City of Tipton, IN Flood Resilience Plan

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City of Tipton

Flood Resilience Plan

Prepared for

City of Tipton
201 Main Street
Tipton, Indiana 46072

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Prepared by

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On behalf of

Indiana Silver Jackets

Through

FEMA RiskMAP Mitigation Grant

FEMA RiskMAP
Increasing Resilience Together

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The project was undertaken and completed by a team of professionals from Christopher B. Burke Engineering, LLC, including Siavash Beik, Sheila McKinley, and Matt Rummel. Dave Knipe of the IDNR and Matt Riggs of Polis Center also served on the project team. Their contributions and leadership is hereby acknowledged and appreciated.

Mayor Don Havens of the City of Tipton as well as representatives of the City, County, public, and private entities provided support and input throughout the preparation of this plan. Their crucial role in the discussion and vetting of the proposed strategies contained in this report and the expected future success of their implementation is hereby acknowledged and appreciated.

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Many communities in Indiana and across the United States have experienced damages from flooding. Despite the use of expensive, engineered solutions to reduce flooding risk such as elevating buildings and constructing levees, flood damage losses continue to increase. Moreover, climate change projections suggest that floods will intensify in most regions of the United States, especially in the Midwest and Northeast. These trends are creating a sense of urgency among communities to look for better ways to deal with flooding and build flood resilience, particularly in states like Indiana that are expected to experience increased flooding in the future. As used in this report, "flood resilience" means measures taken to reduce the vulnerability of communities to damage from flooding and to support recovery after an extreme flood.

This plan is a pilot effort in Indiana and Tipton was selected as the pilot community due to its significant vulnerability to flooding and flood-related losses during the most recent major flood in April 2013, the city leaders' willingness to explore new flood resiliency approaches, and the extensive previous flood risk management studies and plans that have been already developed for the Big Cicero Creek Watershed (in which the City of Tipton is located).

Overall flood resilience strategies were identified to improve resiliency citywide and within the planning jurisdiction. These include:

- Update floodplain regulations
- Adopt flood elevation data from updated flood studies
- Adopt a comprehensive stormwater ordinance and technical standards
- Update, integrate, and revise plans, policies and regulations
- Conduct regular audits of programs and policies
- Participate in the NFIP Community Rating System

Five distinct flood resilience planning areas were delineated and specific strategies targeted to improve resiliency in Tipton were identified for each. The following summarizes the planning areas and strategies:

1. River Corridor
    - Adopt a river corridor overlay zone and prohibit land disturbance in this zone
    - Protect undeveloped land in the river corridor
    - Minimize streambank erosion
2. Other High Flood Hazard Areas
    - Prohibit development in the floodway fringe (including critical facilities)
    - Protect undeveloped land in the floodway fringe
    - Adopt compensatory floodplain storage requirement (where placement of fill is unavoidable in this area and an official variance has been granted)
3. Vulnerable Settlements
    - Protect existing critical facilities
    - Buyout structures
    - Floodproof structure
    - Bring nonconforming uses into compliance
    - Create new flood storage capacity through redevelopment

- Require building expansion and new accessory structures to meet additional requirements
- Adopt a flood response plan
- Adopt post-flood damage assessment data collection and protocols
- Connect people to the river

4. Safer Areas
    - Steer public policy and investment to support development in safer areas
    - Promote conservation design
    - Promote placement of critical facilities in safer area
5. Watershed
    - Support the Big Cicero Creek Drainage Board recommendations (and implementation of the 2014 Big Cicero Plan)
    - Adopt a natural resource overlay zone

GLOSSARY OF KEY TERMS

Flood Insurance Rate Map (FIRM) – the official map of a community, on which FEMA has delineated both the areas of special flood hazard and the risk premium zones applicable to a community.

Floodway – the channel of a river or stream and those portions of the floodplains adjoining the channel which are reasonably required to efficiently carry and discharge the peak flood flow of the regulatory flood of any river or stream.

Floodway Fringe – the portion of the regulatory floodplain lying outside the floodway.

Fluvial Erosion Hazard (FEH) Area - the area of the stream and land adjacent to the stream where stream processes may occur that enable the stream to re-establish and maintain a stable slope and dimensions over time. FEH area boundaries attempt to capture lands most vulnerable to fluvial erosion in the near term and indicate the type, magnitude, and frequency of fluvial adjustments anticipated during flood events.

Special Flood Hazard Area (SFHA) – the land defined on the flood insurance rate map subject to inundation by the one percent annual chance or regulatory flood (also known as the 100-year flood). These areas are shown on the maps as Zone AE, AH, AO, A.

One Percent Annual Chance of Flooding – the flood that has a one percent chance of being equaled or exceeded in any given year. Any flood zone that begins with the letter A is subject to the one percent annual chance flood. Also referred to as the 100-year flood.

0.2% Annual Chance of Flooding – the flood that has a 0.2 percent chance of being equaled or exceeded in a given year. The area shown on the FIRM that is outside the SFHA and labeled Zone X (unshaded). Also referred to as the 500-year flood.

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CHAPTER 1 INTRODUCTION AND BACKGROUND

Many communities in Indiana and across the United States have experienced damages from flooding. Despite the use of expensive, engineered solutions to reduce flooding risk such as elevating buildings and constructing levees, flood damage losses continue to increase. Moreover, climate change projections suggest that floods will intensify in most regions of the United States, especially in the Midwest and Northeast. According to a 2014 National Climate Assessment report, the Midwest has experienced a greater increase in extreme precipitation over the past few decades than most other regions in the United States; between 1958 and 2012, the Midwest saw a 37% percent increase in the amount of precipitation falling in very heavy events. The frequency and intensity of heavy rainfall events in Midwest and Northeast is expected to continue to increase due to climate change, a trend that will almost certainly increase the risk of river-related flooding in this part of the country in the future.

Flood resilience is defined as measures taken to reduce the vulnerability of communities to damage from flooding and to support recovery after an extreme flood.

These trends are creating a sense of urgency among communities to look for better ways to deal with flooding and build flood resilience, particularly in states like Indiana that are expected to experience increased flooding in the future. As used in this report, flood resilience means measures taken to reduce the vulnerability of communities to damage from flooding and to support recovery after an extreme flood.

In 2014, the U.S. Environmental Protection Agency (EPA) Office of Sustainable Communities, in partnership with the Federal Emergency Management Agency (FEMA), published a report entitled: "Planning for Recovery and Long-Term Resilience in Vermont". This report, which includes Smart Growth approaches for disaster-resilient communities, describes a process through which communities in Vermont and elsewhere could use to achieve flood resiliency through auditing, updating, integrating, and revising their plans, policies, and regulations as well as adopting and implementing specific land use policies.

Recognizing the value of such an approach, the Indiana Department of Natural Resources (IDNR) requested and obtained funding from FEMA in 2015 to prepare, through a collaborative effort with Indiana Silver Jackets, a flood resilience plan that would follow this same approach for a community in Indiana as a pilot. The City of Tipton was chosen as the pilot community due to its significant vulnerability to flooding and flood-related losses during the most recent major flood in April 2013, the city leaders' willingness to explore new flood resiliency approaches, and the extensive previous flood risk management studies and plans that have been already developed for the Big Cicero Creek Watershed (in which the City of Tipton is located).

This flood resilience report, prepared by Christopher B. Burke Engineering, LLC (CBBEL), provides some background on the city, a summary of past flood studies, an overview of this planning process, a set of overall and geographically specific resilience strategies, and recommended implementation measures for the City of Tipton.

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CHAPTER 2 ABOUT THE CITY OF TIPTON

The City of Tipton is located in north central Indiana and serves as the county seat of Tipton County. This 2.8 square mile city promotes itself as a community "where its 5,000-plus residents relish their hometown's close-knit, friendly atmosphere, as well as its proximity to the large, metropolitan areas of Indianapolis, 30 minutes to the south, and Kokomo, 20 minutes to the north. Tipton is blessed with an abundance of virtues: a 30-acre park, a variety of sports venues, including an 18-hole municipal golf course, a family-owned movie theater, a modern public library, a winning school system, festivals, a community theater, a safe and secure environment, a state-of-the-art IU Health-run hospital, human infrastructure that strengthens the city's quality of life, a bustling Main Street, a supportive business outlook, and much more."

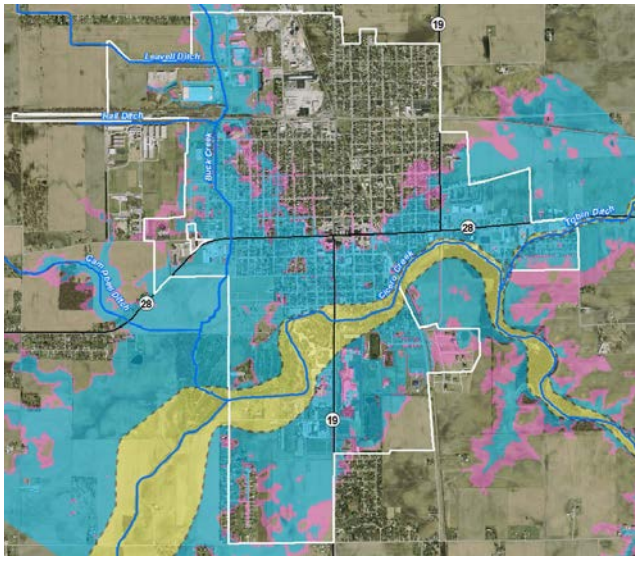

Figure 2-1 City of Tipton and SFHA

Maintaining a healthy population of residents and businesses is important to the social and economic stability of any community, and Tipton is no exception. This challenge is even greater for Tipton since over half of the city is located in a special flood hazard area (SFHA). As shown in ***Figure 2-1***, Big Cicero Creek enters the city from the southwest and meanders through the city before making a near 90-degree turn and flowing southeast out of the City of Tipton. Buck Creek enters the city from the north and stays along the west border before converging with Big Cicero Creek just southwest of the city limits. Two other smaller tributaries, Campbell Ditch and Tobin Ditch, also converge into the Big Cicero Creek. The geometry of these watercourses, along with low-lying elevations and eroding streambanks all contribute to the flooding problems present in the city.

Current land use in the Big Cicero and Buck Creek SFHAs is residential, light industrial, office, institutional, park/open space, and some agriculture. With the exception of Tipton City Park, Tipton Municipal Golf Course, and Fairview Cemetery, the developed areas of the SFHA are vulnerable to flooding and flood-related losses which could devastate the social and economic fabric of the City of Tipton.

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CHAPTER 3 SUMMARY OF FLOOD STUDIES IN TIPTON

The impetus for the preparation of this plan was the widespread flood-related damage that Tipton and the surrounding areas sustained during a heavy rainfall event in April of 2013, though losses from flooding have recurred decade after decade in Tipton.

The City of Tipton is located in the Big Cicero Creek watershed. This watershed can be divided into two sections or lobes that reflect different natural drainage characteristics. The west lobe has a drainage area of approximately 80 square miles. This area was historically very poorly drained and

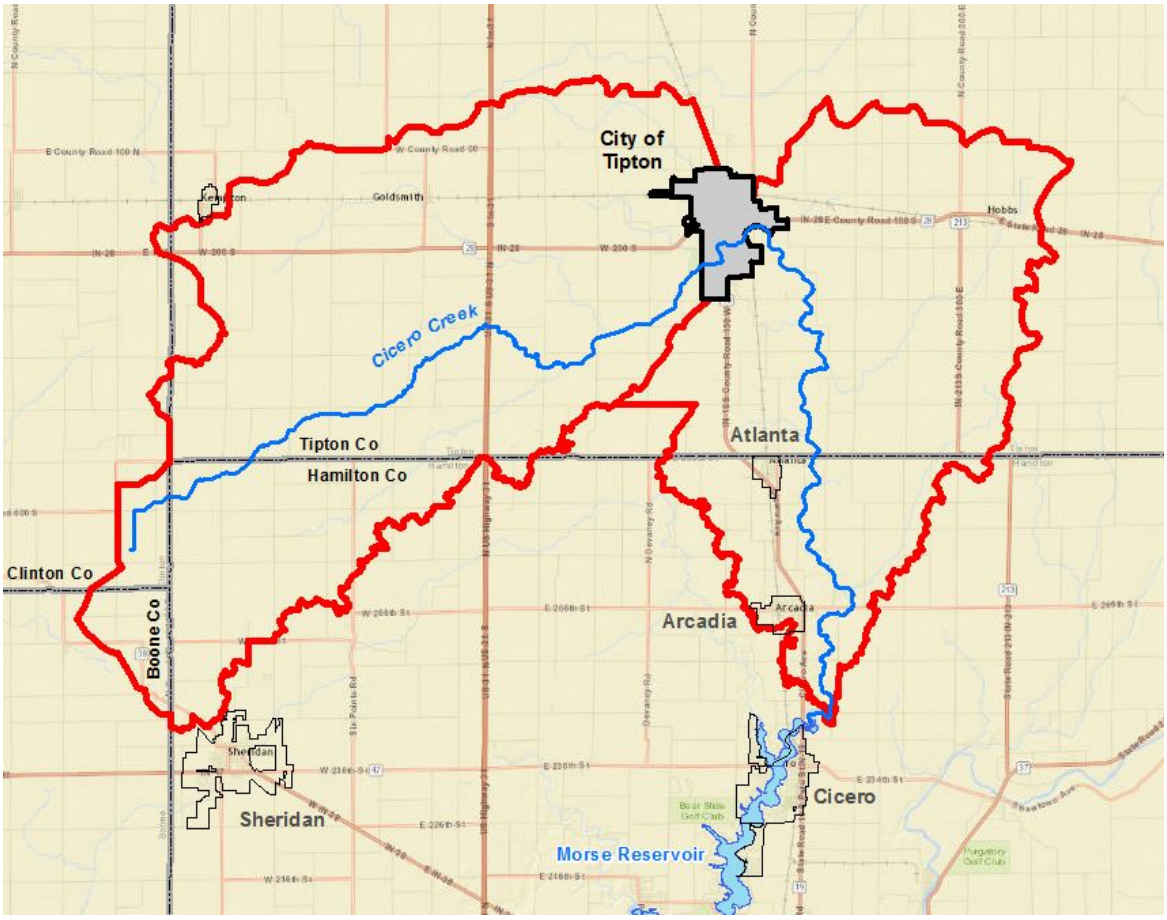

Figure 3-1 Big Cicero Creek Watershed

has been extensively modified to enhance drainage for agricultural use. The west lobe and the east lobe meet right in the City of Tipton as shown in ***Figure 3-1*** where Big Cicero Creek abruptly changes course and begins to flow straight south. The east lobe adds another 55 square miles of drainage area to the watershed by the time the creek reaches Morse Reservoir. The land use in the upper watershed in the west lobe is almost exclusively agricultural, and is primarily row crop. The east lobe is also primarily agricultural, but it has more residential areas, including the small towns of Atlanta and Arcadia. Atlanta and Arcadia are outside of the Big Cicero Creek floodplain. Historically, flooding often lasts up to several days at a time in the agricultural areas and backwater from Big Cicero Creek affects several residences along Buck Creek on the west side of Tipton. Flooding also occurs in the streets and roads in Tipton during heavy rainfall events.

A large concern is that the flooding could get worse. Seven of the top ten historical crests for Big Cicero Creek at Tipton have occurred since 2000. The largest impact may be from the increase in heavy rainfall. As noted earlier, the 2014 National Climate Assessment shows that in the Midwest areas, the heaviest 1% of all daily rainfalls has increased by 37% from 1958 to 2012, and that trend is predicted to continue. The effects of that increase in heavy rainfall can also be seen in changing farm practices such as converting tiles to open ditches, and the continued draining of depressional areas. These drainage modifications may also contribute to increased stream flow and flooding, but likely not to the degree that increased rainfall will. While elimination of flooding may not be a near term possibility, there are ways, including non-structural alternatives, to at least prevent it from becoming worse and also increase the communities' resiliency to flooding.

The following summarizes the recent flood studies in Tipton and the Big Cicero Creek Watershed.

3.1 BIG CICERO CREEK FLOOD CONTROL STUDY (2006)

In 2006, a Big Cicero Creek Flood Control Study was prepared by CBBEL for the Big Cicero Creek Joint Drainage Board; this study focused on analyzing the amount of flow in Big Cicero Creek, identifying the existing flooding problems, and using the analysis to recommend ways to eliminate flooding in Tipton and reduce flood duration of agricultural land in areas southwest of the City. The major recommendations of the study included:

- Extending the hydraulic modeling and mapping downstream through Hamilton County to better define the flood risk areas and also be able to evaluate the impacts of upstream flood control projects on downstream reaches;
- A channel improvement project along a reach of Cicero Creek to somewhat reduce the extent and duration of flooding at an estimated cost of $3 million (although this project did not meet the technical criteria set for the project, the Board agreed it was the only cost-effective solution with a reasonable chance of getting funded);
- Amending existing floodplain and stormwater ordinances to include "no net loss floodplain storage" and updated on-site detention requirements to prevent increase in potential flooding caused by new development; and
- Additional funding towards existing and proposed USGS stream gages.

Subsequent to the 2006 study findings, the Board initiated implementation of those study recommendations. Hydraulic modeling and mapping were extended down to Morse Reservoir and provided to IDNR for use in updating the Flood Insurance Study to more accurately represent risks. An updated stormwater management ordinance along with technical stormwater standards were developed and adopted by the Board. The Board began to fund and has continued to fund a USGS stream gage at Tipton. And lastly, design plans were prepared for the channel improvement projects. However, the Board was unable to secure additional funding for construction of the channel improvement project, primarily because City residents objected to aspects of the assessment strategy, maintaining that the degree of flood relief did not adequately address the flooding concerns within the City.

3.2 BIG CICERO CREEK BYPASS STUDY (2014)

In April 2013 a major storm delivered an average of 4.5 inches of rainfall across the Big Cicero Creek watershed. Major flooding and some erosion along Big Cicero Creek in Tipton and surrounding

agricultural areas resulted and affected some of the city's critical infrastructure (***Figure 3-2***). Tipton reported $2.5 Million in damages, primarily in the low-lying residential areas in the southwestern corner of the city between 1st and 4th Streets.

Seeking to address the observed flooding in the city with a major flood control project, assuming that additional funding could be obtained from outside interests, the Mayor of Tipton requested that the Drainage Board initiate a study to evaluate the impacts and refined cost estimates associated with a proposed plan to bypass high flows around Tipton. This alternative had been considered as part of the 2006 study and found to have technical effectiveness. However, it had not been recommended at the time due to the high cost associated with the plan. This study was undertaken by CBBEL and the results provided to the Board in November 2013. The study concluded that the proposed project could provide flood relief in Tipton, but at a cost of about $30 million. Not included in that value was the additional cost of offsetting negative impacts requiring mitigation in the stream reach downstream of the bypass channel reconnection to Big Cicero Creek.

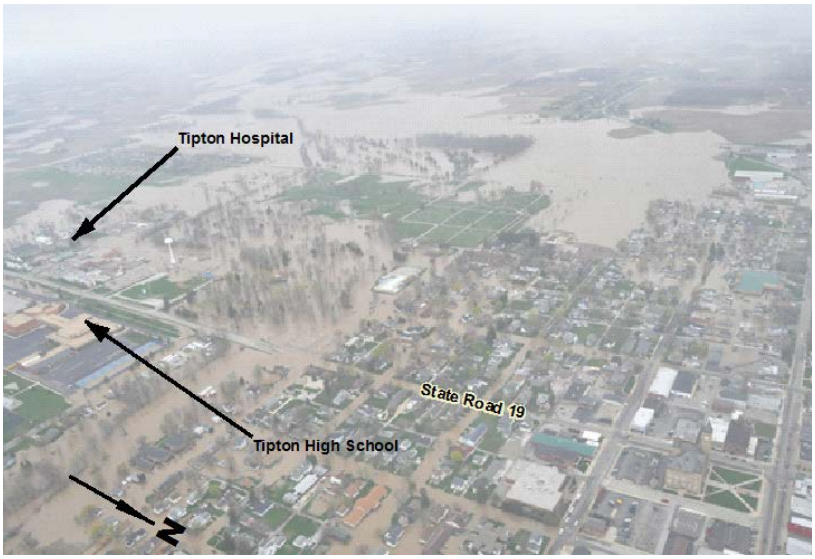

Figure 3-2 Aerial view of Tipton during the April 2013 flood

3.3 BIG CICERO CREEK WATERSHED FLOOD AND EROSION RISK MANAGEMENT PLAN (2014)

Since large scale projects to essentially eliminate flooding in Tipton have been found to be extremely expensive and create negative downstream impacts, the Board requested CBBEL investigate a number of smaller scale practices that could at least reduce the risk of increased flooding and erosion issues. In 2014, CBBEL prepared the Big Cicero Creek Watershed Flood and Erosion Risk Management Plan. As part of this study, CBBEL was able to recalibrate the 100 and 500 year floodplain boundaries based on better data from USGS and actual high water marks from the 2013 flood. In several places, this recalibrated model resulted in a more expansive floodplain than the effective FIRM but more closely resembled the areas affected by the 2013 flood. While this recalibrated map is not an official flood map, it illustrates the potential extent of flooding and provides an excellent foundation for mitigation and planning purposes.

The recommendations from this integrated watershed flood and erosion risk management plan included the following:

- Initiate an update to existing stormwater ordinances and technical standards to ensure preservation of upstream floodplain storage (in both urban and agricultural areas), institute requirements for channel protection volume, and promote LID and green infrastructure in urban areas.

- Promote and incentivize use of cover crops or other soil health practices by farmers to provide additional flood storage within the watershed.
- Construct a 2-stage ditch/channel improvement along the lower reach of Buck Creek and the reach of Big Cicero Creek through Tipton to stabilize erosion and sedimentation and also to partially compensate for the impacts of climate change and/or agricultural practices.
- Develop a Flood Resilience Plan and implement flood resiliency measures in Tipton. Recommended measures include buyout and floodproofing of at-risk homes, individual perimeter protection of major critical facilities, establishment of flood-safe routes, and preparation of a Flood Response Plan.
- Maintain and upgrade existing USGS stream gages to have the capability of continuous sediment and water quality monitoring
- Conduct additional flood risk determination studies along Prairie Ditch and Tobin Ditch.
- Establish and adhere to best maintenance practices along open channels to minimize and manage stream bank erosion issues, looking at each situation individually in order to take measures that address the real reason for the erosion at that location.

The City of Tipton Flood Resilience Plan (this plan) is intended as the necessary first step to implement the Big Cicero Creek Watershed Flood and Erosion Risk Management Plan recommendations for the City of Tipton.

3.4 FLOOD DEPTH MAPPING AND CRITICAL FACILITIES (2016)

To illustrate the impact of flooding from Buck Creek and Big Cicero Creek in the City of Tipton, CBBEL created flood depth maps. **Exhibit 1** through **Exhibit 5** show detailed flood depth mapping for expected extent of flooding of various frequencies/severities in Tipton. Of particular interest are the critical facilities that are at-risk from flooding. Critical facilities are structures that are vital to the community's ability to provide essential services and protect life and property, are critical to the community's response and recovery activities, and/or are the facilities the loss of which would have a severe or catastrophic impact. In Tipton, the critical facilities in the SFHA include the Tipton High School, Tipton Middle School, IU Health Tipton Hospital, Millers Merry Manor, Tipton County Library, Wastewater Treatment Plant, Tipton County Sheriff's Office, Cicero Township Fire Department, and Tipton Fire Department. These critical facilities and access to/from them are vulnerable to flooding.

CHAPTER 4 OVERVIEW OF THE PLANNING PROCESS

The planning process for the City of Tipton Flood Resilience Plan began in July 2015 and wrapped up 10 months later in April 2016. The following sections provide an overview of the major planning steps. These include the review and consolidation of available flood-related data, engaging key stakeholders in the decision-making process, and identifying flood resilient strategies for the City of Tipton.

4.1 REVIEW AND CONSOLIDATION OF FLOOD-RELATED DATA

CBBEL reviewed available flood data, studies, and maps as well as planning documents, development codes, and stormwater and flood hazard ordinances to identify opportunities to incorporate/enhance flood resilient strategies into the city's policies, programs, and projects. The following lists the materials that were reviewed:

- Federal Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) (2014)
- Big Cicero Creek Flood Control Study (2006)
- Big Cicero Creek Bypass Study (2014)
- Big Cicero Creek Watershed Flood and Erosion Risk Management Plan (2014)
- Tipton County Multi-Hazard Mitigation Plan (2015)
- City of Tipton Comprehensive Plan (2012)
- City of Tipton Zoning Ordinance (2010)
- City of Tipton Subdivision Control Ordinances (2000)

4.2 MEETINGS WITH STAKEHOLDERS

In August of 2015, CBBEL met with local officials to introduce the purpose of the plan and to discuss strategies and actions that would help make Tipton become a more flood resilient community. Although the flooding problems in and around the city have been well documented, revisiting such events allowed the group to openly discuss successes and failures that have occurred with past flood events.

At this initial meeting, CBBEL lead the group through a modified version of EPA's Flood Resilience Checklist. This checklist asks a series of yes or no questions to assess the strengths and weaknesses of current policies and procedures related to flooding. As intended, much discussion was generated by each of the questions including where policies, programs, and projects could be added or enhanced as well as development trends and potential areas of expansion in the city. **Appendix A** includes the completed checklist and the list the meeting participants.

CBBEL convened the same group of local officials in March 2016 to present several strategies to improve flood resiliency. At this meeting participants reviewed the flood resilience planning areas, strategies to achieve resilience within each area, and the associated mechanism for successful implementation. A summary of the discussion and list of persons who attended the March meeting is also provided in **Appendix A**.

CBBEL staff also met with several stakeholders throughout the planning process to discuss how the proposed recommendations may affect various assets within Tipton.

4.3 DEVELOP FLOOD RESILIENCE PLANNING AREAS AND STRATEGIES

As noted earlier, EPA Office of Sustainable Communities, in partnership with the Federal Emergency Management Agency (FEMA), published a report in 2014 entitled: "Planning for Recovery and Long-Term Resilience in Vermont". This report, which includes Smart Growth approaches for disaster-resilient communities, describes a process through which communities in Vermont and elsewhere could use to achieve flood resiliency through auditing, updating, integrating, and revising their plans, policies, and regulations as well as adopting and implementing specific land use policies.

CBBEL modified the approach and strategies used in the EPA study to better suit Indiana communities. ***Table 4-1*** lists the different flood resilience planning areas, the boundary it's defined by, and the intent of the strategies for each area. ***Figure 4-1*** is a graphical representation of these areas. The area boundaries are based off the recalibrated flood map that was prepared as part of the 2014 Big Cicero Creek Watershed Flood and Erosion Risk Management Plan.

Table 4-1 Flood Resilience Planning Areas

Flood Resilience Planning Areas	Area Boundaries	Intent of Area Strategies
River Corridor	Floodway or fluvial erosion hazard area, whichever is greater	To conserve land and prohibit development
Other High Flood Hazard Areas	Undeveloped land in the floodway fringe	To conserve land and maintain the natural and beneficial function of the floodway fringe
Vulnerable Settlements	Existing developed land in the SFHA (floodway and floodway fringe)	To protect people, buildings, and facilities in vulnerable areas and reduce future flood risk
Safer Areas	Outside the SFHA but within the planning jurisdiction	To plan for and promote development in areas that are less vulnerable to future floods
Watershed	Entire drainage area	To promote coordination and partnerships and implement practices to slow, spread, and infiltrate flood water

Using the information gathered from the review and consolidation of flood-related data and input from the stakeholder meetings, CBBEL developed a set of overall strategies as well as specific geographic-based strategies for the individual flood resilience planning areas. These are discussed in **Chapter 6** of this plan.

