Piat Place & Harding Ditch

Flood Hazard Analysis

(Floodplain Management Services - FPMS)

Photo: Piat Place neighborhood (62nd Street), July 16, 2024 (IDNR)

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Piat Place & Harding Ditch Flood Hazard Analysis

Executive Summary

The US Army Corps of Engineers (USACE), in collaboration with the Cities of Cahokia Heights and East St. Louis, IL (Sponsors), evaluated opportunities to manage flood risk within portions of the Prairie du Pont watershed. The study was conducted under the USACE Floodplain Management Services (FPMS) program and the intent of this report is to provide information to better assist officials at the cities of Cahokia Heights and East St. Louis officials as they make decisions regarding flood risk management within the study area. The Authority and scope of this study do not include detailed design or construction activities. City officials and other local entities may choose to implement any or all of the measures identified as funding becomes available.

The portion of the study area referred to in this study as Piat Place is bordered by N 58th Street to the west, the railroad north of Summit Avenue to the north, Harding Ditch to the east, and Whispering Willow Lake to the south. Within this area, the area approximately north of Laura Ave is within the City of East St. Louis, and the area south of Laura Ave is in the City of Cahokia Heights. The portion of Harding Ditch within the study area extends from its confluence with Schoenberger Creek to the north to the south pump station at Prairie Du Pont creek to the south. The study area is entirely within St. Clair County, Illinois.

The hydraulic analysis conducted for the study area covers most of Harding Ditch and its larger tributaries and addresses the effects of backwater on the Ditch.

This Piat Place & Harding Ditch Flood Hazard Analysis will evaluate flood risk management alternatives for the purpose of minimizing future flood damages to structures within the defined study area.

The flood risk management measures proposed for evaluation include:

- Stormwater conveyance:
  - Replace undersized main and tributary storm sewers
  - Capture undrained areas in storm sewer system
  - Clean and repair storm sewers
  - Add storm sewer inlets at low points and add new pipes
  - Increase the number and size of inlets/culverts
  - Clean and restore existing drainage ditches
- New pump station(s) and associated conduit network to convey flow into Harding Ditch during high ditch stages
- Harding Ditch dredging
- New pump station(s) at south pump station conveying flow from Harding Ditch into Prairie DuPont Creek
- Constructed wetland

- Road raise (Summit Avenue)

Due to study constraints, non-structural measures are discussed in the report as considerations for the Sponsors but were not evaluated independently. Each structural measure was evaluated independently for effectiveness, and then in combination.

The storm sewer network contributing watersheds extend outside of the defined study area limits. Therefore, an effort was made to identify the western boundary of the watersheds. The storm sewer system analysis was limited to lines that flow into the study area boundary. This study is constrained to the identified study area with little funding or time dedicated to storm sewers in areas beyond the study area identified in this current effort.

Following hydraulic modeling of the watershed, storm sewers, and Harding Ditch, an array of alternatives was developed that take into consideration effectiveness and maintenance requirements. The study area was broken into four individual geographic areas based on sewer lines and ditches (north of Summit Ave, north of State Street, Piat Place neighborhood, and Harding Ditch) because they are largely hydraulically independent. For each component area, at least two alternatives were developed, as listed below. Each alternative will require some level of Operations and Maintenance, Repair, Rehabilitation, and/or Replacement (OMRR&R) conducted by the various owners to remain effective.

The alternatives were developed to provide varying levels of flood risk reduction using structural measures. The Limited Flood Risk Reduction alternatives were developed to provide the least costly option that would have some risk reduction impact. For some areas, Intermediate Flood Risk Reduction alternatives were developed to provide a middle option in terms of cost and level of risk reduction. The Maximum Flood Risk Reduction alternatives were developed to provide the highest level of risk reduction.

Below is a summary of each alternative and its respective measures.

North of Summit Ave:

1) Limited Flood Risk Reduction – Raise low sections of Summit Avenue.
2) Maximum Flood Reduction – Install culverts to drain undrained areas west of the Summit Avenue wetland, put culverts in Summit Avenue under the Interstate 255 overpass to pass more water from west to east, and add a small (30 cfs) pump station with gravity outfall into Harding Ditch.

North of State Street:

3) Limited Flood Risk Reduction – Some improvement to drainage. Fix and replace broken or blocked storm sewer inlets, replace undersized storm sewer lines, run new storm sewer line down westbound lane of State Street, and add 100 cfs pump station that directs drainage into Harding Ditch.

4) Maximum Flood Risk Reduction – Greater improvement to drainage. Fix and replace more broken or blocked storm sewer inlets, replace undersized storm sewer lines, new storm sewer line down westbound lane of State Street, new storm sewer lines picking up drainage to the defunct Wedgwood Pump Station, new storm sewer lines to drain 60th and 61st Street, and add 175 cfs pump station that directs water into Harding Ditch.

Piat Place Neighborhood (south of State Street):

5) Limited Flood Risk Reduction – Direct flow from Piat Place neighborhood south into Whispering Willow Lake (Frank Holten State Park) through new sewer lines and a new ditch.

6) Intermediate Flood Risk Reduction – Take flow from Piat Place neighborhood to a single line bored under 255 east of N 63rd St. This new line would connect to a new pump station that moves water into Harding Ditch.

7) Maximum Flood Risk Reduction – Direct flow from Piat Place down into the Whispering Willow Lake (Frank Holten State Park) through new sewer lines to a newly constructed wetland area.

Harding Ditch:

8) Limited Flood Risk Reduction: Dredging to deepen and widen Harding Ditch from Schoenberger Creek to the south pump station at Prairie Du Pont Creek.

9) Intermediate Flood Risk Reduction – One additional pump at the south pump station plus Harding Ditch dredging.

10) Maximum Flood Reduction – Two additional pumps at the south pump station plus Harding Ditch dredging.

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Appendix A – Hydraulics and Hydrology

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1.0 Study Purpose

This report examines opportunities to reduce the flood inundation risk to structures located in the study area. The study area is within the city limits of Cahokia Heights and East St. Louis in St. Clair County, IL. The portion of the study area referred to as Piat Place in this study is generally bounded by N 58th Street, the railroad north of Summit Avenue, Harding Ditch, and Whispering Willow Lake. Many of these residential structures are repeatedly at risk of inundation during regular precipitation events. A portion of Harding Ditch is also included in the study area, extending between Schoenberger Creek and the pump stations at Prairie Du Pont Creek. The purpose of this report is to provide the cities of Cahokia Heights and East St. Louis with information to support making informed decisions regarding future flood risk management activities within the study area.

1.1 Scope

The scope of this report is to provide the cities of Cahokia Heights and East St. Louis with an evaluation of flood prone areas within the study area, conduct engineering analysis of structural alternatives to reduce flood risk, and present the findings and conceptual cost estimates to assist the city with reducing long-term flood risk. The evaluations in this report take into consideration local hydraulics and existing site conditions. Information referenced during the study was provided by the Cities of Cahokia Heights and East St. Louis (Hurst-Rosche Inc. and Thompson Civil LLC), St. Clair County, Federal Emergency Management Agency (FEMA), Illinois Emergency Management Agency (IEMA), U.S. Army Corps of Engineers (USACE), U.S. Geological Survey (USGS), National Oceanic and Atmospheric Administration (NOAA), Metro East Sanitary District (MESD), HeartLands Conservancy, Illinois Department of Natural Resources (IDNR), and Illinois Environmental Protection Agency (EPA).

The study area includes the Piat Place neighborhood and environs, as well as a portion of Harding Ditch. An analysis of the entire length of Harding Ditch and its watershed was outside the scope of this study.

1.2 Annual Exceedance Probability

Throughout this report, storm events and their resultant inundation will be referred to by Annual Exceedance Probability (AEP). For example, a storm event with a 1% AEP would have a 1% chance of occurring in a given year. Additionally, in the past, storm events have often been described by their “return period” – or the estimated average length of time between storm events of a similar magnitude. A 1% AEP event would have been referred to as having a 100-year return period or being a 100-year event. This terminology is no longer used because it falsely conveys a sense of time and lowers public risk perceptions. AEP terminology reminds the observer that the occurrence of a rare storm does not reduce the chances of another rare storm occurring within a short time period. Table 1 provides a list of standard AEP events for reference, with their equivalent “return period”.

The 1% AEP precipitation event does not necessarily correspond with a 1% AEP stream water level AEP. Several factors such as extent and duration of precipitation as well as the soil moisture conditions at the time of the event have an influence on the volume of runoff into a stream. It is this varying degree of runoff that affect the stream water level. For this study, the 1% AEP rainfall event is assumed to yield the 1% AEP stream water level event. Simulations will use a uniform rainfall distribution, 24-hour duration, and a normal antecedent moisture condition.

Table 1. Comparison of Annual Exceedance Probability (AEP) and Return Period Terminology

AEP	Return Period*
20%	5-year
10%	10-year
4%	25-year
2%	50-year
1%	100-year
0.5%	200-year
0.2%	500-year
0.1%	1000-year
*Note: Return Period is a term that can be misleading, is often misunderstood, and is no longer used by USACE (see ER 1110-2-1450).	

Table 2 shows the 24-hour duration rainfall depths used in the analysis of this study area, based upon Annual Exceedance Probability (AEP).

Table 2. NOAA Atlas 14 24-hour Duration Rainfall Depth for East St. Louis, IL

Storm Event	Depth of Precipitation (Inches)	
	24-hour Duration	72-hour Duration
10 % AEP	4.52	5.59
1% AEP	7.64	9.38

2.0 Study Background

2.1 Study Authority

This study is a special study under the Flood Plain Management Services (FPMS) program and is authorized by Section 206 of the Flood Control Act of 1960 (P.L. 86-645), as amended. The program allows USACE to conduct small, conceptual studies for local communities.

> *"That, in recognition of the increasing use and development of the floodplains of the rivers of the United States and of the need for*

> *information on flood hazards to serve as a guide to such development, and as a basis for avoiding future flood hazards by regulation of use by States and municipalities, the Secretary of the Army, through the Chief of Engineers, Department of the Army, is hereby authorized to compile and disseminate information on floods and flood damages, including identification of areas subject to inundation by floods of various magnitudes and frequencies, and general criteria for guidance in the use of flood plain areas; and to provide engineering advice to local interests for their use in planning to ameliorate the flood hazard: Provided, that the necessary surveys and studies will be made and such information and advice will be provided for specific localities only upon the request of a State or responsible local governmental agency and upon approval by the Chief of Engineers."*

The City of Cahokia Heights provided a letter of request to the District Commander on July 10, 2023 asking for support under the FPMS authority. The letter and scope of work were provided to the MVD FPMS Program Manager and HQUSACE Program Manager which was approved and funded. USACE FPMS assistance is a priority among Senators Durbin and Duckworth and was the subject of a Senate Effects Statement in May 2023.

2.2 Study Location

The study area encompasses portions of Cahokia Heights and East St. Louis, IL and lies within St. Clair County. The area is low-lying and is located in the area known as the American Bottoms which lies at the base of the bluffs, subjecting it to upland drainage. The study area lies behind the federally accredited East St. Louis Levee.

The portion of the study area referred to in this study as Piat Place is bordered by N 58th Street to the west, the railroad north of Summit Avenue to the north, Harding Ditch to the east, and Whispering Willow Lake in Frank Holten State Park to the south. Within this area, the area approximately north of Laura Ave is within the City of East St. Louis, and the area south of Laura Ave is in the City of Cahokia Heights. The portion of Harding Ditch within the study area extends from its confluence with Schoenberger Creek to the north to the south pump station at Prairie Du Pont creek to the south. The study area is entirely within St. Clair County, Illinois.

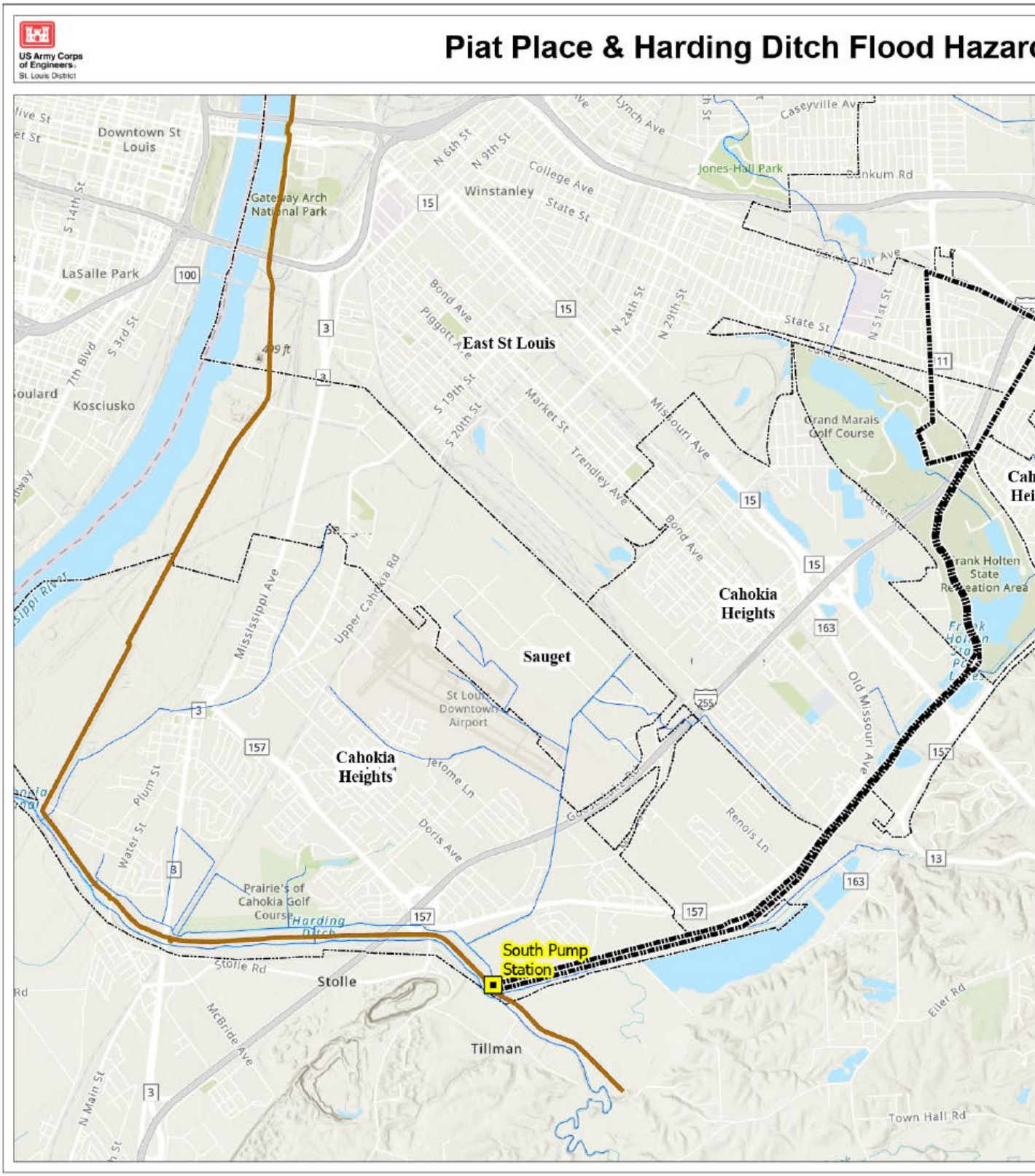
US Army Corps of Engineers
St. Louis District
Piat Place & Harding Ditch Flood Hazar
Downtown St Louis
Gateway Arch National Park
LaSalle Park
Kosciusko
Winstanley
East St Louis
Jones-Hall Park
Grand Marais Golf Course
Cahokia Heights
Sauget
St Louis Downtown Airport
Prairie's of Cahokia Golf Course
Harding Ditch
South Pump Station
Stolle
Tillman
Caseyville Av
Lynch Ave
N 6th St
N 9th St
College Ave
State St
Bond Ave
Piggott Ave
N 24th St
N 29th St
N 31st St
S 19th St
S 20th St
Market St
Trendley Ave
Missouri Ave
Mississippi Ave
Upper Cahokia Rd
Jerome Ln
Doris Ave
Renois Ln
Old Missouri Ave
Plum St
Water St
Stolle Rd
McBride Ave
N Main St
Eiler Rd
Town Hall Rd
Frank Holten State Recreation Area
409 ft

Figure 1 shows the study area boundary and the general vicinity of the area, as well as the boundaries between Cahokia Heights and East St. Louis. The Cahokia Heights area was referred to historically as the city of Centerville and the villages of Cahokia and Alorton, as they were known prior to their merger in May 2021. These historic names may be used in news articles and other reports.

The study area is approximately 517 acres (387 acres Piat Place portion; 130 acres Harding Ditch portion) with a population of about 567 residents in the Piat Place portion of the study area according to the United States Census Bureau (United States Census Bureau, 2020).

