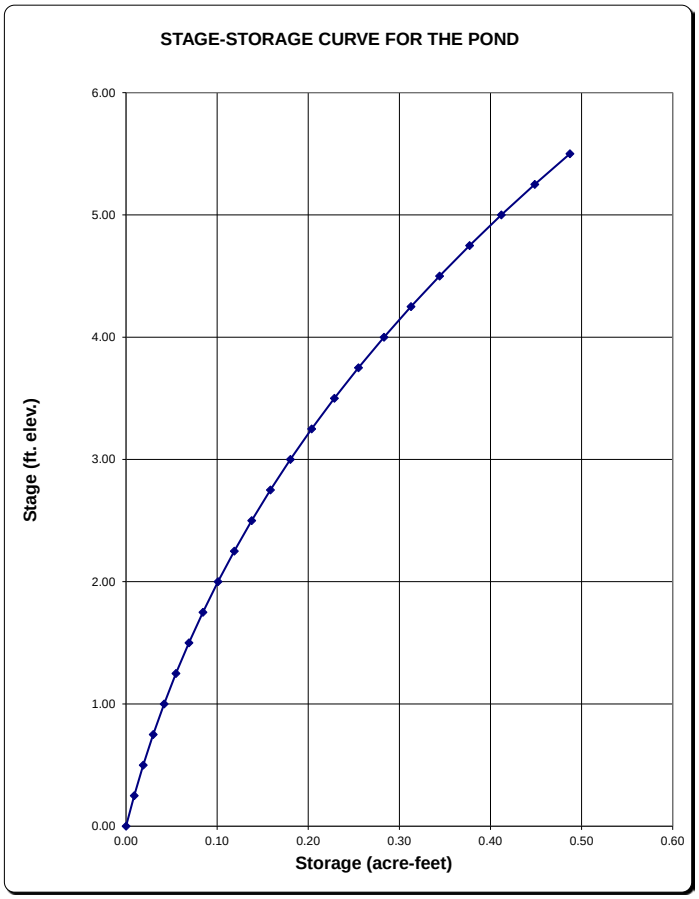
Stage-Storage Relationship:

	MINOR	MAJOR	
Storage Requirement from Sheet 'Modified FAA':			acre-ft.
Storage Requirement from Sheet 'Hydrograph':	0.283		acre-ft.
Storage Requirement from Sheet 'Full-Spectrum':			acre-ft.

Labels for WQCV, Minor, & Major Storage Stages (input)	Stage ft (input)	Side Slope (H:V) ft/ft Below El.	Pond Width at Stage ft (output)	Pond Length at Stage ft (output)	Surface Area at Stage ft^2 (output)	Surface Area at Stage ft^2 User Overide	Volume Below Stage ft^3 (output)	Surface Area at Stage acres (output)	Volume Below Stage acre-ft (output)	Target Volumes for WQCV, Minor, & Major Storage Volumes (for goal seek)
	0.00	(input)	31.44	47.16	1,482.8			0.034	0.000	
	0.25	4.00	33.44	49.16	1,644.0		391	0.038	0.009	
	0.50	4.00	35.44	51.16	1,813.3		823	0.042	0.019	
	0.75	4.00	37.44	53.16	1,990.5		1,298	0.046	0.030	
	1.00	4.00	39.44	55.16	2,175.7		1,819	0.050	0.042	
	1.25	4.00	41.44	57.16	2,368.9		2,387	0.054	0.055	
	1.50	4.00	43.44	59.16	2,570.1		3,005	0.059	0.069	
	1.75	4.00	45.44	61.16	2,779.3		3,673	0.064	0.084	
	2.00	4.00	47.44	63.16	2,996.5		4,395	0.069	0.101	
	2.25	4.00	49.44	65.16	3,221.7		5,173	0.074	0.119	
	2.50	4.00	51.44	67.16	3,454.9		6,007	0.079	0.138	
	2.75	4.00	53.44	69.16	3,696.1		6,901	0.085	0.158	
	3.00	4.00	55.44	71.16	3,945.3		7,856	0.091	0.180	
	3.25	4.00	57.44	73.16	4,202.5		8,875	0.096	0.204	
	3.50	4.00	59.44	75.16	4,467.7		9,959	0.103	0.229	
	3.75	4.00	61.44	77.16	4,740.9		11,110	0.109	0.255	
	4.00	4.00	63.44	79.16	5,022.1		12,330	0.115	0.283	

