



US Army Corps
of Engineers
Kansas City District

**U.S. Army Corps of Engineers - Kansas City District,
and
Missouri Department of Transportation**

**Environmental Assessment,
Finding of No Significant Impact,
&
Clean Water Act Section 404 (b)(1) Evaluation**

**Highway N Bridge
Section 14 Emergency Streambank Stabilization Project
Thompson River, Harrison County, Missouri**

June 2012



DEPARTMENT OF THE ARMY
KANSAS CITY DISTRICT, CORPS OF ENGINEERS
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KANSAS CITY, MISSOURI 64106-2896

Finding of No Significant Impact

Highway N Bridge Section 14 Emergency Streambank Stabilization Project Thompson River, Harrison County, Missouri

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Summary

The U.S. Army Corps of Engineers - Kansas City District (USACE), in cooperation with the Missouri Department of Transportation (MoDOT), District 1, propose an emergency streambank stabilization project under the authority of Section 14 of the Flood Control Act of 1946 (Public Law 79-526), as amended. The purpose of the project is to address severely eroding banks along the Thompson River that are threatening to undermine the bridge piers and bridge abutments of the Highway N Bridge, and lead to its failure. The left descending bank upstream of the bridge is experiencing erosion because of a migrating bend in the Thompson River. There is no vegetation on the slope and stream bank sloughing is occurring. The erosion has allowed the Thompson River channel to migrate towards the left descending bank and is encroaching upon the left bridge abutment. High flow events in 2007 and 2008 have accelerated the rate of erosion on the left descending bank and the unstable river bend is expected to damage the left abutment and potentially flank the bridge in 2 – 3 years. Future high flow events can be expected to accelerate the erosion process even further. Construction for the project is expected to begin in the fall of 2012. The Highway N Bridge is located just west of Cainsville, in Harrison County, Missouri.

Alternatives

A “No-Action” alternative and four build alternatives are being assessed for individual and cumulative effects. Solely using biostabilization techniques to stabilize the streambanks was determined not to be a feasible option at this site because it would have a high probability of failure.

Alternative 1 - “No-Action” Alternative: A “No Action” alternative is required by the Council on Environmental Quality regulations and is to function as the baseline against which potential impacts will be evaluated. This alternative would result in eventual damage to the Highway N Bridge and require its complete replacement. This would require detouring traffic using the Highway N Bridge approximately 25 miles, causing

substantial increases in travel times, while a new bridge was constructed. Replacing the bridge would also require bank stabilization. This alternative would be far more expensive, and have greater negative environmental impacts as a result of increasing the size of the project footprint compared to stabilizing the banks at this time to protect the existing bridge.

Alternative 2 – Bendway Weirs (Recommended Plan): The Recommended Plan would consist of four bendway weirs on the left descending bank upstream of the bridge with full slope revetment on the left abutment and stone toe reinforcement on the right abutment. These weirs would realign the Thompson River channel between the two central bridge piers and stabilize the upstream left bank by directing water towards the center of the bridge. The design would also encourage sediment to stabilize the left bank. The right descending bank under the bridge would also receive stone toe reinforcement. The revetment and reinforcement at the bridge abutments would provide additional protection during high flow events.

Alternative 3 – Stone Dikes: This alternative would consist of three stone dikes on the left bank upstream of the bridge with full slope revetment on the left bridge abutment. The dikes would be angled and spaced to reduce the left banks exposure to erosive conditions without increasing the flow velocities at the bridge. They are designed to protect the lower half of the bank and to move the river channel back to its historic location between the center piers of the bridge. The right descending bank under the bridge would also receive stone toe reinforcement.

Alternative 4 – Longitudinal Peak Stone Toe Protection (LPSTP): A LPSTP with baffle/tiebacks would be constructed along the left descending bank. There would also be a full slope revetment on the left bridge abutment and stone toe reinforcement on the right bridge abutment. The LPSTP would be aligned to relocate the left bank into alignment with the existing bridge piers. LPSTP would protect the toe of the slope and allow the upper banks to continue to erode until it stabilizes and vegetation can be established. The baffle/tiebacks would prevent erosion from occurring between the LPSTP and the bank and encourage sediment deposition.

Alternative 5 – Bendway Weirs with Revetment: This alternative would consist of three bendway weirs on the left descending bank upstream of the bridge with full slope revetment on the left bridge abutment and stone toe reinforcement on the right bridge abutment. The full slope revetment on the left bank would extend further upstream of the bridge than Alternative 1. This design would direct the flow of the river back to the center of the bridge. The bendway weirs would direct water away from the left bank to encourage sedimentation at the left bank toe. The revetment and reinforcement at the bridge abutments would provide additional protection during high flow events.

Alternatives Evaluation

The five alternatives were evaluated as they relate to bank stability, channel stability, maintenance, and damage potential. Evaluation results were determined from

engineering data compiled for the Highway N Bridge Section 14 Emergency Streambank Stabilization Project Feasibility Report. All structural alternatives were determined technically feasible. Additionally, project alternatives were also evaluated with regards to potential natural, cultural, and economic impacts, which are discussed in the Environmental Assessment. Based on these evaluations, Alternative 2 has been determined as the Recommended Plan.

Summary of Environmental Impacts

The Recommended Plan would have no impacts to Federally-listed threatened or endangered species, or their designated critical habitat, and would not have negative impacts to sites listed, or eligible for inclusion, on the National Register of Historic Places. The Recommended Plan would result in short-term minor construction related impacts to water quality, fish and wildlife resources, and land use resulting from construction noise, and physical disturbance of the creek channel. The majority of the disturbed vegetation would consist of grasses and saplings with less than a 4 inch dbh (diameter at breast height). Following construction, approximately 0.5 acres of disturbed land would be planted with native trees and grasses. The Recommended Plan would best meet the purpose and need of the project by providing protection to the Highway N Bridge and roadway. It would not result in any significant, long-term adverse impacts to the human environment.

Mitigation Measures

Any locations that are filled and/or disturbed as part of the Recommended Plan would be planted with a native trees and/or grasses following construction. Construction would most likely occur during the autumn of 2012, which would minimize impacts to water quality, and fish and wildlife because of reduced biological activity during this time of the year.