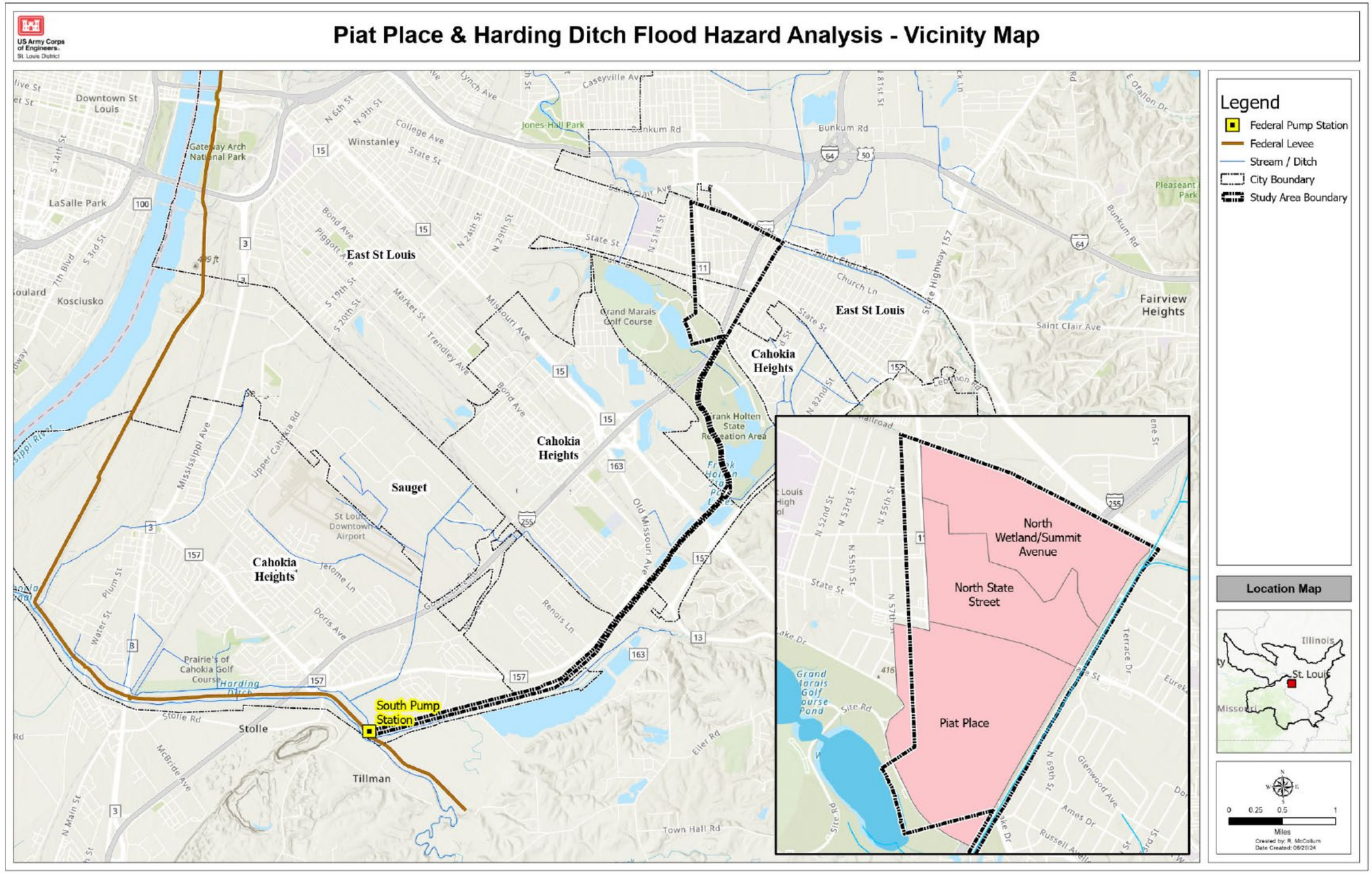

Figure 1. Study Area Boundary Map (Inset: Geographic Areas Within Piat Place Portion of the Study Area)

2.2.1 Watershed Boundaries

The study area lies within the larger Prairie du Pont watershed and is within two sub-watersheds. Shown in Figure 2, they are the Piat Place (07140101050206) and Frank Holten State Park (07140101050209) watersheds. The study area encompasses primarily residential structures with some commercial businesses running along State Street. It has relatively little greenspace overall and is comprised mostly of urban development, with the exception of Frank Holten State Park. The majority of the area is low-lying and has elevations from 402 feet at its lowest point up to 450 feet at the highest point within the study area boundaries (see

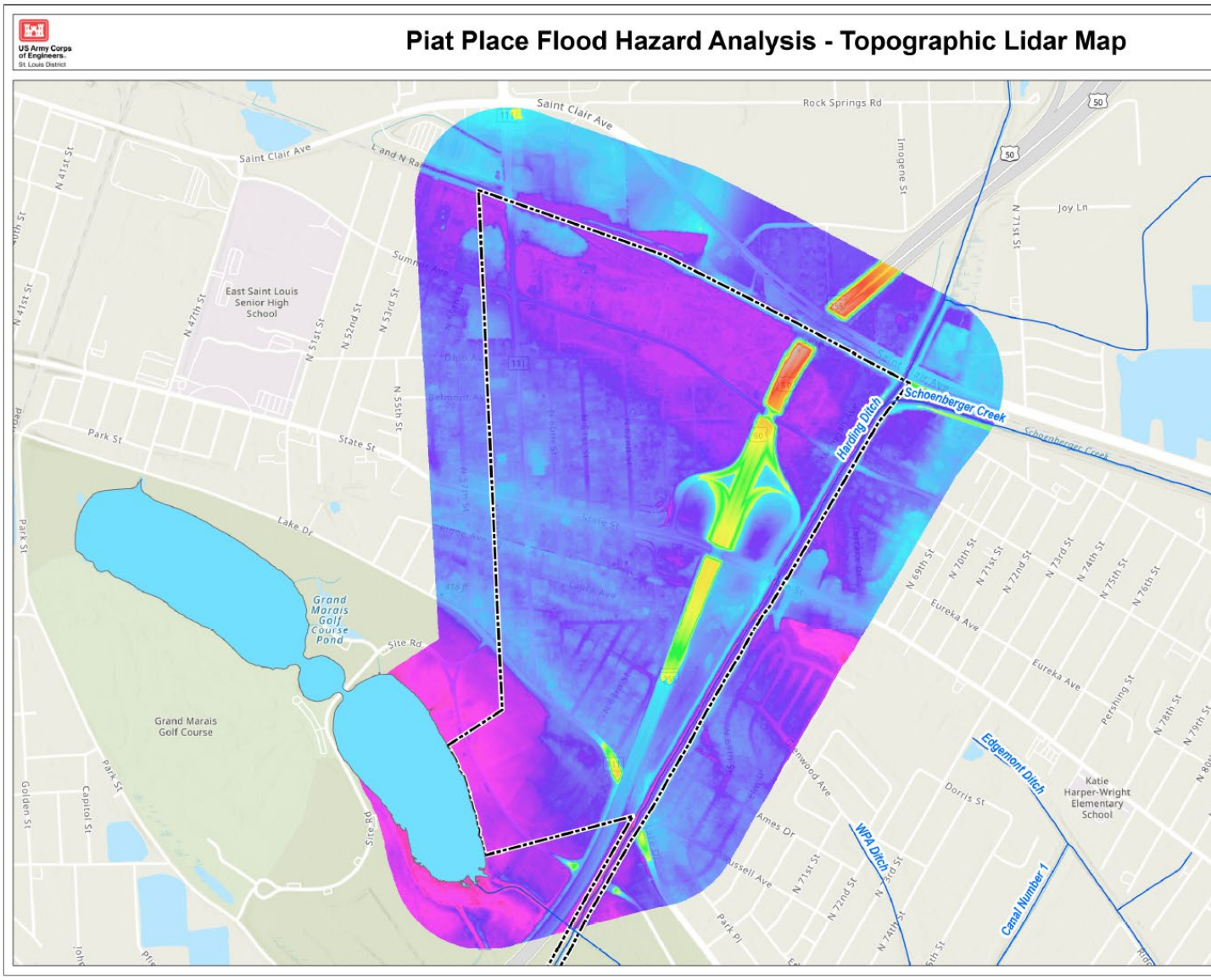

Figure 3). Elevations reported are referenced in the NAVD88 vertical datum unless otherwise noted.

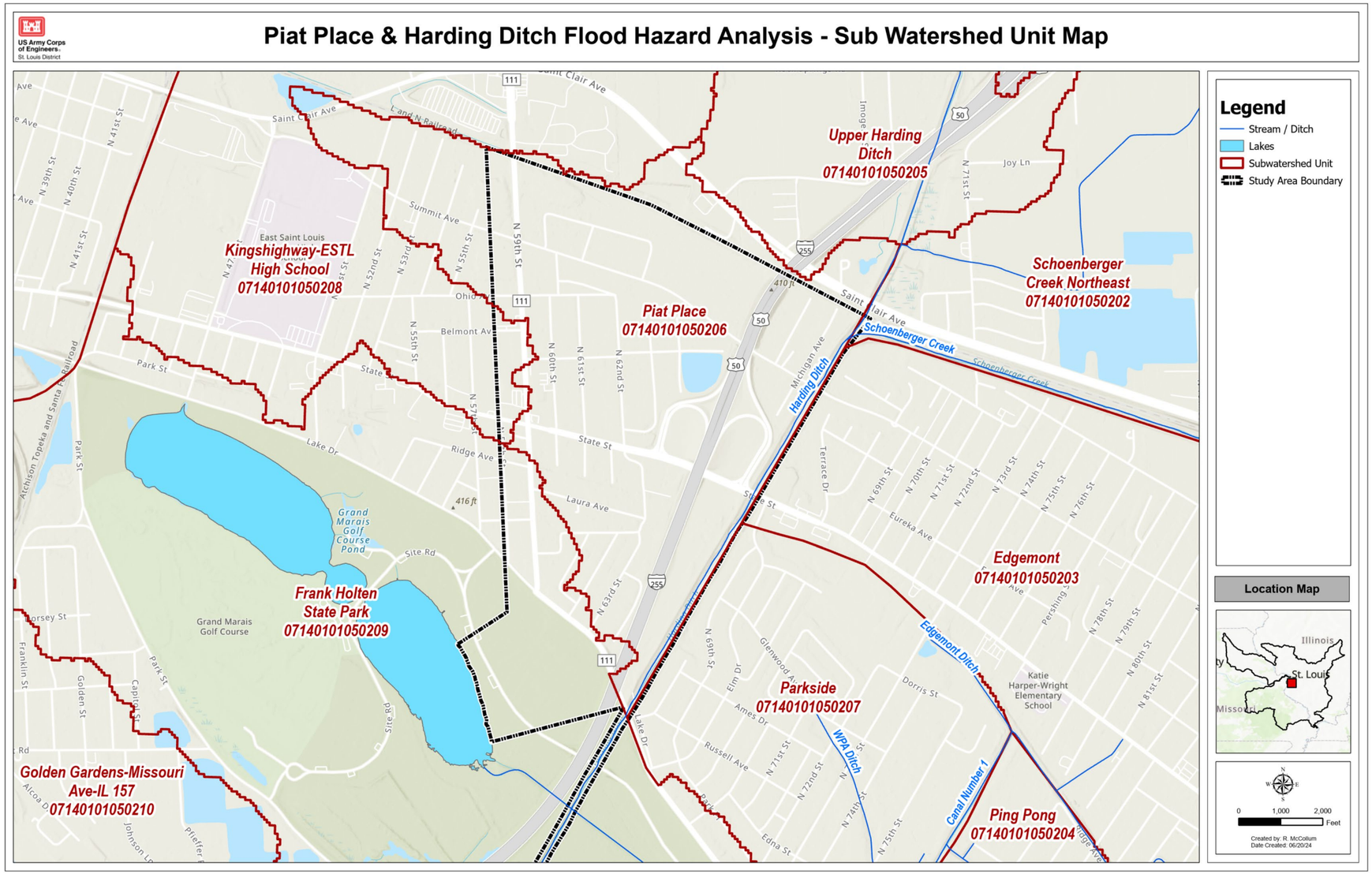

Figure 2. Sub-Watershed Map

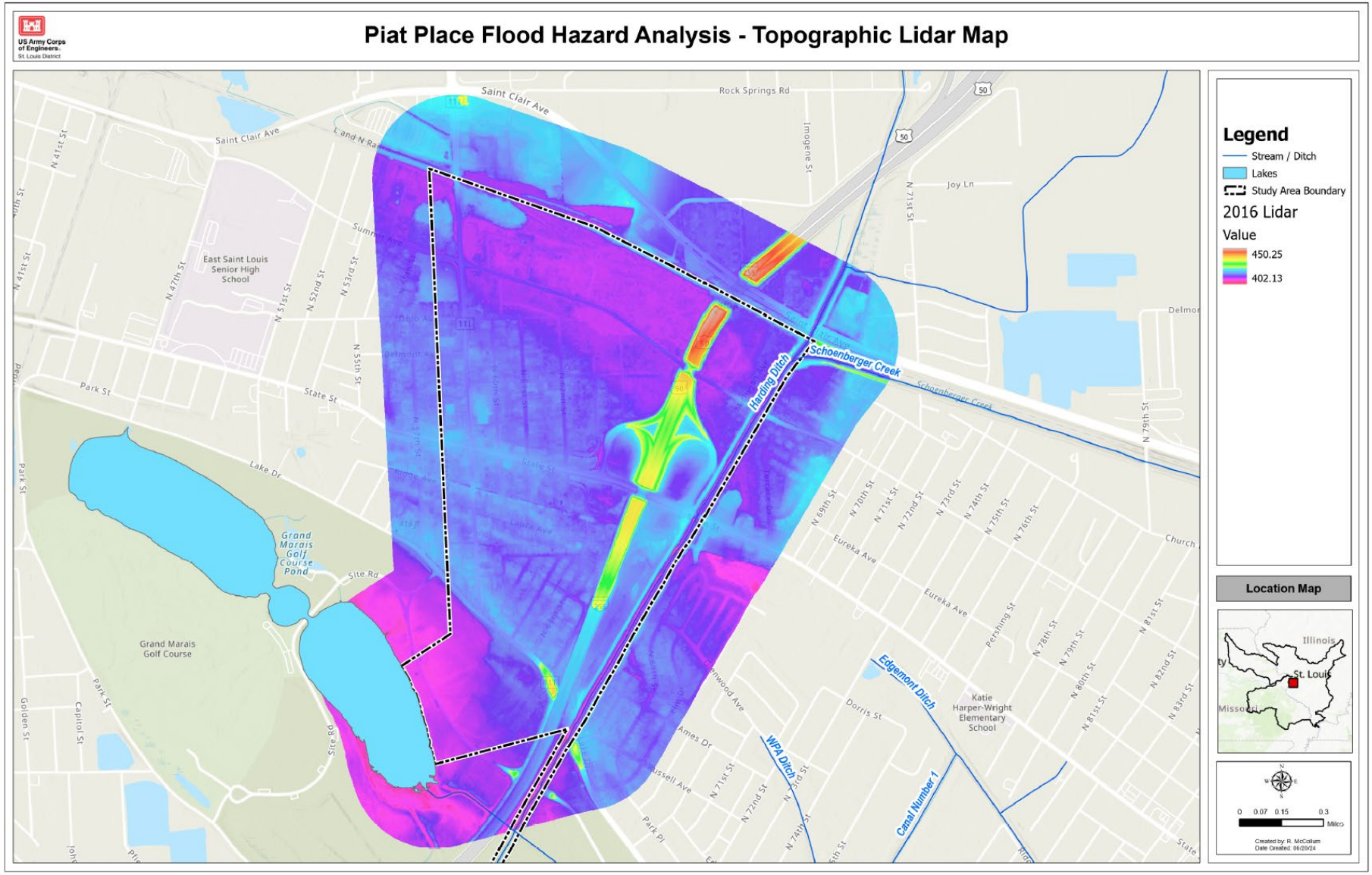

Figure 3. Topography of the Study Area (2016 Lidar)

2.3 Cahokia Heights & East St. Louis History of Flooding, including Piat Place

2.3.1 Environmental Justice

Environmental Justice (EJ) is defined as the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies, with no group bearing a disproportionate burden of environmental harms and risks. The Council on Environmental Quality (CEQ) guidance recommends utilizing the Census Bureau's poverty measures in determining populations with low-income. CEQ has developed a Climate and Economic Justice Screening Tool (CEJST) to identify disadvantaged and/or underserved communities and the categories of burden. Per Implementation Guidance of the Water Resources Development Act 2020, Section 160, an economically disadvantaged community is defined as meeting one or more of the following:

a. Low per capita income - The area has a per capita income of 80 percent or less of the national average;
b. Unemployment rate above national average - The area has an unemployment rate that is, for the most recent 24-month period for which data are available, at least 1 percent greater than the national average unemployment rate;
c. Indian country as defined in 18 U.S.C. 1151 or in the proximity of an Alaska Native Village;
d. U.S. Territories; or
e. Communities identified as disadvantaged by the Council on Environmental Quality's Climate and Economic Justice Screening Tool (USACE, Implementation Guidance for Section 160 of the Water Resources Development Act of 2020 dated 14 March 2023).

Using the CEQ's CJEST (version 1.0) (CEQ, Climate and Economic Justice Screening Tool v. 1.0, 2024), the study team determined this study area does meet the criteria as a disadvantaged community. Per CJEST the study area is economically disadvantaged because it meets the following categories: climate change, energy, health, workforce development, and low income (see Appendix C – Environmental Justice). This information may aid in the development of grant applications for technical/financial assistance to support flood mitigation actions identified in this report.

2.3.2 History of Flooding

The study area has endured decades-long challenges with repeated flooding as a result of several factors including development in low lying areas, upland drainage, increased intensity and frequency of storm events, undersized and failing infrastructure, and maintenance challenges. Water is currently unable to drain effectively from the study area following precipitation events, resulting in flooding of roads and structures. The level of inundation can range from inches to several feet.

The extreme rain event on July 26, 2022, produced several feet of inundation to structures. This event caused considerable structural damage within the study area. Moderate to significant flooding events also have the potential to limit vehicular and pedestrian movement.

The following is an excerpt from the EPA trip report dated July 25-26, 2022:

> *"During the early hours of July 26, 2022, a severe rain event occurred in the St. Louis area, including Cahokia Heights. Over 6 inches of rain fell over Cahokia Heights over an 11-hour period from 1:00 A.M. to noon on July 26 (based on National Weather Service data for the St. Louis Downtown Airport, located in Cahokia Heights). As a result of the storm, which caused widespread flooding throughout the region, the City's Public Works staff were deployed to respond to emergencies throughout the City on July 26."*

The NOAA Weather Service website shows surrounding areas (St. Louis Science Center to the west & Scott Air Force Base to the east) receiving 8.5 to 8.7 inches of rain on July 26, 2022.

The extreme rain event on 15-16 July 2024 occurred while this study was underway, after the hydrologic modeling had been completed. Approximately six to seven inches of rain fell over the study area in a 24-hour period. The majority or rain fell within a six to eight-hour period. The rain event equated to approximately a 1-2% AEP storm event (as estimated by USACE based on National Weather Service data) and resulted in a St. Clair County and a State of Illinois disaster declaration, with a federal declaration pending as of early September 2024.