STAGE-STORAGE SIZING FOR POLYGONAL, ELLIPTICAL, OR IRREGULAR PONDS

Project:
Basin ID:

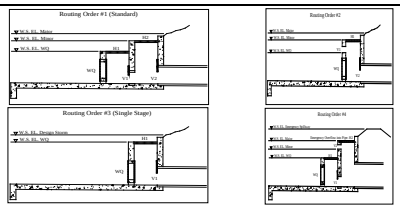


HWC ENGINEERING

Outlet

STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: Linton Stormwater PER
Basin ID:



Current Routing Order is #2

Design Information (Input):

			#1 Horiz.	#2 Horiz.	#1 Vert.	
Circular Opening:	Diameter in Inches	Dia. =			15.00	inches
OR						
Rectangular Opening:	Width in Feet	W =				ft.
	Length (Height for Vertical)	L or H =				ft.
	Percentage of Open Area After Trash Rack Reduction	% open =			100	%
	Orifice Coefficient	C_o =			0.60	
	Weir Coefficient	C_w =				
	Orifice Elevation (Bottom for Vertical)	E_o =			0.00	ft.

Calculation of Collection Capacity:

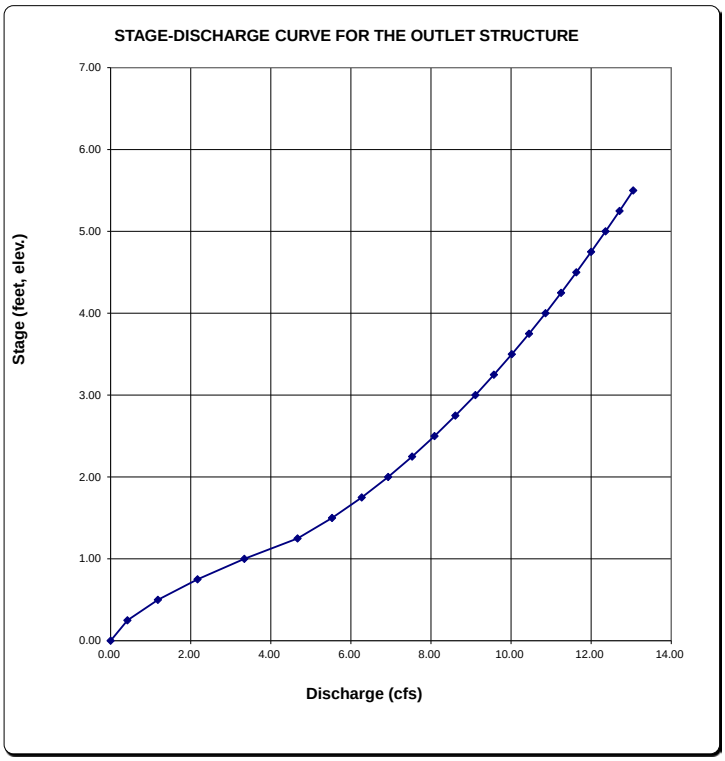
Net Opening Area (after Trash Rack Reduction)	A_o =			1.23	sq. ft.
OPTIONAL: User-Overide Net Opening Area	A_o =				sq. ft.
Perimeter as Weir Length	L_w =				
OPTIONAL: User-Overide Weir Length	L_w =				
Top Elevation of Vertical Orifice Opening, Top =				1.25	ft.
Center Elevation of Vertical Orifice Opening, Cen =				0.63	ft.

Routing 2: Water flows through WQCV plate and #1 vertical opening and #1 horizontal opening into #2 vertical opening (#2 horizontal opening is not used).