Using the Missouri Stream Mitigation Method (MSMM), the overall effect of the Recommended Plan on the aquatic environment would be beneficial as a result of reducing severe erosion along the streambank. The MSMM is used within Missouri to assess the impacts (debits) and benefits (credits) of projects as part of Clean Water Act Section 404 authorizations. Using the MSMM, 1,480 debits would be generated as a result of placing riprap along the streambanks of the Thompson River. A total of 2,738 credits would be generated by providing stability to 740 linear feet of streambank along the Thompson River. Therefore, no additional mitigation measures are proposed.

Public Availability

Prior to a decision on whether to prepare an Environmental Impact Statement, the USACE will circulate a Public Notice (Notice) for the Draft Environmental Assessment (EA) and Finding of No Significant Impact (FONSI), dated June 18, 2012, for a thirty-day public comment period. This Notice will also be e-mailed to individuals/agencies/businesses listed on the USACE Regulatory e-mail distribution list. The Draft EA and

FONSI are also available on the USACE webpage and hard copies are available upon request.

Conclusion

After evaluating the anticipated environmental, economic, and social effects of the proposed activity, it is my determination that the proposed Highway N Bridge Section 14 Emergency Streambank Stabilization Project does not constitute a major Federal action that would significantly affect the quality of the human environment; therefore, preparation of an Environmental Impact Statement is not required.

Date: _____

Anthony J. Hofmann
Colonel, Corps of Engineers
District Commander

DRAFT

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1.0 Introduction

The U.S. Army Corps of Engineers - Kansas City District (CENWK), in cooperation with the Missouri Department of Transportation (MoDOT), District 1, propose an emergency streambank stabilization project under the authority of Section 14 of the Flood Control Act of 1946 (Public Law 79-526), as amended. The purpose of the project is to address the severely eroding banks along the Thompson River that are encroaching on the left descending bank bridge abutment and threatening to lead to its eventual failure (Appendix I - Figures 1). The left bank upstream of the bridge is experiencing erosion because of the migrating bend in the Thompson River. There is no vegetation on the slope and stream bank sloughing is occurring. The channel of the Thompson River has migrated toward the left bank directing the river flow away from the center of the bridge. High flow events in 2007 and 2008 have accelerated the rate of erosion on the left descending bank and the unstable river bend is expected to damage the left abutment and potentially flank the bridge in 2 – 3 years. If the river experiences high flow events before the project is constructed, bridge damage and failure is likely. The Highway N Bridge is located just west of Cainsville, in Harrison County, Missouri.

Section 14 of the 1946 Flood Control Act (Public Law 79-526), as amended, provides authority for the USACE to plan and construct emergency streambank and shoreline protection projects to protect endangered highways, highway bridge approaches, public facilities such as water and sewer lines, churches, public and private nonprofit schools and hospitals, and other nonprofit public facilities. A Section 14 project may include new streambank or shoreline protection works, or may repair, restore, or modify existing works.

The Highway N Bridge is a 483-ft long structure over the Thompson River with a 26-ft wide roadway. Construction of the bridge was completed in 1964. The bridge was originally constructed so the river channel was generally centered under the bridge between Piers 3 and 4. Migration of the river channel has moved the channel approximately 30-ft towards the left descending bank and bridge abutment. Recent MoDOT inspections classify the bridge as serviceable, receiving a deck rating of a 6, superstructure rating of a 7, substructure rating of an 8, and a scour rating of an 8. Ratings of 7-9 are excellent, 4-6 are considered acceptable, 3 is considered marginal, and 1-2 are unserviceable. MoDOT has no plans for replacing the bridge in the foreseeable future. With streambank stabilization and normal maintenance the bridge structure will allow for 20 or more years of continued service. The estimated average daily traffic count for the bridge is approximately 530 vehicles. The bridge serves as the main east-west artery into the town of Cainsville, Missouri and it provides access in and out of the town for the surrounding community as well as access to Interstate 35. The bridge meets all foreseeable traffic needs, and is anticipated to have a remaining lifespan greater than the expected service life of the Section 14 project.

Aerial photographs of the bridge from 1996 and 2009 were compared and illustrate how much the river has meandered upstream of the bridge (Appendix I - Figure 2). The

aerial photo from 2009 clearly shows the erosion and lack vegetation along the left descending bank upstream of the bridge. The 2009 photo also shows more tree cover directly upstream of the bridge than is currently present because the erosion has since moved closer to the bridge.

This Environmental Assessment (EA) provides the necessary information to properly *and fully assess the information that was developed during the public review of the* proposed Highway N Bridge Emergency Streambank Stabilization Project as required under the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S. Code [USC] 4321 et seq.); the President's Council of Environmental Quality (CEQ) Regulations (40 Code of Federal Regulations [CFR] 1500 – 1508)(CEQ 1992); US Army Corps of Engineers (USACE) ER 200-2-2 (33 CFR 230) (USACE, 2008). The proposed action would require individual Section 404 authorization under the Clean Water Act. Furthermore, an individual Section 401 Water Quality Certification would need to be obtained from the Missouri Department of Natural Resources.

1.1 Purpose and Need for Action

The purpose of this project is to address bank instability problems in the vicinity of the Highway N Bridge over the Thompson River that is owned, operated, and maintained by the Missouri Department of Transportation. Erosion along the banks of the Thompson River near the Highway N Bridge is threatening to flank the left descending bank bridge abutment, which would lead to its failure. If bank erosion continues at its present rate, the left bridge abutment could be flanked within 2 - 3 years. However, a series of high flow events could accelerate the rate of erosion and potential for bridge failure. The Missouri Department of Transportation, District 1 has requested assistance from the USACE to provide emergency streambank stabilization in the vicinity of the Highway N Bridge to prevent failure of the bridge.

1.2 Project Location

The project area is located at the MoDOT Highway N Bridge over the Thompson River, just west of Cainsville in Harrison County, Missouri (Appendix I – Figure 3). It is in Section 14 of Township 65 North, Range 26 West. The Thompson River flows from north to south at the crossing for several hundred yards upstream and downstream of the bridge, which is situated east-west across the stream.

