US Army Corps of Engineers ®
St Louis District

GENERAL REEVALUATION REPORT (GRR)

SAINTE GENEVIEVE, MISSOURI - 075453

OCTOBER 2016

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT CORPS OF ENGINEERS
1222 SPRUCE STREET
ST. LOUIS, MISSOURI 63103-2833

NOV 15 2016

REPLY TO
ATTENTION OF:

Dear Sir or Madam:

The U.S. Army Corps of Engineers St. Louis District has prepared a draft report entitled "Sainte Genevieve, Missouri, Draft General Reevaluation Report". You are receiving this letter because you may be interested in this project. However, no action is required on your part. The project is in Sainte Genevieve, Missouri. The draft report reconsiders the plans recommended by the 1984 Feasibility Report and authorized by Congress in the Water Resources Development Act of 1986 (Public Law 99-662). The report considers alternative solutions to flooding along North and South Gabouri Creeks and presents tentatively selected plans. The report also revises the authorized recreation plan.

The report also serves to notify the public of the environmental effects of the project as required by law. These environmental effects are summarized in the report's Draft Finding of No Significant Impact(s) (FONSI), which is contained in the draft report and is unsigned. A signed FONSI is required before project construction can occur. The FONSI will not be signed into effect until all comments received as a result of this public review have been carefully considered.

An electronic version of the draft report, titled "Sainte Genevieve, Missouri, Draft General Reevaluation Report" is available online at the link below or you may request a copy be mailed to you either as a paper document or a CD-ROM.

http://www.mvs.usace.army.mil/Portals/54/docs/pm/Reports/EA/SteGen/SteGenevieveGeneralReevaluationdraftmainreportOctober2016.pdf

You are welcome to comment on the content of the draft report. For questions, comments, or to request a printed copy or CD-ROM please contact Mr. Dennis Gilmore of our Project Development Branch: telephone 314-331-8108, facsimile number 314-331-8041, or email at dennis.w.gilmore@usace.army.mil. Written comments may be sent to our address below.

The comment period runs from November 15, 2016 through December 16, 2016. A public open house will be held on November 22, 2016 at the Sainte Genevieve City Hall, 165 S. 4th Street, Ste. Genevieve, Missouri 63670 from 6:30 to 8:00 PM.

Address:
US Army Corps of Engineers, St. Louis District
ATTN: Project Management (Gilmore)
1222 Spruce St.
St. Louis, MO 63103-2833

Sincerely,

Dennis W. Gilmore
Project Manager

EXECUTIVE SUMMARY

This General Reevaluation Report (GRR) re-examines the remaining unconstructed features of the authorized project for flood risk management for the historically-significant city of Sainte Genevieve, Missouri. The authorized project is documented in the 1984 Feasibility Report (Ste. Genevieve, Missouri, Feasibility Report, Flood Control Study for Historic Ste. Genevieve - June 1984). The primary purpose of the GRR is to re-examine various alternatives (including the authorized plan) for providing flood damage reduction, identify the optimal plan, and provide recommendations, giving consideration to each plan's economic, environmental, and social impacts. The GRR will serve as the decision document required to execute a Project Partnership Agreement for construction.

The Ste. Genevieve, Missouri, flood control project was authorized by the Water Resources Development Act of 1986. The language of the act states, in part, "Congress finds that, in view of the historic preservation benefits resulting from the project, the overall benefits of the project exceed the costs of the project." The purposes of the project are to reduce flood damages to the city of Ste. Genevieve and its nationally-recognized historic resources from Mississippi River flooding, to reduce flood damages along North and South Gabouri (pronounced gá-bur-ee) Creeks, and to provide outdoor recreation opportunities. A levee and pump station which provide flood damage reduction against the 0.2% frequency flood (500-year event) and have been constructed to address the Mississippi River flooding problem. The authorized plans for both creeks involved channel widening, bridge replacements, construction of small levees, and some bank armoring via rip rap and gabions. The authorized recreation plan included trails, ball diamonds and picnic tables to be located on lands purchased for the Ste. Genevieve flood damage reduction project.

When design and construction funds were first received in 1995, priority was given to construction of the Mississippi River levee and pump station and efforts on the other features were delayed until levee construction was nearing completion in 1999. At that time, it became apparent that the authorized plan for the creeks would need to be re-examined, given the physical and social changes that had occurred since the Feasibility Report was completed in 1984.

Subsequent to project authorization, structure buyouts following the 1993 flood (by the State of Missouri and by the Federal Emergency Management Agency) greatly reduced the number of structures being damaged by flash flooding along the two creeks. In addition, the social climate regarding environmental effects of projects has changed since the project was authorized. These two changes resulted in a need to re-examine the authorized plans for those parts of the project which address creek flooding.

During this study, a number of structural and non-structural measures were developed to address flooding damages along both creeks. Measures were combined into alternative plans and screened down to 6 plans (three for each creek) which were then evaluated and compared. The creeks are hydrologically and hydraulically independent and, therefore, each creek was evaluated independently of the other, resulting in two tentatively selected plans. Once those two plans were identified, a recreation plan was developed to provide recreation facilities on lands acquired for the project.

After careful consideration of many alternatives, this report tentatively recommends that non-structural measures be implemented for both North and South Gabouri Creeks. Non-structural measures would be the most cost-effective, environmentally-conscious, and historically-sensitive actions to address damages caused by creek flooding. The total first cost of implementing the non-structural alternatives is $1,095,000 (October 2015 price levels).

The tentatively selected recreation plan includes a hiking/biking trail on top of the Mississippi River Levee, and related facilities. The total first cost of the tentatively selected recreation plan is $535,000 (October 2015 price levels) and the benefit-to-cost ratio is 1.1.

It is recommended that this project proceed with design and construction at a total first cost of $1,630,000. The project sponsor will be the City of Sainte Genevieve, Missouri, which is fully supportive of the tentatively selected plan and capable of fulfilling all of the non-Federal sponsor's obligations.

SAINTE GENEVIEVE, MISSOURI
GENERAL REEVALUATION REPORT

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1. Project Authority

The Ste. Genevieve, Missouri, flood control project was authorized by the Water Resources Development Act of 1986 (Public Law 99-662), which was signed by the President on November 17, 1986. The authorized project costs are at October 1985 price levels. The language in the act is as follows:

> TITLE IV – FLOOD CONTROL
>
> SEC. 401. AUTHORIZATION OF PROJECTS
>
> (a) AUTHORIZATION OF CONSTRUCTION. – The following works of improvement for the control of destructive floodwaters are adopted and authorized to be prosecuted by the Secretary substantially in accordance with the plans and subject to the conditions recommended in the respective reports designated in this subsection, except as otherwise provided in this subsection:
>
> STE. GENEVIEVE, MISSOURI
>
> The project for flood control, Ste. Genevieve, Missouri: Report of the Board of Engineers for Rivers and Harbors, dated April 16, 1985, at a total costs of $34,400,000, with an estimated first Federal cost of $25,800,000 and an estimated first non-Federal cost of $8,600,000. Congress finds that, in view of the historic preservation benefits resulting from the project, the overall benefits of the project exceed the costs of the project.

The project's cost sharing requirements were established by the Water Resources Development Act of 1986 which, in general, requires a minimum non-Federal contribution of 25% and a maximum contribution of 50%. Additional information about the cost sharing requirements can be found in Section 11.4 of this report.

The purposes of the project are to reduce flood damages to the city of Ste. Genevieve and its nationally-recognized historic resource from Mississippi River flooding, to reduce flood damages along North and South Gabouri (pronounced ga-bur-ee) Creeks, and to provide outdoor recreation opportunities. The authorized project is documented in the 1984 Feasibility Report (Ste. Genevieve, Missouri, Flood Control Study for Historic Ste. Genevieve). This study re-examines portions of the authorized project.

2. Study Purpose and Scope

The City of Ste. Genevieve is located in Ste. Genevieve County in southeastern Missouri. It is on the edge of the Mississippi River floodplain, on the west bank of the river, at approximately river mile 123 above the mouth of the Ohio River. The nearest major metropolitan area is the City of St. Louis, Missouri, approximately 46 miles north of the project.

The purpose of the Ste. Genevieve project is to reduce flood damages to the historic city of Ste. Genevieve which result from Mississippi River flooding and flash flooding on North and South Gabouri Creeks. The construction of recreational features on project lands is another project purpose.

The purpose of this general reevaluation study is to re-examine the unconstructed portions of the authorized project in light of physical and social changes that have occurred since its authorization.

In 1986, Congress authorized the project described in the 1984 Feasibility Report. This included the construction of an urban-level (0.2% frequency or 500-year) levee system to provide flood damage reduction from the Mississippi River (now complete), channelization of nearly two miles of North and South Gabouri Creeks to achieve flood damage reduction for a 4% frequency event (a 25-year flood), and recreation features on lands purchased for project features. Construction funds were first received in 1995. The non-Federal funding comes from a combination of historical preservation grants and a city sales tax.

When design and construction work was initiated, the City's highest priority was the completion of the Mississippi River levee. The remaining work for the creeks and recreation was postponed until construction of the Mississippi River levee was near completion in 1999. At that time, during review and analysis of the work planned for the creeks, it was determined that the authorized plan would need to be re-examined, given the physical and social changes that had occurred since the 1984 Feasibility report.

The physical change was a result of the flood of 1993 which devastated the City of Ste Genevieve and resulted in the loss of a significant number of structures, including historic structures in the vicinity of the two creeks. Due to the adverse impacts of the 1993 flood, the re-evaluation of the project features now include two additional focus areas: 1) additional space available along the creeks for consideration of additional structural features, and 2) protection of the remaining historic structures.

Additionally, the social climate regarding channelization of streams has changed significantly since the project was authorized. Channelization of streams is not as acceptable to State and Federal agencies as it was in 1984 and current regulations require significant levels of mitigation to compensate for the environmental impacts.

The purpose of the General Reevaluation study is to re-examine the authorized plans for North and South Gabouri Creeks, consider opportunities for alternative plans, and determine the most cost-effective, environmentally-conscious, and historically-sensitive plan. Once the authorized plans for the Creeks have been affirmed or modified, this study re-examines the authorized recreation plan to see if it also needs to be modified in accordance with the creek plans and in consideration of the current recreation needs of the City of Sainte Genevieve.

3. Prior Studies and Reports

- The results of the feasibility study, previous investigations, and reports were documented in the Ste. Genevieve, Missouri Feasibility Report, including an Environmental Impact Statement, dated June 1984. The report was prepared by the St. Louis District, U.S. Army Corps of Engineers, and included the District Engineer's finding that "no Federal action by the Corps of Engineers is warranted when examined under the National Economic Development criteria."

- An Addendum to the 1984 Feasibility Report was prepared by the St. Louis District in March 1985. It provided additional information on the historic resource and several other aspects of the project.

- A Supplemental Report was prepared by the Lower Mississippi Valley Division of the Corps of Engineers in March 1985. In it, the Division Engineer concurs with the District Engineer's recommendation that Plan 1, for flood protection and related purposes in the historic community of Ste. Genevieve, Missouri, be authorized for implementation as a Federal project.

  Plan 1 included the following features:

  Part 1 (Complete): Levee and interior drainage features that include 17,600 feet (3.3 miles) of earthen levee, 3 closure structures, one 650 cubic feet per second (cfs) pump station, 3 gravity drains, and approximately 1 mile of channel modifications and ditching (to convey interior water to the gravity drains and pump station).

  Parts 2 and 3 (Current GRR Effort): 1.85 miles of channel modifications on North and South Gabouri Creeks, two small levees totaling 1800 feet, six bridge replacements, one bridge removal, and two bridge modifications.

  Part 4 (Current GRR Effort): Trails, ball diamonds, picnic tables, parking lots, bike racks and plantings.

- In a report to the Chief of Engineers dated 16 April 1985, the Board of Engineers of Rivers and Harbors recommended "that improvements for flood control in Ste. Genevieve, Missouri, be authorized for construction generally in accordance with the plan and recommendations of the Division Engineer…" Congress referred to the Board of Engineers report when authorizing the project.

- The Ste. Genevieve, Missouri, Flood Control Project Design Memorandum, dated October 1994, indicates that due to the FEMA buyouts following the flood of 1993, "the flood control improvements along North and South Gabouri Creeks may be modified or not constructed at all due to the buyout plan." It also says that the buyouts should be completed sometime in 1995 and, due to the uncertainty in the number of buyouts that would be accepted, the creek plans "have not been redesigned for this Design Memorandum, and they are not scheduled at this time."

- 29 March 2000, Memorandum of Agreement (MOA) between FEMA and the Department of the Army Regarding the Hazard Mitigation Grant Program (HMGP) and Corps of Engineers Flood Damage Reduction Projects; and subsequent update to that MOA, dated 3 November 2003. The 2000 MOA essentially prohibits Corps structural projects from being implemented on lands purchased using HMGP funds, but had a provision for "limited exceptions". The 2003 updated MOA provides a list of ongoing Corps projects that are potentially impacted by the 2000 MOA and are candidates for the "limited exceptions" provision. Ste Genevieve was one of the projects on that list.

4. Background Information

4.1 Creek Alternatives Considered in the 1984 Feasibility Study

During the course of the Ste. Genevieve Feasibility Study (completed in 1984), many flood damage reduction measures to address creek flooding were considered. The measures were subjected to a screening process that included such factors as the effect of the measure on cultural resources, costs and economic benefits, engineering feasibility, local acceptance, hydraulics effects, level of risk reduction, and environmental effects. Some measures were screened out relatively quickly and others were carried into the detailed design and evaluation stage. Both structural and non-structural flood damage reduction measures were considered.

Structural measures included levees; floodwalls; interior drainage features such as pump stations, gravity drains, ditching, and channel relocation; detention dams and reservoirs; diversions; channel enlargement; clearing and snagging; bridge replacement; and improvement of the hydraulic efficiency of bridges.

The 1984 study also included a preliminary examination of floodwater detention dams - five in the North Gabouri Creek watershed and two in the South Gabouri Creek watershed. At that time, the detention sites were determined to be unfeasible based upon the following rationale: dams and reservoirs constructed above urban areas are generally very costly; foundations and seepage problems typically result in areas of Karst topography (as is present in Ste. Genevieve); the Mississippi Lime Company's mine runs under a significant part of the area; the two potential detention dams on tributaries of South Gabouri Creek are a considerable distance from the flood damage problem area; and a relatively low level of economic and historical benefits would be gained from construction of detention dams on either creek.

Major diversions of the high flows from North and South Gabouri Creeks through tunnels to the north and south limits of the study area, respectively, were considered to reduce flooding along these streams and reduce pumping and other interior drainage costs for some levee plans. However, major tunnel diversions were determined to be unfeasible because of high costs, Karst topography, and the extensive Mississippi Lime Company's mine which runs under the majority of the area around the City. Minor channel diversions were included in some alternatives.

Non-structural measures included demolition of buildings, relocation of buildings, floodproofing, elevating buildings, and the construction of small localized levees.

The non-structural measures found to be technically feasible in the Ste. Genevieve area were: demolition of structures, relocation of structures or contents, raising the first floor elevation of structures, and floodproofing commercial structures. Floodproofing of residential buildings, by making the structures watertight (dry floodproofing), was found to be impractical because of the age of the foundations and structures, as well as the nature of the structures' constructions.

The 1994 Design Memorandum did not do any further study of the creek plans, due to the uncertainty surrounding the FEMA buyouts that were occurring following the 1993 flood. The effects of the 1993 flood are discussed further in Section 6.1.8.

4.2 Feasibility Study Results

The 1984 Feasibility Study recommended providing flood risk reduction features along both creeks for a 4% chance of exceedance in any given year (a 25-year flood) via channel widening, bridge replacements, construction of small levees, and some bank armoring provided by placement of rip rap and gabions. The feasibility study did not consider various levels of flood risk reduction from tributary flooding. The channel size was dictated by available space and the levee heights were space-constrained and designed to have minimal visual impact. Based on these constraints, the final 1984 study results indicated that a 4% probability design would be the maximum achievable level of risk reduction.

The 1984 Feasibility Study also recommended recreational features such as trails, ball diamonds and picnic tables be included on lands purchased for the flood damage reduction project.

4.3 Project Sponsorship

The Mississippi River Levee was constructed under the provisions of a Project Cooperation Agreement executed with the Ste Genevieve Joint Levee Commission on August 8, 1995. This general reevaluation report has been completed under the provisions of a Design Agreement executed with the City of Ste Genevieve on May 27, 2005. The City intends to be the sponsor for construction of the remaining project components. Based on the project's authorization, both PED and Construction are to be cost-shared at 75% Federal and 25% non-Federal costs.

5. Report Format

This General Reevaluation Report (GRR) documents the results of the following four essential tasks:

- The definition of problems and opportunities, and consideration of potential solutions, including the authorized plan.
- A determination of whether the project should proceed further (into construction).
- An estimate of time and cost for PED and Construction.
- An assessment of the level of interest and support of non-Federal stakeholders in the identified potential solutions.

