

# TOPEKA, KANSAS, LOCAL PROTECTION PROJECT FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT

## REPORT SUMMARY FOR CIVIL WORKS REVIEW BOARD

### STUDY INFORMATION

**Study Authority.** The Topeka, Kansas, Flood Risk Management Feasibility Study (the Study) was authorized under Section 216 of the 1970 Flood Control Act, which reads as follows:

*The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects, the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to the significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying structures or their operation, and for improving the quality of the environment in the overall public interest.*

**Study Sponsor.** The City of Topeka, Kansas, and the North Topeka Drainage District are the designated non-Federal Sponsors for ownership, operation and maintenance of the existing levee system. The City of Topeka represents both entities as the cost-share sponsor for the Study.

**Study Purpose and Scope.** First, the study serves to update and verify data on the reliability of the existing flood risk management units. Secondly, the study provides a means to examine and develop alternative plans (including a review of the “no Federal action” alternative) for reliability (performance) improvement of the units to reduce damages from potential flooding on the Kansas River in the vicinity of Topeka, with the ultimate aim of a final recommended plan for authorization and implementation. The recommended plan for improving the reliability of the system will be selected through the basic tests of technical effectiveness and completeness, economic feasibility, and environmental acceptability.

**Project Location/Congressional District.** The existing project is located along both banks of the Kansas River through the City of Topeka, Shawnee County, Kansas. Congressional District: KS-2, as represented by Honorable Nancy Boyda (however, defeated in November by Congresswoman-elect Lynn Jenkins). Kansas Senators are Sen. Sam Brownback and Sen. Pat Roberts.

### **Prior Reports and Existing Water Projects.**

**a. Reports.** There have been multiple prior studies and reports of flooding conditions on the Kansas River. Those most pertinent to the Topeka vicinity are:

*Definite Project Report, Levee System at Topeka, Kansas, 27 October 1936.* This document was prepared subsequent to the Flood Control Act of 1936 and contains general discussion of the

purpose, layout, and costs of the original Federal levee project at Topeka.

*Design Memorandums, Volumes 1-15, Topeka, Kansas, Flood Protection Project, Kansas City District, U.S. Army Corps of Engineers, 1956 through 1967.* The design memorandums are the justification documents, subsequent to the Flood Control Act of 1954, which recommend proceeding with plans and specifications for the various units within the Topeka, Kansas, Project. They include general design data, previous projects, and a general description of the authorized project.

*Flood Insurance Study (FIS), City of Topeka, Kansas, Federal Emergency Management Agency, June 1981.* Federal Emergency Management Agency (FEMA) report of flood discharges, water surface profiles, and flooded area and floodway maps for use in developing flood insurance rates for the City of Topeka.

*The Upper Mississippi and Missouri River Flow Frequency Study, U.S. Army Corps of Engineers, 2003.* Updated hydraulic modeling for the Upper Mississippi and Missouri Rivers, and several tributaries including the Kansas River, using updated gage records and state of the art technology.

**b. Other Projects.** Federal levee units are located along the Kansas River at several locations, both upstream and downstream of Topeka. Downstream units are located at Lawrence, Kansas, approximately 25 river miles below Topeka, and at the river mouth at Kansas City. Upstream units are located at the cities of Manhattan and Abilene.

There are sixteen Federal reservoirs in the Kansas River basin above Topeka, five managed by the Corps and eleven managed by the Bureau of Reclamation. The five Corps reservoirs and the waterways on which they are located, in order of increasing distance from Topeka, are: Tuttle Creek (Big Blue River), Milford (Republican River), Kanopolis (Smoky Hill River), Wilson (Saline River), and Harlan County (Republican River).

The City of Topeka owns and maintains a water diversion weir across the Kansas River at the upstream end of the levee system.

**Federal Interest.** The Federal Interest in flood risk management in Topeka, Kansas, was first established in the Flood Control Act of 1936, and expanded by the Flood Control of 1954. This Federal Interest now extends to the current Feasibility Study and the Recommended Plan presented therein. The Recommended Plan improves the reliability of the existing levee system consistent with prior Congressional intent and does not expand the flood risk management benefits beyond the boundaries or scope of the existing system. The Recommended Plan minimizes environmental effects, produces a positive benefit to cost ratio, and maximizes the net annual economic benefits of the proposed work.

## STUDY OBJECTIVES

**Problems and Opportunities.** The existing levee system does not reliably provide the intended level of flood risk management benefit. This is supported by the research of previous design and authorizing documents, engineering analysis performed using current criteria, and mathematical modeling. Each of the units in the existing system was systematically analyzed and critical reaches for geotechnical and structural concerns were identified. For those reaches that did not meet current factor of safety criteria, an additional reliability analysis was conducted to calculate the probability of failure. Table 1 presents the current estimates of the probability of passing the 1-percent annual chance event for each unit and the specific areas of concern.