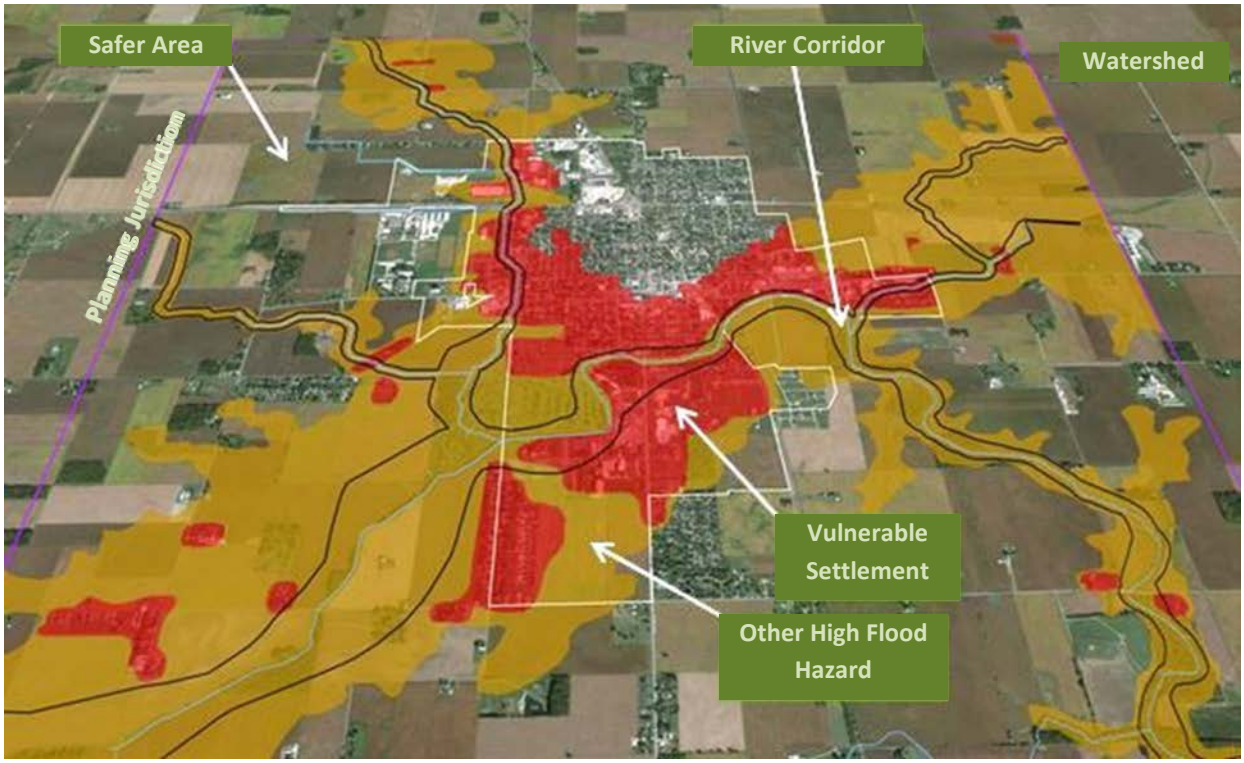

Figure 4-1 Graphic illustration of the flood resilience planning areas

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CHAPTER 5 OVERALL STRATEGIES TO ENHANCE RESILIENCE IN TIPTON

Overall strategies are meant to improve resiliency citywide and within the planning jurisdiction. These include:

- Update floodplain regulations to prevent future development activities from causing increased flood damages
- Further refine the flood risk modeling and mapping along Big Cicero Creek and Buck Creek to reflect most recent changes by USGS in their estimated magnitude of the April 2013 flood and adopt flood elevation data from the updated Tobin Ditch and Prairie Creek studies, and also add to the regulatory process for planning and building permits
- Adopt a comprehensive stormwater ordinance and accompanying technical standards to properly regulate existing and future stormwater control measures
- Update, integrate, and revise plans, policies, and regulations as noted in the strategies for the individual flood resilience planning areas (see Chapter 6)
- Conduct regular audits of policies and programs and update plans and ordinances for consistency
- Participate in the NFIP Community Rating System (CRS) Program

5.1.1 **Update Floodplain Regulations**

While floodplain management regulations are addressed within the City's Zoning Ordinance (Article 4, Section 402), it is recommended that a stand-alone floodplain ordinance be developed, or at a minimum, the development standards should be made stricter in the existing regulations. The purpose of regulations is to prevent future development activities from causing increased flood damages or from undoing the reduction in flood levels achieved by flood mitigation projects. After a review of the existing floodplain regulations, the following changes are recommended to help Tipton move toward becoming a flood resilient community:

- Adopt a "No Adverse Impact" philosophy toward development. In other words, any proposed development anywhere in the watershed has to protect itself and be constructed in a manner that it will not create flood elevation increases on other properties
- Restrict the construction of critical facilities within the SFHA
- Strictly enforce current or enhanced regulations regarding post development runoff limits, compensatory floodplain storage, and construction in a floodway permits. Ideally, restricting the construction of any new structures in the SFHA would be preferred, but that is not always an option
- Develop requirements for providing channel protection volume (may be included in Stormwater Standards)
- Encourage the use of LID practices, and perhaps even offer some form of monetary incentive for putting LID practices into use (may be included in Stormwater Standards)

5.1.2 **Adopt Flood Elevation Data from Updated Flood Studies**

As part of the 2014 Big Cicero Creek Watershed and Erosion Risk Management Plan, the hydraulic modeling and mapping along Big Cicero Creek and Buck Creek were updated based on a calibration to high water marks and the USGS estimates of flood magnitudes associated with the April 2013 flood. However, this updated calibrated modeling and mapping has not yet been submitted to IDNR to be incorporated into regulatory FEMA maps. Subsequent to the noted 2014 study efforts,

the USGS has revised its estimate of the magnitude of the April 2013 flood at the Tipton USGS gaging station site. As a result of this latter change, the hydraulic modeling of Big Cicero Creek and Buck Creek will need to be further refined and then provided to IDNR to be incorporated into official FEMA mapping of the risk areas.

The 2014 Big Cicero Creek Watershed Flood and Erosion Risk Management Plan also identified two streams in need of updated hydraulic/hydrologic modeling. The first is Tobin Ditch where modeling is needed to determine flood elevations and the floodway boundary. The second stream is Prairie Creek which is in need of modeling to identify the extent of floodplain storage from its confluence with Big Cicero Creek to about CR 500 S (1.5 miles).

Once complete, the new or revised flood elevation and floodway boundary data should be used in the regulatory processes for planning and building permits. The updates will provide a better understanding of existing flood risks and also flood storage potential in agricultural areas which may help mitigate flooding in the City of Tipton.

5.1.3 **Adopt a Comprehensive Stormwater Ordinance and Technical Standards**

Currently, Tipton does not have a freestanding stormwater management ordinance and technical standards that require use of best management practices. There are basic stormwater management standards in Tipton's Zoning Ordinance, but those standards are very general and are not required for every development. The City's Subdivision Control Ordinance requires stormwater management plans for new subdivisions (but not for single-lot developments), and these are also very general in nature. The state of Indiana regulates stormwater discharges from construction sites and industrial sites only, with no standards governing the quantity of stormwater runoff from other types of land uses.

It would be of the city's best interest to develop a dedicated stormwater ordinance and accompanying technical standards to properly regulate existing and future stormwater control measures. This would help to ensure the preservation of upstream floodplain storage (urban and agricultural areas), institute requirements for channel protection volume, and promote Low-Impact Development (LID) and green infrastructure in urban areas. The City should consider adopting the comprehensive stormwater management technical standards that were recently adopted by the Big Cicero Creek Joint Drainage Board and Tipton County, which effectively addresses these issues.

5.1.4 **Update, Integrate, and Revise Plans, Policies and Regulations**

Critical to the successful implementation of this plan and flood resilience in the City of Tipton is to update, integrate, and revise the plans, policies, and regulations to meet overall resilience goals and as a mechanism to implement the strategies for the individual flood resilience planning areas discussed in Chapter 6. These include the comprehensive plan, multi-hazard mitigation plan (MHMP), zoning ordinance, subdivision control ordinance, capital improvement plan, and economic development plan.

Local governments adopt comprehensive plans to guide future land use decisions in their communities. This plan represents the community's vision for growth and development and as such can play a significant role in flood resilience. The Comprehensive Plan for the City of Tipton was updated and adopted in 2012. While this plan is comprehensive and covers the social and

economic aspects for growth and development it could use some enhancements to improve flood resilience. These plans are typically updated every 10 years or as noted in the city's plan that it "be revised and updated accordingly should new issues arise".

In addition to the individual flood resilience planning area strategies listed in Chapter 6, the next round of enhancements to the Comprehensive Plan should include:

- A section dedicated to flood hazards, floodplain management, and fluvial erosion hazards
- Future land use that protects the river corridor, SFHA, and guides development to areas less vulnerable to flooding and streambank erosion

Comprehensive plans shape communities' flood resilience by determining where and how development will be built in the future, and Hazard Mitigation Plans shape communities' flood resilience by informing how communities will plan for and reduce or eliminate risk from natural hazards such as floods. And yet, communities do not always integrate their comprehensive plans with their Hazard Mitigation Plans. Comprehensive plans are often silent on the topics of hazard planning and resilience, and many MHMPs do not discuss land use tools that could guide future development away from known flood hazard areas.

State governments and FEMA encourage communities to prepare Hazard Mitigation Plans to improve planning for and reduce or eliminate risk from natural hazards. A community must have a Hazard Mitigation Plan to receive Hazard Mitigation Grant Program funding from FEMA. While the City of Tipton does not have a separate hazard mitigation plan, the 2011 Tipton County Multi-Hazard Mitigation Plan is multi-jurisdictional and covers the City of Tipton. This plan provides several mitigation strategies to prevent or reduce the potential damages caused by flooding. Additionally, the MHMP suggested a timeline of implementation for each strategy. The implementation of mitigation strategies in the near future could save the City a considerable amount of time and money as opposed to waiting for the next flooding event to occur. The City should make an effort to review the recommendations applicable to the City and assess the progress of each. To continue to be eligible for funding from FEMA, the MHMP has to be updated every five years.

In addition to the individual flood resilience planning area strategies listed in Chapter 6, the following should be incorporated in the next MHMP update:

- Add elements related to pre-disaster mitigation beyond focusing on structural repairs and solutions. Examples of such elements include improved stormwater management and controls on development in floodplains
- Discuss land use tools that can be used to guide future development away from known flood hazard areas

Municipal code updates should also coincide with these planning efforts. Zoning and subdivision control ordinances are a means to implement the comprehensive plan and MHMP by dictating where, what, and how development will be permitted and in known hazard areas, prohibited. Similarly, capital improvement plans and economic development plans need to match the priorities outlined in the comprehensive plan and MHMP. This approach may mean that a community might prioritize fixing or expanding facilities and infrastructure in safer locations, or a community might choose to strengthen or relocate existing facilities and infrastructure that are located in vulnerable locations. Using these approaches can help make better use of scarce capital improvement funds and economic development resources while also enhancing flood resilience.

5.1.5 **Conduct Regular Audits of Programs and Policies**

An important implementation action for Tipton will be to conduct a regular audit of policies and programs and update plans and ordinances for consistency. A consistent message among the comprehensive plan, MHMP, and development codes (zoning, subdivision control, stormwater, and floodplain ordinances) will help the city achieve resiliency much faster and more efficiently. As part of this planning effort, CBBEL facilitated an assessment of plans, policies, and regulations with local officials during the initial planning meeting. This effort brought to light several areas where the city could improve to be more resilient. These include the need for:

- Better coordination and collaboration among city staff on planning efforts
- Address implications of climate change on areas that regularly flood
- Restrictive zoning to protect the river corridor and other high flood hazard areas
- Incentives for implementation of pre-disaster mitigation measures
- Innovative smart growth planning techniques and stormwater management practices
- Post-disaster procedures and protocols

Coordinating these plans and implementing the appropriate policies, regulations, and strategies to make these plans a reality can also place communities in a better position to request post-disaster assistance if and when the next disaster occurs. Communities that identify potential hazard mitigation projects and begin completing hazard mitigation grant applications before a disaster occurs, instead of having to quickly develop such lists of projects in the aftermath of a disaster, are better positioned to apply for federal funding for disaster recovery and can speed up their recovery process. An effective way to audit the completeness, effectiveness, and implementation status of flood resiliency measures is to periodically complete the Flood Resilience Checklist developed as part of this study. A blank copy of the noted checklist is contained in **Appendix B**.

5.1.6 **Participate in the Community Rating System Program**

The Community Rating System (CRS) is a voluntary program that recognizes and encourages community floodplain management activities that exceed the minimum standards of the NFIP. The CRS uses a class rating system that is similar to fire insurance rating to determine flood insurance premium reductions. Most communities enter with a Class 9 rating, which entitles policyholders to a 5 percent discount on their flood insurance premiums. The maximum discount is 45 percent for Class 1 communities. As of September 30, 2015, there are 149 flood insurance policies in effect in the City of Tipton, paying a total of $98,620 in premiums. A 10% discount associated with a very achievable Class 8 can mean a total savings of nearly $10,000 within the city, which is expected to directly be invested in the city's economy. This savings becomes increasingly important to flood insurance policyholders as the NFIP transitions to actuary flood insurance rates and premiums are expected to increase significantly.

CHAPTER 6 STRATEGIES FOR FLOOD RESILIENCE PLANNING AREAS

As introduced in Section 4.3, five flood resilience planning areas were identified for the City of Tipton. These are based on the different geographic areas within a river valley including the river corridor, other high flood hazard areas, vulnerable settlements, and the watershed (**Exhibit 6)**. The area boundaries are based off the recalibrated flood map that was prepared as part of the 2014 Big Cicero Creek Watershed Flood and Erosion Risk Management Plan. The strategies most effective at enhancing flood resilience will differ depending on the planning area while at the same time offer multiple and interrelated benefits. For example, directing development out of floodplains and into safer areas not only keeps people and property safe, it also protects the ability of floodplains to hold and slow down flood water before it reaches downstream settlements.

Based on the review of available flood data and studies as well as input from key stakeholders, the following are the recommended strategies to improve flood resiliency in the City of Tipton. Chapter 7 summarizes these strategies in a table and recommended implementation timeline.

6.1 RIVER CORRIDOR

The river corridor flood resilience area is defined by the floodway or fluvial erosion hazard (FEH) area boundary, whichever is greater (***Figure 6-1***). The floodway encompasses the channel of a river or stream and those portions of the floodplains adjoining the channel which are reasonably required to efficiently carry and discharge the peak flood flow of the regulatory flood of any river or stream. During a flood, the velocity and volume of water in the floodway is great and can be destructive to obstacles in its path.

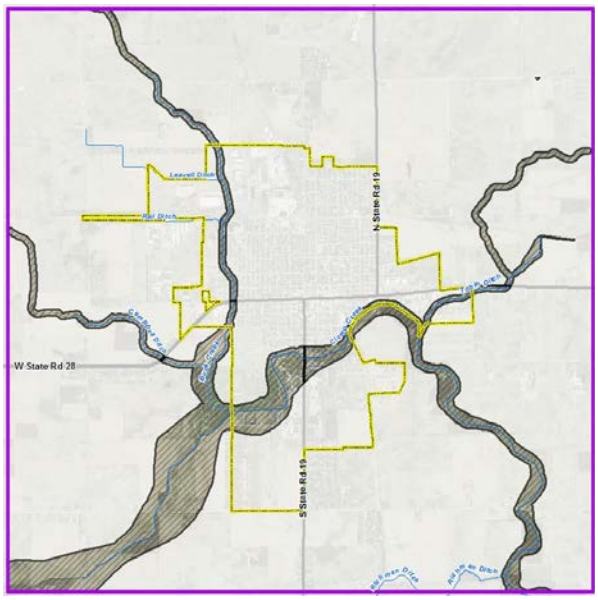

Figure 6-1 River Corridor Planning Area

In addition to carrying flood waters, the land adjacent to the channel is needed for the river to adjust laterally over time and maintain its natural stable form and become less prone to severe flooding. In many cases, flood damage is not only the result of inundation, but erosion as well. This area is known as the FEH area. Development and infrastructure that encroach in this area may be adversely affected by the natural stream processes and also exacerbate flooding and erosion potentials in other areas.

Conserving land and prohibiting development in this particularly vulnerable area is imperative to improving flood resilience in the City of Tipton. The following strategies detail how to successfully achieve this.

6.1.1 **Adopt a River Corridor Overlay Zone and Prohibit Land Disturbance in this Zone**

An overlay zone is a zoning district which is applied over one or more previously established zoning districts, establishing additional or stricter standards and criteria for covered properties in addition to those of the underlying zoning district. An overlay zone is a very effective regulatory tool for the City of Tipton to conserve land and prohibit development in the river corridor. At present, the city incorporates floodplain regulations into their zoning ordinance, and does regulate land use in floodplains based on minimum standards necessary to obtain national flood insurance through the NFIP. However, these standards are designed to protect insured structures from losses from inundation, but don't necessarily address erosion or the negative impacts of allowing development within these areas on other property owners or the natural and beneficial functions of the floodplain.

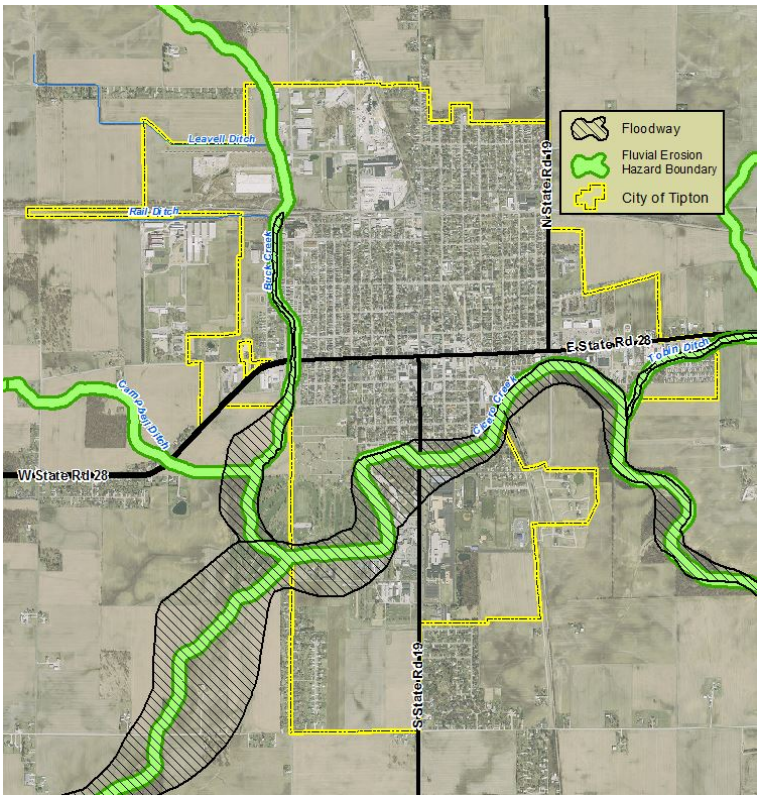

Figure 6-2 Floodway and Fluvial Erosion Hazard Areas

The river corridor overlay zone boundary should be defined as floodway or the FEH area whichever is greater (***Figure 6-2***). Floodway boundaries, where delineated, are found on the FIRM. In Indiana, FEH boundaries have been determined as part of a 2014 initiative by Indiana Silver Jackets, through funding obtained from the Indiana Office of Community and Rural Affairs (OCRA).

Because of this areas susceptibility and vulnerability to flooding and erosion, development should be prohibited. This includes structures, infrastructures, and utilities, as well as any land disturbance activities including parking areas, land clearing, excavation, and grading.

6.1.2 **Protect Undeveloped Land in the River Corridor**

For the floodway to function and provide critical conveyance for flood water, it must remain undeveloped. This includes encroachment from structures, infrastructures, and utilities, as well as any land disturbance activities including parking areas, land clearing, excavation, and grading must be prohibited. To achieve this, in addition to prohibiting new development, Tipton can help perpetuate the preservation of these areas by identifying willing landowners and partnering them

with local land trusts, USDA, IDNR, and SWCD organizations that are willing to outright purchase, accept land donations, or hold conservation easements on undeveloped properties in the river corridor. Many of these programs have incentives to help with implementation such as cost-share funding, purchase agreements, and property tax reductions. Depending on the program, funds may be available to restore or enhance natural features on the site like wetlands, forest, or prairie as well as provide long-term maintenance of the protected property. **Appendix C** contains a list of land trusts, agencies, and cost-share programs in Indiana. This list should be updated as other organizations and programs become available.

6.1.3 Minimize Streambank Erosion

Erosion and deposition is a natural stream process. However, encroachment and modifications to the river corridor disrupt this natural process and can result in as much damage as flooding itself. Loss of soil and vegetation can be significant to adjacent landowners as well as where debris collects downstream. The 2014 Big Cicero Watershed Flood and Erosion Risk Management Plan inventoried the streams in Tipton and identified the two-stage ditch as a viable solution to improve overall stream health and stability as well as help to reduce flood elevations.

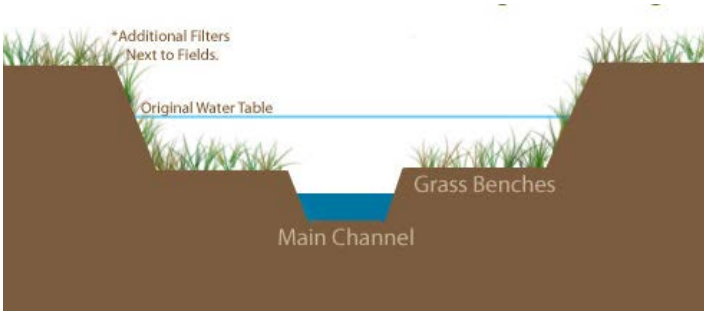

Figure 6-3 Two-stage Ditch Design

Two-stage ditches are constructed leaving a low-flow channel intact and creating a bench on each side. The bench extends back from the stream some distance before sloping up to meet the existing ground. Ideally, the bench varies in width and is as wide as the natural floodplain should be in the area (***Figure 6-3***).

The city should support the ongoing design and construction of two-stage ditch/channel improvements along the Big Cicero Creek being undertaken by the Big Cicero Creek Joint Drainage Board and support efforts to do the same along Buck Creek. Inventorying and monitoring area streams long-term for erosion problems are critical to the success of these efforts.

6.2 OTHER HIGH FLOOD HAZARD AREAS

Other high flood hazard areas include the undeveloped land in the floodway fringe (***Figure 6-4***). The intent of the strategies identified for this flood resilience planning area is to conserve land and maintain the natural and beneficial function of the floodway fringe.

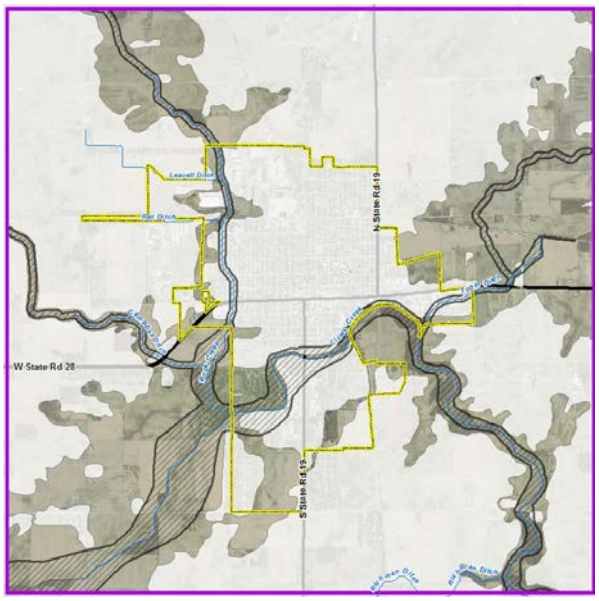

Figure 6-4 Other High Flood Hazard Areas

While the floodway is critical for flood conveyance, the floodway fringe is critical for flood storage. Flooding in this area is an essential part of the river's hydrologic and hydraulic processes, geomorphic processes, and biologic processes that shape and maintain this natural system. Encroachment in the floodway fringe upsets this delicate balance and disturbs the functions and overall health of the river's ecosystem. In the City of Tipton, this area is substantial. However, the short-term economic gain as a result of developing in the floodplain is unsustainable and ultimately shifts the adverse environmental impacts to future generations.

Similar to the river corridor, conserving land and prohibiting development in this particularly vulnerable area is imperative to improving flood resiliency in the City of Tipton. The following strategies detail how to successfully achieve this.

6.2.1 **Prohibit Development in the Floodway Fringe**

To maintain the natural and beneficial function of the floodplain, the City of Tipton should prohibit new development on undeveloped land in the floodway fringe. This is especially important for critical facilities. These facilities (police, fire, hospital, schools, etc.) provide essential services to the residents of Tipton and should not, under any circumstances, be constructed in a known flood hazard area. The floodway fringe areas are most suitable for open space uses such as parks, woods, and fields that can experience flooding without causing significant damage to life and property, or exacerbating flooding problems elsewhere.

The floodway fringe boundary of area streams is clearly delineated and regulated on the FIRM. However, for the purpose of implementing this plan, it is recommended that the floodway fringe as identified on the recalibrated map from the 2014 Big Cicero Creek Watershed Flood and Erosion Risk Management Plan be used since it is based on more recent data from USGS and high water marks from the April 2013 flood event. Local governments may adopt more restrictive policies and regulations than the State and Federal requirements. To prohibit new development in the floodway fringe, the City of Tipton will need to draft more restrictive language, including critical facilities, and adopt it as an amendment to the floodplain ordinance.

6.2.2 **Protect Undeveloped Land in the Floodway Fringe**

As in the discussion in the river corridor section, for the floodway fringe to function and provide critical storage for flood water, it must remain undeveloped. To achieve this, in addition to prohibiting new development, Tipton can help perpetuate the preservation of these areas by identifying willing landowners and partnering them with local land trusts, USDA, IDNR, and SWCD organizations that are willing to outright purchase, accept land donations, or hold conservation easements on undeveloped properties in the river corridor. Many of these programs have incentives to help with implementation such as cost-share funding, purchase agreements, and property tax reductions. Depending on the program, funds may be available to restore or enhance natural features on the site like wetlands, forest, or prairie as well as provide long-term maintenance of the protected property. **Appendix C** contains a list of land trusts, agencies, and cost-share programs in Indiana. This list should be updated as other organizations and programs become available.

6.2.3 Adopt Compensatory Floodplain Storage Requirements

It is necessary to preserve the natural storage within the floodplain because loss of floodplain storage on one property could lead to increases in flood depths and frequency of flooding and negatively impact other properties along the stream or with the watershed. Floodplain storage is lost when a portion of the floodplain is filled, occupied by a structure, or when as a result of a project a change in the channel hydraulics occurs that reduces the existing available floodplain storage volumes. Compensatory floodplain storage is an effective regulatory tool to compensate for any fill, structure, or other materials above grade in the regulatory floodplain that temporarily or permanently displaces floodplain storage volume. ***Figure 6-5*** provides an illustration of how compensatory storage works.

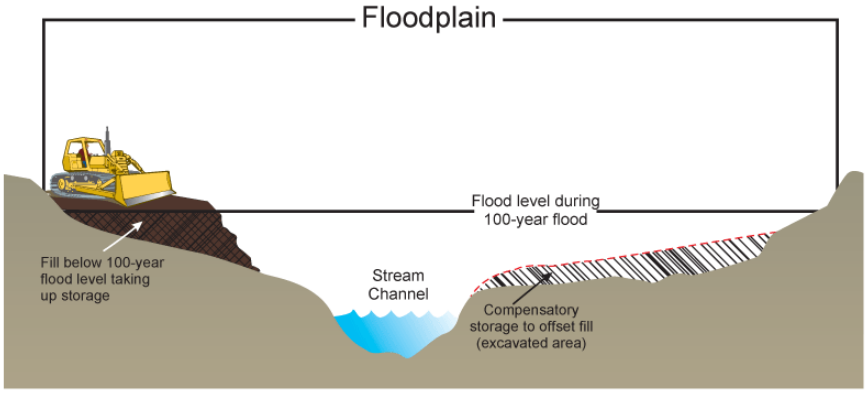

Figure 6-5 Compensatory Storage

In the rare circumstance where the placement of fill in the floodway fringe is unavoidable and a variance has been granted, the City of Tipton should require a minimum 3:1 compensation of the floodplain storage that is lost. This requirement will be most effective if incorporated into, and enforced through, the city's proposed comprehensive stormwater ordinance.

6.3 VULNERABLE SETTLEMENTS

Vulnerable settlements are existing developed areas within the floodway and floodway fringe or SFHA (***Figure 6-6***). The intent of the strategies in this flood resilience planning area is to protect people, buildings, and facilities in vulnerable areas and reduce future flood risk.

While ideally removing these structures through a buyout program provides the best protection from future floods, it is unlikely that such a strategy can cover the entire affected area because Tipton has a large number of buildings in the SFHA. Many of these are relatively close to the historic and appealing downtown and as a result, it is likely that there will be the desire to repair and/or rebuild structures damaged by major floods.

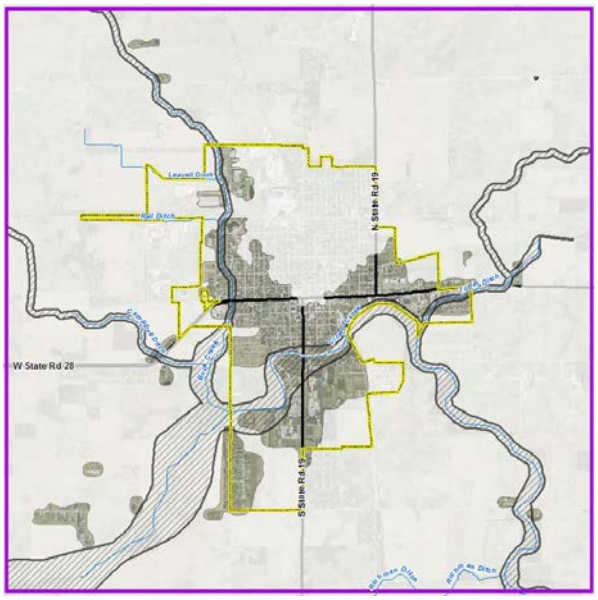

Figure 6-6 Vulnerable Settlements Planning Area

Below are strategies to safeguard development and redevelopment in areas that are susceptible to future flooding. Although the risk to flooding cannot be eliminated entirely, these strategies will help reduce the potential damage from future flooding events.

6.3.1 **Protect Existing Critical Facilities**

Critical facilities such as police, fire, medical facilities, schools, and wastewater treatment facilities should not be located in vulnerable areas – no exceptions. However, in many older communities like Tipton, several critical facilities were built prior to the adoption of flood maps and advanced flood modeling techniques. When relocation of a critical facility is not practical, measures should be taken to floodproof these structures. Such techniques include perimeter berms or floodwalls, which include automatic flood gates for easy access to these facilities when they ae not surrounded with floodwaters. In all cases, valuable records or equipment should be stored in locations that are not susceptible for future flood risk. There should also be provisions for flood-free access to these facilities so that they can continue to operate during flood emergencies.

As discussed in Section 3.4, there are eight critical facilities in Tipton that are located in the SFHA. These include Tipton High School, Tipton Middle School, IU Health Tipton Hospital, Millers Merry Manor, Tipton County Library, Wastewater Treatment Plant, Tipton County Sheriff, Cicero Township Fire Department, and Tipton Fire Department. **Exhibit 1** through **Exhibit 5** illustrate anticipated depth of flooding for various flood events and **Exhibit 7** illustrates the overall location of these critical facilities in relationship to the recalibrated map used for this planning effort.

A conceptual level feasibility analysis was performed as part of the preparation of this plan on providing perimeter flood protection for three major vulnerable critical facilities in Tipton including the IU Health Tipton Hospital, Tipton High School and Middle School, and the Tipton Wastewater Treatment Plant. These facilities are deemed critical because the health of the city would be compromised if the facilities were to be out of operation for an extended period of time.