2.0 Recommended Plan and Alternatives

A “No-Action” alternative and four construction alternatives are being assessed for individual and cumulative effects in this document. Solely using biostabilization techniques to stabilize the streambank was determined not to be a feasible option at this site because it would have a high probability of failure (HNTB Corporation, 2011). If any plantings used for biostabilization were inundated before growing sufficiently, the slopes would be damaged. Additionally, the slopes would have to be graded to 3:1 to

insure stability, which would require extensive excavation and filling (HNTB Corporation, 2011). The Missouri Department of Conservation (MDC) also noted that many of the rivers in the region are not suitable for biostabilization because of the degree to which the channels are incised (Pitchford and Kerns, 1994).

2.1 Alternative 1 - “No-Action” Alternative: A “No Action” alternative is required by the Council on Environmental Quality regulations and is to function as the baseline against with potential impacts will be evaluated. This alternative would result in eventual damage to the Highway N Bridge and require its complete replacement. Failure of the bridge over the Thompson River would create a detour of approximately 24 miles for local residents, school busses, and emergency vehicles. Replacement of the bridge is a viable alternative; however, it is not economically desirable because the cost of a new bridge, roadway, and utilities would be significantly more expensive than stabilizing the upstream channel bank. Furthermore, the new bridge will still be susceptible to damage from erosion because replacing the bridge does not solve the bank instability problems upstream of the bridge. Alternative 1 would be expected to cost approximately \$1,340,000.

2.2 Alternative 2 – Bendway Weirs (Appendix I - Figure 4) (Recommended Plan): The Recommended Plan would consist of four bendway weirs on the left descending bank upstream of the bridge with full slope revetment on the left abutment and stone toe reinforcement on the right abutment. These weirs would realign the river channel and stabilize the upstream left descending bank by directing water towards the center of the bridge. The design would also encourage sediment deposition to stabilize the left bank. Each bendway weir would extend into the channel 60-ft and be approximately 5-ft above the channel bed with a trapezoidal key below the channel bed. They would be spaced 100-ft apart and point upstream to direct water away from the unstable left streambank as it flows over the crest of the weirs. All the rock used for the bendway weirs would utilize Type 2 gradation. The revetment and reinforcement at the bridge abutments would provide additional protection during high flow events. The left bridge abutment would be protected by a 140-ft full slope revetment that extends up both drainage ditches without impeding local drainage flow. The right bridge abutment would be protected by a 170-ft stone toe reinforcement that also extends up both drainage ditches. These measures would protect the abutments during high water events. All the rock used in the left bank revetment and right bank reinforcement would utilize Type 1 gradation. Alternative 2 would be expected to cost approximately \$762,000.

2.3 Alternative 3 – Stone Dikes (Appendix I - Figure 5): This alternative would consist of three stone dikes on the left bank upstream of the bridge with full slope revetment on the left descending bank bridge abutment. There would be a total of three dikes, each extending 60-ft into the channel. Dike #1 would be placed 600-ft upstream of the bridge and angled downstream to deflect debris and ice. Dike #2 and dike #3 would be spaced between 150-ft and 180-ft apart and be arranged more perpendicular to the bank. The dikes would be angled and spaced to reduce the left banks exposure

to erosive conditions without increasing the flow velocities at the bridge. They are designed to protect the lower half of the bank and to move the river channel back to its historic location between the center piers of the bridge and encourage sedimentation at the left bank. Each dike has a partially exposed stone root that runs up the bank for self launching stone protection and preventing flanking if the surrounding bank is eroded by conditions that exceed the expected design. Additionally, each dike would have a stone toe reinforcement that would extend 25-ft upstream. All the rock used for the dikes would utilize Type 2 gradation. The full slope revetment of the left bridge abutment would extend 320-ft. The right descending bank under the bridge would also receive stone toe reinforcement 170-ft long. All the rock used in the left bank revetment and right bank reinforcement would utilize Type 1 gradation. Alternative 3 would be expected to cost approximately \$1,172,000.

2.4 Alternative 4 – Longitudinal Peak Stone Toe Protection (LPSTP) (Appendix I - Figure 6): A LPSTP with baffle/tiebacks would be constructed along 620-ft of the left descending bank. There would also be a full slope revetment on the left bridge abutment and stone toe reinforcement on the right bridge abutment. The LPSTP would be aligned to relocate the left bank into alignment with the existing bridge piers. LPSTP would protect the toe of the slope and allow the upper banks to continue to erode until it stabilizes and vegetation can be established. The baffle/tiebacks would prevent erosion from occurring between the LPSTP and the bank and encourage sediment deposition. The baffle/tiebacks would be 100-ft apart with the most upstream baffle tying into a 40-ft buried stone root to prevent flanking of the structures. The right bank reinforcement would be 170-ft long. All the rock used in this alternative would be Type 1 gradation. Alternative 4 would be expected to cost approximately \$1,184,000.

2.5 Alternative 5 – Bendway Weirs with Revetment (Appendix I – Figure 7): This alternative would consist of three bendway weirs on the left descending bank upstream of the bridge with full slope revetment on the left bridge abutment and stone toe reinforcement on the right bridge abutment. The full slope revetment on the left bank would extend 320-ft upstream of the bridge. This design would direct the flow of the river back to the center of the bridge. Each Bendway weir would extend 60-ft into the channel and would be spaced 100-ft apart. The bendway weirs would direct water away from the left bank to encourage sedimentation at the left bank toe. All the rock used for the bendway weirs would utilize Type 2 gradation. The revetment and reinforcement at the bridge abutments would provide additional protection during high flow events. The right bank reinforcement would be 170-ft long. All the rock used in the left bank revetment and right bank reinforcement would utilize Type 1 gradation. Alternative 5 would be expected to cost \$1,059,000.

2.6 Alternatives Evaluation

To evaluate the four construction alternatives, a matrix was developed as part of the feasibility study. Each alternative was rated between 1 and 4, with a lower score being more desirable, as it related to cost, maintenance, channel stability, bank stability,

environmental impacts, and damage potential (HNTB Corporation, 2011). The average ratings have been summarized in Table 1. All structural alternatives were determined technically feasible. Alternative 2, consisting of bendway weirs, had the best overall score. The “No-Action” Alternative was the most expensive and would not directly address the bank stability issue so was not within the matrix.

Table 1: Summary of the Construction Alternatives Evaluation Matrix. A lower value indicates a better rating.