2.4 Flood Impacts

The Piat Place portion of the study area is a flat, low-lying area. There are antiquated storm sewers that primarily drain this area into Harding Ditch. Portions of the storm sewer system are mostly blocked and filled with trash and are likely undersized. A functioning flap gate prevents backup from Harding Ditch into the Piat Place neighborhood, however, drainage into Harding Ditch is limited when the flap gate is closed. Widespread flooding in this area is of utmost concern, as it poses a threat to the health and economic stability of the community. Localized flooding has been shown to be a continued problem, and Harding Ditch backwater continues to worsen the situation.

The specific problems in the Piat Place portion of the study area identified by the hydraulic analysis (including IDNR storm sewer data) are shown in

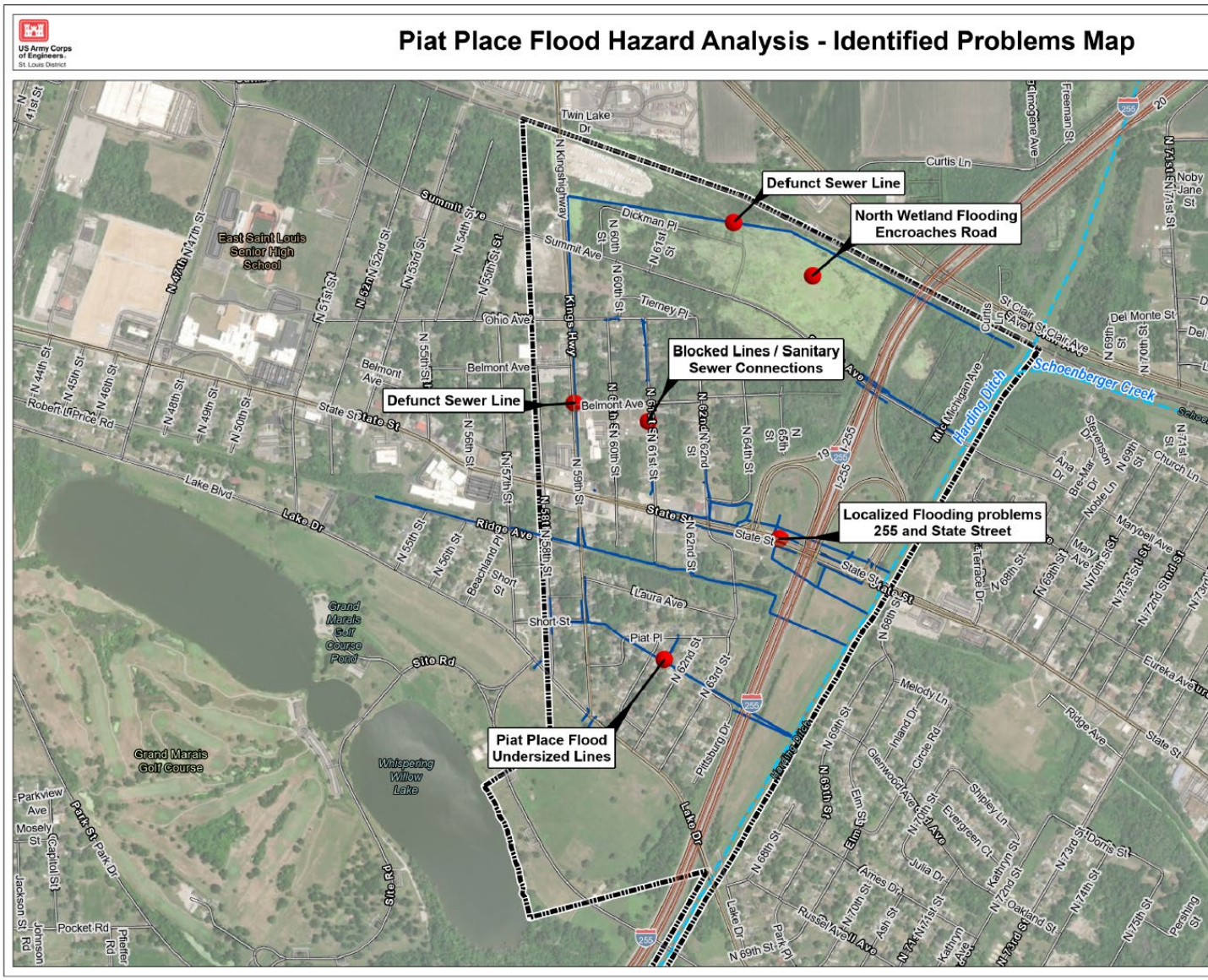

Figure 4.

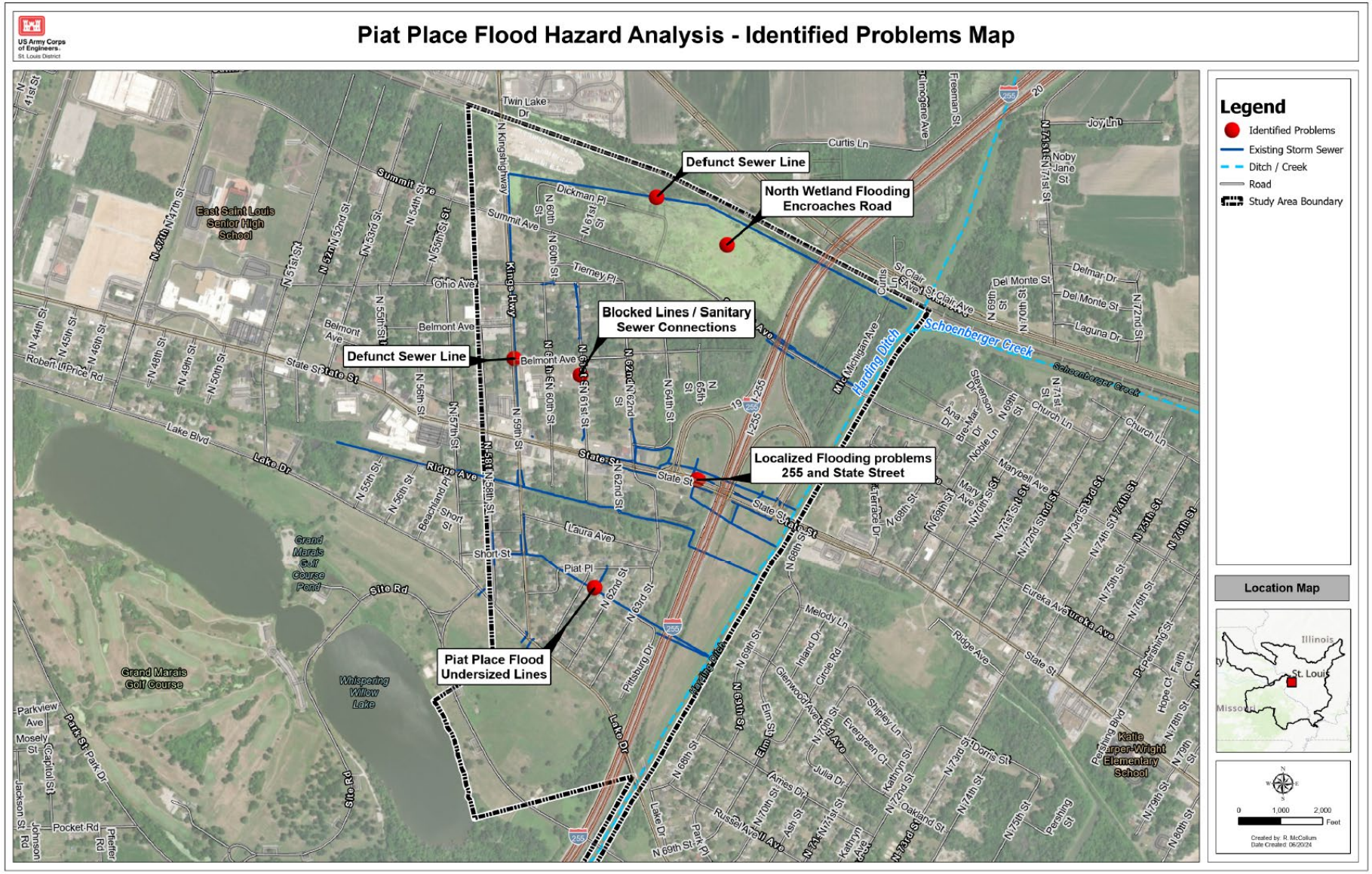

Figure 4. Problem Areas Identified by Hydraulic Modeling in this Study

2.4.1 Flooding on Roads

During the July 26, 2022, flood event, several area streets in the Piat Place neighborhood were impassible to pedestrian and vehicular traffic for a period of several hours. Figure 5 shows inundation on North 62nd Street in the Piat Place neighborhood during the July 2022 flooding event. The waters receded relatively quickly but left sediment and debris on the streets.

Figure 5. North 62nd Street facing Northeast during July 2022 Flooding (Photo: USACE)

Figure 6. North 63rd Street Facing South during July 2024 Flooding (Photo: USACE)

2.4.2 Impacts on Structures

The impact of flooding to structures can be devastating. Figure 6 and Figure 7 show inundation at the Piat Place neighborhood during flooding in July 2024. Repeated inundation can cause structures to develop mold and become structurally compromised.

Figure 7. Photo: Piat Place Facing Northwest During July 16, 2024 Flooding (IDNR drone)

2.4.3 Impacts on Sanitary Sewer

Flooding issues in the study area have exacerbated existing sanitary sewer problems for years. During rain events, the sanitary sewer system appears to become overwhelmed and begins surcharging. Surcharging occurs when the capacity of the system is exceeded, and water begins coming up to the surface. This results in sewage backing up into residences, streets, and yards. While the sanitary sewer problems are separate from the storm sewer concerns noted in this report, any improvements to the storm sewer and flooding issues are anticipated to have a positive impact on the sanitary sewer issues as well, by preventing surface drainage from intruding into the sanitary sewer system. In order to address the sanitary sewer issues, the city of Cahokia Heights is partnering with USACE on a Section 219 project to initiate crucial sanitary sewer system improvements.

3.0 Existing Conditions

3.1 Flood Risk Management Context

The study area lies within the larger Metro East Levee system (Figure 8). The primary outlet for the interior drainage within the Piat Place portion of the study area is Harding Ditch. Harding Ditch runs along the East side of the study area heading south, eventually reaching Prairie du Pont Creek which empties directly into the Mississippi River. Harding Ditch is maintained by MESD. The MESD south pump station brings water from Harding Ditch into Prairie du Pont Creek. Operation of the MESD south pump station is directly affected by Mississippi River conditions. Therefore, conditions on the Mississippi River affect water levels on Harding Ditch. Flooding problems on Harding Ditch have been noted during high Mississippi River stages; see Section 3.2.3 for more detail.

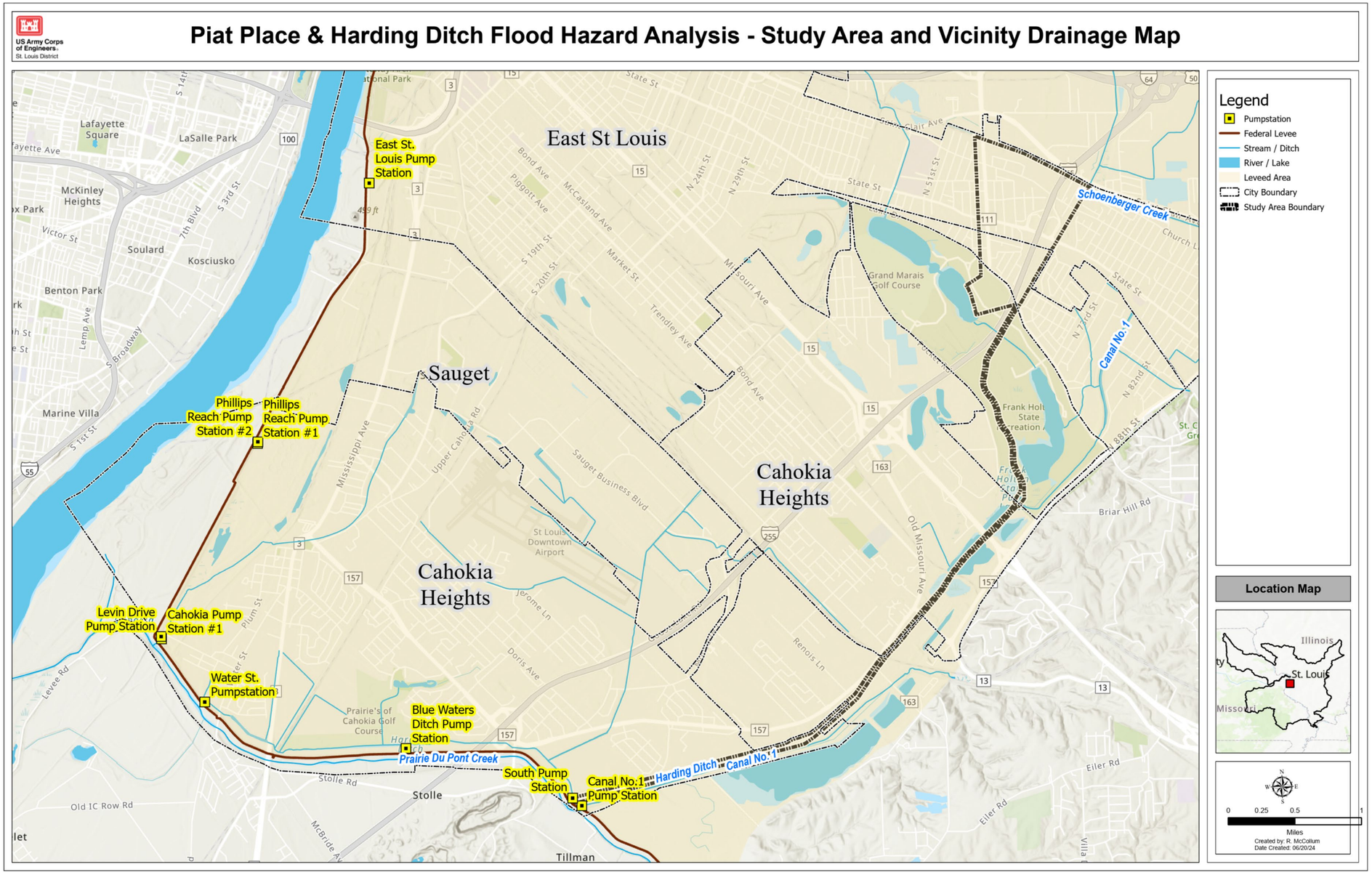

Figure 8. Study Area and Vicinity Drainage Map

3.2 Hydraulics and Hydrology

3.2.1 Existing Storm Sewer System

Information and data about the existing storm sewer system were identified from a 2023 IDNR storm sewer survey, PCSWMM modeling of the storm sewer system (see Section 7.0), issues identified by residents in a HeartLands Conservancy map, field observations, input from partner organizations including the cities of East St. Louis and Cahokia Heights, and conversations with residents in the project area during a site visit on 21 March 2024.

The current state of the storm sewer systems is poor. Several inlets are filled with silt and trash. Several are damaged and do not properly drain the contributing area, leaving standing water. Several areas do not drain into their intended inlet due to changes in the roadway or land surface. These inlet conditions do not provide adequate drainage and leave water ponded in the roadways and ditches. Several pipes have adverse slopes, probably due to settlement over time, which further restricts drainage in the network. The ditches in several areas along the roadside are discontinuous. Either due to settlement or landowners regrading yards, most ditches do not drain as originally conceived. As a result, standing water can be seen throughout the drainage area.

The wetland area north and south of Summit Avenue has ditches and culverts connecting the wetlands. There are ditches alongside Summit Avenue and a culvert that allows flow under the Interstate 255 overpass. East of Interstate 255, the area drains to a culvert into Harding Ditch. The north wetland area does not have a clear path to drain into Harding Ditch. Figure 9 shows a blocked storm sewer culvert in the wetland area north of Summit Avenue.

Figure 10 is a photo taken on a site visit (in non-flood conditions) from Summit Avenue, showing high water in the existing condition in the area north of Summit Avenue.

The area directly south of State Street is mainly drained by a ditch that parallels Ridge Avenue. The ditch turns and runs along Interstate 255 before entering a culvert that drains to Harding Ditch. A functioning flap gate prevents backup from Harding Ditch into the Piat Place

neighborhood. The Piat Place portion of the study area contains an existing storm sewer network for drainage which primarily drains under Interstate 255 into Harding Ditch. Flap gates are employed to restrict backwater from Harding Ditch.
Appendix A – Hydrology and Hydraulics contains more detailed information on hydraulics and hydrology in the study area.

Figure 9. Blocked Culvert Under I-255 Adjacent to Summit Avenue Wetlands (Photo: USACE, March 2024)

Figure 10. Wetland area North of Summit Ave, Showing Standing Water (Photo: USACE, 2024)

3.2.4 Hydrologic Modeling – Piat Place Portion of Study Area

Hydraulic engineers ran numerical stormwater and hydraulic models to capture the existing conditions of the area drainage. The PC Stormwater Management Model (PCSWMM) was utilized for modeling stormwater in pipe networks, and additional hydraulic modeling was completed using the Hydrologic Engineering Center's River Analysis System (HEC-RAS). These models were also used to examine the effects of the proposed measures. The models used a terrain dataset that incorporated additional field survey data collected by USACE. The storm sewer network analysis relied on a storm sewer survey performed by IDNR in 2023. Appendix A – Hydrology and Hydraulics has more information on the modeling methods.

HEC-RAS simulations provided flood inundation data for the study area west of Harding Ditch. Figure 11 and Figure 12 show flood inundation in the 10% AEP event, and Figure 13 and Figure 14 show inundation in the 1% AEP event. In the illustrations, the darker the inundation color, the higher the depth of water. As seen in the figures, flooding occurs throughout the watersheds during a 10% AEP storm event. The sewer lines surcharge at the storm inlets inundating the area around them. This indicates that the existing sewer and ditch networks are inadequate to drain the watersheds. The primary problem areas in the Piat Place portion of the study area are the north area wetland waters encroaching on Summit Avenue, drainage around the State Street/Interstate 255 interchange, and the Piat Place neighborhood flooding.

