



Action Discovery Report

Lower White River Watershed, HUC 05120202
Upper White River Watershed, HUC 05120201

November, 2014



FEMA

RiskMAP
Increasing Resilience Together

Discovery Appendix

Mitigation Needs Assessment for the Lower and Upper White River Watershed, Indiana

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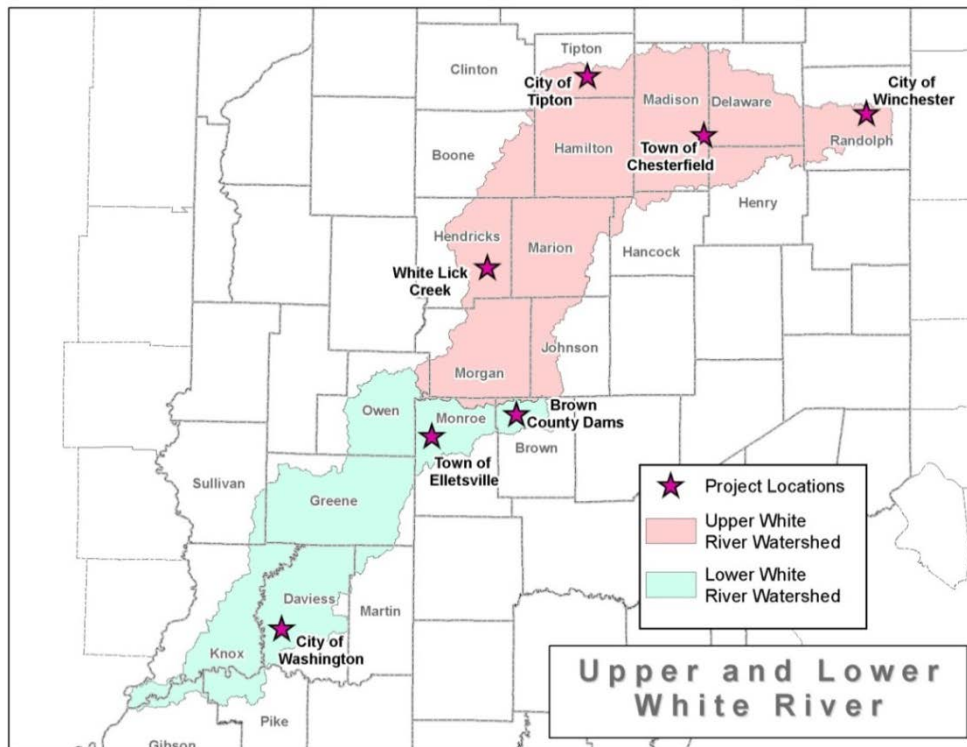
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Background

This appendix has been added to the Discovery Report for the Upper and Lower White River Discovery Reports in order to add information regarding a follow-up Discovery effort for these watersheds focused on mitigation action. The seven communities were identified based on previous Risk MAP and MapMOD efforts that have focused on the Lower and Upper White River Watershed counties. These efforts include Discovery, Resiliency, MHMP development, FIRM modernization, and Discovery Demonstration projects.

This effort was headed by the Indiana Department of Natural Resources (IDNR) Division of Water with assistance from The Polis Center at IUPUI and FEMA. The project team met with the stakeholders for each of the identified communities to discuss in detail the issues impacting the community, the local interest in risk reduction, and the community's interest in commitment to reducing and mitigating risk. The information discussed during these meeting helped identify mitigation actions that DNR can help the communities to pursue. A decision was made to intentionally focus on smaller communities for this Action Discovery effort. These communities were chosen because they needed assistance, and they have proven to be proactive and forward thinking when trying to mitigate flood hazards.

Figure 1. Action Discovery Locations



Town of Ellettsville

Location

The Town of Ellettsville is located in Monroe County, Indiana. The Town is located approximately 8 miles north of Bloomington, which is the county seat.

Population

The population is 6,378 according to the 2010 Census.

Map Status

The Flood Insurance Rate Maps for Monroe County have been modernized. The current effective map date is December 17, 2010.

Floodplain Status

Ellettsville participates in the NFIP and there are 34 Flood Insurance policies in place. There have been 23 claims since 1978. The community floodplain ordinance is dated November 22, 2010.

Based on aerial mapping from 2011, there appear to be a total of 155 total structures located inside a Special Flood Hazard Area identified within the community. However, this does not identify all structures that should carry a policy since the exact number of federally backed loans is unknown.

Approximately 10 LOMC's were revalidated when the maps were finalized in 2010. Since the maps have been published, approximately 20 LOMA's have been issued for the community; many of these were along the unnamed tributaries of Jacks Defeat Creek.

MHMP Status

The current Monroe County Multi-Hazard Mitigation Plan has been in place since 2011 and expires October 20, 2015.

Risk MAP Projects

The Town of Ellettsville was included in the Lower White River Watershed Discovery project dated January 31, 2012.

Principal Flooding Threat

The principal flooding threat in the Town of Ellettsville is from Jacks Defeat Creek. Tributaries of Jacks Defeat Creek are noted as secondary flood threats.

Past Mitigation Successes

There is no record of FEMA funding that has gone towards implementing a mitigation project in Ellettsville; however, there have been locally implemented projects that were not recorded. In December 2013, the Town relocated the repetitively flooded Town Hall from Sale Street to an area outside the floodplain. Additionally, in 2002 the police station was moved from a location that repeatedly flooded.

In 1995 the US Army Corps of Engineers (USACE) completed an Initial Assessment Report based on the results of the preliminary phase of the USACE reconnaissance study. It identified potential solutions to the flooding problem in Ellettsville, including the proposed construction of three detention basins and an

alternative levee that would protect against the 100-year flood. These projects were not pursued by the Town due to a lack of funding.

Community Overview

Major floods principally occur during the winter and spring months, but can occur during any season in the Town of Ellettsville. Generally, two types of storm events cause flooding. During the winter and spring, storms of moderate intensity and long duration, coupled with frozen ground, cause flooding, and during the summer, floods are caused by thunderstorms with high intensities and relatively short durations.

The current FIRM floodplain for Jacks Defeat Creek was based on hydrologic and hydraulic analysis performed by US Geological Survey (USGS) Water Resources Division and was completed July 1992. An additional study for Jacks Defeat Creek was performed by the Indiana Department of Natural Resources for the 2010 Monroe County FIS. The stream has a drainage area of 21.7 square miles at the mouth and 9.96 square miles at the Main Street stream crossing in Ellettsville.

The table below outlines the numerous declared disasters including emergency declarations for the Monroe County. This data ranges from 1998 to present since a listing of the affected county before 1998 was not available.

Table 1. Disasters in Monroe County

| Disaster Declaration | Disaster Type | Incident Period | Type of Assistance |
|-----------------------------|---|------------------------|---------------------------------------|
| DR-1997 | Indiana Severe Storms, Tornadoes, Straight-Line Winds, and Flooding | June 2011 | Public Assistance |
| DR-1766 | Indiana Severe Storms and Flooding | June 2008 | Both Individual and Public Assistance |
| EM-3238 | Indiana Hurricane Katrina Evacuation | September 2005 | Emergency Declaration |
| DR-1573 | Indiana Severe Winter Storms and Flooding | January 2005 | Individual Assistance |
| EM-3197 | Indiana Snow | December 2004 | Emergency Declaration |
| DR-1520 | Indiana Severe Storms, Tornadoes, and Flooding | June 2004 | Individual Assistance |
| DR-1487 | Indiana Severe Storms, Tornadoes, and Flooding | September 2004 | Individual Assistance |
| DR-1433 | Indiana Severe Storms and Tornadoes | September 2002 | Both Individual and Public Assistance |
| DR-1234 | Indiana Severe Storms, Tornadoes and Flooding | July 1998 | Public Assistance |

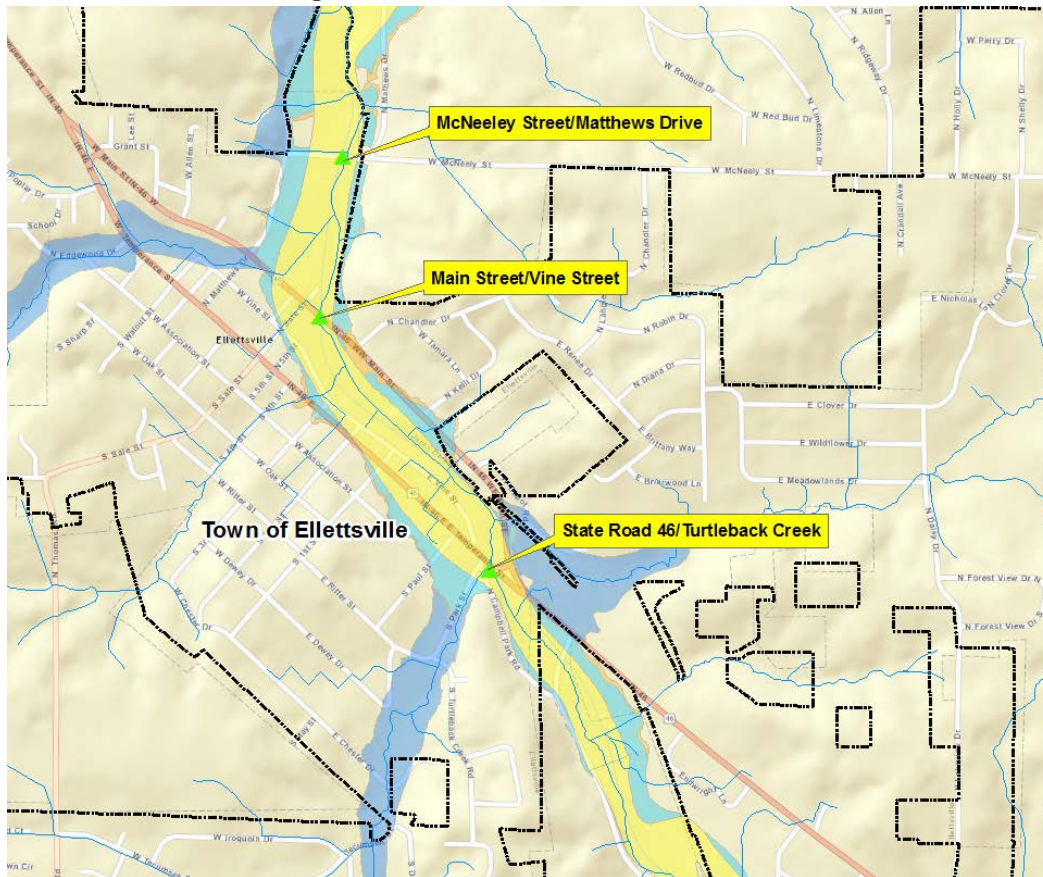
Local Champions:

- Planning Director – Kevin Tolloty
- Town Manager - Jim Davis
- Jon Thomas - Bynum Fanyo & Associates, Inc.
- Rick Coppock - Bynum Fanyo & Associates, Inc.

Identified Issues

A meeting was held on August 21, 2014 in the Town of Ellettsville to discuss the Action Discovery project and areas within the community that are of concern. The meeting was attended by Connie Griffin (Floodplain Administrator and Planning Director), Jim Davis (Town Manager), Jon Thomas and Rick Coppock (City Engineer's, Bynum Fanyo & Associates, Inc.), David Knipe (DNR), Jim Wertz (DNR), John Buechler (The Polis Center), and Lacey Duncan (The Polis Center). The following issues were identified during this meeting:

Figure 2. Ellettsville Problem Overview



State Road 46/Turtleback Creek

Flooding has affected the intersection at State Road 46 or East Temperance Street and Park Street for many years. The community relocated emergency services from the building adjacent to the tributary. Currently the town manages the street department out of this facility.

The tributary flowing into Jacks Defeat Creek at this location is locally referred to as Turtleback Creek. Floodwaters from Turtleback Creek have a hard time passing through the culvert at Campbell Park Road as well as Turtleback Creek Road.

Figure 3. Ellettsville Issue Overview

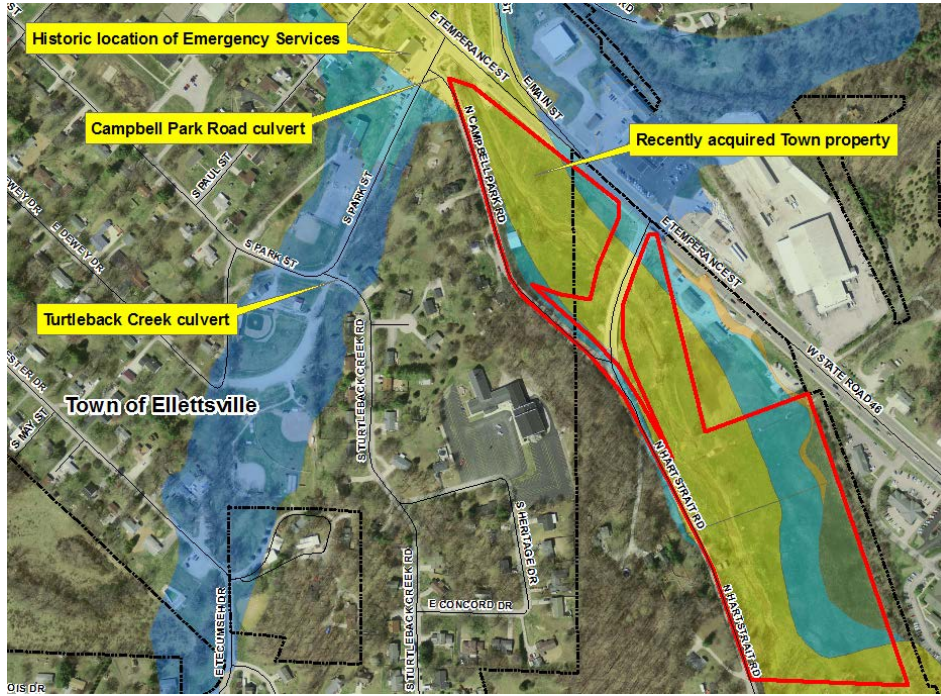


Figure 4. April 2011 Temperance Street Town Property



Figure 5. April 2011 Turtleback Creek along Park Street and Turtleback Creek Road



Figure 6. April 2014 Campbell Park Road Culvert



Main Street and Vine Street

The Main Street stream crossing is just downstream of the State Road 46 (Temperance Street) Bridge. Vine Street parallels the creek along the left bank. Areas along Vine Street are subject to flooding as the photos in Figures 8 and 9 documents. There is at least one record of a demolished structure along Vine Street near Sale Street due to flooding. Figure 9 shows the flooding at the demolished structure in December 2013. It was discussed that few permits have been issued for rebuilding in this area. It is believed that the main reason for this is that since the residents are generally renters, a minimal effort has been put into the rehabilitation of these structures post-flood.