The drainage areas of North and South Gabouri Creeks are entirely hydrologically and hydraulically separate upstream of and within the areas impacted by headwater flooding. Additionally, the Mississippi River levee design included sufficient ponding areas and pump station capacities to handle interior creek flooding events during Mississippi River high water events. This means that the selection of a plan for one creek does not depend upon or have an impact upon the selection of a plan for the other creek and also that any coincident Mississippi River flooding would have no impact on the flood heights for creek events.

However, the creeks share many basic characteristics, which made the identification and evaluation of alternatives very similar for each creek. Therefore, the evaluations are presented simultaneously for both creeks. Following identification of a tentatively selected plan for each creek, the report presents the evaluation of recreation opportunities.

6. Existing and Future Without Project Conditions

The steps for successful plan formulation include: documentation of the existing conditions; forecasting likely future conditions; identifying all known problems, needs and opportunities; establishing specific planning objectives and identifying any planning constraints; preparation and evaluation of alternative solutions; comparison of alternatives; and, finally, selection of the recommended plan.

This section documents existing conditions, future conditions, and objectives and constraints common to both creeks. Differences between the creeks are specifically called out as needed.

6.1 Existing Conditions

6.1.1 *Topography.*

Elevations in the watershed range from 360 feet NGVD where the Gabouri Creek meets the Mississippi River to 900 feet NGVD in the western uplands of North Gabouri Creek and 850 feet in the western uplands of South Gabouri Creek. Large areas around the city exhibit karst features such as sink holes, joint cavities, caves, karst ponds, losing streams, swallow holes, and springs. The bedrock underlying the entire area is principally composed of limestones and occasional shales and sandstones.

6.1.2 Stream Characteristics.

Gabouri Creek enters the Mississippi River at river mile 122.5 above the Ohio River. The creek divides into North Gabouri Creek and South Gabouri Creek at a point 0.9 miles from the Mississippi River.

The floodplain of North Gabouri Creek is used for pastures or crop production for the majority of its six mile length. Dense urban development occurs in the floodplain only from river mile 1.2 to 2.0, as measured from the Mississippi River. Above river mile 2.0, the watershed is primarily in farmland and low-density housing. The creek channel generally has a gravel and limestone bottom and is lined sparsely with trees.

The South Gabouri Creek floodplain is highly developed from river mile 1.4 to 2.3 above its confluence with the Mississippi River. A few homes are located in the floodplain from river mile 2.3 to 2.9 at U.S. Highway 61. Above U.S. Highway 61 the creek flows through the Mississippi Lime Company mining operation for nearly one mile. For the remainder of its six mile length, the South Gabouri Creek floodplain is generally used for agricultural production. The creek channel generally consists of a gravel bottom. The creek is lined with trees except in parts of the Mississippi Lime Company area and some areas within the city of Ste. Genevieve.

6.1.3 Environmental

The upper ends of the North and South Gabouri Creeks' watersheds experience intermittent flows during drought periods. The creeks pass through a mixture of pasture, forest and cropland in their upper reaches and have beds of cobble and gravel with little in-stream cover. The lower portions of the creeks pass through urban Ste. Genevieve and have a bed of bedrock, cobble, and gravel with some man-made debris. In the lower area, the creek banks are generally vegetated and the streams shaded. The creeks are narrow streams with low base flows.

Although the downstream water quality of South Gabouri Creek has been subjected to limestone runoff from a limestone plant located upstream, it is in fair condition in the project area. The channels of both creeks meander, have pools and riffles, resting areas in undercut banks and pools, and are shaded by riparian vegetation, including trees that are 30 or more years old. Water quality meets all the state criteria except for the lower reach of the South Gabouri Creek, which is adversely affected by turbidity and deposition of solids resulting from the previous limestone quarry runoff.

Remnants of forested lands exist along both creeks. Most of the uplands consist of a patchwork of forest and pasture with forest being more extensive in the headwater regions. Crop production is limited to the narrow creek floodplains, located primarily outside of the City limits. Wildlife habitat quality varies from good to excellent in the headwaters, and from poor to fair in the urban and agricultural areas

With the exception of a few areas, the riparian zone consists of very narrow vegetated strips. The larger trees in this riparian zone consist of sycamore, elm, cottonwood and silver maple. The general quality of the wildlife habitat is poor to fair. The US Fish and Wildlife Service has indicated that the following threatened or endangered species are in the vicinity of the proposed project areas: federally endangered Indiana bat (Myotis sodalis), pallid sturgeon (Scaphirhynchus albus), interior least tern (Sterna antillarum), and the threatened northern long-eared bat (Myotis septentrionalis), piping plover (Charadrius melodus) and Rufa red knot (Calidris canutus rufa) the federally endangered Indiana bat (Myotis sodalis), and the federally threatened protected bald eagle (Haliaeetus leucocephalus). No state-listed threatened or endangered plants or animals are known to occur in the project area.

The National Wetlands Inventory maps indicated locations of wetlands along North Gabouri Creek. However, field reconnaissance determined that this area was not a wetland, but rather a

former pasture/barnyard which has experienced some vegetative succession and a wooded area that has been partially cleared and mowed.

6.1.4 Aquatic Habitat.

North Gabouri Creek is a narrow stream with low base flows. The upper end is intermittent during drought periods. The stream passes through a mixture of pasture, forest, and cropland in its upper reach and the City of Ste. Genevieve in its lower reach. The upstream reaches of the creek have a cobble and gravel substrate with little instream cover. The downstream reaches have a mixture of bedrock, gravel, cobble and muck for substrate. Instream cover consists of a mixture of man-made and natural debris.

South Gabouri Creek is similar in width, base flows and riparian habitat as the North Gabouri Creek. The water in the upper reaches is normally clear during low flows and becomes turbid during periods of runoff. The upper creek is shallow, consisting of a cobble and gravel substrate with sparse instream cover. The lower creek is shallow with a substrate comprised of gravel and limestone mining wastes. In areas of heavy limestone waste deposits, downstream of the Mississippi Lime Company, the limestone deposit is over one-foot thick. At times, the creek has a milky color from disturbance of the limestone mining wastes.

North and South Gabouri Creeks are narrow streams with low base flows. The upper ends of the watersheds are intermittent during drought periods. The streams pass through a mixture of pasture, forest and cropland in their upper reach and Ste. Genevieve in their lower reaches. The upper portions of the streams have a cobble and gravel substrate with little in-stream cover. The channels of both forks of Gabouri Creek meander, with pools, riffles, and resting areas in undercut banks and pools, shaded by riparian vegetation that includes trees in the 30 plus year old category. At the confluence of the two streams, the stream is wide and deep. Water levels are influenced by the watershed flows and Mississippi River water levels. A gate and pump house are located on Gabouri Creek at the MRL and are activated when Mississippi River levels are above flood stage. The creek is connected

6.1.5 Water Quality

Area water quality samples were last taken in December of 1982 on the North and South Gabouri Creeks and Valle Spring Branch. A Phase I - HTRW Hazard assessment was conducted in the area and completed in March of 2010. Water quality on both the North and South Gabouri Creeks met all of the general State of Missouri water quality criteria, with the exception of a portion of the creek near South Gabouri Creek adjacent to the mining operation of the Mississippi Lime Company. Storm runoff and mine waste discharges from the facility contribute to water higher than average chlorides and chemical oxygen demand (COD) parameters which degrades the water quality in the stream line. Sewage discharges, increased urbanization and farming also contribute to reduce water quality in the southern portion of the creek.

6.1.6 Population

U.S. Census population data between 1980 and 2013 is displayed in Figure 6-1. Population increases from 1980 to 200 were likely the result of population influxes resulting from the gentrification of historic communities. The total population in 2013 was 17,778 residents; this represents an increase of approximately 2,608 residents from the 1980 population of 15,180. The total population has remained virtually unchanged from 2013 to 2015.

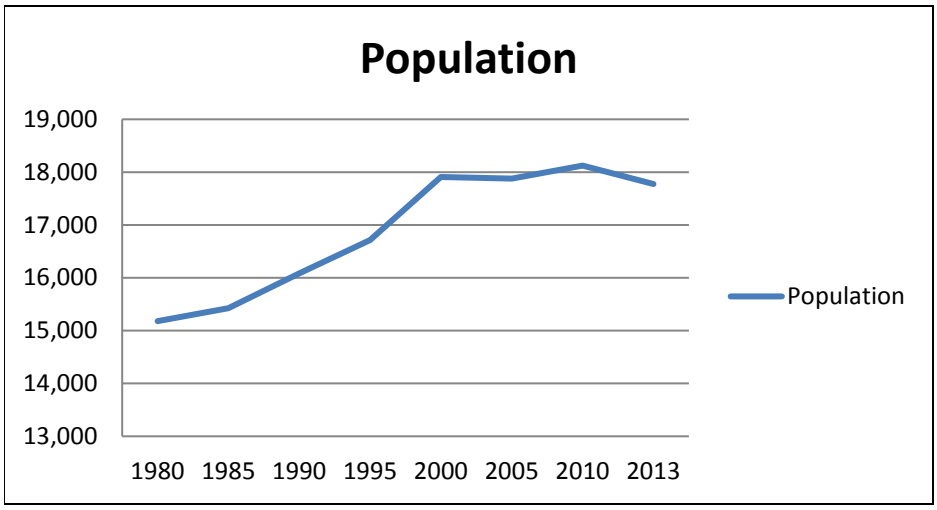

Figure 6-1: Population Trend

6.1.7 Cultural Resources

Ste. Genevieve was founded c.1750 by French Canadian *habitants*, most of who came from earlier settlements just across the Mississippi in present-day Illinois. The French made trips to the area to extract salt and lead, but depleted soils on the east side of the Mississippi galvanized the permanent settlement of the west bank of the river at Ste. Genevieve. The *Grand Champ,* or Common Field, a large agricultural field with narrow long lots, still exists today. After a great flood in 1785, the town was moved inland approximately three miles. Some buildings were constructed anew, others were moved from the old town. At first, Ste. Genevieve was primarily an agricultural settlement, but soon it also became a hub of trade. During the late 18th century, Indian tribes in the area began trading and developing personal relationships with the residents. Approximately one third of Ste. Genevieve residents were enslaved African Americans, but the community was also home to free blacks. Following the Revolutionary War, there was an influx of Anglo-Americans and then in the early 19th century, German Americans were the next major group to settle in the town. Eclipsed by St. Louis for dominance in the region, Ste. Genevieve retains many of its historic buildings and community characteristics.

It is this unique historic character that in 1960 was the catalyst for designating Ste. Genevieve as one of the first National Historic Landmark districts in the country. When initially designated in 1960, it was recognized for the unique concentration of French vertical log architecture. With new research and an expanded understanding of French settlement in the mid-Mississippi "Illinois Country," new resources have been identified and the nationally significant district encompasses much of the City of Ste. Genevieve and agricultural landscapes and archeological sites in Ste. Genevieve County. The Ste. Genevieve district is nationally significant under National Historic Landmark Criterion 4 (36 CFR 65.4), possessing a large and

rare collection of French vernacular vertical log houses, including three of the five known remaining *poteaux en terre* buildings in the United States. It is also significant under Criterion 1, with architectural resources complemented and enriched by contemporaneous examples of British American and German American architecture that contribute to the compelling historical associations with French exploration and settlement of the interior of the United States in the late 18th and early 19th century and with the American territory that developed following the Louisiana Purchase.

After the flood of 1993, the City acknowledged the significance of its historic structures and wanted to expand recognition of what was deemed historic beyond the early French settlement. It prepared a nomination for a National Register Historic District which contained building, structures and sites representative of the history of the city from its founding in its current location in 1790 to the mid-twentieth century; this illustrated the evolving continuity of Sainte Genevieve over time. Included within the district are a total of 824 buildings, including outbuildings. Of these buildings, 646 or 78% contribute to the district's significance. The district comprises an entity that is significant under the National Register of Historic Places criteria A, C and D. Areas of significance of the district include architecture, archaeology, commerce, community planning and development, ethnic heritage, exploration and settlement, industry and transportation The Ste. Genevieve National Register Historic District was officially entered in the National Register of Historic Places in 2002.

The National Register Historic District includes all those contiguous areas of Ste. Genevieve with a generally high level of architectural integrity areas in which substantial development occurred by 1951. The northern edge of the district is defined on the east by North Main Street and on the north by Roberts Street. The district extends west to Biltmore Street at the north edge, Seventh Street in the central section and Fourth Street in the southern section of the district. The southern portion of the district is generally defined by Seraphin Street and St. Mary's Road. The eastern edge of the district is largely defined by North Main Street, St. Mary's Road and Front Street. It is within the confines of the National Landmark District. Figure 6-2 shows the boundaries of the National Register Historic District (overlay H-1) and the National Historic Landmark District (overlays H-1 and H-2 combined). The H-3 overlay, when combined with H-1 and H-2, displays the City's incorporated boundaries. Figure 6-3 displays the National Register District boundaries overlaid on a map showing the study areas for the two creeks.

The City of Sainte Genevieve has a Heritage Commission whose purpose and duties are spelled out in the city Historic Preservation Ordinance which was revised in February of 2015 [Ord. No. 3945[1] §1, 2-12-2015]. This commission and ordinance are requirements of Missouri's Certified Local Government Program in which Ste Genevieve is a participant. This program is administered by the Missouri State Historic Preservation Officer. The Historic Preservation Ordinance requires a "Certificate of Appropriateness "for any exterior project requiring a building permit to any landmark, any structure or site within one hundred eighty-five (185) feet of any landmark in the H-2 Historic District Overlay, or any structure or site within the National Register Historic District; Any project affecting an exterior character-defining architectural feature or appearance of a designated landmark or contributing structures or sites within the National Register Historic District; Any construction, alteration or removal involving earth-disturbing activities that might affect archaeological resources; and Any sign to be erected

upon the property of a landmark, or on property within one hundred eighty-five (185) feet of a landmark in the H-2 Historic District Overlay or within the National Register Historic District."

In October 2006, Public Law 109-319 authorized the Secretary of the Interior to study the suitability and feasibility of designating portions of Ste Genevieve County as a unit of the National Park System. A Draft Special Resources Study and Environmental Assessment were published by the National Park Service, U.S. Department of Interior in August of 2015 which concludes that Ste. Genevieve meets the criteria for suitability for inclusion in the national park system. Should Ste. Genevieve be included in the national park system, the National Park Service would work closely with the affiliated entities, the City of Ste. Genevieve and State of Missouri at the Felix Valle State Historic Site, to develop and coordinate interpretive programs and special events. Partnerships could be established with the Bolduc House Museum, the Foundation for the Restoration of Ste. Genevieve, and the Ste. Genevieve Welcome Center. The National Park Service would work with the state, city, and other local organizations to write a general management plan to govern the area and would provide technical assistance in implementing the plan. The success of this would be contingent upon agreements with partners to sustain the Affiliated Area. In addition to these benefits, the Affiliated Area would receive a name such as "National Historical Site" and would be entitled to display the NPS arrowhead logo on signage and in appropriate marketing and interpretive materials and exhibits. The city would continue to exercise permit authority within the historic preservation zoning area, and the state would continue to protect its properties (the Felix Valle and Bossier [Shaw] houses). All sites identified as part of the affiliation with the National Park Service would agree to meet *The Secretary of the Interior's Standards for the Treatment of Historic Properties*, and sign agreements to be in harmony with NPS *Management Policies 2006* to assure a standardization of maintenance and interpretation to meet taxpayer expectations for NPS affiliations.

Other than the risk of the complete loss of a historic structure, there is also a risk that flood-prone historic structures would be less appealing to individuals or businesses who wish to own and maintain a historic structure. This not only affects the structure's attractiveness on the real estate market, but also has long-term adverse consequences for its historic integrity, as owners are likely to invest less time and money in rehabilitation and restoration. All of the historic structures damaged by North and South Gabouri Creek flooding are privately owned and most are occupied.

Additional information about the specific architectural styles of Ste Genevieve's historic structures can be found in the 1984 Feasibility Report.