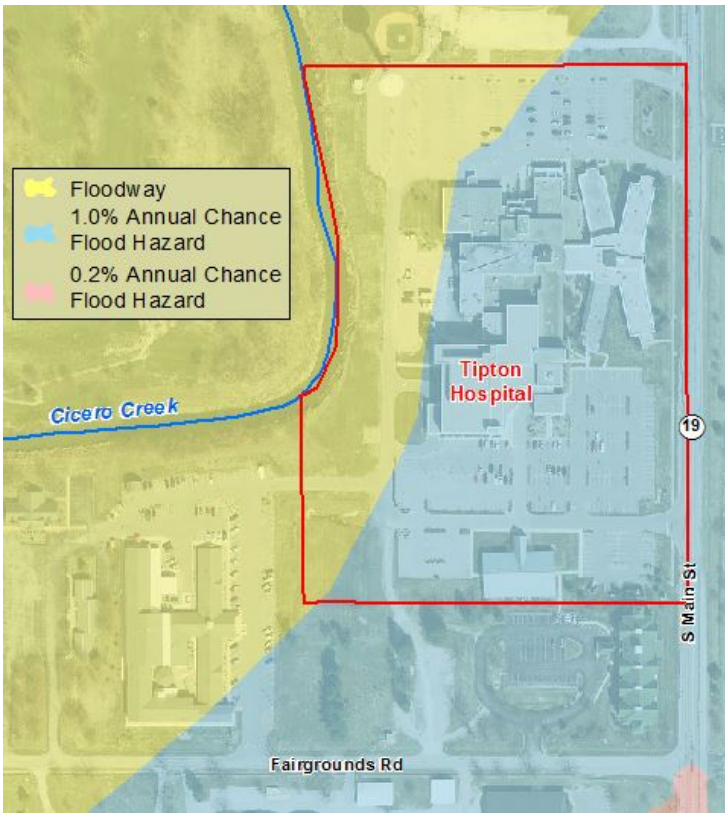

Figure 6-7 Location of IU Health Tipton Hospital and SFHA

<u>IU Health Tipton Hospital</u>

The IU Health Tipton Hospital (Hospital) is located just west of South State Road 19 and North of

Fairgrounds Road approximately 1 mile south of downtown Tipton. The hospital is the only major medical facility within the City of Tipton. However, the facility is susceptible to flooding as almost the entirety of the building is located within the Big Cicero Creek floodplain, with a portion of the property in the regulatory floodway (***Figure 6-7***).

One of the ways to reduce the risk of flooding to the hospital is by means of structural floodproofing with a levee. A levee could be utilized to help reduce the risk of flooding with the use of floodwalls and earthen levees. Closures would also be necessary in order to allow for the facility to function properly during normal business operations. Since the hospital property is almost entirely within the 100-year floodplain and in order to reduce the risk of flooding to the facility with a levee, the levee must completely encircle the facility. A closure would be required for access to the building from South State Road 19. In addition, several other locations would need closures in order to allow access from critical ingress/egress locations. ***Figure 6-8*** and ***Figure 6-9*** illustrate what a floodwall would look like during dry weather and a flood event respectfully.

In order to minimize any negative impacts on flood elevations as a result of floodplain storage loss and/or flow conveyance loss typically associated with flood protection projects, an attempt must be made to be as close to the building while also minimizing, as much as possible, negative impacts to the ease of access and operation of the facility. Where space is limited, a floodwall would need to be constructed in order to limit the footprint of the levee structure. For example, a floodwall would need to be incorporated on the west side of the facility where space is limited adjacent to Big Cicero Creek. Where more property is available, an earthen embankment levee could be constructed in order to reduce the cost of the levee structure. Near the northwest side of the hospital where a building has been demolished recently, an earthen levee could be incorporated into the design of the levee in order to reduce the cost of the overall structure. **Exhibit 8** shows a conceptual layout of a perimeter ring levee flood protection system around the hospital facility.

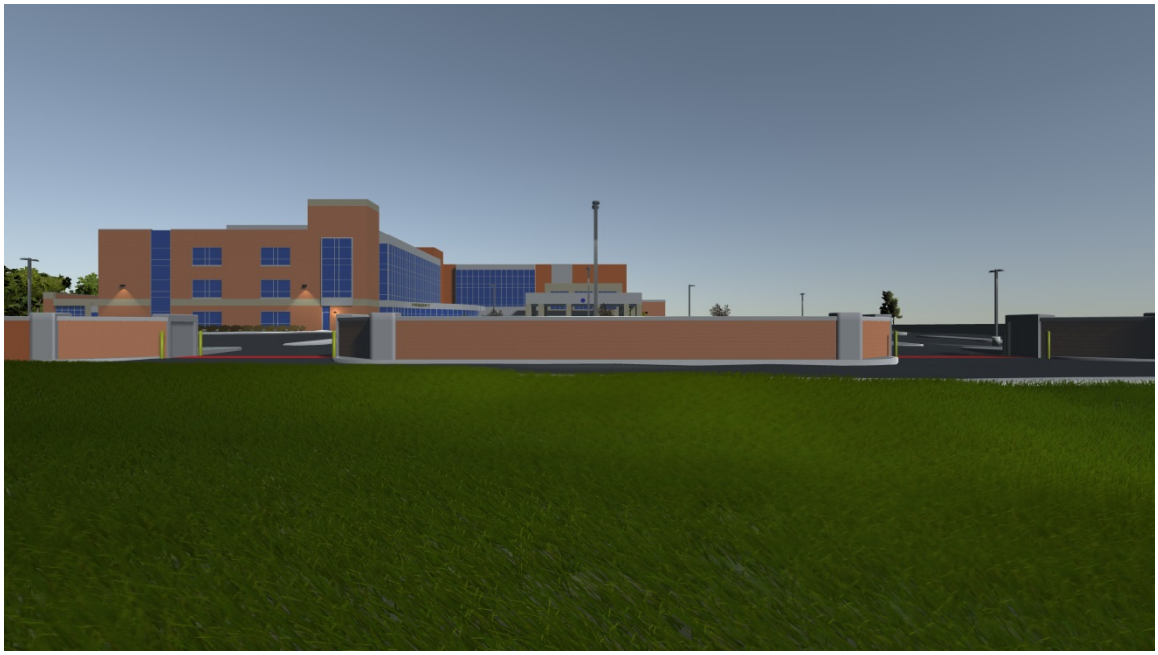

Figure 6-8 IU Health Tipton Hospital floodwall illustration with gates open during dry weather

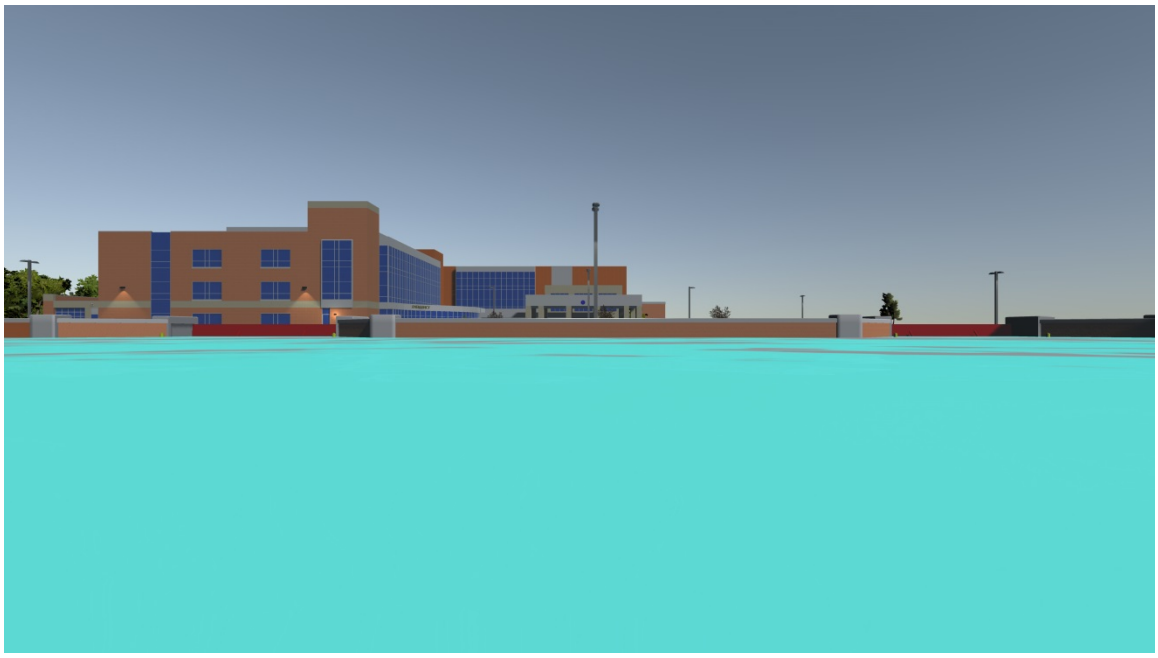

Figure 6-9 IU Health Tipton Hospital floodwall illustration with gates closed during a flood

As can be seen from this exhibit, in order to minimize disruption to the facility's operation, a portion of the floodwall would encroach into the Big Cicero floodway. The loss of conveyance resulting from this encroachment would need to be compensated for, potentially through compensatory shelf excavation along the Creek in order to minimize any impacts on flood elevations. In addition, interior drainage structures (possibly pump stations) would need to be incorporated into the design in order to help protect the facility during coincident flooding events on Big Cicero Creek as well as a rainfall event on the interior of the hospital.

The estimated conceptual level cost for the proposed perimeter flood protection is approximately $7.5 Million. This preliminary cost estimate does not include any required floodway compensation excavation or the necessary interior drainage pumping facilities, the cost of the latter could be very substantial. Combining the necessary floodwalls, levees, closures, and interior drainage pump stations could help reduce the risk of flooding and provide an option to flood proof the facility. **Appendix D** provides additional information regarding the proposed improvements, including a more detailed drawing, a flood profile, and a breakdown of the preliminary cost estimate.

Tipton Schools

The Tipton High School and Middle School (school) are located on the east side of South State Road 19 just across from the hospital one mile south of downtown Tipton. The school is the predominant school in Tipton. The majority of the property is located within the 100-year floodplain. Similar to the hospital, the northwest corner of the northernmost building is also within the floodway of Big Cicero Creek (***Figure 6-10***).

As discussed previously, levees in the form of earthen embankments, floodwalls, closures, and interior drainage structures would be necessary in order to reduce the risk of flooding of the school via structural floodproofing. Similar to the hospital, the levee for the school would need to completely encircle the facility. At the west side of the school near South State Road 19, a floodwall would possibly be required on due to a lack of available space between State Road 19 and the parking areas to the west of the school. In addition, several utilities are located on the west side of the building would limit the viability of an earthen embankment in this location. On the south and east side of the school property where more space is available; an earthen embankment could be utilized in order to reduce cost of the total project. Several closures would need to be incorporated into the levee, as there is a lack of available property for run-ups (gently-sloped that would be suitable for vehicular passage over the earthen embankment). Locations for closures would include, but not be limited to, the access points from State Road 19, access from County Road 200 South (north of the building), the main school bus access point to the east of the building, and the access to the east side of the building just south of the baseball fields. **Exhibit 9** shows a conceptual layout of a perimeter ring levee flood protection system around the facility.

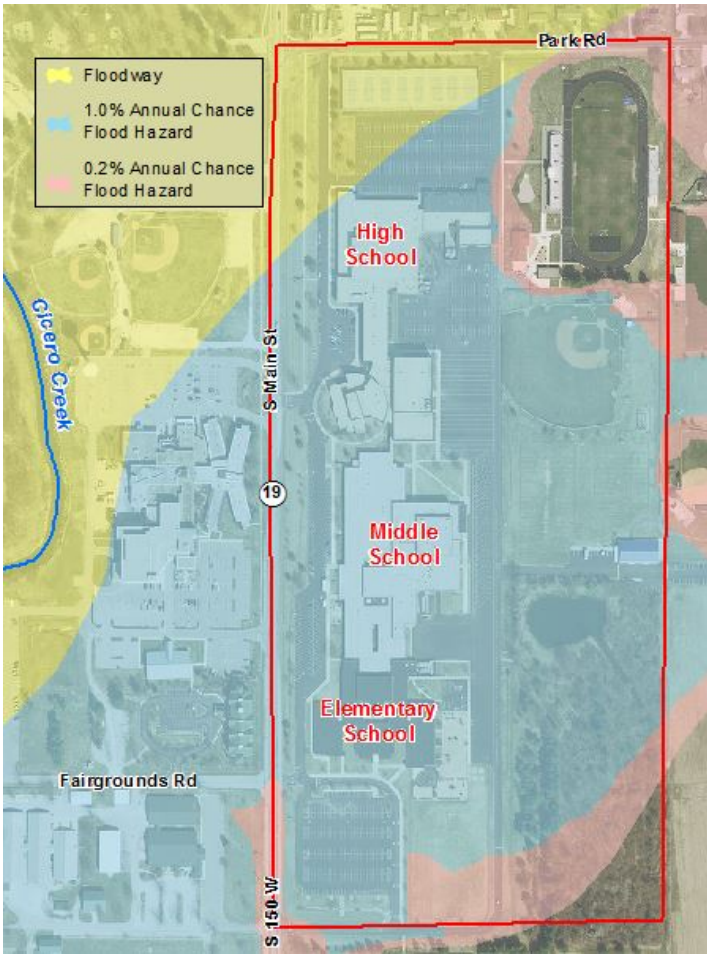

Figure 6-10 Location of Tipton High School and Middle School in the SFHA

As in the case of hospital, in order to minimize disruption to the facility's operation, a portion of the floodwall would encroach into the Big Cicero floodway. The loss of conveyance resulting from this encroachment would need to be compensated for, potentially through compensatory shelf excavation along the Creek in order to minimize any impacts on flood elevations. In addition, interior drainage pump stations may be required to reduce the risk of flooding during coincident rainfall events on Big Cicero Creek and rainfall on the interior of the levee.

The estimated conceptual level cost for the proposed perimeter flood protection is approximately $18.6 Million. This preliminary cost estimate does not include any required floodway compensation excavation or the necessary interior drainage pumping facilities, the cost of the latter could be very substantial. **Appendix D** provides additional information regarding the

proposed improvements, including a more detailed drawing, a flood profile, and a breakdown of the preliminary cost estimate.

Tipton Wastewater Treatment Plant

The Tipton Wastewater Treatment Plant (treatment plant) is located south of Jefferson Street/State Road 28 approximately one mile east of downtown Tipton (***Figure 6-11***). An access drive just east of the Marsh Supermarket is the primary access point to the facility. The wastewater treatment plant is the primary treatment facility in Tipton which the almost entirely is within the 100-year floodplain. Similar to the hospital and the school, part of the treatment plant is within the floodway as it lies adjacent to Big Cicero Creek on the east (left) bank. Only a small portion of the primary office facility is above the 100-year base flood elevation (while even this small portion is below the 500-year elevation).

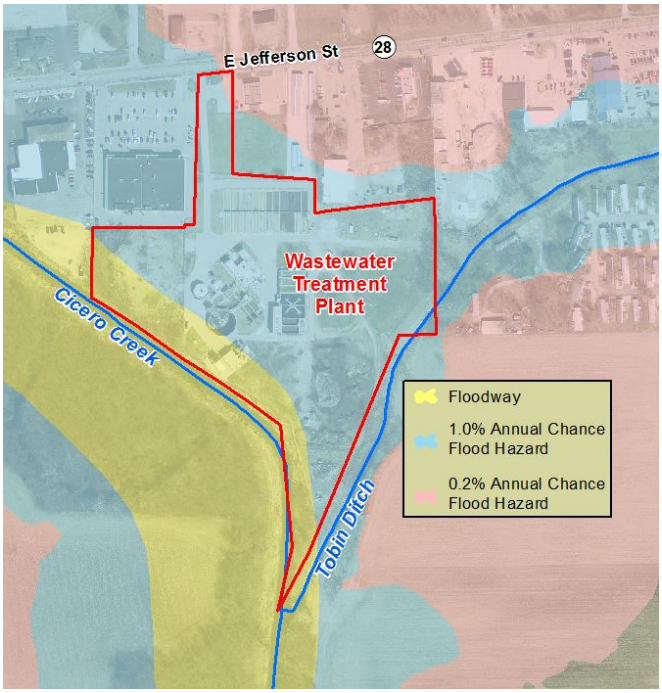

Figure 6-11 Location of Tipton Wastewater Treatment Plant and SFHA

For the treatment plant, the levee would also need to encircle the property in order to reduce the risk of flooding at the facility. Because the property is so close to the Big Cicero Creek, floodwalls would need to be utilized, at a minimum, near the creek as an earthen embankment would not be feasible at this location. In addition, a floodwall would need to be incorporated into the north end of the site due to the locations of equipment and access on the northern portion of the property. Earthen embankments could be utilized on the east and west side of the site as space is more available on those sides of the property. In addition, run-ups could be utilized to gain access to the east and west side of the site in order to gain access to critical areas. Due to the space availability and taking into consideration the cost, closures would not be required to gain access to these locations. The primary ingress/egress to the site from Jefferson Street; however, would need a closure due to a lack of available property. **Exhibit 10** shows a conceptual layout of a perimeter ring levee flood protection system around the facility.

Due to its proximity to the Creek, the proposed floodwall severely encroaches into the floodway, which will likely result in negative impacts on flood elevations. For this proposed project to be feasible, floodway compensation would need to be added to the project. In addition, as with the other two properties interior drainage structures, possibly in the form of a pump station, could be required to reduce the risk of flooding during coincident flooding events on Big Cicero Creek as well as the interior of the levee.

The estimated conceptual level cost for the proposed perimeter flood protection is approximately $6 Million. This preliminary cost estimate does not include any required floodway compensation

excavation or the necessary interior drainage pumping facilities, with the additional cost being substantial. **Appendix D** provides additional information regarding the proposed improvements, including a more detailed drawing, a flood profile, and a breakdown of the preliminary cost estimate.

6.3.2 Relocation/Buyout Structures

Relocation and buyouts removes individual flood prone structures from harm's way by physically moving the structure or demolishing and rebuilding in a low risk flood area. Not only does this greatly reduce the flood risk to the building and its contents but it opens up more area for storage or conveyance of flood waters. When several strategically chosen structures in an area are relocated, this option can reduce localized flood elevations.

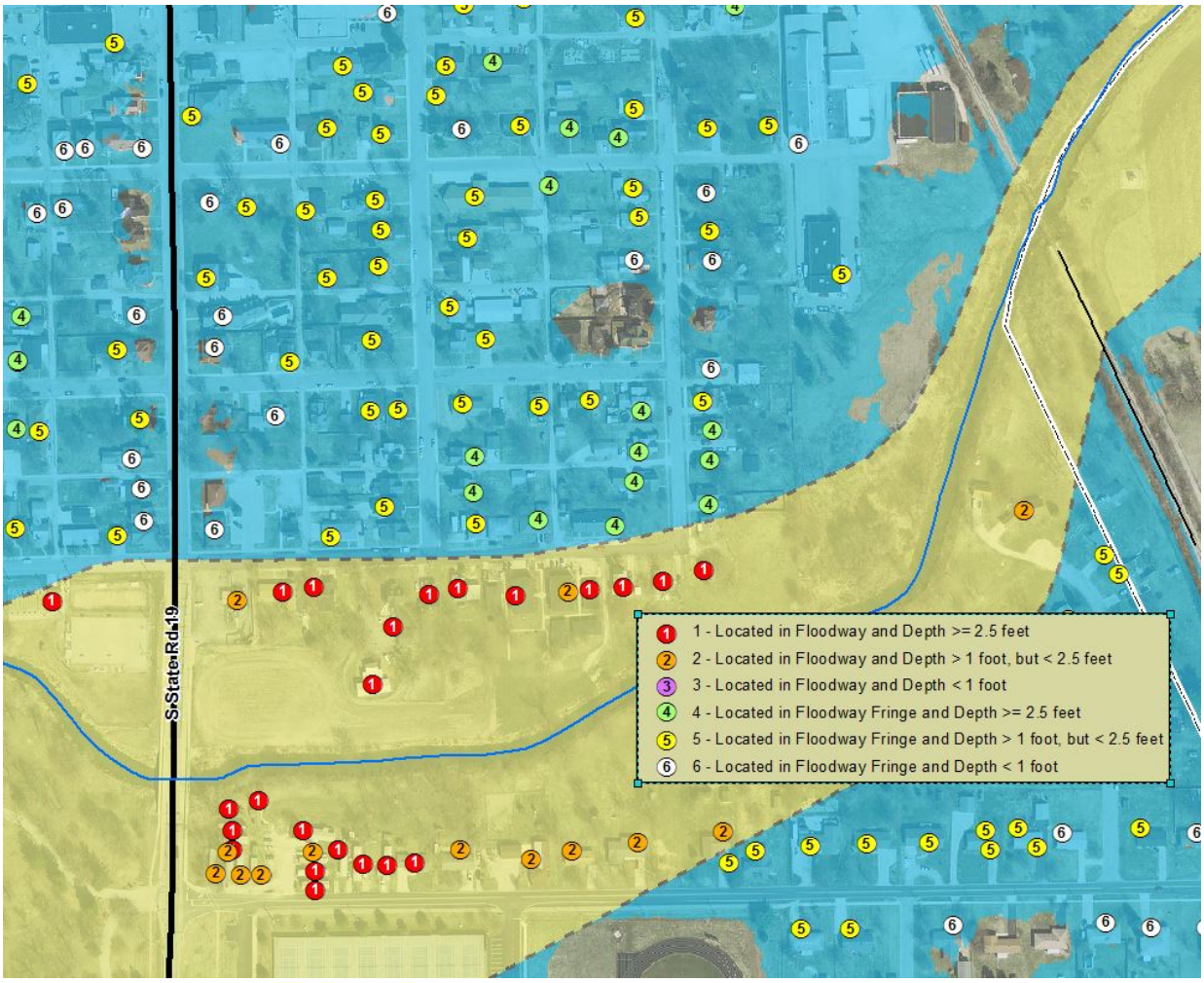

Figure 6-12 Building Flood Depths Based on 1% Annual Chance Flood Elevations

Based on the data gathered as part of the 2014 Big Cicero Creek Flood and Erosion Risk Management Plan, over 800 homes and businesses in the City of Tipton are vulnerable to flooding from Big Cicero Creek and Buck Creek. The following is a summary of the analysis from the 2014 plan. ***Figure 6-12*** shows the location of a portion of the structures and anticipated depth of flooding

from a 1% annual chance flood. **Exhibit 11** is a larger map of structures in the SFHA and depth of flooding. ***Table 6-1*** lists the total number of structures in the SFHA, their location with respect to the floodway, floodway fringe, and depth of flooding and how they should be prioritized for relocation/buyout.

Table 6-1 Categorization of Buyout/Relocation Priorities

Priority for Buyout/Relocation	In the Floodway	In the Flood Fringe	1% Annual Chance Flood Depth			Number of Structures in Category
			> 2.5	1 – 2.5	0-1	
1	√		√			26
2	√			√		13
3	√				√	2
4		√	√			197
5		√		√		363
6		√			√	222

Structures that are in the floodway and are expected to experience 1% annual chance flood depths of around 2½ feet or more are recommended as the first priority for relocation because of lack of options for flood proofing these structures, their location in the areas of faster flowing water, and the potential for increasing stream flow capacity with their removal. Flood depths for the buildings in the City of Tipton are based on the updated 1% annual chance flood elevations from the 2014 recalibrated model. At some locations, these elevations are about 2 feet higher than the existing FIS elevations. Priorities 1-3 are structures in the floodway, with priority 1 structures having higher flood levels and priority 3 structures having lower flood depths. Priorities 4-6 are structures that are not in the floodway but fall within the floodway fringe. Priority 4 structures have the higher flood depths and priority 6 structures have the lower flood depths. Structures in priority 1 are highest priority while structures in priority 6 become good candidates for floodproofing instead of relocation (unless they are surrounded by buyout candidates).

The numbers shown in *Table 6-1* may seem disproportionate to the number of flooded structures reported in the April 2013 flood. This is due in part to the recalibration of the modeling since the FIS. Based on the comparison of the rainfall depths during the April 2013 storm and the expected depth of a 1% annual chance rainfall determined through NOAA Atlas 14 published data, that calibration raised the 1% annual chance flood elevation about 2 feet from the 1% annual chance flood elevation in the FIS in some areas, thus indicating that the April 2013 flood is believed to be smaller than a 1% annual chance flood event. In addition, some structures shown in the floodplain may be elevated above the ground so the flood depth above ground that was used for the structure flood depth determination over exaggerates the flood depth at which structure damage actually begins. Before a final decision is made regarding flood protection for each structure, an Elevation Certificate by a licensed surveyor should be obtained in order to identify the true structure elevation for risk assessment on each building. The Elevation Certificate can also be used in determining flood insurance rates that have been impacted by recent federal legislation. Until this more detailed data exists on structure elevations, the numbers in each category in *Table 6-1* serve only as initial estimates.

Fifteen parcels with 13 of the identified structures in the floodplain are already in the process of being bought out using a $900,000 grant from FEMA through Indiana Department of Homeland Security (IDHS) and $225,000 in local cost share. These structures are in the area bounded by Adams, Madison, 2nd St and Conde Street west of SR 19 and between South Street and Big Cicero Creek east of SR 19.

Flooding depths for structures north of Walnut Street (about 160 structures) are based on Buck Creek flood elevations, not Big Cicero Creek. Of these 160, approximately 25 appear to be low enough to also be flooded by Big Cicero Creek in the 1% annual chance event.

6.3.3 **Floodproof Structures**

Floodproofing is more applicable for buildings with less than 3 feet of flood depth and can be accomplished by several different methods. These include raising the building, construction of on-site floodwalls or levees, dry floodproofing (sealing a building to prevent floodwaters from entering) or wet floodproofing (letting water enter the structure but protecting/ elevating/removing everything that could be damaged by flood waters). Each method is better suited to different building construction and site conditions. Floodproofing costs can range from less than $100 to thousands of dollars depending on the site considerations and the method selected.

As discussed in previous section on relocation and buyouts, about 224 structures in the City of Tipton would be expected to have less than 1 foot of flooding in the 1% annual chance flood event. About 359 would be expected to have 1 -2½ feet, and 223 to have greater than 2½ feet of depth. Approximately 41 of these structures are also located in the floodway and are therefore included in the recommendation for buyout or relocation instead of flood proofing.

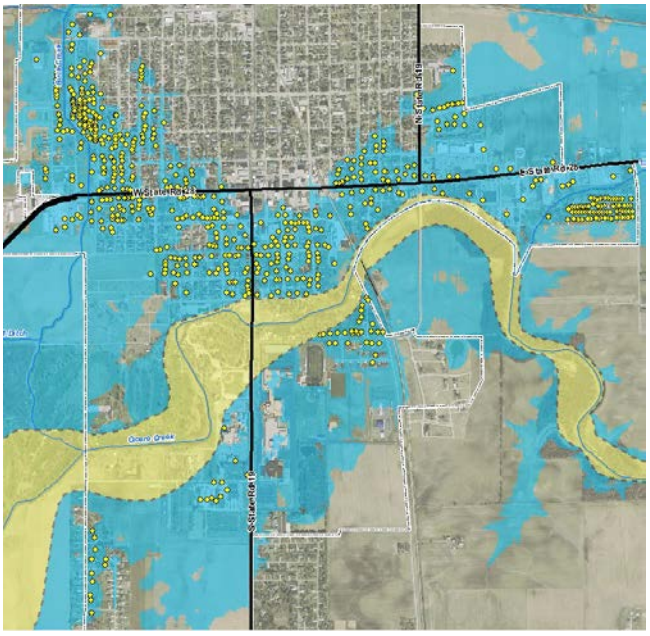

Figure 6-13 Structures with potential for floodproofing

The first step to planning for floodproofing is to understand the flood risk and then to determine an acceptable level of protection. Because of the additional model calibration to the April 2013 flood, the 1% annual chance flood is expected to be higher than the regulatory elevations in the FIS. For that reason, flood protection to the FIS base flood elevation plus 2 feet is recommended in order to provide protection from the potentially higher flooding. A 3-foot freeboard may be prudent, given the National Climate Assessment conclusion that the higher 1% of daily rainfalls could be increasing by 37%. Structures with expected flood depths suitable for floodproofing based on the base flood elevation plus 2 feet are those shown in ***Figure 6-13*** with flood depths less than 3 feet and outside the floodway.

When flooding occurs again, it will be important for communities to document flood damage so they can demonstrate previous damage and meet requirements for the Hazard Mitigation Grant Program. The purchase of conservation easements on undeveloped, flood-prone lands is becoming an increasingly popular practice in other communities that experience frequent flooding. The City should work to set priorities for acquiring or purchasing conservation easements for properties that will provide the greatest flood resilience benefits.

A resilient community is a community that takes proactive measures before a disaster strikes. Preparation is more than just sandbags and retaining walls; stressed throughout this document is the need for local regulations and/or public education to protect the loss of life and property during a flooding event.

6.3.4 **Bring Nonconforming Uses into Compliance**

Nonconforming uses are defined as uses and structures which were begun or constructed before rules and regulations existed, or they were allowed, but due to changes in the legislation, they have since become noncompliant. A legal nonconforming use can continue in perpetuity unless the use ceases for a period of no less than 12 consecutive months. However, the use or structure cannot be expanded, enlarged, or extended without being in compliance with the current regulations.

Even though the City of Tipton is in good standing with the NFIP and regulates development in the floodplain, there are many older structures that do not meet the recent flood regulation which is that the lowest floor of a structure must be elevated at least two feet above the base flood elevation.

Figure 6-14 Example of compliance with flood ordinance requirements

Normally, a nonconforming use will be brought into compliance during a major repair as the result of substantial damage from a flood, wind, fire, or similar. A major renovation will also trigger compliance with the current regulations. However, minor repairs or renovations will not. If uses and structures are going to remain in the SFHA they should be in compliance with the most recent flood regulations to reduce future losses and damages from floods.

The City of Tipton should implement a program to encourage owners of all nonconforming uses to voluntarily come into compliance, or even partial compliance, with the most recent flood regulations. This can be achieved by using flood-resistant materials, installing vents, or elevating HVAC equipment (***Figure 6-14***). The city will need to identify incentives such as cost-share programs or waived permit fees to improve participation in the program.

6.3.5 **Create New Flood Storage through Redevelopment**

Although it is preferred those structures in vulnerable areas are vacated and the land converted to open space for flood storage, there are times when redevelopment is unavoidable. This situation can create an opportunity for communities to require additional flood storage capacity as part of the redevelopment project. New flood storage capacity could mean creating parks and other open spaces in vulnerable locations, replacing a vertical wall along a riverbank with a more gradual slope to create more room in the river channel for rising water, creating a shallow depression in a lawn that can accommodate inundation, or redesigning buildings to enable the first floor or basement to flood rather than armoring the buildings to repel rising waters.