Figure 7. Main Street and Vine Street

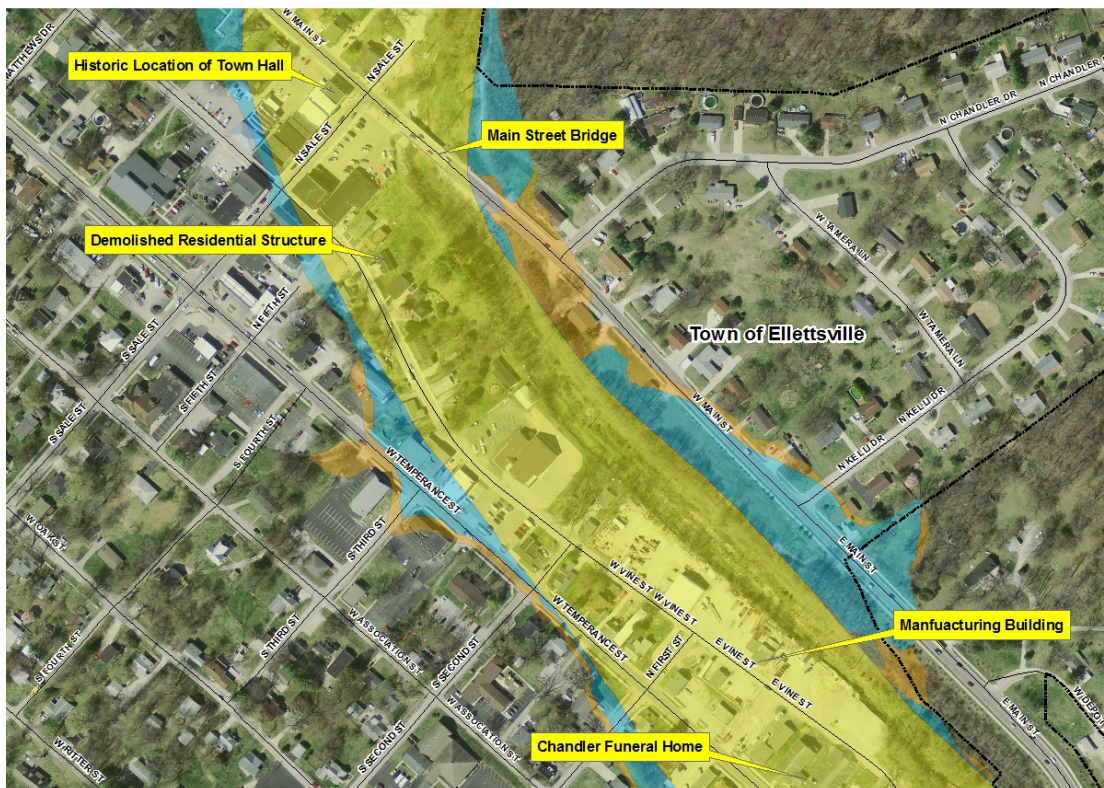


Figure 8. December 2013 Flooded Rental that was recently demolished



The Town Hall located along Sale Street was subjected to three bouts of flooding within the last five years. A discussion on how to mitigate this issue occurred following flooding at Town Hall in December 2013. The Town investigated the option of obtaining flood insurance to avoid relocation costs; however, since the structure is considered commercial, the rates were actuarial and therefore very costly. It made

more fiscal sense to relocate the Town Hall versus obtaining flood insurance. The council authorized the move for \$50,000, but the action cost was only \$10,000.

Figure 9. December 2013 Flooding at Main and Sale



Figure 10. Old Town Hall Location at Main and Sale



The Main Street Bridge was replaced in 1986. As seen in the bridge plan below, the third opening is not completely open. At the time of construction, the existing 8" sewer just downstream along the right bank was not relocated due to the cost. It is believed that this may be the reason the area beneath the bridge is not completely open. With the changes in technology related to sewer relocation, it would be considerably less expensive to relocate this sewer today and perhaps could be completed by local maintenance staff.

Figure 11. Main Street Bridge Plan 1986

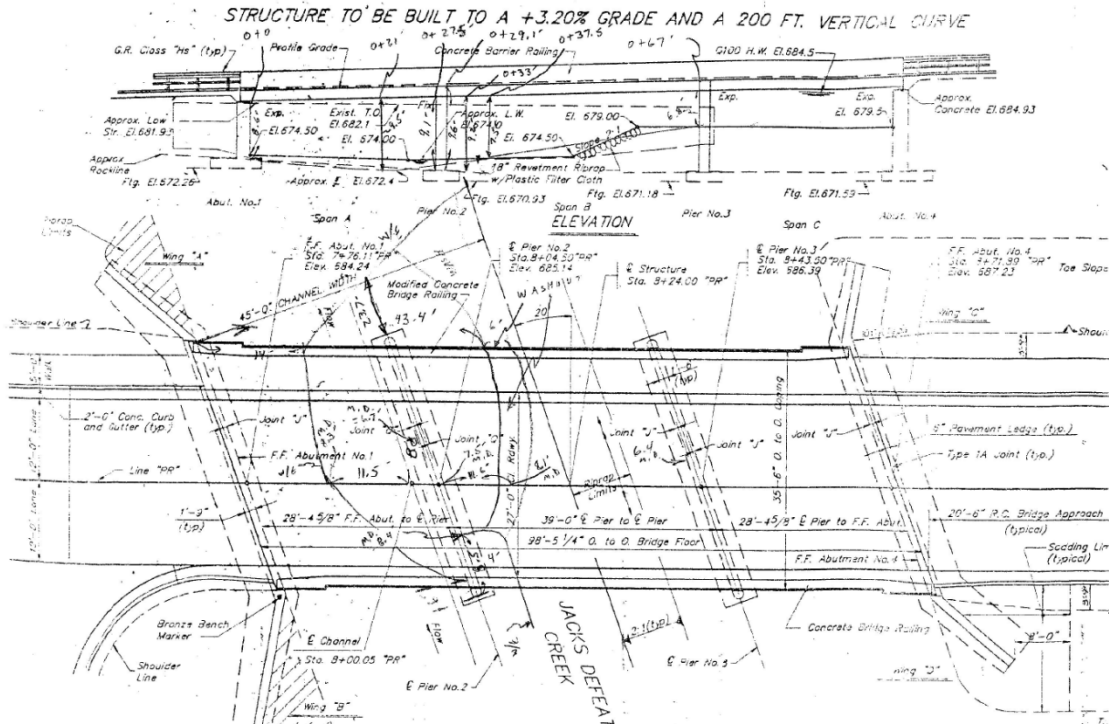


Figure 12. August 1995 Sale Street



Figure 13. March 2011 Main Street Bridge



Figure 14. March 2011 along Vine Street



McNeely Street/Matthews Drive

Flooding is common near the McNeely Street stream crossing. Along the upstream left bank is Chads Refuse, an area that frequently has high water. Water backs up along the left bank and is blocked by debris in the chain link fence that parallels McNeely Street. Ideas were raised about placing multiple culverts along the west end of McNeely Street, allowing for flood flows to cross under the road versus forcing flows through the creek opening. An issue raised with this proposal is that the fence would still continue to block flood flows.

Along the downstream end of the McNeely Street bridge is where the Town stores its salt. The location is referred to as the Big Blue Building and has been flooded multiple times. The Town has looked into relocating this to a safer location. Efforts to alleviate flooding at this site are currently being investigated. A dry detention basin has been designed between the Big Blue Building and West McNeely Street, but it has not been modeled to determine if this could control flood waters. Sewer relocations would be necessary for this to happen.

Stranded motorists are a common occurrence along Matthews Drive. The Town Manager recognized this as a repeat problem along the drive and that emergency management staff is tasked with rescuing motorists along this portion of the road. There is a pending project to relocate portions of Matthews Drive. There is good support from Law Enforcement in regards to getting information out to the public on flooded roads. Additionally, the hope is that the relocation of portions of Matthews Drive should alleviate some flooding in the area.

Figure 15. McNeely Street/Matthews Drive

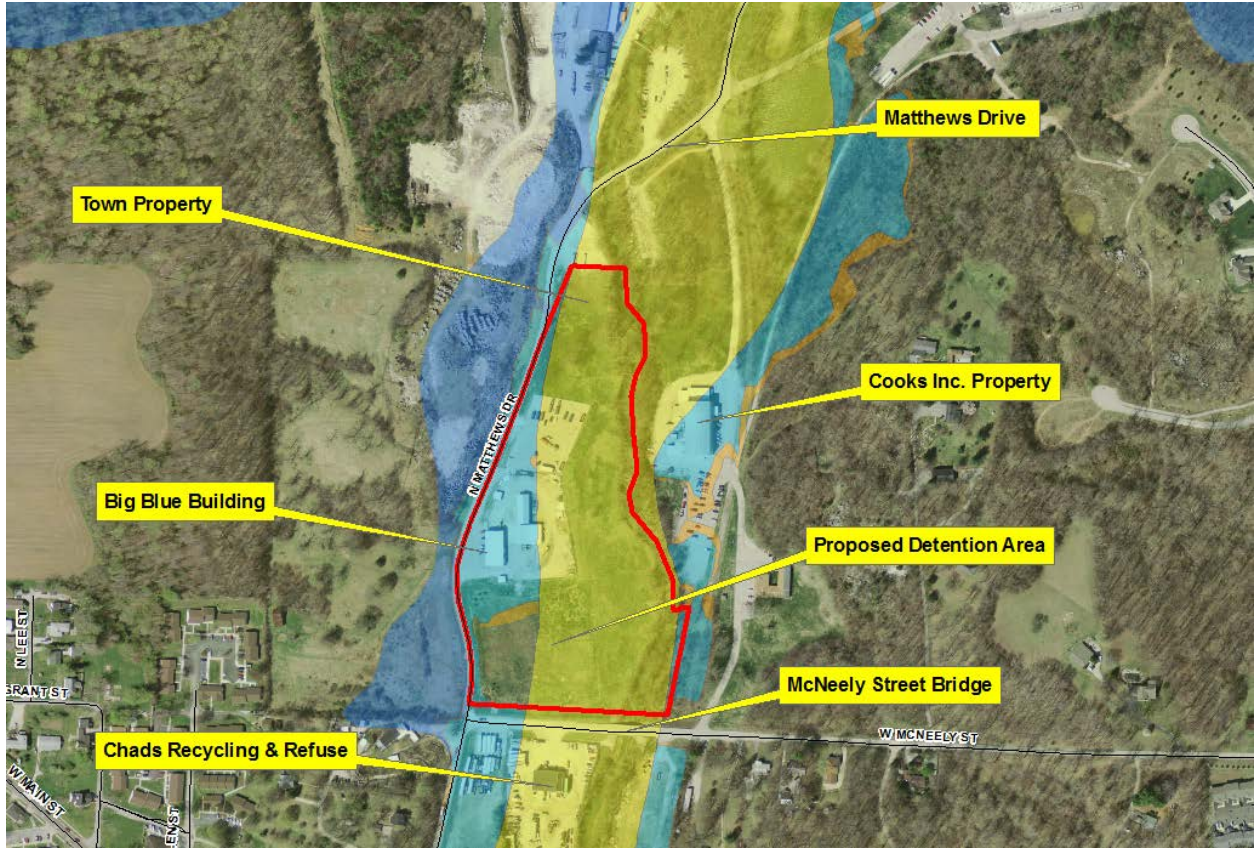


Figure 16. June 1993 Chads Recycling & Refuse

Image shows Chad's Recycling and Refuse, LLC
Flood June 14, 1993
Photos Provided by Ellettsville Street Department



Figure 17. November 1993 Cooks Property



Figure 18. May 1995 McNeely Town Property



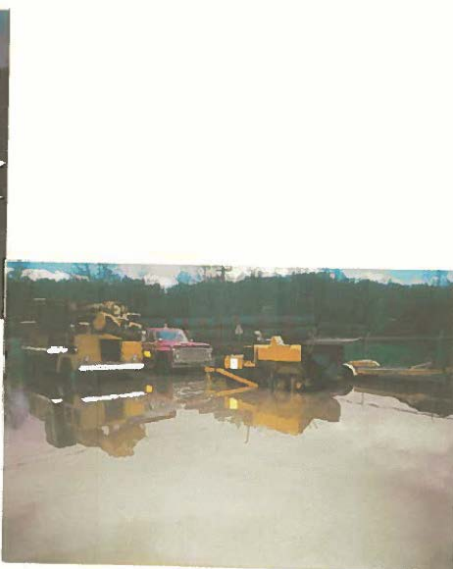
Figure 19. November 2002 McNeely Town Property



Flood 2002
Photos provided by Ellettsville Street Department

Ellettsville Utility Department on
McNeely and Matthews less than 500 Feet from
the proposed salvage and recycling operation.

(North of Chad's Recycling and Refuse, LLC)



Planned Scope of Work

- Evaluate alternatives at the Town property at East Temperance Street to determine if detention in this area would affect flood elevations through town. Also review the drainage at the culverts along Turtleback Creek to determine if mitigation efforts are needed.
- Evaluate alternatives at the Main Street Bridge to determine if additional conveyance at the bridge would affect flood elevations through town.
- Evaluate alternatives at McNeely Street to determine if detention or modifications to the McNeely Street bridge would affect flood elevations in the general area of McNeely Street, and/or upstream through town.

Deliverables

- Reports detailing alternatives for the three areas identified as potential mitigation sites.
 - i. Document the sources of local staff to be used for projects that are located on property that is owned by the Town.

Action Potentials

The potential actions that may be moved forward as a result of these efforts includes (but is not limited to) the following:

- Develop a detention basin on the existing town property at State Road 46/Turtle Creek using local maintenance staff.
- Relocate the 8” utility line blocking the Main Street Bridge over Jacks Defeat Creek to open the bridge using local maintenance staff.
- Develop a detention basin on the existing town property at McNeely Street using local maintenance staff.
- The Town recently lost their Floodplain Administrator who was very knowledgeable on floodplain management processes and had administered them for the Town for many years. Develop training for the new Planning Director to be named by the Town of Ellettsville on how to handle permits and pre and post flood protocols.

Town of Chesterfield

Location

The Town of Chesterfield is located in both Madison and Delaware County, Indiana. The majority of the Town is located in Madison County.

Population

The population is 2,547 according to the 2010 Census.

Map Status

The Flood Insurance Rate Maps for Madison County have been modernized. The first modernized maps were published May 3, 2011. A Physical Map Revision became the current effective maps June 9, 2014.

Floodplain Status

Chesterfield participates in the NFIP, and there are 22 Flood Insurance policies in place. There have been 2 claims since 1978. The community flood ordinance is dated May 16, 2014.

Based on aerial mapping from 2011, there appear to be a total of 78 total structures located inside a Special Flood Hazard Area identified within the community. However, this does not identify all structures that should carry a policy since the exact number of federally backed loans is unknown.

There were no LOMC's revalidated when the maps were finalized in 2014. Since the maps have been published there has been one LOMA issued for the community; along Mill Creek Drive.

MHMP Status

The Madison County Multi-Hazard Mitigation Plan has been in place since 2008 and expired on January 28, 2013.

Risk MAP Projects

The Town of Chesterfield was included in the Upper White River Watershed Discovery project dated September 30, 2012.

Principal Flooding Threat

The principal flooding threat in the Town of Chesterfield is from Chesterfield Branch.

Community Overview

Low-lying areas of Chesterfield are subject to periodic flooding caused by the overflow of the West Fork White River and Chesterfield Branch. The highest known flood on the West Fork White River in the Chesterfield area was that of March 25, 1913.

The Town's highest risk to residential flooding is from Chesterfield Branch, which runs through the city and flows from south to north then drains into the West Fork White River. Chesterfield Branch has also historically been referred to as Mill Creek and as legal drain J.M. Donnely. The stream has a drainage area of 2.41 square miles at the mouth and 1.08 at the Mulberry Road stream crossing.

The 2011 floodplain for Chesterfield Branch was based on hydrologic and hydraulic analysis performed by James and Berger Associates and compiled in September 1978. The PMR for the county in 2014

included a revised Flood Insurance Study for the stream that included revisions to the hydrology and hydraulics and was performed by Christopher B. Burke, Inc. through the CTP agreement with the State of Indiana.

Table 21 outlines the numerous declared disasters including emergency declarations for the Madison County. This data ranges from 1998 to present since a listing of the affected county before 1998 was not available.