			Horizontal Orifices				Vertical Orifices		
Labels for WQCV, Minor, & Major Storage W.S. Elevations (input)	Water Surface Elevation ft (linked)	WQCV Plate/Riser Flow cfs (User-linked)	#1 Horiz. Weir Flow cfs (output)	#1 Horiz. Orifice Flow cfs (output)	#2 Horiz. Weir Flow cfs (output)	#2 Horiz. Orifice Flow cfs (output)	#1 Vert. Collection Capacity cfs (output)	**Total Collection Capacity cfs (output)**	Target Volumes for WQCV, Minor, & Major Storage Volumes (link for goal seek)
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	
	0.25	0.00	0.00	0.00	0.00	0.00	0.42	**0.42**	
	0.50	0.00	0.00	0.00	0.00	0.00	1.18	**1.18**	
	0.75	0.00	0.00	0.00	0.00	0.00	2.17	**2.17**	
	1.00	0.00	0.00	0.00	0.00	0.00	3.34	**3.34**	
	1.25	0.00	0.00	0.00	0.00	0.00	4.67	**4.67**	
	1.50	0.00	0.00	0.00	0.00	0.00	5.53	**5.53**	
	1.75	0.00	0.00	0.00	0.00	0.00	6.27	**6.27**	
	2.00	0.00	0.00	0.00	0.00	0.00	6.93	**6.93**	
	2.25	0.00	0.00	0.00	0.00	0.00	7.53	**7.53**	
	2.50	0.00	0.00	0.00	0.00	0.00	8.09	**8.09**	
	2.75	0.00	0.00	0.00	0.00	0.00	8.61	**8.61**	
	3.00	0.00	0.00	0.00	0.00	0.00	9.11	**9.11**	
	3.25	0.00	0.00	0.00	0.00	0.00	9.57	**9.57**	
	3.50	0.00	0.00	0.00	0.00	0.00	10.02	**10.02**	
	3.75	0.00	0.00	0.00	0.00	0.00	10.45	**10.45**	
	4.00	0.00	0.00	0.00	0.00	0.00	10.86	**10.86**	

STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: Linton Stormwater PER
Basin ID:



HWC ENGINEERING

Photos and Descriptions

for the

Stormwater System Improvements

for

City of Linton

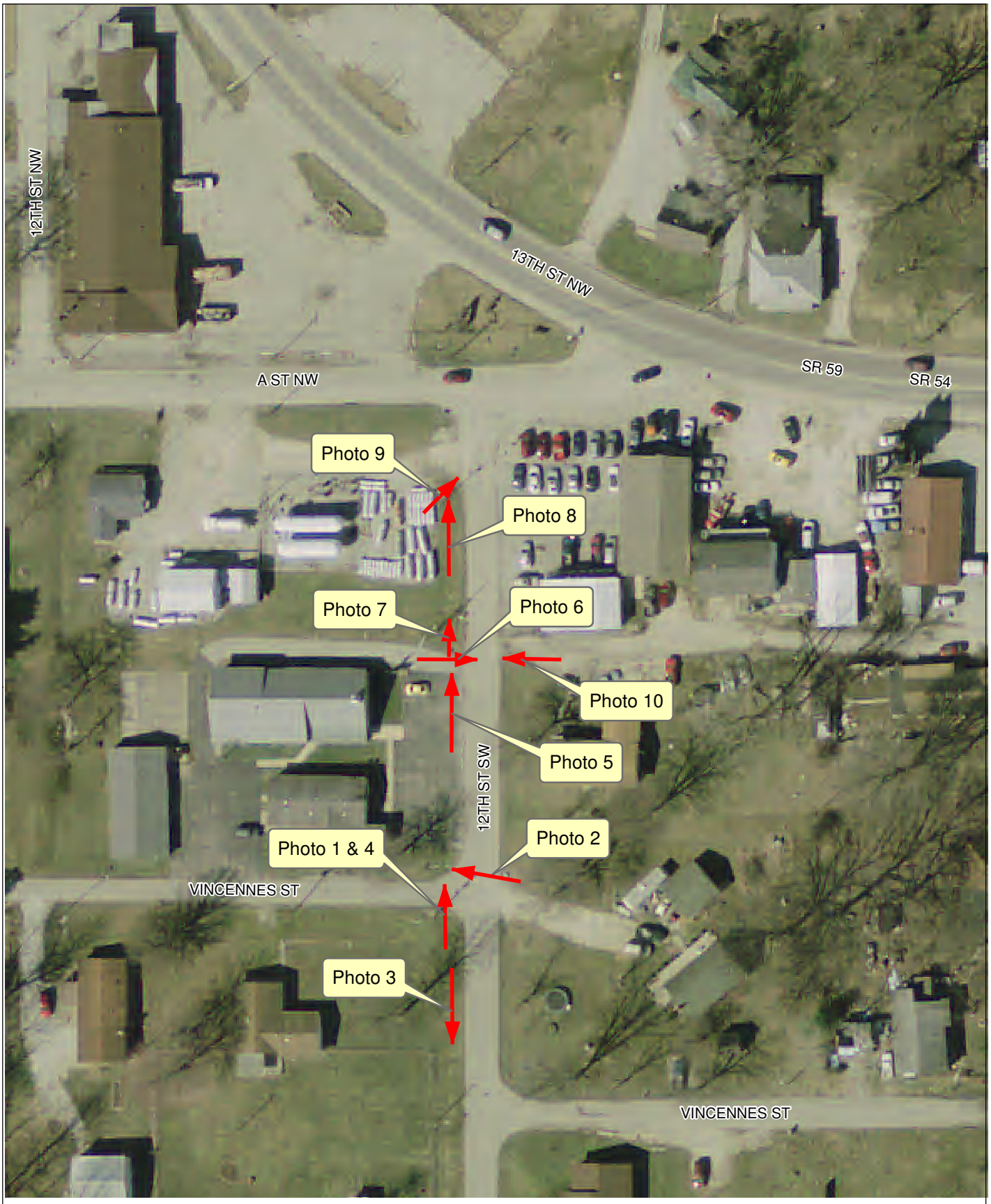
Greene County, Indiana

Appendix C

Prepared by:

HWC ENGINEERING

135 N. Pennsylvania St. Suite 2800
Indianapolis, IN 46204
Phone: (317) 347-3663
Fax: (317) 347-3664



N

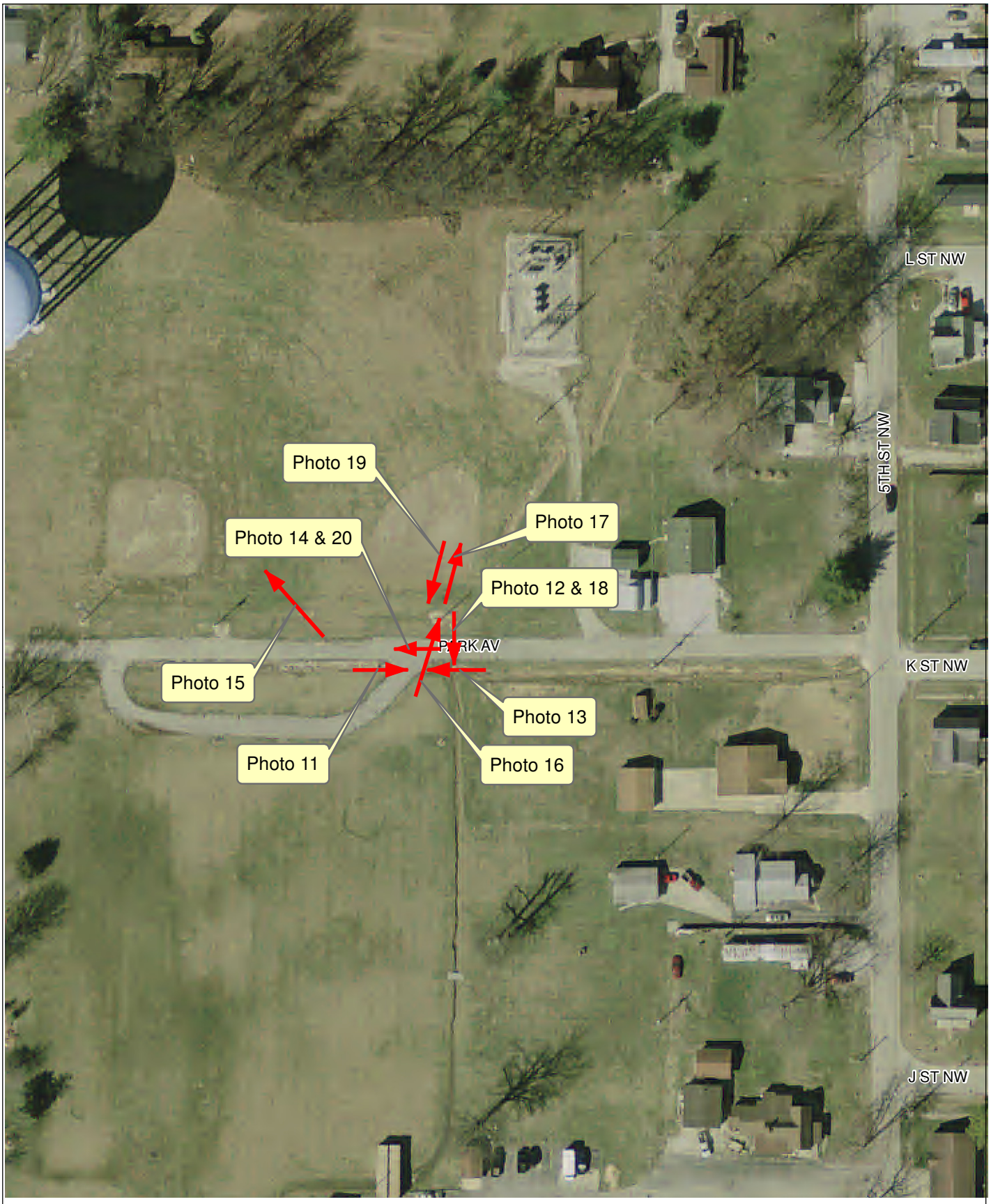
Graphic Scale (Feet)