The City of Tipton should draft and adopt language into their stormwater ordinance to encourage redevelopment projects to provide additional flood storage as part of their project. To aid this effort, incentives such as density bonuses (without increasing the building footprint), floodproofing assistance, or a credit toward the stormwater utility fee should be used.

6.3.6 **Require Building Expansions to Meet Additional Requirements**

As already noted, it is preferred that structures in vulnerable areas are relocated or bought out and the land converted to open space for flood storage. However, when this is not feasible and a property owner wishes to expand their building footprint in the floodway fringe, the City of Tipton should enforce additional requirements to reduce future flood losses. At a minimum this should include 1:1 compensatory floodplain storage requirements on site and not allow the building expansion, or new accessory structure, to be any closer to the river than the original structure. The city should draft and adopt language in both the stormwater ordinance and floodplain ordinance respectfully and identify incentives like flexible zoning, floodproofing assistance, or stormwater utility credits.

6.3.7 **Adopt a Flood Response Plan**

With every major flood, there comes an overwhelming level of activity and a need for quick information and response. To minimize risks of property damage, injury and death during a flood, communities need to prepare and have a good plan for early warning, response, and recovery before, during, and after a flood event. Planning for flood emergencies reduces the risk to health and life and the damage caused by flooding. A flood response plan (FRP) outlines the roles and responsibilities of all parties to be involved, actions to be taken, coordination among entities, and communication channels to be used prior to, during and after a flood event.

A FRP documents the flood response process, informs those involved in the chain of command, lists specific responsibilities and task assignments, and provides a schedule of activities tied to stages of the flood fight. A good plan helps prevent duplication of effort and wasted resources, and helps avoid gaps in response and recovery. The plan is especially important in providing continuity during events where the most experienced staff is unavailable (on vacation, retired, or otherwise unavailable). The best plans are updated to include experiences and lessons learned after each flood event. This information is invaluable to identifying and reducing the risks to life, health, and property during future floods.

A FRP provides advanced warning to emergency responders, local leaders and decision-makers about severity and potential impacts of an approaching storm as well as step-by-step protocols for effective flood response and post-flood recovery. The typical process to prepare a FRP includes:

- Understand and document past flood events and flood fight efforts;
- Develop guidance on flood event detection, flood event level determination;
- Estimate the expected extent and severity of flooding;
- Develop protocols for notification and communication;
- Identify impacted areas, road closures, flood-safe routes for various flood frequencies;
- Develop a list of actions that need to be taken to monitor data and conditions, conduct warning and evacuation, record observation and actions, and re-evaluate the situation as the conditions changes; and
- A tabletop training exercise to test the plan and train responders, local leaders and decision-makers.

While the impact of the April 2013 flood is still relatively fresh in everybody's minds and there is good data available, the City of Tipton should prepare a FRP.

6.3.8 **Adopt Post-flood Damage Assessment Data Collection Protocols**

After the flood waters subside and response efforts are substantially completed, the recovery process begins. Citizens need to understand how to safely reenter their homes. Business and residents may also need to know how to safely rebuild. Damages must be documented for insurance purposes, grants, or other assistance applications. A post-flood damage assessment protocol give the community a defined plan to make sure community ordinance requirements are met and damage is property assessed.

After the 2013 flood, residents indicated that they were going to begin repairing damages to their homes as soon as flood waters receded without waiting for the city to assess damages. To avoid this situation in the future, the City of Tipton should adopt language that imposes a post-disaster building moratorium on construction/reconstruction in flooded areas until that time when the flood risk has ceased and the areas are deemed safe by a qualified inspector. IDNR's Floodplain Administrator's Handbook and Post-Flood Guidance for Local Floodplain Administrators are both good resources.

6.3.9 **Connect People to the River**

Development in many historic, riverfront towns and villages often faces away from the river. Except for at bridge crossings, community members may rarely see or consider the river as a part of community life—until a flood arrives. A river can be a social and economic asset if community members can safely access and interact with the riverfront. Opportunities to see and engage with the river could help communities plan for future flooding by increasing community members' consciousness of the river's presence. When redevelopment takes place in vulnerable settlements, communities can consider creating parks, outdoor dining and vending, walking and biking paths, and other activities that can withstand flooding and bring people closer to the river during normal flows.

Tipton's Comprehensive Plan lays out a proposed network of trails and open space to connect people with the river (***Figure 6-15***). As land and funding become available, this plan should be

implemented as well as private partnerships to visually and physically connect people with the river.

Figure 6-15 Portion of Tipton's Proposed Trails and Open Space Network

6.4 SAFER AREAS

Safer areas are located outside the SFHA but within the planning jurisdiction (***Figure 6-16***). The intent of this flood resilience planning area is to plan for and promote development in areas that are less vulnerable to future floods. The following strategies can be taken to foster growth in these areas:

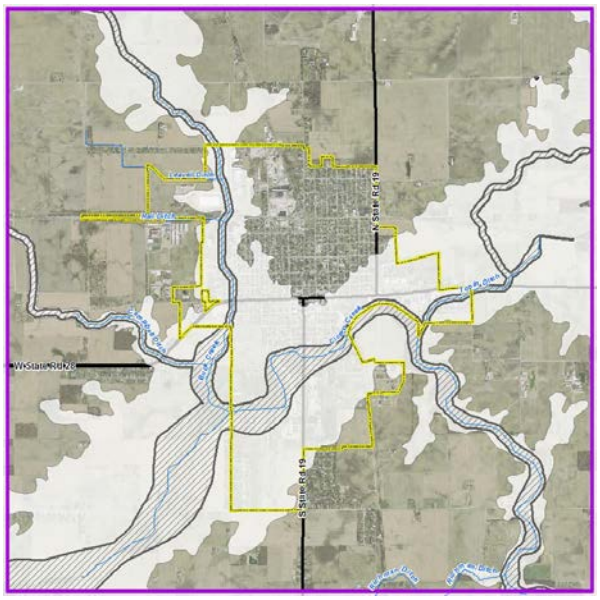

Figure 6-16 Safer Areas for Growth and Development

6.4.1 Steer Public Policy and Investment to Support Development in Safer Areas

At the core of the comprehensive plan is the land use and development section, which designates appropriate land uses for all areas of the city while providing policies and identifying appropriate land uses for the future development of the city and its growth areas. The City of Tipton 2012 Comprehensive Plan identifies functional subareas for the downtown core, east and west gateway corridors, civic/institutional core and industrial core. All of these guide, in one way or another, future growth and development in the SFHA of Big Cicero

Creek, Tobin Ditch, and Buck Creek. This approach promotes growth in vulnerable areas and is directly in conflict with this resilience plan. As a result of recent and better data from USGS, actual high water marks from the 2013 flood, and recalibrated flood map from the 2014 Big Cicero Plan, the City of Tipton should revisit their comprehensive plan to steer public policy and investment into safer areas outside the SFHA.

Tipton should also consider promoting smart growth principles when delineating preferred growth areas. Principles suitable to the City of Tipton include, but are not limited to:

- Mix land uses
- Take advantage of compact building design
- Create a range of housing opportunities and choices
- Create a walkable community
- Foster a distinctive, attractive community with a strong sense of place
- Preserve open space, farmland, natural beauty and critical environment areas
- Strengthen and direct development toward the existing community
- Provide a variety of transportation options
- Make development decisions predictable, fair, and cost-effective
- Encourage community and stakeholder collaboration in development decisions

Once preferred safe growth areas are identified, Tipton should revisit their zoning and subdivision regulations, and identify and remove any unnecessary barriers to encourage development in these areas. For example, Tipton officials should review any setback requirements or off-street parking standards that may require more land and increase the cost of development.

Tipton should target future capital improvements, extend utilities, and infrastructure in locations that are designated as safer growth areas by formally coordinating local capital improvement plans with the city's comprehensive and development plans. By prioritizing capital improvements in safer areas, Tipton can provide incentives for development to locate there. This may include TIF districts, flexible zoning practices, or permit waivers as examples. At present, Tipton does not have a formal capital improvement plan in place, so the development of such should be a high priority.

6.4.2 **Promote Conservation Design**

Conservation design is a land development practice that allows for growth and development while protecting sensitive ecological resources, prime agricultural lands, scenic landscapes, as well as historic and cultural resources. ***Figure 6-17*** illustrates this practice and compares a traditional residential development to a conservation residential development

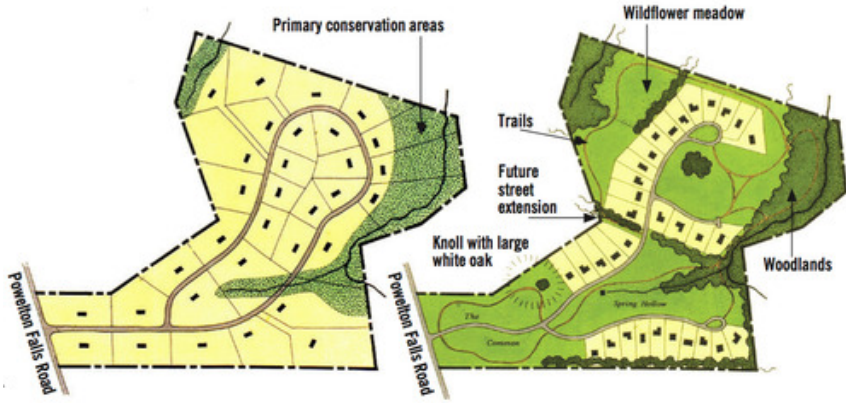

Figure 6-17 Illustration comparing traditional and conservation design approach

approach. The open space is typically held and managed as a conservation easement by a land trust or similar organization. While less common, the same approach can apply to other land use categories as well.

Conservation design is an effective tool to preserve the natural and beneficial function of the floodplains, wooded areas, and wetlands. Economically, conservation design allows developers to distinguish themselves in a competitive market. Houses in conservation design neighborhoods tend to appreciate faster than their traditional counterparts.

The City of Tipton should draft conservation design standards into their subdivision control ordinance. Identifying incentives such as density bonuses, property tax and stormwater fee credits may help with implementation.

6.4.3 Promote Placement of Critical Facilities in Safer Areas

Critical facilities are structures that are vital to the community's ability to provide essential services and protect life and property, are critical to the community's response and recovery activities, and/or are the facilities the loss of which would have a severe or catastrophic impact. These typically include fire stations, police stations, schools, and hospitals for example. Current floodplain regulations in Tipton allow critical facilities to be constructed in the SFHA, if 'no feasible alternative site is available'. However, due to the importance of these facilities to the operation and function of the city before, during, and after a hazard event, under no circumstances should they be located in the SFHA.

Although the city has no immediate plans for the development of additional critical facilities, the city should draft and adopt language as an amendment to the floodplain ordinance to:

- Allow critical facilities outside the SFHA only, and
- Elevate critical facilities to 3 feet above the base flood elevation or 0.2% annual chance of flood (500-year) elevation, whichever is higher, and
- Provide flood-free access to critical facilities.

These requirements are consistent with Executive Order 11988, Floodplain Management as well as federal agencies requirements for funding and/or permitting for critical facilities.

6.5 WATERSHED

The watershed flood resilience planning area is outside the SFHA and includes the entire drainage area (***Figure 6-18***). The intent of this planning area is to promote coordination and partnerships in the watershed and implement practices to slow, spread, and infiltrate flood water. The following lists the watershed planning area strategies.

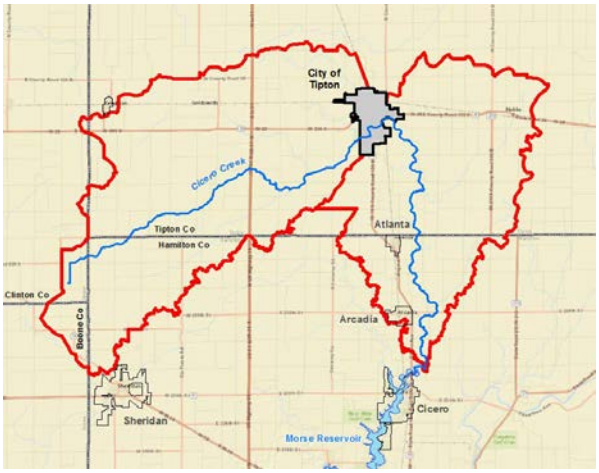

Figure 6-18 Watershed Planning Area

6.5.1 **Support the efforts of the Big Cicero Creek Joint Drainage Board**

The City of Tipton is fortunate to be in a watershed with a well-educated and well-informed drainage board. The Big Cicero Joint Drainage Board regulates all issues that pertain to Cicero Creek from Boone County thru Hamilton County including Tipton and Clinton Counties. They also set all fees for those watersheds the flow into Cicero Creek. The surveyors from each of these four counties sit on this board.

As referenced throughout this plan, the 2014 Big Cicero Creek Watershed Flood and Erosion Risk Management Plan provided recommendations on how to better control flooding within the watershed. In addition to promoting the implementation of flood resiliency measures, the Big Cicero Plan recommended other watershed-wide measures including:

- Promote and incentivize the use of cover crops or other soil health practices by farmers. This would potentially provide additional flood storage within the watershed, compensating for the impact of some ongoing farm practices. Additionally, cover crops increase storage of water within soil layers, which helps to reduce the frequency of the stream flows that determine the channel size, thereby reducing increases in streambank erosion and sedimentation.
- Partner and support USGS to maintain stream gages, add additional gages, and incorporate water quality and sediment load modeling into one or more gages.
- Construct a 2-stage ditch/channel improvement project along the lower reach of Big Cicero Creek through Tipton to stabilize erosion and sedimentation and also to partially compensate for the impacts of agricultural practices and impending climate change[i].
- Establish and adhere to best management practices along open channels to minimize and manage stream bank erosion issues, looking at each situation individually to determine the exact causes for erosion
- Study flood elevations on Tobin Ditch and flood storage potential on Prairie Creek

The City of Tipton should continue to support the efforts of the Big Cicero Joint Drainage Board and implementation of the Big Cicero Creek Watershed Flood and Erosion Risk Management Plan especially where it improves flood resiliency for the city directly.

6.5.2 **Adopt Natural Resource Overlay Zone**

A natural resource overlay zone is intended to be used with any underlying base zoning throughout the watershed. The purpose of this overlay zone is to protect and improve the natural resource function and values that contribute to flooding, water quality, fish and wildlife habitat as well as economic resource, and recreation and aesthetics. This overlay encompasses open water, floodplains, riparian corridors, wetlands, woodlots, and urban tree canopy. These natural areas have a tremendous ability to capture, store, and treat flood water. Protecting and enhancing these areas will go a long way toward the city's resiliency.

For the City of Tipton, the implementation of this strategy is two-fold:

1. Partner with the Big Cicero Joint Drainage Board to delineate, draft language, and require adoption of a natural resource overlay zone throughout the watershed
2. Adopt and implement the natural resource overlay zone within the city limits

The implementation of a natural resource overlay zone does not have to restrict agricultural practices or plans for Tipton or other municipalities in the Big Cicero Creek Watershed to development. It would require a much more sustainable approach that supports the natural and beneficial function of natural resources.

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CHAPTER 7 RECOMMENDED IMPLEMENTATION PLAN

Preparation and adoption of this Flood Resilience Plan is a necessary first step for the City of Tipton to reduce its vulnerability to future flooding events. However, the plan by itself is not going to bring flood resiliency to the city, unless its recommendations are implemented in a sustained and methodical manner. ***Table 7-1*** provides a summary of the flood resilience strategies, major implementation steps, and recommended timeline. This table should be used to track the city's progress throughout the implementation phase.

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Table 7-1 Summary of Flood Resilience Strategies, Implementation Steps, and Timeline

AREA	PROPOSED STRATAGIES	IMPLEMENTATION STEPS	SHORT-TERM (1-5 YRS)	MID-TERM (5-10 YRS)	LONG-TERM (10+ YRS)	ONGOING	COMPLETED
Overall Strategies	1. Update floodplain regulations	1. Update flood ordinance with the appropriate alternative language in IDNR model Flood Hazard Ordinance	X				
		2. Adopt as an amendment to floodplain ordinance	X				
		3. Add reference to MHMP and comprehensive plan updates	X				
	2. Adopt flood elevation data from updated flood studies	1. Further refine the hydraulic modeling and mapping along Big Cicero Creek and Buck Creek to reflect calibration to the newly revised estimate of the April 2013 flood magnitude by USGS	X				
		2. Provide the updated modeling and mapping to IDNR for approval and incorporation into official FEMA flood maps	X				
		3. Complete study of Prairie Creek upstream from confluence with Big Cicero Creek and obtain approval from IDNR – study in progress, anticipate IDNR approval late summer 2016	X				
		4. Review completed study of Tobin Ditch	X				
		5. Adopt revised flood elevation data for Tobin Ditch and Prairie Creek studies and add to the regulatory process for planning and building permits	X				
		6. Add reference to MHMP and flood ordinance updates	X				
	3. Adopt a comprehensive stormwater ordinance and technical standards	1. Review the recently adopted County Stormwater Ordinance and Technical Standards	X				
		2. Adopt a stand-alone stormwater ordinance and technical standards to preserve upstream floodplain storage, institute requirements for channel protection volume, compensatory storage, and promote low impact development/green infrastructure in developed areas	X				

AREA	PROPOSED STRATAGIES	IMPLEMENTATION STEPS	SHORT-TERM (1-5 YRS)	MID-TERM (5-10 YRS)	LONG-TERM (10+ YRS)	ONGOING	COMPLETED
		3. Add reference to MHMP, comprehensive, and flood ordinance updates	X				
	4. Update, integrate, and revise plans, policies and regulations	1. Amend and adopt language in comprehensive plan, MHMP, and development codes (zoning, subdivision control, stormwater, floodplain ordinances) as noted in the strategies for individual flood resilience planning areas (Chapter 6 and in this table)				X	
		2. Amend and adopt language in the comprehensive plan to include a section dedicated to flood hazards, floodplain management, and fluvial erosion hazards and future land use that protects the river corridor,	X				
		3. Amend and adopt language in the comprehensive plan to show how future land use protects river corridors, SFHA, and guides development to safer areas that are less vulnerable to flooding and streambank erosion	X				
		4. Amend and adopt language in the MHMP to address non-structural solutions for pre-disaster mitigation	X				
		5. Amend and adopt language in the MHMP to discuss tools to direct growth and development from known flood hazard areas	X				
	5. Conduct regular audits of programs and policies	1. Complete the Flood Resilience Checklist provided in Appendix B annually to track the progress made in making the City more resilient to flooding				X	
		2. Assemble a list of representatives responsible for MHMP, comprehensive plan, zoning/subdivision control, stormwater, floodplain, and flood response plan				X	

AREA	PROPOSED STRATAGIES	IMPLEMENTATION STEPS	SHORT-TERM (1-5 YRS)	MID-TERM (5-10 YRS)	LONG-TERM (10+ YRS)	ONGOING	COMPLETED
		3. Meet annually (could coincide with MHMP annual update meeting) to revisit the resilience checklist and to ensure plans and policies are consistent with each other, CIP, and economic development efforts				X	
		4. Document progress made, evaluate goals and target implementation dates to become a flood resilient community				X	
	6. Participate in the Community Rating System	1. Review CRS materials available through FEMA webpage	X				
		2. Meet with ISO representative to discuss CRS program and potential points for city	X				
		3. Assemble materials for initial CRS application and submit to ISO	X				
		4. Once enrolled, maintain information for annual recertification and 5-year cycle visit				X	
		5. Annually (at minimum) revisit the CRS checklist and look for opportunities for additional points to reduce flood insurance premiums and become a more flood resilient community				X	
River Corridor	1. Adopt a river corridor overlay zone and prohibit land disturbance in this zone	1. Delineate/define the river corridor overlay zone as either the floodway or fluvial erosion hazard area, whichever is greater	X				
		2. Draft language to prohibit development including structures, infrastructure, and utilities as well as any land disturbance such as parking areas, land clearing, excavation, and grading	X				
		3. Adopt language as an amendment to zoning ordinance	X				
		4. Add reference in next MHMP, comprehensive plan, and flood ordinance update	X				

AREA	PROPOSED STRATAGIES	IMPLEMENTATION STEPS	SHORT-TERM (1-5 YRS)	MID-TERM (5-10 YRS)	LONG-TERM (10+ YRS)	ONGOING	COMPLETED
	2. Protect undeveloped land in the river corridor	1. Identify landowners with undeveloped land in the river corridor	X				
		2. Partner with local land trusts and IDNR/USDA with agriculture, wetlands, forest, and wildlife conservation and/or restoration programs	X				
		3. Identify incentives for implementation such as conservation easements, cost-share, donation or purchase agreements	X				
	3. Minimize streambank erosion	1. Support the ongoing design and construction a 2-stage ditch/channel improvements on Big Cicero through Tipton	X				
		2. Secure funding, design, and construct a 2-stage ditch/channel improvements along Buck Creek		X			
		3. Study Tobin Ditch for erosion problems and identify solutions		X			
		4. Monitor streams long-term for erosion problems				X	
		5. Add reference to streambank erosion in the next MHMP especially if it relates to critical infrastructure	X				
Other High Flood Hazard Areas	1. Prohibit Development in the floodway fringe (including critical facilities)	1. Draft language to prohibit new development (including critical facilities) in the floodway fringe	X				
		2. Amend language in the floodplain ordinance to prohibit new critical facilities from being constructed in the floodway fringe (currently permitted)	X				
		3. Adopt language as an amendment in the floodplain ordinance	X				
		4. Add reference in the next MHMP and comprehensive plan updates	X				
	2. Protect undeveloped land in the floodway fringe	1. Identify landowners of undeveloped land in the floodway fringe		X			

AREA	PROPOSED STRATAGIES	IMPLEMENTATION STEPS	SHORT-TERM (1-5 YRS)	MID-TERM (5-10 YRS)	LONG-TERM (10+ YRS)	ONGOING	COMPLETED
		2. Partner with local land trusts and IDNR/USDA with agriculture, wetlands, forest, and wildlife conservation and/or restoration programs		X			
		3. Identify incentives for implementation through conservation easements, cost-share, donation, or purchase agreements, etc.		X			
	3. Adopt compensatory floodplain storage requirement (where placement of fill is unavoidable and variance is granted)	1. Review the compensatory storage requirements in the recently adopted County Stormwater Ordinance and Technical Standards	X				
		2. Set compensatory storage ratio at 3:1	X				
		3. Adopt language as an amendment to the stormwater ordinance	X				
		4. Add reference to next MHMP and floodplain ordinance updates	X				
Vulnerable Settlements	1. Protect existing critical facilities	1. Review analysis completed for the hospital, schools, and wastewater treatment plant	X				
		2. Prioritize remaining critical facilities to be protected based on depth of flooding	X				
		3. Identify flood protection techniques that will protect these facilities (as well as provide flood-free access) 3-feet above the base flood elevation or 500-year (0.2% annual chance flood) whichever is higher, no exceptions	X				
		4. Secure funding from FEMA to assist with flood protection efforts – ability to secure funding may delay implementation			X		
		5. Add reference to MHMP update	X				
	2. Buyout structures	1. Prioritize structures for voluntary buyout based those located in the river corridor first and then on depth of flooding in the floodway fringe	X				

AREA	PROPOSED STRATAGIES	IMPLEMENTATION STEPS	SHORT-TERM (1-5 YRS)	MID-TERM (5-10 YRS)	LONG-TERM (10+ YRS)	ONGOING	COMPLETED
		2. Identify landowners and determine level of interest		X			
		3. Secure funding from FEMA to implement buyout efforts – ability to secure funding may delay implementation		X			
		4. Maintain properties in perpetuity as open space				X	
		5. Add reference to MHMP, comprehensive plan and zoning updates	X				
	3. Floodproof structures	1. Prioritize structures for floodproofing based on depth of flooding and type of foundation	X				
		2. Identify landowners and floodproofing options		X			
		3. Secure funding from FEMA to assist with floodproofing efforts – ability to secure funding may delay implementation		X			
		4. Add reference to MHMP updates	X				
	4. Bring nonconforming uses into compliance	1. Identify nonconforming uses in SFHA	X				
		2. Draft nonconforming use requirements that recognize partial compliance with development standards for non-substantially damaged structures	X				
		3. Identify incentives for implementation (expanding buildings floor area, cost-share, waived permit fees, etc.) to encourage voluntary compliance	X				
		4. Adopt language as an amendment to the flood ordinance	X				
		5. Add reference to next MHMP update	X				
	5. Create new flood storage capacity through redevelopment	1. Draft language to encourage redevelopment projects to provide additional flood storage through open space, green infrastructure stormwater management practices, underground detention, building design, etc.	X				
		2. Identify incentives for implementation such as density bonuses (without increasing footprint), floodproofing assistance, stormwater utility fee credit	X				

AREA	PROPOSED STRATAGIES	IMPLEMENTATION STEPS	SHORT-TERM (1-5 YRS)	MID-TERM (5-10 YRS)	LONG-TERM (10+ YRS)	ONGOING	COMPLETED
		3. Adopt language as an amendment to the stormwater ordinance	X				
		4. Add reference to next MHMP, zoning, subdivision control, and stormwater ordinance updates	X				
	6. Require building expansion and new accessory structures to meet additional requirements	1. Set compensatory storage ratio at 1:1 for building expansions and new accessory structures	X				
		2. Draft language to not allow the building expansions, or new accessory structures, to not be any closer to the river	X				
		3. Require all building expansions to meet or exceed additional requirements – no exceptions or grandfathering	X				
		4. Identify incentives such as flexible zoning, floodproofing assistance, stormwater utility fee credit	X				
		5. Adopt as an amendment to the stormwater and floodplain ordinances	X				
		6. Add reference in next MHMP update	X				
	7. Adopt a flood response plan	1. Correlate river flood stages with the expected extent and severity of flooding (road closures, flooded areas, evacuations, etc.)	X				
		2. Document procedures and protocols for flood response notification, communication, and expected actions	X				
		3. Adopt and maintain the flood response plan	X				
	8. Adopt post-flood damage assessment data collection and protocols	1. Review IDNR post-flood damage assessment data collection and protocol materials	X				
		2. Adopt language as an amendment to the flood ordinance	X				
		3. Add reference to next MHMP and flood response plan updates	X				
	9. Connect people to the river	1. Implement the multi-use path/trail along the river that is proposed in the comprehensive plan			X		

AREA	PROPOSED STRATAGIES	IMPLEMENTATION STEPS	SHORT-TERM (1-5 YRS)	MID-TERM (5-10 YRS)	LONG-TERM (10+ YRS)	ONGOING	COMPLETED
		2. Identify opportunities for exposure to river including parks, river walks, outdoor dining and recreation			X		
		3. Partner with landowners to allow access (visual and/or physical) to the river			X		
		4. Add reference to next comprehensive plan update	X				
Safer Areas	1. Steer public policy and investment to support development in safer areas	1. Identify locations suitable for development and redevelopment that are safer from flooding	X				
		2. Draft language to promote smart growth principles such as mixed use/mixed density development	X				
		3. Prioritize safer areas for future CIP improvements to extend utilities and infrastructure	X				
		4. Identify incentives such as TIF districts and incentive zoning practices (density bonuses, flexible regulations, fee waivers, etc.)	X				
		5. Adopt language as an amendment to the zoning and subdivision control ordinances	X				
		6. Add reference to MHMP and comprehensive plan updates	X				
	2. Promote conservation design	1. Draft conservation or cluster development standards for new development that includes language to preserve the natural and beneficial function of the floodplain	X				
		2. Identify incentives for implementation such as conservation easements, density bonuses, and stormwater utility fee credits	X				
		3. Adopt language as an amendment to the subdivision control ordinance	X				
		4. Add reference to next MHMP and comprehensive plan updates	X				

AREA	PROPOSED STRATAGIES	IMPLEMENTATION STEPS	SHORT-TERM (1-5 YRS)	MID-TERM (5-10 YRS)	LONG-TERM (10+ YRS)	ONGOING	COMPLETED
	3. Promote placement of critical facilities in safer areas	1. Draft language to allow critical facilities outside the SFHA only and to be elevated 3-feet above the base flood elevation or 500-year (0.2% annual chance flood) whichever is higher, no exceptions	X				
		2. Adopt language as an amendment to the flood ordinance	X				
		3. Add reference to MHMP, comprehensive plan, and zoning updates	X				
Watershed	1. Support the efforts of the Big Cicero Creek Drainage Board (and implementation of the 2014 Big Cicero Plan)	1. Promote cover crop programs especially with landowners of highly erodible soils	X				
		2. Partner with USGS to maintain the Tipton stream gage				X	
		3. Support USGS' efforts to include water quality and sediment load modeling at the Tipton stream gage		X			
		4. Encourage USGS to locate a stream gage upstream of Tipton to be used for flood alerts and notifications		X			
		5. Incorporate findings from studies on Tobin Ditch and Prairie Creek	X				
	2. Adopt a natural resource overlay zone	1. Delineate/define a natural resource overlay zone that includes forested areas, wetlands, and urban tree canopy		X			
		2. Identify landowners of natural resource areas to be protected		X			
		3. Partner with local land trusts and IDNR/USDA with agriculture, wetlands, forest, and wildlife conservation and/or restoration programs		X			
		4. Identify incentives for implementation such as conservation easements, cost-share, donation or purchase agreements		X			
		5. Draft language to limit encroachment and fragmentation of these areas		X			
		6. Adopt language as an amendment to zoning ordinance		X			

AREA	PROPOSED STRATAGIES	IMPLEMENTATION STEPS	SHORT-TERM (1-5 YRS)	MID-TERM (5-10 YRS)	LONG-TERM (10+ YRS)	ONGOING	COMPLETED
		7. Add reference in next MHMP, comprehensive plan, and flood ordinance update		X			

SOURCES REFERENCED

Association of State Floodplain Managers (2008) *Natural and Beneficial Floodplains Functions: Floodplain Management – More than flood Loss Reduction.* http://www.floods.org/PDF/WhitePaper/ASFPM_NBF%20White_Paper_%200908.pdf

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City of Tipton (2000) *Subdivision Control Ordinance*