Table 2. Disasters in Madison County

| Disaster Declaration | Disaster Type | Incident Period | Type of Assistance |
|-----------------------------|--|------------------------|---------------------------------------|
| DR-4173 | Indiana Severe Winter Storm and Snowstorm | January 2014 | Public Assistance |
| DR-1766 | Indiana Severe Storms and Flooding | June 2008 | Both Individual and Public Assistance |
| EM-3274 | Indiana Snow | February 2007 | Emergency Declaration |
| EM-3238 | Indiana Hurricane Katrina Evacuation | September 2005 | Emergency Declaration |
| DR-1573 | Indiana Severe Winter Storms and Flooding | January 2005 | Both Individual and Public Assistance |
| EM-3197 | Indiana Snow | December 2004 | Emergency Declaration |
| DR-1520 | Indiana Severe Storms, Tornadoes, and Flooding | June 2004 | Individual Assistance |
| DR-1487 | Indiana Severe Storms, Tornadoes, and Flooding | September 2004 | Individual Assistance |
| DR-1476 | Indiana Severe Storms, Tornadoes, and Flooding | July 2003 | Both Individual and Public Assistance |
| DR-1433 | Indiana Severe Storms and Tornadoes | September 2002 | Both Individual and Public Assistance |
| EM-3135 | Indiana Winter Storm | January 1999 | Emergency Declaration |
| DR-1234 | Indiana Severe Storms, Tornadoes and Flooding | July 1998 | Public Assistance |

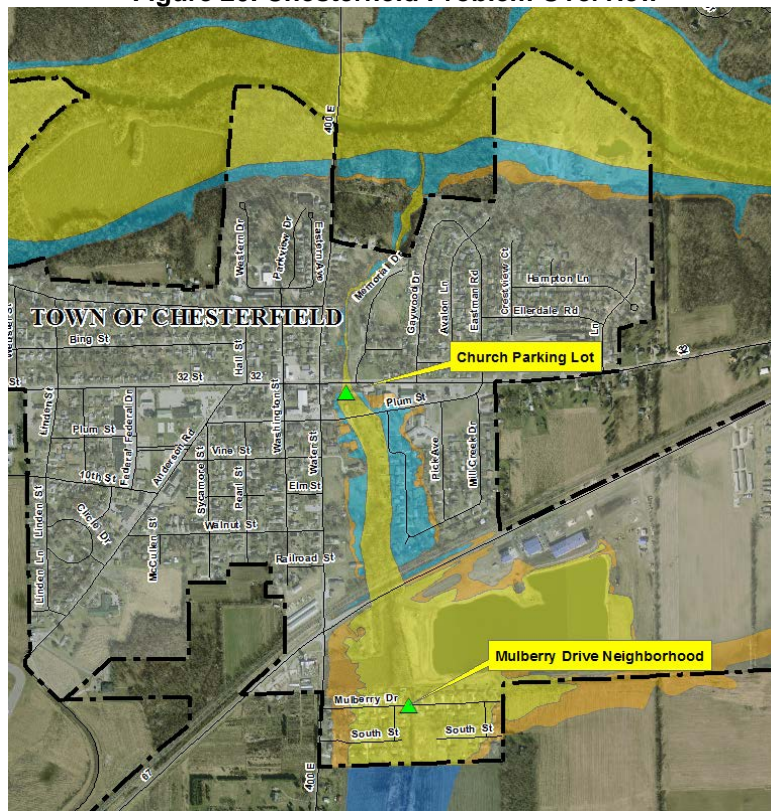
Local Champions:

- Clerk Treasurer – Deb Dunham
- County Planning Director – Brad Newman
- County Surveyor – Patrick Manship
- Local Resident – Al Stoner

Identified Issues

A meeting was held on August 29, 2014 in the Town of Chesterfield to discuss the action discovery project and areas within the community that are of concern. The meeting was attended by Deborah Dunham (Floodplain Administrator and Clerk Treasurer), Al Stoner (Local Resident), David Knipe (DNR), Dustin Thurston (DNR), Matt Riggs (The Polis Center), and Lacey Duncan (The Polis Center). The following issues were identified during this meeting:

Figure 20. Chesterfield Problem Overview



Church Parking Lot

There are two bridges located near the church parking lot; the State Road 32 Bridge and the parking lot that exists over the stream crossing. The culvert for the parking lot is undersized and is believed to be the reason the properties along Mill Creek Drive are at risk of flooding.

Figure 21. Church Parking Lot Culvert

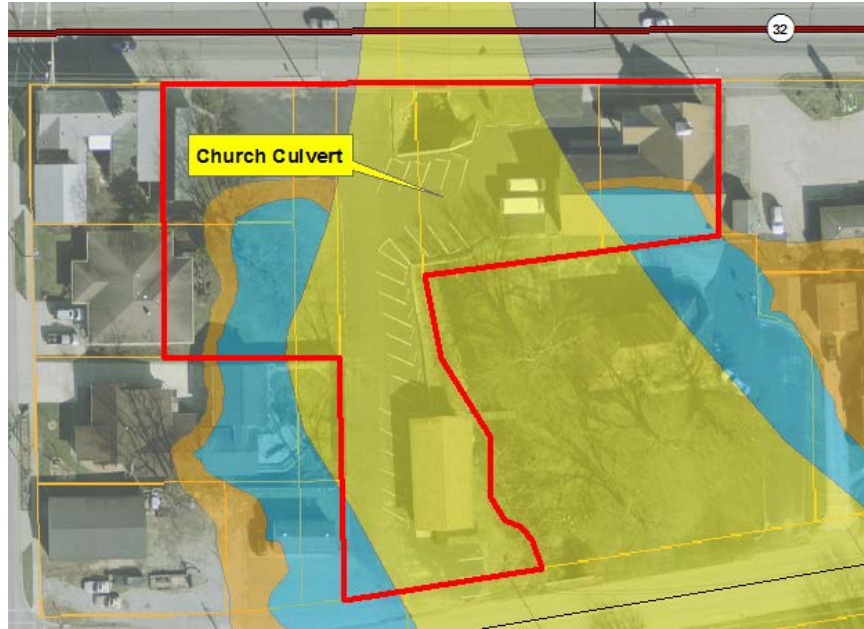
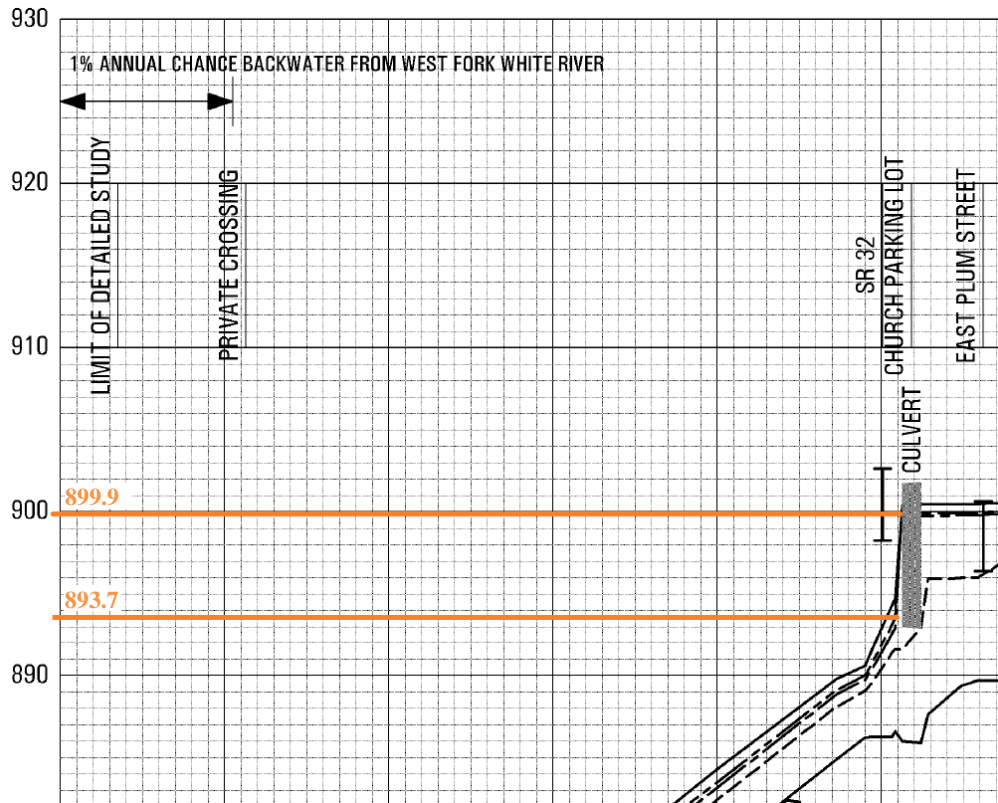


Figure 22. Chesterfield Branch Profile



The parking lot is owned by the Parkview Wesleyan Church, and it was discussed that there is a possibility that the church would turn over a portion of the property to the town. It is believed removing the culvert crossing would cause flood elevations to drop dramatically, reducing the flooding risk to Mill Creek Drive residents.

Figure 23. Church Culvert



Mulberry Drive Neighborhood

The Mulberry Drive Neighborhood is mapped in the Special Flood Hazard Area Zone AE/Floodway. It is believed that the neighborhood is at a high-risk of flooding because of the insufficient size of the culverts beneath the Railroad just downstream of the State Road 67 Bridge. As can be seen in Figure 24, there are two small culverts for the railroad crossing. With the Physical Map Revision in 2014, the mapping in the Mulberry Drive neighborhood area was mapped as storage behind the railroad culverts.

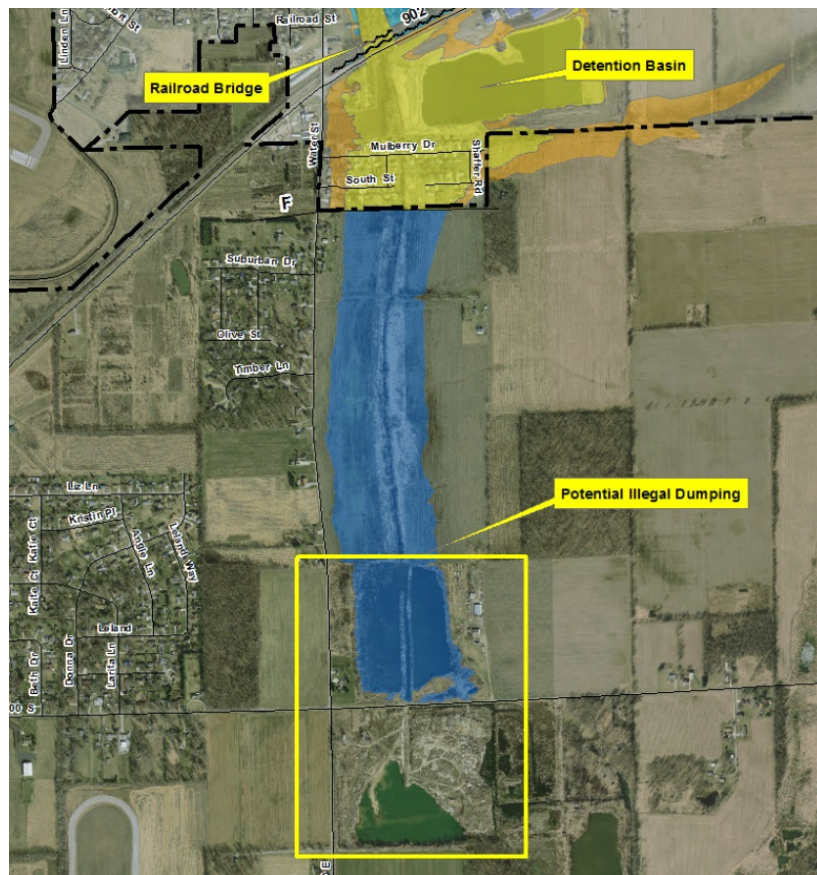
Figure 24. Railroad Culverts



A gravel pit located just upstream of the SR 67 bridge is owned by a local chapter of the International Union Operating Engineers and is used as a training facility. This could potentially work to reduce the floodplain in the area, but since this is not a site owned by the town, it could be a challenge to certify the location as a flood control project.

The local resident who joined the meeting stated that when flood waters rise, there is a foul smell in the area. It is believed that since the three GM plants closed in 2006, illegal dumping from the plants has been occurring upstream, to the south, along County Road 100 South. There is also a Peat excavation occurring in this area, and it is hypothesized that this is where the foul smell comes from.

Figure 25. Upstream of Mulberry Drive



Planned Scope of Work

- Using the existing FIS model, evaluate alternatives at the Church culvert to determine if removing the structure in this area would affect flood elevations along Mill Creek Drive, and/or upstream near Mulberry Drive.
- Evaluate alternatives at the Railroad culverts to determine if enlarging the structure in this area would affect flood elevations upstream of State Road 67.
- Explore the potential of using the gravel pit as a detention basin. Determine if the town and the private landowner could develop an agreement about the site or determine if the parcel could be divided and portions of the property turned over to the Town.
- Investigate areas upstream of Mulberry Drive and determine impacts to flood elevations.

Deliverables

- Reports detailing alternatives for the two areas identified as potential mitigation sites.
- Develop an agreement between the city and the union operators regarding the use of the site for flood detention purposes.

Action Potentials

The potential actions that may be moved forward as a result of these efforts includes (but is not limited to) the following:

- Reduce flooding risk to the Mill Creek Drive Neighborhood by removing the existing Church Culvert
- Alleviate flooding risk to the Mulberry Neighborhood by certifying a flood control structure at the existing gravel pit

City of Winchester

Location

The City of Winchester is the county seat of Randolph County, Indiana.

Population

The population is 4,395 according to the 2010 Census.

Map Status

The Flood Insurance Rate Maps for Randolph County have been modernized. The current effective map date is March 4, 2013.

Floodplain Status

Winchester participates in the NFIP and there are 50 Flood Insurance policies in place. There have been 3 claims since 1978. The Randolph County Plan Commission administers floodplain regulations for the City of Winchester, through the floodplain ordinance dated February 4, 2013. A quick analysis indicates that there are potentially over 125 structures in the community that are located within the SFHA.

MHMP Status

The Randolph County Multi-Hazard Mitigation Plan was written and met FEMA's submittal requirements in 2009, but there is no record that the plan was adopted by the communities in Randolph County. At this time there is an active proposal for updating Randolph County's MHMP. The information produced by this effort will be included in the update.

Risk MAP projects

Randolph County was included in the Upper White River Discovery project dated September 30, 2012.

Principal Flooding Threat

Salt Creek, Sugar Creek, West Fork White River and Kemm-Perry Legal Drain. The recent update to the FIRM maps identified approximate flood zones (based on modeling) along Salt Creek, Sugar Creek and the West Fork White River within the limits of the City of Winchester. The Kemm-Perry Legal Drain was not mapped but is the source of additional flooding concerns in Winchester.

Past Mitigation Successes

The City of Winchester has made improvements to help reduce the flooding impact along Kemm-Perry Legal Drain. These include the installation of a 30" drainage pipe between the Baker School and Summerfield detention basins and re-grading of the Summerfield detention basin.

Walmart development included a detention basin that positively impacted the flooding in the Spring Village subdivision.

The City of Winchester has adopted a modified drainage ordinance that requires that any new development must reduce drainage discharge. The community is also looking into implementing a storm water utility. The water utility design between by the Town of Whiteland and Indiana-American Water Company is being used as a model.

Community Overview

The City of Winchester is the county seat of Randolph County, which is located in eastern Indiana near the Ohio state line. According to the City of Winchester’s community information guide, the largest employer in Winchester is Anchor Glass Container Corporation (now Ardagh Glass, INC), which employs over 400 people and is considered an essential facility to the community.

The table below outlines the numerous declared disasters including emergency declarations for Randolph County. This data ranges from 1998 to present since a listing of the affected county before 1998 was not available.