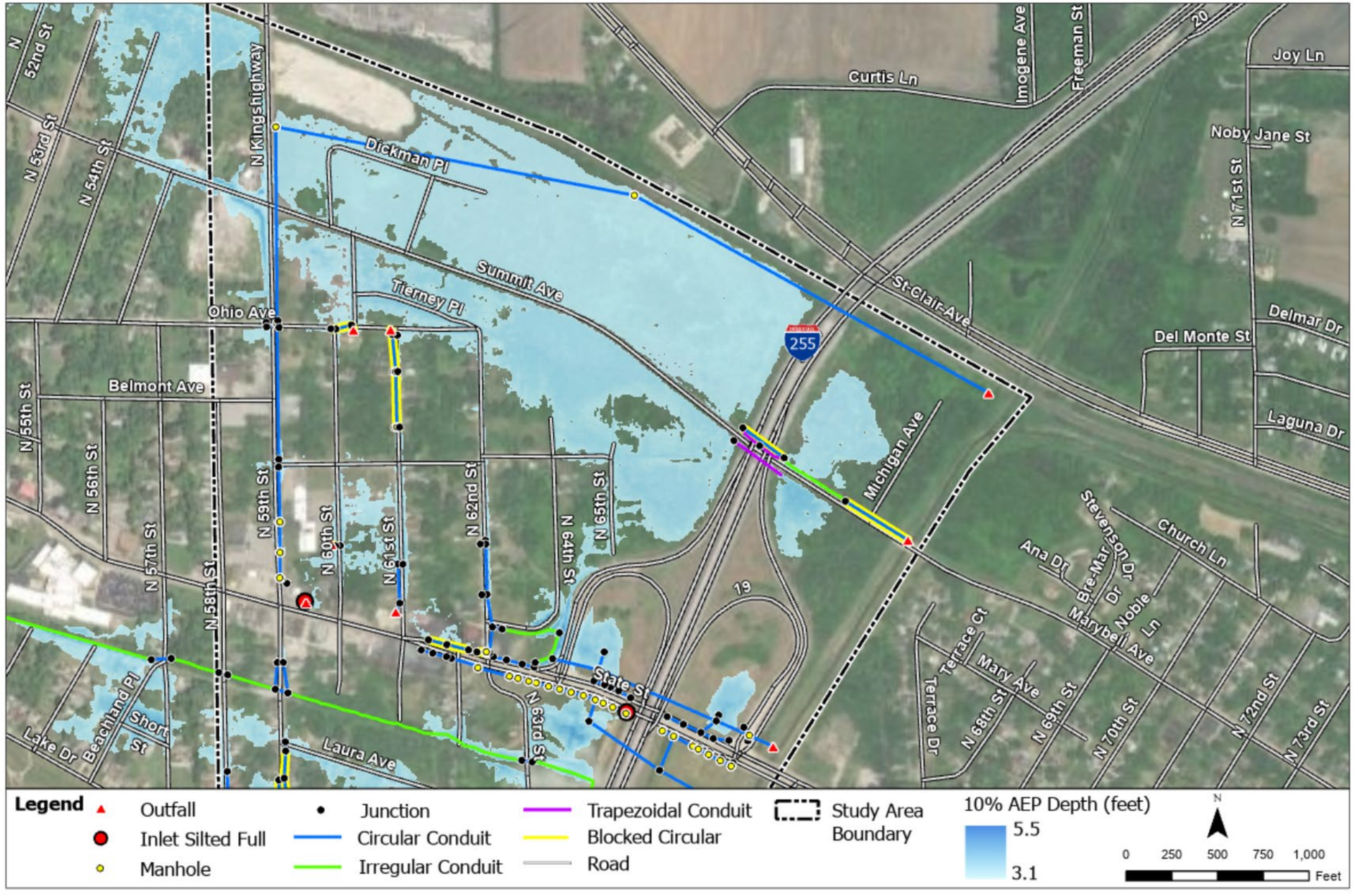

Figure 11. Existing Storm Sewer Infrastructure and 10% AEP (10-year) Flood Inundation – North of State Street.

Figure 12. Existing Storm Sewer Infrastructure and 10% AEP (10-year) Flood Inundation - South of State Street.

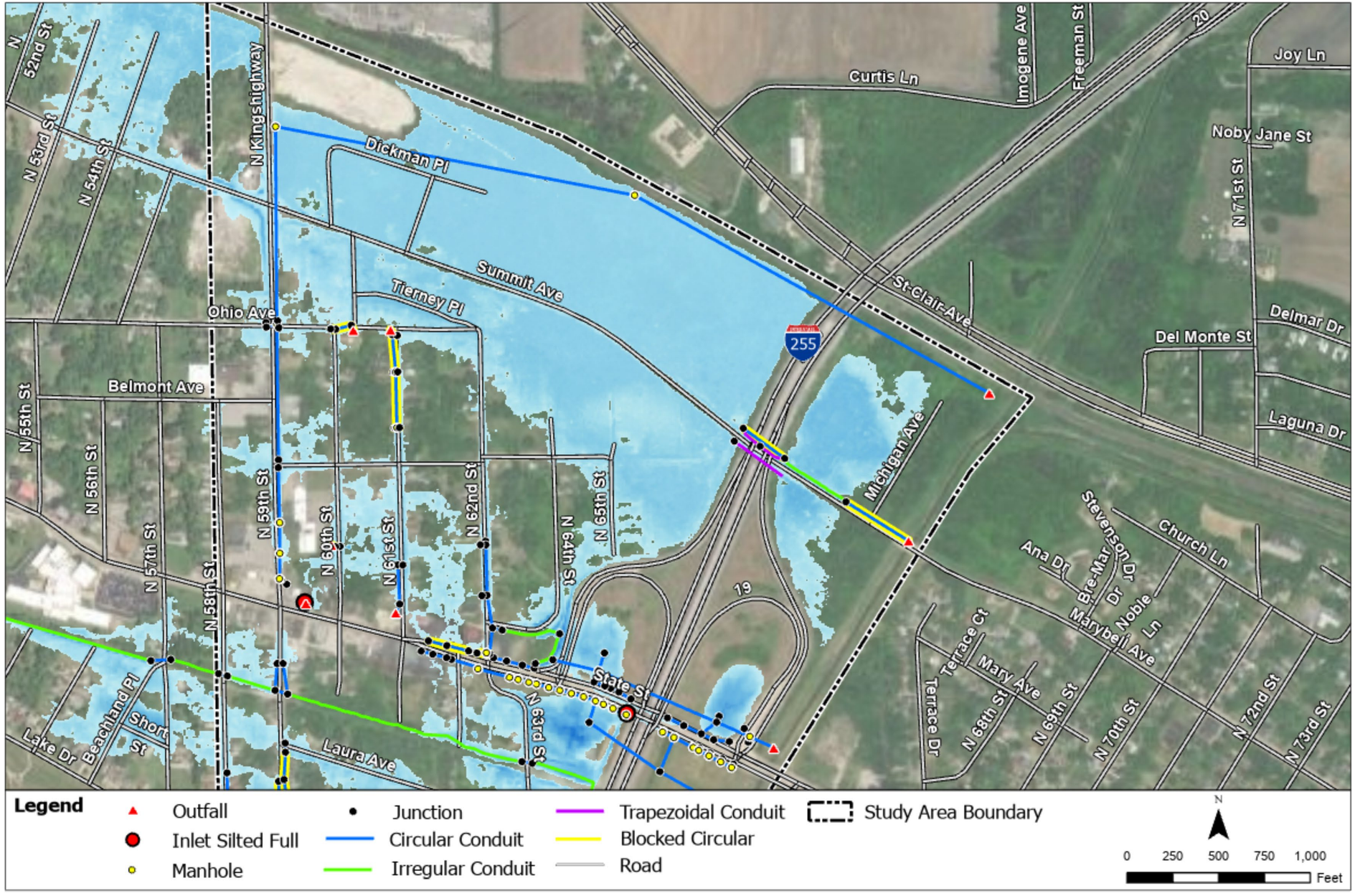

Figure 13. Existing Storm Sewer Infrastructure and 1% AEP (100-year) Flood Inundation – North of State Street

Figure 14. Existing Storm Sewer Infrastructure and 1% AEP (100-year) Flood Inundation – South of State Street

3.2.3 Hydrologic Modeling – Harding Ditch Portion of Study Area

As discussed in Sec. 3.1, Harding Ditch is the primary drainage path for the southern portion of the Metro East Levee system with multiple tributaries that empty into the ditch. To assess the degree of flooding in the region from Harding Ditch, a HEC-RAS model was created from a 2012 existing MESD system model. The 2012 model was built with both cross sections surveyed in 2012 and from plans of the original design channel.

As noted in Section 1.1 (Scope), an analysis of the entire Harding Ditch watershed was outside the scope of this study. The portion of Harding Ditch assessed in this study extends from Schoenberger Creek in the north to the south pump station at Prairie Du Pont Creek in the south. To assess changes in Harding Ditch over time, new channel cross section data was gathered by USACE in 2024. These cross-sections were compared against what was in the original 2012 HEC-RAS model. The analysis showed that the channel has narrowed over time. It degraded (eroded) in the upstream sections and aggregated (received deposition) in the downstream segments. This has led to increased water levels in Harding Ditch.

High Mississippi River stages require operation of the MESD south pump station for the drainage from Harding Ditch. When stages exceed 21.5 feet at the St. Louis gage on the Mississippi River, the gravity drains at the south pump station are closed and pump operation moves water from Harding Ditch into Prairie du Pont Creek. While under these higher backwater conditions, operation of the pump station is not as efficient for conveyance of stormwater as during gravity flow conditions (low Mississippi River stages). Though the probability of a high Mississippi River stage coincident with a 10% AEP or 1% AEP interior flood event is low, extensive Harding Ditch backwater flooding is still possible.

Results from the HEC-RAS modeling of the Harding Ditch project area demonstrate that the influence of backwater flooding from Harding Ditch extends approximately five miles upstream of the south pump station during a 1% AEP storm event. This places the backwater effect to just upstream of the Canal 1 confluence. This signifies that the backwater effects propagate upstream on Canal 1 as well as influence the Frank Holten State Park (FHSP) lake levels. Harding Ditch backwater reaches Lake Drive on Canal 1 during the 1% AEP storm event with low Mississippi River stages as well.

Figure 15 and Figure 16 show Harding Ditch with water at the bank level in July 2022.

Further detail on the differences in Harding Ditch frequency water surface profiles from the 2012 and 2024 modeling are discussed in Appendix A – Hydrology and Hydraulics.

Figure 15. Harding Ditch with Water at Bank Level (Photo: USACE, July 2022)

Figure 16. Harding Ditch Facing South (Parkside Pump Station Seen on Left Bank) July 26, 2022 (Photo Courtesy of Cahokia Heights Mayor Curtis McCall)

4.0 Study Assumptions and Constraints

4.1 Assumptions

Several site visits were performed to determine channel conditions, drainage structure (manholes, culverts etc.) and pump station conditions, and survey elevations. A survey of storm sewer networks was conducted by IDNR in 2023. However, not all required information was able to be obtained and some assumptions were needed.

Assumptions were made regarding how the sewer lines connect and the dimensions of some culverts and pipes in the Piat Place portion of the study area where IDNR survey data was not available. The modeling was shared with partners following the Interagency Partner Meeting in April 2024 to obtain review from personnel most familiar with the area.

Several inlets were silted-in or filled with trash. Inlet invert information could not be collected. In these cases, invert elevations were interpolated from surrounding inlet inverts. Where there were groups of inlets silted-in, inverts were set approximately two to three feet below the ground surface.

The alternatives formulated and presented in this report have a 10% AEP rainfall event level of design. The 10% AEP storm event was used, as it is the standard threshold for storm sewer system capacity. It coincides with St. Clair County regulations for storm water management. Less frequent events, such as the 1% AEP event, are simulated to ensure water does not enter structures.

The Piat Place FPMS study hydraulic analysis assumed that a 24-hour duration is sufficient to capture the extents of flooding in the study area. For the Harding Ditch analysis, a 72-hour duration was used. The storm durations used for each portion of the study area are based on the time that it takes for runoff to travel from the most upstream point in the watershed to the most downstream point.

The assumption was made that the Harding Ditch levees are functioning and would continue to function in the future without project condition. No stability or seepage analyses were performed as part of this study.

As noted in Section 1.1 (Scope), an analysis of the entire Harding Ditch watershed was outside the scope of this study. Any potential projects upstream of the study area, such as a project under consideration by partners at Spring Lake, may reduce flow into Harding Ditch but are not captured in this analysis. Conversely, potential projects or development upstream of the study area that might increase flow into Harding Ditch are not accounted for.

4.2 Constraints and Considerations

Constraints are restrictions that limit the planning process. Some constraints are general and common to all studies (such as resource constraints and legal and policy constraints). Resource constraints are those associated with limits on knowledge, expertise, experience, ability, data,

information, money and time. Legal and policy constraints are those defined by law, USACE policy and guidance. Other constraints are specific and unique to each study. Study considerations include information that may influence the study process or conclusions. A clear understanding of constraints and considerations is essential to the success of the planning and evaluation process.

The following specific constraints were identified for this study:

- The study is limited to the scope and funding identified in the FPMS Scope of Work developed between USACE and the City of Cahokia Heights & East St. Louis.
- The availability of storm sewer and pump station data may impact the model accuracy.
- No measure should be implemented that negatively impacts an adjacent or larger watershed.

The following are considerations for the study:

- A potential project may need outside entity and/or government buy-in to aid in implementation and potential funding.
- Negative impacts to other areas with proposed modifications should be avoided if possible and addressed if unavoidable.
- Avoid or minimize negative environmental and cultural impacts.
- Construction should take place from downstream to upstream, to prevent increased pipe sizes from overloading the storm sewer system.
- Alternatives typically require cooperation of cities and/or property owners to install and maintain them.
- Coincident frequency of high and low Mississippi River levels and their impact on the water surface levels on Harding Ditch (see Appendix A-Section 4.2.5).

5.0 Structural Measures to Reduce Flood Damages

A management measure is a feature or an activity that can be implemented at a specific geographic site to address one or more identified problems. Management measures are the building blocks of alternative plans and are categorized as structural and nonstructural.

Structural measures are physical modifications designed to reduce the frequency of damaging levels of flood inundation. Structural measures can be designed to act as a physical barrier between floodwaters and structures at risk of being damaged by those floodwaters, or physical systems to convey water away from the area. Structural measures considered in this report include detention basins and storm water conveyance systems (pump stations, storm sewers, channels, and culverts).

5.1 Stormwater Conveyance

5.1.1 Storm Sewers

Storm sewers are drains that carry surface water runoff from rainfall and melting snow. These sewers convey this runoff to water bodies such as catch basins, creeks, rivers, and lakes. A storm sewer's components include the above-ground drain that is usually found at street-level, just below the sidewalk line, and the subsurface piping that carries the water downstream. The storm sewer networks within the study area are undersized and in disrepair. Replacement and repair of the storm sewer networks is needed. Additional inlets are also proposed for areas with insufficient drainage.

5.1.2 Channels

Modifications to channels can include many types of actions that modify the flow characteristics of the water. For this study, the channel modification includes cleaning out (deepening) the existing channels to remove the sediment that has built up over decades and increase their capacity to hold and carry water. It should be noted that these are not permanent modifications and will need to be maintained. Over time, sediment will inevitably deposit in the channel again, reducing the capacity until removed again.

5.1.3 Culverts

A culvert is any enclosed channel open at both ends carrying water through an artificial barrier such as a roadway embankment. Culverts are the structures in line with the drainage ditches that pass under roadways, driveways, or berms. Culverts will begin to fill with sediment and debris, requiring additional cleanouts in the future. They can also be damaged or settle over time, preventing them from continuing to carry water. Debris clogs may be prevented or more easily removed if grating is added to the culvert ends.

5.2 New Pump Stations at Harding Ditch

Improvements to the Piat Place portion of the study area could include construction of a pump station to move water out of the neighborhoods and into Harding Ditch. Pump station capacities of 30, 100, or 175 cubic feet per second (cfs) were considered. The station design may consist of submersible pumps with discharge piping of either 24, 30, or 42-inch steel piping to ensure the appropriate velocities. This is the assumed configuration needed based on preliminary analysis and similarities to the Parkside pump station with specifics to be established during a design phase. The station should be designed for automatic operation with float switches, and a manual override option.

5.3 Harding Ditch Dredging

As discussed in Section 3.2.3, Harding Ditch has narrowed over time. It degraded in the upstream sections and aggregated in the downstream segments south of Highway 163. This has led to increased water levels in Harding Ditch. Therefore, returning the channel to original design conditions is warranted. In order to return the channel to original design, the upstream sections need to be widened, and the downstream sections need to be widened and deepened.

Harding Ditch modifications would require disposal of dredge material. There are two options for dredge disposal: 1) hauling to a landfill, and 2) local disposal on adjacent land on the other side of the Harding Ditch embankment. Local disposal requires USACE regulatory permitting. This project assumes the conservative option of hauling to a landfill in its cost estimate of dredge disposal from Harding Ditch.

Local disposal of dredge material (e.g., creating new disposal areas outside the channel) would involve additional considerations, including determination of permitting requirements, avoiding placement of material in wetlands, and acquiring the necessary real estate interests.

A Section 404 permit would be needed for any Harding Ditch dredging; disposal of the spoil material should avoid wetlands. The original Section 401 certification would likely allow dredging and widening to restore the channel to its original design conditions.

The Nationwide Permit (NWP) 41 is generally used for the removal of accumulated sediment and reshaping of the ditch/canal banks. Some of the key restrictions or language within the permit are:

> "The reshaping of the drainage ditch cannot increase drainage capacity beyond the original as-built capacity nor can it expand the area drained by the drainage ditch as originally constructed (i.e., the capacity of the drainage ditch must be the same as originally constructed and it cannot drain additional wetlands or other waters of the United States).
>
> "Compensatory mitigation is not required because the work is designed to improve water quality.
>
> "This NWP does not authorize the relocation of drainage or irrigation ditches constructed in waters of the United States; the location of the centerline of the reshaped drainage or irrigation ditch must be approximately the same as the location of the centerline of the original drainage or irrigation ditch.
>
> "This NWP does not authorize stream channelization or stream relocation projects."

Other permits such as NWP 3 or NWP 31 could potentially cover some of the activities outside of the NWP 41.