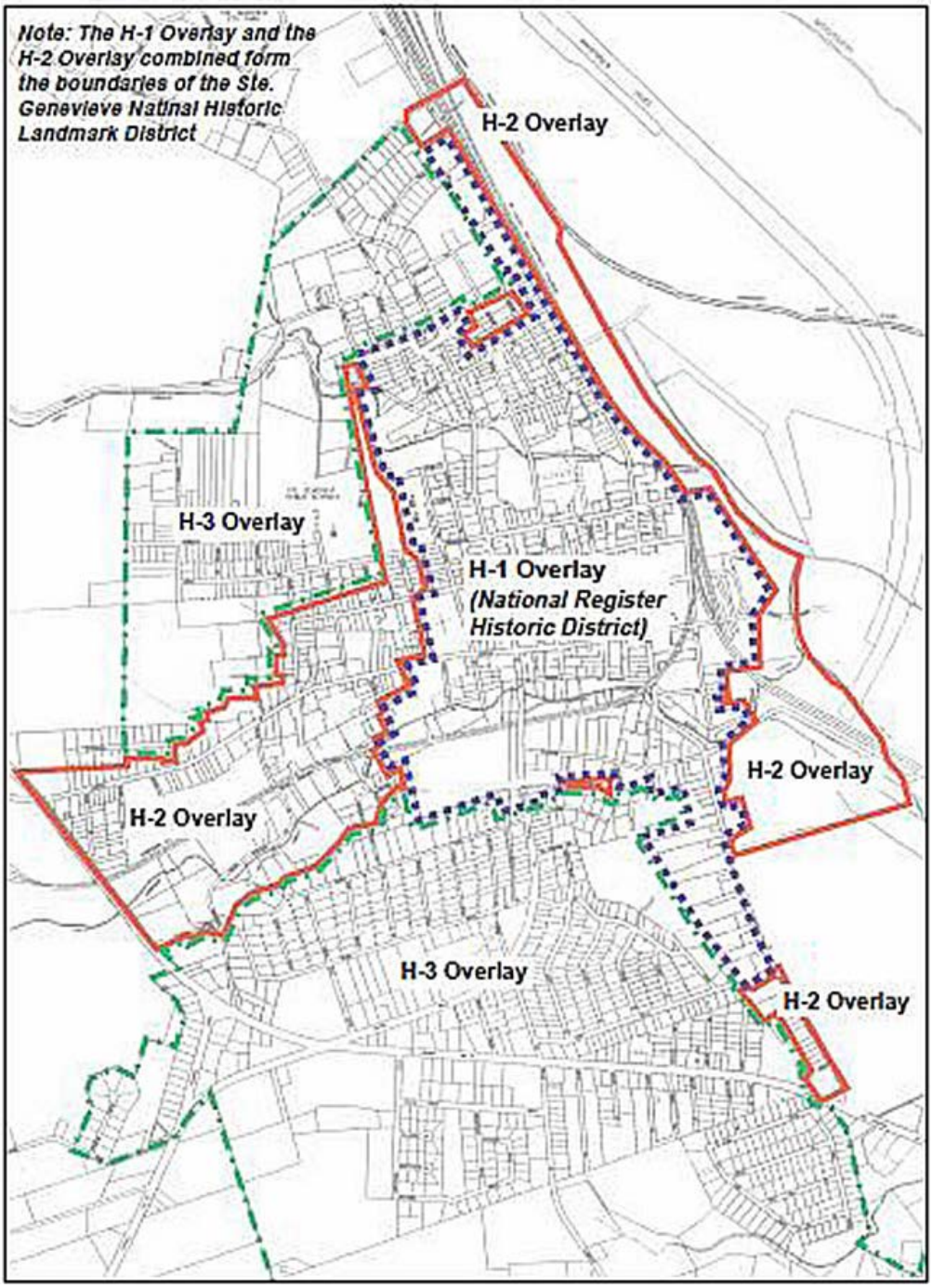

Figure 6-2. Boundaries of the Ste Genevieve National Register and National Landmark Historic Districts

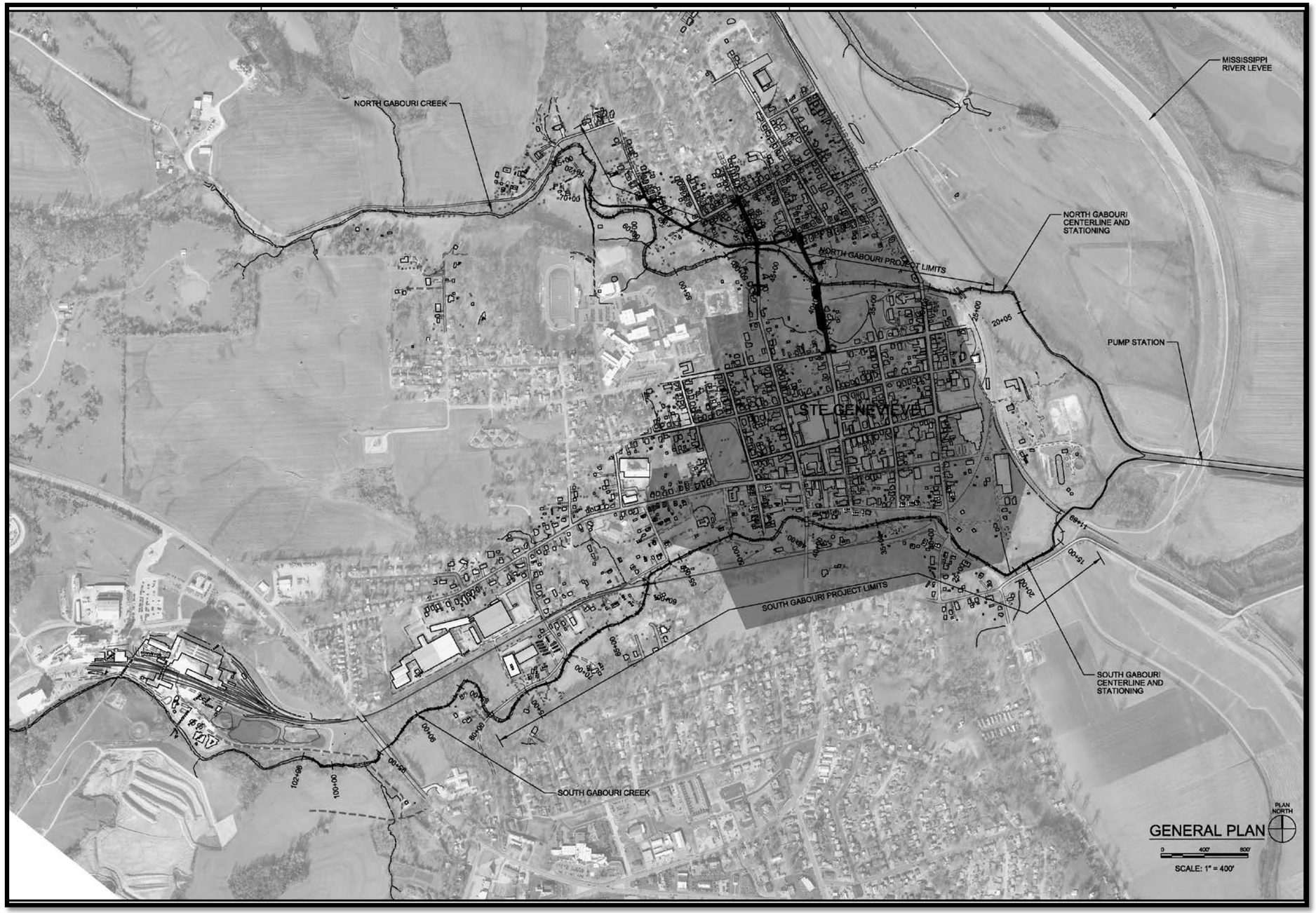

Figure 6-3. The National Register Historic District Overlaid on the Study Area.

6.1.8 Hydrology and Hydraulics.

6.1.8.1 Flooding History

The 1993 Mississippi River flood caused severe damages in parts of Ste. Genevieve, most notably in the Front Street area in the center part of the community, along North Main Street, and along the north bank of North Gabouri Creek. A State and FEMA buyout program was approved for the City of Ste Genevieve shortly after the flood. Under the buyout program, the owners of approximately 130 residences within the city limits of Ste Genevieve received buyout offers.

The buyout program did not have a major effect on the design of the Mississippi River levee because the levee protects a large number of buildings that were not in the buyout program. However, 19 homes along North Gabouri Creek and 20 homes along South Gabouri Creek were offered buyouts and many accepted. The removal of the buyout structures resulted in a significant reduction in the number of homes potentially damaged by headwater floods along the two creeks and also created more open space adjacent to the creeks.

Headwater floods on North and South Gabouri Creeks are not as well documented as the Mississippi River floods. There are no stream gages on these creeks. Interviews with local residents and newspaper accounts indicate that large floods occurred on both creeks in 1922, 1957, 1961, 1964, 1972, 1977, 1979, and 1982. No estimates were made of the damages resulting from these historical floods on the creeks. There were no reports of deaths resulting from these events. Headwater floods in the 1990's tended to occur simultaneously with high water levels on the Mississippi River, which caused more extensive damage than would have occurred with an independent headwater flood. The construction of the Mississippi River levee, which addresses Mississippi River flooding up to the 0.2% (500-year) event and provides ponding areas and pumping capacity sufficient to address interior flood events, has greatly reduced the chance of increased creek flooding damages due to future coincident flood events.

6.1.8.2 Hydrologic and Hydraulic Modeling

In order to establish the existing conditions, aerial mapping of the study area was performed and maps were prepared with 2-foot contour intervals. For areas of the watershed located outside the city, USGS quad sheets were used to determine the topography. North and South Gabouri Creeks combine in the Mississippi River floodplain approximately 0.9 miles from the Mississippi River, to become Gabouri Creek. Gabouri Creek passes through the Mississippi River levee through three 12x16-foot gravity drains, which are closed during Mississippi River flood events. When the gravity drains are closed, the pump station (containing three pumps with a combined capacity of approximately 575 cubic feet per second) evacuates interior water out of the interior of the levee system. 505 acres of ponding area, acquired for the Mississippi River levee project, was included in the development and consideration of alternative plans during this reevaluation.

The hydrologic model (HEC-HMS) utilized regional rainfall data to simulate storm events. These simulated storm events were then entered into a hydraulic model (HEC-RAS). The

hydraulic model generated flood heights for each of these storm events at various locations along both creeks. The storm events that were modeled include the 50% (2-year), 20% (5-year), 10% (10-year), 4% (5-year), 2% (50-year), and 1% (100-year) chance of exceedance events.

To quantify the extent of flood damages within the study area, the Corps of Engineers inventoried all buildings subject to flooding and determined potential flood depths in these buildings. The hydrologic and hydraulic analyses to define flood heights in Ste. Genevieve are described in detail in APPENDIX B - HYDROLOGY AND HYDRAULICS. Flood profiles for the 50%, 20%, 10%, 4%, 2%, and 1% probability floods and the Probable Maximum Flood (PMF) were defined for both creeks.

A 2-foot contour map, with an identification number on each structure, was used to inventory flood prone structures in Ste. Genevieve. The inventory data for each structure includes the address, first floor elevation (all instrument surveyed), type of structure (e.g. two story with basement, slab on grade, etc.), stream mile location of the structure, and any relevant historic information about the structure. In the initial screening process, the flood heights generated by the hydraulic model were compared to the information known about each of these structures, and a determination was made regarding which structures were being damaged at each storm event. Because the project was authorized based on its historic (not economic) benefits, the study team was directed by Mississippi Valley Division that presentation of economic structure damages is not required. The number and type (historic versus non-historic) of structures damaged at each flood event was simply tallied and this information was used as an indicator of effectiveness. The number and types of structures damaged under existing conditions is summarized in the detailed discussions of each creek in Section 6.1.9.

Additionally, there are 12 homes along North Gabouri Creek that are located south of a small locally-constructed levee that was included in the authorized creek improvements. This levee was built on the south side of North Gabouri Creek at Third Street in 1985 by the City of Ste Genevieve. The 12 homes located behind the levee were not included in the FEMA buyout plan because they were located behind the levee. The 1994 Design Memorandum indicates that partial Section 104 credit will be given for the construction of this levee but defers further examination of the amount of credit until the plan for North Gabouri Creek is completed. During the GRR analysis, the hydraulic analysis affirmed that this levee plays an integral role in reducing flood risk to this group of homes.

Table 6-1 shows the peak flows for 6 flood frequency events at Main Street for both North Gabouri (Table 6-1) and South Gabouri Creeks. Main Street is at or near the downstream boundary of the study areas for both creeks.

Table 6-1: Peak Flows for North and South Gabouri Creeks, CFS

Location:	Peak Discharge in cubic feet per second (cfs) for each Frequency Event, by Annual Chance Exceedance (ACE)							
	50%	20%	10%	4%	2%	1%	0.5%	0.2%
North Gabouri Creek @ Main St.	877	1,605	2,173	2,940	3,530	4,209	4,810	5,660
South Gabouri Creek @ Main St.	635	1,111	1,480	1,976	2,358	2,796	3,250	3,900

Figures 6-4 and 6-5 show the 4% and 1% chance of exceedance floodplains calculated by the hydraulic model and identify the structure inventory numbers for those structures located within or adjacent to the 1% floodplains for North Gabouri Creek (Figure 6-4) and South Gabouri Creek (Figure 6-5). Due to the topography, the 0.2% (500-year) floodplain is very similar to the 1% floodplain and it is not displayed on the figures below.

Flooding events on both creeks are generally contained in the creeks' banks up to the 20% event. For the 1%, 24-hour precipitation event, floodwaters would be expected to be out of bank for about 4.5 hours (for more than 24-hours of precipitation, out-of-bank durations would not be expected to exceed 8 hours). For the Probable Maximum Precipitation, 4-day event, floodwaters could be out of bank for up to 14 hours. Out of bank velocities are generally about 1.5 feet per second during the 1% event, ranging from 0.2 to 2.7 feet per second and generally lessening with the distance from the creek. Velocities for less frequent events (0.5% and 0.2%) are consistent with the 1% event.

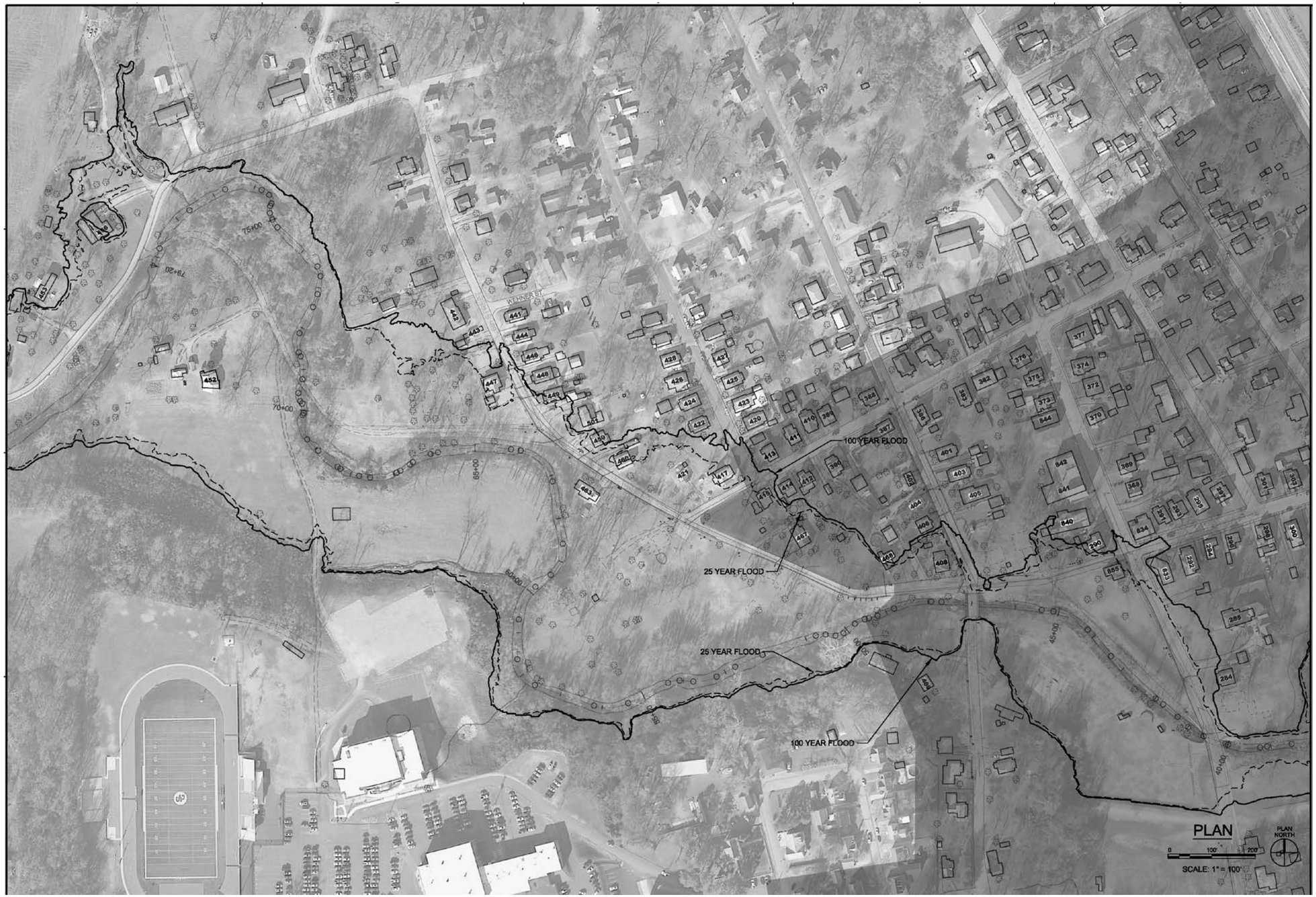

Figure 6-4. North Gabouri Creek Existing Conditions – 4% (25-year) and 1% (100-year) Floodplains Displayed (with the National Register Historic District in dark gray)