Table 3. Disasters in Randolph County

| Disaster Declaration | Disaster Type | Incident Period | Type of Assistance |
|----------------------|--|-----------------|---------------------------------------|
| DR-1766 | Indiana Severe Storms and Flooding | June 2008 | Both Individual and Public Assistance |
| EM-3274 | Indiana Snow | February 2007 | Emergency Declaration |
| EM-3238 | Indiana Hurricane Katrina Evacuation | September 2005 | Emergency Declaration |
| DR-1573 | Indiana Severe Winter Storms and Flooding | January 2005 | Both Individual and Public Assistance |
| EM-3197 | Indiana Snow | December 2004 | Emergency Declaration |
| DR-1487 | Indiana Severe Storms, Tornadoes, and Flooding | September 2004 | Individual Assistance |
| DR-1476 | Indiana Severe Storms, Tornadoes, and Flooding | July 2003 | Individual Assistance |
| DR-1433 | Indiana Severe Storms and Tornadoes | September 2002 | Individual Assistance |
| EM-3135 | Indiana Winter Storm | January 1999 | Emergency Declaration |

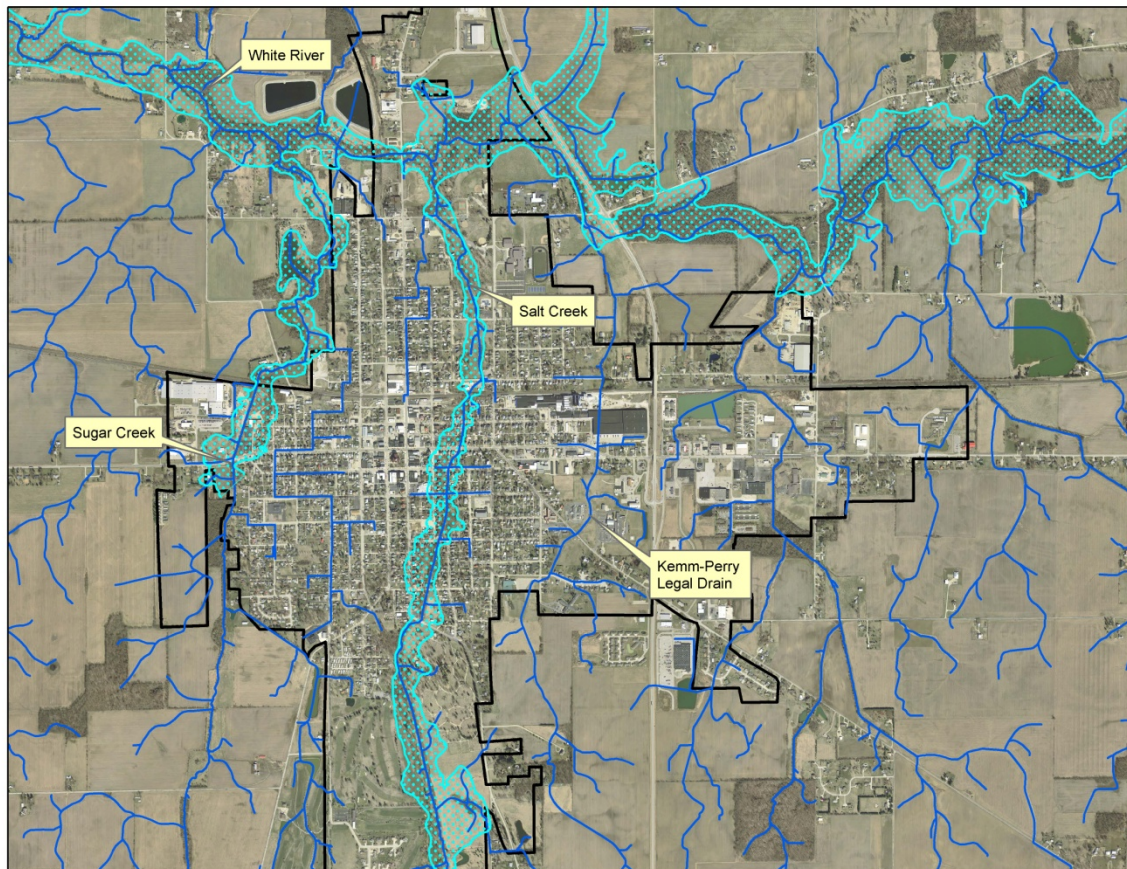
Local Champions:

- Mayor - Steven Croyle
- Plan Commission Director - Bill Richmond
- EMA, Randolph County - Chris Shaneyfelt
- County Surveyor - Ed Thornburg
- City Engineer - HWC Engineering - Brian Pohlar

Identified Issues

A meeting was held on August 29, 2014 at the City of Winchester Mayor's office to discuss the action discovery project and areas within the community that are of concern. The meeting was attended by Steven Croyle (Mayor), Brian Pohlar (City Engineer, HWC Engineering), David Knipe (DNR), Dustin Thurston (DNR), Matt Riggs (The Polis Center), and Lacey Duncan (The Polis Center). The following issues were identified during this meeting:

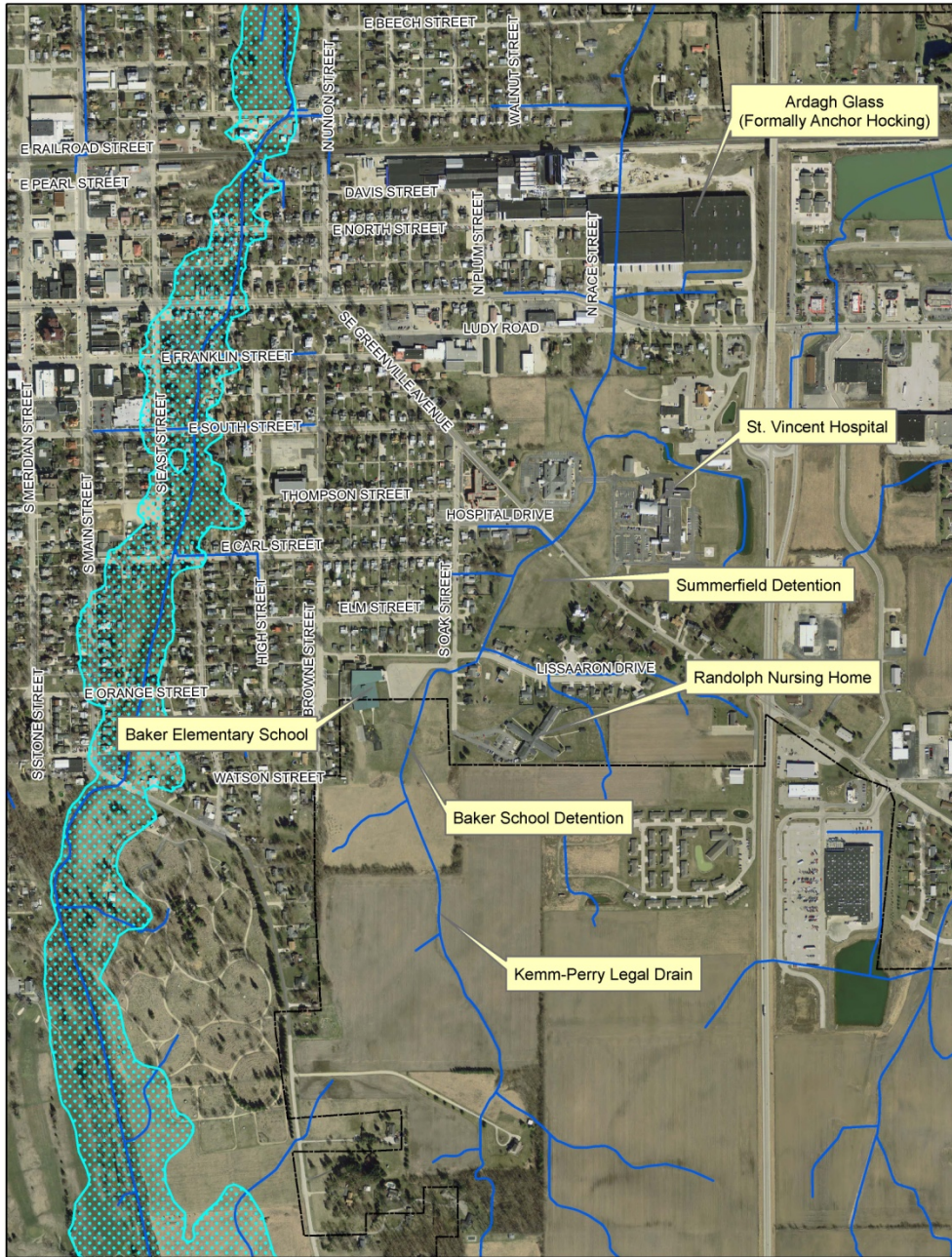
Figure 26. Winchester Overview



Kemm-Perry Legal Drain and Baker School

Much of the flooding in Winchester comes from the Kemm-Perry Legal Drain that runs from south to north in the eastern half of Winchester. The legal drain takes on drainage from several acres of farm field to the south and continues north between Baker Elementary School and the Randolph Nursing Home. Kemm-Perry continues north through culverts beneath Lissaaron Drive and S Greenville Avenue through the St. Vincent Hospital property (west of the hospital building). Kemm-Perry eventually crosses under State Road 32 and travels beneath Ardagh Glass resurfacing beneath the railroad south of Short Street.

Figure 27. Kemm-Perry Legal Drain and Baker School



During severe rain events the Baker Elementary School property experienced flooding and on occasion, the flooding overtopped roads in the vicinity. The following images were taken in January 23, 2008 by Chris Martin, City of Winchester Wastewater Superintendent.

Figure 28. 2008 Flooding a Baker Elementary School



Figure 29. Overtopped Road in Vicinity of Baker Elementary School



Figure 30. Flooding near Baker Elementary School



Baker Elementary School drainage improvements involved installing a 30 inch drainage pipe from the drainage basin at Baker Elementary School into the Summerfield Detention basin. The work for this project was completed in March of 2009. The pipe runs from the north side of Baker Elementary School detention basin beneath East Oak Street and Lissaaron Drive to the south end of Summerfield Detention basin.

In addition, an engineering plan was created and implemented to enlarge Summerfield Detention basin to ensure that the basin can handle the increased volume of water from Baker Elementary School Detention basin. The work was started after the installation of the drainage pipe and completed in 2009.

Preliminary investigations have begun regarding the drainage beneath the Ardagh Glass (formally Anchor Hocking) plant on the north side of the Kemm-Perry Legal Drain and the Summerfield Detention Basin. Initial efforts have identified an existing 42 inch tile on the south side or upstream side and a 70 inch tile on the north side or downstream side of the plant.

Figure 31. Ardagh Glass



Figure 32. Ardagh Glass Inlet



Spring Village

The Spring Village subdivision is located in southeast Winchester. This subdivision receives drainage from an Unnamed Tributary to Peach Creek located in the farm field to the south. The drainage enters the subdivision through a culvert beneath Cedar Road. In heavy rain events, corn stalks will block the entrance to the culverts causing flooding in the field, subdivisions and across the road. Flooding events have decreased in frequency since the development of Walmart's detention pond.

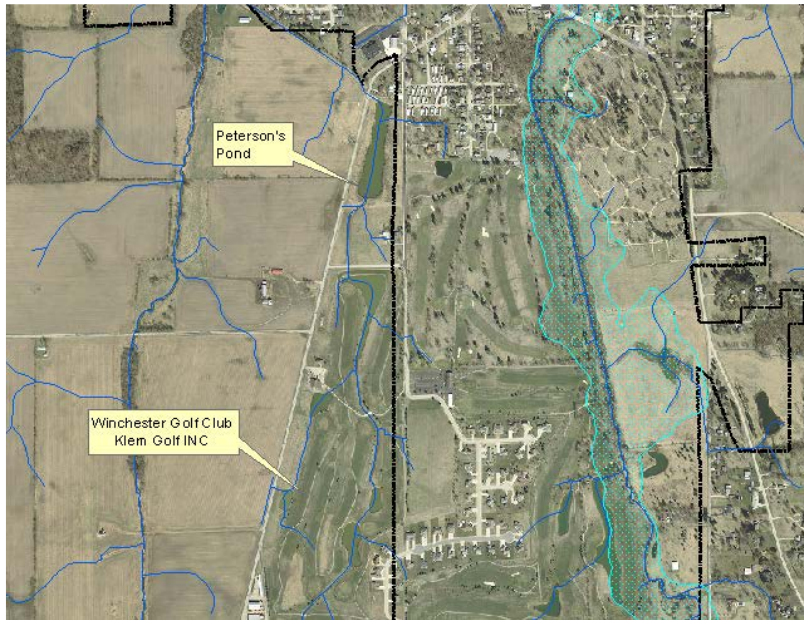
Figure 33. Spring Village



Peterson Pond and Golf Course Retention

There have been some modifications made to the drainage in the Winchester Golf Club (owned by Klem Golf, INC) and the Peterson Properties to the north that may have impacted flooding in the city limits downstream from these properties. Historically this area has experienced flooding from Sugar Creek, and it is unknown if the drainage modifications have had a positive or negative impact on Winchester.

Figure 34. Peterson Pond and Golf Course Retention



Salt Creek Retaining Walls

There are several retaining walls (locally referred to as seawalls) built on land along Salt Creek on both privately and publically owned land. The City has been contacted by land owners, whose seawalls have fallen in disrepair, asking the City to rebuild them. There was some discussion of liability and whether these have any impact on base flood elevations or if these seawalls were considered when the mapping was done.

Figure 35. Salt Creek Retaining Walls



Planned Scope of Work

The Division of Water, with a Community Development Block Grant through the US Department of Housing and Development (administered through the Indiana Office of Community and Rural Affairs), has planned to do a complete Hydrologic and Hydraulics Study through the City of Winchester for the three main waterways in town (Salt Creek, Sugar Creek and Kemm-Perry Drain). This task will include the following activities:

- Survey of all structures along each stream (including reconnaissance of the culvert under Ardagh Glass.
- Hydrologic modeling for all three streams, using HEC-HMS, including any ponds or retention structures in place for analysis, and a model without structures for regulatory purposes.
- Hydraulic modeling of all three streams, using HEC-RAS (including depth-grid mapping).

For the Risk MAP portion of this project, the following tasks will be completed:

- An evaluation of the culvert under Ardagh Glass with recommendations for any mitigation measures that may be needed.
- An evaluation of the retaining walls along Salt Creek with recommendations for any mitigation measures.
- An overall evaluation of the flooding threats within the City of Winchester with recommendations for any mitigation measures.
- An evaluation of the Hydrologic and Hydraulic studies with a recommendation on the updating of the Flood Insurance Rate Maps based on the study (and possibly any mitigation measures).

Deliverables

- A report detailing the hydrologic and hydraulic studies, including depth grids and Changes Since Last FIRM mapping.
- A report detailing the results of the evaluations of the Ardagh Glass culvert, the Salt Creek seawalls, and any other identified at-risk areas.

Action Potentials

The City of Winchester is very interested in continuing to invest efforts to mitigate potential flood impacts along Kemm-Perry Legal Drain, but do not want to move blindly forward. The information received from the efforts expended by DNR will allow the city to focus their attention on real solutions that may include the following:

- Additional drainage improvements from Summerfield Detention pond to the Culvert beneath Ardagh Glass
- Improvements to the culvert located beneath Ardagh Glass
- Potential expansion of the Summerfield and Baker Elementary School Detention Basin

In addition, recommendations regarding the retaining walls along Salt Creek will allow the city to properly address the condition of these features to best mitigate flooding impacts along the creek.

City of Tipton

Location

The City of Tipton is the county seat of Tipton County, Indiana.

Population

The population is 5,106 according to the 2010 Census.

Map Status

The Flood Insurance Rate Maps for Tipton County have been modernized. The current effective map date is June 9, 2014.

Floodplain Status

The City of Tipton participates in the NFIP, and there are 72 Flood Insurance policies in place. There are approximately 200 parcels with improvements that are impacted by the SFHA. There have been 57 claims since 1978. The community flood ordinance date is May 27, 2014.

MHMP Status

The current Tipton County Multi-Hazard Mitigation Plan has been in place since 2011 and will expire on May 11, 2016.

Risk MAP projects

Tipton County was included in the Upper White River Discovery project dated September 30, 2012 and the City of Tipton was included in the Risk Map Demonstration project in February 2011 and Flood Risk Report for the Upper White River Watershed in February 2011.

Principal Flooding Threat

The principal flooding threat in the City of Tipton is from Big Cicero Creek and Buck Creek. The confluence of these is located in the City of Tipton.

Past Mitigation Successes

When the preliminary maps were released to the community, the Tipton Community School Board made the decision to be proactive and purchase flood insurance for the schools impacted by the updated flood zones. This proved beneficial on April 19, 2013 when flood waters entered the high school auditorium, the orchestra pit, and the boiler room. Flooding also caused minor damage to the school's tennis courts and submerged 37 cars in its parking lot.

The City of Tipton was awarded a \$900,000 grant from IDHS, and that, along with a \$225,000 match by the city, will be used for buyouts of properties that experience repetitive losses from flooding. The appraisals are currently in progress, and the report is pending. It is anticipated that approximately 14 structures will be bought, leaving 30 or more homes that remain eligible if additional funding is secured.

Community Overview

The City of Tipton is the county seat and the largest city located within Tipton County. The city sits at the confluence of Big Cicero Creek and Buck Creek. Tipton County is located on the Tipton Till Plain and the topography is typically flat to gently rolling. The predominant land use is agricultural. Many of the

streams within the county have been straightened, and many of the fields have been tilled, increasing the speed and efficiency of water draining to Buck Creek and Big Cicero Creek. It is believed that this channelization of the streams and addition of field tiles has increased the rate and height of flooding in Tipton.

The table below outlines the numerous declared disasters including emergency declarations for Tipton County. This data ranges from 1998 to present since a listing of the affected county before 1998 was not available.