City of Tipton "Welcome to Tipton" https://www.tiptongov.com/city/

City of Tipton (2010) *Zoning Ordinance*

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Christopher B. Burke Engineering, LLC (2014) *Big Cicero Creek Watershed Flood and Erosion Risk Management Plan*

Federal Emergency Management Agency *Executive Order 11988, Floodplain Management* https://www.fema.gov/executive-order-11988-floodplain-management

Global Change (2014) *National Climate Assessment* http://nca2014.globalchange.gov/report

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Indiana Department of Natural Resources (2008) *Post-Flood Guidance for Local Floodplain Administrators* http://www.in.gov/dnr/water/files/407_all.pdf

Indiana Silver Jacket/Polis Center (2013) *FEH Analysis* http://feh.iupui.edu/

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U.S. Environmental Protection Agency Office of Sustainable Communities (2014) "Planning for Recovery and Long-Term Resilience in Vermont" https://www.epa.gov/sites/production/files/2014-07/documents/vermont-sgia-final-report.pdf

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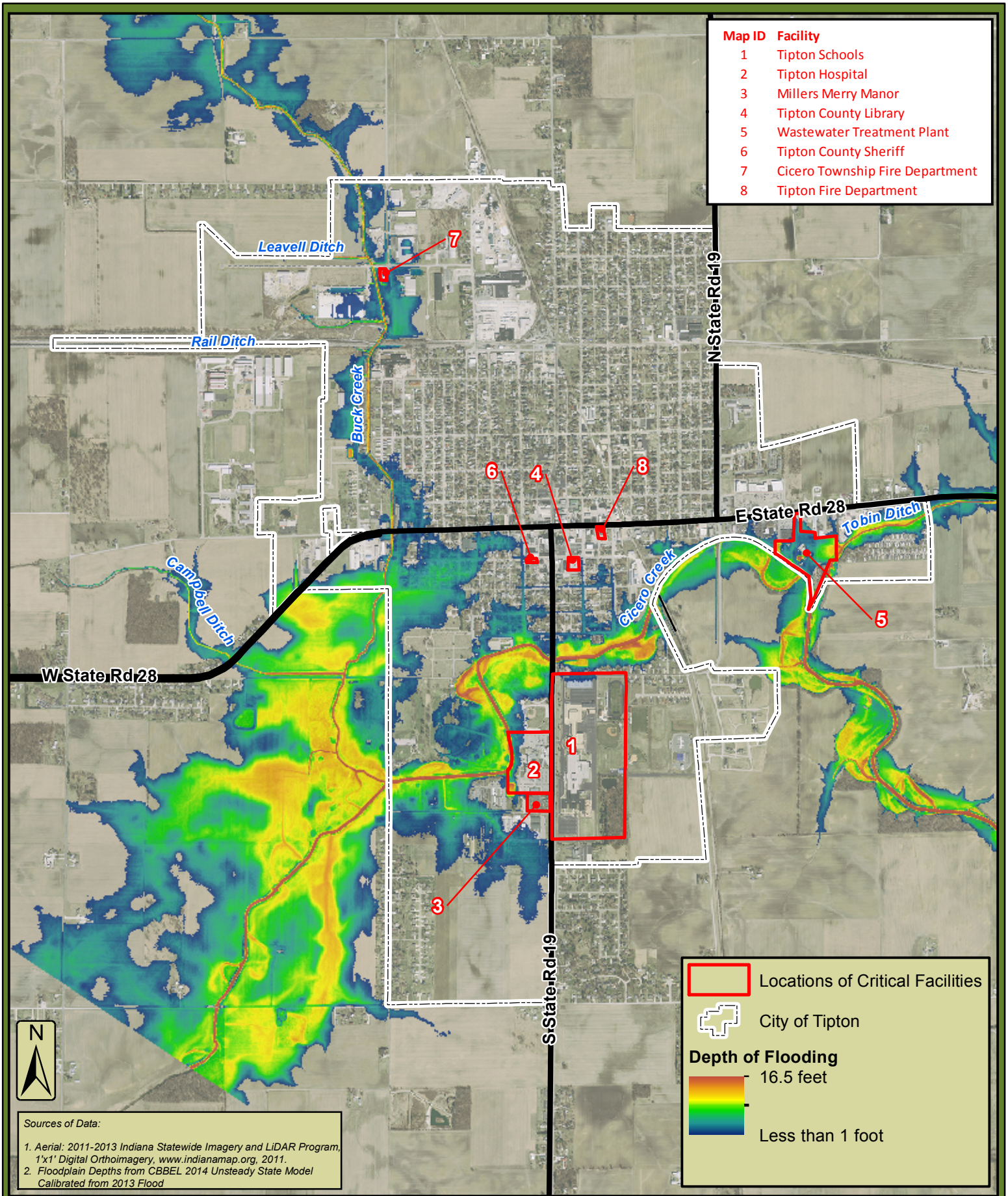

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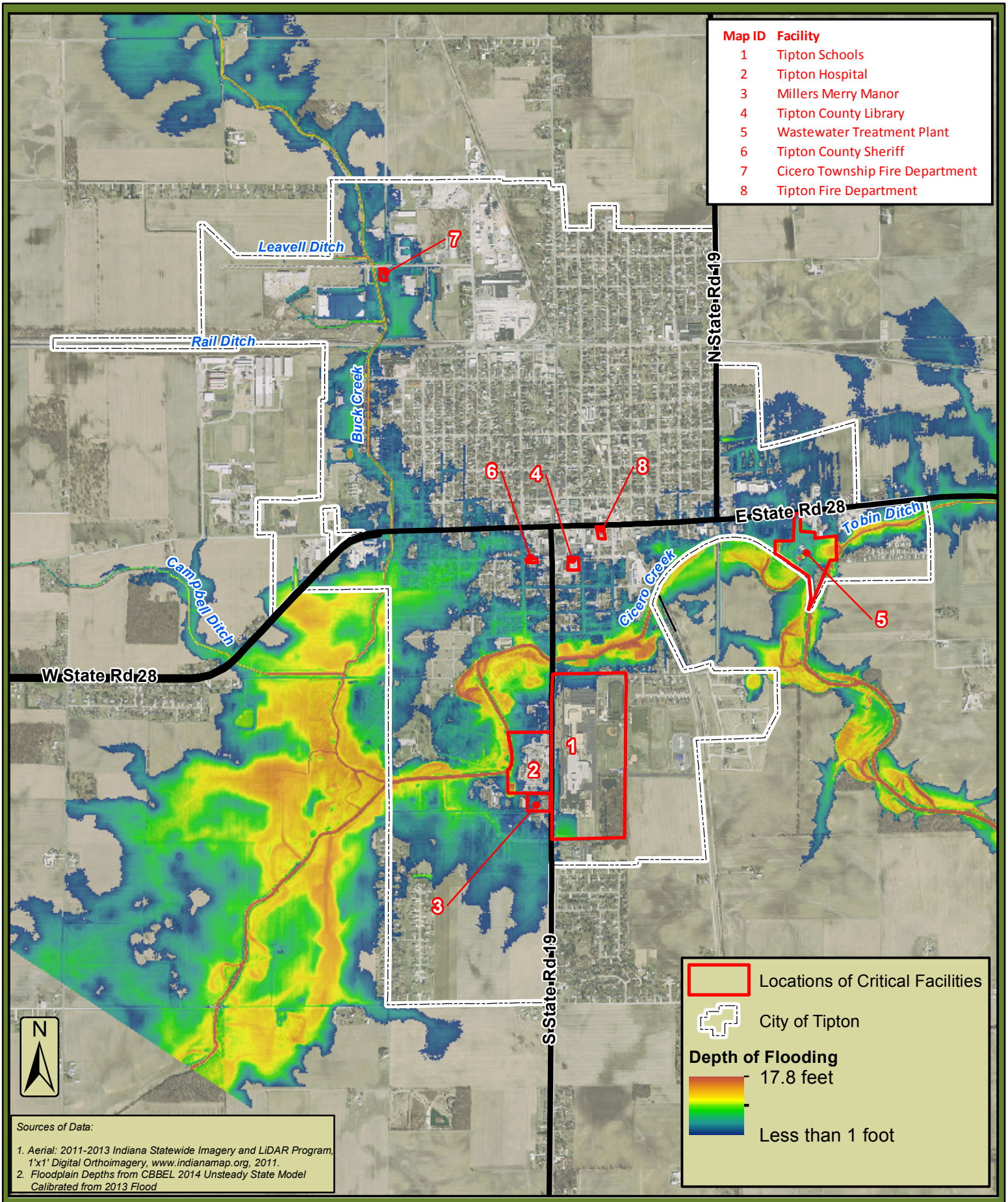
115 West Washington Street
Indianapolis, Indiana 46204
(t) 317.266.8000 (f) 317.632.3306

PROJECT: City of Tipton Flood Resilience Plan		PROJECT NO. 15-0363	APPROX. SCALE 1 " = 2,000 '
TITLE: Depth of Flooding 10% Annual Chance Flood Hazard			DATE: 04/2016
			EXHIBIT 1



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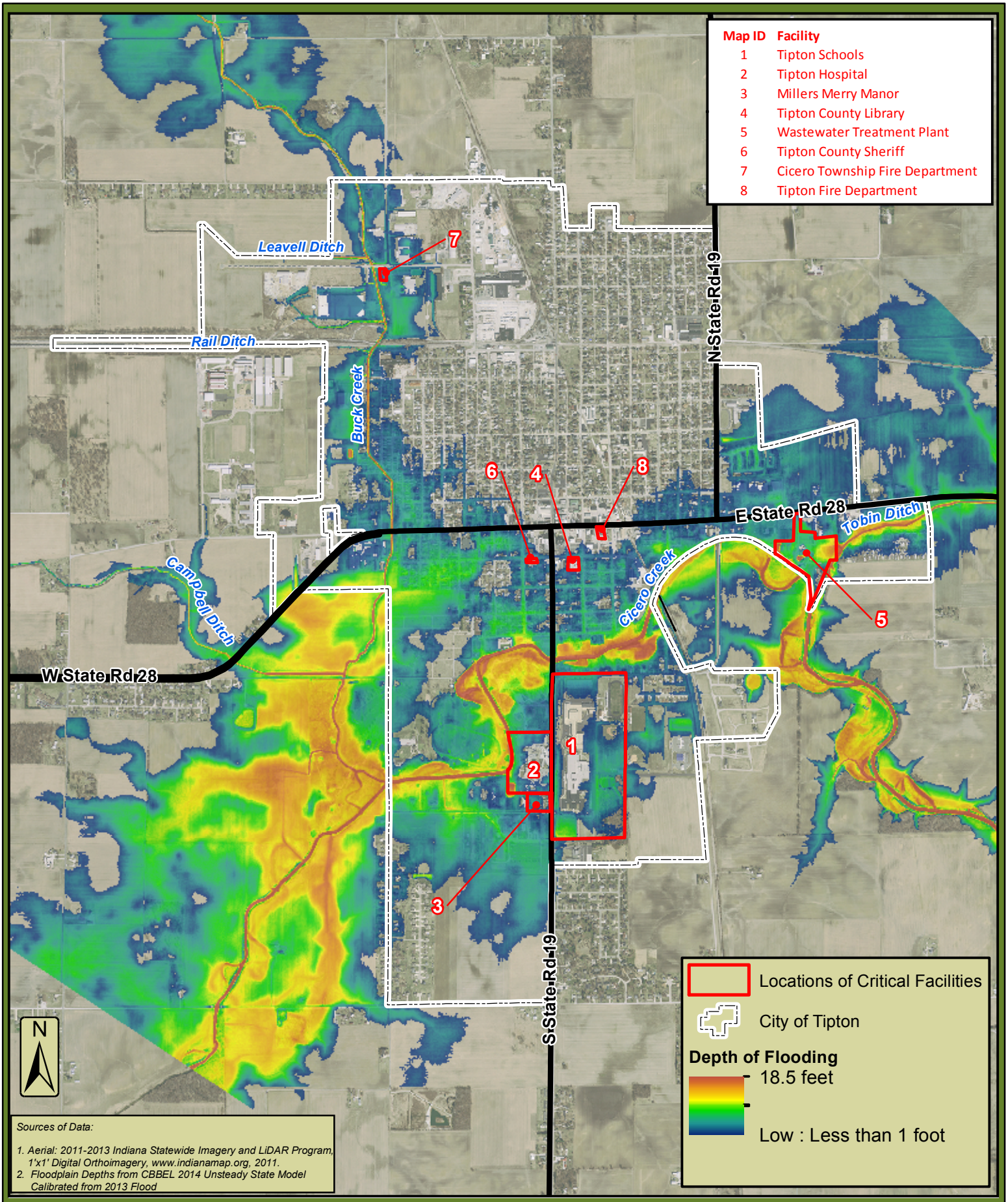
PROJECT: City of Tipton Flood Resilience Plan		PROJECT NO. 15-0363	APPROX. SCALE 1 " = 2,000 '
TITLE: Depth of Flooding 4.0% Annual Chance Flood Hazard			DATE: 04/2016
			EXHIBIT 2



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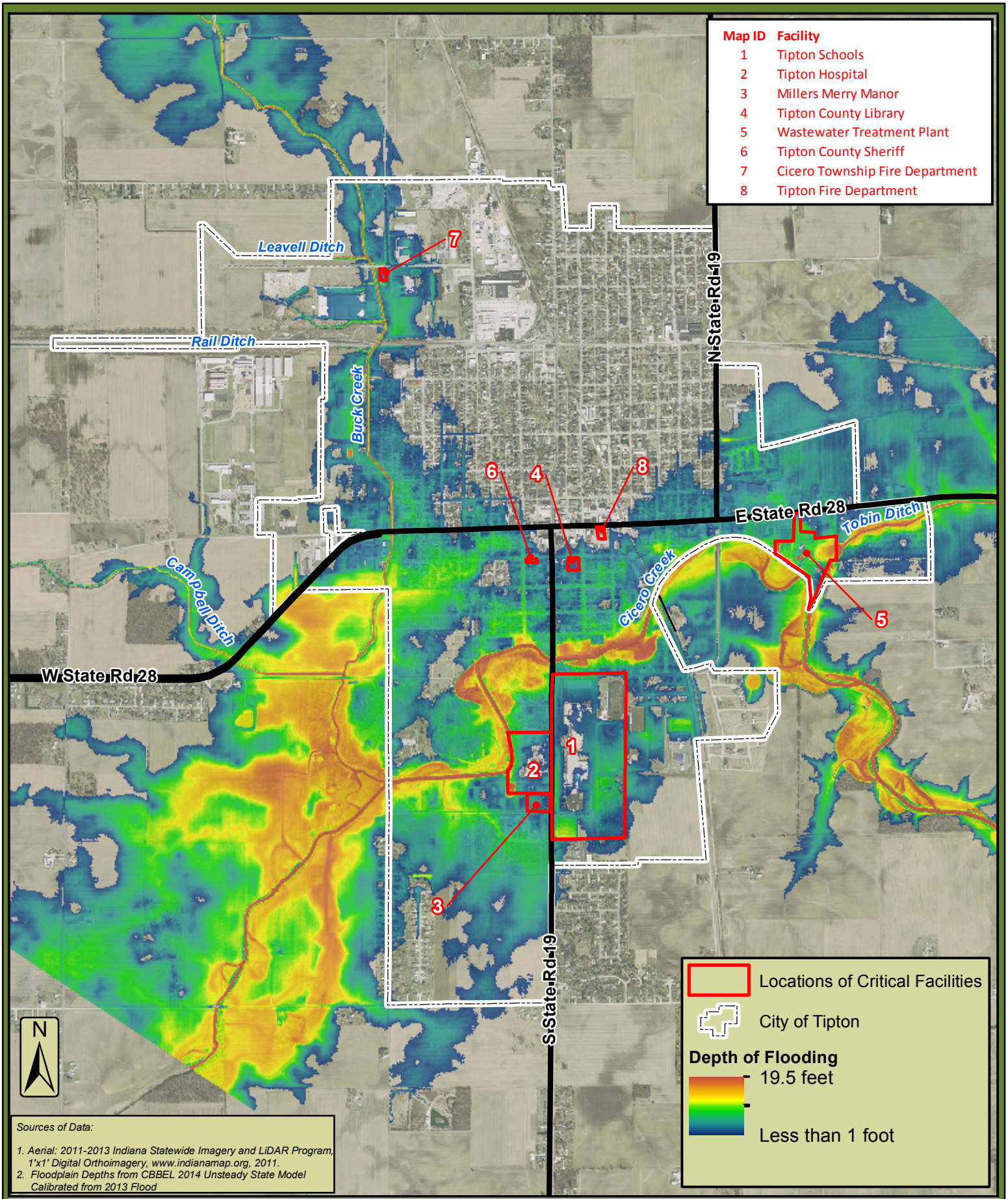
PROJECT: City of Tipton Flood Resilience Plan		PROJECT NO. 15-0363	APPROX. SCALE 1 " = 2,000 '
TITLE: Depth of Flooding 2.0% Annual Chance Flood Hazard			DATE: 04/2016
			EXHIBIT 3



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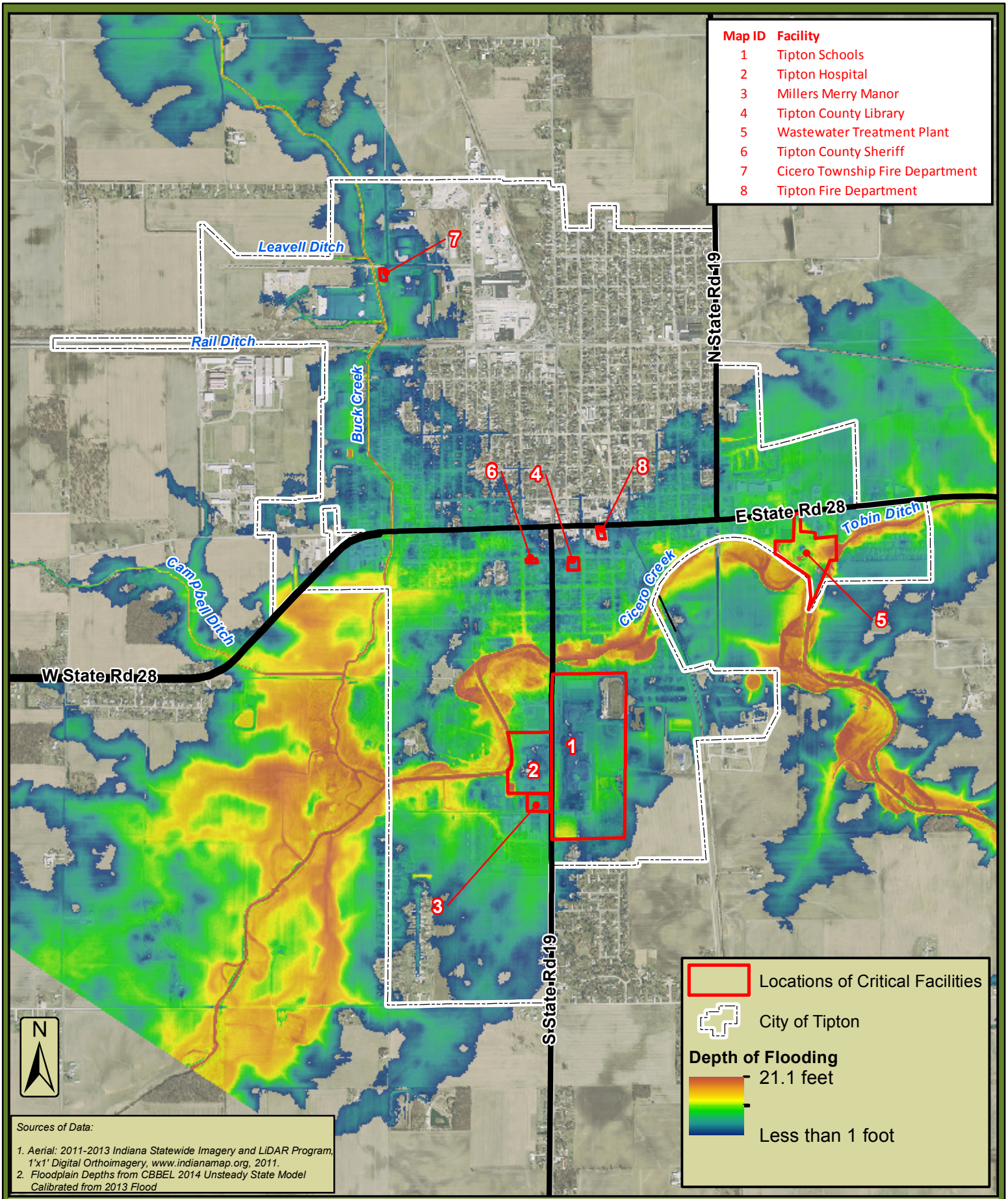
PROJECT: City of Tipton Flood Resilience Plan		PROJECT NO. 15-0363	APPROX. SCALE 1 " = 2,000 '
TITLE: Depth of Flooding 1.0% Annual Chance Flood Hazard			DATE: 04/2016
			EXHIBIT 4



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PROJECT: City of Tipton Flood Resilience Plan		PROJECT NO. 15-0363	APPROX. SCALE 1 " = 2,000 '
TITLE: Depth of Flooding 0.2% Annual Chance Flood Hazard			DATE: 04/2016
			EXHIBIT 5

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River Corridor

Other High Flood Hazard Areas

Vulnerable Settlements

Safer Areas

River Corridor	Floodway or fluvial erosion hazard area, whichever is greater	To conserve land and prohibit development
Other High Flood Hazard Areas	Undeveloped land in the floodway fringe	To conserve land and maintain the natural and beneficial function of the floodway fringe
Vulnerable Settlements	Existing developed land in the SFHA (floodway and floodway fringe)	To protect people, buildings, and facilities in vulnerable areas and reduce future flood risk
Safer Areas	Outside the SFHA but within the planning jurisdiction	To plan for and promote development in areas that are less vulnerable to future floods
Watershed	Entire drainage area	To promote coordination and partnerships and implement practices to slow, spread, and infiltrate flood water

Sources of Data:

1. *Aerial: 2011-2013 Indiana Statewide Imagery and LiDAR Program, 1'x1' Digital Orthoimagery, www.indianamap.org, 2011.*
2. *Floodplain Delineation from CBBEL 2014 Unsteady State Model Calibrated from 2013 Flood*
3. *Floodway delineation from Tipton County Effective FIS, dated 06/09/2014*

River Corridor

Vulnerable Settlements

Other High Flood Hazard Areas

City of Tipton Planning Jurisdiction

City of Tipton

N

0 0.25 0.5

Scale in Miles

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PROJECT: City of Tipton Flood Resilience Plan

PROJECT NO. 15-0363

APPROX. SCALE as shown

DATE: 04/2016

TITLE: Flood Resilience Planning Areas

EXHIBIT 6

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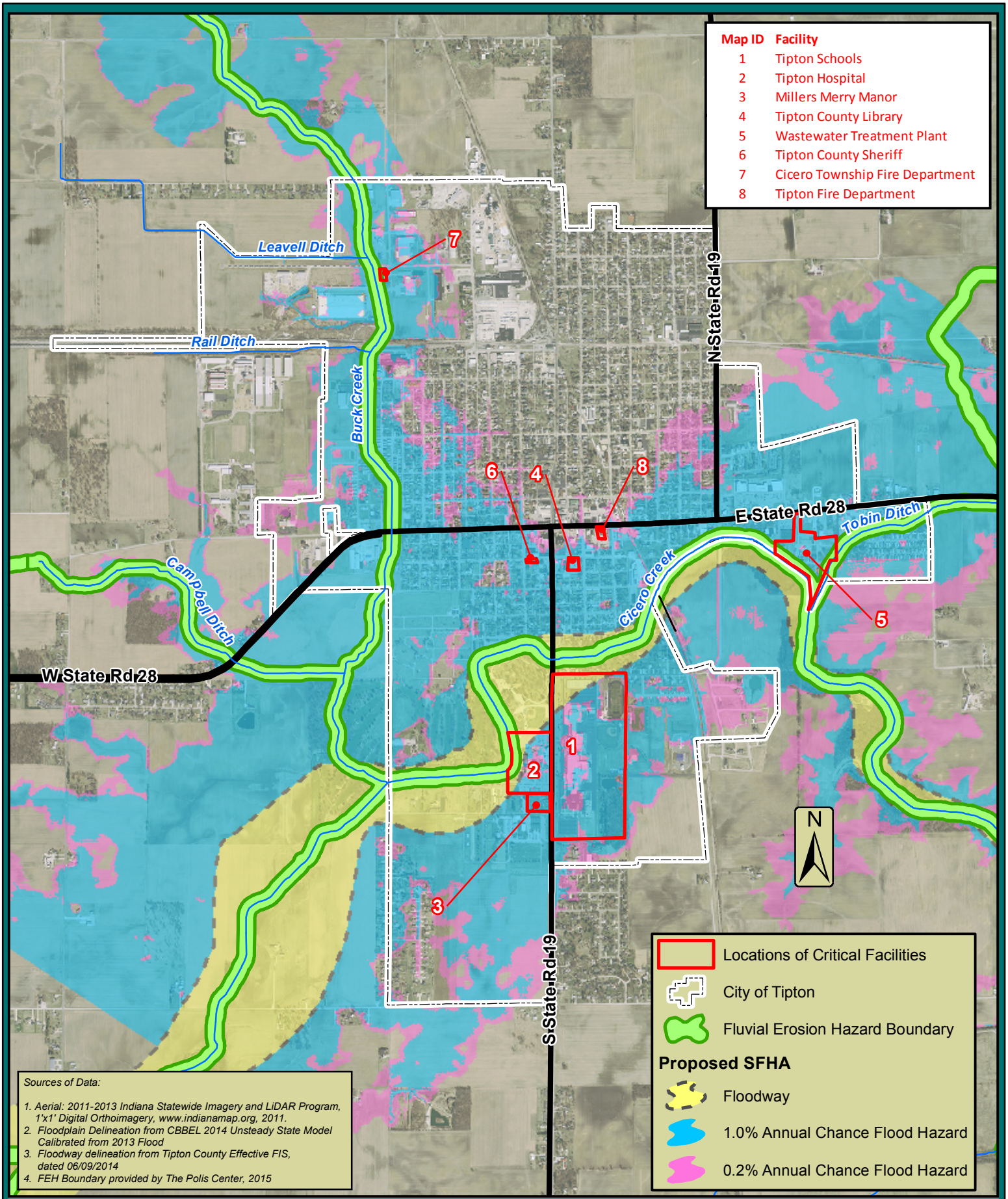

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PROJECT: City of Tipton Flood Resilience Plan		PROJECT NO. 15-0363	APPROX. SCALE 1 " = 2,000 '
TITLE: Critical Facilities, Fluvial Erosion Hazard Areas, and Proposed Flood Zones			DATE: 04/2016
			EXHIBIT 7

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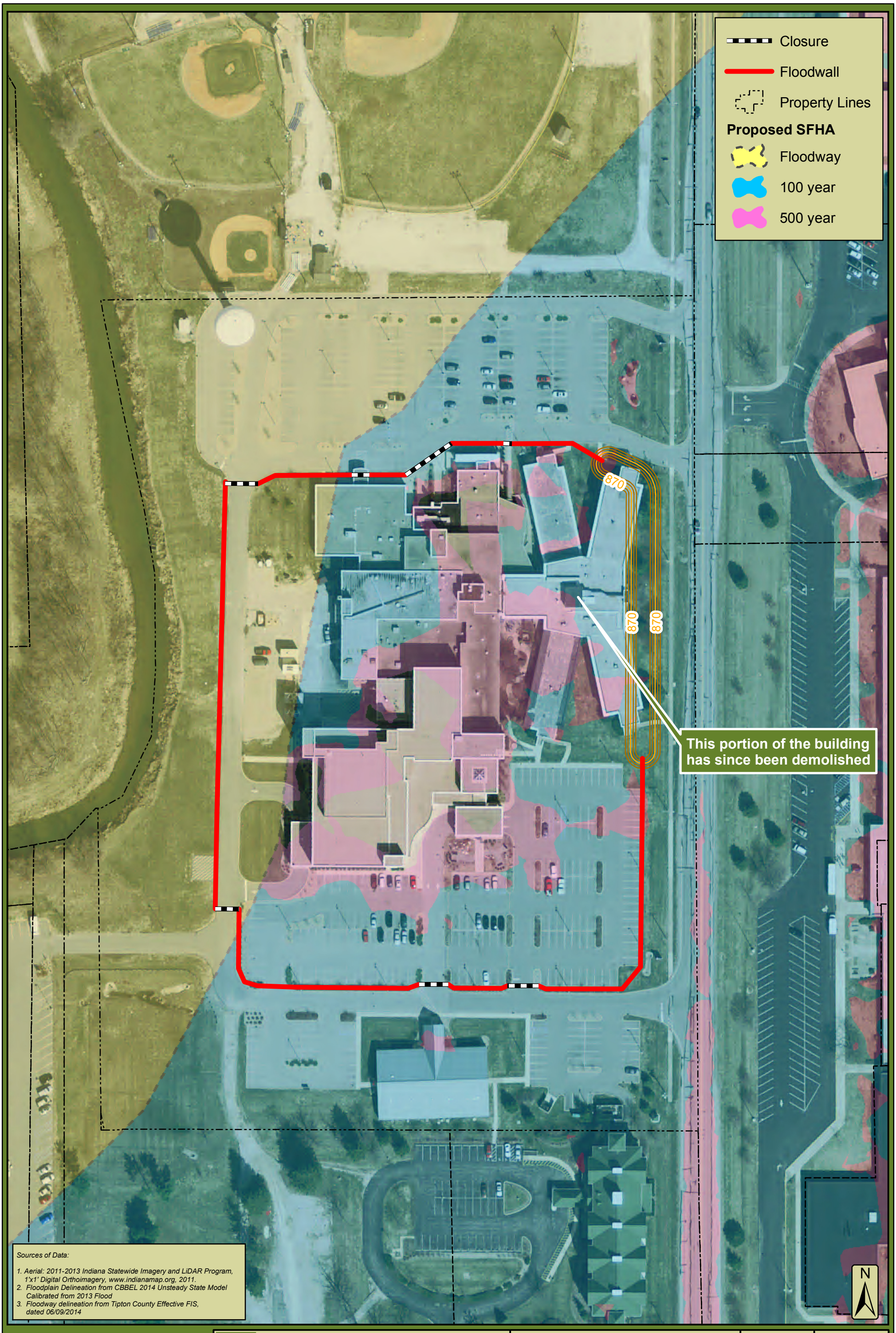