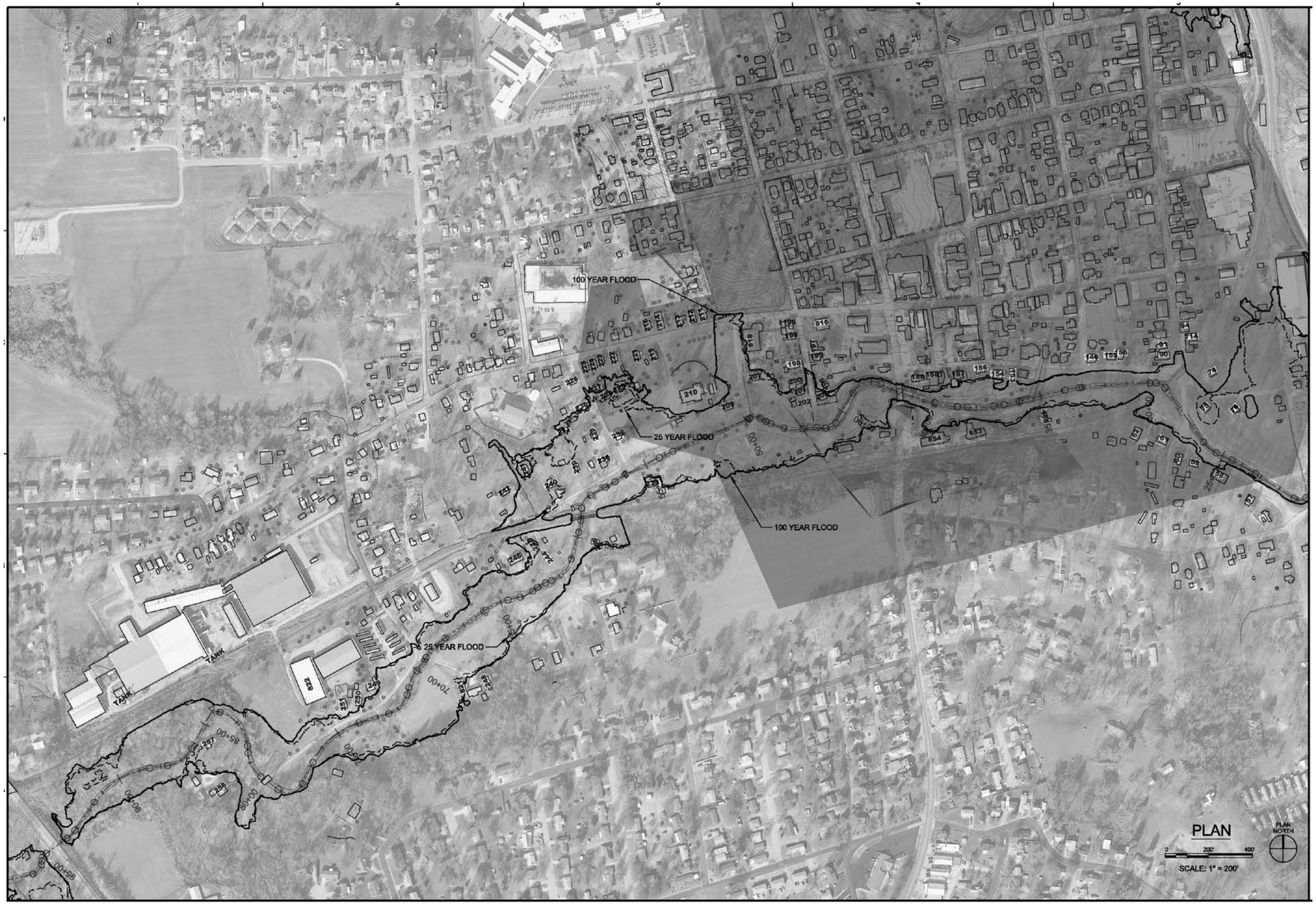

Figure 6-5. South Gabouri Creek Existing Conditions – 4% (25-year) and 1% (100-year) Floodplains Displayed (with the National Register Historic District in dark gray)

6.1.9 Structure Damages.

A detailed summary of the structures located in the 1% probability floodplain of both creeks can be found in Appendix A - ENGINEERING.

Table 6-2 summarizes the number and historic nature of the structures damaged by storm events up to the 0.2% probability (500-year) event. Table 6-3 lists details of the structures damaged up to the 0.2% flood event. The listed structures are currently occupied, with the exception of structure numbers 76, 244 and 257. The "Beginning Damage Elevation" was determined using regional structure damage curves which take structure type into consideration to determine at what elevation (relative to the first floor) damages will begin to occur. These curves were not used for any other calculation, as economic benefits were not calculated for this study.

Table 6-2. Existing Conditions Structures Damaged
Number and types of structures damaged due to flooding under Existing Conditions.

	National Register or Landmark Structures Damaged (Cumulative)	Non-Historic Structures Damaged (Cumulative)	Total Structures Damaged (Cumulative)
North Gabouri Creek			
50% (2-year) event	1	0	1
20% (5-year) event	1	0	1
10% (10-year) event	1	2	3
4% (25-year) event	2	2	4
2% (50-year) event	2	3	5
1% (100-year) event	2	3	5
0.5% (200-year) event	3	3	6
0.2% (500-year) event	4	4	8
South Gabouri Creek			
50% (2-year) event	1	1	2
20% (5-year) event	2	3	5
10% (10-year) event	3	3	6
4% (25-year) event	5	3	8
2% (50-year) event	5	3	8
1% (100-year) event	7	3	10
0.5% (200-year) event	7	3	10
0.2% (500-year) event	7	3	10

Table 6-3. List of Damaged Structures in Existing Conditions

Structure Number*	First Floor Elevation (feet NGVD)	Beginning Damage Elevation (feet NGVD)	1% Flood Elevation (feet NGVD)	1% Flood Depth Relative to First Floor (feet)	Beginning Damage Frequency	Historic Nature of Structure
North Gabouri Creek						
290	390.4	387.4	386.9	-3.5	0.2% (500-year)	Contributor to National Historic District
300	388.9	385.9	386.1	-2.8	2% (50-year)	Contributor to National Historic District
311	388.3	385.3	386.1	-2.2	10% (10-year)	
408	389.6	386.6	388.9	-0.7	4% (25-year)	Contributor to National Historic District
452	394.9	391.9	395.4	0.5	50% (2-year)	National Historic Landmark
454	398.3	395.3	396.5	-1.8	10% (10-year)	
460	394.5	391.5	391.4	-3.1	0.2% (500-year)	
468	398.1	390.1	389.0	-9.1	0.5% (200-year)	National Historic Landmark
South Gabouri Creek						
76	387.6	384.6	384.9	-2.7	1% (100-year)	Contributor to National Historic District
207	395.5	382.5	393.2	-2.3	50% (2-year)	
209	394.9	391.9	393.4	-1.5	20% (5-year)	
232	395.0	394.0	394.3	-0.6	1% (100-year)	
233	396.9	393.9	394.8	-2.1	4% (25-year)	National Register Eligible
236	396.5	393.5	394.8	-1.7	4% (25-year)	National Register Eligible
240	398.0	395.0	395.2	-2.8	1% (100-year)	National Register Eligible
244	397.8	394.8	397.3	-0.5	20% (5-year)	National Register Eligible
255	398.7	395.7	397.3	-1.5	10% (10-year)	National Register Eligible
257	403.8	400.8	406.0	2.2	50% (2-year)	National Register Eligible

*Additional information about individual structures can be found in Appendix A.

6.1.10 Recreation

The Comprehensive Plan for the City of Ste. Genevieve (1978) shows an interest by the City in future acquisition and development of parks adjacent to North and South Gabouri Creeks and Valle Spring Branch. Neighborhood parks are spread throughout the city. The plan recommends the development of small parks at the St. Jude subdivision and the Point Basse area. No timetable has been set or money appropriated for these recommendations. The City has recently developed a walking/biking trail along North Main Street from the downtown area to the ferry crossing on the north side of Ste. Genevieve. This could serve as an additional access route to the Division St. access to the Mississippi River levee.

6.2 Future Conditions

The floodplains of both creeks, within the city limits, have very little land available for additional development. Significant areas of the floodplains have been purchased via FEMA or State buyout grants and are deed-restricted to prevent any further development. The City is participating in the National Flood Insurance Program and will regulate development in the 1% chance of exceedance (100-year) floodplain. Additionally, due to the presence of the Mississippi River levee and the commitment by the City to preserve all historic structures to the greatest extent possible, it is not anticipated that there will be any significant voluntary removal of historic structures within the creeks' floodplains.

Without a Federal project, the City may opt to replace the undersized bridges located over each creek. However, as presented in the alternatives analysis, bridge replacement alone is not effective in reducing the number of structures experiencing flood damages and only reduces flood heights a minimal amount.

Climate change reports differ on whether precipitation may increase or decrease and describe significant uncertainty in forecasting regional precipitation change in the next 50 to 100 years. Therefore, the study assumed that these watersheds are not anticipated to incur significant precipitation changes due to climate change within the anticipated 50 year period of analysis.

These anticipated future-without conditions will have marginal impacts upon hydraulic and hydrology characteristics within the study area. For the purpose of the assessment of future flood damages, the future-without-project conditions were assumed to be the same as the existing conditions.

6.3 Problems, Opportunities, Objectives and Constraints

6.3.1 Problems and Opportunities

Clearly identification of the problems to the addressed the potential opportunities to be considered guides the formulation and evaluation of measures and alternatives developed during the study. In this section, the problems and opportunities of each creek are described separately.

The study area for North Gabouri Creek includes the entire watershed of the creek, to its confluence with South Gabouri Creek and through the Mississippi River levee. The North Gabouri watershed consists of approximately 7.7 square miles and can be seen in Figure 6-6.

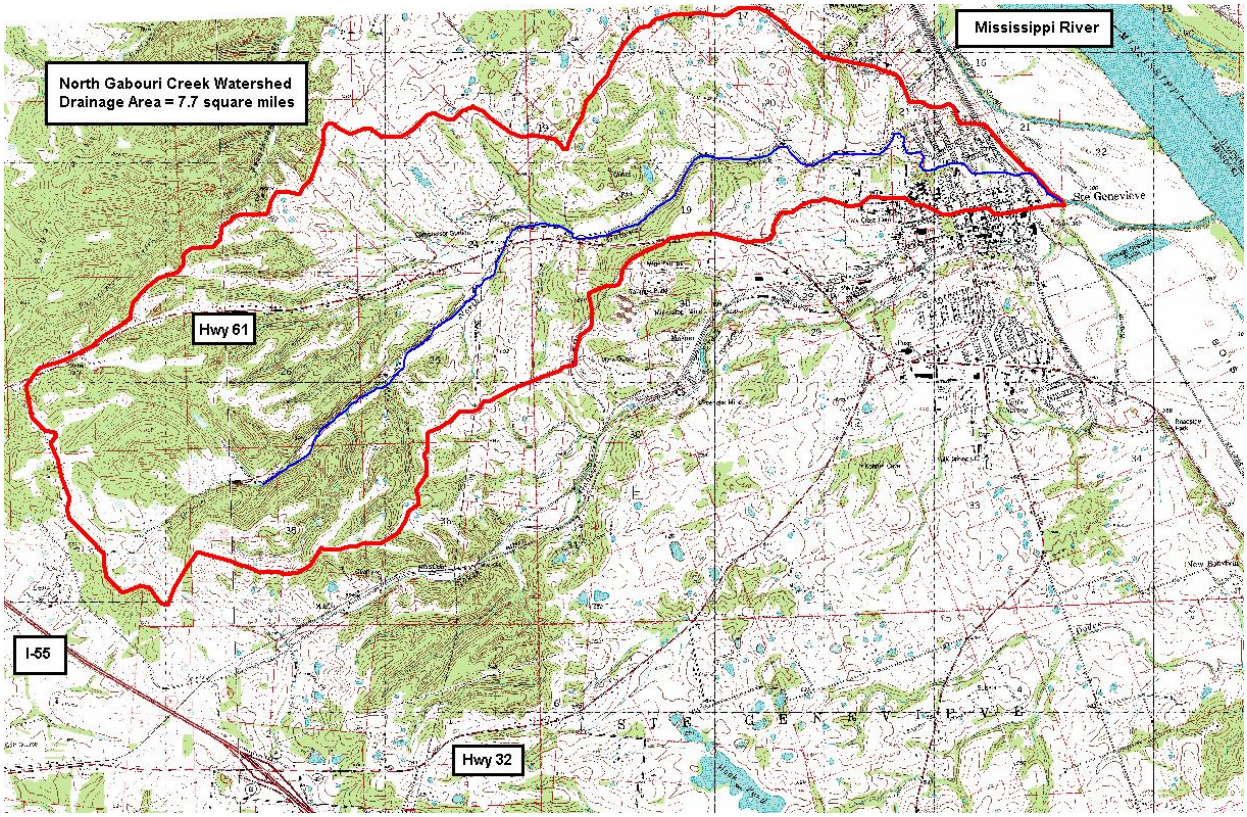

Figure 6-6. North Gabouri Creek watershed

Historic structures impacted by North Gabouri Creek flooding are located within the City limits, between Main Street and the beginning of Creek Road. Both historic and non-historic structures in this reach are now protected from Mississippi River backwater flooding by the urban design Mississippi River levee. However, these structures are still vulnerable to headwater flooding from North Gabouri Creek.

Photos 1, 2, and 3 illustrate the some of the existing conditions and problems along North Gabouri Creek.

Photo 1. North Gabouri. Undersized bridges, such as this one at Third Street, may contribute to the flooding problem.

Photo 2. North Gabouri Existing Conditions - Flooding. Flooding in May 2009 in the vicinity of the Third Street Bridge.

Photo 3. North Gabouri Existing Conditions - Historic Structure. This house is a contributing structure to the Landmark District and is one of the most flood-prone structures on North Gabouri Creek.

The study area for South Gabouri Creek includes the entire watershed of the creek, down to its confluence with North Gabouri Creek and through the Mississippi River levee. The South Gabouri watershed consists of approximately 5.8 square miles and is shown in Figure 6-7.

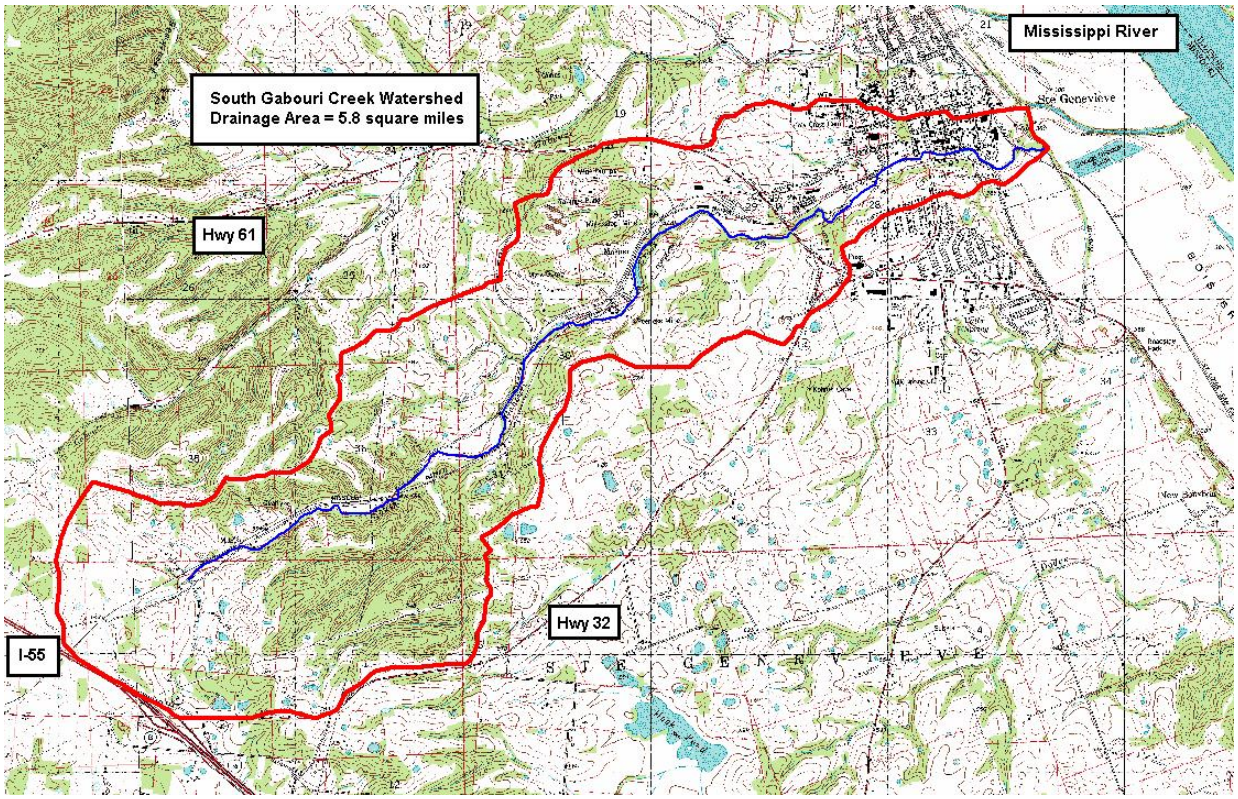

Figure 6-7. South Gabouri Creek Watershed

Historic structures impacted by South Gabouri Creek flooding are located within the City limits of Ste. Genevieve, between Main Street and State Highway 61. Both historic and non-historic structures in this reach are now protected from Mississippi River backwater flooding by the urban design Mississippi River levee. However, these structures are still vulnerable to headwater flash flooding from South Gabouri Creek.