Table 4. Disasters in Tipton County

| Disaster Declaration | Disaster Type | Incident Period | Type of Assistance |
|-----------------------------|--|------------------------|---------------------------------------|
| DR-4173 | Indiana Severe Winter Storm and Snowstorm | January 2014 | Public Assistance |
| EM-3274 | Indiana Snow | February 2007 | Emergency Declaration |
| EM-3238 | Indiana Hurricane Katrina Evacuation | September 2005 | Emergency Declaration |
| DR-1573 | Indiana Severe Winter Storms and Flooding | January 2005 | Both Individual and Public Assistance |
| DR-1520 | Indiana Severe Storms, Tornadoes, and Flooding | June 2004 | Individual Assistance |
| DR-1476 | Indiana Severe Storms, Tornadoes, and Flooding | July 2003 | Both Individual and Public Assistance |
| DR-1433 | Indiana Severe Storms and Tornadoes | September 2002 | Individual Assistance |
| EM-3135 | Indiana Winter Storm | January 1999 | Emergency Declaration |

Local Champions:

- Mayor - Don Havens
- City Engineer – Wyatt Henderson
- County Surveyor - Jason Henderson

Identified Issues

A meeting was held on September 4, 2014 at the City of Tipton Mayor’s office to discuss the action discovery project and areas within the community that are of concern. The meeting was attended by Don Havens (Mayor), Kevin Tolloty (Floodplain Manager), Angela Shelton (Mayor’s Assistant), Wyatt Henderson (City Engineer), Joe VanBibber (commissioner), Peggy Shepherd (Christopher B. Burke Engineering, Ltd.), Kirstin Kuenzi (FEMA), David Knipe (DNR), Steve Bradley (DNR), Matt Riggs (The

Polis Center), and Lacey Duncan (The Polis Center). The following issues were identified during this meeting:

Big Cicero Creek Flooding

In 2005, the Big Cicero Creek Joint Drainage Board commissioned Christopher B. Burke Engineering, Ltd (CBBEL) to evaluate and recommend flood protection measures to mitigate flooding along Big Cicero Creek from County Road 500 west downstream through the City of Tipton. The results of this study were presented in a report titled “Big Cicero Creek Flood Control Study” in November 2006. There were many recommendations presented in this report including a recommendation to extend the study downstream through Hamilton County to better define the risk and impact of upstream flood control projects; a channel improvement project along a reach of the Big Cicero to reduce the duration and extent of flooding; and amendments to existing floodplain and stormwater ordinances and to update onsite detention requirements.

As a result, the Drainage Board extended the study of the Big Cicero downstream to Morse Reservoir in Hamilton County, included performing hydraulic modeling and mapping efforts. In addition, stormwater management ordinances were updated, and technical stormwater standards were developed. Funding for a USGS stream gage at Tipton was initiated and continues, and designs were prepared for channel improvement project. The recommended channel improvement project was dropped due to funding issues.

In April 2013, a major storm hit Indiana, and an average of 4.5 inches of rain fell across the Big Cicero Creek watershed. This triggered major flooding and bank erosion along the creek in Tipton and surrounding agricultural fields. (Additional details of the impact of this storm are discussed later in this report.) In response, the Mayor of Tipton requested that the Drainage Board evaluate the cost and impact of a plan that was initially proposed in the 2006 study to bypass high flows around Tipton. The analysis of the bypass was completed and presented to the Board in 2013. It was determined that this could provide flood relief in Tipton but would cost approximately \$30 million to implement (plus the cost of mitigating resulting negative impacts created downstream).

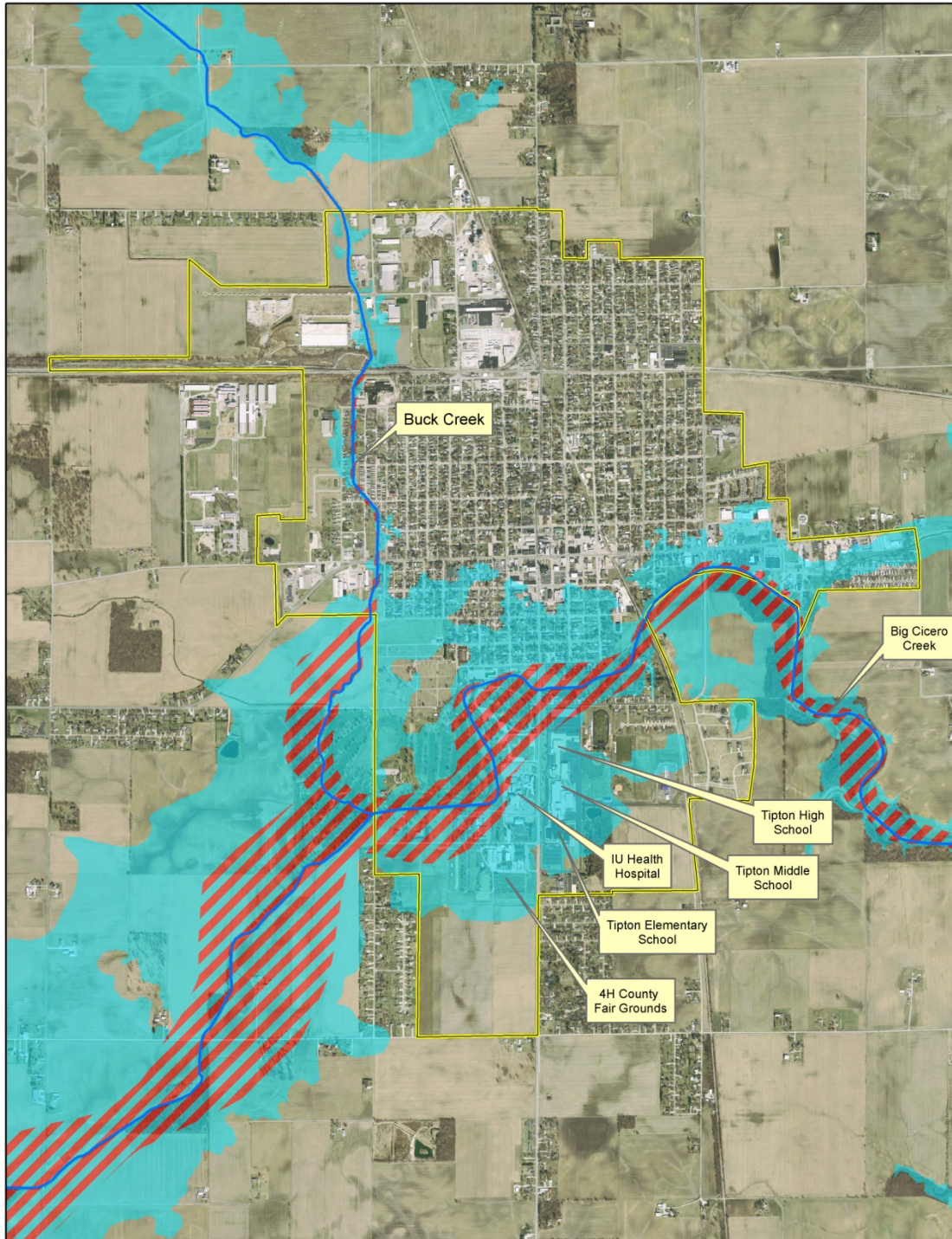
The high cost of this large scale project and the negative downstream impacts redirected the Board to engage CBBEL to investigate smaller scale practices that could at least reduce the risk of increased flooding and erosion. This effort is currently underway and is expected to be complete before the end of 2014. Some of the goals of this investigation are to address these risks in a way that:

- Reduce flood threats to critical facilities and major transportation system components
- Enhance and maintain economic viability of the City and agriculture
- Increase the community sustainability and resiliency to flood-related risks
- Guide the Board in future required expenditures, management of and reduction of the Big Cicero Joint Drainage Board expenses associated with sedimentation/dredging and streambank erosion problems
- Reduce long-term sedimentation in Morse Reservoir

The new effective flood maps for Tipton County included updated hydrologic and hydraulic analysis for Big Cicero Creek based on a 2006 Big Cicero Creek flood control study prepared by CBBEL for the Big Cicero Creek Drainage Board. The new study has expanded the mapped flood boundary so it now impacts

several significant structures in Tipton including Tipton schools, IU Tipton Hospital, Millers Merry Manor Nursing Home, and the Tipton 4H County Fairgrounds buildings. Initially the City of Tipton appealed the new flood maps and worked with Indiana Department of Natural Resources to evaluate the validity of the new mapping. It was also noted that the sewage treatment plant is impacted by flooding.

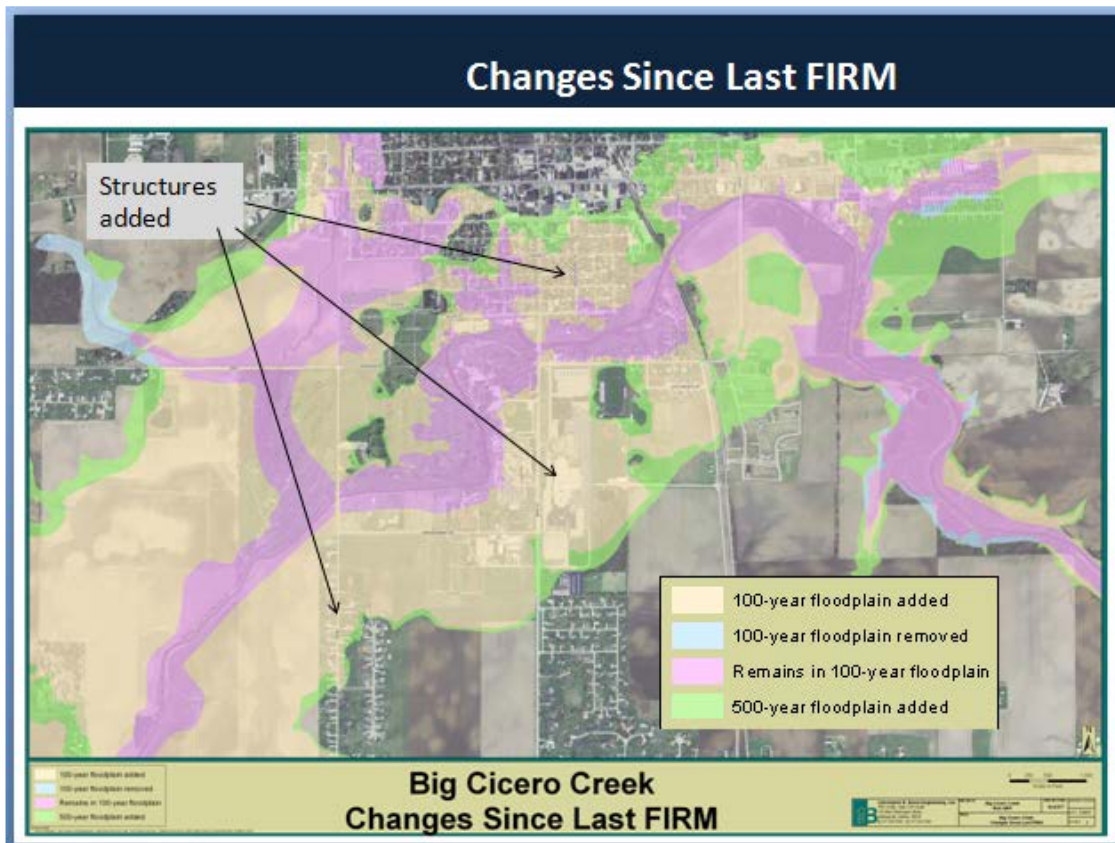
Figure 36. Overview of Mapped Floodplains in Tipton



According to the 2006 study, the Big Cicero Creek watershed area is approximately 80 square miles at the confluence of Buck Creek in the City of Tipton. Flooding along Big Cicero often lasts for days at a time in agricultural areas, and back water from Big Cicero Creek affects residents along Buck Creek in the west side of town. Streets and roads in Tipton and the county are also impacted by flooding along Big Cicero Creek.

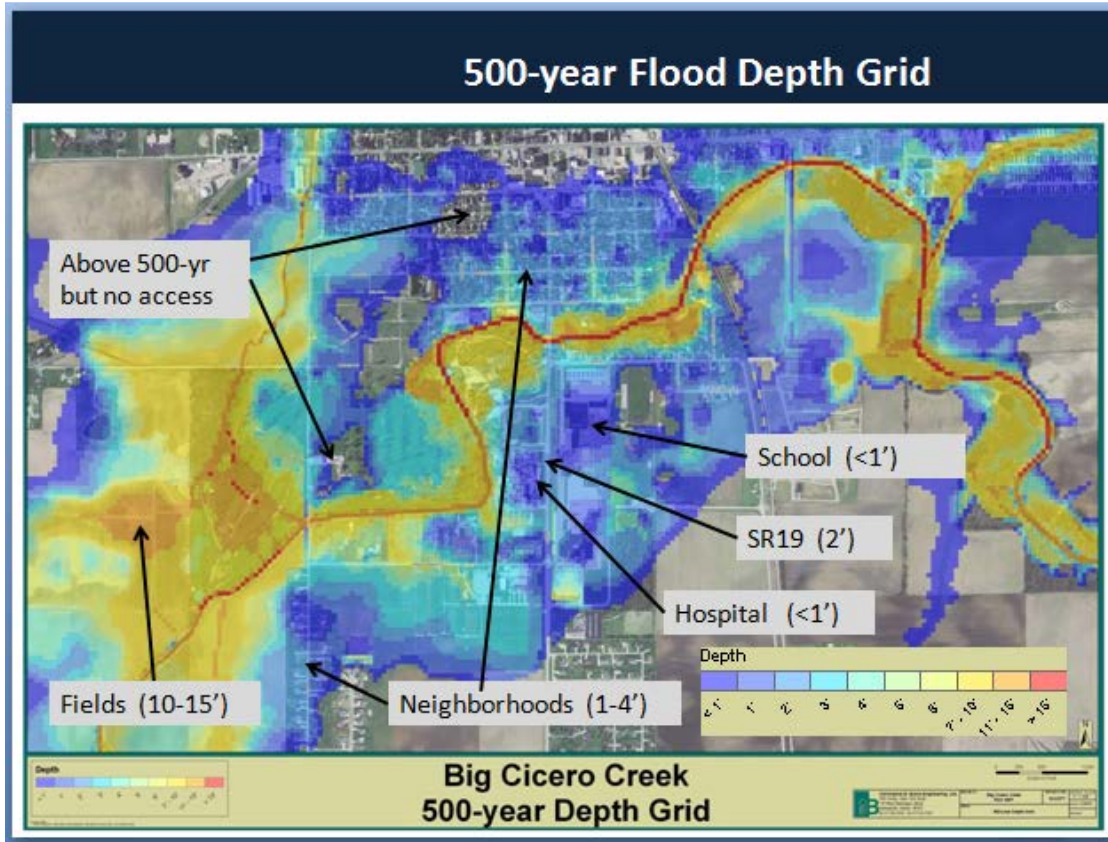
In 2011, IDNR, CBBEL, and The Polis Center participated in a Discovery demonstration project that included a portion of Big Cicero Creek in the vicinity of the City of Tipton. This demonstration project included the preparation of several FEMA non-regulatory Risk MAP products. These products were designed to help convey the extent and level of risk to impacted communities. One such project is a map showing the changes to the flood mapping since the last effective FIRM. The 1-percent flood boundary for the City of Tipton has expanded extensively and is shown in the figure below.

Figure 37. Changes Since Last FIRM



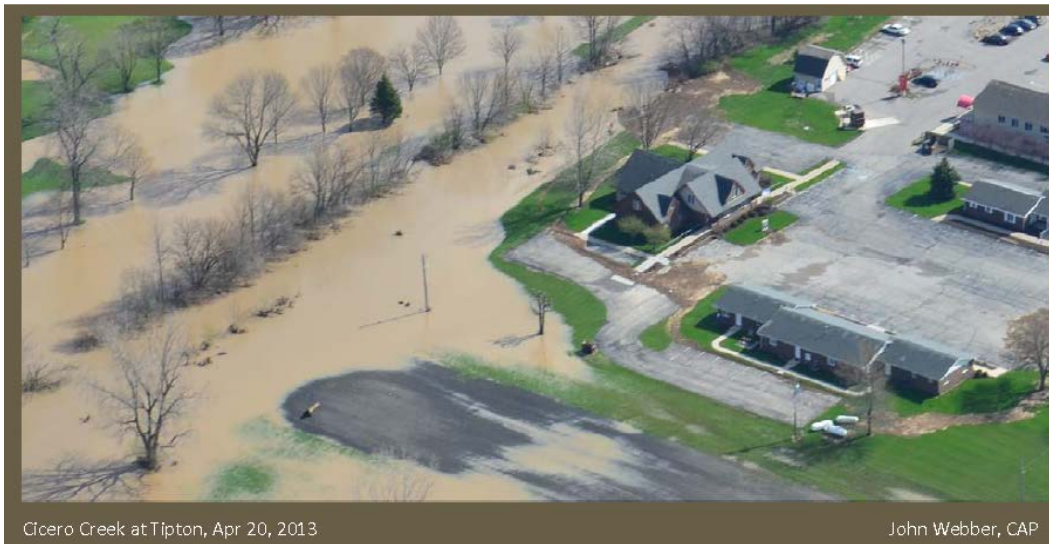
A series of depth grids were produced for the Big Cicero Creek as part of the demonstration project. The 0.2% depth grid shown below implies that during the 0.2% flood event, water elevations of just less than 1 foot could be reached in the vicinity of the Tipton schools and the hospital. The flooding along SR19, the access route to the schools and hospital could reach levels between 1 and 2 feet. Flood waters blocking major roadways are a significant concern that is well illustrated in the following image.