5.4 New Pump Stations at South Pump Station

In addition to Harding Ditch channel widening and deepening, new pump stations at the south pump station were considered to increase the pump capacity from Harding Ditch to Prairie Du Pont Creek. The current configuration of the south pump station includes four identical electric, vertical, mixed flow pumps each with a capacity of 60,000 gallons per minute (gpm) (134 cfs) and 42-inch diameter discharge pipes. An increase of one or two pumps was considered (131.5 cfs each).

5.5 Constructed Wetland

Constructed wetlands are human-made treatment systems using the natural processes occurring in wetland vegetation and soils to slow flood velocities, improve water quality, create wildlife habitat, and in some cases provide recreation opportunities.

Based on preliminary analysis of available open space, a wetland area could be created in Frank Holten State Park north of Whispering Willow Lake which would remain wet during non-flood conditions. The wetland would receive flow from new sewer lines in the Piat Place neighborhood to the north, and discharge into the lake to the south. The wetland would increase storage during flood events and improve water quality of water entering the lake.

Any use of IDNR lands would require appropriate coordination and approval with the state.

5.6 Stormwater Detention

A detention basin is a storage area designed to mitigate adverse impacts of excess water by holding that water and gradually releasing it downstream. A conceptual design for a typical in-line detention basin is presented in Figure 17.

A detention basin could be implemented in Frank Holten State Park north of Whispering Willow Lake as a dry detention pond which would remain dry during non-flood conditions, so that maximum storage would be available during storm events.

There are vacant areas adjacent to Harding Ditch that could be modified for off channel detention storage, such as the field south of State Street and east of Interstate 255 owned by the State of Illinois. A detention basin in this location was not analyzed in this study; a subsequent study could assess potential designs and the magnitude of Harding Ditch stage reduction.

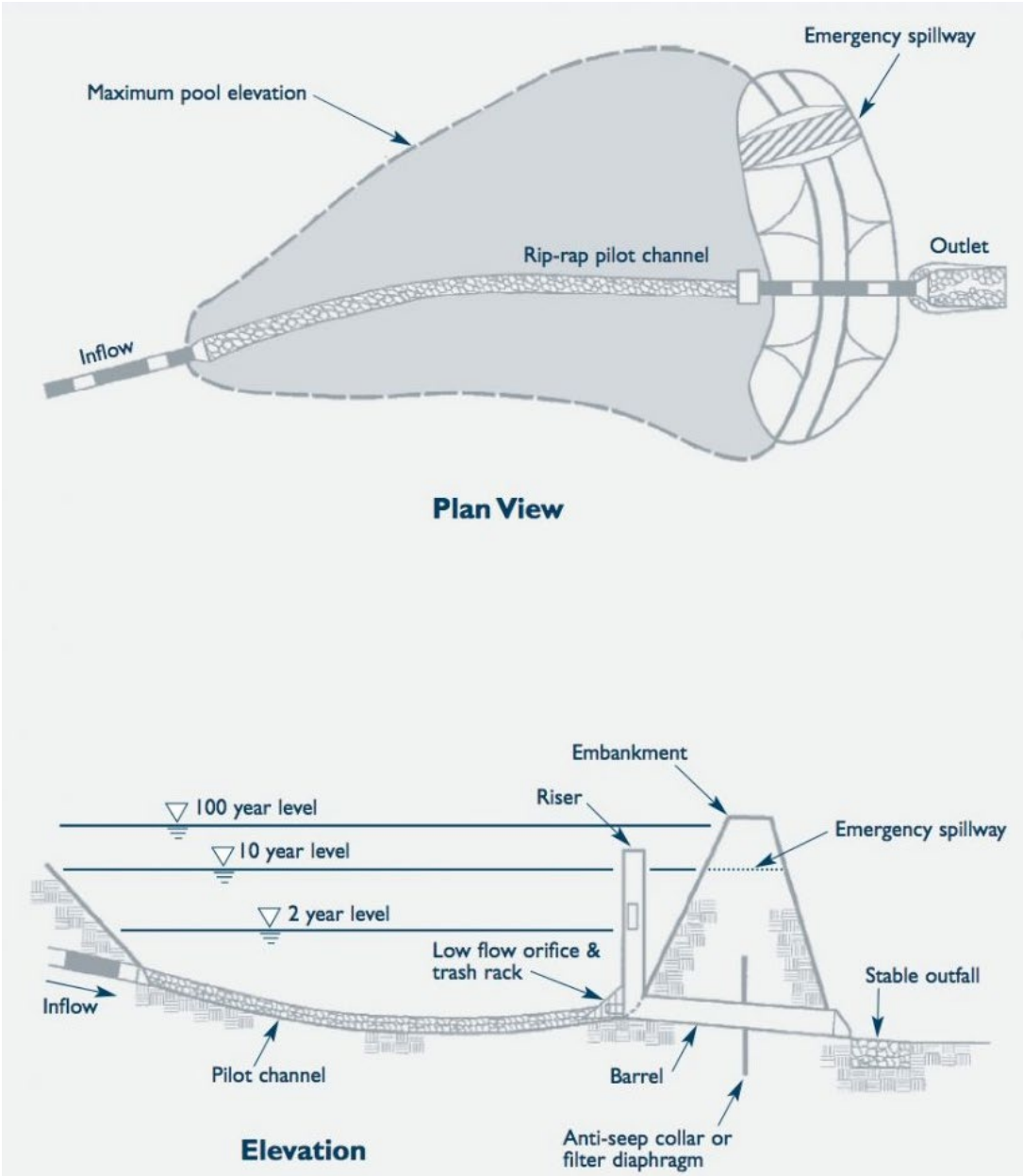

Figure 17. Detention Basin Design Example (Connecticut Department of Environmental Protection, 2004)

5.7 Road Raise

A road raise (elevation of the road surface) was considered for Summit Avenue as a way to increase the accessibility of the road during flood events. The road elevations used in design would be based on a certain percent AEP flood event. The frequency storm events examined were the 10%, 4%, and 1% AEP events; a frequency of 1% AEP was selected as the design frequency to develop quantities and costs for this study.

5.7 Low Impact Design

Low Impact Design (LID) measures were considered for the Piat Place portion of the study area. LID measures include (but are not limited to): rain gardens, non-potable rainwater harvesting, and permeable surfaces. These are considered interception actions that hold water in the area as opposed to moving it away. Detailed analysis of the capabilities of these measures were not within the scope of this study, but it is unlikely that these measures would sufficiently address flood risk reduction in the study area without additional infrastructure improvements. These measures can still be considered as a means of supplementing other flood risk reduction actions.

6.0 Nonstructural Measures

Nonstructural measures reduce flood damages without significantly altering the nature or extent of flooding. Damage reduction from nonstructural measures is accomplished by changing the use of the floodplains, or by altering existing uses to accommodate the flood hazard. Examples are flood proofing, relocation or elevation of structures, flood warning and preparedness systems (including associated emergency measures), and regulation of floodplain uses. The information in this section is provided for awareness as the sponsors look to future flood risk reduction planning efforts. Due to budget constraints of this study, no analysis was conducted on non-structural measures.

The following information on nonstructural measures was summarized from the August 2023 Cahokia Heights and East St. Louis Flood Hazard Analysis FPMS report; more information on each measure can be found in that report.

6.1 Dry Floodproofing

Dry floodproofing consists of modifying the structure to make it watertight below the level of floodwater. It can be applied to residential homes as well as commercial and industrial structures. Based on laboratory tests, a “conventional” built structure can generally be dry floodproofed up to 3 feet. Structural analysis of the strength of the walls would be required if a higher level of protection is desired. Making the structure watertight requires sealing the walls with waterproof coatings, impermeable membranes, or a supplemental layer of masonry or concrete. A sump pump and/or French drain system should also be installed as part of the measure. Closure panels are used at openings such as windows and doors. Dry floodproofing is not recommended for basements or crawlspaces due to excessive costs of reinforcing the exterior walls, preventing seepage, and the possibility of making the whole structure buoyant. Excessive floodwater velocities can damage the floodproofing materials, and unless a passive system is incorporated into the design, there may not be adequate time to install closures during a flash flood event. Extra caution should be taken when considering dry floodproofing for residential structures due to associated risks including installation challenges, structural integrity, passive or manual operation, life safety and flood insurance limitations. Figure 18 shows a diagram that summarizes the features of dry floodproofing.

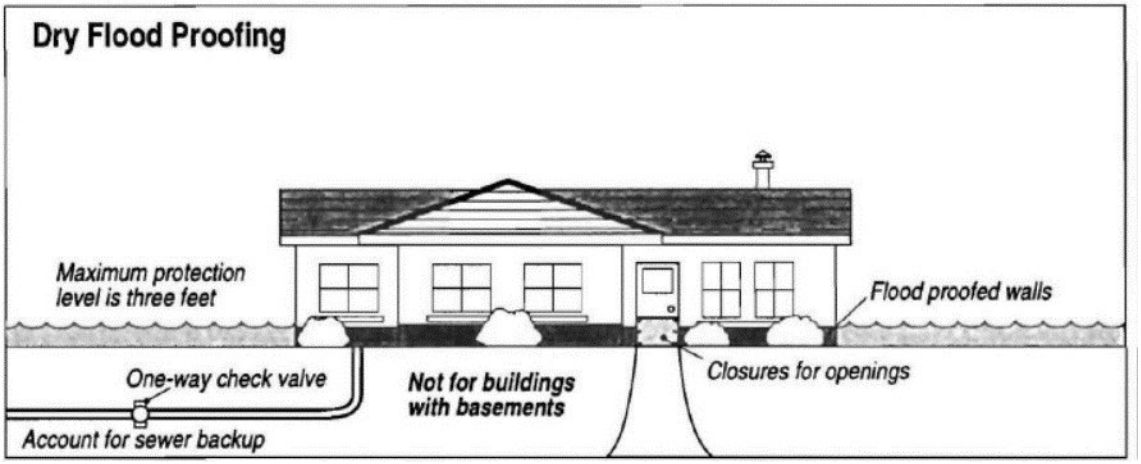

Figure 18. Dry Floodproofing Diagram

6.2 Wet Floodproofing

Wet floodproofing allows water to move into the enclosed parts of a structure (e.g., crawlspace or unoccupied area) and then move out when the water recedes. Construction materials and finishing materials need to be water resistant and all utilities must be elevated above the design flood elevation. Wet floodproofing is generally not applicable in large flood depths which could create large forces on interior walls, or in high velocity flows or flashy conditions which will not allow hydrodynamic pressures to equalize quickly. Wet floodproofing may be applied to commercial and industrial structures when combined with a flood warning and flood preparedness plan.

While not typically recommended, a residential structure can be wet floodproofed by being constructed and finished with water resistant materials as shown in Figure 19. Wet floodproofing is best suited for warehouse structures given the open floorplans that can be retrofitted to elevate high value machinery and inventory.

Figure 19. Wet Floodproofing Diagram

6.3 Elevation

Elevation (Figure 20) is the lifting of an existing structure to an elevation which is at least equal to or greater than the target flood elevation. The final elevation should place the first floor and associated ductwork, plumbing, mechanical and electrical systems above the design water surface elevation. In many elevation scenarios, the cost of elevating a structure an extra foot or two is less expensive than the first foot, due to the cost incurred for mobilizing equipment. Elevation can be performed using fill material, on extended foundation walls, on piers, posts, piles, and columns. Elevation is also a very successful measure for reinforced slab on grade structures. It is possible that the structure being assessed has an existing crawlspace or basement which would require abandoning to reduce future flood damages and to implement the structural supports for the elevation. Abandonment would consist of filling in the existing basement or crawlspace with clean run fill material and possibly capping with concrete. If the basement or crawlspace is abandoned, a small addition to the structure may need to be constructed on the side of the structure above the projected water surface elevation to contain utilities and mechanical equipment.

Figure 20. Elevation of a Residential Structure (Image: USACE)

6.4 Acquisition or Relocation

Structure acquisition (buyout) and relocations are mitigation strategies that remove the hazard from the floodplain, which is the only nonstructural alternative that permanently reduces flood risk.

6.4.1 Acquisition

Property acquisition consists of purchasing the at-risk structure and land that the structure sat upon. The structure is either demolished or is sold to others and relocated to a site outside of the floodplain. The land where the structure was originally located is purchased, becoming deed restricted to prevent development from occurring in the future, and becomes available for open space management. Property acquisition and structure removal are usually associated with frequently damaged structures. Implementation of other measures may be effective but if a structure is subject to repeated damage, this measure may represent the best alternative to eliminating risks to the property and residents in perpetuity. Acquisition and conversion to open space (Figure 21) reduces the opportunity for flood damages, causes no increase in flood potential elsewhere, and improves the natural riparian environment.

Figure 21. Acquisition (Buyout) of a Residential Structure and Conversion to Open Space

6.4.2 Relocation

Relocation requires physically moving the existing at-risk structure away from the flood hazard area to a location which is completely outside of the floodplain. The land where the structure had been originally located is purchased, becoming deed restricted to prevent development from occurring in the future, and becomes available for open space management. Relocation makes the most sense when at-risk structures can be relocated from a high flood risk area to a location of no flood risk. Where possible, relocating a structure within its existing community continues to support the local tax structure which could otherwise be adversely impacted by a significant number of acquisitions, and provides societal cohesion for the relocated residents. Permanent relocation and conversion to open space reduces the risk for flood damages, causes no increase in flood potential elsewhere, and improves the natural riparian environment.

6.5 Floodplain Mapping

Floodplain mapping is a non-physical, nonstructural measure that identifies flood risk, whether in the form of a map which portrays flood boundaries, or as an inundation map illustrating the depth of flooding. This measure is a significant tool when assessing and communicating flood risk.

6.6 Risk Communication

Risk communication develops and uses educational tools such as presentations, workshops, hand-outs, and pamphlets to communicate flood risk and flood risk reduction measures to government entities and floodplain occupants in an effort to reduce the consequences associated with flooding.

6.7 Land Use Regulations and Ordinances

Land use regulations are effective tools in reducing flood risk and flood damage. The principles of these tools are based in the National Flood Insurance Program (NFIP) which requires minimum standards of floodplain regulation. Floodplain ordinances restrict or control development that would significantly increase flood levels and are particularly restrictive in

floodway areas that include the stream and a high velocity flood area adjacent to the stream. Development is normally allowed in the floodplain area outside of the designated floodway (in the floodway fringe), but this development must be elevated on fill or by some other method so that it would not be damaged by a 1% AEP flood event. Communities and counties have the option of passing more restrictive floodplain ordinances or development regulations such as those that would earn points in FEMA's Community Rating System program. Floodplain ordinances that comply with the National Flood Insurance Program requirements are in effect in St. Clair County Flood Plain Code - Chapter 13.

7.0 Array of Alternatives Evaluated

For this study, alternatives were developed for four geographic areas (Figure 1) within the study area which are largely hydraulically independent based on sewer lines and ditches:

1. North of Summit Ave: Area north of Summit Ave, bounded to the south by Summit Ave, to the north by the railroad, to the east by Harding Ditch, and to the west by N 58th Street.
2. North of State Street: Area generally north of State Street, bounded to the south approximately by State Street, to the north by Summit Ave, to the east by Harding Ditch, and to the west by N 58th Street.
3. Piat Place Neighborhood: Area south of State Street bounded to the south by Whispering Willow Lake in Frank Holten State Park, to the north by State Street, to the east by Harding Ditch, and to the west by N 59th Street and an approximate northeast-southwest oriented boundary between N 59th Street and Whispering Willow Lake.
4. Harding Ditch: Length of Harding Ditch bounded by Schoenberger Creek to the north, Prairie Du Pont Creek to the south, and the levees on the east and west sides of the ditch.

Within these geographic areas, ten alternatives were developed using only structural measures described in Section 5.0. The alternatives were named based on their location and level of flood risk reduction, as shown in Table 3.

The alternatives were developed to provide varying levels of flood risk reduction using structural measures. The study team approached development of the alternatives based on expected flood risk reduction and cost. The Limited Flood Risk Reduction alternatives were developed to provide the least costly option that would have some risk reduction impact. For some areas, Intermediate Flood Risk Reduction alternatives were developed to provide a middle option in terms of cost and level of risk reduction. The Maximum Flood Risk Reduction alternatives were developed to provide the highest level of risk reduction.

For the Summit Ave and State Street geographic areas, the study team only developed a Limited and a Maximum Flood Risk Reduction alternative because fewer feasible alternative options were available, and to keep the overall number of alternatives in the study to a

manageable number per the scope of the effort. For the Piat Place geographic area, the study team developed two Intermediate alternatives and one Maximum Flood Risk Reduction alternative; while the team had anticipated there would be a Limited Flood Risk Reduction option at a lower cost, the lowest cost alternative, Alternative 5 – Piat A, had a similar intermediate level of flood risk reduction to the intermediate cost alternative, Alternative 6 – Piat B. For Harding Ditch, the study team developed Limited, Intermediate, and Maximum Flood Risk Reduction alternatives because each was a feasible option with a significantly different level of flood risk reduction and cost.