Photos 4, 5, and 6 illustrate the some of the existing conditions and problems along South Gabouri Creek.

Photo 4. South Gabouri Existing Conditions - Bridges. This old wooden railroad trestle snags debris coming down the creek, possibly contributing to flooding upstream.

Photo 5. South Gabouri Existing Conditions - Structures. The first floors of the homes in this area are roughly the same elevation as the high bank of the creek.

Photo 6. South Gabouri Existing Conditions - Flooding. This photo shows flooding in May 2009 in the area of Seventh Street. The white house on the right is structure #233 and is eligible for listing on the National Historic Register.

The problems the study intends to address are 1) flash flooding of both historic and non-historic structures located adjacent to North and South Gabouri Creeks, and 2) cultural resources losses resulting from repeated flooding.

The opportunities that the study will consider are to provide facilities for outdoor recreational activities on project-related lands.

6.3.2 Objectives and Constraints

Objectives are statements of what the alternative plans should try to achieve and are indications of what is important to people. Constraints are restrictions to the planning process and are things that the alternative plans should try to avoid. Alternative plans are developed with the intent to achieve the objectives while not violating the constraints.

Early in the study, a stakeholder working group was identified and met regularly to discuss study progress and direction. This working group included representatives of the Corps, City, and State and Federal stakeholder (Missouri Department of Natural Resources - Water Quality Office and State Historic Preservation Office, Missouri Department of Conservation, U.S. Fish and Wildlife Service, and the Environmental Protection Agency). At a January 2003 meeting, the following project objectives and constraints were identified by the stakeholder group:

Table 6-4. Project Objectives and Constraints Developed by Stakeholders

Objectives
Safeguard and improve the quality of life of all citizens of the City of Ste. Genevieve.
Minimize displacement of people, homes, and businesses.
Minimize operations and maintenance costs and responsibilities.
Maximize the number of structures being protected.
Safeguard and improve the quality of the environment in the study area, including ecological and archaeological resources.
Reduce future flood damages to historic structures, the economic losses, and the social disruption caused by flooding of North Gabouri Creek and South Gabouri Creek.
Preserve and enhance the historic character of Ste. Genevieve.
Increase the quantity and quality of outdoor recreation facilities in the project area.
In the design of project features, the Project Delivery Team will consider the visual impact on the historic character of the community.
The historic classification of the structures will be taken into consideration during design of project features.
Constraints
The historic character and historic setting in Ste. Genevieve are constraints on the type and magnitude of flood damage reduction measures that are acceptable from a cultural resources standpoint.
The historic nature and condition of many of the flood prone buildings is a constraint regarding non-structural flood damage reduction measures.
Karst topography and limestone mining in the study area are constraints regarding detention measures, in both watersheds.
Natural Resources Agencies' concerns for preserving and/or enhancing the existing stream character is a constraint on the type and magnitude of flood damage reduction measures.
Properties of historic significance may affect the ability to acquire real estate.
Mitigation requirements under the National Environmental Protection Act may impact the budget, the schedule, real estate acquisition, and plan selection.
North and South Gabouri Creeks have some cultural and physical differences which may result in a constraint on the type of flood damage reduction measures that will be successful and workable for each creek.
FEMA Hazard Grant Mitigation Program funds were used for some buyouts along both creeks, which could affect placement of structural measures and/or require coordination with FEMA to obtain modifications to deed restrictions. In the year 2000, the Corps and FEMA entered into a Memorandum of Agreement which stated that construction of flood damage reduction levees on lands purchased through the Hazard Grant Mitigation Program is incompatible with open space use and, therefore, will not be recommended for implementation by the Corps. However, this same memorandum indicates that, at that time, there existed a limited number of cases where local governments were already pursuing construction of flood damage reduction levees on HMGP lands. In these limited cases, FEMA and the Corps must coordinate to determine if those levee projects should proceed. The memorandum provides a list of these limited cases and the Ste. Genevieve project was on that list.

Measurable objectives allow the alternative plans to be evaluated for their effectiveness. From the list above, the following measurable objectives were identified:

1. Minimize displacement of people, homes, and businesses.
2. Minimize operations and maintenance costs and responsibilities.
3. Maximize the number of structures with reduced damages.
4. Safeguard and improve the quality of the environment in the study area, including ecological and archaeological resources.
5. Reduce future flood damages to historic structures, the economic losses, and the social disruption caused by flooding of North Gabouri Creek and South Gabouri Creek.
6. Increase the quantity and quality of outdoor recreation facilities in the project area.

6.3.3 Levels of Risk Reduction

The 1984 Feasibility Report recommended flood risk reduction features for the structures affected by headwater flooding along North and South Gabouri Creeks with a 4% chance of exceedance in any given year (a 25-year flood). At the time of the report, due to space restrictions and the desire to avoid adverse visual impacts to the historic structures, the analysis determined this was the highest level of flood risk reduction that was possible at that time. After the buyouts following the 1993 flood, there is additional space available adjacent to the creeks that allows consideration of other structural features to address greater flood events.

Table 6-1 demonstrates that there are a total of 12 structures damaged at the 4% event (7 historic), 15 damaged at the 1% event (9 historic), and 18 damaged at the 0.2% event (11 historic). Given that most of the damaged historic structures are damaged by the 1% event, that the 0.5% and 0.2% events are significantly less frequent events, the desire of the City to protect the remaining historic resources along the two creeks, and the level of risk reduction provided by the Mississippi River Levee, the study focused on formulating and evaluating alternatives that address flooding up to the 1% (100-year) event.

7. Flood Damage Reduction Plan Development and Analysis

While plan selection for each creek was conducted independently, similar measures and alternatives were developed and evaluated simultaneously.

7.1 Measures Developed

To address the planning objectives, both structural and non-structural measures were developed and preliminarily evaluated for each creek. Each measure was given a two-letter designation to help identify it during the development and analysis of alternatives. A complete list and description of the measures can be found in Appendix G – PLAN FORMULATION. The following paragraphs describe the general nature of the measures.

The plans authorized in the 1984 Feasibility report were comprised primarily of channelization and bridge replacements. These two measures were carried forward into this reevaluation. Other structural measures developed for the reevaluation included removing other

types of restrictions from the floodplain (embankments, structures), levees, lime deposit excavation for South Gabouri Creek, and detention at several sites. Full and partial diversions during high and low flow frequency events were also considered but screened early due to high cost, highly variable subsurface topography, environmental impacts, and existing mining operations.

Non-structural measures considered include floodproofing (to include wet, dry, and elevation), buyouts, and relocations. For floodproofing, each structure was evaluated for possible floodproofing in its current location. For relocations, each structure damaged by flooding was evaluated for possible relocation out of the floodplain. Considerations for both of these measures included construction type, foundation type, historical restrictions, and the depth of flooding. Buyout structures would be demolished and removed from the floodplain.

7.2 Alternative Plans Developed and Screened

All of the measures were carried forward alone or in combination with other measures into the alternatives analysis. The alternatives were simulated in the hydraulic model and the effectiveness of each alternative was determined by comparing the number of structures damaged during each flood event in the existing conditions to the number damaged after the alternative was modeled, as well as changes in flood depths at each structure, paying close attention to historic structures. The alternatives that were modeled and the subsequent results of the preliminary alternatives screening are described in the following paragraphs. The two-letter designation for a measure or combination of measures (shown with hyphens between the two-letter designations) is given in parentheses following each alternative.

7.2.1 Structural Alternatives

For North Gabouri Creek, the following structural alternatives were evaluated:

- The authorized plan of channelization and bridge replacements (CH-BR),
- Bridge replacements alone (BR),
- Opening up the floodplain by removal of obstructions (OF)
- A levee located on top of LaHaye Street (LH),
- The LaHaye levee with bridge replacements (LH-BR),
- A small levee on the north side of Third Street (3L),
- A levee from Main Street to upstream of Sixth Street (L2-CH2), and
- Detention dams at five sites (N1, N2, N3, N4, N5).

A detention dam to reduce the risk from the 1% event at site N5 was determined to be the most effective of the dam sites but also very costly, therefore various dam heights and combinations with other measures were examined in an attempt to find a more affordable alternative that was also very effective .

For South Gabouri Creek, the following structural alternatives were evaluated:

- The authorized plan (CH-BR),
- Bridge replacements alone (BR),
- Excavation of lime deposits (LE),

- Replace bridges and excavate lime (BR-LE),
- Removal of obstructions from the floodplain (OF),
- A levee on Gabouri Street (GL),
- Obstruction removal and creek widening downstream of Main Street (OF-DW),
- The Gabouri Street levee with obstruction removal and downstream widening (GL-OF-DW), and
- Detention at seven sites (S1 through S7), alone and in combination.

Of the seven potential detention sites evaluated, only two (S6 and S7) were found to yield significant flood risk reduction potential. Detention at site S7 for the 1% chance of exceedance event was determined to be the most effective but also very costly, therefore various dam heights and combinations with other measures were examined to find a more affordable alternative which would also be effective.

7.2.2 Non-structural Alternatives

Many methods of floodproofing (FP) were considered for implementation. However, some of the more traditional methods that have been implemented in response to floods on large rivers (which rise slowly, giving homeowners time to take actions) are not useful in responding to the more rapid rise of the creeks' floods. For slow-rising floods, there is usually sufficient time to install barriers in doors and windows, elevate valuables, and close openings in ring levees. In the relatively quick rise and fall of the creeks' floodwaters, it is unlikely that there would be sufficient time to perform these tasks, even if the homeowner was home and alerted to the coming event. Therefore, only dry floodproofing techniques that do not require human intervention to make the structure watertight were considered for this project such as a veneer wall around the structure and waterproof entry doors.

In addition to dry floodproofing, wet floodproofing measures were considered. In wet floodproofing, floodwaters are allowed to enter the structure but damages are avoided by relocating damageable items (such as furnaces and air conditioning units) and/or preventing damages to basements by filling them in.

Structure elevation was considered for all structures. With only one exception, most structures would not need to be elevated to raise their first floors above the 1% probability flood elevation. Only two structures have flooding above their first floor elevations. If performed successfully, elevation could be accomplished with little visual impact to the structures. However, any modification to a historic structure is considered highly detrimental to that structure's historic value. Any recommendation for elevation must include weighing the economic and cultural damages of flooding the structure versus the cultural damages of elevating the structure.

Buyouts (BO) and Relocations (RL) were not considered stand-alone options for this project. Buyouts would involve destroying historic structures and was considered to be a last-resort option. Relocations, while preserving the structure, would remove it from its historic setting, causing damage to the historic value of the structure. Additionally, due to a shortage of available land and housing inside the city limits, both buyouts and relocations would likely remove

residents from the city, along with the associated tax income, while creating additional vacant land for the City to maintain. After losing many residents to buyouts following the 1993 flood, the City is reluctant to consider buyouts and relocations as stand-alone alternatives for the North Gabouri Creek. In coordination with the Missouri SHPO, it was determined that buyouts and relocations would have the greatest adverse impact to cultural resources.

Finally, a combination of floodproofing, buyouts, and relocations was considered as a non-structural alternative (FP-BO-RL).

7.2.3 Combinations of Structural and Non-structural Measures

Non-structural measures were considered in conjunction with structural measures whenever a particular structural measure was proving to be effective for all but a few structures.

7.2.4 Alternatives Screening

All alternatives were initially screened for effectiveness and engineering feasibility.

Table 7-1 summarizes the alternatives that were considered for North and South Gabouri Creeks and displays which were carried forward to the final array, including screening rationale. A more detailed discussion of the screening of each alternative can be found in Appendix G – PLAN FORMULATION.

Table 7-1: Screening of Nonstructural and Structural Alternatives for North and South Gabouri Creeks

Nonstructural Measures	**Screening Results and Rationale**
BO – Full Acquisition/Buy-out/Demolition	Considered the most damaging to historic resources, as well as the least cost-effective of the non-structural measures, this was screened from further consideration.
FP – Floodproofing (wet/dry-proofing, elevation)	Carried forward for further consideration with some concern for cultural impacts.
RL – Relocation	Considered very damaging to historic resources, as well as less cost-effective than floodproofing, this was screened from further consideration.
Structural Measures	
Levees (designated with combinations of "L")	Only the North Gabouri Main Street to Sixth Street levee (L2) was found to be effective at reducing flood damages and engineeringly feasible. All other levee configurations and combinations were screened from further consideration.
Detention Dams (designated with combinations of "N" or "S" for each creek)	Many locations and configurations considered but screened from further consideration due to technical infeasibility (lack of suitable foundation conditions).
CH-BR – Channelization and Bridge Replacement (Authorized Plan)	Carried forward for further consideration on both creeks.
BR - Bridge Replacement	Screened from further consideration due to ineffective as a stand-alone measure.
LE - Excavation of Lime Deposits	Screened from further consideration due to ineffective as a stand-alone measure.
BR-LE – Bridge Replacements with Lime Deposit Excavation	Combining these two measures did not significantly increase their effectiveness. Screened from further consideration.
OF – Open Floodway	Screened from further consideration due to ineffective as a stand-alone measure.
OF-DW – Open the Floodway with Downstream Widening	Adding downstream widening did not increase the effectiveness of the Open Floodway alternative. Eliminated from further consideration due to lack of effectiveness.

7.2.5 Plans Carried Forward for Comparison (Final Array)

7.2.5.1 North Gabouri Creek

After initial screening (where alternatives were evaluated for effectiveness and engineering feasibility), four alternatives were carried forward for further evaluation.

The alternatives carried forward into the final analysis for North Gabouri were:

- EC – No Action
- CH-BR-FP – Channel and Bridges with limited Floodproofing (updated authorized project)
- L2-CH2 – North Gabouri Levee
- FP – Floodproofing

The Channel and Bridges (CH-BR-FP) alternative is essentially the authorized plan for North Gabouri Creek, adjusted slightly to account for changes to the existing conditions and to address the 1% (100-year) flood event. It involves channel widening from the double railroad bridge downstream of Main Street to a point upstream of Sixth Street. The new channel would have a 30-foot bottom width with 1 on 2.5 side slopes. The two railroad bridges and the bridges at Main Street and Fourth Street would be replaced. This plan protects all but 2 structures (structures 452 and 454). As discussed later in the floodproofing alternative, it was determined that there was no effective and acceptable action that could be taken to floodproof structure 452. Structure 454 would be wet floodproofed.

The North Gabouri levee alternative (L2-CH2) would start upstream at high ground behind the homes on the west side of Sixth Street, run southeast and curve through the City park, and then run adjacent to the north bank of the creek until it reaches high ground near Main Street. The levee would be approximately 8 feet high, on average. The alignment cuts across a meander of North Gabouri Creek, necessitating a channel realignment and related environmental mitigation. This levee alignment also crosses three FEMA Hazard Mitigation Grant Program buyout properties. Coordination with FEMA was completed and final draft modifications to deed restrictions were received. During high water events, interior drainage would be temporarily ponded in the park and two other locations downstream where gravity drains would be installed. There is insufficient area available to pond the 1% (100-year) rainfall event and, therefore, a pump station would be installed near Third Street. There are no closure structures planned, due to the rapid rise of flood waters during a flash flood event. Therefore, to maintain prompt emergency access, Fourth Street would need to cross over the levee, requiring the Fourth Street bridge to be replaced. There would be some induced flooding adjacent to and upstream of the levee but it would not adversely affect any structures. To accommodate the levee and Fourth Street bridge relocation, structure 408 (a National Register structure) would need to be removed or relocated. Additionally, the vibration caused by driving sheet pile in the vicinity of structure 468 (a vertical log structure contributing to the National Register District and the Draft National Historic Landmark District) has a high potential to damage the structure. This plan places all but 2 structures (structures 452 and 454) inside the levee's protected area. As discussed later in the floodproofing alternative, it was determined that there was no effective and acceptable action that could be taken to floodproof structure 452. Structure 454 would be wet floodproofed.

For the floodproofing alternative, most of the flooded structures were visited and evaluated (as homeowners would allow) to determine engineeringly feasible floodproofing options. The costs of the feasible measures were estimated and the least-costly measure was identified. Details about the evaluation of each structure can be found in the Engineering Appendix. For the North Creek, wet floodproofing was identified as the most cost-effective measure for all six structures. Maintenance responsibilities would fall on the individual structure owners but are not anticipated to be any different than normal home maintenance.