Table 1 - Existing Conditions Reliability and Areas of Concern in Kansas River Units

Levee Unit	Reliability Against the 1% Event	Key Problem Area
Waterworks	92.8%	<ul style="list-style-type: none"> <li>• Low factors of safety for floodwall sliding stability.</li> </ul>
South Topeka	84.2%	<ul style="list-style-type: none"> <li>• High probability of underseepage failure in earthen levee section.</li> <li>• Low factors of safety for pump station strength and manhole uplift.</li> <li>• Unacceptable probability of axial capacity failure in floodwall timber pile foundation.</li> </ul>
Oakland	2.9%	<ul style="list-style-type: none"> <li>• High probability of underseepage failure in earthen levee section.</li> <li>• Low factors of safety for pump station and manhole uplift.</li> <li>• Low factors of safety for floodwall sliding stability.</li> </ul>
North Topeka	14.1%	<ul style="list-style-type: none"> <li>• High probability of underseepage failure in two reaches of earthen levee section.</li> <li>• Low factors of safety for pump station uplift.</li> </ul>
Auburndale	96.8%	<ul style="list-style-type: none"> <li>• No problem areas detected.</li> </ul>

Large areas of existing residential, business, and industrial development are vulnerable to flood damage due to unacceptable reliability. If a project is not authorized and implemented, FEMA could initiate a revision of the Flood Insurance Rate Map. The area currently shown as protected from the 1-percent flood would be placed in the Special Flood Hazard Area. The designation requires additional considerations for new construction and substantial improvements, and requires the mandatory purchase of flood insurance as a condition to financial assistance from a federally regulated source, potentially causing the area to enter into an economic decline with less viability for improvement or enhancement.

This study presents the opportunity to restore the reliability of the local flood risk management system and thereby minimize damages from future flood events. By doing so, there is the opportunity to provide the affected community the confidence to sustain and improve economic health and viability. Opportunities for protection or enhancement of the natural and cultural resources of the area also exist and may be addressed by the study or by other related activities

taking place or proposed in the study area.

**Planning Objectives.** The Feasibility Study will update and verify data on the reliability of the existing project performance under flood conditions and formulate measures/alternatives that provide a complete plan to restore system reliability to acceptable levels as needed. The comprehensive system plan will maximize net economic benefits for each unit, be technically sound, economically feasible and environmentally acceptable, and reduce the potential for loss of life and human suffering caused by flooding within the project area. The Environmental Operating Principles will be integrated into the project plan by minimizing the impact of the proposed project, maintaining or improving the current environmental conditions, and preserving the cultural and historical resources within the project area.

**Planning Constraints.** Planning constraints include the geographic limits of the existing project and authority; all applicable Federal and state laws, executive orders, and guidance pertaining to water resources projects; and, the existing relationships between the levee units. The study will not recommend any measures which would directly or indirectly exacerbate any performance weaknesses (or relative weaknesses) of another unit, or that would contribute to increasing the level of performance of one unit at the expense of another unit.

## **ALTERNATIVES**

**Plan Formulation Rationale.** The levee system was evaluated in a systematic fashion in order to assess reliability and likely future performance, including the identification of critical areas or cross sections. The results of the existing conditions analysis, and observations and effects from historic and recent flood events, were used to formulate potential engineered solutions aimed at lowering the risk of flooding for units under study. An initial set of management measures was developed using experience from other levee system studies and application of current engineering standards and practices. These measures were screened and refined for their application at each critical Area of Interest (AOI). As the process continued, additional measures surfaced and were examined. All measures were examined and compared considering the Federal criteria of completeness, efficiency, effectiveness, acceptability, and constructability, as well as for their potential to impact the environment. As the measures passed through this evaluation and screening process, a preliminary economic analysis of each measure's cost was used as a ranking factor in the final selection. Measures passing the evaluation criteria were carried forward for more detailed analysis.

The following sections describe the specific measures considered and the results of the screening and evaluation process.

### **Management Measures and Alternative Plans.**

***No Federal Action Alternative.*** For each AOI, the No Federal Action alternative was considered. When examining the No Federal Action alternative, it is necessary to project what course of action local entities may take given the lack of Federal involvement. It is possible that some of the measures recommended by the report may be undertaken by the local sponsors.

These local initiatives are likely to be focused on the measures which are the least costly of the recommendations. However, the major requirement associated with the South Topeka floodwall is just as likely not to be accomplished under a local initiative. This would mean significant long-term risk remaining for at least one of the major units analyzed in this report.

The No Federal Action alternative does nothing to alleviate risks to public health and safety. While some local emergency preparedness plans will be updated and general awareness of the risks will be increased, this could be considered an inappropriate small scale response to significant life, safety and economic risks.