Table 3. Alternatives Evaluated

Alternative	**Short Description of Alternative**
1 – Summit A (Limited Flood Risk Reduction)	Least flood risk reduction, least costly alternative for the area north of Summit Ave. Provides limited flood risk reduction. Includes raising low sections of Summit Avenue.
2 – Summit B (Maximum Flood Risk Reduction)	Higher flood risk reduction, higher cost alternative for the area north of Summit Ave. Provides greater flood risk reduction. Includes installing culverts and storm sewer lines, cleaning out ditches, and adding a small pump station to move water into Harding Ditch during high stages.
3 – State Street A (Limited Flood Risk Reduction)	Least flood risk reduction, least costly alternative for the area north of State Street but south of Summit Ave. Provides limited flood risk reduction. Focusing on flooding in the vicinity of Interstate 255 and State Street, this alternative includes replacing and installing new inlets and storm sewer lines and adding a pump station to move water into Harding Ditch.
4 – State Street B (Maximum Flood Risk Reduction)	Higher flood risk reduction, higher cost alternative for the area north of State Street. Provides greater flood risk reduction. Includes replacing and installing new inlets and storm sewer line throughout the entire neighborhood north of State Street. Compared to Alternative 3, it proposes a larger pump station to move water from the proposed sewer system into Harding Ditch.
5 – Piat A (Intermediate Flood Risk Reduction A – South Ditch)	Intermediate flood risk reduction, least cost alternative for the Piat Place neighborhood. Increases the level of flood risk reduction to a similar level to Alternative 6. Includes, replacing storm sewer line and inlets and a new sewer line that directs flow south along 62nd Street to a new ditch that empties into Whispering Willow Lake in Frank Holten State Park.
6 – Piat B (Intermediate Flood Risk Reduction B – East Under Highway)	Intermediate flood risk reduction, intermediate cost alternative for the Piat Place neighborhood. Increases the level of flood risk reduction to a similar level to Alternative 5. Includes, replacing storm sewer line and inlets, and a new sewer line bored under Interstate 255 directing flow eastward to a new pump station that discharges into Harding Ditch.
7 – Piat C (Maximum Flood Risk Reduction)	Higher flood risk reduction, highest cost alternative for the Piat Place neighborhood. Provides the highest level of flood risk reduction. Has a similar sewer system in the Piat Place neighborhood as in Alternative 5. Includes, replacing storm sewer line and inlets and a new sewer line that directs flow south along 62nd Street to a new detention area or wetland that empties into Whispering Willow Lake in Frank Holten State Park.

Alternative	Short Description of Alternative
8 – Harding A (Limited Flood Risk Reduction)	Least flood risk reduction, least cost alternative for Harding Ditch. Provides limited flood risk reduction. Includes widening and deepening Harding Ditch, restoring it to approximately its design condition.
9 – Harding B (Intermediate Flood Risk Reduction)	Intermediate flood risk reduction, intermediate cost alternative for Harding Ditch. Increases the level of flood risk reduction. Includes widening and deepening Harding Ditch, restoring it to approximately its design condition, and adding one pump station at the existing south pump station location.
10 – Harding C (Maximum Flood Risk Reduction)	Highest flood risk reduction, highest cost alternative for Harding Ditch. Provides the highest level of flood risk reduction. Includes widening and deepening Harding Ditch, restoring it to approximately its design condition, and adding two pump stations at the existing south pump station location.

Note: Through implementation of the proposed measures, there is some level of risk of transferring flood impacts downstream, or between sub-watersheds. Preliminary analysis of increased discharges into Harding Ditch shows that for a uniform 72-hour duration storm event over the entire Harding Ditch watershed, peak storm sewer system discharges from the Piat Place study area will reach Harding Ditch before the Harding Ditch reaches its peak stages. Also, the addition of Piat Place drainage into Whispering Willow Lake is not anticipated to be an issue as impacts would be localized and minor.

7.1 North of Summit Ave

Table 4 shows a summary of the measures and alternatives developed for the area north of Summit Avenue, a low-lying area which includes wetlands. This area is entirely within the City of East St. Louis.

As noted by IDOT, conditions along Summit create a backup of water causing flooding and roadway closures on St. Clair Ave (north of the railroad at the north boundary of the study area). One of the major issues is dumping along Summit Ave; IDOT noted there is a lot of trash and debris that restricts flow from the area. IDOT noted that when they cleaned out debris in this area, the wetland water surface levels dropped significantly. So if the area was kept clean, the existing system may be sufficient for a lot of rain events.

Table 4. Measures and Alternatives Evaluated for area North of Summit Ave

Measures	Alternative 1: Summit A – Limited Flood Risk Reduction	Alternative 2: Summit B – Maximum Flood Risk Reduction
Raise low sections of Summit Avenue	X	
Install culverts to drain undrained areas west of wetland. Add or replace existing culverts		X
Put culverts in Summit Avenue under the Interstate 255 overpass		X
Re-establish ditch flow		X
Increase size of culvert into Harding Ditch. Add 30 cubic feet per second pump station		X

Alternative 1: Summit A – Limited Flood Risk Reduction

This alternative is the least costly alternative for the area north of Summit Ave but only provides a limited amount of flood risk reduction.

Alternative 1 includes one measure: raising certain low sections of the road. Options on the degree of road raise for Summit Avenue were assessed, dependent on which flood frequency water level the road is raised to. For the quantities and costs in this study, a road raise to the 1% AEP elevation was developed. Figure 22 shows the alternative components and the inundation during a 10% AEP event. The inundation may be compared with Figure 11 and Figure 12 to show the difference in water surface elevation from the 10% AEP event in the existing condition. Impacts due to the road raise should not impact structures in the area and are considered minor. Appendix A-Section 4.1.2 has more detailed information about the hydraulic modeling.

Alternative 2: Summit B – Maximum Flood Risk Reduction (N of Summit Ave)

This alternative is a higher cost alternative for the area north of Summit Ave and increases the level of flood risk reduction.

Alternative 2 includes installing or replacing culverts to drain undrained areas west of the wetland, installing culverts to convey water from wetland, installing storm sewer line under 255, replacing storm sewer line to Harding Ditch, and adding a small (30cfs) pump station with gravity outflow capability. Figure 23 shows the alternative components and the inundation during a 10% AEP event. The inundation may be compared with Figure 11 and Figure 12 to show the difference in water surface elevation from the 10% AEP event in the existing condition. Appendix A-Section 4.1.2 has more detailed information about the hydraulic modeling.

Alternative 2 shows a reduction in water surface levels in the wetland area between Interstate 255 and Kingshighway of approximately 0.2 feet for the 10% AEP storm event and 0.5 feet for the 1% AEP storm event. When stages are high in Harding Ditch, the north wetland area is unable to drain; to mitigate this, Alternative 2 includes a pump station at the culvert that drains the north wetland into Harding Ditch. Without it, there is no reduction in water level during the frequency storm events. The degree of reduction is determined by the capacity of the pump station. A sensitivity analysis would yield the optimum capacity for a target water surface level reduction. For Alternative 2, the goal was to alleviate the roadway flooding and improve environmental value.

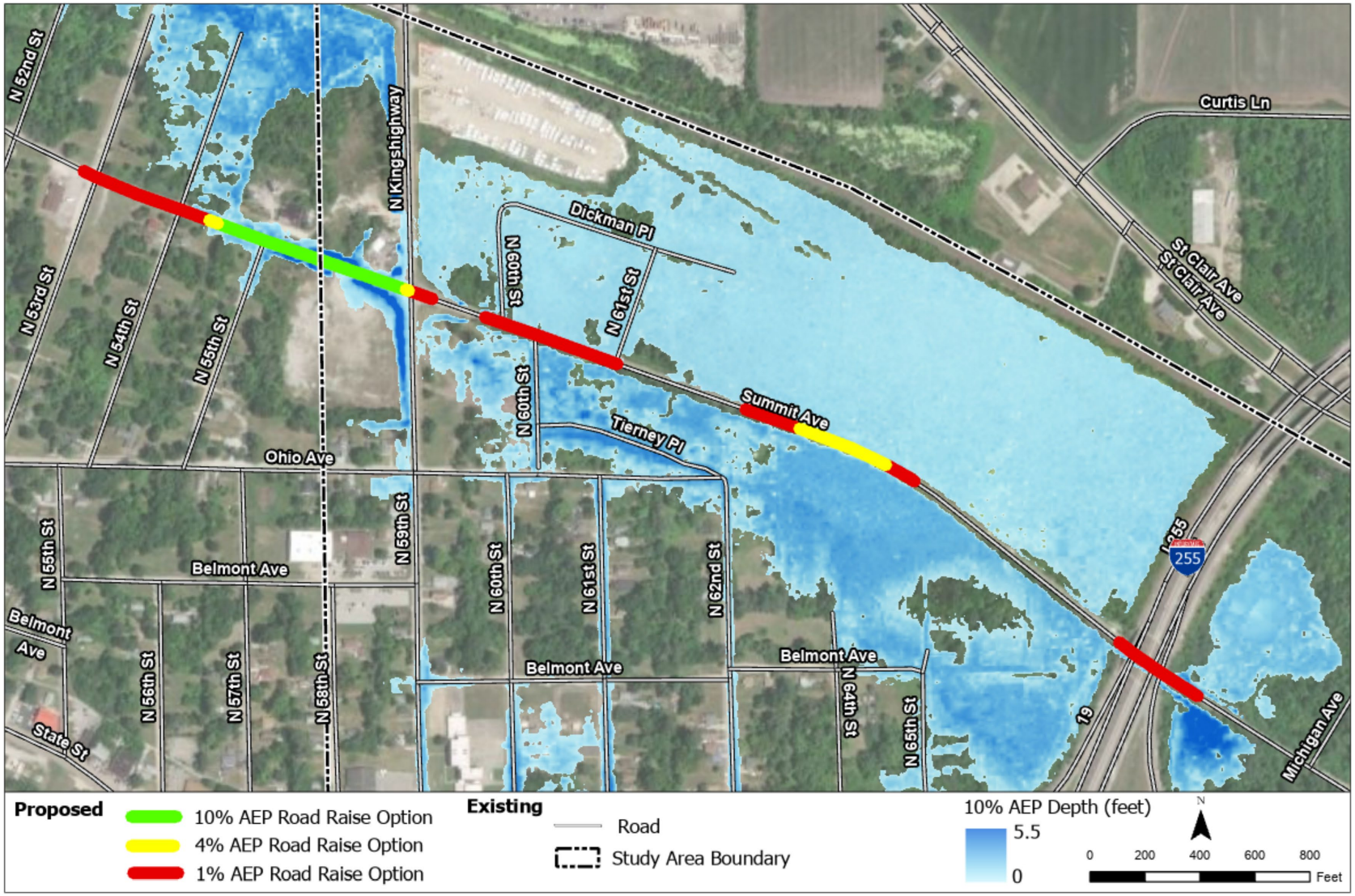

Figure 22. Alternative 1 – Summit A, with 10% AEP Inundation

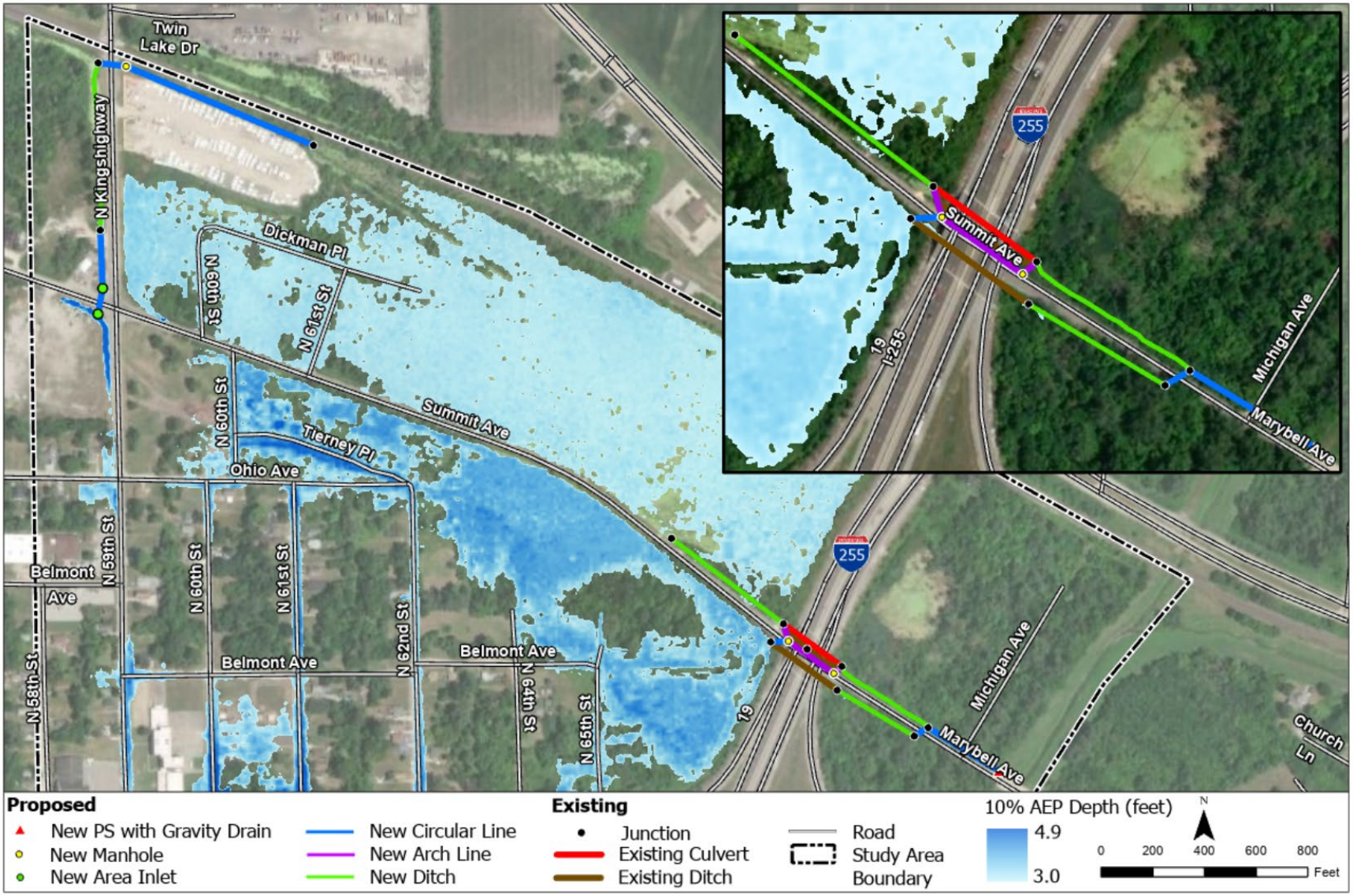

Figure 23. Alternative 2 – Summit B, with 10% AEP Inundation

7.2 North of State Street

Table 5 shows a summary of the measures and alternatives developed for the area north of State Street, a low-lying residential area within the City of East St. Louis. IDOT noted that the flooding issues at State St affect the closure of the I-255 exit ramp which causes issues for not only those that live in the area, but also those that travel through the area.

Table 5. Measures and Alternatives Evaluated for area North of State Street

Measures	Alternative 3: State Street A – Limited Flood Risk Reduction	Alternative 4: State Street B – Maximum Flood Risk Reduction
Fix or replace broken or blocked storm sewer inlets	X	X
Replace undersized storm sewer lines	X	
Run new storm sewer line down westbound lane of State Street. Add additional lines to new pump station	X	X
Add new storm sewer lines that pick up drainage from non-functional line to Wedgwood Pump Station		X
Add new storm sewer lines to drain 60th and 61st Street, including separating storm sewer from sanitary sewer system		X
Install 100 cfs pump station	X	
Install 175 cfs pump station		X

Alternative 3: State Street A – Limited Flood Risk Reduction

This alternative is the least costly alternative for the area north of State Street but only provides a limited amount of flood risk reduction and still leaves many structures at increased risk of inundation.

Alternative 3 includes replacing some inlets and sewer lines near the Interstate 255 interchange, adding a new main sewer line along State Street, adding new lines to a new pump station, and adding a 100 cfs pump station to bring the drainage into Harding Ditch. Figure 24 shows the alternative components and the inundation during a 10% AEP event. The inundation may be compared with Figure 11 and Figure 12 to show the difference in water surface elevation from the 10% AEP event in the existing condition. Appendix A-Section 4.1.3 has more detailed information about the hydraulic modeling.

For both Alternative 3 and Alternative 4 drainage is mostly contained underground during a 10% AEP storm event. There is some residual flooding in the area south of State Street between 63rd and Interstate 255. It is a low-lying area that is regularly inundated and to further alleviate flooding would require replacing a conduit that goes under Interstate 255. Since the area that is impacted is mostly vacant, the alternatives allow this area to continue to flood at the 10% AEP level. With the proposed modifications for Alternative 3, a water level reduction 0.44 feet is expected over this area during the 10% AEP storm event. During the 1% AEP storm event, water remains outside of residential structures.

Alternative 4: State Street B – Maximum Flood Risk Reduction

This alternative is a higher cost alternative for the area north of State Street and increases the level of flood risk reduction.

Alternative 4 includes replacing and adding some inlets and sewer lines throughout the entire area north of State Street. This addresses the line to the defunct Wedgwood Pump Station, lines connected to the sanitary sewer system and undrained areas. This alternative calls for new sewer lines to a 175 cfs pump station that moves the drainage into Harding Ditch. Figure 25 shows the alternative components and the inundation during a 10% AEP event. The inundation may be compared with Figure 11 and Figure 12 to show the difference in water surface elevation from the 10% AEP event in the existing condition. Appendix A-Section 4.1.3 has more detailed information about the hydraulic modeling.

Alternative 4 shows higher flood risk reduction compared to Alternative 3. For Alternative 4, the PCSWMM model shows that stormwater can be mostly contained underground during the 10% AEP storm event. The residual flooding in the area south of State Street between 63rd and Interstate 255 is reduced by 0.48 feet during the 10% AEP event. During the 1% AEP storm event water remains outside of residential structures.