Figure 38. 500-year Flood Depth Grid



On April 19, 2013, following an average of 4.5” of rain in the watershed, Big Cicero Creek reached a record flood stage of 17.09 feet. This flood event impacted more than 250 homes in Tipton County, with more than 50 homes suffering major damage and 100 homes suffering minor damage. In an interview, Tipton Mayor Don Havens estimated that more than \$2.5 million in property damage was caused by the flooding and could result in a loss of as much as 10 percent of the City’s property tax base. Following are two images showing the extent of the flooding in Tipton on April 20, 2013. These photos were taken by John Webber, Civil Air Patrol.

Figure 39. April 2013 Flooding at Nursing Home



Cicero Creek at Tipton, Apr 20, 2013

John Webber, CAP

Figure 40. April 2013 Flooding at Hospital and School

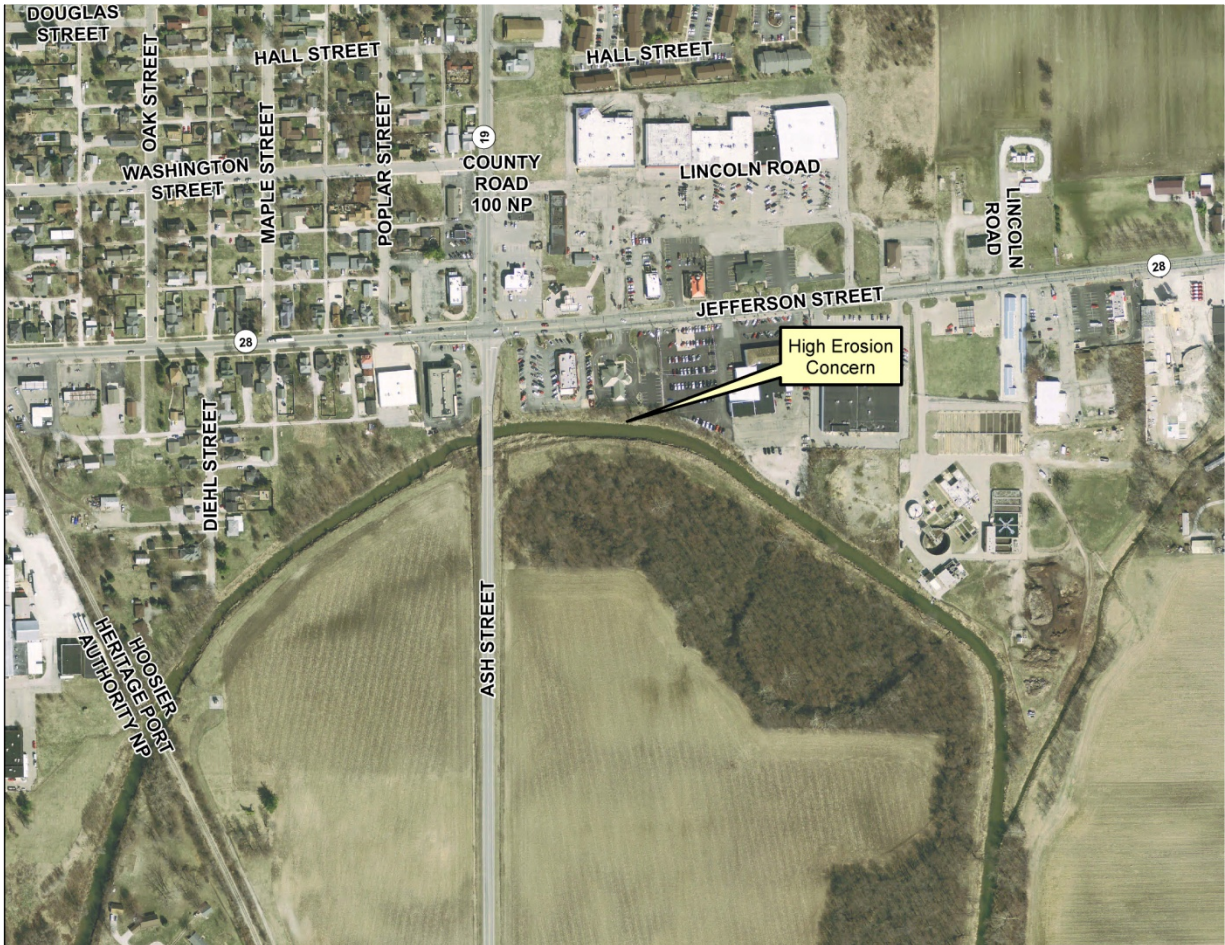


This flood event confirmed the updated flood maps for Big Cicero Creek and Buck Creek. The Tipton County Surveyor, Jason Henderson, stated that the Big Cicero Creek flood maps were accurate based on the April 19th flooding and that there may be some minor modifications made to the Buck Creek flood boundaries. He went on to say that the flooding data will help determine which areas need to be prioritized for mitigation. During the Action Discovery meeting, Mayor Havens stated that the community has resolved that the updated flood maps are correct. The next action is to work to mitigate the potential for flood damage.

Commercial District Stream Bank

During our discussion at the Action Discovery meeting with Tipton, an area along Big Cicero Creek was identified for having problems with bank and stream bed erosion. This area is along the commercial properties on the south side of Jefferson Street east of Ash Street, and is shown on the map below.

Figure 41. Commercial District Stream Bank



According to Wyatt Henderson, City Engineer, when the channel was dredged at the site, the banks were 10 feet in height and have been altered significantly from erosion. The community has started to discuss mitigation measures to alleviate the erosion hazard.

Planned Scope of Work

The project scope of work will include a holistic approach to solving some of the issues relating to flooding in the City of Tipton. It is believed that land management in the Big Cicero and Buck Creek watersheds have increased the occurrence interval and elevation of the flooding in Tipton. The Mayor states that the ongoing tiling of the fields, modification of the stream channels and clear cutting need to be addressed as part of the mitigation efforts for Tipton.

The following scope of work has been proposed:

- Collect and consolidate available data including flood vulnerability, detailed mapping, building elevations, and current buyout plans.
- Develop flood depth grids for various frequencies using the most recent modeling for Big Cicero Creek.
- Develop conceptual plans and cost estimates for the individual building flood reduction measures at the three major critical facilities (hospital, school and waste water treatment plant).
- Develop a series of comprehensive river corridor maps that would incorporate and leverage Indiana's SFHA map layer, existing Fluvial Erosion Hazard Mapping layer and setback layer along each riverine flooding source. These maps will highlight areas where development should be discouraged and areas that are developed and vulnerable to flooding and should be mitigated and safer areas where development should be planned.

Deliverables

- Series of flood depth grids for the City of Tipton.
- Conceptual layout and cost estimates for flood protection measures for the hospital, school and waste water treatment plant.
- River corridor maps as described above for mitigation and planning purposes.
- Report documenting the efforts undertaken.

Action Potentials

The City of Tipton is actively working to mitigate flooding issues within its community. They are working with the Big Cicero Drainage Board and other entities to better understand the cause and recommended actions. Some of the potential actions that will be moved forward from this effort include:

- Moving forward with flood protection efforts around the impacted essential facilities
- Zoning regulations related to new construction within the identified fluvial erosion hazard zones
- Additional flood hazard mitigation measures that may include construction of detention basins or by pass channels
- Implementation of better land management practices on a countywide basis which would help to mitigate the flooding in Tipton

City of Washington

Location

The City of Washington is the county seat of Daviess County, Indiana.

Population

The population is 11,509 according to the 2010 Census.

Map Status

The Flood Insurance Rate Maps for Daviess County have not been modernized. The current effective date for the county is January 3, 1986. Currently, there are no Special Flood Hazard Areas identified within the community. The modernized preliminary Digital Flood Insurance Rate Maps were published September 30, 2010. These maps will be adopted in 2015.

Floodplain Status

Washington participates in the NFIP, and there are 3 flood insurance policies in place. There have been no claims since 1978. The community floodplain ordinance is dated April 16, 1979.

Currently, there is no identified Special Flood Hazard Area defined within the community. Based on aerial mapping from 2011, there appear to be a total of 230 total structures located inside the preliminary Special Flood Hazard Area identified within the community.

There have been two LOMAs to areas outside of the community. There have been no identified LOMC's in the community.

MHMP Status

The current Daviess County Multi-Hazard Mitigation Plan has been in place since 2012 and will expire on January 19, 2017.

Risk MAP projects

The City of Washington was included in the Lower White River Watershed Discovery project dated January 31, 2012. The community was included in the Resilience Report for Daviess County in April 2013.

Principal Flooding Threat

The preliminary maps for the county identified approximate flood zones (based on modeling) along Hawkins Creek in the City of Washington.

Past Mitigation Successes

There is no record of FEMA funding that has gone towards implementing a mitigation project in Washington; however, there have been locally implemented projects. In the early 1990s, the City completed two detention basins to aid in reducing flood flows to Hawkins Creek. In 2009, the City completed a constructed wetland to assist in the prevention of combined sewer overflows and improving water quality; this was only the second record of this type of project at the time of completion.

Community Overview

The preliminary FIRM maps identify an approximate flood zone along Hawkins Creek within the limits of the City of Washington.

Prompted by multiple floods in the early 1990s, the City designed two detention basins and enclosed portions of Hawkins Creek to alleviate flooding. Before the detention basins were developed, as little as one-tenth of an inch of rain produced a sewer overflow in the City.

The detention basins solved many of the surface flooding issues, but there were still state water quality standards that were not being met. The City constructed a state-of-the-art Combined Sewer Overflow Treatment Project in 2011. The innovative component is the use of a constructed wetland for the treatment of combined sewer wet weather overflows. The city has a median household income of \$34,000. This is one of the reasons alternatives to a complete sewer separation were thoroughly researched.

The table below outlines the numerous declared disasters including emergency declarations for Daviess County. This data ranges from 1998 to present since a listing of the affected county before 1998 was not available.

Table 5. Disasters in Daviess County

| Disaster Declaration | Disaster Type | Incident Period | Type of Assistance |
|----------------------|---|-----------------|---------------------------------------|
| DR-1997 | Indiana Severe Storms, Tornadoes, Straight-Line Winds, and Flooding | June 2011 | Public Assistance |
| DR-1832 | Indiana Severe Storms, Tornadoes, and Flooding | March 2009 | Individual Assistance |
| DR-1795 | Indiana Severe Storms and Flooding | October 2008 | Public Assistance |
| DR-1766 | Indiana Severe Storms and Flooding | June 2008 | Both Individual and Public Assistance |
| EM-3238 | Indiana Hurricane Katrina Evacuation | September 2005 | Emergency Declaration |
| DR-1573 | Indiana Severe Winter Storms and Flooding | January 2005 | Both Individual and Public Assistance |
| EM-3197 | Indiana Snow | December 2004 | Emergency Declaration |
| DR-1542 | Indiana Tornadoes, and Flooding | July 2004 | Public Assistance |
| DR-1433 | Indiana Severe Storms and Tornadoes | September 2002 | Individual Assistance |

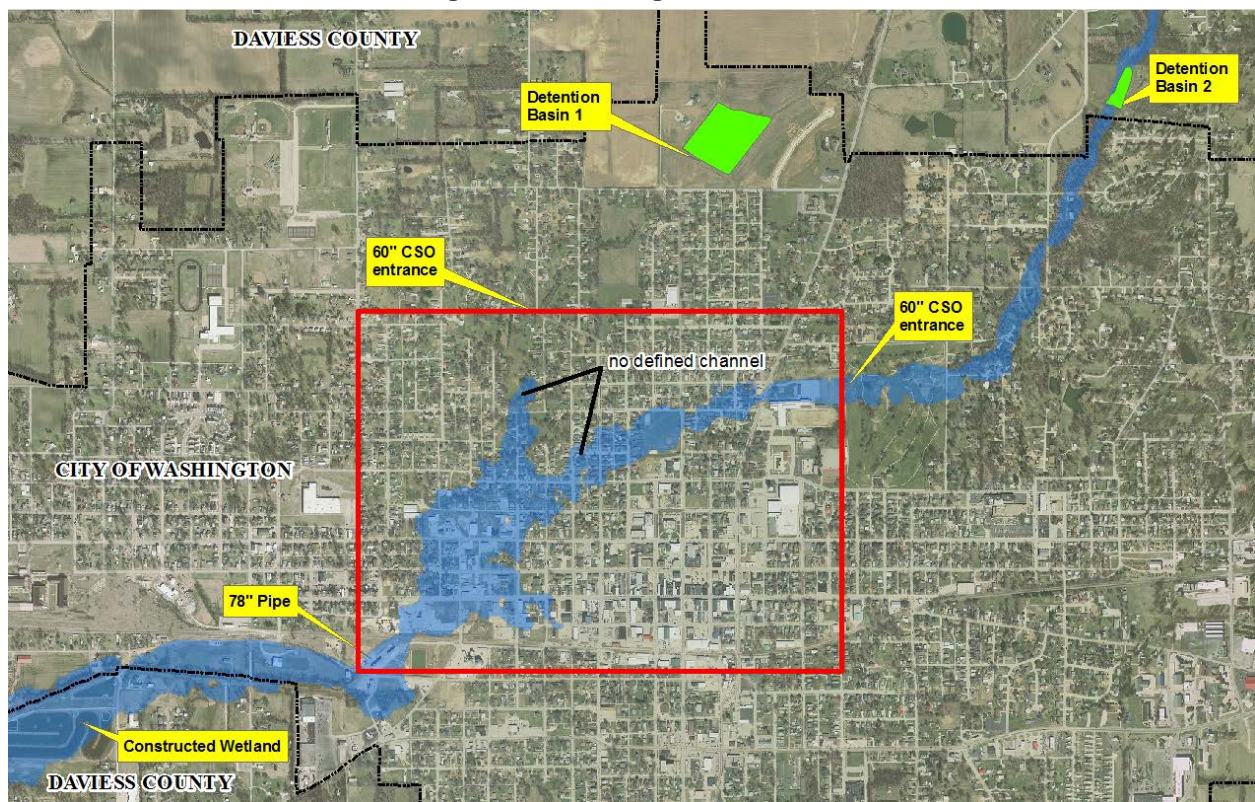
Local Champions:

- Mayor – Joe Wellman
- Plan Commission Director – Terry Winger
- City Engineer – Ed Barnett
- Stormwater Superintendent – Scott Rainey
- EMA Director – Paul Goss
- County Surveyor – Dennis Helms
- Midwestern Engineers, Inc.– David Dahl

Identified Issues

A meeting was held on September 22, 2014 at the City of Washington Mayor’s office to discuss the Action Discovery project and areas within the community that are of concern. The meeting was attended by Joe Wellman (Mayor), Ed Barnett (City Engineer), Scott Rainey (Wastewater/Stormwater Superintendent), David Dahl (Midwestern Engineers, Inc.), David Knipe (DNR), Matt Riggs (The Polis Center), and Lacey Duncan (The Polis Center). The following issues were identified during this meeting:

Figure 42. Washington Overview



Detention Basins

The original design for the detention basins was completed in 1993. Detention basin 1 is owned by the City and located inside the corporate limits. Detention basin 2 is owned by Jack and Carolyn Sue Colbert and is located just outside of the City limits. At the time of the meeting it was believed that there was an

agreement in place between Mr. Colbert and the City. After the meeting it was discovered that parcel information for the county appears to have two owners on this parcel of land: the City and Mr. Colbert.

In order to develop the constructed wetland the detention basins required some improvements, which were completed in 2006 and 2008.