Alternative	Description	Overall Rating (Lower is Better)	Overall Rank
2	Bendway Weirs	1.8	1
3	Stone Dikes	2.2	4
4	LPSTP	1.9	2
5	Bendway Weirs with Revetment	2.0	3

Source: Modified from HNTB Corporation, 2011.

3.0 Affected Environment

The Thompson River is a tributary to the Grand River, which originates in southern Iowa and flows through northern Missouri for about 188 miles before it enters the Grand River. At the Highway N Bridge, the Thompson River has a drainage area of approximately 828 square miles. The soils along the banks of the Thompson River in Harrison County, Missouri are derived from alluvial deposits consisting of silty loam. In general, the right descending bank has a narrow riparian corridor of moderate to heavy woody vegetative cover with dense undergrowth. Beyond the riparian corridor and adjacent to the left bank are predominately agricultural lands. Most of the affected area is adjacent to agricultural fields.

3.1 Aquatic Resources

A records search of the U.S. EPA STORET, Missouri Department of Natural Resources (MDNR) Water Quality Assessment System, and the MDC Missouri Watershed Database were searched for water quality data. The U.S. EPA STORET and the Missouri Department of Natural Resources has the Thompson River listed on the 303(d) due to *E. coli* contamination from an unknown source (USEPA, 2010) (MDNR, 2012). Section 303(d) identifies waters that are not meeting water quality standards. No other water quality parameters were at a level of concern. Non-point source pollution has the greatest negative influence upon water quality within the Thompson River basin. The most common problems are low dissolved oxygen, high levels of turbidity, and organic nutrients, all of which are influenced by excessive runoff and extended low flows (MDC, 2012). The project would impact both the left and right streambanks for approximately 740 linear feet.

3.2 Wetlands

Field reconnaissance was conducted on May 2, 2012 to assess the natural resources within the proposed project area. No wetlands were identified within or adjacent to the project area (CARES, 2012).

3.3 Terrestrial Habitat

Approximately 48% of the Thompson River watershed is classified as grassland, 27% as cropland, and 17% as forested (CARES, 2012). The remaining land cover is composed of developed areas, wetlands, and water. The project boundary is approximately 2.25 acres in size including the staging and access areas and is bordered by agricultural cropland. In some locations, there is no buffer between the cropland and the eroding creek banks. Within the project boundary, the terrestrial habitat consists of lands that have been previously disturbed by agriculture, road construction and bank erosion. The staging areas are adjacent Highway N on either side of the river. These areas are made up of native and non-native grasses in previously disturbed habitat. There are no large trees within the planned project area.

3.4 Fish and Wildlife

Wildlife that likely utilizes the riparian corridor along the Thompson River includes small mammals such as eastern cottontail rabbit, fox squirrel, opossum, and raccoon. Whitetail deer, red fox, and various other wildlife species are also expected to utilize the area. The river is also utilized by various fish, reptiles, and amphibians including chorus frogs, eastern American toads, red-sided gartersnakes, northern watersnakes, common snapping turtles, orange-spotted sunfish, longnose gar, and emerald shiners. In addition, numerous bird species occur in the area such as downy woodpeckers, wild turkeys, indigo buntings, and American kestrels.

The MDC Resource Assessment and Monitoring Database were searched for any fish and aquatic invertebrate survey's that may have been conducted in the Thompson River, but no information was found (Missouri Department of Conservation, 2008).

3.5 Threatened or Endangered Species

There are no Federally-listed threatened or endangered species known to occur within or adjacent to the proposed project area and anticipated time frame of work. The U.S. Fish and Wildlife Service was consulted and they also concluded that no Federally-listed species, candidate species, or designated critical habitat are located within or adjacent to the project area (Appendix II).

3.6 Invasive Species

Invasive species have the potential to displace native plants and animals. According to Executive Order 13122, Federal agencies may not authorize, fund, or carry out actions that are likely to cause or promote the introduction or spread of invasive species.

Invasive aquatic species that are a concern in Missouri which have the potential to be introduced into new water bodies by contaminated construction equipment include zebra mussels (*Dreissena polymorpha*), quagga mussels (*Dreissena bugensis*), New Zealand mudsnails (*Potamogyrpus antiposarum*), purple loosestrife (*Lythrum salicaria*), and Eurasian watermilfoil (*Myriophyllum spicatum*), among others. Invasive terrestrial species often flourish on land that has recently been disturbed. They may also be transported to new locations on construction equipment. Examples of invasive terrestrial species of concern in Missouri include Johnson grass (*Sorghum halepense*), reed canary grass (*Phalaris arundinacea*), and brome grass (*Bromus sterilis*). No invasive species were observed within the project area during a May 2, 2012 field assessment.

3.7 Floodplain

The Thompson River floodplain has been greatly impacted by agricultural practices. A large percentage of the watershed has been converted to cropland, and only a narrow riparian corridor remains along portions of the river. This has likely contributed to bank erosion, channel instability and accumulation of fallen trees along the Thompson River.

3.8 Land Use

Over 48% of the land within the Thompson River watershed is grassland (CARES, 2012). Cropland and forested areas also comprise large portions of the watershed, approximately 27% and 18% respectively. The area immediately surrounding the project location is cropland.

3.9 Socioeconomics

Harrison County is a rural area in northern Missouri and contains several small towns. In 2010, the total population in the Thompson River watershed was around 30,623 people with an average density of 13.9 people per square mile (CARES, 2012). Educational/health/social assistance, retail trade, agriculture, forestry, fishing, hunting, and mining, construction, and manufacturing are the major industries in Harrison County (U.S. Census Bureau, 2011). The Highway N Bridge is an important transportation link between the communities of Harrison County, northern Missouri, and southern Iowa. The average daily traffic count over the bridge is approximately 530 vehicles per day.

3.10 Cultural Resources

Section 106 of the National Historic Preservation Act (NHPA) of 1966 (amended June 17, 1999) requires Federal agencies to take into account the effects of their undertakings on historic properties. By definition, historic properties are properties eligible for or listed on the National Register of Historic Places (NRHP). Federal undertakings refer to any Federal involvement including funding, permitting, licensing, or approval. Federal agencies are required to define and document the Area of Potential

Effect (APE) for undertakings. The APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if such properties exist.