Sources of Data:

1. *Aerial: 2011-2013 Indiana Statewide Imagery and LiDAR Program, 1'x1' Digital Orthoimagery, www.indianamap.org, 2011.*
2. *Floodplain Delineation from CBBEL 2014 Unsteady State Model Calibrated from 2013 Flood*
3. *Floodway delineation from Tipton County Effective FIS, dated 06/09/2014*

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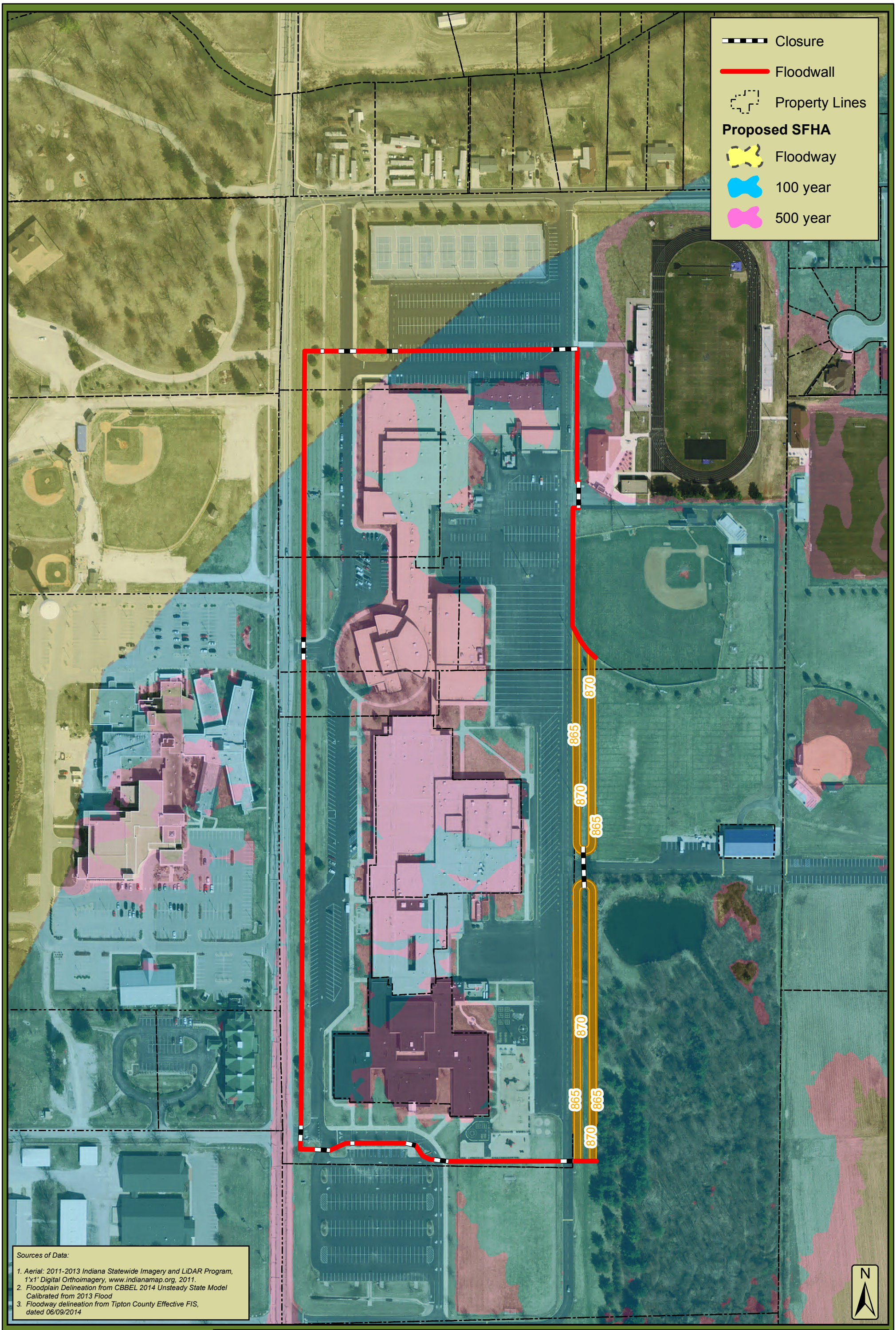
PROJECT:	**City of Tipton Flood Resilience Plan**	PROJECT NO. **15-0363**	APPROX. SCALE **1 " = 100 '**
TITLE:	**Proposed Levee/Floodwall Schematic IU Health Tipton Hospital**		DATE: **04/2016**
			EXHIBIT **8**



Sources of Data:

1. *Aerial: 2011-2013 Indiana Statewide Imagery and LiDAR Program, 1'x1' Digital Orthoimagery, www.indianamap.org, 2011.*
2. *Floodplain Delineation from CBBEL 2014 Unsteady State Model Calibrated from 2013 Flood*
3. *Floodway delineation from Tipton County Effective FIS, dated 06/09/2014*

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PROJECT:	City of Tipton Flood Resilience Plan	PROJECT NO.	15-0363
		APPROX. SCALE	1 " = 200 '
TITLE:	Proposed Levee/Floodwall Schematic Tipton Schools	DATE:	04/2016
		EXHIBIT	9

Sources of Data:

1. *Aerial: 2011-2013 Indiana Statewide Imagery and LiDAR Program, 1'x1' Digital Orthoimagery, www.indianamap.org, 2011.*
2. *Floodplain Delineation from CBBEL 2014 Unsteady State Model Calibrated from 2013 Flood*
3. *Floodway delineation from Tipton County Effective FIS, dated 06/09/2014*

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PROJECT: City of Tipton Flood Resilience Plan	PROJECT NO. 15-0363	APPROX. SCALE 1 " = 100 '
		DATE: 04/2016
TITLE: Proposed Levee/Floodwall Schematic Wastewater Treatment Plant		EXHIBIT 10

Proposed SFHA

Floodway

0.1% Annual Chance Flood Hazard

1% Annual Chance Flood Depths at Buildings

Priority & Description

1. 1 - Located in Floodway and Depth >= 2.5 feet
2. 2 - Located in Floodway and Depth > 1 foot, but < 2.5 feet
3. 3 - Located in Floodway and Depth < 1 foot
4. 4 - Located in Floodway Fringe and Depth >= 2.5 feet
5. 5 - Located in Floodway Fringe and Depth > 1 foot, but < 2.5 feet
6. 6 - Located in Floodway Fringe and Depth < 1 foot

Leavell Ditch

Rail Ditch

Cicero Creek

Campbell Ditch

Cicero Creek

Robin Ditch

N State Rd 19

S State Rd 19

W State Rd 28

E State Rd 28

Sources of Data:

1. *Aerial: 2011-2013 Indiana Statewide Imagery and LiDAR Program, 1'x1' Digital Orthoimagery, www.indianamap.org, 2011.*
2. *Floodplain Delineation from CBBEL 2014 Unsteady State Model Calibrated from 2013 Flood*
3. *Floodway delineation from Tipton County Effective FIS, dated 06/09/2014*

N

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PROJECT: City of Tipton Flood Resilience Plan	PROJECT NO. 15-0363	APPROX. SCALE 1 " = 1,500 '
		DATE: 04/2016
TITLE: 1.0% Annual Chance Flood Depths at Buildings and Prioritization for Relocation/Buyout		EXHIBIT 11

APPENDIX A

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Tipton Flood Resilience Plan – Stakeholder Meeting

August 12, 2015

Tipton County Foundation Building, 1020 West Jefferson Street, Tipton, Indiana

AGENDA ITEMS

1. Welcome and Introductions
2. Scope of the Plan and Purpose of the Meeting
3. Overview of FEMA Risk Map Project
4. Introduction to Resiliency Planning
5. Flood Resiliency Checklist

ATTENDED BY

Don Havens, Mayor
Phil Beer, Tipton County Engineer
Chuck Bell, Emergency Management Director
AJ Bytnar, Floodplain Administrator, Zoning Administrator, Building Commissioner, and Planning Director
Kevin Emsweller, Superintendent of Tipton Community School Corporation
Michael Harlowe, Tipton Hospital Administrator (President/CEO)
Jason Henderson, Tipton County Surveyor, Tipton County Drainage Board
Jeff Sheridan, Tipton County Economic Development Executive Director
Joe Van Bibber, County Commissioner

David Knipe, IDNR
Matt Riggs, Polis Center
Lacey Duncan, Polis Center
Siavash Beik, CBBEL
Matt Rummel, CBBEL

FEMA

Tipton, Indiana

Planning for Flood Recovery and Long-Term Resilience

RiskMAP
Increasing Resilience Together

Agenda

- **Welcome and Introductions**
- **Scope of the Plan and Purpose of the Meeting**
- **Overview of FEMA Risk Map Project**
- **Introduction to Resiliency Planning**
- **Flood Resiliency Checklist**

Scope and Purpose

- **Scope of the Resiliency Plan**
  - Identify overall and specific geographic- based land use policy options and strategies that the community can adopt to improve flood resiliency
- **Purpose of this Meeting**
  - The initial Kick-off meeting for the plan development
  - Provide a brief overview of the funding source: FEMA Risk Map Project
  - Brief introduction to Resiliency Planning
  - Conduct the Plan's first working meeting: Go over and try to fill out together as much as possible of a resiliency checklist we have developed

The Vision for Risk MAP

Through collaboration with State, Local, and Tribal entities, Risk MAP will deliver quality data that increases public awareness and leads to action that reduces risk to life and property

Silver Jackets Collaboration

FEMA and State Contacts

FEMA Region V

Risk Analysis Branch
Risk Analysis – Ken Hinterlong
Ken.Hinterlong@fema.dhs.gov
312-408-5529
Mitigation Planning – Kirstin Kuenzi
kirstin.kuenzi@fema.dhs.gov
312-408-4460

Hazard Mitigation Assistance Branch
Richard Foody
richard.foody@fema.dhs.gov
312-408-5340

Floodplain Management and Insurance Branch
Laurie Smith-Kuypers
laurie.smith-kuypers@fema.dhs.gov
312-408-5244

Flood Mapping/ Risk MAP
National Dam Safety Program
Mitigation Planning
National Earthquake Hazards Reduction
Building Science

Hazard Mitigation Assistance Grant Programs

National Flood Insurance Program
Community Rating System

State Floodplain Management
Dave Knipe
dknipe@dnr.in.gov
317-232-4173

Hazard Mitigation Officer
Mary Moran
mmoran@dhs.in.gov
317-232-3831

NFIP Coordinator
Greg Main
gmain@dnr.in.gov
317-234-1107

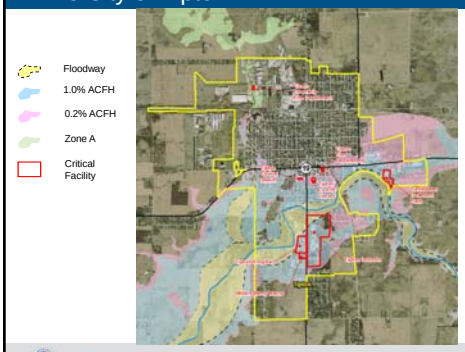
Indiana Dept of Natural Resources and Dept of Homeland Security

What is Flood Resiliency Planning?

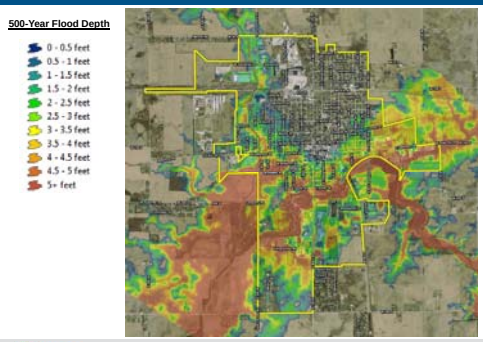
- **Flood resilience** means measures taken to reduce the vulnerability of communities to damages from flooding and to support long-term recovery after an extreme flood.

- **Why was Tipton selected for this project?**
  - First community in Indiana
  - Previous flood risk management studies and plans developed for the Big Cicero Creek Watershed,
  - No feasible structural alternatives

The City of Tipton



The City of Tipton



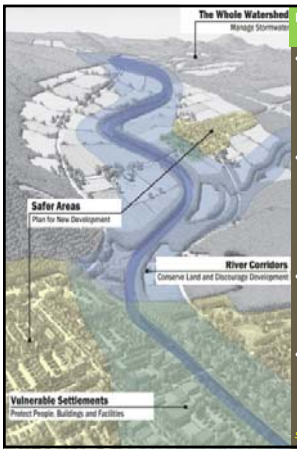
What is Flood Resiliency Planning (cont'd)?

- **Project Team's Approach**
  - A newer concept – alternative to expensive structural solutions
  - Dynamic plan
  - Involvement of Local officials and stakeholders
  - Prioritization of recommendations
  - Develop a River Corridor Map
  - Interviews and follow-up meetings

What Can Your Community Do?

- **Adopt Overall Strategies**
  - Flood Resiliency Checklist
  - Audits of policies and budgets
  - Consistency between plans – update as needed
  - Pursue cooperation among groups within the watershed

- **Adopt Specific Land Use Strategies for Distinct Geographical Areas**



FLOOD RESILIENCE STRATEGIES BY GEOGRAPHIC REGION WITHIN THE CITY (and the Watershed)

- **River Corridors**: Conserve land and discourage development in particularly vulnerable areas along river corridors such as floodplains and erosion zones.
- **Vulnerable Settlements**: Where development already exists in vulnerable areas, protect people, buildings, and facilities to reduce future flooding risk.
- **Safer Areas**: Plan for and encourage new development in areas that are less vulnerable to future floods.
- **The Whole Watershed**: Implement enhanced stormwater management techniques to slow, spread, and infiltrate floodwater.

Source: Vermont Agency of Commerce and Community Development

Current Documents

- **City of Tipton**
  - Subdivision Control Ordinance 2000-2009
  - Zoning Ordinance 2010-03
  - Big Cicero Creek Watershed, Flood and Erosion Risk Management Plan 2014
  - City Comprehensive Plan?
- **Tipton County**
  - Subdivision Control Ordinance 2009
  - Zoning Ordinance 2008-12
  - Hazard Mitigation Plan 2011
  - Comprehensive Plan 2013
- **Others?**

The Flood Resiliency Checklist

- **Is your community prepared for a possible flood?**
  - Initial assessment of flood preparedness and recovery
  - Identify policy options and resources
- **Includes Overall Strategies**
  - Integrated community Comprehensive Plan and Hazard Mitigation Plans
  - Encourage green infrastructure techniques
  - Consider possible impacts of climate change
  - Coordinate flood mitigation approaches with capital improvement plans and budget priorities
  - Participation in the NFIP

The Flood Resiliency Checklist

- **Includes specific strategies to:**
  - Conserve land and discourage development in River Corridors
  - Protect people, buildings, and facilities located in Vulnerable Settlements
  - Direct development to Safer Areas
  - Implement and coordinate sound stormwater management practices throughout the Whole Watershed

The Flood Resiliency Checklist

Overall Strategies to Enhance Flood Resilience

1. **Does the community's comprehensive plan have a hazard element or flood planning section?**
   - a. Does the comprehensive plan cross-reference the local Hazard Mitigation Plan and any disaster recovery plans? ☐ Yes ☐ No
   - b. Does the comprehensive plan identify flood- and erosion- prone areas, including river corridor and fluvial erosion hazard areas, if applicable? ☐ Yes ☐ No
   - c. Did the local government emergency response personnel, floodplain manager, and department of public works participate in developing/updating the comprehensive plan? ☐ Yes ☐ No

Page 1 of 4

The Flood Resiliency Checklist

Overall Strategies to Enhance Flood Resilience

1. **Does the community have a local Hazard Mitigation Plan approved by the Federal Emergency Management Agency (FEMA) and the state emergency management agency?** ☐ Yes ☐ No
   - a. Does the Hazard Mitigation Plan cross-reference the local comprehensive plan? ☐ Yes ☐ No
   - b. Was the local government planner or zoning administrator involved in developing/updating the Hazard Mitigation Plan? ☐ Yes ☐ No
   - c. Were groups such as local businesses, schools, hospitals/medical facilities, agricultural landowners, and others who could be affected by floods involved in the Hazard Mitigation Plan drafting process? ☐ Yes ☐ No
   - d. Were groups such as local businesses, schools, hospitals/medical facilities, agricultural landowners, and others who could be affected by floods involved in the Hazard Mitigation Plan drafting process? ☐ Yes ☐ No

Page 2 of 4

The Flood Resiliency Checklist

Overall Strategies to Enhance Flood Resilience

- e. Does the Hazard Mitigation Plan emphasize non-structural pre-disaster mitigation measures such as acquiring flood-prone lands and adopting No Adverse Impact floodplain regulations? ☐ Yes ☐ No
- f. Does the Hazard Mitigation Plan encourage using green infrastructure techniques to help prevent flooding? ☐ Yes ☐ No
- g. Does the Hazard Mitigation Plan identify projects that could be included in pre-disaster grant applications and does it expedite the application process for post-disaster Hazard Mitigation Grant Program acquisitions? ☐ Yes ☐ No

3. **Do other community plans (e.g., open space or parks plans) require or encourage green infrastructure techniques?** ☐ Yes ☐ No
4. **Do all community plans consider possible impacts of climate change on areas that are likely to be flooded?** ☐ Yes ☐ No

Page 3 of 4

The Flood Resiliency Checklist

Overall Strategies to Enhance Flood Resilience

5. **Are structural flood mitigation approaches (such as repairing bridges, culverts, and levees) and non-structural approaches (such as green infrastructure) that require significant investment of resources coordinated with local capital improvement plans and prioritized in the budget?** ☐ Yes ☐ No
6. **Does the community participate in the National Flood Insurance Program Community Rating System?** ☐ Yes ☐ No

Page 4 of 4

The Flood Resiliency Checklist

Conserve Land and Discourage Development in River Corridors

1. **Has the community implemented non-regulatory strategies to conserve land in river corridors, such as:**
   a. Acquisition of land (or conservation easements on land) to allow for stormwater absorption, river channel adjustment, or other flood resilience benefits? ☐ Yes ☐ No
   b. Buyouts of properties that are frequently flooded? ☐ Yes ☐ No
   c. Transfer of development rights program that targets flood- prone areas as sending areas and safer areas as receiving areas? ☐ Yes ☐ No
   d. Tax incentives for conserving vulnerable land? ☐ Yes ☐ No
   e. Incentives for restoring riparian and wetland vegetation in areas subject to erosion and flooding? ☐ Yes ☐ No

Page 1 of 3

The Flood Resiliency Checklist

Conserve Land and Discourage Development in River Corridors

2. **Has the community encouraged agricultural and other landowners to implement pre-disaster mitigation measures, such as:**
   a. Storing hay bales and equipment in areas less likely to be flooded? ☐ Yes ☐ No
   b. Installing ponds or swales to capture stormwater? ☐ Yes ☐ No
   c. Planting vegetation that can tolerate inundation? ☐ Yes ☐ No
   d. Using land management practices to improve the capability of the soil on their lands to retain water? ☐ Yes ☐ No
3. **Has the community adopted flood plain development limits that go beyond FEMA's minimum standards for Special Flood Hazard Areas and also prohibit or reduce any new encroachment and fill in river corridors and Fluvial Erosion Hazard areas?** ☐ Yes ☐ No

Page 2 of 3

The Flood Resiliency Checklist

Conserve Land and Discourage Development in River Corridors

4. **Has the community implemented development regulations that incorporate approaches and standards to protect land in vulnerable areas, including:**
   a. Fluvial erosion hazard zoning? ☐ Yes ☐ No
   b. Agricultural or open space zoning? ☐ Yes ☐ No
   c. Conservation or cluster subdivision ordinances, where appropriate? ☐ Yes ☐ No
   d. Other zoning or regulatory tools that limit development in areas subject to flooding, including river corridors and Special Flood Hazard Areas? ☐ Yes ☐ No

Page 3 of 3

The Flood Resiliency Checklist

Protect People, Buildings, and Facilities in Vulnerable Settlements

1. **Do the local comprehensive plan and Hazard Mitigation Plan identify developed areas that have been or are likely to be flooded?** ☐ Yes ☐ No
   a. If so, does the comprehensive plan discourage development in those areas or require strategies to reduce damage to buildings during floods (such as elevating heating, ventilation, and air conditioning (HVAC) systems and flood- proofing basements)? ☐ Yes ☐ No
   b. Does the Hazard Mitigation Plan identify critical facilities and infrastructure that are located in vulnerable areas and should be protected, repaired, or relocated (e.g., town facilities, bridges, roads, and wastewater facilities)? ☐ Yes ☐ No

Page 1 of 3

The Flood Resiliency Checklist

Protect People, Buildings, and Facilities in Vulnerable Settlements

2. **Do land development regulations and building codes promote safer building and rebuilding in flood-prone areas? Specifically:**
   a. Do zoning or floodplain regulations require elevation of two or more feet above base flood elevation? ☐ Yes ☐ No
   b. Does the community have the ability to establish a temporary post-disaster building moratorium on all new development? ☐ Yes ☐ No
   c. Have non-conforming use and structure standards been revised to encourage safer rebuilding in flood-prone areas? ☐ Yes ☐ No
   d. Has the community adopted the International Building Code or American Society of Civil Engineers (ASCE) standards that promote flood-resistant building? ☐ Yes ☐ No
   e. Does the community plan for costs associated with follow-up inspection and enforcement of land development regulations and building codes? ☐ Yes ☐ No

Page 2 of 3

The Flood Resiliency Checklist

Protect People, Buildings, and Facilities in Vulnerable Settlements

3. **Does the community require developers who are rebuilding in flood-prone locations to add additional flood storage capacity in any new redevelopment projects such as adding new parks and open space and allowing space along the river's edge for the river to move during high-water events?** ☐ Yes ☐ No
4. **Is the community planning for development (e.g., parks, river- based recreation) along the river's edge that will help connect people to the river AND accommodate water during floods?** ☐ Yes ☐ No
5. **Does the comprehensive plan or Hazard Mitigation Plan discuss strategies to determine whether to relocate structures that have been repeatedly flooded, including identifying an equitable approach for community involvement in relocation decisions and potential funding sources (e.g., funds from FEMA, stormwater utility, or special assessment district)?** ☐ Yes ☐ No

Page 3 of 3

The Flood Resiliency Checklist

Plan for and Encourage New Development in Safer Areas

1. **Does the local comprehensive plan or Hazard Mitigation Plan clearly identify safer growth areas in the community?** ☐ Yes ☐ No
2. **Has the community adopted policies to encourage development in these areas?** ☐ Yes ☐ No
3. **Has the community planned for new development in safer areas to ensure that it is compact, walkable, and has a variety of uses?** ☐ Yes ☐ No
4. **Has the community changed their land use codes and regulations to allow for this type of development?** ☐ Yes ☐ No

Page 1 of 2

The Flood Resiliency Checklist

Plan for and Encourage New Development in Safer Areas

5. **Have land development regulations been audited to ensure that development in safer areas meets the community's needs for off- street parking requirements, building height and density, front- yard setbacks and that these regulations do not unintentionally inhibit development in these areas?** ☐ Yes ☐ No
6. **Do capital improvement plans and budgets support development in preferred safer growth areas (e.g., through investment in wastewater treatment facilities and roads)?** ☐ Yes ☐ No
7. **Have building codes been upgraded to promote more flood- resistant building in safer locations?** ☐ Yes ☐ No

Page 2 of 2

The Flood Resiliency Checklist

Implement Stormwater Management Techniques throughout the Whole Watershed

1. **Has the community coordinated with neighboring jurisdictions to explore a watershed-wide approach to stormwater management?** ☐ Yes ☐ No
2. **Has the community developed a stormwater utility to serve as a funding source for stormwater management activities?** ☐ Yes ☐ No
3. **Has the community implemented strategies to reduce stormwater runoff from roads, driveways, and parking lots?** ☐ Yes ☐ No
4. **Do stormwater management regulations apply to areas beyond those that are regulated by federal or state stormwater regulations?** ☐ Yes ☐ No

Page 1 of 2

The Flood Resiliency Checklist

Implement Stormwater Management Techniques throughout the Whole Watershed

5. **Do stormwater management regulations encourage the use of green infrastructure techniques?** ☐ Yes ☐ No
6. **Has the community adopted tree protection measures?** ☐ Yes ☐ No
7. **Has the community adopted steep slope development regulations?** ☐ Yes ☐ No
8. **Has the community adopted riparian and wetland buffer requirements?** ☐ Yes ☐ No

Page 2 of 2

Questions or Comments?

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FLOOD RESILIENCY CHECKLIST - RESULTS FROM DISCUSSION

Overall Strategies to Enhance Resilience		
1. Does the community's comprehensive plan have a hazard element or flood planning section?	☐ Yes	■ No
a. Does the comprehensive plan cross-reference the local Hazard Mitigation Plan and any disaster recovery plans?	☐ Yes	■ No
b. Does the comprehensive plan identify flood- and erosion- prone areas, including river corridor and fluvial erosion hazard areas, if applicable?	☐ Yes	■ No
c. Did the local government emergency response personnel, floodplain manager, and department of public works participate in developing/updating the comprehensive plan?	■ Yes	☐ No
2. Does the community have a local Hazard Mitigation Plan approved by the Federal Emergency Management Agency (FEMA) and the state emergency management agency?	■ Yes	☐ No
a. Does the Hazard Mitigation Plan cross-reference the local comprehensive plan?	■ Yes	☐ No
b. Was the local government planner or zoning administrator involved in developing/updating the Hazard Mitigation Plan?	☐ Yes	■ No
c. Were groups such as local businesses, schools, hospitals/medical facilities, agricultural landowners, and others who could be affected by floods involved in the Hazard Mitigation Plan drafting process?	☐ Yes	■ No
d. Were groups such as local businesses, schools, hospitals/medical facilities, agricultural landowners, and others who could be affected by floods involved in the Hazard Mitigation Plan drafting process?	☐ Yes	■ No
e. Does the Hazard Mitigation Plan emphasize non-structural pre-disaster mitigation measures such as acquiring flood-prone lands and adopting No Adverse Impact floodplain regulations?	■ Yes	☐ No
f. Does the Hazard Mitigation Plan encourage using green infrastructure techniques to help prevent flooding?	☐ Yes	■ No
g. Does the Hazard Mitigation Plan identify projects that could be included in pre-disaster grant applications and does it expedite the application process for post-disaster Hazard Mitigation Grant Program acquisitions?	■ Yes	☐ No
3. Do other community plans (e.g., open space or parks plans) require or encourage green infrastructure techniques?	☐ Yes	■ No
4. Do all community plans consider possible impacts of climate change on areas that are likely to be flooded?	☐ Yes	■ No

5. Are structural flood mitigation approaches (such as repairing bridges, culverts, and levees) and non-structural approaches (such as green infrastructure) that require significant investment of resources coordinated with local capital improvement plans and prioritized in the budget?	☐ Yes	■ No
6. Does the community participate in the National Flood Insurance Program Community Rating System?	☐ Yes	■ No

Overall Strategies to Enhance Resilience		
1. Has the community implemented non-regulatory strategies to conserve land in river corridors, such as:		
a. Acquisition of land (or conservation easements on land) to allow for stormwater absorption, river channel adjustment, or other flood resilience benefits?	☐ Yes	■ No
b. Buyouts of properties which are frequently flooded?	■ Yes	☐ No
c. Transfer of development rights program that targets flood- prone areas as sending areas and safer areas as receiving areas?	☐ Yes	■ No
d. Tax incentives for conserving vulnerable land?	☐ Yes	■ No
e. Incentives for restoring riparian and wetland vegetation in areas subject to erosion and flooding?	☐ Yes	■ No
2. Has the community encouraged agricultural and other landowners to implement pre-disaster mitigation measures, such as:		
a. Storing hay bales and equipment in areas less likely to be flooded?	■ Yes	☐ No
b. Installing ponds or swales to capture stormwater?	☐ Yes	■ No
c. Planting vegetation that can tolerate inundation?	☐ Yes	■ No
d. Using land management practices to improve the capability of the soil on their lands to retain water?	☐ Yes	■ No
3. Has the community adopted flood plain development limits that go beyond FEMA's minimum standards for Special Flood Hazard Areas and also prohibit or reduce any new encroachment and fill in river corridors and Fluvial Erosion Hazard areas?	■ Yes	☐ No
4. Has the community implemented development regulations that incorporate approaches and standards to protect land in vulnerable areas, including:		
a. Fluvial erosion hazard zoning?	☐ Yes	■ No
b. Agricultural or open space zoning?	☐ Yes	■ No
c. Conservation or cluster subdivision ordinances, where appropriate?	☐ Yes	■ No
d. Other zoning or regulatory tools that limit development in areas subject to flooding, including river corridors and Special Flood Hazard Areas?	☐ Yes	■ No

Protect People, Buildings, and Facilities in Vulnerable Settlements		
1. Do the local comprehensive plan and Hazard Mitigation Plan identify developed areas that have been or are likely to be flooded?	■ Yes	☐ No
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b. Does the Hazard Mitigation Plan identify critical facilities and infrastructure that are located in vulnerable areas and should be protected, repaired, or relocated (e.g., town facilities, bridges, roads, and wastewater facilities)?	■ Yes	☐ No
2. Do land development regulations and building codes promote safer building and rebuilding in flood-prone areas? Specifically:		
a. Do zoning or flood plain regulations require elevation of two or more feet above base flood elevation?	■ Yes	☐ No
b. Does the community have the ability to establish a temporary post-disaster building moratorium on all new development?	☐ Yes	■ No
c. Have non-conforming use and structure standards been revised to encourage safer rebuilding in flood-prone areas?	■ Yes	☐ No
d. Has the community adopted the International Building Code or American Society of Civil Engineers (ASCE) standards that promote flood-resistant building?	☐ Yes	■ No
e. Does the community plan for costs associated with follow-up inspection and enforcement of land development regulations and building codes?	☐ Yes	■ No
3. Does the community require developers who are rebuilding in flood-prone locations to add additional flood storage capacity in any new redevelopment projects such as adding new parks and open space and allowing space along the river's edge for the river to move during high-water events?	■ Yes	☐ No
4. Is the community planning for development (e.g., parks, river- based recreation) along the river's edge that will help connect people to the river AND accommodate water during floods?	■ Yes	☐ No
5. Does the comprehensive plan or Hazard Mitigation Plan discuss strategies to determine whether to relocate structures that have been repeatedly flooded, including identifying an equitable approach for community involvement in relocation decisions and potential funding sources (e.g., funds from FEMA, stormwater utility, or special assessment district)?	☐ Yes	■ No