Figure 43. Detention Basin 2 Parcel Layout

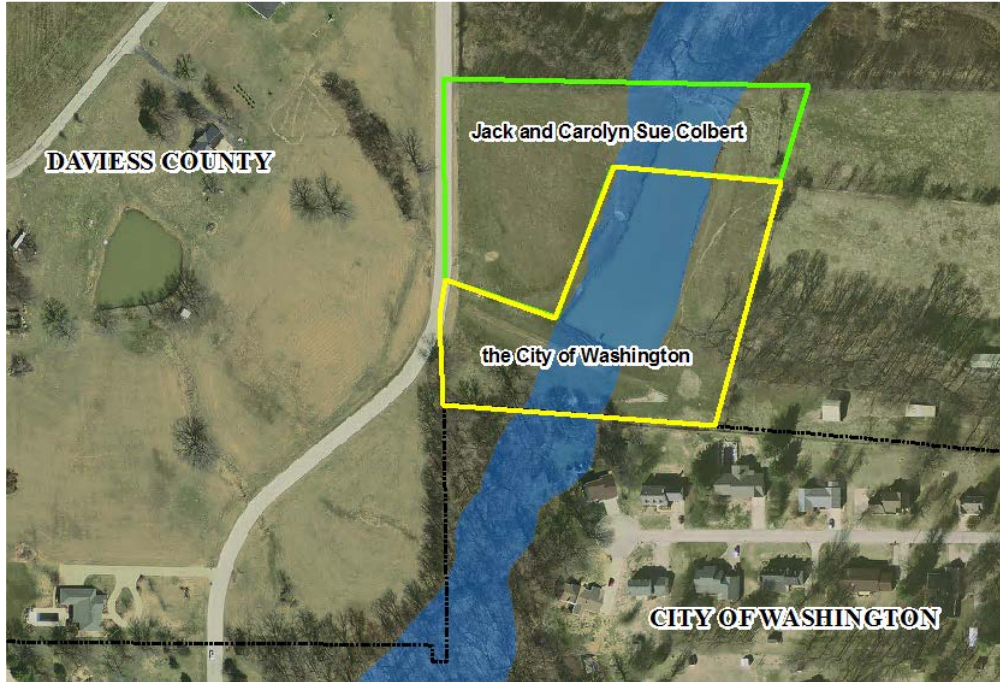


Figure 44. Detention Basin 1



Figure 45. Detention Basin 2



Underground Creeks

An initiative to combat flooding in the City in the early 1990s prompted the burial of portions of Hawkins Creek and an adjacent tributary to Hawkins Creek. The main channel enters the below ground sewers at the golf course and have recently been improved. The tributary to Hawkins Creek enters the below

ground sewer at Apraw Road. The main 78" outlet for these sewers is just downstream of the Railroad crossing near Cosby Road.

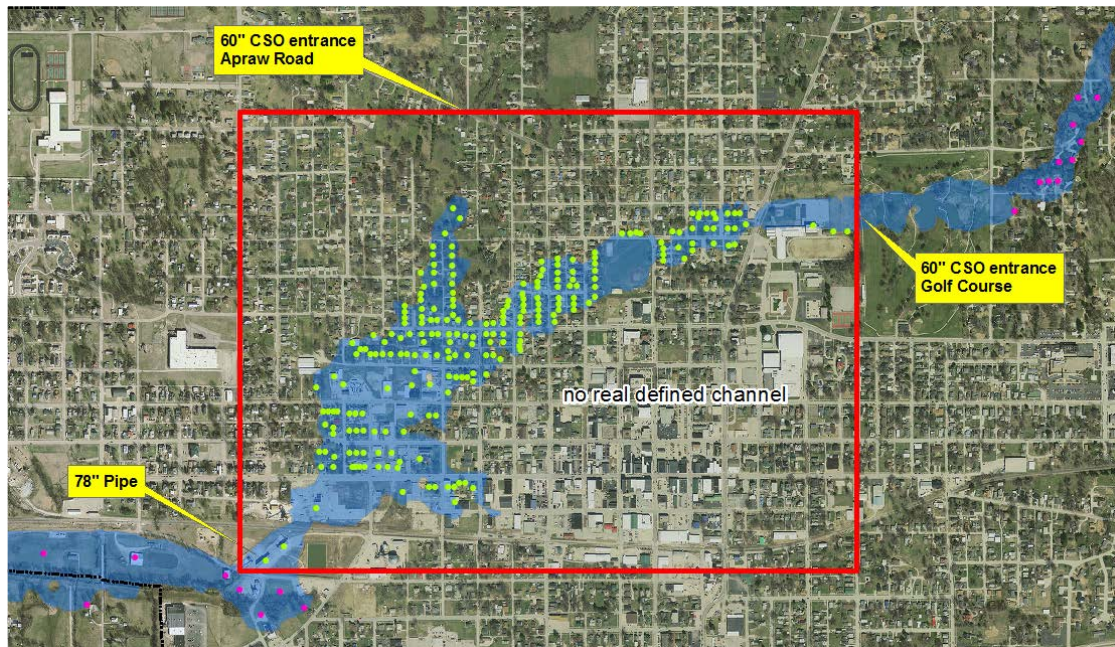
As shown in the following figure from a presentation on the wetland project, the underground piping that outlet into the creek near the railroad is very intricate. An effort to understand how the control structure functions at this location will be required to understand the hydrology upstream.

Figure 46. Underground Pipes



Currently there are approximately 230 structures that are at a high-risk of flooding in the areas where the creek has been buried.

Figure 47. Structures Location in Floodplain



Planned Scope of Work

- Evaluate the function of the entire system including detention basins, underground piping, and control structure, and determine their effects on the hydrology of the creek.
- Ensure there is the proper documentation in place to certify the detention basins as flood control.

Deliverables

- Reports detailing the findings of the hydrology analysis.
- Develop an agreement between the City and the private landowner if one is not in place.

Action Potentials

The City of Washington is very proactive and has made significant mitigation efforts to reduce potential flooding including the establishment of two detention basins and the creation of a wetland as previously described. Some additional efforts that may result from this effort include:

- Improvements to the CSO structures that will mitigate future flooding
- Establishment of additional detention if appropriate and shown to mitigate future flooding
- It was later determined that the City will be taking over the permitting for the County. Additionally, with the newly identified floodway training will be developed for the local permit officials.

Brown County Dams

Location

The Town of Nashville is the nearest city to the dams. Nashville is the county seat of Brown County, Indiana.

Population

The population of the county is 15,242 according to the 2010 Census.

Map Status

The Flood Insurance Rate Maps for Brown County have not been modernized. The current effective date is January 3, 1986. The modernized preliminary Digital Flood Insurance Rate Maps will be published October 30, 2014. These maps will be adopted sometime in 2017.

Floodplain Status

The County participates in the NFIP, and there are 164 flood insurance policies in place. There have been 128 claims since 1978. The community floodplain ordinance is dated December 2, 2002.

MHMP Status

The Brown County Multi-Hazard Mitigation Plan has been in place since 2006 and expired June 12, 2011. There is currently a revision to this report in progress.

Risk MAP Projects

Brown County was included in the Lower White River Watershed Discovery project dated January 31, 2012.

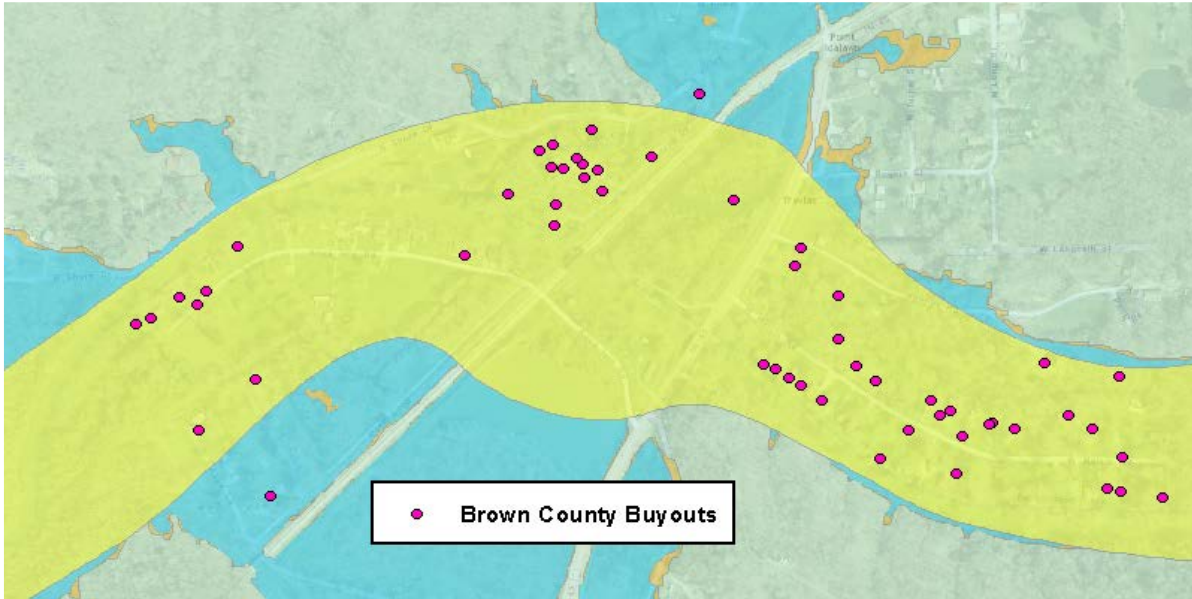
Principal Flooding Threat

The principal threats of flooding in the county are dam breaches along tributaries to Beanblossom Creek.

Past Mitigation Successes

Nearly 100 homes were bought-out in 2008 near the mouth of Beanblossom Creek just upstream of Lake Lemon after severe flooding in June 2008. This is the only record of FEMA funded mitigation projects.

Figure 48. Buyouts Upstream of Lake Lemon along Beanblossom Creek



Community Overview

The total land area of Brown County is 312 square miles. The county is home to portions of Yellowwood State Forest, Brown County State Park, and the Hoosier National Forest. More than 100 square miles in the county is managed by state, federal, or local entities. Its county seat is Nashville, located approximately 60 miles south of Indianapolis. Brown County is served by State Routes 45, 46, and 135.

Brown County encompasses nearly 16,000 acres of rugged hills, ridges and fog-shrouded ravines. Glaciers from the most recent ice ages stopped short of the “hills o’ Brown,” but their meltwaters helped create the narrow ridges, steep slopes and deep gullies of Brown County State Park. Brown County has 94 dams, which is 10% of the state’s dams. Twenty of those dams are located within the Lower White River Watershed.

The following table outlines the numerous declared disasters including emergency declarations for Brown County. This data ranges from 1998 to present since a listing of the affected county before 1998 was not available.

Table 6. Disasters in Brown County

| Disaster Declaration | Disaster Type | Incident Period | Type of Assistance |
|-----------------------------|--|------------------------|---------------------------------------|
| DR-1766 | Indiana Severe Storms and Flooding | June 2008 | Both Individual and Public Assistance |
| EM-3238 | Indiana Hurricane Katrina Evacuation | September 2005 | Emergency Declaration |
| DR-1573 | Indiana Severe Winter Storms and Flooding | January 2005 | Individual Assistance |
| EM-3197 | Indiana Snow | December 2004 | Emergency Declaration |
| DR-1520 | Indiana Severe Storms, Tornadoes, and Flooding | June 2004 | Individual Assistance |
| DR-1433 | Indiana Severe Storms and Tornadoes | September 2002 | Individual Assistance |
| DR-1418 | Indiana Severe Storms, Tornadoes and Flooding | June 2002 | Public Assistance |

Local Champions:

- Plan Commission Director – Dave Woods
- EMA Director – Sara Vasquez
- Ken Smith – DNR, Division of Water, Assistant Director
- George Crosby – DNR, Division of Water, Head of Dams and Levee Safety

Identified Issues

When completing the revised hydraulics and hydrology for the Beanblossom Creek during Map Modernization, it became apparent that some changes to the hydrology in the watershed had occurred. The best estimate for this change would be that there may have been dams that failed during the June 2008 flooding. This is another reason that it is important to reevaluate these structures.

An assessment of which dams need further analysis was completed, determining that a total of 10 dams require further assessment. Four of the identified dams have a high-hazard ranking. A high-hazard rank is where failure or mis-operation has the highest risk to cause loss of human life and significant damage to buildings and infrastructure. Six of the assessed dams were identified as low to significant hazard, but there is some concern that these dams are incorrectly categorized. It is believed that these dams may actually be considered high-hazard once reevaluated.

Figure 49. Dams Identified for Further Assessment

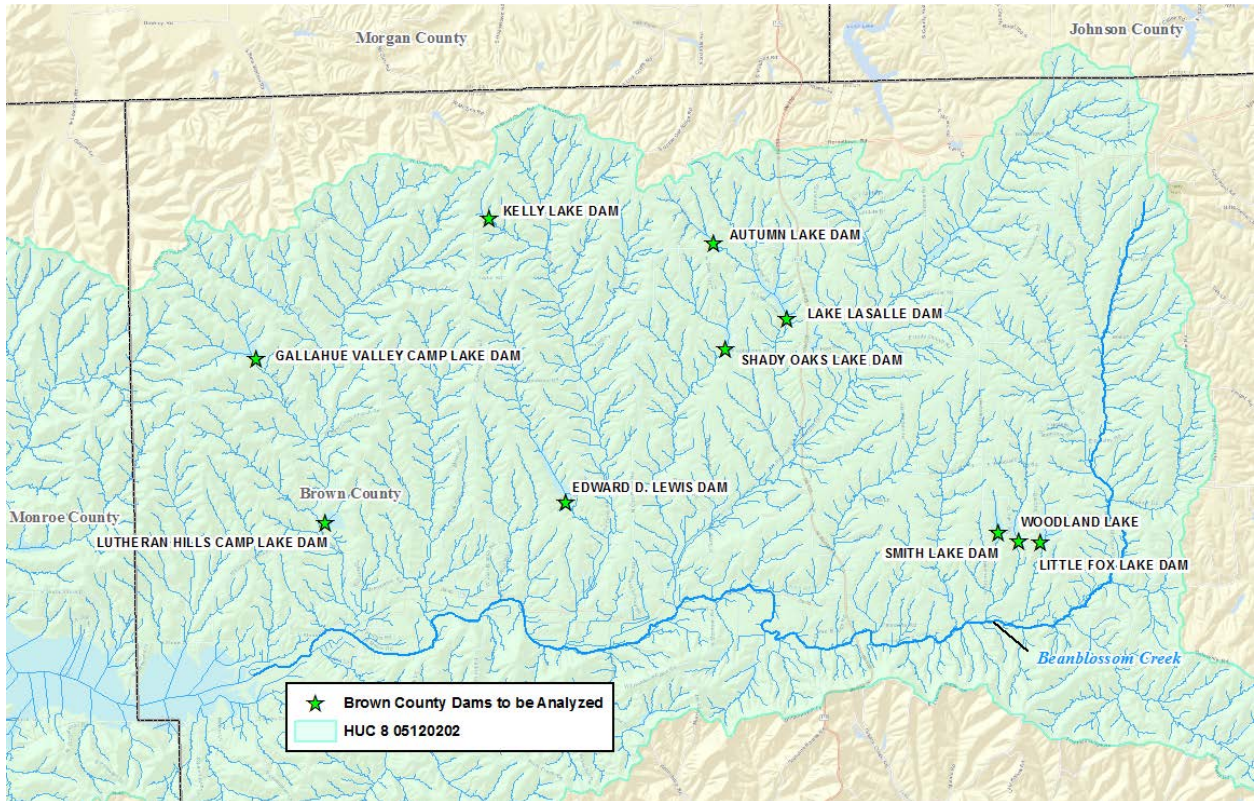


Table 7. Dams Details

| Dam Name | State ID | Hazard Rank | Phase 1 | Spillway Cap |
|-------------------------------|----------|-------------|---------|--------------|
| Autumn Lake Dam | 7-64 | High | Y | 25 |
| Edward D. Lewis Dam | 7-44 | High | Y | 62 |
| Lake Lasalle Dam | 7-6 | High | Y | 100 |
| Lutheran Hills Camp Lake Dam | 7-22 | High | Y | 100 |
| Gallahue Valley Camp Lake Dam | 7-3 | Significant | Y | 60 |
| Little Fox Lake Dam | 7-32 | Significant | N | unknown |
| Smith Lake Dam | 7-66 | Significant | N | unknown |
| Kelly Lake Dam | 7-52 | Low | N | unknown |
| Shady Oaks Lake Dam | 7-23 | Low | Y | unknown |
| Woodland Lake | 7-15 | Low | Y | 27 |

Planned Scope of Work

- Complete an analysis of each identified dam using FEMA's GeoDam-BREACH toolset, which creates an inundation model using the National Weather Service's Simplified Dam Break Model entirely within a geospatial environment.
- Prepare data to be used in the Incident and Emergency Action Plan to be prepared with FEMA's National Dam Safety Program grant funding in 2016.
- Reevaluate the dam hazard rank.