7.2.5.2 South Gabouri Creek

The alternatives carried forward into the final analysis for South Gabouri were:

- EC – No Action
- CH-BR-FP – Channel and Bridges with limited Floodproofing
- FP – Floodproofing

The Channel and Bridges (CH-BR-FP) alternative is essentially the authorized project, adjusted slightly to account for changes to the existing conditions and to address the 1% (100-year) flood event. It involves channel widening from the railroad bridge just upstream of Main Street to State Highway 61. The new channel would have a 20-foot bottom width with 1 on 2 side slopes. Two railroad bridges (where the Missouri-Illinois railroad crosses the creek upstream of Main Street and upstream of Seventh Street), and the bridge at Fourth Street would be replaced. The combination of channel modifications and bridge replacements protects all but two structures (236 and 255). These would be protected by wet floodproofing.

For the floodproofing alternative, most of the flooded structures were visited and evaluated (as homeowners would allow) to determine engineeringly feasible floodproofing options. The costs of the feasible measures were estimated and weighed against cultural resources impacts. For the South Creek, wet floodproofing was identified as the most cost-effective measure for all but one structure (structure 257). Structure 257 receives first floor flooding and is therefore a poor candidate for wet floodproofing. It also has a stone foundation that is in a severely deteriorated state and would need to be re-built in order to dry floodproof it. Elevating the structure was determined to be the most effective measure. Maintenance responsibilities would fall on the individual structure owners but are not anticipated to be any different than normal home maintenance.

7.2.6 Evaluation of Alternative Plans

The following paragraphs describe the significant contributions or effects of each alternative. The cultural and ecological effects are examined, as well as how each alternative meets the project's objectives. Costs are evaluated and each alternative's completeness, effectiveness, efficiency and acceptability are discussed.

7.2.6.1 Cultural Resources Effects

Visual Impacts.

Of the final array of alternatives, the authorized plan (CH-BR-FP) would have a minimal visual impact to the historic fabric of the city. The primary noticeable changes would be new bridges (which could be constructed to appear historic), the temporary loss of vegetation along the creek, and a more uniform creek channel throughout the city.

Any structure elevation (FP) would have visual impacts not only on the structure itself but also on nearby structures. Wet floodproofing (FP) would have little to no visual impacts on the structures themselves or the surrounding structures, as exterior modifications are anticipated to be minimal or non-existent.

The North Gabouri Levee alternative (L2-CH2) would have visual impacts on most of the historic structures located along North Gabouri Creek. It would average 8 feet high, making it very noticeable and altering the setting of the historic structures.

Physical Impacts

The authorized plan (CH-BR-FP) would have impacts to four bridges which are historic resources. The North Fourth Street bridge, North Main Street bridge, the railroad bridge that crosses South Main Street, and the South Fourth Street bridge are all contributing structures to the National Register District. Their removal would require further consultation including a Memorandum of Agreement with the SHPO as well as a mitigation plan.

In consultation with the staff of the State Historic Preservation Officer of Missouri and National Register staff regarding the floodproofing (FP) alternatives, a determination was made that buildings that have been elevated may no longer eligible for the National Register due to the diminished historic integrity of the property's design, setting, and feeling. For wet floodproofing, if foundations must be modified for water ingress and egress, this could be determined to be a physical impact.

The North Gabouri Levee (L2-CH2) would require the buyout or relocation of one historic structure and construction activities have the potential to damage a second historic structure due to its proximity to the levee where sheetpile must be driven. Additionally, the North Fourth Street bridge would need to be replaced and is a contributing structure to the National Register District.

Cultural Mitigation

All of the action alternatives would have adverse impacts and require cultural resources mitigation. The channel alternatives and the North Gabouri Levee alternative would all require a thorough cultural resources investigation for the construction footprint, as well as HABS/HAER (Historic American Buildings Survey/Historic American Engineering Record) documentation related to the replacement of the Fourth Street and Main Street bridges over both creeks. There may be additional mitigation requirements for these alternatives, depending on the outcome of the investigations but those potential mitigation requirements are not known at this time. The

floodproofing alternatives would also require HABS/HAER documentation of the conditions of the structures prior to any floodproofing action.

7.2.6.2 Ecological Effects

The authorized plan (CH-BR-FP) would impact 2,042 ft. of North Gabouri Creek, and approximately 2 acres of riparian forest. On the South Creek, the authorized plan (CH-BR-FP) would disturb approximately 7,457 feet of South Gabouri Creek and impact 1.2 acres of riparian habitat. In both cases, there would be major impacts to aquatic invertebrates and fish habitat. The loss of riparian habitat could also impact Indiana and northern long-eared bats.

The North Gabouri levee and floodproofing alternative (L2-CH2) would impact 530 feet of the creek, 3.0 acres of riparian forest and one half acre of forested wetland. The existing channel is bordered by a mature, fully functioning, riparian corridor.

The floodproofing alternatives (FP) for South and North Gabouri Creeks is not anticipated to have any significant environmental effects. There may be short-term minor impacts due to construction activities.

7.2.6.3 Fulfillment of Objectives

Each alternative plan that was carried into the final analysis was compared to the project's key objectives (reduce flood damages, preserve historic character, and minimize OMRR&R) and rated on a scale of 0 to 3 according to its fulfillment of that objective. A score of 0 indicates that the alternative does not meet the objective. A score of 1 indicates that it minimally meets the objective; 2 indicates that it moderately meets the objective; and 3 indicates that it fully meets the objective. The scoring of each alternative, along with a brief explanation, can be found in Table 7-2.

Table 7-2. Fulfillment of Objectives

Planning Objective	EC- No Action	CH-BR-FP – Channel and Bridges (North and South)	L2-CH2-FP – Levee, limited channel and floodproofing (North only)	FP – Floodproofing (North and South)
Minimize operations and maintenance costs and responsibilities	3 – requires no additional operation and maintenance.	2 – O&M costs primarily associated with occasional channel clean-out	1 – requires regular levee maintenance and occasional channel maintenance.	3 – O&M costs are the responsibility of the homeowners.
Prevent future flood damages to historic structures, the economic losses, and the social disruption caused by flooding of North Gabouri Creek and South Gabouri Creek	0 – does not address.	3 – eliminates all 100-yr structure flooding.	2 – eliminates most but not all 100-yr structure damages.	2 – eliminates most but not all 100-yr structure damages.
Preserve and enhance the historic character of Ste. Genevieve	0 – does not address.	2 - channel modification would have some visual impacts and physical impacts to bridges.	1 – preserves most but not all structures, has significant visual impacts, and has physical impacts to one bridge.	2 – reduces damages to structures but has some physical impacts and does not prevent possible foundation degradation.
Total Score	3	7	5	8

7.2.6.4 Costs

Table 7-3 displays the total implementation cost estimate for each alternative in the final array.

Table 7-3. Alternative Costs

Alternative	Design/ Construction	Real Estate	Mitigation		Total First Cost
			Environmental	Cultural	
EC – No Action	$0	$0	$0	$0	$0
North Gabouri Creek					
CH-BR-FP – Channel and Bridges	$14,962,000	$1,130,000	$363,000	$40,000	$16,495,000
L2-CH2-FP – Levee, limited channel and floodproofing	$9,090,000	$1,550,000	$252,000	$35,000	$10,927,000
FP – Floodproofing	$395,000	$16,000	$0	$10,000	$421,000
South Gabouri Creek					
CH-BR-FP – Channel and Bridges	$26,481,000	$926,000	$1,549,000	$40,000	$28,996,000
FP - Floodproofing	$581,000	$58,000	$0	$35,000	$674,000

7.2.6.5 Completeness, Effectiveness, Efficiency & Acceptability

Effectiveness

Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities. An effective plan is responsive to the identified needs and makes a significant contribution to the solution of some problem or to the realization of some opportunity. It also contributes to the attainment of planning objectives. The most effective alternatives make significant contributions to all the planning objectives. The effectiveness of each plan can be seen in Tables 7-3 and 7-5 (Effectiveness) and in Table 7-6 (Fulfillment of Objectives).

Table 7-6 demonstrates that all of the alternatives contribute to the project's objectives to some degree, except for the No Action alternative. The most effective alternative is floodproofing, followed by channelization. The North Gabouri Levee is the least effective of the final alternatives for that creek, due to its higher OMRR&R costs and concerns with significant impacts to historic resources.

Each alternative except the No Action plan addresses the risk for flood damages to some degree. However, no alternative eliminates the risk for flood damages completely and therefore there remains a residual risk. For all of the action alternatives, there is a residual risk of flooding for events greater than the 1% flood event. For the channelization alternatives, four structures do not fully benefit from the plan (452, 454, 236, and 255) and would continue to experience flood damages for events more frequent than the 1% flood event. The North Gabouri Levee alternative leaves two structures outside of the levee alignment (452 and 454) and their flood risk remains unchanged. The floodproofing alternative does not address the flood risk for three structures where damages begin at the 0.5% and 0.2% flood events.

Efficiency

Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment. Costs of the various alternatives are summarized in Table 7-7.

Table 7-7 illustrates that the authorized plan (Channel and Bridges) is the most costly alternative and is anticipated to require the most environmental mitigation. The second most costly alternative is the North Gabouri Levee, and it also requires some mitigation. Floodproofing is the least costly alternative and requires no environmental mitigation. All of the action alternatives require cultural resources mitigation actions.

Acceptability

Acceptability is defined as the workability and viability of the alternative plan with respect to acceptance by Federal and non-Federal entities and the public and the compatibility with existing laws, regulations, and public policies.

All of the final alternative plans are generally acceptable to the Federal, State, and non-Federal entities involved in the stakeholder working group. However, each stakeholder comes to the working group with a different point of view and has different preferences with regard to which alternative should be implemented. Regardless of these different preferences, all stakeholders are concerned with minimizing cultural impacts. The floodproofing alternative best minimizes cultural impacts. The Federal and State stakeholders also have a strong interest in minimizing ecological impacts, which floodproofing also satisfies best of the final array alternatives.

The City wants to make an informed decision regarding expenditure of local funds for alternatives supported by the residents. In past public meetings, there has been no clear public support for any single alternative on either creek.

Completeness

Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. To establish the completeness of a plan, it is helpful to list those factors beyond the control of the planning team that are required to make the plan's effects (benefits) a reality.

The authorized plan is complete and requires no additional action by others to realize the plans' benefits. The North Gabouri Levee is also complete. For the floodproofing alternatives to be complete, the homeowners must agree to participate (participation is voluntary).

7.2.7 Comparison of Alternative Plans

Table 7-4 summaries the information from many of the preceding tables, including the effectiveness and costs associated with each of the final alternatives. From this information, it can be seen that the floodproofing alternative is the most effective and best fulfills the project's objectives. It is also the least costly alternative, has no significant environmental impacts. All action alternatives would have cultural resources impacts. The cultural mitigation costs are displayed separately from the environmental mitigation costs.

Table 7-4. North Gabouri Comparison of Alternative Plans

Alternative		Total First Cost	Objective Score	Environmental Mitigation Cost	Cultural Mitigation Cost
Shorthand	**Name**				
North Gabouri					
CH-BR-FP	Authorized Plan	$16,495,000	7	$363,000	$40,000
L2-CH2	Levee	$10,927,000	5	$252,000	$35,000
FP	Floodproofing	$421,000	8	$0	$10,000
South Gabouri					
CH-BR-FP	Authorized Plan	$28,996,000	7	$1,549,000	$40,000
FP	Floodproofing	$674,000	8	$0	$35,000

8. Public Input

8.1 *February 2004 Public Meeting*. City residents and interested individuals were briefed on the progress of the study and then broken into small groups based on the watershed they were interested in. Corps facilitators of these small groups then presented several alternatives that were considered to be the most effective. The participants were invited to ask questions and comment on the alternatives. In the final small group activity, participants were asked to vote for their first, second and third preferences among the alternatives presented. The participants were then brought back together into a large group and each facilitator reported on any general themes of discussion and the results of the voting. Participants were asked to submit any additional questions or comments on the provided comment form within the next 30 days. Documentation of the participants, their questions and comments, and the results of voting can be found in Appendix J – PUBLIC INVOLVEMENT.

8.2 *July 2006 Homeowner Meetings*. Two meetings were held with the owners of those structures impacted by flooding along both creeks. The purpose of the meeting was to educate them regarding the non-structural alternative of structure elevation and seek their input as to the acceptability of this alternative. The responses of the structure owners can be found in Appendix J.

8.3 *September 2006 Public Meeting*. A public meeting was held to present the final array of alternatives to the citizens of Ste Genevieve and solicit feedback regarding their preferences. The comments submitted at the meeting and in the 30-day comment period can be found in Appendix J. There was no strong opposition or support regarding any of the alternatives and the questions and comments centered primarily around understanding possible implications to specific properties.

9. Identification of Flood Damage Reduction Tentatively Selected Plans

In general, flood risk management studies will identify the National Economic Development (NED) plan as part of their decision-making process. The NED plan is defined as “the alternative plan with the greatest net economic benefit consistent with protecting the Nation’s environment”. Because the project’s authorizing language stipulated that the project is justified based on historical benefits, traditional economic benefits have not been developed during this study.

Instead, each alternative's cost has been weighed against its effectiveness in reducing the number of structures being damaged and the environmental and cultural impacts.

The lowest cost action alternative for each creek is Floodproofing. This alternative has also been shown to best address the project's objectives of reducing flood damages while preserving historic resources.

After carefully weighing the costs, the cultural impacts, and the risks, the City, State and Corps agree that the floodproofing alternatives on both the North Gabouri and South Gabouri Creeks, are identified as the tentatively selected plans to reduce flood damages. The total combined estimated first cost of these two alternatives is estimated to be $1,095,000.

Full details of the tentatively selected plans can be found in Section 11.

10. Recreation Plan Development and Analysis

The 1965 Report (Subject: Sainte Genevieve) of the Board of Engineers for River and Harbors, which is cited in the authorizing language, includes recreation features in its description of the "Plan of Improvement" for Ste Genevieve. The authority to include recreation in civil works projects is found in the Flood Control Act of 1944 (Public Law 78-534)a, as amended by the Water Resources Development 1986 (Public Law 99-662).

Recreation features were not included during the implementation of the Mississippi River levee and, therefore, the following paragraphs examine recreation opportunities related to all three of the flood risk management systems implemented or proposed for Ste Genevieve (the Mississippi River levee, and the North and South Gabouri Creeks).

10.1 Problems and Opportunities

Walking, bicycling, exercise, nature and multipurpose trails are needed in Southeast Missouri according to the 2013-2017 Missouri Statewide Comprehensive Outdoor Recreation Plan (SCORP) community needs assessment. The 2011 ***Missouri Residents Survey***, a statewide survey of 768 Missouri residents confirmed a high demand for trails, walkable streets and sidewalks, and more organized youth and teen activities. The SCORP assessment also indicated that establishment of trails have grown in importance to the public since 1996 and the importance of bicycle lanes, surfacing of roads and provision of separate trails for exercise, walking and bicycling have equal future importance. According to prior SCORP assessments and the responses of surveyed groups for the present SCORP, participation in trail hiking and trail bicycling continues to increase in the state of Missouri. Trails in Missouri communities alone are only meeting half of the existing demand according to the current SCORP. The Ste. Genevieve flood damage reduction project's main levee provides an opportunity for establishing a trail on the levee that would complement the City's bike trail to the Ste. Genevieve Mississippi River ferry. The proposed tributary levee at North Gabouri would also provide an opportunity for development of day-use facilities at the City's park on LaHaye Street.

10.1.1 Existing Conditions

Ste. Genevieve is an historic city on the Mississippi River that attracts visitors from around the country to view its colonial French structures. The City's economy is heavily influenced by tourism and the provision of services and activities to enhance the existing activities. Since completion of the Mississippi River Levee in 2002, local residents have visited the 3.5-mile levee to walk, view wildlife or bicycle. Promotion and provision for bicycling activities through the development of bicycling maps by the States of Illinois and Missouri has also resulted in cyclists visiting Ste. Genevieve.

National trails that pass through or near Ste. Genevieve, such as the Mississippi River Trail and the Transamerica Trail respectively, bring visitors to the area as well. Bicycle traffic is very evident; the ferry service north of the city on the Mississippi River reported that approximately 250 bicyclists use their service annually.

The City of Ste. Genevieve has expressed interest in improving access to the levee and developing additional recreation features to enhance visitor use of the levee. The City has constructed a walk/bike trail from the historic downtown area to the Mississippi River ferry, which is located just north of the Mississippi River Levee. A trail on top of the levee, approximately 12,125 feet (2.3 mi.) long, is proposed for the northern portion of the Mississippi River Levee. Access to the levee is feasible at ramps located along the levee and at the marina road at the southern end as shown on the map in Figure 10-3.

Opportunities for cost-shared recreational facilities are limited to lands required to construct the project; therefore, the primary focus of this recreation analysis will be for project lands, namely the Mississippi River Levee.