A background review of the project area was conducted using the Missouri Department of Natural Resources Archaeology Viewer (on-line). No sites were identified within the project area. An archeological survey of the project area was conducted in May 2012. The survey found no archeological sites within the proposed project area.

The results of the background review and survey were coordinated by letter with State Historic Preservation Officer (SHPO) on May 23, 2012 (Appendix III). In that letter, the Corps requested concurrence that any proposed work in the project area would have no effect on historical properties and that any work could proceed with any further coordination, unless in the unlikely event that archeological materials were discovered during construction. SHPO concurred with this recommendation in a letter dated May 29, 2012 (Appendix III).

4.0 Environmental Consequences (Impacts)

Primary resources of concern identified during impact evaluation for the “No-Action” alternative and four build alternatives included: aquatic resources, wetlands, terrestrial habitat, fish and wildlife, threatened and endangered species, invasive species, floodplain, land use, socioeconomics, and cultural resources.

4.1 Aquatic Resources

Alternative 1 - “No-Action” Alternative: In the short-term, there would be no change in the existing water quality of the Thompson River under this alternative. There would be continued erosion of the stream banks at the proposed project location. If the bridge needed to be replaced, it would likely have a larger construction footprint and have a greater impact to water quality than the other alternatives.

Alternative 2 - Bendway Weirs (Recommended Plan): The Recommended Plan would have minor, short-term construction related impacts to water quality due to activities taking place within the river channel and on the river banks. During construction, downstream waters would see an increase in turbidity. Construction activities with this alternative would occur in a jurisdictional water of the United States and require a Clean Water Act (CWA) Section 404 authorization and CWA Section 401 State Water Quality Certification. A Draft 404 (b)(1) Evaluation (40 CFR 230) has been prepared for this plan and is included as Appendix IV. A CWA State Water Quality Certification would need to be obtained from MDNR. Additionally, the construction contractor would be required to obtain a Section 402 National Pollutant Discharge Elimination System (NPDES) stormwater permit from MDNR. These CWA requirements would need to be met prior to any construction activities. Best Management Practices (BMPs) would be implemented to minimize the incidental

fallback of material into the waterway and to minimize the introduction of fuel, petroleum products, or other deleterious material from entering the waterway. Such measures could include the use of erosion control fences; storing equipment, solid waste, and petroleum products above the ordinary high water mark and away from areas prone to runoff; and requiring that all equipment be clean and free of leaks. To prevent fill from reaching water sources by wind or runoff, fill would be covered, stabilized or mulched, and silt fences would be used as required. Other measures to minimize adverse effects would include using clean rock fill with minimal fines, stabilizing the earthen material with rock, using appropriate construction equipment, minimizing the amount of time that equipment would be in the creek channel, and not placing fill in the creek during unusual high water events. The project would impact both the left and right streambanks for approximately 740 linear feet.

The Missouri Stream Mitigation Method (MSMM) is used within Missouri to assess the impacts (debits) and benefits (credits) of projects as part of CWA Section 404 authorizations. This method has been publicly vetted and approved for use by Corps Regulatory Offices within the state of Missouri. Completion of the MSMM worksheets demonstrated that the Recommended Plan would result in an overall net benefit to the environment. The Recommended Plan generated 1,480 debits resulting from the addition of armor to the river banks. A total of 2,738 credits would be generated by restoring streambank stability along 740 linear feet of the Thompson River. The MSMM worksheets are located in Appendix V. Once construction has been completed, the water quality of the Thompson River would return to its current state. No significant adverse long-term impacts to water quality would occur as a result of this alternative.

Alternative 3 - Stone Dikes: Similar to the Recommended Plan, this alternative would have minor, short-term construction related impacts to water quality due to activities taking place within the creek channel and on the creek banks. The MSMM for this alternative was same as the Recommended Plan. Construction activities would occur in jurisdictional waters of the United States. A CWA Section 404 authorization and a CWA Section 401 State Water Quality Certification would be required prior to any construction. Additionally, the construction contractor would be required to obtain a Section 402 NPDES stormwater permit from MDNR. BMPs, as described in the Recommended Plan, would also be implemented. This alternative would not result in any significant long-term impacts to water quality.

Alternative 4 - LPSTP: As with the other alternatives, this plan would also result in minor, short-term construction related impacts to water quality. The MSMM for this alternative was same as the Recommended Plan. A CWA Section 404 authorization and a CWA Section 401 State Water Quality Certification would be required prior to any construction. It would be the construction contractor's responsibility to obtain a Section 402 NPDES stormwater permit prior to the start of construction. BMPs, as previously described would also be implemented during construction. No significant adverse long-term impacts to water quality would occur as a result of this alternative.

Alternative 5 - Bendway Weirs with Revetment: This alternative would also result in minor, short-term construction related impacts to water quality. The MSMM for this alternative was same as the Recommended Plan. As with the other alternatives, a CWA Section 404 authorization and a CWA Section 401 State Water Quality Certification would be required prior to any construction. It would be the construction contractor's responsibility to obtain a Section 402 NPDES stormwater permit prior to the start of construction. BMPs, as previously described, would also be implemented during construction. No significant adverse long-term impacts to water quality would occur as a result of this alternative.

4.2 Wetlands

Alternative 1 - "No-Action" Alternative: The "No-Action" alternative would not have any impact on wetlands. There are no wetlands in or adjacent to the project site.

Alternative 2 - Bendway Weirs (Recommended Plan): The Recommended Plan alternative would not have any impact on wetlands. There are no wetlands in or adjacent to the project site.

Alternative 3 - Stone Dikes: This alternative would not have any impact on wetlands. There are no wetlands in or adjacent to the project site.

Alternative 4 - LPSTP: The LPSTP alternative would not have any impact on wetlands. There are no wetlands in or adjacent to the project site.

Alternative 5 - Bendway Weirs with Revetment: This alternative would not have any impact on wetlands. There are no wetlands in or adjacent to the project site.

4.3 Terrestrial Habitat

Alternative 1 - "No-Action" Alternative: The "No-Action" alternative would have minor long-term impacts to the terrestrial habitat along the Thompson River. The streambanks would continue to erode, which would continue to impact existing vegetation along the banks. If the bridge needed to be replaced, it would have an impact on approximately 0.5 more acres of terrestrial habitat than the other alternatives.