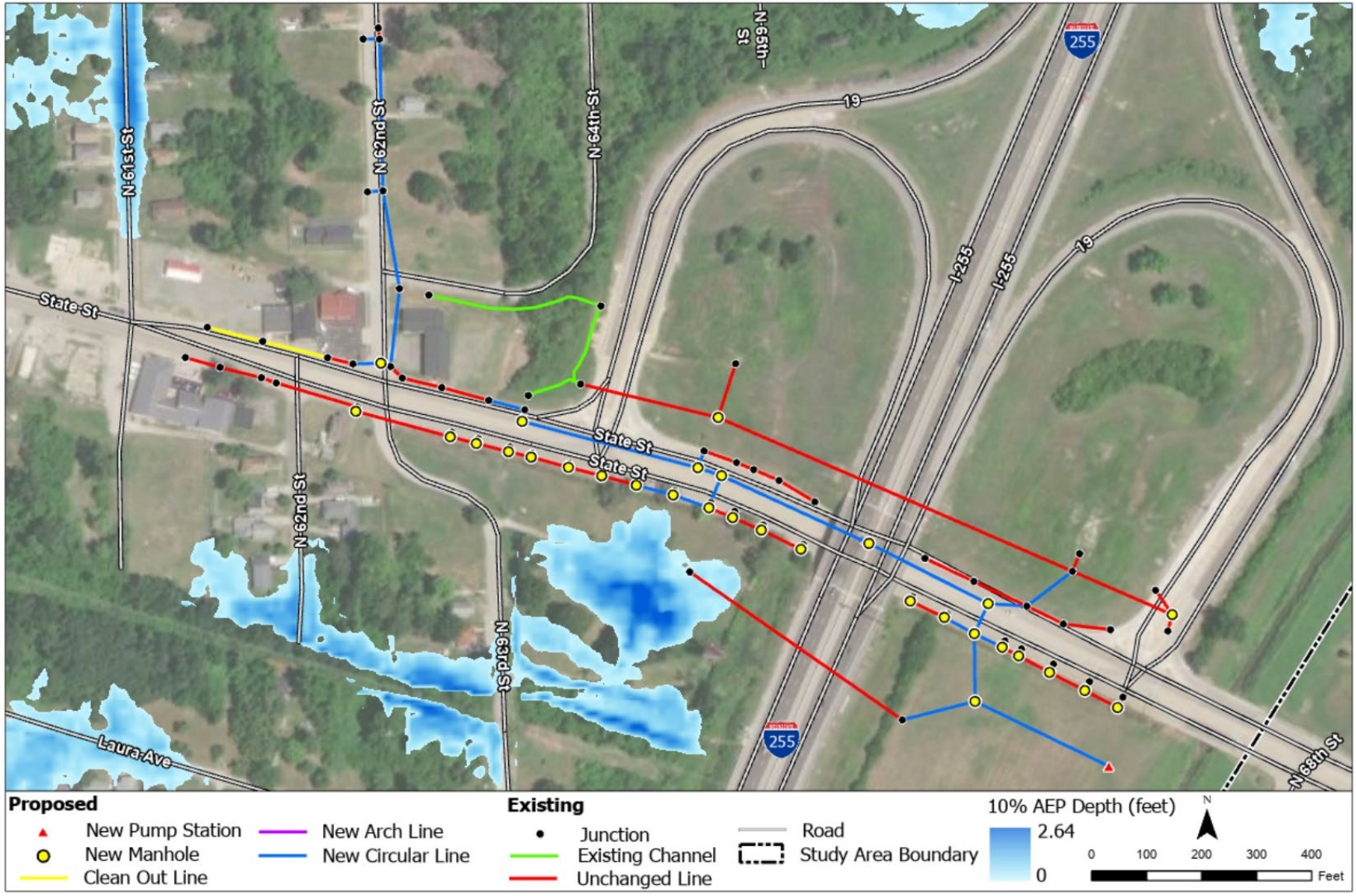

Figure 24. Alternative 3 – State Street A, with 10% AEP Inundation

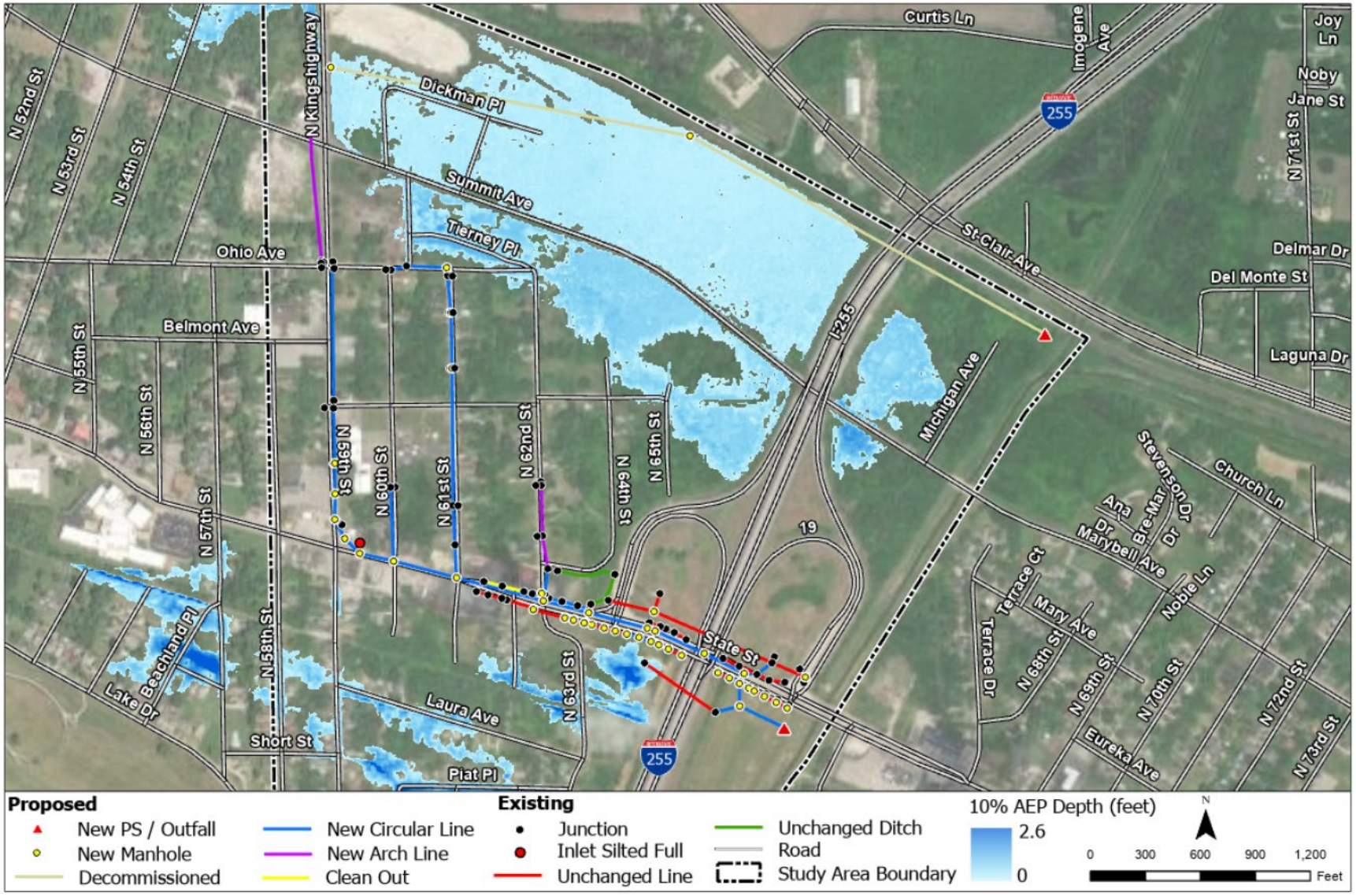

Figure 25. Alternative 4 – State Street B, with 10% AEP Inundation

7.3 Piat Place Neighborhood (south of State Street)

Table 6 shows a summary of the measures and alternatives developed for the Piat Place neighborhood located south of State Street, a low-lying residential area partially within the City of East St. Louis but mostly within the City of Cahokia Heights. As noted in Section 7.0, for the Piat Place geographic area, the study team developed two Intermediate and one Maximum Flood Risk Reduction alternative; while the team had anticipated there would be a Limited Flood Risk Reduction option at a lower cost, the lowest cost alternative, Alternative 5 – Piat A, had a similar intermediate level of flood risk reduction to the intermediate cost alternative, Alternative 6 – Piat B.

Table 6. Measures and Alternatives Evaluated for Piat Place Neighborhood

Measures	Alternative 5: Piat A (Intermediate Flood Risk Reduction A – South Ditch)	Alternative 6: Piat B (Intermediate Flood Risk Reduction B – East Under Highway)	Alternative 7: Piat C (Maximum Flood Risk Reduction)
Fix and replace broken or blocked storm sewer inlets	X	X	X
Replace undersized storm sewer lines	X	X	X
Replace ditches with storm sewer line fed by area inlets	X	X	X
New main storm sewer line south down 62nd Street	X		X
Bore main storm sewer line east under Interstate 255		X	
Add ditch through FHSP into Whispering Willow Lake	X		
Install 110 cfs pump station		X	
Create wetland in FHSP that drains to Whispering Willow Lake			X

Alternative 5: Piat A (Intermediate Flood Risk Reduction A – South Ditch)

This alternative is the least costly alternative for the Piat Place neighborhood and provides an intermediate amount of flood risk reduction similar to Alternative 6.

Alternative 5 focuses on improving drainage by moving the water south down 62nd Street and into a new ditch in Frank Holton State Park (FHSP) that empties into Whispering Willow Lake. Items addressed are repairing broken and blocked inlets, putting ditch flow into the sewer system, replacing undersized lines, adding an additional main line down 62nd Street, and adding a ditch that channels water through FHSP into Whispering Willows Lake. Figure 26 shows the alternative components and the inundation during a 10% AEP event. The inundation may be compared with Figure 11 and Figure 12 to show the difference in water surface elevation from the 10% AEP event in the existing condition. Appendix A-Section 4.1.4 has more detailed information about the hydraulic modeling.

For Alternative 5, the PCSWMM model shows that stormwater can be contained underground during the 10% AEP storm event. During the 1% AEP storm event, water remains outside of residential structures and in the streets.

IDNR provided comments stating preliminary support for studying features at Frank Holten State Park that could alleviate flooding in adjacent neighborhoods. However, they provided the following concerns that should be addressed if Alternative 5 moves forward to further design and construction.

1) A primary goal of IDNR is to promote outdoor recreation. The final design of a project should not increase flood impacts on IDNR property that could adversely affect the existing purpose of the park.
2) Project designs should be developed in coordination with IDNR to take into consideration future construction projects that IDNR is considering at Frank Holten State Park, such as additional walking trails. Final designs could incorporate these trails to surround the project.
3) Project designs should consider whether there are other projects such as pump stations that could be placed at Frank Holten State Park that could provide benefits to the park and the surrounding areas.
4) Long-term maintenance of the project is a concern; a final design should help reduce maintenance and costs, including trash or debris management/removal.

Alternative 6: Piat B (Intermediate Flood Risk Reduction B – East Under Highway)

This alternative is the higher cost alternative for the Piat Place neighborhood compared to Alternative 5. It provides an intermediate amount of flood risk reduction like Alternative 5.

Alternative 6 focuses on improving drainage by moving the water east under Interstate 255 to a pump station that empties into Harding Ditch. Items addressed are repairing broken and blocked inlets, putting ditch flow into the sewer system, replacing undersized lines, adding an additional main line under Interstate 255, and adding a 110 cfs pump station that empties water into Harding Ditch. Figure 27 shows the alternative components and the inundation during a 10% AEP event. The inundation may be compared with Figure 11 and Figure 12 to

show the difference in water surface elevation from the 10% AEP event in the existing condition. Appendix A-Section 4.1.4 has more detailed information about the hydraulic modeling.

Alternative 6 shows some flood risk reduction compared to the existing conditions inundation. For Alternative 6, the PCSWMM model shows that stormwater can be contained underground during the 10% AEP storm event. During the 1% AEP storm event, water remains outside of residential structures and in the streets.

IDOT noted that designs for this alternative would need to be developed further to determine the feasibility of boring under the interstate highway. They noted that such a project would not be cheap to construct and would likely be difficult to maintain; the new lines would likely need to be maintained by an entity besides IDOT.

The study team discussed other possible configurations of this alternative such as incorporating pump station inflow from the area north of State Street with Piat Place pump station inflow south of State Street to a single pump station, or to two new pump stations (one for East St. Louis and one for Cahokia Heights). These pump station configurations were not developed for analysis in this study due to the limited scope of the study and the anticipated higher cost of these configurations compared to the Alternative 6 cost developed.

Alternative 7: Piat C (Maximum Flood Risk Reduction)

This alternative is a high-cost alternative for the Piat Place neighborhood which increases the level of flood risk reduction compared to the Piat A and Piat B alternatives.

Alternative 7 focuses on improving drainage by moving the water south down 62nd Street and into a wetland in Frank Holton State Park (FHSP) that empties into Whispering Willow Lake. Items addressed are repairing broken and blocked inlets, putting ditch flow into the sewer system, replacing undersized lines, adding an additional main line down 62nd Street, and adding a wetland in FHSP that empties water into Whispering Willows Lake. IDNR has stated that they preliminarily prefer a wetland at this location rather than a detention basin (Alternative 6). Figure 28 shows the alternative components and the inundation during a 10% AEP event. The inundation may be compared with Figure 11 and Figure 12 to show the difference in water surface elevation from the 10% AEP event in the existing condition. Appendix A-Section 4.1.4 has more detailed information about the hydraulic modeling.

For Alternative 7, the PCSWMM model shows that stormwater can be contained underground during the 10% AEP storm event. During the 1% AEP storm event, water remains outside of residential structures and in the streets.

IDNR provided comments stating preliminary support for studying features at Frank Holten State Park that could alleviate flooding in adjacent neighborhoods. However, they provided the

following concerns that should be addressed if Alternative 7 moves forward to further design and construction.

1) A primary goal of IDNR is to promote outdoor recreation. The final design of a project should not increase flood impacts on IDNR property that could adversely affect the existing purpose of the park.
2) Project designs should be developed in coordination with IDNR to take into consideration future construction projects that IDNR is considering at Frank Holten State Park, such as additional walking trails. Final designs could incorporate these trails to surround the project.
3) Project designs should consider whether there are other projects such as pump stations that could be placed at Frank Holten State Park that could provide benefits to the park and the surrounding areas.
4) Long-term maintenance of the project is a concern; a final design should help reduce maintenance and costs, including trash or debris management/removal.
5) Project designs should consider additional beneficial uses at Frank Holten State Park, for example, whether a larger or deeper wetland or detention area could support additional fishing and provide the same or more storage than is currently being proposed.