10.1.1.1 The Mississippi River Trail

The Mississippi River Trail (see Figure 10-1) parallels the entire 2000-mile length of the Mississippi River and traverses several of the states on both sides of the river. The trail begins at the headwaters of the Mississippi at Lake Itasca, Minnesota, winding through Wisconsin, Iowa, Illinois, Missouri, Kentucky, Arkansas, Tennessee, Mississippi, and Louisiana before reaching its southern terminus in the French Quarter in New Orleans. The Missouri section begins in Hannibal, Missouri and continues south past the St. Louis Arch, eventually leaving Missouri at Dorena and crossing the Mississippi River via the Dorena-Hickman Ferry. While the Missouri section is not totally complete, it is signed from Hannibal to St. Louis and from south of St. Louis to Dorena with signs featuring the "MRT" logo. The Missouri section of the Mississippi River Trail is approximately 400 miles long, comprising 20 percent of the entire 2000-mile route. This trail is located on designated roadways and is primarily geared towards bicyclists. In the Ste. Genevieve area the trail follows U.S. Highway 61.

Figure 10-1 - Mississippi River Trail in the Vicinity of Ste Genevieve

10.1.1.2 The Transamerica Trail

The Transamerica Trail (Figure 10-2) traverses the United States west to east beginning near Astoria, Oregon and ending at Yorktown, Virginia. The 4,250-mile bike route offers everything one would expect from a coast-to-coast crossing. All types of scenery and terrain including ocean coastline, lush forests, high desert, and mountain passes, snow-capped peaks, expansive plains, rolling hills, and wide rivers can be experienced. The Missouri section of the Transamerica Trail begins at the southwestern border along State Route 126 east of Pittsburg, Kansas, continuing east to Golden City and through Missouri's South Central Ozark region, including the communities of Hartville, Houston, Summersville, and Eminence. From there the route continues in a northeasterly direction through Ellington, Ironton, Farmington, and Ste. Genevieve and crosses the Mississippi River on State Route 51 to Chester, Illinois. The Missouri section of the Transamerica Trail is approximately 350 miles long, comprising 8.2 percent of the entire 4,250-mile route. This trail is located on designated roadways and is primarily geared towards bicyclists. In the vicinity of Ste. Genevieve it follows State Highway 32 and U.S. Highway 61.

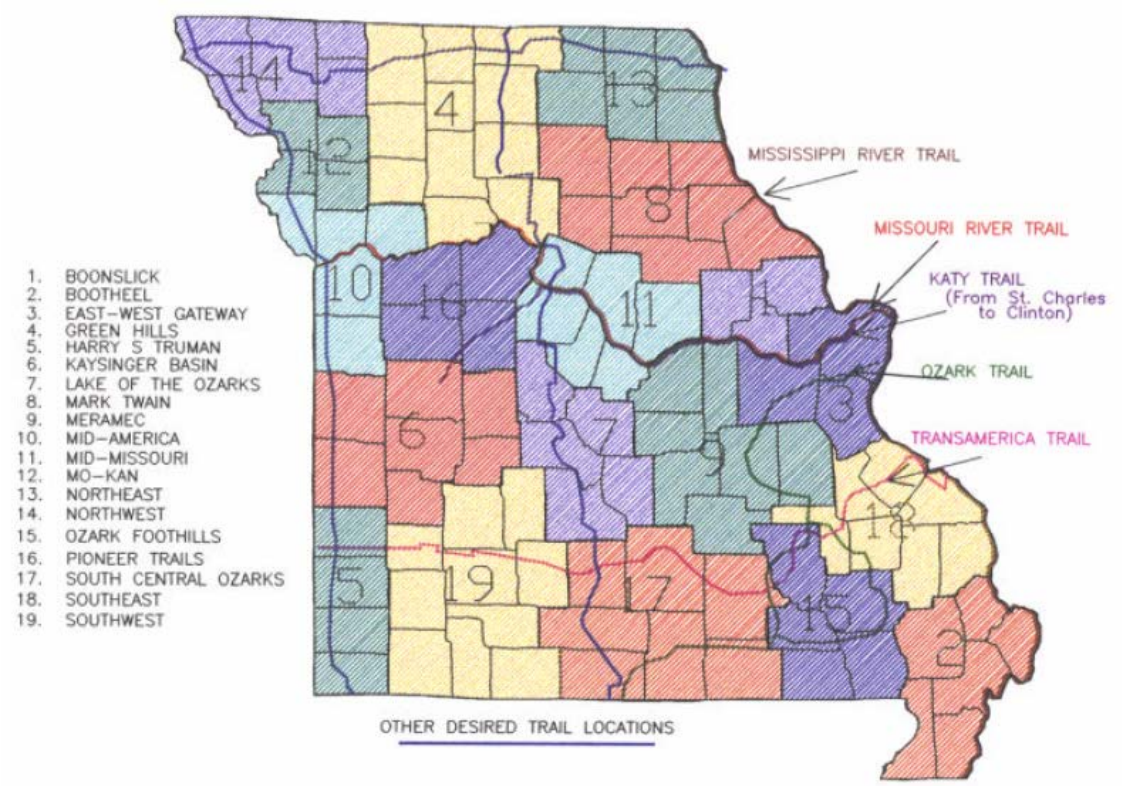

FIGURE 10-2 - TRANSAMERICA TRAIL IN MISSOURI

10.1.1.3 Hawn State Park

Hawn State Park, located approximately 1 mile southwest of Ste. Genevieve, is known as Missouri's loveliest state park. There is camping and two hiking and backpack trails that total approximately 17.5 miles in length.

10.1.1.4 Other Recreation Features in Ste. Genevieve

Table 10-1 lists recreation features located in and around Ste. Genevieve.

Table 10-1. Existing Recreational Facilities in Ste. Genevieve, Missouri.

Existing Recreation Areas	Acres/Uses	Owner
Pere Marquette Park	48.9; urban recreation but no trails	City of Ste. Genevieve
Ball park (adjoining Pere Marquette	4; ball field	City of Ste. Genevieve
Lions Club Park	0.25; urban park, benches	City of Ste. Genevieve
Khoury League Field	4, ball field	VFW
Skateboard Park and BMX track	1, urban skate park and bike track	City of Ste. Genevieve
Hawn State Park	1500, state park	MDNR

Existing trails in the Ste. Genevieve area are summarized in Table 10-2.

Table 10-2. Existing Trails in and Adjacent to Ste. Genevieve, Missouri

#	MILES	STATUS	LOCATION OF TRAIL
1	400*	Existing	Mississippi River Trail
2	350*	Existing	Transamerica Trail
3	17.5	Existing	Hawn State Park Hiking and Backpacking Trail (2)

* Trail miles in Missouri only.

10.1.2 Future Conditions

It is expected that tourism in Ste. Genevieve would be maintained or expanded and continue to be stable in the community. As stated in the current Missouri SCORP, only half of the demand for trails in these communities is being met. The City of Ste. Genevieve has developed a trail to connect downtown Ste. Genevieve to the Mississippi River Ferry on the north side. This trail would be approximately three miles long, be hard-surfaced, and would provide at least one access to the Mississippi River Levee trail from the City. The expectation is that City residents would continue to visit the North Gabouri Park for picnicking and hiking.

10.2 Objectives and Constraints

10.2.1 Objectives

The following recreation objectives have been developed with input from the City of Ste. Genevieve.

- Increase and enhance day-use facilities associated with the Mississippi River Levee project
- Improve access and parking at the Mississippi River Levee
- Provide interpretive displays at the main levee

10.2.2 Constraints

- The recreation plan for a flood damage reduction project must be formulated solely utilizing lands acquired for non-recreation purposes.
- Protect the integrity of the levees.
- Corps guidance requires that only recreation facilities located on basic project lands be included in the 50/50 cost share. Cost of lands required to provide access to and along the Corps project can be included in the sponsor's cost-share portion.
- Recreation features are limited to 10% of the total project cost. The total project cost includes the approximately $55 million spent on the Mississippi River Levee plus the cost of the recommended plans for the two creeks.

10.3 Plan Developed

Because the tentatively selected plans for North and South Gabouri Creeks do not include any real estate acquisition, the only project lands available for recreation plan development are those acquired for the Mississippi River Levee construction.

The proposed plan as shown in Figure 10-3 includes a 2.3 mile-long asphalt-surfaced trail on the main levee and access ramps. An asphalt surface would accommodate all recreationists including persons with disabilities. Typical trail support facilities, such as benches and signage, would be included in the final design. Lighting would be provided on the main levee for visitor safety.

Figure 10-3 – Hike/Bike Trail on Main Levee

10.4 Evaluation of Recreation Plan

10.4.1 Fulfillment of Objectives

The recreation plan would provide more opportunities and better quality recreational facilities, especially for persons with disabilities.

10.4.2 Environmental Effects

The proposed alternatives would all be constructed on previously disturbed areas (levee); therefore, no adverse environmental effects are anticipated. An environmental assessment has been prepared for the project.

10.4.3 Costs

The estimated first cost for the construction of the proposed recreation facilities is $383,000. Additionally, there are portions of the proposed trail located on permanent easements acquired for the Mississippi River Levee. Permanent easements are insufficient for construction of recreation features and therefore there is an additional estimated cost of $152,000 to acquire this land in fee. The total estimated first cost of constructing recreation features is $535,000.

10.4.4 Recreational Benefits Analysis

The levee trail has the potential to attract walkers and bicyclists. In addition to local residents, Ste. Genevieve has many tourists who come to visit the nationally significant historical structures. The proximity of the levee trail to the historic district may entice many of these visitors to explore the trail and Mississippi River. However, the trail is also expected to be used primarily by people living or working in Ste. Genevieve. The convenience of the levee trail to those who live and/or work in Ste. Genevieve would generate much of the use. Bicyclists would be more likely than walkers to access other trails via the levee trail, and most bicyclists and walkers using the levee trail would be expected to be new trail users rather than transferring their activities from other trails. It is anticipated that most levee trail users would begin in the Ste. Genevieve city and county area, but some may begin on other trails.

Data used in the levee recreation analysis was coordinated with the City of Ste. Genevieve. However, use of the proposed levee trail was estimated using the facility capacity method. Recreation criteria, presented in Table 10-3, reflect the anticipated use of the proposed trail through the Ste. Genevieve urban area. The percentage of annual visitation expected to occur during the peak month was based on projections of expected monthly visitation (as a proportion of the peak month visitation). The monthly visitation proportions are presented in Table 10-3. It was estimated that the trail could accommodate 13,104 bicyclists, rollerbladers, and skateboarders and 33,930 walkers, hikers, and joggers annually using the recreation criteria for bicycling and hiking, respectively. Annual visitation was projected at 3 percent of capacity the first year, 7 percent of capacity the second year, and 10 percent of capacity the third year, based on the levee trail location and the observations of visitation at existing trails. Due to its location in a small city and mostly rural county, average annual visitation for the trail would be expected to be about 10 percent of capacity (approx. 4,700).

The proposed 2.3-mile levee trail would address the demand for a hike/bike trail based on the evaluation in the 2013-2017 Missouri SCORP for the Southeast Region. The proximity of the hike/bike trail to potential new trail users; its potential connectivity to other bicycle trails; and

the existing need for bicycle trails would support the projection that the peak day use trail could reach 10 percent of capacity within 3 years after trail construction is completed.

Without the development of the levee trail, recreation in the project area would be limited to walking, sightseeing and wildlife observation. A recreation use estimate of 75 persons per levee mile per year for low-density recreation without developed facilities was formulated from information supplied by the City of Ste. Genevieve. Low-density recreation would be expected to occur on a total of 2.3 publicly accessible miles of levee (the northern levee). As presented in Table 10-4, it was estimated that 173 visitors (75 x 2.3) per year would engage in low-density recreation activities on levee lands if no trail development occurred.

The Unit Day Value (UDV) method was used to determine daily recreation benefits for casual use of the main levee. A total of 17 points were obtained using the Guidelines for Assigning Points for General Recreation table from EGM 15-01: a=3 (predominantly hiking and nature observation); b=0 (several within 30 minutes); c=3 (basic facility); d=3(fair access within site); and e=6 (average aesthetic). Based on Economic Guidance Memorandum (EGM) 15-01, the UDV was calculated to be $4.98 and annual benefits were calculated to be $862, as presented in Table 10-4.

If the proposed 2.3-mile-long trail is constructed, all the low-density visitors described above would be expected to use the trail and to derive increased enjoyment from the proposed recreation facilities. A total of 35 points were obtained for visitors using the levee trail as proposed from the Guidelines for Assigning Points for General Recreation table of EGM 15-01: a=5 (hiking, walking, jogging, bicycling, picnicking, environmental interpretation/ education); b=8 (limited opportunities within 1 hour); c=5 (trail is basic surface, 10 feet wide); d=11 (good trail within site, accessed by good city streets); and e=6 (average aesthetic). For the maximum trail development users accessing the Mississippi River Levee Trail, 47 points were obtained: a=10 (skateboarding and rollerblading are added activities); b=10; c=10 (optimum facility); d=11 (good access); and e=6 (average aesthetic).

Based on EGM 15-01, the value of a day of general recreation for the Ste. Genevieve project was calculated to be $8.01 for Mississippi River Levee Recreation. With an interest rate of 3.125 percent and a 50-year project life, annual recreation benefits were calculated to be $35,134 as presented in Table 10-4.

Table 10-3. Annual Visitation, Sainte Genevieve Trail (Using site-based, urban trail recreation criteria)

ANNUAL VISITATION, STE GENEVIEVE TRAIL, STE GENEVIEVE, MISSOURI
USING SITE-BASED, URBAN TRAIL RECREATION CRITERIA

	BICYCLING, ROLLERBLADING, AND SKATEBOARDING			WALKING, HIKING, AND JOGGING
2.3	miles of trail		2.3	miles of trail
12	trail users/mile	x	25	trail users/mile
28	instantaneous carrying capacity of trail	=	58	instantaneous carrying capacity of trail
4	turnover rate	x	4	turnover rate
112	trail users per peak day	=	232	trail users per peak day
9	peak days per month (weekends and holidays)	x	9	peak days per month (weekends and holidays)
1,008	peak-day trail users during peak month	=	2,088	peak-day trail users during peak month
0.5	proportion of peak month trail users on peak days	/	0.4	proportion of peak month trail users on peak days (from table below)
2,016	peak month trail users	=	5,220	peak month trail users
0.15385	proportion of annual visitation during peak month (from table below)	/	0.15385	proportion of annual visitation occurring during peak month
13,104	Annual Bicycling, Rollerblading, and Skateboarding Visitation	=	33,930	Annual Walking, Hiking, and Jogging Visitation

47,034 TOTAL ANNUAL TRAIL VISITATION

Month	Proportion of Peak Month Visitation
January	0.10
February	0.10
March	0.20
April	0.75
May	0.95
June	1.00
July	1.00
August	0.85
September	0.80
October	0.45
November	0.20
December	0.10
TOTAL	6.50

0.153846 Proportion of annual visitation occurring during peak month

Month	Proportion of Peak Month Visitation
January	0.10
February	0.10
March	0.20
April	0.75
May	0.95
June	1.00
July	1.00
August	0.85
September	0.80
October	0.45
November	0.20
December	0.10
TOTAL	6.50

0.153846 Proportion of annual visitation occurring during peak month

Table 10-4. Recreation Benefits (50-year @3.125)

STE GENEVIEVE, MAIN LEVEE RECREATION (50-YEAR @ 3.125) AND NORTH GABOURI RECREATION ACCESS

Recreation Activity or Facility	Unit Day Value (UDV) Points	FY 2010 Gen. Recreation Benefit /Day	Annual Visitors	PV, Benefits Years 1-2	PV, Benefits Years 3-50	Annual Benefits
Main Levee Hiking (Recreation Benefits without Trail Development)	17	$4.98	173	$1,646	$20,005	$862
Hiking/Bicycle Trail, 2.3 miles, max capacity in year 3						
Main Levee Recreation with Support Facilities	47	$8.01	4,700	$30,401	$874,166	$35,995
Total Benefits Added						$35,134

10.4.4.1 Economic Analysis of Proposed Recreation Facilities.

The economic analysis calculations for the proposed recreation facilities are presented in Table 10-5. Annual recreation benefits realized by construction of the Main Levee recreation facilities are estimated at $35,134. The present value of estimated construction costs, contingencies, engineering, design, and construction management were also calculated. The present value was amortized at 3.125 percent over the 50-year life of the project. The resulting annualized cost was added to the estimated annual operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) cost for a total annual cost. The detailed OMRR&R data were estimated based on the OMRR&R of existing trails and recreation facilities and is provided in Table 10-5. The net annual benefits or the annual benefits minus the annual costs were computed for the recreation plan. The benefit-cost ratio, or the annual benefits divided by the annual costs, was calculated at 1.1. As the tables show, the Mississippi River Levee Recreation is economically justified. The proposed recreation facilities are within the 10 percent limit of Federal costs of the Ste. Genevieve flood damage reduction project, in accordance with ER 1105-2-100.