Alternative 2 - Bendway Weirs (Recommended Plan): The Recommended Plan would result in minor, short term impacts to the terrestrial habitat along the Thompson River. These impacts would result from the removal of herbaceous vegetation and grasses from along the banks, necessary for accessing the river during construction. The areas disturbed during project construction would be planted with native vegetation once the project is complete.

Staging and material storage areas would be located on the top of each bank adjacent to the existing bridge. Again, these locations would be planted with native vegetation

following project construction. The staging and material storage locations would be the same for Alternatives 2 – 5. All four construction alternatives would impact approximately 2.25 acres of terrestrial habitat.

Alternative 3 - Stone Dikes: This alternative would have a similar project footprint as the Recommended Plan and have minor, short term impacts to the terrestrial habitat along the Thompson River. The areas disturbed during project construction would be planted with native vegetation once the project is complete.

Alternative 4 - LPSTP: This alternative would have a similar project footprint as the Recommended Plan and have minor, short term impacts to the terrestrial habitat along the Thompson River. The areas disturbed during project construction would be planted with native vegetation once the project is complete.

Alternative 5 - Bendway Weirs with Revetment This alternative would have a similar project footprint as the Recommended Plan and have minor, short term impacts to the terrestrial habitat along the Thompson River. The areas disturbed during project construction would be planted with native vegetation once the project is complete.

4.4 Fish and Wildlife

Alternative 1 - “No-Action” Alternative: The “No-Action” alternative would not directly impact any fish and wildlife resources. Indirectly, continued erosion along the streambanks could contribute to negatively impacting species in the river that are not tolerant of turbid conditions. If the bridge needed to be replaced, it would likely have a greater impact on fish and wildlife than the other alternatives because of a larger construction footprint.

Alternative 2 - Bendway Weirs (Recommended Plan): This plan would have minor, short-term impacts to fish and wildlife in the Thompson River. Short-term impacts to the aquatic community may result from the direct displacement of individual organisms, and an increase in turbidity, during project construction. These impacts may affect individual organisms in the river, but would be unlikely to have a significant impact on the overall population of any particular species within the river.

There would be minor, short-term impacts to terrestrial wildlife during project construction as a result of noise and land disturbance. Additionally, individual organisms would be displaced that utilize the approximate 2.25 acres of vegetation that is within the project footprint. The project is scheduled to start in the fall so there should be no impact to nesting birds along the river. Following project construction, the cleared area would be replanted with native herbaceous vegetation and grasses. This would result in a minor short-term impact to wildlife within the project area. No significant long-term adverse impacts to fish and wildlife would occur under this alternative.

Alternative 3 - Stone Dikes: This plan would have similar impacts to fish and wildlife as described for the Recommended Plan. No significant long-term impacts to fish and wildlife would occur under this alternative.

Alternative 4 - LPSTP: This plan would have similar impacts to fish and wildlife as described for the Recommended Plan. No significant long-term impacts to fish and wildlife would occur under this alternative.

Alternative 5 - Bendway Weirs with Revetment: This plan would have similar impacts to fish and wildlife as described for the Recommended Plan. No significant long-term impacts to fish and wildlife would occur under this alternative.

4.5 Threatened or Endangered Species

Alternative 1 - “No-Action” Alternative: The “No-Action” alternative would not result in any impacts to Federally-listed threatened or endangered species.

Alternative 2 - Bendway Weirs (Recommended Plan): The Recommended Plan would not impact any Federally-listed threatened or endangered species, candidate species, or designated critical habitat. No Federally-listed threatened or endangered species, candidate species, or designated critical habitats are located within or adjacent to the project area.

Alternative 3 - Stone Dikes: As with Recommended Plan, this alternative would not impact any Federally-listed threatened or endangered species, candidate species, or designated critical habitat. No Federally-listed threatened or endangered species, candidate species, or designated critical habitats are located within or adjacent to the project area.

Alternative 4 - LPSTP: As with the other alternatives, this alternative would not impact any Federally-listed threatened or endangered species, candidate species, or designated critical habitat.

Alternative 5 - Bendway Weirs with Revetment: As with the other alternatives, this plan would not impact any Federally-listed threatened or endangered species, candidate species, or designated critical habitat.

4.6 Invasive Species

Alternative 1 - “No-Action” Alternative: The “No-Action” alternative would not result in the introduction of any invasive species.

Alternative 2 - Bendway Weirs (Recommended Plan): The Recommended Plan is not expected to introduce any invasive species to the project site. The construction contractor would be required to ensure that all construction equipment has been

cleaned and is free from soil residuals, egg deposits from plant pests, noxious weeds, plant seeds, and aquatic nuisance species prior to its use on the project. Disturbed land areas would be replanted with native plant species to minimize the likelihood that invasive plants would become established.

Alternative 3 – Stone Dikes: This alternative is not expected to introduce any invasive species to the project site. Precautions to prevent the introduction of invasive species as described in the Recommended Plan would also be used for this alternative.

Alternative 4 – LPSTP: As with the other alternatives, this plan is not expected to introduce any invasive species to the project site. Precautions to prevent the introduction of invasive species as described in Recommended Plan would also be implemented under this alternative.

Alternative 5 – Bendway Weirs with Revetment: This alternative is not expected to introduce any invasive species to the project site. Precautions to prevent the introduction of invasive species as described in Recommended Plan would also be used for this plan.

4.7 Floodplain

Alternative 1 - “No-Action” Alternative: The “No-Action” alternative would result in continued erosion of the descending bank and channel, modifying the existing floodplain and threatening the stability of the Highway N Bridge and roadway.

Alternative 2 - Bendway Weirs (Recommended Plan): The Recommended Plan would not appreciably change the peak flows, flood flow volume, water velocities, or the flashiness of the Thompson River. Furthermore, the project would not affect local surface drainage, downstream river meandering, or substantially contribute to downstream sedimentation. This alternative is designed to prevent erosion and protect the Highway N Bridge and roadway. No significant adverse impacts to the floodplain or the floodplain hydraulics would be anticipated.

Alternative 3 - Stone Dikes: As with the Recommended Plan, this alternative would not change the peak flows, flood flow volume, water velocities, or the flashiness of the river. Furthermore, the project would not affect local surface drainage, downstream river meandering, or substantially contribute to downstream sedimentation. This alternative is designed to prevent erosion and protect Highway N Bridge and roadway. No significant adverse impacts to the floodplain or the floodplain hydraulics would be anticipated.