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4. Has the community changed their land use codes and regulations to allow for this type of development?	☐ Yes	■ No

5. Have land development regulations been audited to ensure that development in safer areas meets the community's needs for off- street parking requirements, building height and density, front- yard setbacks and that these regulations do not unintentionally inhibit development in these areas?	☐ Yes	■ No
6. Do capital improvement plans and budgets support development in preferred safer growth areas (e.g., through investment in wastewater treatment facilities and roads)?	☐ Yes	■ No
7. Have building codes been upgraded to promote more flood- resistant building in safer locations?	☐ Yes	■ No

Implement Stormwater Management Techniques throughout the Whole Watershed		
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4. Do stormwater management regulations apply to areas beyond those that are regulated by federal or state stormwater regulations?	■ Yes	☐ No
5. Do stormwater management regulations encourage the use of green infrastructure techniques?	☐ Yes	■ No
6. Has the community adopted tree protection measures?	☐ Yes	■ No
7. Has the community adopted steep slope development regulations?	☐ Yes	■ No
8. Has the community adopted riparian and wetland buffer requirements?	☐ Yes	■ No

Tipton Flood Resilience Plan – Stakeholder Meeting

March 31, 2015

Tipton County Foundation Building, 1020 West Jefferson Street, Tipton, Indiana

AGENDA ITEMS

1. Welcome and Introductions
2. Overview of Flood Resilience Planning
3. Introduce Flood Resilience Planning Areas
4. Discuss and Prioritize Strategies for Flood Resilience
5. Next Steps

ATTENDED BY

Don Havens, Mayor
Kevin Emsweller, Superintendent of Tipton Community School Corporation
Michael Harlowe, Tipton Hospital Administrator (President/CEO)
Jason Henderson, Tipton County Surveyor, Tipton County Drainage Board
Wyatt Johnson, City Engineer
John Junco, Tipton Community Schools Assistant Supervisor
Nathan Kring, Tipton County Economic Development Organization Project Manager
Jeff Sheridan, Tipton County Economic Development Executive Director
Joe Van Bibber, County Commissioner
Vicki Warner, Tipton County Chamber of Commerce

David Knipe, IDNR
Matt Riggs, Polis Center
Siavash Beik, CBBEL
Matt Rummel, CBBEL
Sheila McKinley, CBBEL

FEMA

Tipton, Indiana

Planning for Flood Recovery and Long-Term Resilience

Planning Team Meeting
March 31, 2016

RiskMAP
Increasing Resilience Together

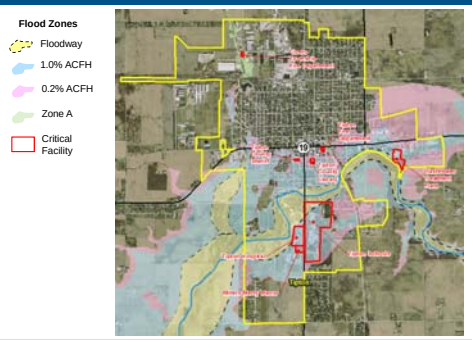
Agenda

- Welcome and Introductions
- Overview of Flood Resilience Planning
- Introduce Flood Resilience Planning Areas
- Discuss and Prioritize Strategies for Flood Resilience
- Next Steps

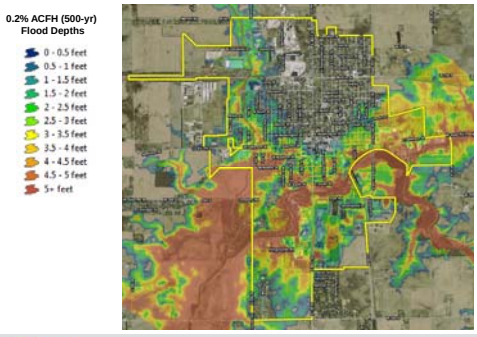
Flood Resilience Planning

- **Flood resilience** means measures taken to reduce the vulnerability of communities to damages from flooding and to support long-term recovery after an extreme flood.
- **Why was Tipton selected for this project?**
  - First community in Indiana
  - Previous flood risk management studies and plans developed for the Big Cicero Creek Watershed,
  - No feasible structural alternatives

The City of Tipton – Flood Zones



The City of Tipton – Flood Depths



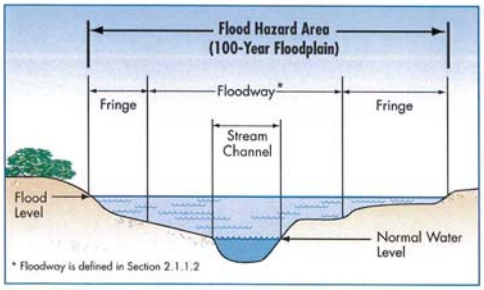
Flood Resilience Planning

- **Project Team's Approach**
  - A newer concept – alternative to expensive structural solutions
  - Dynamic plan
  - Involvement of local officials and stakeholders
  - Prioritization of recommendations
  - Develop a River Corridor Map
  - Interviews and follow-up meetings

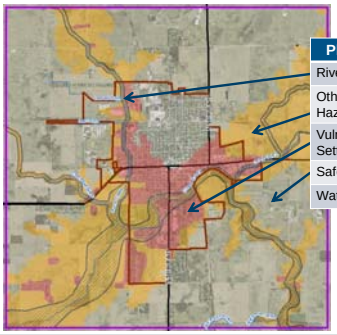
Flood Resilience for Tipton…

- **Adopt Overall Strategies**
  - Flood Resiliency Checklist
  - Audits of policies and budgets
  - Consistency between plans – update as needed
  - Pursue cooperation among groups within the watershed
- **Adopt Specific Land Use Strategies for Distinct Geographical Areas**

Floodplain Terminology Refresher



Flood Resilience Planning Areas



Planning Areas
River Corridor
Other High Flood Hazard Areas
Vulnerable Settlements
Safer Areas
Watershed

Flood Resilience Planning Areas

Planning Area	Area Boundary	Intent of Area Strategy
River Corridor	Floodway or fluvial erosion hazard area, whichever is greater	To conserve land and prohibit development
Other High Flood Hazard Areas	Undeveloped land in the floodway fringe	To conserve land and maintain the natural and beneficial function of the floodway fringe
Vulnerable Settlements	Existing developed land in the SFHA (floodway fringe and floodway)	To protect people, buildings, and facilities in vulnerable areas and reduce future flood risk
Safer Areas	Outside the SFHA but within the planning jurisdiction	To plan for and promote development in areas that are less vulnerable to future floods
Watershed	Entire drainage area	To promote coordination and partnerships and implement practices to slow, spread, and infiltrate flood water

Strategies for Flood Resilience

- Criteria for Strategies *(must meet 2 of 3)*
  1. Does it prevent the situation from getting worse?
  2. Does is not cause harm to others?
  3. Does it improve the situation overall?
- Worksheet Exercise *(see handout)*
  - Discuss strategies for each planning area
  - Discuss policy vehicle for implementation
  - Prioritize strategies within each planning area
  - Prioritize strategies overall

River Corridor

River Corridor

1. Adopt a river corridor overlay zone
2. Protect undeveloped land
3. Minimize streambank erosion
4. …….
5. …….

River Corridor
1. Adopt a River Corridor Overlay Zone

River Corridor
2. Protect Undeveloped Land

River Corridor
3. Minimize Streambank Erosion

River Corridor

1. Adopt a river corridor overlay zone
2. Protect undeveloped land
3. Minimize streambank erosion
4. …….
5. …….

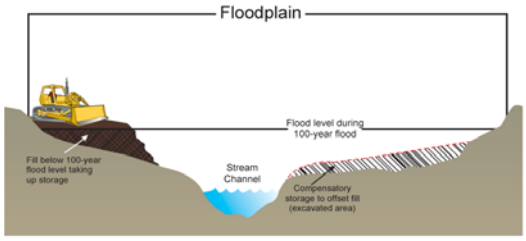
Other High Flood Hazard Areas

Other High Flood Hazard Areas

1. Protect undeveloped land
2. Require compensatory storage with new development
3. Promote conservation design
4. Prohibit new critical facilities
5. …….
6. …….

Other High Flood Hazard Areas
1. Protect Undeveloped Land

Other High Flood Hazard Areas
2. Require Compensatory Storage



Other High Flood Hazard Areas
3. Promote Conservation Design

Other High Flood Hazard Areas
4. Prohibit New Critical Facilities

Other High Flood Hazard Areas

1. Protect undeveloped land
2. Require compensatory storage with new development
3. Promote conservation design
4. Prohibit new critical facilities
5. …….
6. …….

Vulnerable Settlements

FEMA 25 RiskMAP

Vulnerable Settlements

1. Bring nonconforming uses into compliance
2. Buyout structures
3. Floodproof structures
4. Protect critical facilities
5. Add flood storage capacity with redevelopment
6. Prepare a Flood Response Plan
7. Adopt post-flood damage assessment protocols
8. Create positive connection to river
9. …….
10. …….

FEMA 26 RiskMAP

Vulnerable Settlements
1. Bring Nonconforming Uses into Compliance

FEMA 27 RiskMAP

Vulnerable Settlements
2&3. Buyout / Floodproof Structures

FEMA 28 RiskMAP

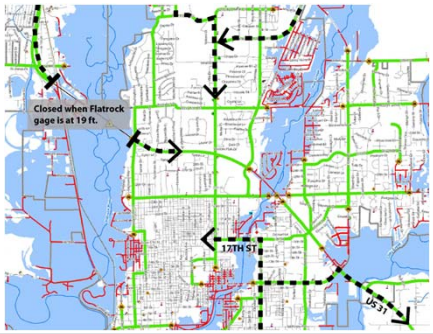
Vulnerable Settlements
4. Protect Critical Facilities

FEMA 29 RiskMAP

Vulnerable Settlements
5. Add Flood Storage with Redevelopment

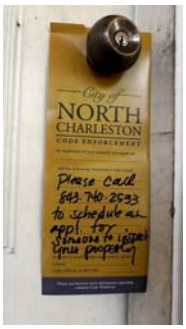
FEMA 30 RiskMAP

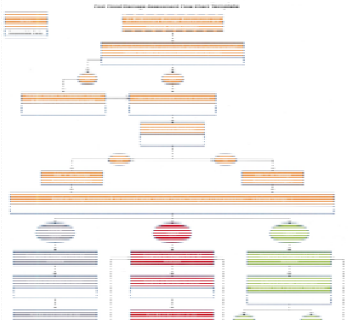
Vulnerable Settlements
6. Prepare a Flood Response Plan



FEMA 31 RiskMAP

Vulnerable Settlements
7. Adopt Post-flood Damage Assessment





FEMA 32 RiskMAP

Vulnerable Settlements
8. Connect People to the River

FEMA 33 RiskMAP

Vulnerable Settlements

1. Bring nonconforming uses into compliance
2. Buyout structures
3. Floodproof structures
4. Protect critical facilities
5. Add flood storage capacity with redevelopment
6. Prepare a Flood Response Plan
7. Adopt post-flood damage assessment protocols
8. Create positive connection to river
9. …….
10. …….

FEMA 34 RiskMAP

Safer Areas

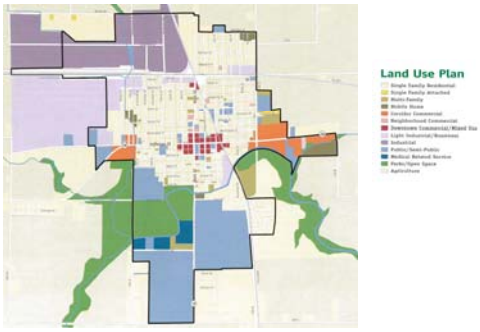
FEMA 35 RiskMAP

Safer Areas

1. Direct growth and development
2. Allow critical facilities
3. …….
4. …….

FEMA 36 RiskMAP

Safer Areas
1. Direct Growth & Development

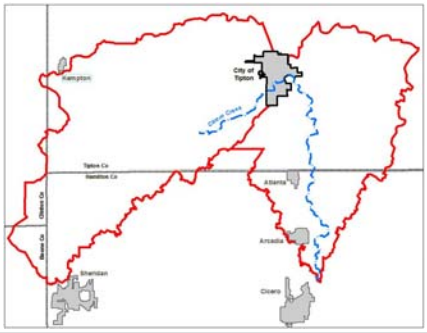


Safer Areas
2. Allow Critical Facilities

Safer Areas

1. Direct growth and development
2. Allow critical facilities
3. …….
4. …….

Watershed

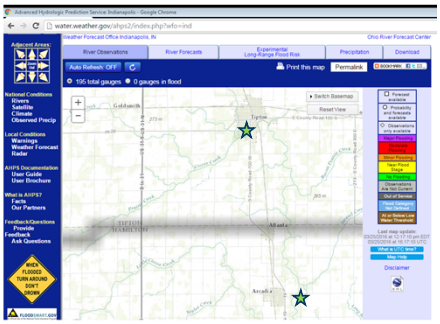


Watershed

1. Promote cover crop programs
2. Support USGS stream gages
3. Incorporated findings from updated flood studies
4. Adopt natural resource protection overlay zone
5. …….
6. …….

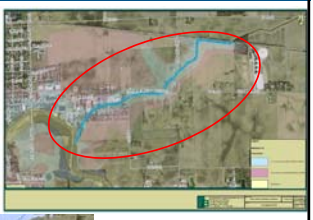
Watershed
1. Promote Cover Crop Programs

Watershed
2. Support USGS Stream Gages



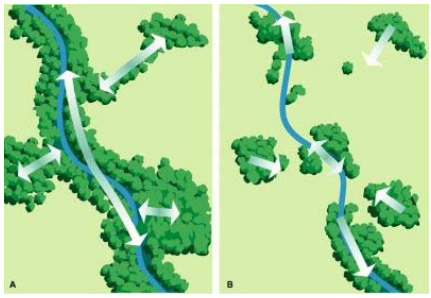
Watershed
3. Incorporate Updated Flood Data

Prairie Creek



Tobin Ditch

Watershed
4. Adopt Natural Resource Overlay Zone



Watershed

1. Promote cover crop programs
2. Support USGS stream gages
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5. …….
6. …….

Overall Strategies

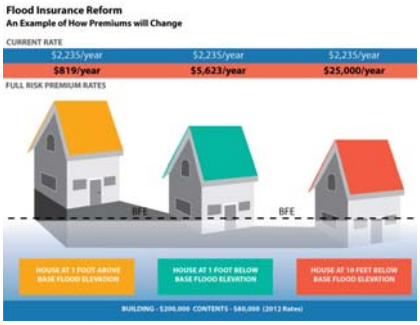
1. Update stormwater ordinance and technical standards
2. Conduct policy audits and update plans for consistency
3. Participate in the NFIP Community Rating System
4. …….
5. …….

Overall Strategies
1. Update Stormwater Ordinance & Standards

Overall Strategies
2. Conduct Policy Audits

- Multi-Hazard Mitigation Plan
- Comprehensive Plan
- Zoning Ordinance
- Subdivision Control Ordinance
- Stormwater Ordinance
- Flood Ordinance
- Flood Response Plan

Overall Strategies
3. Participate in the CRS Program



Overall Strategies

1. Update stormwater ordinance and technical standards
2. Conduct policy audits and update plans for consistency
3. Participate in the NFIP Community Rating System
4. …….
5. …….

Prioritize All Strategies

- Where to start?
- Consider social, technical, administrative, political, legal, economic, and environmental factors
- Suggested priorities:
  1. High priority implemented within 1-5 years
  2. Moderate priority implemented within 5-10 years
  3. Low priority implemented within 10+ years

Next Steps

- Draft Plan – distribute for review early April
- Comments due – mid April
- Finalize Plan and Presentation – late April

Questions or Comments?

Indiana Department of Natural Resources – Division of Water
Indianapolis, Indiana
317.232.4173
dknipe@dnr.in.gov

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317.266.8000
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mrummel@cbbel-in.com
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The Polis Center
Indianapolis, Indiana
317.278.4935
mhriggs@iupui.edu
lardunca@iupui.edu

PROPOSED FLOOD RESILIENCE STRATEGIES WORKSHEET – SUMMARY

AREA	PROPOSED STRATEGIES	CRITERIA	PRIORITY WITHIN AREA	PRIORITY OVERALL (H,M,L)
River Corridor	1. Adopt a River Corridor Overlay Zone	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#1	H
	2. Protect undeveloped land in river corridor	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#2	H
	3. Minimize streambank erosion	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#3	H
Other High Flood Hazard Areas *(Undeveloped Vulnerable Areas)*	1. Protect undeveloped land in the floodway fringe	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#3	H
	2. Require compensatory storage	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#2	H
	3. Promote conservation development	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#4	L
	4. Prohibit new critical facilities	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#1	H
Vulnerable Settlements *(Developed Vulnerable Areas)*	1. Bring nonconforming uses into compliance	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#4	H
	2. Buyout structures	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#2	M
	3. Floodproof structures	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#3	M

	4. Protect existing critical facilities	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#1	H
	5. Add flood storage capacity with redevelopment	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#5	M
	6. Prepare a Flood Response Plan	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#6	H
	7. Adopt post-flood damage assessment data collection and protocols	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#7	H
	8. Connect people to the river	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#8	L
Safer Areas	1. Steer public policy and investment to support development in safer areas	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#1	H
	2. Allow critical facilities	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#2	H
Watershed	1. Promote cover crop programs	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#4	L
	2. Support USGS stream gages	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#2	M
	3. Incorporate findings from updated flood studies	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#1	H
	4. Adopt natural resources protection overlay zone	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#3	M

Overall Strategies	1. Update stormwater ordinance and technical standards	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#1	H
	2. Conduct policy audits and update plans for consistency	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#2	H
	3. Participate in the NFIP Community Rating System (CRS)	☐ Does it prevent the situation from getting worse? ☐ Does it not harm others? ☐ Does it improve the situation overall?	#3	M

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APPENDIX B

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COMMUNITY RESILIENCE CHECKLIST

Completed By: _____ ___ **Date of Completion:** _____

Notes: _____

_____

_____

Overall Strategies to Enhance Resilience		
1. Does the community's comprehensive plan have a hazard element or flood planning section?	☐ Yes	☐ No
a. Does the comprehensive plan cross-reference the local Hazard Mitigation Plan and any disaster recovery plans?	☐ Yes	☐ No
b. Does the comprehensive plan identify flood- and erosion- prone areas, including river corridor and fluvial erosion hazard areas, if applicable?	☐ Yes	☐ No
c. Did the local government emergency response personnel, floodplain manager, and department of public works participate in developing/updating the comprehensive plan?	☐ Yes	☐ No
2. Does the community have a local Hazard Mitigation Plan approved by the Federal Emergency Management Agency (FEMA) and the state emergency management agency?	☐ Yes	☐ No
a. Does the Hazard Mitigation Plan cross-reference the local comprehensive plan?	☐ Yes	☐ No
b. Was the local government planner or zoning administrator involved in developing/updating the Hazard Mitigation Plan?	☐ Yes	☐ No
c. Were groups such as local businesses, schools, hospitals/medical facilities, agricultural landowners, and others who could be affected by floods involved in the Hazard Mitigation Plan drafting process?	☐ Yes	☐ No
d. Were groups such as local businesses, schools, hospitals/medical facilities, agricultural landowners, and others who could be affected by floods involved in the Hazard Mitigation Plan drafting process?	☐ Yes	☐ No
e. Does the Hazard Mitigation Plan emphasize non-structural pre-disaster mitigation measures such as acquiring flood-prone lands and adopting No Adverse Impact floodplain regulations?	☐ Yes	☐ No
f. Does the Hazard Mitigation Plan encourage using green infrastructure techniques to help prevent flooding?	☐ Yes	☐ No

g. Does the Hazard Mitigation Plan identify projects that could be included in pre-disaster grant applications and does it expedite the application process for post-disaster Hazard Mitigation Grant Program acquisitions?	☐ Yes	☐ No
3. Do other community plans (e.g., open space or parks plans) require or encourage green infrastructure techniques?	☐ Yes	☐ No
4. Do all community plans consider possible impacts of climate change on areas that are likely to be flooded?	☐ Yes	☐ No
5. Are structural flood mitigation approaches (such as repairing bridges, culverts, and levees) and non-structural approaches (such as green infrastructure) that require significant investment of resources coordinated with local capital improvement plans and prioritized in the budget?	☐ Yes	☐ No
6. Does the community participate in the National Flood Insurance Program Community Rating System?	☐ Yes	☐ No

Conserve Land and Discourage Development in River Corridors and Other High Flood Hazard Areas		
1. Has the community implemented non-regulatory strategies to conserve land in river corridors, such as:		
a. Acquisition of land (or conservation easements on land) to allow for stormwater absorption, river channel adjustment, or other flood resilience benefits?	☐ Yes	☐ No
b. Buyouts of properties which are frequently flooded?	☐ Yes	☐ No
c. Tax incentives for conserving vulnerable land?	☐ Yes	☐ No
d. Incentives for restoring riparian and wetland vegetation in areas subject to erosion and flooding?	☐ Yes	☐ No
2. Has the community encouraged agricultural and other landowners to implement pre-disaster mitigation measures, such as:		
a. Storing hay bales and equipment in areas less likely to be flooded?	☐ Yes	☐ No
b. Installing ponds or swales to capture stormwater?	☐ Yes	☐ No
c. Planting vegetation that can tolerate inundation?	☐ Yes	☐ No
d. Using land management practices to improve the capability of the soil on their lands to retain water?	☐ Yes	☐ No
3. Has the community adopted flood plain development limits that go beyond FEMA's minimum standards for Special Flood Hazard Areas and also prohibit or reduce any new encroachment and fill in river corridors and Fluvial Erosion Hazard areas?	☐ Yes	☐ No
4. Has the community implemented development regulations that incorporate approaches and standards to protect land in vulnerable areas, including:		
a. Fluvial erosion hazard zoning?	☐ Yes	☐ No
b. Agricultural or open space zoning?	☐ Yes	☐ No

c. Other zoning or regulatory tools that prohibit development in areas subject to flooding, including river corridors and Special Flood Hazard Areas?	☐ Yes	☐ No

Protect People, Buildings, and Facilities in Vulnerable Settlements		
1. Do the local comprehensive plan and Hazard Mitigation Plan identify developed areas that have been or are likely to be flooded?	☐ Yes	☐ No
a. If so, does the comprehensive plan discourage development in those areas or require strategies to reduce damage to buildings during floods (such as elevating heating, ventilation, and air conditioning (HVAC) systems and flood- proofing basements)?	☐ Yes	☐ No
b. Does the Hazard Mitigation Plan identify critical facilities and infrastructure that are located in vulnerable areas and should be protected, repaired, or relocated (e.g., town facilities, bridges, roads, and wastewater facilities)?	☐ Yes	☐ No
2. Do land development regulations and building codes promote safer building and rebuilding in flood-prone areas? Specifically:		
a. Do zoning or flood plain regulations require elevation of two or more feet above base flood elevation?	☐ Yes	☐ No
b. Does the community have the ability to establish a temporary post-disaster building moratorium on all new development?	☐ Yes	☐ No
c. Have non-conforming use and structure standards been revised to encourage safer rebuilding in flood-prone areas?	☐ Yes	☐ No
d. Has the community adopted the International Building Code or American Society of Civil Engineers (ASCE) standards that promote flood-resistant building?	☐ Yes	☐ No
e. Does the community plan for costs associated with follow-up inspection and enforcement of land development regulations and building codes?	☐ Yes	☐ No
3. Does the community require developers who are rebuilding in flood-prone locations to add additional flood storage capacity in any new redevelopment projects such as adding new parks and open space and allowing space along the river's edge for the river to move during high-water events?	☐ Yes	☐ No
4. Is the community planning for development (e.g., parks, river- based recreation) along the river's edge that will help connect people to the river AND accommodate water during floods?	☐ Yes	☐ No
5. Does the comprehensive plan or Hazard Mitigation Plan discuss strategies to determine whether to relocate structures that have been repeatedly flooded, including identifying an equitable approach for community involvement in relocation decisions and potential funding sources (e.g., funds from FEMA, stormwater utility, or special assessment district)?	☐ Yes	☐ No

Plan for and Encourage New Development in Safer Areas		
1. Does the local comprehensive plan or Hazard Mitigation Plan clearly identify safer growth areas in the community?	☐ Yes	☐ No
2. Has the community adopted policies to encourage development in these areas?	☐ Yes	☐ No
3. Is conservation or cluster subdivision development encouraged?	☐ Yes	☐ No
4. Has the community planned for new development in safer areas to ensure that it is compact, walkable, and has a variety of uses?	☐ Yes	☐ No
5. Has the community changed their land use codes and regulations to allow for this type of development?	☐ Yes	☐ No
6. Have land development regulations been audited to ensure that development in safer areas meets the community's needs for off- street parking requirements, building height and density, front- yard setbacks and that these regulations do not unintentionally inhibit development in these areas?	☐ Yes	☐ No
7. Do capital improvement plans and budgets support development in preferred safer growth areas (e.g., through investment in wastewater treatment facilities and roads)?	☐ Yes	☐ No
8. Have building codes been upgraded to promote more flood- resistant building in safer locations?	☐ Yes	☐ No

Implement Stormwater Management Techniques throughout the Whole Watershed		
1. Has the community coordinated with neighboring jurisdictions to explore a watershed-wide approach to stormwater management?	☐ Yes	☐ No
2. Has the community developed a stormwater utility to serve as a funding source for stormwater management activities?	☐ Yes	☐ No
3. Has the community implemented strategies to reduce stormwater runoff from roads, driveways, and parking lots?	☐ Yes	☐ No
4. Do stormwater management regulations apply to areas beyond those that are regulated by federal or state stormwater regulations?	☐ Yes	☐ No
5. Do stormwater management regulations encourage the use of green infrastructure techniques?	☐ Yes	☐ No
6. Has the community adopted tree protection measures?	☐ Yes	☐ No
7. Has the community adopted steep slope development regulations?	☐ Yes	☐ No
8. Has the community adopted riparian and wetland buffer requirements?	☐ Yes	☐ No

APPENDIX C

List of Land Trusts, Agencies, and Cost-share Programs

Offering tax or other monetary incentives is an effective way to conserve land and discourage development in river corridors and vulnerable lands. Educating landowners on available programs allows the residents to realize the benefits of enrolling in such programs. More information can be found through the following organizations and institutions:

LAND TRUSTS

Central Indiana Land Trust
1500 N. Delaware St.
Indianapolis, IN 46202
(317) 631-5263
http://www.conservingindiana.org/

Indiana Land Protection Alliance
http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/indiana/partners/indiana-land-protection-alliance.xml

Land Trust Alliance
http://www.landtrustalliance.org/

Red-tail Land Conservancy
125 E Charles St., Ste. 200
Muncie, IN 47305-2478
(317) 288-2587
http://www.fortheland.org

The Nature Conservancy
INDIANA FIELD OFFICE
EFROYMSON CONSERVATION CENTER
620 E. Ohio St.
Indianapolis, IN 46202
(317) 951-8818
http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/indiana/

AGENCIES & COST-SHARE PROGRAMS

IDNR
Department of Natural Resources
402 West Washington Street
Indianapolis, IN 46204
(317) 232-4200 or (877) 463-6367
http://www.in.gov/dnr/

IDNR Division of Fish and Wildlife - Landowner Assistance Program
http://www.in.gov/dnr/fishwild/2352.htm

- Classified Forest and Wildlands Program
- Game Bird Habitat Development Program
- Wildlife Habitat Cost-Share Program

- Game Bird Partnership Program
- N.E. Wetland/Grassland Restoration Program

USDA Natural Resources Conservation Service
Indiana NRCS State Office
6013 Lakeside Boulevard
Indianapolis, IN 46278
(317) 290-3200
http://www.nrcs.usda.gov/wps/portal/nrcs/site/in/home/

- Wildlife Habitat Incentives Program (WHIP)
- Wetlands Restoration Program (WRP)
- Environmental Quality Incentives Program (EQIP)
- Conservation Reserve Enhancement Program (CREP)
- Conservation Reserve Program (CRP)
- Conservation Reserve Program (CRP) – Continuous Sign-up Program

U.S. Fish and Wildlife Service
Northern Indiana Ecological Services Sub-Office
1000 WEST OAKHILL ROAD
PORTER, INDIANA 46304-9722
(219) 983-9753
http://www.fws.gov/midwest/northernindiana/