The economic implications of the No Federal Action alternative are broadly negative. The investment at risk within each unit is so large that No Federal Action will subject the study area to the possibility of an overall long-term adverse impact on the local economy, and dislocations of industry may even result. In the short term, with an absence of flooding, the current trends in place for the local economy, tax base, population, and employment may remain intact. However, if major flooding occurred and one or more of the levee units failed, the long term effects are likely to include: diminished economic stability, business interruptions that could jeopardize workers jobs and wages, potential losses in population and employment, and reductions in the tax base (given net movement out of the protected areas) and generally diminished property values.

***Non-Structural Measures.*** Nonstructural approaches have merit when the site characteristics and the flooding threat are compatible with the nonstructural capabilities. In the case of the existing Topeka flood risk management system, nonstructural methods were eliminated early as potential solutions due to their inability to meet the planning objectives and provide the large-scale risk reduction and performance required over the extensive study area.

***Structural Measures.*** The structural measures that we considered for improving reliability were those that were appropriate to an existing levee and floodwall system and its major components. Underseepage control measures that were considered include landside berms, buried collector systems, and relief wells, either ground discharging or pumped. Measures for uplift control of structures considered include structure abandonment, operational changes, heel extensions, and replacement. Measure to address floodwall sliding stability considered were wall replacement, foundation modification, and landside stability berms. Pump station strength concerns were addressed by considering reinforcement or replacement of the structure. Floodwall foundation measures analyzed included reinforcement, soil strengthening, and construction of a new wall and foundation.

The measures presented were examined to address their ability to adequately address the deficiencies and potential failure modes. Those found lacking sufficient validity or effectiveness were screened-out. Table 2 lists the initial array of measures for each AOI, the results of the screening review, and indicates whether the measure was carried forward for more detailed analysis.

Those measures identified as being carried forward for further analysis were labeled and combined into alternative plans for each levee unit. In some cases only one measure was carried forward for a particular area of interest. Measures within a unit that are consistent among different alternative plans were combined for simplicity. Measures from the same area of interest cannot be combined. The implementation of corrective measures at each area of interest was evaluated for impact on the overall system reliability. It was determined that each alternative plan must include a measure from each area of interest in order to provide a complete plan for obtaining the desired overall system performance and reliability.

**Table 2 – Array of Measures Evaluated**

Description of Problem by Levee Unit and Location	Alternative Corrective Measures					Measure Recommended
	1	2	3	4	5	
North Topeka Unit, Station 364+60 Fairchild Pump Station Problem: Uplift	Operational changes	Heel Extension	Remove and replace	Abandon		Measure No 4
North Topeka Unit, Station 246+00 to 250+00 Problem: Underseepage	Underseepage berm.	Buried collector system.	Relief wells discharging to ground.	Relief wells discharging to manhole w/ temporary pumping.	Relief wells discharging to permanent pump station.	Measure No 4
North Topeka Unit, Station 165+00 to 189+00 Problem: Underseepage	Underseepage berm.	Buried collector system.	Relief wells discharging to ground.	Relief wells discharging to manhole w/ temporary pumping.	Relief wells discharging to permanent pump station.	Measure No 1
Oakland Unit, Station 220+00 East Oakland Pump Station Problem: Uplift	Operational changes	Heel Extension	Remove and Replace	Abandon		Measure No 2
Oakland Unit, Station 75+50 - Manhole Problem: Uplift	Heel Extension	Remove and Replace				Measure No 1
Oakland Unit, Station 485+86 to 491+01 Problem: Sliding Stability	Stability berm	Foundation Mod				Measure No 1
Oakland Unit, Station 64+00 to 80+00 Problem: Underseepage	Underseepage berm.	Buried collector system.	Relief wells discharging to ground.	Relief wells discharging to manhole w/ temporary pumping.	Relief wells discharging to permanent pump station.	Measure No 1
South Topeka Unit, Station 75+84 Kansas Avenue Pump Station Problem: Strength	Wall Stiffener	Remove and Replace	Abandon			Measure No 1
South Topeka Unit, Station 86+00 Madison St. Pump Station Problem: Uplift	Operational changes	Heel Extension	Remove and Replace	Abandon		Measure No 1
South Topeka Unit, Station 16+07 - Manhole Problem: Uplift	Heel Extension	Remove and Replace				Measure No 1
South Topeka Unit, Station 84+10 - Manhole Problem: Uplift	Heel Extension	Remove and Replace				Measure No 1
South Topeka Unit, Station 84+10a - Manhole Problem: Uplift	Heel Extension	Remove and Replace				Measure No 1
South Topeka Unit, Station 85+57 - Manhole Problem: Uplift	Heel Extension	Remove and Replace				Measure No 1
South Topeka Unit. Station 74+41 to 93+86 Problem: Floodwall foundation weakness	New wall on offset alignment	New wall on existing alignment	Earthen Levee behind existing wall	Modify existing wall		Measure No 2
South Topeka Unit, Station 22+00 to 48+00 Problem: Underseepage	Underseepage berm.	Buried collector system.	Relief wells discharging to ground.	Relief wells discharging to manhole w/ temporary pumping.	Relief wells discharging to permanent pump station.	Measure No 1
Waterworks Unit, Station 0+78 to 7+00, 10+00 to 16+50 Problem: Sliding Stability	Stability berm	Foundation Mod	Wall replacement			Measure No 1
Waterworks Unit, Station 13+07 to 15+95 Problem: Sliding Stability	Stability berm	Foundation Mod	Wall replacement			Measure No 1