Alternative 4 - LPSTP: As with the Recommended Plan, this alternative would not change the peak flows, flood flow volume, water velocities, or the flashiness of the river. Furthermore, the project would not affect local surface drainage, downstream river meandering, or substantially contribute to downstream sedimentation. This alternative

is designed to prevent erosion and protect Highway N Bridge and roadway. No significant adverse impacts to the floodplain or the floodplain hydraulics would be anticipated.

Alternative 5 - Bendway Weirs with Revetment: As with the Recommended Plan, this alternative would not change the peak flows, flood flow volume, water velocities, or the flashiness of the river. Furthermore, the project would not affect local surface drainage, downstream river meandering, or substantially contribute to downstream sedimentation. This alternative is designed to prevent erosion and protect Highway N Bridge and roadway. No significant adverse impacts to the floodplain or the floodplain hydraulics would be anticipated.

4.8 Land Use

Alternative 1 - “No-Action” Alternative: The “No-Action” alternative could potentially have minor, long-term impacts to land use in the vicinity of the Thompson River in Harrison County, Missouri and the Highway N Bridge if the bridge were to fail and were not replaced. If the bridge failed and were replaced, it would likely result in minor, short-term impacts to land use in the immediate area.

Alternative 2 - Bendway Weirs (Recommended Plan): The Recommended Plan would have minor, short-term impacts to land use. In total, approximately 2.25 acres of land habitat would be impacted during construction. Currently, most of the project area is undeveloped. However, during construction the approximately 0.75 acres of adjacent cropland would be impacted to gain access to the project site. Following project construction, this area would be planted with native herbaceous vegetation and grasses.

Alternative 3 - Stone Dikes: This alternative would have a similar project footprint as the Recommended Plan. It would also result in similar minor, short-term impacts to existing land use.

Alternative 4 - LPSTP: This alternative would have a similar project footprint as the Recommended Plan. It would also result in similar minor, short-term impacts to existing land use as described for the Recommended Plan.

Alternative 5 - Bendway Weirs with Revetment: As with the other alternatives, the project footprint would be similar to the Recommended Plan. It would also result in similar minor, short-term impacts to existing land use as previously described.

4.9 Socioeconomics

Alternative 1 - “No-Action” Alternative: If the Highway N Bridge or roadway were to fail, it would need to be replaced. This would cost approximately twice as much as the Recommended Plan. Furthermore, traffic would need to be detoured while a new

bridge is constructed, creating a moderate, short-term economic impact to the local area. This alternative is expected to cost \$141,000 per year.

Alternative 2 - Bendway Weirs (Recommended Plan): The Recommended Plan has an approximate annual cost of \$58,000 and an annual benefit of \$141,000 yielding a benefit-cost ratio of 2.4 and the greatest net benefits of the alternatives evaluated. A functioning Highway N Bridge and roadway are necessary to maintain the existing economic conditions of the region.

Alternative 3 - Stone Dikes: The benefit-cost ratio of this alternative is 1.5, which was calculated from an annual cost of approximately \$91,000 and benefit of \$141,000. It also has lower net benefits compared to the Recommended Plan. A functioning Highway N Bridge and roadway are necessary to maintain the existing economic conditions in the area.

Alternative 4 - LPSTP: The benefit-cost ratio of this alternative is 1.5, which was calculated from an annual cost of approximately \$91,000 and benefit of \$141,000. It also has lower net benefits compared to the Recommended Plan. A functioning Highway N Bridge and roadway are necessary to maintain the existing economic conditions in the area.

Alternative 5 - Bendway Weirs with Revetment: The benefit-cost ratio of this alternative is 1.7, which was calculated from an annual cost of approximately \$83,000 and benefit of \$141,000. It also has lower net benefits compared to the Recommended Plan. A functioning Highway N Bridge and roadway are necessary to maintain the existing economic conditions in the area.

4.10 Cultural Resources

Alternative 1 - "No-Action" Alternative: The "No-Action" alternative would not impact any cultural resources.

Alternative 2 - Bendway Weirs (Recommended Plan): Because no archeological material was identified within the project area, this alternative would not adversely impact any cultural resources.

Alternative 3 - Stone Dikes: As with the Recommended Plan, this alternative would not adversely impact any cultural resources.

Alternative 4 - LPSTP: As with the other alternatives, this alternative would not adversely impact any cultural resources.

Alternative 5 - Bendway Weirs with Revetment: As with the other alternatives, this alternative would not adversely impact any cultural resources.

5.0 Cumulative Impacts

The Council on Environmental Quality (CEQ) Regulations defines cumulative impacts as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time” (CEQ, 1997). The cumulative impacts addressed in this document consist of the impacts of multiple actions that result in similar effects on the natural resources. The geographical areas of consideration are actions located within/along the Thompson River channel from Iowa to its confluence with the Grand River.

A review of USACE Regulatory Branch records for Clean Water Act Section 404 regulatory actions indicate that there are four other projects along the Thompson River between the Iowa state line and the confluence with the Grand River that have required permitting in the last 5 years. All four permits were issued in 2010 and all four are bank stabilization projects. Three of the projects are very small, with impacts to 0.1 acres each. The fourth is a bit larger and has a total project area of approximately 0.85 acres. These projects were expected to have a minor short term impact on increased sediment within this stretch of the Thompson River. There are no other known on-going or proposed construction projects along the Thompson River. Large portions of the lower stretches of the Thompson have been straightened and channelized for navigation. The stretch of the Thompson River that is crossed by the Highway N Bridge is in a portion of the river that is relatively unchannelized. The watershed is rural in nature and is primarily used for agriculture. Approximately 48% of the watershed is currently used as grassland and approximately 27% is used as cropland. The Recommended Plan is not expected to result in any significant long-term adverse cumulative impacts in combination with the other bank stabilization projects, past channelizations, or ongoing agricultural activities within the watershed.