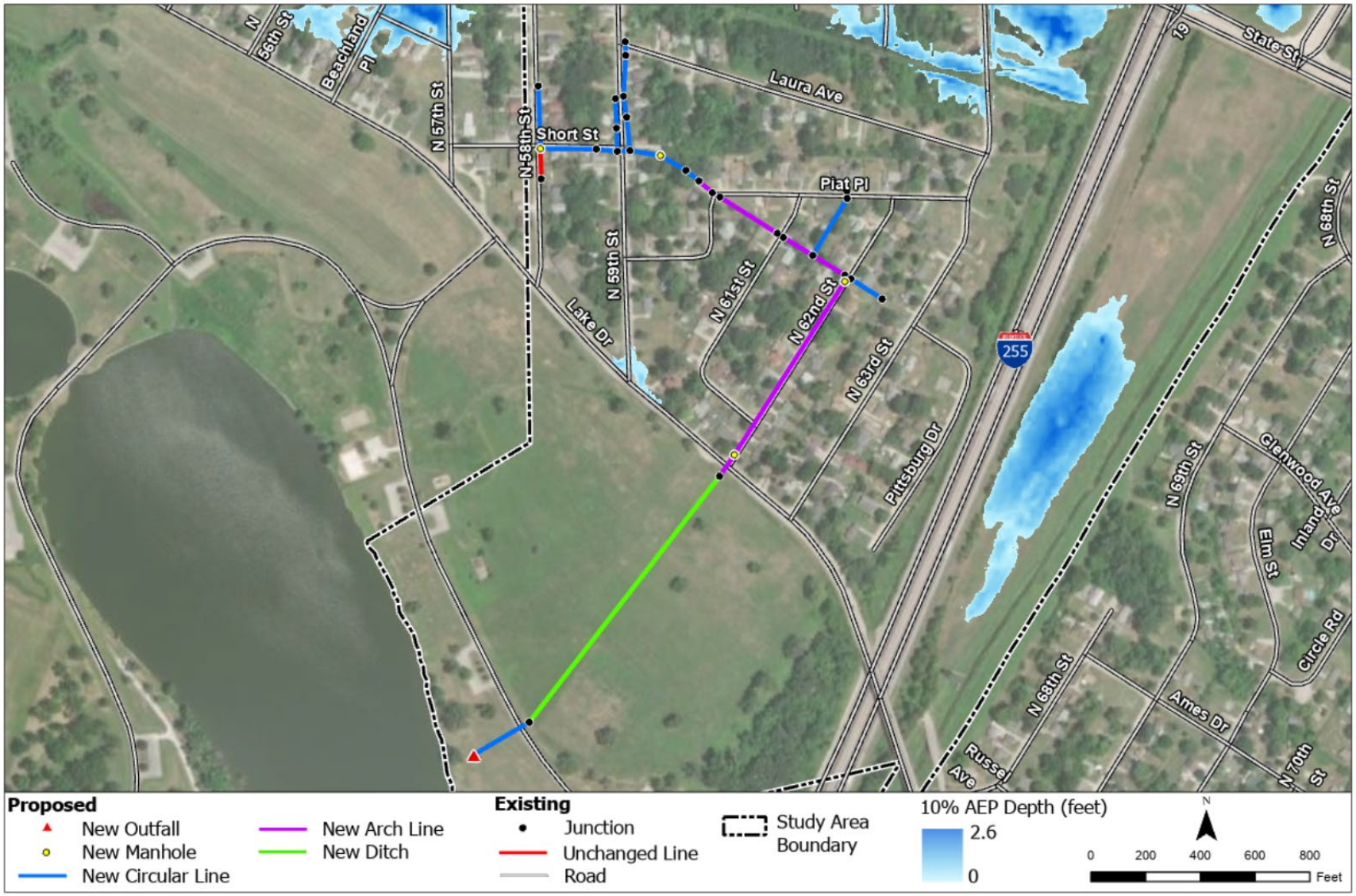

Figure 26. Alternative 5 – Piat A, with 10% AEP Inundation

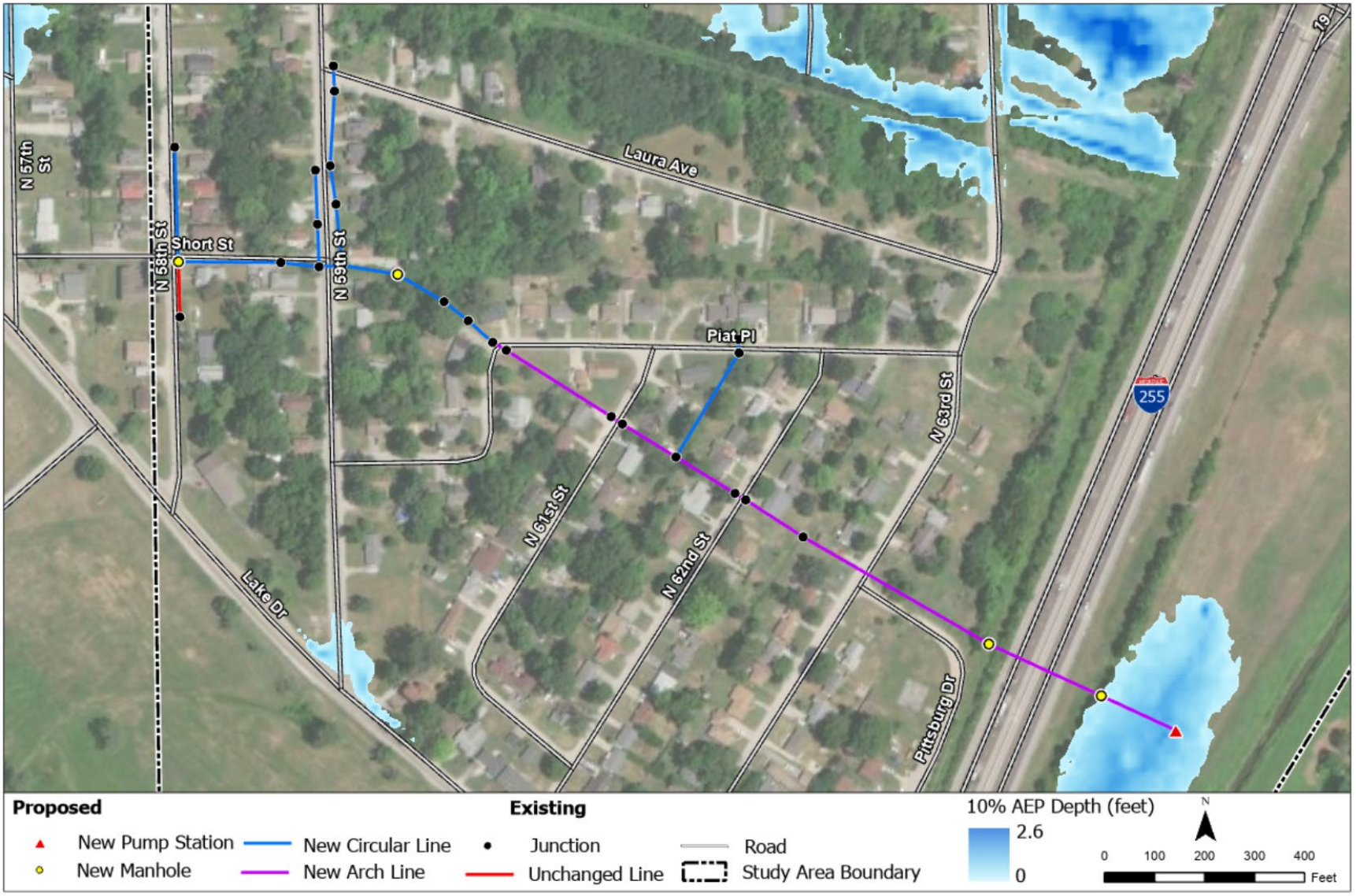

Figure 27. Alternative 6 – Piat B, with 10% AEP Inundation

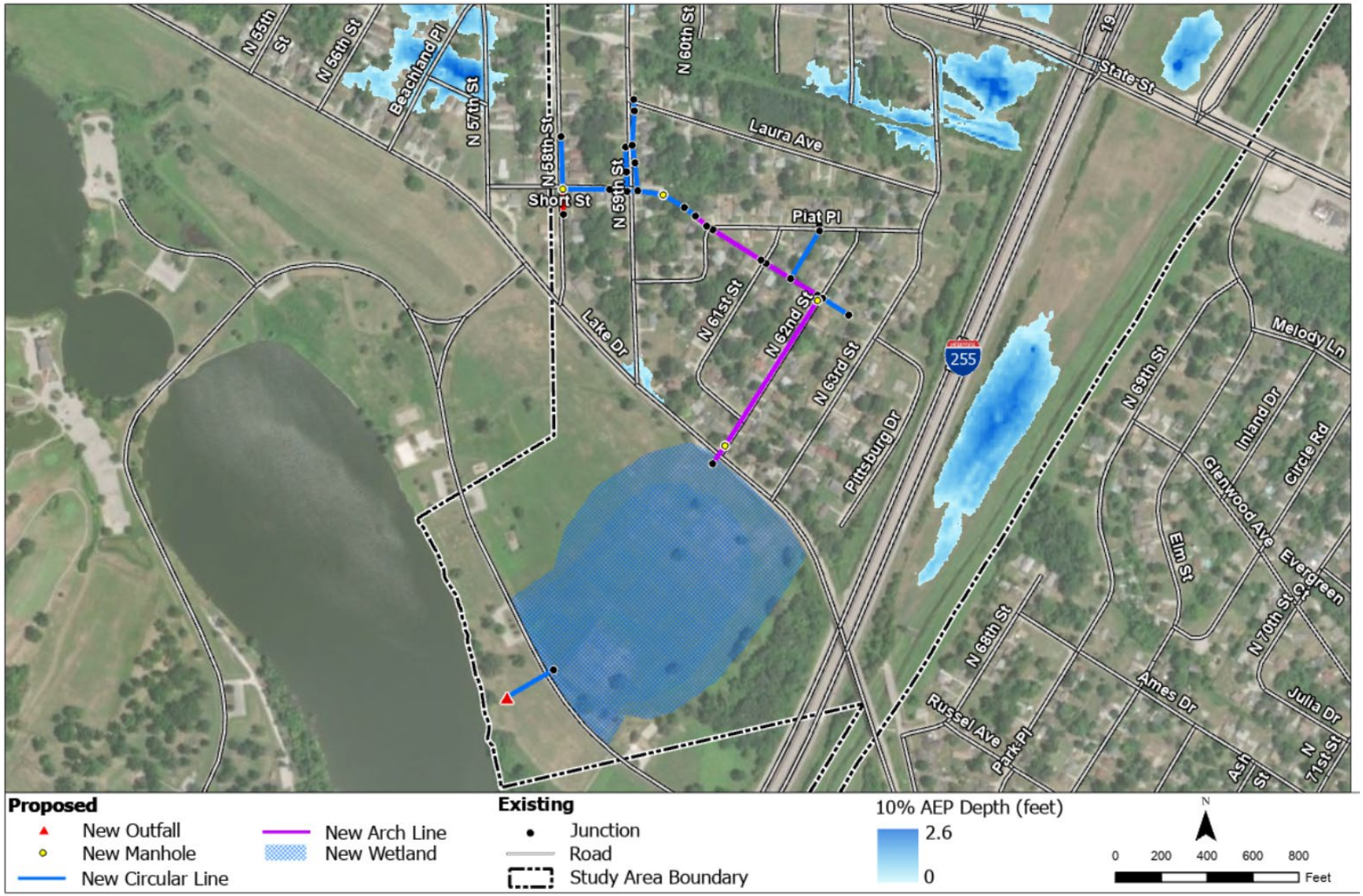

Figure 28. Alternative 7 – Piat C, with 10% AEP Inundation

7.4 Harding Ditch

Table 7 shows a summary of the measures and alternatives developed for Harding Ditch between its confluence with Schoenberger Creek and its outfall into Prairie Du Pont Creek at the south pump station.

Potential future studies for the American Bottom area that include Harding Ditch may develop different solutions to these three alternatives. For example, the watershed of the entire American Bottom area is larger than the watershed evaluated for this FPMS study, so a larger study might recommend more/larger pumps. USACE and its partners should coordinate closely on development of future studies to ensure congruence on solutions implemented.

Table 7. Measures and Alternatives Evaluated for Harding Ditch

Measures	Alternative 8: Harding A (Limited Flood Risk Reduction)	Alternative 9: Harding B (Intermediate Flood Risk Reduction)	Alternative 10: Harding C (Maximum Flood Risk Reduction)
Dredge and widen Harding Ditch from Schoenberger Creek to south pump station	X	X	X
Add one 131.5 cfs pump to south pump station		X	
Add two 131.5 cfs pumps to south pump station			X

Alternative 8: Harding A – Limited Flood Risk Reduction

This alternative is the least costly alternative for Harding Ditch and provides limited flood risk reduction.

Alternative 8 includes widening and deepening Harding Ditch, restoring it to approximately its design condition. Deepening would largely be done south of Canal 1. The ditch was assumed to be widened to a bottom width of 25 feet in the upper section (north of Canal 1) and widened to a bottom width of 30 feet in the lower section (south of Canal 1 to the south pump station). 3:1 side slopes were assumed. Figure 29 shows the widening at the upper and lower sections of Harding Ditch. Appendix A-Section 4.2.6 has more detailed information about the hydraulic modeling.

For the widening measure as compared to the current conditions, the magnitude of stage reduction downstream of Canal 1 for the 10% AEP storm event is an average of 2.0 feet. Upstream of Canal 1 the average reduction is 1.5 feet. For the 1% AEP storm event, the average reduction downstream of Canal 1 is 1.6 feet. Upstream of Canal 1 the average is reduction is 1.0 feet. From the figures it can be seen that channel widening does bring the current condition water surface below the 2012 model computed water surface profile.

Alternative 9: Harding A – Intermediate Flood Risk Reduction

This alternative is an intermediate cost alternative for Harding Ditch and increases the level of flood risk reduction.

Alternative 9 includes widening and deepening Harding Ditch, restoring it to approximately its design condition, and adding one pump station at the existing south pump station location. Deepening would largely be done south of Canal 1. The ditch was assumed to be widened to a bottom width of 25 feet in the upper section (north of Canal 1) and widened to a bottom width of 30 feet in the lower section (south of Canal 1 to the south pump station). 3:1 side slopes were assumed. Figure 29 shows the widening at the upper and lower sections of Harding Ditch, and the south pump station location where a new pump is proposed for this alternative. Appendix A has more detailed information about the modeling done.

Water surface profiles for the pump addition for the 10% AEP and 1% AEP storm event were computed. The magnitude of stage reduction downstream of Canal 1 for the 10% AEP storm event is an average of 0.6 feet and 1.2 feet, respectively. Upstream of Canal 1 the average reduction is 1.5 feet for this alternative (the same as for the two-pump alternative). For the 1% AEP storm event, the average reduction with the addition of one pump downstream of Canal 1 is 0.3 feet. Upstream of Canal 1 the average reduction is 1.0 feet. The main reason for the same difference between one and two pump additions upstream of Canal 1, is that the effects of backwater from the south pump station only propagate up to Canal 1. The water surface reduction in that upstream reach is due to the channel widening. The reductions due to the pump station changes is only in the backwater zone.

Alternative 10: Harding C – Maximum Flood Risk Reduction

This alternative is the highest cost alternative for Harding Ditch with the highest level of flood risk reduction.

Alternative 10 includes widening and deepening Harding Ditch, restoring it to approximately its design condition, and adding two pump stations at the existing south pump station location. Deepening would largely be done south of Highway 163. The ditch was assumed to be widened to a bottom width of 25 feet in the upper section (north of Highway 163) and widened to a bottom width of 30 feet in the lower section (south of Highway 163 to the south pump station). 3:1 side slopes were assumed. Figure 29 shows the widening at the upper and lower sections of Harding Ditch, and the south pump station location where two new pumps are proposed for this alternative. Appendix A has more detailed information about the modeling done.

Water surface profiles for the pump addition for the 10% AEP and 1% AEP storm event were computed. The magnitude of stage reduction downstream of Canal 1 for the 10% AEP storm

event is an average of 0.6 feet and 1.2 feet, respectively. Upstream of Canal 1 the average reduction is 1.5 feet for this alternative (the same as for the one-pump alternative). For the 1% AEP storm event, the average reduction with the addition of two pumps downstream of Canal 1 is 0.5 feet. Upstream of Canal 1 the average reduction is 1.0 feet. The main reason for the same difference between one and two pump additions upstream of Canal 1, is that the effects of backwater from the South pump station only propagate up to Canal 1. The water surface reduction in that upstream reach is due to the channel widening. The reductions due to the pump station changes are only in the backwater zone.

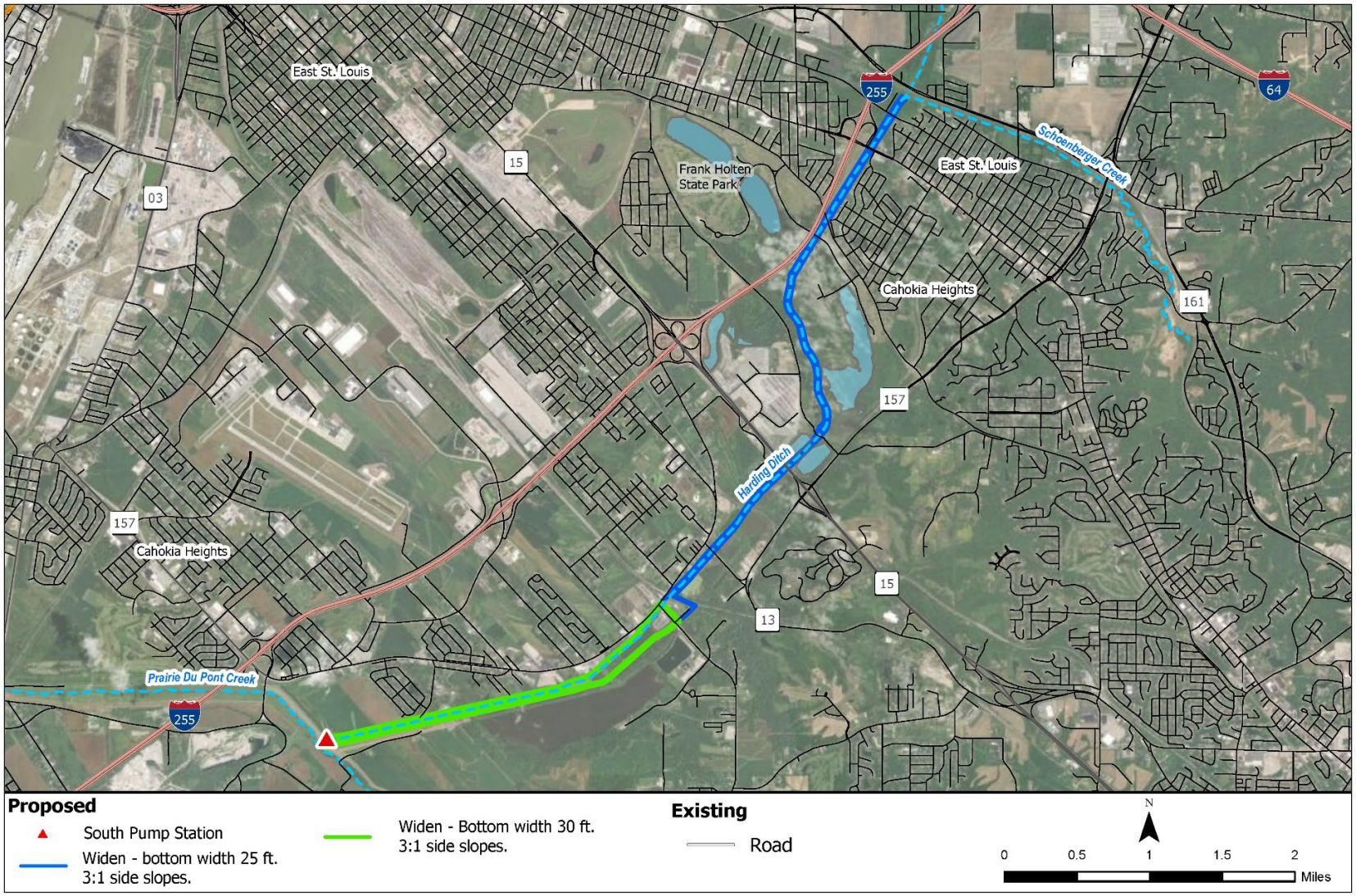

Figure 29. Alternatives 8, 9, and 10 – Harding A, B, and C

8.0 Cost Estimates

8.1 Alternative Cost Estimates

The tables below (Table 8) summarize the rough order of magnitude (ROM) cost estimates for each alternative. A more detailed summary is provided in Appendix C. A contingency of 35% is included in the construction costs. Engineering and Design (E&D) costs were estimated at 18% of construction costs. Additionally, Construction Management (CM) costs were estimated at 10% of construction costs. Development of real estate interests costs, environmental mitigation costs, and life cycle operation and maintenance (O&M) costs was outside of the scope of this study. These costs should be developed and carefully evaluated prior to selecting a course of action for implementation. Disposal at a landfill was assumed for dredged material from Harding Ditch. See Appendix B – Civil Engineering for further information on quantity determinations and assumptions.

Table 8. Alternatives Costs Tables (Construction Costs Only)

E&D = Engineering and Design. CM = Construction Management. Costs are in FY24 dollars. Costs do not include real estate interests, environmental mitigation, or O&M costs.

North of Summit Ave

	Construction	E&D	CM	Total Cost
Alt. 1 - Summit A	$748,000	$130,000	$70,000	$948,000
Alt. 2 - Summit B	$7,927,000	$1,430,000	$790,000	$10,147,000

North of State Street

	Construction	E&D	CM	Total Cost
Alt. 3 - State St. A	$17,453,000	$3,140,000	$1,750,000	$22,343,000
Alt. 4 - State St. B	$27,447,000	$4,940,000	$2,740,000	$35,127,000

Piat Place Neighborhood

	Construction	E&D	CM	Total Cost
Alt. 5 - Piat A	$9,455,000	$1,700,000	$950,000	$12,105,000
Alt. 6 - Piat B	$22,556,000	$4,060,000	$2,260,000	$28,876,000
Alt. 7 - Piat C	$24,708,000	$4,450,000	$2,470,000	$31,628,000

Harding Ditch

	Construction	E&D	CM	Total Cost
Alt. 8 - Harding A	$21,352,000	$3,840,000	$2,140,000	$27,332,000
Alt. 9 - Harding B	$35,050,000	$6,310,000	$3,510,000	$44,870,000
Alt. 10 - Harding C	$48,750,000	$8,780,000	$4,880,000	$62,410,000

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