0 80 160

1 inch = 80 feet

Stormwater Drainage Master Plan
Photo Orientation Map
Linton, Indiana
June 2016

HWC ENGINEERING



N

Graphic Scale (Feet)

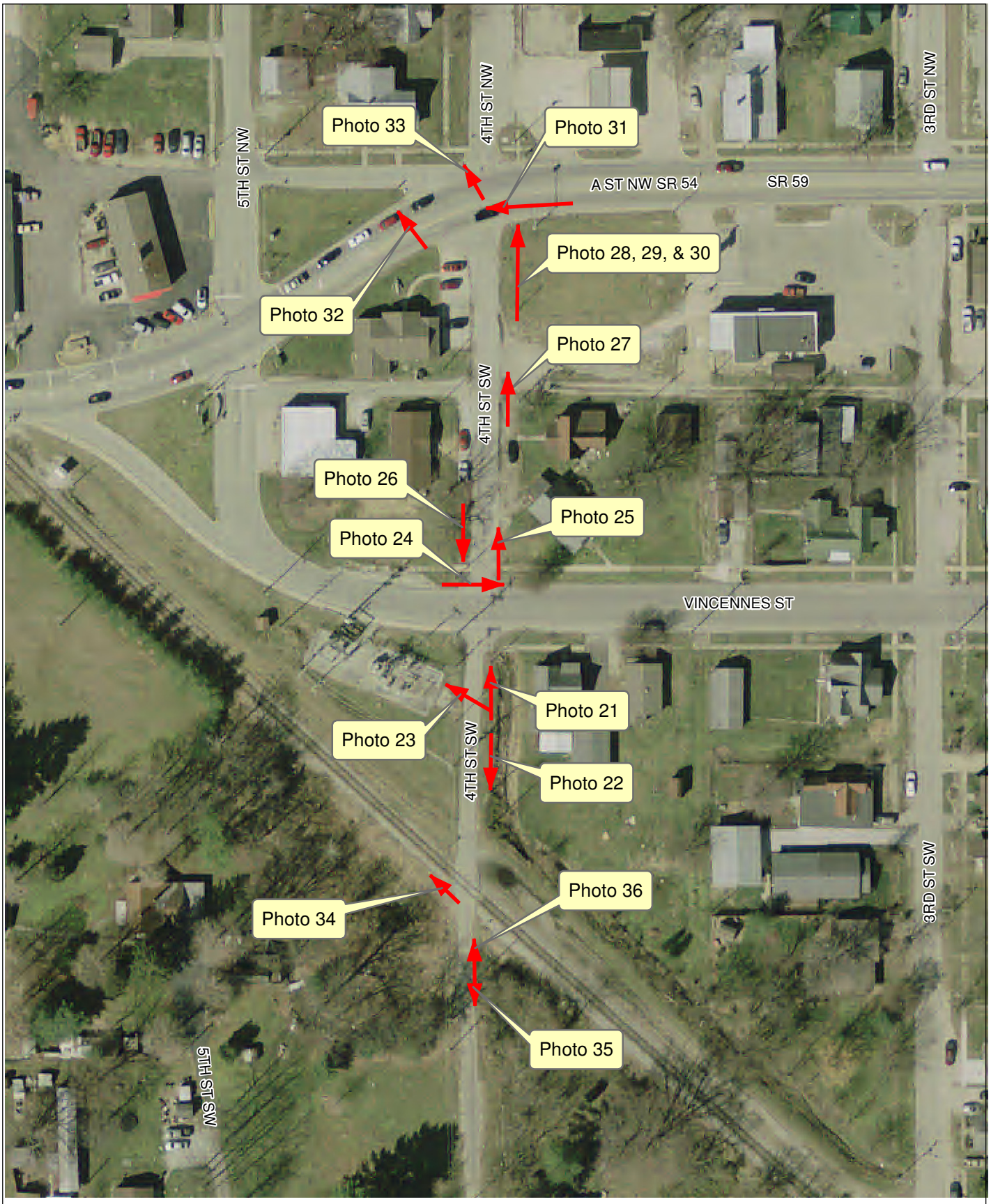
0 100 200

1 inch = 100 feet

Stormwater Drainage Master Plan
Photo Orientation Map

Linton, Indiana
June 2016

HWC ENGINEERING



N

Graphic Scale (Feet)

0 100 200

1 inch = 100 feet

Stormwater Drainage Master Plan
Photo Orientation Map
Linton, Indiana
June 2016

HWC ENGINEERING

Photo 1) Looking north from the northwest corner of Vincennes Street and 12th Street SW.

Photo 2) Looking northwest from the northwest corner of Vincennes Street and 12th Street SW.

Photo 3) Looking South along the west side of 12th Street SW from just south of Vincennes Street.

Photo 4) Looking north from the southwest corner of Vincennes Street and 12th Street SW.

Photo 5) Looking north along west side of 12th Street SW from just north of Vincennes Street.

Photo 6) Looking east at an alley crossing 12th Street SW between A Street NW and Vincennes Street.

Photo 7) Looking north along the west side of 12th Street SW from the alley between A Street NW and Vincennes Street.

Photo 8) Looking north along the west side of 12th Street from just south of A Street NW.

Photo 9) Looking northeast at the intersection of A Street NW and 12th Street SW.

Photo 10) Looking west at an alley crossing 12th Street SW between A Street NW and Vincennes Street.

Photo 11) Looking east along south side of Park Avenue just west of 5th Street SW.

Photo 12) Looking south along ditch flowing perpendicular to Park Ave just west of 5th Street NW.

Photo 13) Looking west at culvert crossing a drive along the south side of Park Avenue just west of 5th Street NW.

Photo 14) Looking west along Park Avenue from a drive just west of 5th Street NW.

Photo 15) Looking northwest at the elevated tank from the north side of Park Ave from just west of 5th Street NW.

Photo 16) Looking north at an inlet along the north side of Park Avenue just west of 5th Street NW.

Photo 17) Looking north at a substation from north side of Park Avenue just west of 5th Street NW.

Photo 18) Looking south at an inlet along the north side of Park Avenue just west of 5th Street NW.

Photo 19) Looking southwest at a drive along the south side of Park Avenue just west of 5th Street NW.

Photo 20) Looking west along the south side of Park Avenue from a drive just west of 5th Street NW.

Photo 21) Looking north along east side of 4th Street SW at the intersection of Vincennes Street.

Photo 22) Looking south along east side of 4th Street SW just south of Vincennes Street.

Photo 23) Looking northwest at a substation on the southwest corner of Vincennes Street and 4th Street SW.

Photo 24) Looking east along north side of Vincennes Street from the intersection with 4th Street SW.

Photo 25) Looking north along east side of 4th Street SW from the intersection with Vincennes Street.

Photo 26) Looking south at the intersection of Vincennes Street and 4th Street SW.

Photo 27) Looking north along the east side of 4th Street SW just south of the intersection with SR 54.

Photo 28) Looking north along the east side of 4th Street SW just south of the intersection with SR 54.

Photo 29) Looking north along the east side of 4th Street SW just south of the intersection with SR 54.

Photo 30) Looking north along the east side of 4th Street SW just south of the intersection with SR 54.

Photo 31) Looking northwest at the intersection of SR54 and 4th Street SW.

Photo 32) Looking northwest at the intersection of SR54 and 4th Street SW.

Photo 33) Looking northwest at the intersection of SR54 and 4th Street SW.

Photo 34) Looking northwest along the south side of railroad tracks at the crossing with 4th Street SW.

Photo 35) Looking south along the east side of 4th Street SW at the railroad crossing.

Photo 36) Looking north along the east side of 4th Street SW at the railroad crossing.