Deliverables

- Reports detailing the findings of the GeoDam-BREACH for each dam identified.

Action Potentials

The potential actions that may be moved forward as a result of these efforts includes (but is not limited to) the following:

- Develop Incident and Emergency Action Plans from funds from FEMA's National Dam Safety Program for each Dam without a plan in place.
- Revise existing Incident and Emergency Action Plans from funds from FEMA's National Dam Safety Program for each Dam with an existing plan in place.
- Reassess the Dam Hazard Rank.

Hendricks County

Location

White Lick Creek is over 45 miles long and flows from Boone County to its confluence with the West Fork White River near the Town of Centerton in Morgan County. This project involves the section of White Lick Creek that flows through Hendricks County. This section of White Lick Creek flows through the communities of Avon, Plainfield, Brownsburg as well as portions of Hendricks County.

Population

The population of Hendricks County was 145,448 according to the 2010 Census. In 2010, the population of Avon was 12,446, Plainfield was 27,631 and Brownsburg was 21,285.

Map Status

The Flood Insurance Rate Maps for Hendricks County have been modernized. The current effective map date is September 25, 2009.

Floodplain Status

Avon, Plainfield and Brownsburg participate in the NFIP, and Hendricks County participates in FEMA's Community Rating System. The following table documents the NFIP status for the communities:

Table 8. Hendricks County NFIP Details

| Community Name | Total NFIP Premium Paid | Number of Policies | Total Coverage | Total Claims Since 1978 | Total Paid Since 1978 | Ordinance Date |
|---------------------------------|-------------------------|--------------------|----------------|-------------------------|-----------------------|----------------|
| Hendricks County Unincorporated | \$102,539 | 168 | \$39,144,200 | 39 | \$323,874 | 8/18/2009 |
| Town of Avon | \$4,054 | 8 | \$1,221,600 | 0 | \$0 | 12/3/2009 |
| Town of Brownsburg | \$11,590 | 28 | \$7,559,800 | 5 | \$65,628 | 8/27/2009 |
| Town of Plainfield | \$64,106 | 84 | \$19,452,500 | 15 | \$49,491 | 9/8/2009 |

MHMP Status

The Hendricks County Multi-Hazard Mitigation Plan was written and adopted by the county and communities. The plan expires on July 23, 2014.

Risk MAP projects

Hendricks County was included in the Upper White River Discovery project dated September 30, 2012.

Principal Flooding Threat

The principal flooding threat in this section of Hendricks County is White Lick Creek. For this particular Action Discovery project, White Lick Creek is also the principal fluvial erosion threat.

Community Overview

Hendricks County is located in central Indiana just west of Indianapolis. The county lies entirely within the White River drainage basin, and the eastern half of the county is in the Upper White River HUC 8. The drainage is much better defined in the southern than the northern part of the county. The floodplains in the unincorporated portions of the county are primarily use for agricultural production.

The table below outlines the numerous declared disasters including emergency declarations for Hendricks County. This data ranges from 1998 to present since a listing of the affected county before 1998 was not available.

Table 9. Disasters in Hendricks County

| Disaster Declaration | Disaster Type | Incident Period | Type of Assistance |
|----------------------|--|-----------------|---------------------------------------|
| DR-4173 | Indiana Severe Winter Storm and Snowstorm | January 2014 | Public Assistance |
| DR-1766 | Indiana Severe Storms and Flooding | June 2008 | Both Individual and Public Assistance |
| EM-3274 | Indiana Snow | February 2007 | Emergency Declaration |
| EM-3238 | Indiana Hurricane Katrina Evacuation | September 2005 | Emergency Declaration |
| DR-1573 | Indiana Severe Winter Storms and Flooding | January 2005 | Individual Assistance |
| DR-1520 | Indiana Severe Storms, Tornadoes, and Flooding | Jun 2004 | Individual Assistance |
| DR-1487 | Indiana Severe Storms, Tornadoes, and Flooding | September 2004 | Individual Assistance |
| DR-1433 | Indiana Severe Storms and Tornadoes | September 2002 | Individual Assistance |
| EM-3135 | Indiana Winter Storm | January 1999 | Emergency Declaration |

Local Champions

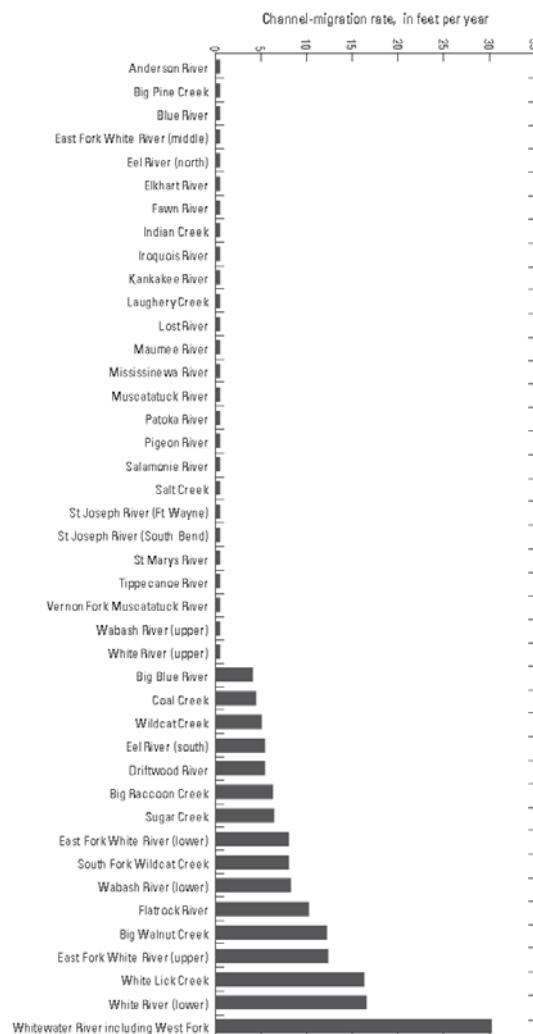
- Inspection Coordinator, Tonya A. Cottrell
- EMA Director, David M. Warren
- County Surveyor, David Gaston

Identified Issues

Properties adjacent to streams come with a certain degree of risk not only associated with flooding but also from fluvial erosion caused by stream channel migration or from high velocity flood waters. Where the National Flood Insurance program has reduced flooding losses by guiding floodplain management and mitigation practices, no such federal program exists for damages caused from fluvial erosion. In response, the Indiana Silver Jackets Hazard Mitigation Task Force has initiated a multi-agency program to provide mitigation planning resources for communities and individuals impacted by fluvial erosion.

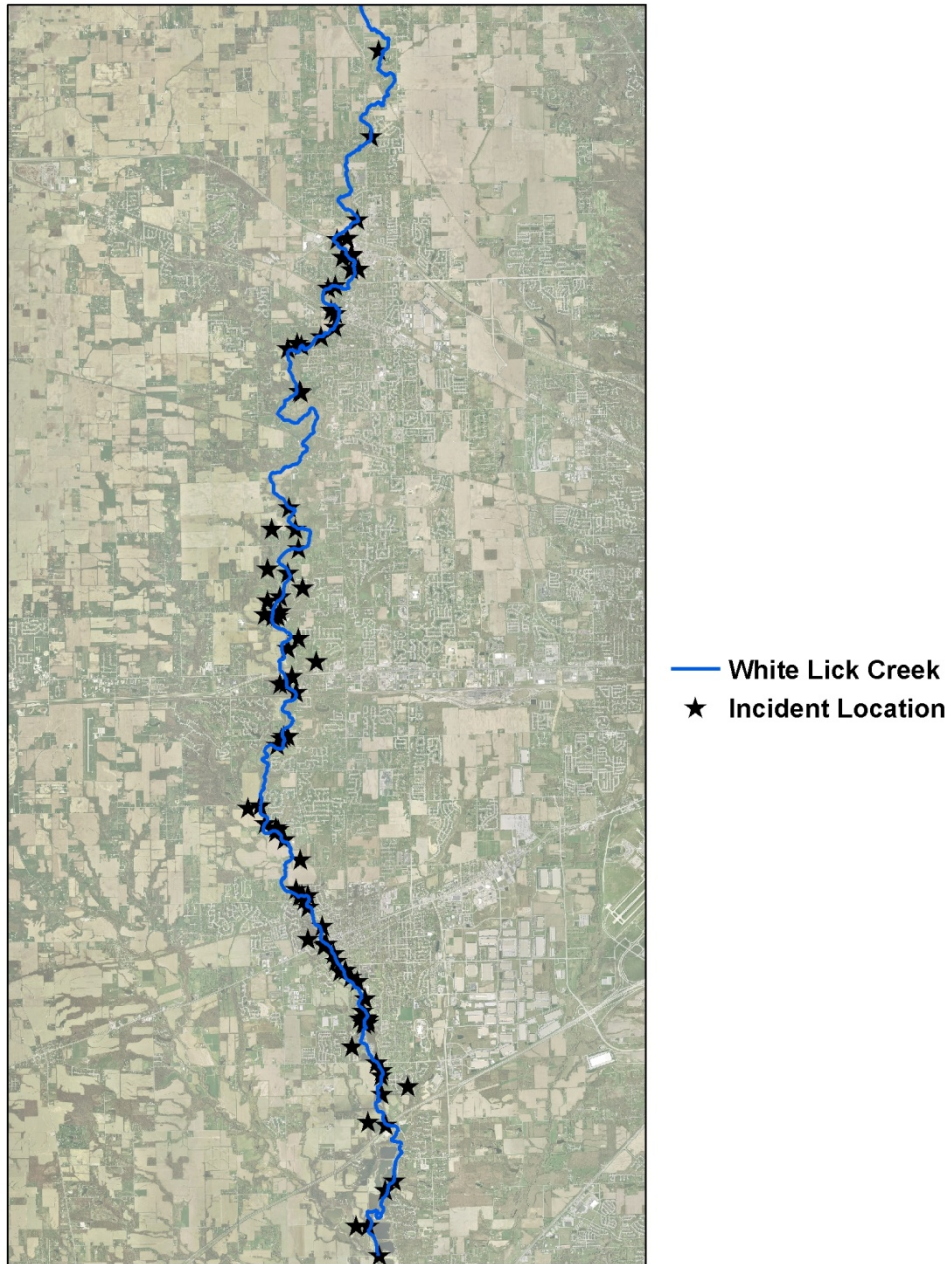
White Lick Creek in Hendricks County has been documented as a highly mobile stream in the USGS Scientific Investigations Report 2013-5168 compiled by Bret Robinson (Recent (circa 1998 -2011) Channel-Migrations Rates of Selected Streams in Indiana). For his report, Robinson studied multiple segments of the largest streams in Indiana. Within this study group, White Lick Creek is identified as one of the top three mobile streams, as shown in the figure below.

Figure 50. Mobile Streams in Indiana



DNR maintains a database of activity that impacts a floodplain, stream or river. Isolating the entries related to any items along White Lick Creek pertaining to bank stabilization activity or mention of erosion produced over 140 incidents. The large volume of activity along White Lick Creek is further evidence that it is highly mobile.

Figure 51. Stabilization Activity along White Lick Creek



Despite several erosion control measures along White Lick Creek in Hendricks County, severe streambank erosion persists along the river and threatens the livelihood of various communities within the river corridor. In addition, several communities along the river corridor are exposed to flooding risk, exacerbated by the noted erosion hazards.

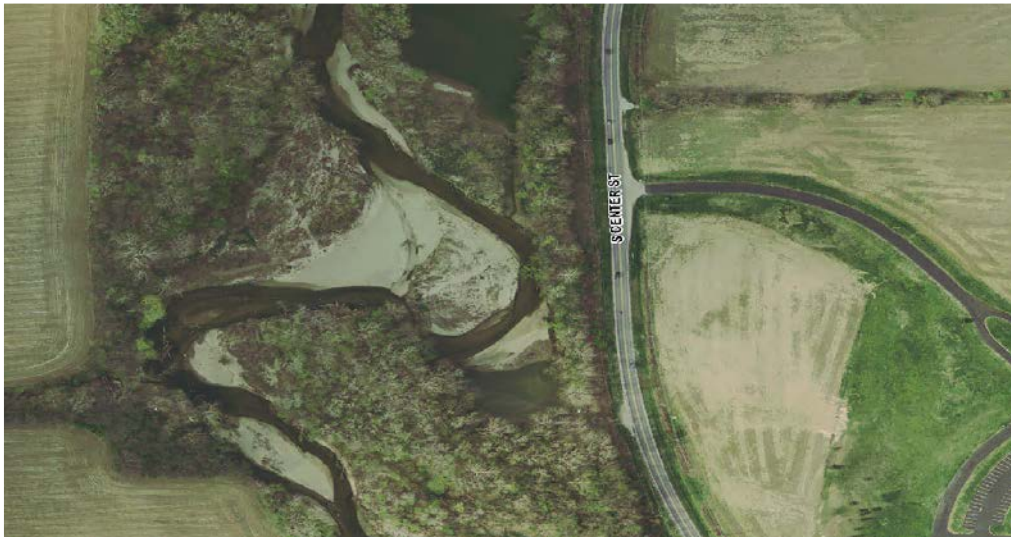
Evidence of the channel migration and erosion issues can be seen in the photos that follow. In the first image, the Timber Bend subdivision is located adjacent to White Lick Creek. The creek channel is migrating east towards the homes along Timber Bend Drive.

Figure 52. Timber Bend Subdivision



In the following image located along White Lick Creek near the town of Plainfield, the channel is migrating towards Center Street. Much of the financial impact of fluvial erosion is due to the interaction of the stream channels with infrastructure. If the movement of this channel is not mitigated, Center Street will be undermined and require repair.

Figure 53. Center Street



The next photograph, taken by Bret Robinson, USGS, along White Lick Creek, clearly shows an area of significant point bar development. This type of feature is common in streams with high sediment loads and is indicative of active erosion upstream from this site.

Figure 54. White Lick Creek Point Bar Development



Planned Scope of Work

In order to find practical but sustainable solutions to the ongoing problems along the stream corridor, a watershed assessment should be conducted to give an accurate diagnosis of the sources of the problems and major factors contributing to the apparent increase in the risk exposure along the corridor. The watershed assessment would include a review of previous studies of the White Lick Creek watershed, an assessment of the current hydrologic and geomorphologic conditions, and an assessment of the risk of flooding and/or fluvial instabilities. The assessment would include the following:

- Data gathering and coordination – Including gathering previous reports and analysis for the watershed, historical aerial photography and topographic data to assess changes in hydrologic response of watershed over time.
- Use existing hydrologic and hydraulic models to assess the current flooding risk associated with White Lick Creek.
- Identify specific locations in the watershed that are likely contributing to the overall flooding. The identified problem areas will be classified by type and geographic locations to help pinpoint the portions that are contributing to increasing the risk of flooding.
- A watershed assessment will be completed to establish the current hydrologic and channel processes that are potential stressors on the stability of the watershed. The identified stressors will be classified by type and geographic location. This task includes an extensive on-site assessment component needed to thoroughly understand the unique aspects of the fluvial processes in the watershed. Up to seven site visits are anticipated.
- Conceptual solutions will be developed for each of the contributors to flooding risk identified in the previous task. A master implementation timeline for the recommended conceptual solutions will be developed.

Deliverables

The primary project deliverable will be a report that includes the following information:

- Notable excerpts from previous studies
- Details concerning the hydrologic and geomorphic watershed assessments
- Conceptual solutions for flooding hazards and fluvial instabilities in the watershed
- The report will include exhibits providing the geographic distribution of hazards and locations for implementing the conceptual solutions as well as appendices that provide additional information and details concerning these solutions and the associated mitigation practices

Action Potentials

The potential actions that may be moved forward as a result of these efforts includes (but is not limited to) the following:

- Mitigation of the areas identified as contributors to the flooding.
- Identification and mitigation of current land use practices that are causing flooding and acceleration of channel migration
- Creation of a clearly defined fluvial erosion corridor that will aid with mitigation activity along White Lick Creek

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