Table 10-5. Recreation Economic Analysis

ECONOMIC ANALYSIS FOR RECREATION
STE GENEVIEVE, MISSOURI

Main Levee Recreation and North Gabouri Access

Recreation Benefits	
Annual Recreation Benefits of Hiking/Bicycle Trail	$35,134
Annual Benefits Added by Recreation	$35,134
Recreation Costs	
Total Recreation Cost	$535,000
Investment Cost Amortized at 3.125 percent over 50 years	$21,289
Annual OMRR&R Costs for Recreation Facilities	$10,000
Total Annual Costs of Recreation Facilities	$31,289
Economic Justification of Recreation Facilities	
Annual Benefits Added by Recreation	$35,134
Total Annual Costs of Recreation Facilities	$31,289
Net Annual Benefits of Proposed Recreation Facilities	$3,845
Benefit-Cost Ratio of Proposed Recreation Facilities	1.1

10.5 Public Input.

The recreation plan has been coordinated with the City of Ste. Genevieve and will be shared with the public during the public review of the draft report.

10.6 Recreation Tentatively Selected Plan

The tentatively selected recreation plan consists of an asphalt-surfaced trail on the main levee. All typical trail support facilities such as benches and signage would be included in the final design. Lighting would be provided on the main levee for visitor safety. The costs of the tentatively selected recreation facilities is 0.9% of the estimated total project cost including the completed Mississippi River Levee ($535,000 divided by approximately $56.6 million).

11 Summary and Description of Tentatively Selected Plans

11.1 North Gabouri

After careful consideration of the alternatives' costs, effectiveness, and cultural and environmental impacts, the Floodproofing alternative is the tentatively selected plan for North Gabouri Creek. Table 11-1 identifies the floodproofing actions to be taken at each damaged structure. Four structures are identified for wet floodproofing actions.

The proposed wet floodproofing action is to relocate utilities and home systems (e.g. furnace, water heater, etc.) to areas above the design flood elevation or waterproof them. Items such as electrical connection boxes can be waterproofed. Basements and crawlspaces would be filled with coarse sand or pea gravel to an elevation 30" below the joist of the elevated structure. Filling the areas to this elevation prevents these areas from being used or "finished off" and subsequently flood damage still accrues. Vents that meet the FEMA requirements for ingress and egress of water are also required.

Due to the historic significance, a National Historic Landmark, and unique construction of structure 452, it was determined that any floodproofing action would result in unacceptable physical impacts to the structure and/or to its historic value. The structure involves a combination of construction types, one of which is vertical log on sill construction. For this reason, it is not engineeringly feasible to safely elevate or relocate the structure. Wet floodproofing by filling the basement and elevating the furnace and water heater could reduce damages at flood events below the first floor but would not address the first floor flooding which begins at the 2% (50-year) event. Filling the basement could also restrict access to the sill which supports the vertical logs, thereby making maintenance of this unique foundation more difficult. Therefore no action is recommended for structure number 452.

Figure 11-1 identifies the features of the tentatively selected plan for North Gabouri Creek. The preliminary Total Project First Cost for the North Gabouri floodproofing alternative is $421,000 at the October 2015 price level.

Table 11-1. Tentatively Selected Non-Structural Actions for North Gabouri Structures

Structure #	Historic	Wet Floodproofing	No Action
300	X	X	
311		X	
408	X	X	
452	X		X
454		X	

11.2 South Gabouri

After careful consideration of the alternatives' costs, effectiveness, and cultural and environmental impacts, the Floodproofing alternative is the tentatively selected plan for South Gabouri Creek. Table 11-2 identifies the floodproofing actions to be taken at each damaged structure. Nine structures are identified for wet floodproofing actions. Due to the depth of flooding, foundation conditions, and technical challenges, elevation is recommended for structure number 257. Figure 11-2 identifies the features of the tentatively selected plan for South Gabouri Creek.

The proposed wet floodproofing action is to relocate utilities and home systems (e.g. furnace, water heater, etc.) to areas above the design flood elevation or waterproof them. Items such as electrical connection boxes can be waterproofed. Basements and crawlspaces would be filled with coarse sand or pea gravel to an elevation 30" below the floor joist of the structure. Filling the areas to this elevation prevents these areas from being used or "finished off" and subsequently flood damage still accrues. Vents that meet the FEMA requirements for ingress and egress of water are also required.

Table 11-2. Tentatively Selected Non-Structural Actions for South Gabouri Structures

Structure #	Historic	Elevation	Wet Floodproofing
257	X	X	
244	X		X
255	X		X
240	X		X
233	X		X
236	X		X
232			X
209			X
207			X
76	X		X

The preliminary Total Project First Cost for the South Gabouri floodproofing alternative is $674,000 at the October 2015 price level.

Figure 11-1. Tentatively Selected Plan for North Gabouri Creek (dark shaded area displays the National Register Historic District)

Figure 11-2. Tentatively Selected Plan for South Gabouri Creek (dark shaded area displays the National Register Historic District)

11.3 Recreation

The tentatively selected recreation plan for the Mississippi River levee is an asphalt-surfaced trail on top of the levee. All typical trail support facilities such as benches and signage would be included in the final design. Lighting would be provided on the main levee for visitor safety.

The preliminary Total Project First Cost for the recreational features is $535,000 at October 2015 price levels.

The cost sharing for recreational features is 50% Federal and 50% non-Federal. As seen in Table 11-3, the non-Federal sponsor will contribute $115,500 in cash and $152,000 in real estate acquisition credit.

11.4 Total Project Cost and Cost-Sharing

The preliminary Total Project First Cost for the tentatively selected plans is estimated to be $1,630,000 at October 2015 price levels.

Table 11-3 provides a summary of the costs and cost-sharing for each project purpose and provides a total cost.

Table 11-3. Total Project Cost and Cost-Sharing (October 2015 Price Level)

Project Purpose	Total Cost	Land/ Relocation Cost	Federal Cost	Non-Federal Cost		
				Cash	Land/Reloc	Total
Flood Risk Management	$1,095,000	$74,000	$821,250	$199,750	$74,000	$273,750
Recreation	$535,000	$152,000	$267,500	$115,500	$152,000	$267,500
Totals	**$1,630,000**	**$226,000**	**$1,088,750**	**$315,250**	**$226,000**	**$541,250**

For the Flood Risk Management features, the cost for this tentatively selected plan requires a minimum of 25% ($273,730) and a maximum of 50% ($547,500) in non-Federal contributions, with at least 5% ($54,750) of the contribution being cash. As seen in Table 11-3, the sponsor's contribution is anticipated to be $74,000 in land acquisition credit and $199,750 in cash.

11.5 Executive Order 11988

Executive Order (E.O.) 11988, Floodplain Management, tasks federal agencies to "*avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains*" and "*reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial*

values served by floodplains" (FedCenter 2012). Federal agencies who participate in or permit the construction of future projects are subject to this E.O.

The TSP identified in this report does not modify the floodplain in any way nor, by its implementation, encourage others to modify the floodplain. Therefore, the recommendation is in full compliance with E.O. 11988.

11.6 Environmental and Cultural Impacts of the Tentatively Selected Plan

The selection of the wet floodproofing for most of the identified historic structures has essentially eliminated impacts to the biological, physical, and economic resources in the project area. There are cultural resources impacts which require mitigation. For all floodproofed structures, this would involve HABS/HAER documentation of the structure's condition prior to floodproofing. The environmental and cultural impacts are addressed in detail in the Environmental Assessment located in Appendix F.

11.7 Real Estate Requirements of the Tentatively Selected Plan

For the tentatively selected plan on North and South Gabouri Creeks, after the Project Partnership Agreement is executed between USACE and the sponsor, the sponsor will enter into Flood Proofing Agreements with individual property owners on a voluntary basis. The Flood Proofing Agreements will serve as a consensual restrictive easement to ensure that the structure modifications are not alterered, modified, or eliminated and shall be recorded and serve as a restriction on the deed. The exact language of the restriction has yet to be determined. More information about the Flood Proofing Agreements can be found in Appendix E – REAL ESTATE.

Incidental administrative costs and Title III payments were included for each voluntary participant. If there are tenants in the homes, the cost of their temporary relocation under the Uniform Relocation Act was also included. It is estimated that of the 14 homes, 5 are tenant occupied and 9 are owner occupied.

The majority of the recreation trail is planned to be constructed on land previously purchased as a permanent easement for the levee project. The Sponsor will need to acquire approximately 1 acre in fee that is currently owned as a permanent easement.

Additional information about all of the real estate requirements can be found in Appendix E – REAL ESTATE.

11.8 Operations, Maintenance, Repair, Rehabilitation and Replacement (OMRR&R) of the Tentatively Selected Plan

OMRR&R for the recreation features includes maintenance of the asphalt trail, benches, lighting fixtures, and interpretive displays.

For the floodproofing on North and South Gabouri Creeks, there will be no OMRR&R requirements for the sponsor and no additional OMRR&R requirements for the homeowner beyond normal household maintenance.

11.9 Risk and Uncertainty Associated with the Tentatively Selected Plan

This report and subsequent analysis was conducted based on preliminary data. The preliminary data includes first floor elevation surveys, topographic surveys, structural assessments, boring data, geotechnical evaluations, and structural evaluations. Any one change in this preliminary data could affect the number of damaged structures and recommended floodproofing technique for a given structure. However, the data utilized to formulate and evaluate alternative plans is sufficient to support the TSP and it is unlikely that there is any uncertainty large enough that it could significantly change the TSP.

11.10 Sponsor Support

The sponsor is the City of Ste. Genevieve and it is fully supportive of the tentatively selected plans. The City has the financial capability to cost-share the estimated implementation costs and is willing to sign the Project Partnership Agreement at the appropriate time.

11.11 Sponsor Requirements

Federal implementation of the recommended project would be subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including but not limited to:

1) Provide a minimum of 25 percent, but not to exceed 50 percent of total flood damage reduction costs as further specified below:
   a) Provide 25 percent of design costs allocated by the Government to flood damage reduction in accordance with the terms of a design agreement entered into prior to commencement of design work for the flood damage reduction features;

   b) Provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs allocated by the Government to flood damage reduction;

   c) Provide, during construction, a contribution of funds equal to 5 percent of total flood damage reduction costs;

   d) Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Government to be required or to be necessary for the construction, operation, and maintenance of the flood damage reduction features;

e) Provide, during construction, any additional funds necessary to make its total contribution for flood damage reduction equal to at least 25 percent of total flood damage reduction costs;

2) Provide 50 percent of total recreation costs as further specified below:

a) Provide 25 percent of design costs allocated by the Government to recreation in accordance with the terms of a design agreement entered into prior to commencement of design work for the recreation features; Provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs allocated by the Government to recreation;

b) Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Government to be required or to be necessary for the construction, operation, and maintenance of the recreation features;

c) Provide, during construction, any additional funds necessary to make its total contribution for recreation equal to 50 percent of total recreation costs;

3) Provide, during construction, 100 percent of the total recreation costs that exceed an amount equal to 10 percent of the Federal share of total flood damage reduction costs;

4) Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefor, to meet any of the non-Federal obligations for the project unless the Federal agency providing the Federal portion of such funds verifies in writing that expenditure of such funds for such purpose is authorized;

5) Not less than once each year, inform affected interests of the extent of protection afforded by the flood damage reduction features;

6) Agree to participate in and comply with applicable Federal floodplain management and flood insurance programs;

7) Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal interest to prepare a floodplain management plan within one year after the date of signing a project cooperation agreement, and to implement such plan not later than one year after completion of construction of the flood damage reduction features;

8) Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the flood damage reduction features;

9) Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on

project lands, easements, and rights-of-way or the addition of facilities which might reduce the level of protection the flood damage reduction features afford, hinder operation and maintenance of the project, or interfere with the project's proper function;

10) Keep the recreation features, and access roads, parking areas, and other associated public use facilities, open and available to all on equal terms;

11) Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

12) For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

13) Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

14) Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;

15) Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

16) Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c *et seq.*);

17) Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

18) Assume, as between the Federal Government and the non-Federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project;

19) Agree, as between the Federal Government and the non-Federal sponsor, that the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA; and

20) Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213(j)), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element

12 Recommendations

As stated previously, the tentatively selected plans for flood damage reduction include floodproofing of structures along both creeks. The recreation plan includes a trail and related facilities associated with the Mississippi River levee.

The Corps seven Environmental Operating Principles, published in 2002, and the USACE Campaign Plan FY13-14-18, dated June 2013, were considered as alternative plans were developed and formulated. This section discusses the application of these two guidelines to the formulation and recommendations of this report.

Campaign Plan

The USACE Campaign Plan provides goals, objectives, and actions for improving the USACE contribution to the nation in the areas of warfighting; civil works processes and delivery systems; risk reduction from natural events; and preparation for the future. The Sainte Genevieve Flood Risk Management Project supports the Campaign Plan with a contribution to Goal 2, “Transform Civil Works,” and Goal 3, ”Reduce Disaster Risks”.

Objective 2c of Goal 2 aims to "Improve USACE methods of delivery to produce quality engineering solutions and services on schedule." Supporting action 2.c.4 aims to "implement a customer/stakeholder engagement strategy" with an end state of establishing and maintaining "collaborative relationships with Federal, state, Tribal, and local agencies, and other stakeholders." The Sainte Genevieve Project supports Goal 2 through its thorough coordination with significant stakeholder groups throughout the study process.

Objective 3.c. of Goal 3 aims to "enhance interagency disaster preparation and mitigation capabilities." Supporting action 3.c.2. aims to "enhance capacity to reduce the Nation's Flood Risk" with an end state of sustainable and resilient FRM for the Nation and communities." The Sainte Genevieve Project supports Goal 3 by providing needed FRM to a historically valuable resource. The project works in concert with other local initiatives that together integrate structural engineering features, nonstructural measures, and program and policy enforcement into an overall system for sustainable and resilient flood risk management.

Environmental Operating Principles.

The tentatively selected plan supports each of the seven USACE Environmental Operating Principles. The tentatively selected plan strives to achieve *environmental sustainability* by implementing a project to provide flood damage reduction while minimizing negative changes to the natural environmental and maintaining the fundamental structure and function of North and South Gabouri Creeks. Developing alternatives that were *sensitive to environmental effects* was key during the plan formulation process. While recognizing the economic benefits to be gained from flood risk reduction, the NED plan has been developed to be *sustainable but sensitive to the balance and synergy between development and nature* through the use of USACE design criteria and guide specifications while striving to reduce the amount of disruption to riparian habitats. In developing mitigation solutions, coordination and site visits were conducted with multiple public resource agencies such as the U.S. Fish and Wildlife Service, the Missouri Departments of Conservation and Natural Resources, and the Missouri State Historical Preservation Office, as well as with private citizens during public meetings *to build knowledge to understand environmental impacts* in order to collaboratively develop *innovative, win-win solutions that also protect and enhance the environment*. For each adverse effect identified, a responsible mitigation or action to minimize the adverse effect is identified in the Environmental Assessment and will be implemented to reflect USACE commitment to *accept responsibility and accountability* for its actions.

Recommendation

I recommend that the Sainte Genevieve, MO, flood damage reduction project, as generally described in this report as the TSP and with such modifications as may be advisable within statutory discretion, authorized by the Water Resources Development Act of 1986, be approved and remaining construction implementation completed.

The preliminary Total Project First Cost for the TSP is $1,630,000. Total average annual costs for the project are $76,229. The tentatively selected recreation plan has a benefit to cost ratio of 1.1.

Table 12-1 compares the TSP to the Authorized Plans for Parts 2, 3, and 4 (North and South Gabouri Creeks and Recreation). While the TSP departs from the authorized plan components for the creeks, the overall project (which includes the Mississippi River Levee) is not significantly changed in overall cost and features and the changes do not exceed the Chief of Engineers' discretionary authority to approve. No additional Congressional authorization is needed to implement the TSP.

Table 12-1. Comparison of the Tentatively Selected Plans with the Authorized Plans for Parts 2, 3, and 4

	TSP 3.325%	TSP 7%	Authorized Project	Authorized Project*
Price Level	2015	2015	1982	2015
Interest Rate	3.125%	7.0%	7.875%	3.125%
Period of Analysis	50-years	50-years	50-years	50-years
North and South Gabouri Creek Features				
Channelization	None		1.85 mi	
Bridge Replacements	None		6 bridges replaced. One removed.	
Floodproofing	14 structures		None	
Levees	None		800 feet (50-year), 1000 feet (10-year)	
Real Estate Acquisition	15 acres, 14 ownerships		33 acres, 54 ownerships	
Total Costs for North and South Gabouri Creek Features				
Total First Cost	$1,095,000	To be Provided in Final Report	$4,550,000	$6,551,000
Annualized Cost	$44,940	To be Provided in Final Report	$362,000	$261,000
Recreation				
Costs	$535,000	To be Provided in Final Report	$150,000	$216,000
Benefits (Annualized)	$35,134	To be Provided in Final Report	$45,200	$8,600

*The costs in this column were simply price-leveled to 2015 values.

The recommendations herein reflect the information available at the time and current Department of the Army policies governing the formulation of individual projects. They do not reflect programming and budgeting priorities inherent in the formulation of national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently the recommendations may be modified before they are approved for implementing funding. However, prior to approval, the state, Federal agencies and other parties will be advised of any modifications and afforded the opportunity to comment.