- Partners for Fish and Wildlife Program

Tipton County SWCD
243 Ash St., Ste. B
Tipton, IN 46072
(765) 675-8900

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APPENDIX D

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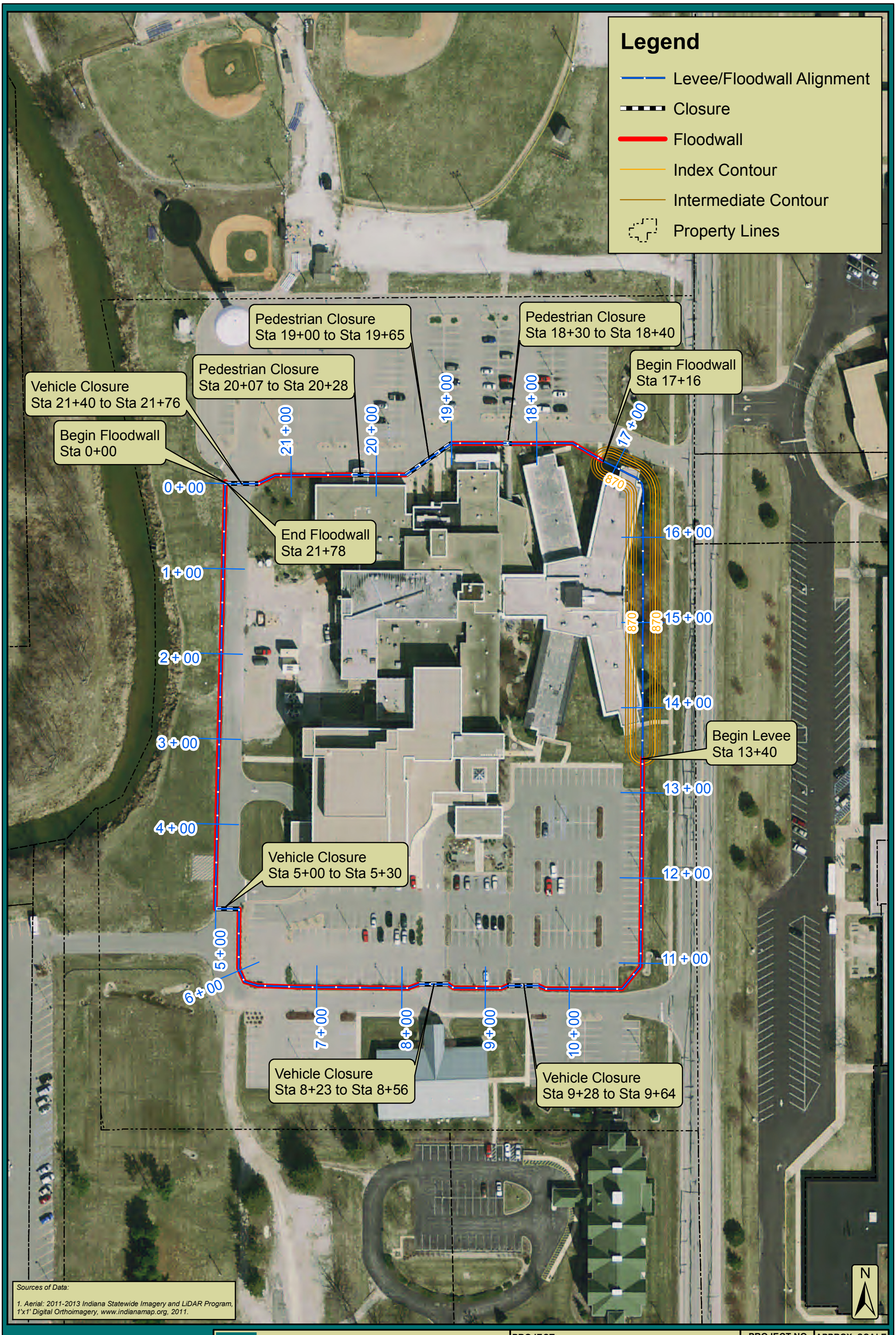
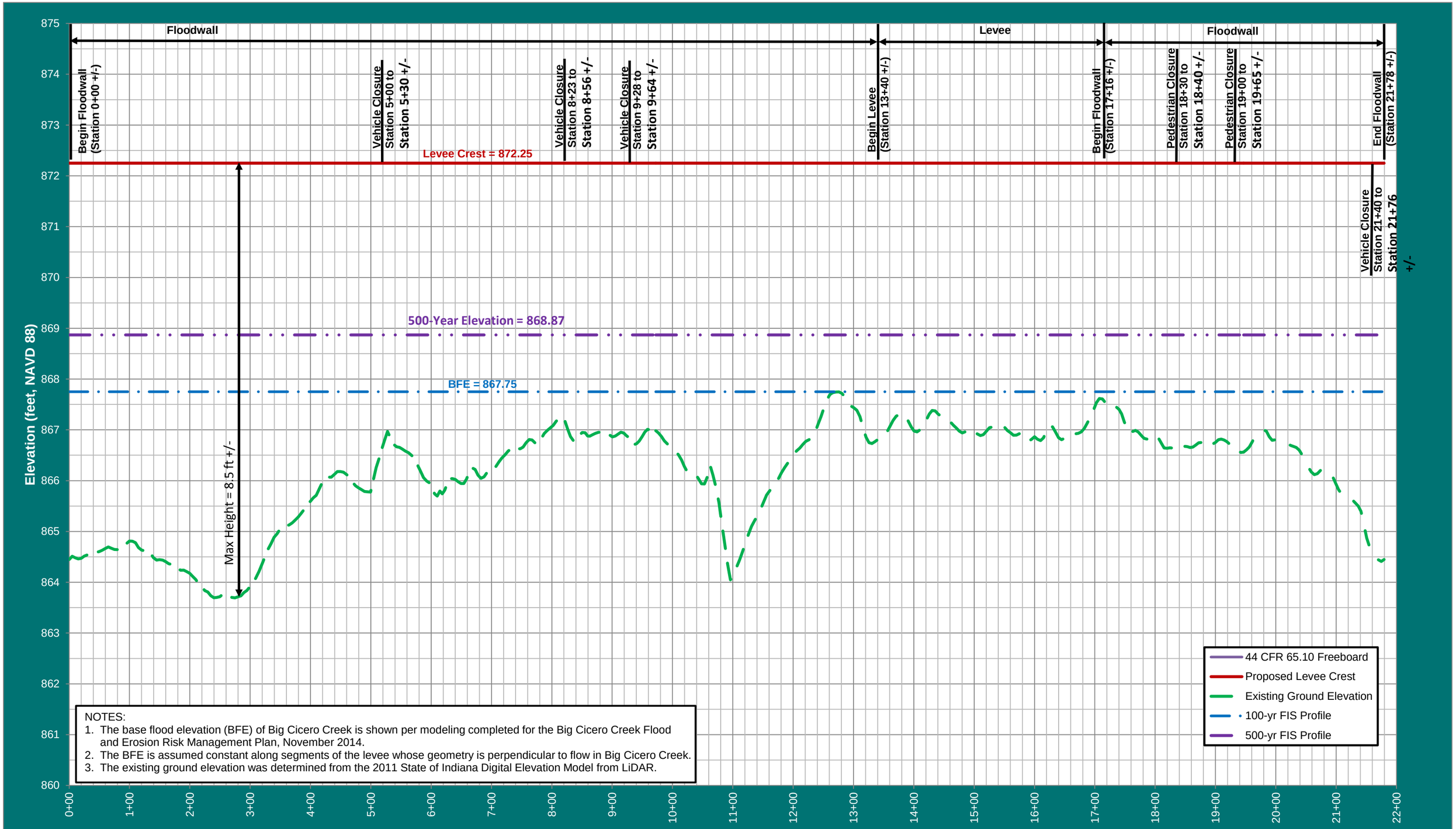
IU HEALTH TIPTON HOSPITAL

Detailed Schematic and Cost Estimates



Christopher B. Burke Engineering, LLC
PNC Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
(t) 317.266.8000 (f) 317.632.3306

PROJECT: City of Tipton Flood Resilience Plan		PROJECT NO. 15-0363	APPROX. SCALE 1 " = 100 '
TITLE: Levee/Floodwall Schematic IU Helath Tipton Hospital			DATE: 04/2016
			EXHIBIT D-1



NOTES:
1. The base flood elevation (BFE) of Big Cicero Creek is shown per modeling completed for the Big Cicero Creek Flood and Erosion Risk Management Plan, November 2014.
2. The BFE is assumed constant along segments of the levee whose geometry is perpendicular to flow in Big Cicero Creek.
3. The existing ground elevation was determined from the 2011 State of Indiana Digital Elevation Model from LiDAR.

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115 West Washington Street
Indianapolis, Indiana 46204
(t) 317.266.8000 (f) 317.632.3306

PROJECT:	PROJECT NO.	APPROX SCALE
City of Tipton Flood Resilience Plan	15-0363	NTS
TITLE:		DATE: 04/2016
IU Health Tipton Hospital Freeboard Analysis Profile		EXHIBIT D-2

Tipton Flood Resiliancy Plan

IU Health Tipton Hospital - Conceptual Opinion of Probable Cost

Line	Description	Estimated Quantities	Units	Unit Price	Estimated Cost (Rounded)
1	**Professional Services**				
2	Engineering Design, Project Management, and Permitting	1	LS	$ 430,000	$ 430,000
3	Topographic Survey	1	LS	$ 108,000	$ 108,000
4	Wetland Delineation	1	LS	$ 10,000	$ 10,000
5	Right-of-Way Engineering	1	LS	$ 27,000	$ 27,000
6	Geotechnical Engineering	1	LS	$ 54,000	$ 54,000
7					$ 629,000
8	**Flood Protection System**				
9	Clearing and Grubbing	1.0	ACRE	$ 15,000	$ 15,000
10	Strip and Stockpile Topsoil	810	CYS	$ 5	$ 4,100
11	Excavate Keyway	320	CYS	$ 10	$ 3,200
12	Place and Compact Fill	2,280	CYS	$ 15	$ 34,200
13	Topsoil Placement	810	CYS	$ 5	$ 4,100
14	Finish Grading	4,830	SYS	$ 2	$ 9,700
15	Hydroseed and Mulch	4,830	SYS	$ 3	$ 14,500
16	Interior Drainage (manholes, conduits, inlets)	1	LS	$ 80,000	$ 80,000
17	Interior Drainage (pump station)	1	LS	$ 620,000	$ 620,000
18	Concrete Floodwall, 6 FT (Includes Excavation & Backfill)	620	LFT	$ 760	$ 471,200
19	Concrete Floodwall, 7 FT (Includes Excavation & Backfill)	390	LFT	$ 870	$ 339,300
20	Concrete Floodwall, 8 FT (Includes Excavation & Backfill)	440	LFT	$ 1,050	$ 462,000
21	Concrete Floodwall, 9 FT (Includes Excavation & Backfill)	140	LFT	$ 1,160	$ 162,400
22	Toe Drain with Filter Layer	1,590	LFT	$ 50	$ 79,500
23	Vehicle Closure	920	SFT	$ 1,200	$ 1,104,000
24	Pedestrian Closure	450	SFT	$ 1,200	$ 540,000
25	Asphalt Removal and Replacement	4,040	SYS	$ 45	$ 181,800
26	Sidewalk Removal and Replacement	370	SYS	$ 60	$ 22,200
27				Estimated Flood Protection System Cost	$ 4,147,200
28	**Erosion and Sediment Control**				
29	Silt Fence	800	LF	$ 3	$ 2,400
30	Stabilized Construction Entrance	1	EA	$ 3,000	$ 3,000
31	Concrete Washout	1	EA	$ 3,000	$ 3,000
32	Inlet Protection/Other Misc. Erosion Control	1	LS	$ 40,000	$ 40,000
33				Estimated Erosion and Sediment Control Cost	$ 48,400
34	**Miscellaneous Construction Costs**				
35	Construction Surveying (3%)	1	LS	$ 125,900	$ 125,900
36	Dewatering (3%)	1	LS	$ 125,900	$ 125,900
37	Utility Relocations (10%)	1	LS	$ 419,600	$ 419,600
38	Maintenance of Traffic (5%)	1	LS	$ 209,800	$ 209,800
39	Mobilization/Demobilization and Administration (5%)	1	LS	$ 209,800	$ 209,800
40					$ 1,091,000
41	**Construction Contingencies**				
42	Construction Contingencies (30%)	1	LS	$ 1,586,000	$ 1,586,000
43				Estimated Construction Contingencies	$ 1,586,000
44					
45				**Estimated Construction Cost**	$ 6,872,600
46					
47				**Estimated Total Cost**	$ 7,501,600

Notes and Assumptions

Gen. All costs are estimates based on the engineer's knowledge of common construction methods and materials. Christopher B. Burke Engineering LLC does not guarantee that the actual bid price will not vary from the costs used with this estimate.

Gen. All costs are in 2015 dollars.

Gen. Estimated costs have been rounded.

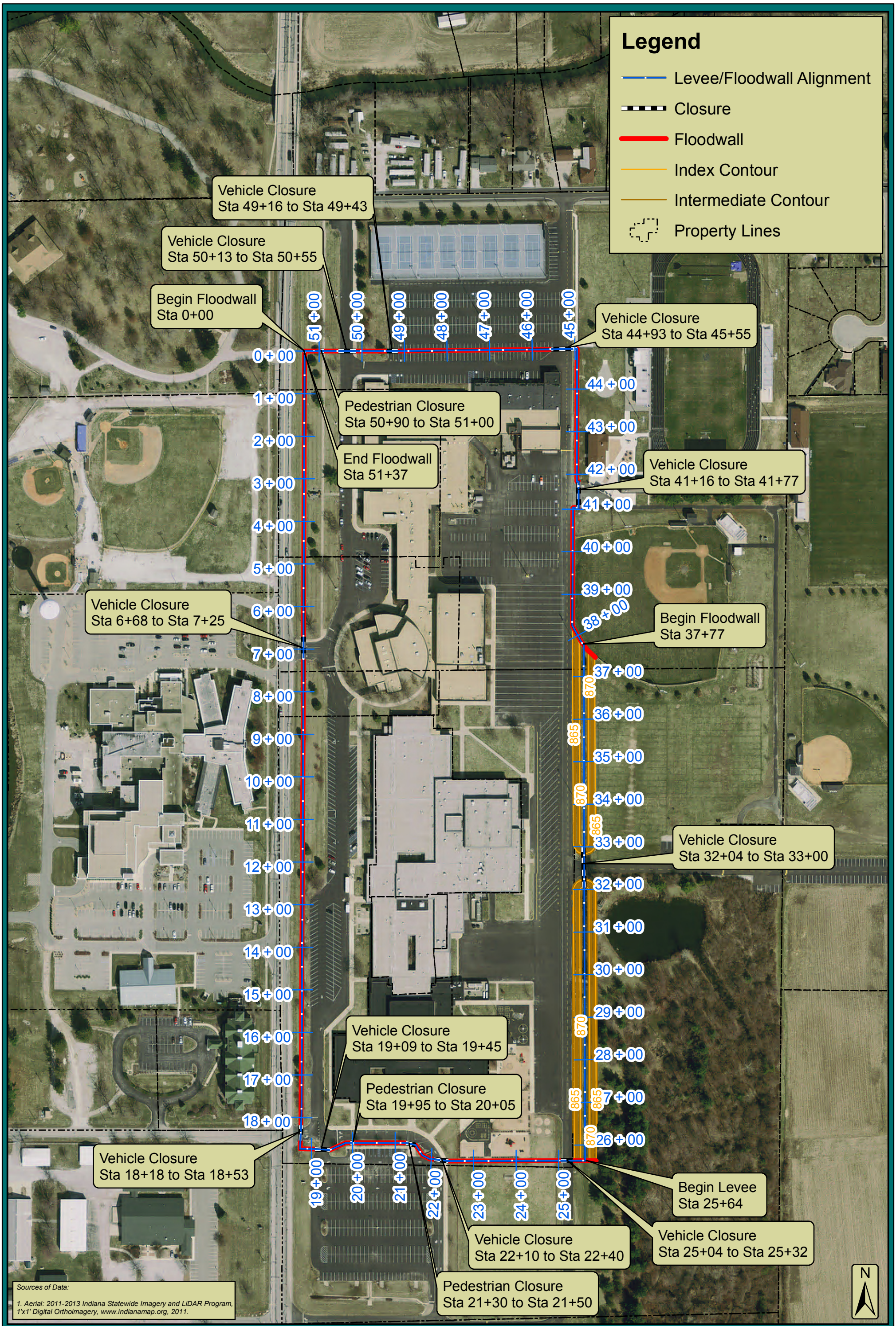
Gen. This estimate does not include unforeseen cost increases that may result from shortages in fuel and materials as a result of natural or man made disasters.

Gen. This estimate does not include land acquisition or environmental mitigation that may be required.

Gen. This estimate does not include construction observation/inspection services.

TIPTON SCHOOLS

Detailed Schematic and Cost Estimates



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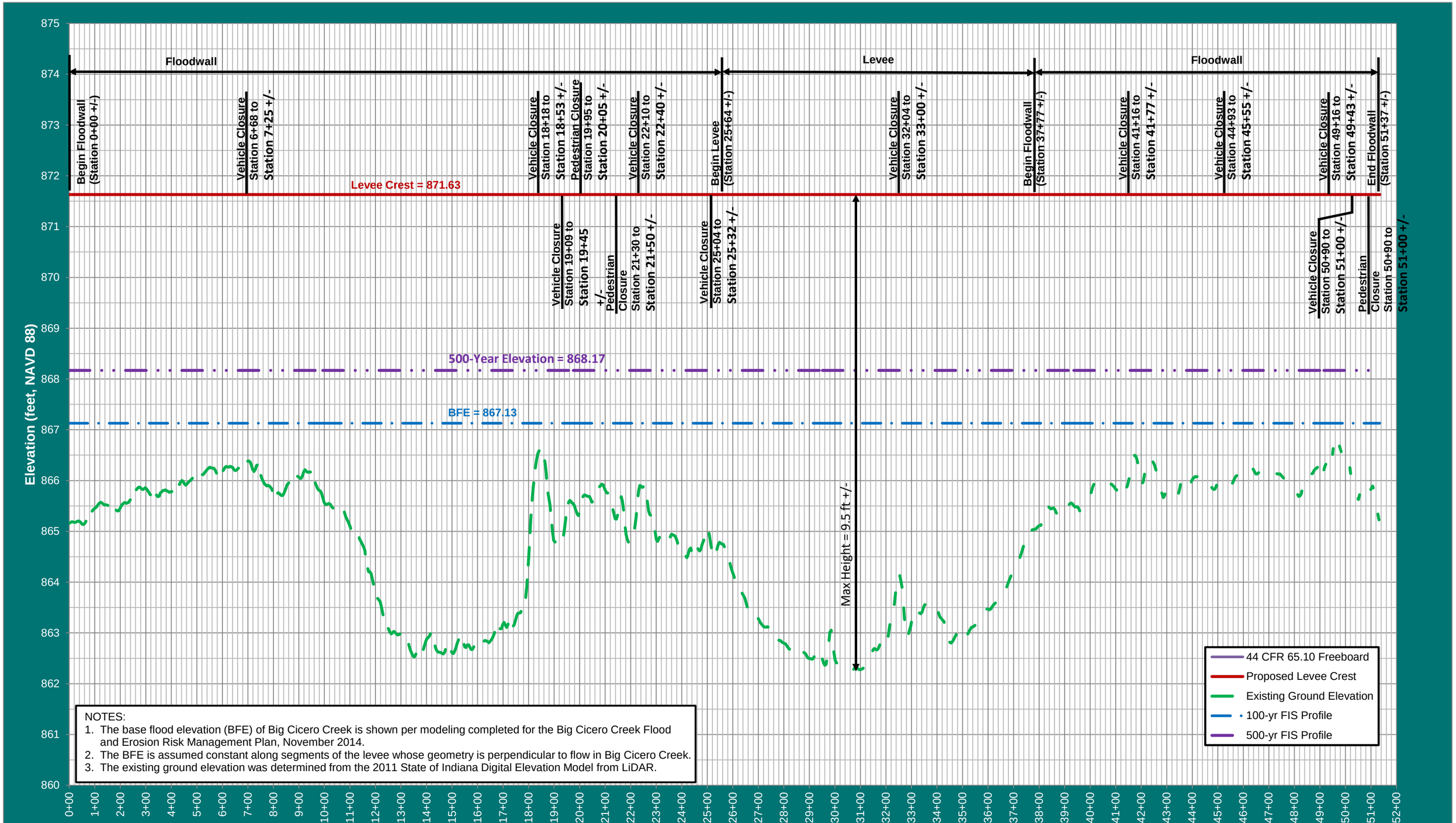
Indianapolis, Indiana 46204
(t) 317.266.8000 (f) 317.632.3306

PROJECT: City of Tipton Flood Resilience Plan		PROJECT NO. 15-0363	APPROX. SCALE 1 " = 200 '
TITLE: Levee/Floodwall Schematic Tipton Schools			DATE: 04/2016
			EXHIBIT D-3



NOTES:
1. The base flood elevation (BFE) of Big Cicero Creek is shown per modeling completed for the Big Cicero Creek Flood and Erosion Risk Management Plan, November 2014.
2. The BFE is assumed constant along segments of the levee whose geometry is perpendicular to flow in Big Cicero Creek.
3. The existing ground elevation was determined from the 2011 State of Indiana Digital Elevation Model from LiDAR.

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PROJECT:	PROJECT NO.	APPROX SCALE
City of Tipton Flood Reslience Plan	15-0363	NTS
TITLE:		DATE: 04/2016
Tipton Schools Freeboard Analysis Profile		EXHIBIT D-4

Tipton Flood Resiliancy Plan

Tipton Schools - Conceptual Opinion of Probable Cost

Line	Description	Estimated Quantities	Units	Unit Price	Estimated Cost (Rounded)
1	**Professional Services**				
2	Engineering Design, Project Management, and Permitting	1	LS	$ 820,000	$ 820,000
3	Topographic Survey	1	LS	$ 270,000	$ 270,000
4	Wetland Delineation	1	LS	$ 30,000	$ 30,000
5	Right-of-Way Engineering	1	LS	$ 68,000	$ 68,000
6	Geotechnical Engineering	1	LS	$ 68,000	$ 68,000
7					$ 1,256,000
8	**Flood Protection System**				
9	Clearing and Grubbing	3.7	ACRE	$ 15,000	$ 55,500
10	Strip and Stockpile Topsoil	2,980	CYS	$ 5	$ 14,900
11	Excavate Keyway	940	CYS	$ 10	$ 9,400
12	Place and Compact Fill	11,500	CYS	$ 15	$ 172,500
13	Topsoil Placement	2,980	CYS	$ 5	$ 14,900
14	Finish Grading	17,900	SYS	$ 2	$ 35,800
15	Hydroseed and Mulch	17,900	SYS	$ 3	$ 53,700
16	Interior Drainage (manholes, conduits, inlets)	1	LS	$ 200,000	$ 200,000
17	Interior Drainage (pump station)	1	LS	$ 1,600,000	$ 1,600,000
18	Concrete Floodwall, 6 FT (Includes Excavation & Backfill)	1,640	LFT	$ 760	$ 1,246,400
19	Concrete Floodwall, 7 FT (Includes Excavation & Backfill)	1,410	LFT	$ 870	$ 1,226,700
20	Concrete Floodwall, 8 FT (Includes Excavation & Backfill)	120	LFT	$ 1,050	$ 126,000
21	Concrete Floodwall, 9 FT (Includes Excavation & Backfill)	580	LFT	$ 1,160	$ 672,800
22	Toe Drain with Filter Layer	3,740	LFT	$ 50	$ 187,000
23	Vehicle Closure	3,270	SFT	$ 1,200	$ 3,924,000
24	Pedestrian Closure	620	SFT	$ 1,200	$ 744,000
25	Asphalt Removal and Replacement	6,650	SYS	$ 45	$ 299,300
26			Estimated Flood Protection System Cost		$ 10,582,900
27	**Erosion and Sediment Control**				
28	Silt Fence	2,200	LF	$ 3	$ 6,600
29	Stabilized Construction Entrance	1	EA	$ 3,000	$ 3,000
30	Concrete Washout	1	EA	$ 3,000	$ 3,000
31	Inlet Protection/Other Misc. Erosion Control	1	LS	$ 100,000	$ 100,000
32			Estimated Erosion and Sediment Control Cost		$ 112,600
33	**Miscellaneous Construction Costs**				
34	Construction Surveying (3%)	1	LS	$ 320,900	$ 320,900
35	Dewatering (2%)	1	LS	$ 214,000	$ 214,000
36	Utility Relocations (10%)	1	LS	$ 1,069,600	$ 1,069,600
37	Maintenance of Traffic (5%)	1	LS	$ 534,800	$ 534,800
38	Mobilization/Demobilization and Administration (5%)	1	LS	$ 534,800	$ 534,800
39					$ 2,674,100
40	**Construction Contingencies**				
41	Construction Contingencies (30%)	1	LS	$ 4,010,900	$ 4,010,900
42			Estimated Construction Contingencies		$ 4,010,900
43					
44			**Estimated Construction Cost**		$ 17,380,500
45					
46			**Estimated Total Cost**		$ 18,636,500

Notes and Assumptions

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TIPTON WASTEWATER TREATMENT PLANT

Detailed Schematic and Cost Estimates

Legend

- Levee/Floodwall Alignment
- Closure
- Floodwall
- Internediate Contour
- Index Contour
- Property Lines

Vehicle Closure
Sta 9+10 to Sta 9+58

Begin Floodwall
Sta 6+85

Begin Levee
Sta 13+88

Begin Levee
Sta 4+10

Begin Floodwall
Sta 0+00

End Levee/Tie into Floodwall
Sta 21+65

0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
11+00
12+00
13+00
14+00
15+00
16+00
17+00
18+00
19+00
20+00
21+00

860
865
855

N

Sources of Data:

1. Aerial: 2011-2013 Indiana Statewide Imagery and LiDAR Program, 1'x1' Digital Orthoimagery, www.indianamap.org, 2011.

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PROJECT: City of Tipton Flood Resilience Plan	PROJECT NO. 15-0363	APPROX. SCALE 1 " = 100 '
		DATE: 04/2016
TITLE: Levee/Floodwall Schematic Wastewater Treatment Plant		EXHIBIT D-5

Floodwall
Levee
Floodwall
Levee
Begin Floodwall (Station 0+00 +/-)
Begin Levee (Station 4+10 +/-)
Begin Floodwall (Station 6+85 +/-)
Vehicle Closure Station 9+10 to Station 9+58 +/-
Begin Floodwall (Station 13+88 +/-)
End Levee/ Tie into Floodwall (Station 21+65 +/-)
Levee Crest = 868.8
500 Year Elevation = 866.3
BFE = 864.3
Max Height = 13 ft +/-
Elevation (feet, NAVD 88)
873
872
871
870
869
868
867
866
865
864
863
862
861
860
859
858
857
856
855
854
853
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
11+00
12+00
13+00
14+00
15+00
16+00
17+00
18+00
19+00
20+00
21+00
22+00
Station (feet)
44 CFR 65.10 Freeboard
Proposed Levee Crest
Existing Ground Elevation
100-yr FIS Profile
500-yr FIS Profile

NOTES:
1. The base flood elevation (BFE) of Big Cicero Creek is shown per modeling completed for the big Cicero Creek Flood and Erosion Risk Management Plan, November 2014.
2. The BFE is assumed constant along segments of the levee whose geometry is perpendicular to flow in Big Cicero Creek.
3. The existing ground elevation was determined from the 2011 State of Indiana Digital Elevation Model from LiDAR.

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PROJECT:	PROJECT NO.	APPROX SCALE
City of Tipton Flood Resiliency Plan	15-0363	NTS
		DATE: 04/2016
TITLE: Wastewater Treatment Plant Freeboard Analysis Profile		EXHIBIT D-6

Tipton Flood Resiliancy Plan

Waste Water Treatment Plant - Conceptual Opinion of Probable Cost

Line	Description	Estimated Quantities	Units	Unit Price	Estimated Cost (Rounded)
1	**Professional Services**				
2	Engineering Design, Project Management, and Permitting	1	LS	$ 340,000	$ 340,000
3	Topographic Survey	1	LS	$ 85,000	$ 85,000
4	Wetland Delineation	1	LS	$ 10,000	$ 10,000
5	Right-of-Way Engineering	1	LS	$ 21,000	$ 21,000
6	Geotechnical Engineering	1	LS	$ 42,000	$ 42,000
7					$ 498,000
8	**Flood Protection System**				
9	Clearing and Grubbing	3.4	ACRE	$ 15,000	$ 51,000
10	Strip and Stockpile Topsoil	2,710	CYS	$ 5	$ 13,600
11	Excavate Keyway	880	CYS	$ 10	$ 8,800
12	Place and Compact Fill	15,600	CYS	$ 15	$ 234,000
13	Topsoil Placement	2,710	CYS	$ 5	$ 13,600
14	Finish Grading	16,300	SYS	$ 2	$ 32,600
15	Hydroseed and Mulch	16,300	SYS	$ 3	$ 48,900
16	Interior Drainage (manholes, conduits, inlets)	1	LS	$ 60,000	$ 60,000
17	Interior Drainage (pump station)	1	LS	$ 490,000	$ 490,000
18	Concrete Floodwall, 9 FT (Includes Excavation & Backfill)	380	LFT	$ 1,160	$ 440,800
19	Concrete Floodwall, 10 FT (Includes Excavation & Backfill)	260	LFT	$ 1,250	$ 325,000
20	Concrete Floodwall, 11 FT (Includes Excavation & Backfill)	120	LFT	$ 1,340	$ 160,800
21	Concrete Floodwall, 12 FT (Includes Excavation & Backfill)	500	LFT	$ 1,430	$ 715,000
22	Toe Drain with Filter Layer	1,260	LFT	$ 50	$ 63,000
23	Vehicle Closure	480	SFT	$ 1,200	$ 576,000
24	Asphalt Removal and Replacement	1,270	SYS	$ 45	$ 57,200
25		Estimated Flood Protection System Cost			$ 3,290,300
26	**Erosion and Sediment Control**				
27	Silt Fence	2,100	LF	$ 3	$ 6,300
28	Stabilized Construction Entrance	1	EA	$ 3,000	$ 3,000
29	Concrete Washout	1	EA	$ 3,000	$ 3,000
30	Inlet Protection/Other Misc. Erosion Control	1	LS	$ 30,000	$ 30,000
31		Estimated Erosion and Sediment Control Cost			$ 42,300
32	**Miscellaneous Construction Costs**				
33	Construction Surveying (3%)	1	LS	$ 100,000	$ 100,000
34	Dewatering (5%)	1	LS	$ 166,700	$ 166,700
35	Utility Relocations (10%)	1	LS	$ 333,300	$ 333,300
36	Maintenance of Traffic (2%)	1	LS	$ 66,700	$ 66,700
37	Mobilization/Demobilization & Administration (5%)	1	LS	$ 166,700	$ 166,700
38					$ 833,400
39	**Construction Contingencies**				
40	Construction Contingencies (30%)	1	LS	$ 1,249,800	$ 1,249,800
41		Estimated Construction Contingencies			$ 1,249,800
42					
43		**Estimated Construction Cost**			$ 5,415,800
44					
45		**Estimated Total Cost**			$ 5,913,800

Notes and Assumptions

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