6.0 Mitigation Measures

Locations that are filled and/or disturbed would be seeded with a native herbaceous and woody vegetation following construction to stabilize the soil. Construction would most likely occur during mid/late autumn of 2012, which would minimize impacts to water quality, and fish and wildlife because of reduced biological activity during this time of the year. The Recommended Plan would have an overall positive benefit to the aquatic environment, as determined by the Missouri Stream Mitigation Method (MSMM). The Missouri Stream Mitigation Method is used to determine compensatory mitigation for Clean Water Act Section 404 within the state of Missouri. This method has been publicly vetted and approved for use by Corps Regulatory Offices within the state of Missouri. Using the MSMM, a total of 1,480 debits were generated by armoring the stream bank. A total of 2,738 credits were generated by providing streambank stability

along 740 feet of the Thompson River. Therefore, no additional mitigation measures are proposed.

7.0 Conclusion

The Recommended Plan would have no impacts to Federally-listed threatened or endangered species, or their designated critical habitat, and would not have negative impacts to sites listed, or eligible for inclusion, on the National Register of Historic Places. Temporary, short-term construction impacts to water quality, fish and wildlife resources, and land use would be related to noise, and physical disturbance of the creek channel and riparian corridor. No wetlands would be impacted. Approximately 0.5 acres of native herbaceous vegetation and grasses would be planted upon project completion. The Recommended Plan would best meet the purpose and need of the project by providing protection to the Highway N Bridge and roadway. It would not result in any significant, long-term adverse impacts to the human environment.

8.0 Coordination and Comments

The CENWK will circulate a Public Notice for the Draft Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) for a thirty-day public comment period. This Public Notice will also be e-mailed to individuals/agencies/businesses listed on the CENWK Regulatory e-mail distribution list.

9.0 Agency Compliance with Other Environmental Laws

Compliance with other environmental laws is listed below.

Federal Polices	Compliance
Archeological Resources Protection Act, 16 U.S.C. 470, et seq.	Not Applicable
Clean Air Act, as amended, 42 U.S. C. 7401-7671g, et seq.	Full Compliance
Clean Water Act (Federal Water Pollution Control Act), 33 U.S.C. 1251, et seq.	Full Compliance
Coastal Zone Management Act, 16 U.S.C. 1451, et seq.	Not Applicable
Endangered Species Act, 16 U.S.C. 1531, et seq.	Full Compliance
Environmental Justice (Executive Order 12898)	Full Compliance
Estuary Protection Act, 16 U.S.C. 1221, et seq.	Not Applicable
Farmland Protection Policy Act, 7 U.S.C. 4201, et. seq.	Full Compliance
Federal Water Project Recreation Act, 16 U.S.C. 4601-12, et seq.	Full Compliance
Fish and Wildlife Coordination Act, 16 U.S.C. 661, et seq.	Full Compliance
Floodplain Management (Executive Order 11988)	Full Compliance
Invasive Species (Executive Order 13122)	Full Compliance
Land and Water Conservation Fund Act, 16 U.S.C. 4601-4, et seq.	Not Applicable
Marine Protection Research and Sanctuary Act, 33 U.S.C. 1401, et seq.	Not Applicable
Migratory Bird Treaty Act, 16 U.S.C. 703 – 712, et. seq.	Full Compliance
National Environmental Policy Act, 42 U.S.C. 4321, et seq.	Full Compliance
National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470a, et seq.	Full Compliance
Protection & Enhancement of the Cultural Environment (Executive Order 11593)	Full Compliance
Protection of Wetlands (Executive Order 11990)	Full Compliance
Rivers and Harbors Act, 33 U.S.C. 403, et seq.	Full Compliance
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq.	Full Compliance
Wild and Scenic River Act, 16 U.S.C. 1271, et seq.	Not Applicable

NOTES:

- a. Full compliance. Having met all requirements of the statute for the current stage of planning (either preauthorization or post authorization).
- b. Partial compliance. Not having met some of the requirements that normally are met in the current stage of planning.
- c. Noncompliance. Violation of a requirement of the statute.
- d. Not applicable. No requirements for the statute required; compliance for the current stage of planning.

10.0 References

- CARES. 2012. Watershed Evaluation and Comparison Tool, Thompson River (10280102) Watershed Profile. Retrieved from <http://ims.missouri.edu/website/watershedTool/profileComb.asp>
- Council on Environmental Quality (CEQ). 1992. Regulations for Implementing the Procedural Provisions of NEPA, 40 CFR Parts 1500-1508, in accordance with 40 CFR 1507.3.
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- HNTB Corporation. December 2011. Highway N Bridge, Section 14 Emergency Streambank Stabilization Project, Thompson River, Harrison County, Missouri, Feasibility Report.
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- Missouri Department of Conservation. 2012. Missouri Watershed Map. <http://extra.mdc.mo.gov/fish/watershed/grand/contents/>
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- Pitchford, Greg, and Kerns, Harold. 1994. Grand River Watershed Inventory and Assessment. Missouri Department of Conservation.
- U.S. Army Corps of Engineers. 2008. Procedures for Implementing the National Environmental Policy Act. Engineer Regulation (ER) 200-2-2, 33 CFR 230.
- U.S. Census Bureau. 2011. Selected Economic Characteristics: 2005-2009 American Community Survey, Platte County Missouri. Retrieved from <http://factfinder.census.gov>.
- U.S. Environmental Protection Agency. 2010. Water Assessment, Tracking & Environmental Results. http://iaspub.epa.gov/tmdl_waters10/attains_waterbody.control?p_list_id=MO_0549&p_cycle=2010&p_state=MO&p_report_type=T

11.0 List of Preparers

This EA and draft FONSI were prepared by Mr. Rick Morrow, Biologist, with cultural resource assistance provided by Mr. David Cain, Archeologist. The address of the preparers is: U.S. Army Corps of Engineers, Kansas City District; PM-PR, Room 529, 601 E. 12th Street, Kansas City, Missouri 64106.

12.0 Appendices

APPENDIX I
PROJECT FIGURES & DRAWINGS

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APPENDIX II
U.S. FISH AND WILDLIFE SERVICE COORDINATION

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APPENDIX III
MISSOURI STATE HISTORIC PRESERVATION OFFICE
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APPENDIX IV
PUBLIC NOTICE
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APPENDIX V

MISSOURI STREAM MITIGATION METHOD WORKSHEETS

APPENDIX VI
CLEAN WATER ACT SECTION 401 PERMIT

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APPENDIX VII
PUBLIC COMMENTS

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