## **Final Alternatives**

**No Federal Action.** No additional flood risk management or risk reduction would be provided under the “No Action” Alternative. Without modification to the existing flood risk management system, the study area would continue to be at greater risk from large flooding events and the affected community would be faced with continued economic concerns. The problem would worsen with time if no action is taken because flood-insurance rates could rise and the economic health of the City and region could decline significantly.

**Structural Plans.** The structural plans consist of reliability improvements to each unit in the system. These plans are confined to modification or replacement of existing unit features on the existing unit alignment. Two alternative plans each have been prepared for the North Topeka, South Topeka, and Oakland Units, and one plan for the Waterworks Unit. Each plan includes a measure for addressing the reliability concern at each area of interest. Multiple plans for the same unit differ only in their treatment of underseepage concerns (berms versus relief wells). There were no plans formulated that would raise levee units or modify the existing alignment of the levee units.

## **Comparison of Alternatives**

Screening-level costs were prepared in 2006 by cost engineering staff for each of seven alternatives. Screening costs were based on October 2005 prices as updating would not have changed the screening process, and only the identified NED plan elements were subsequently updated.

Annual costs for operations and maintenance (O&M) are included only for the alternatives that produce additional O&M costs over and above current without-project levels. The three alternatives with net additional O&M costs are the alternatives that include relief wells. For these alternatives, the life-cycle cost analysis for each alternative assumes that each pump will require servicing every four years and complete replacement after 40 years at a cost equal to the current construction cost plus 17 percent to account for E&D and S&A.

In addition to the relief wells, the North Topeka alternative also includes an underground collector system and a temporary pumping component. The O&M costs for the collector systems assume that flushing and cleaning would be required every 25 years. The temporary pumping plan would be needed when the water surface elevation comes within three feet of top of levee, which would require an event of about a 0.5 percent magnitude. It is assumed that the pumping capability will be needed three times over the 50-year period of analysis, requiring one week of pump rental per instance.

The results of the risk-based screening were:

- Waterworks – Only one alternative was carried forward from initial screening. This alternative maximizes the net benefits over the No Action alternative and is

recommended as the NED Plan.

- South Topeka – Two alternatives were carried forward from the initial screening. Alternative 1 maximizes the net benefits and is recommended as the NED Plan.
- Oakland – Two alternatives were carried forward from the initial screening. Alternative 1 maximizes the net benefits and is recommended as the NED Plan.
- North Topeka – Two alternative were carried forward from the initial screening. Alternative 1 maximizes the net benefits and is recommended as the NED Plan.

### **Key Assumptions**

Combinations of reliability improvements other than the identified NED (optimal) plans for each unit would produce lower levels of net benefits over the period of analysis. The “No Action” alternative would not resolve the continuing risk to which the area is subject. The No Action plan would have detrimental long term effects to the business and home owners in the area and to the economy of the community.

**Recommended Plan.** Based upon consideration of all pertinent factors, Alternative 1 was selected as the recommended plan for implementation in each levee unit. For each unit, Alternative 1 is the NED plan, meeting the planning objectives and the National Economic objectives of maximizing net project benefits while providing the lowest cost. The combination of each individual unit NED plan is selected and recommended as the NED plan for the overall Topeka levee system.

Implementation of the project will improve the reliability of the system to provide increased flood risk management benefits to the local community. Negative social, environmental or cultural impacts from the recommended project would be minimal. Some disruption during construction could be expected, affecting traffic and agricultural activities. No relocation of homes or businesses is required.

The evaluation results show strong economic justification for the recommended project. The existing project would be improved to provide greater than 90% reliability against damages from the base flood, that with 1 percent chance of occurrence in any given year.

### **Recommended Plan - Construction Components.**

The NED Plan consists of a combination of remedial measures and improvements for multiple sites as summarized in the descriptions below. The NED plan essentially grows from an assembly of the recommended alternatives from each of the four levee units addressed in the Feasibility Report. If examined on a unit by unit basis, each unit's recommendations are also the NED measures for that unit. The NED Plan assembles these individual recommendations into one complete set of recommendations (one selected plan) for the system. The economic analysis of the NED plan shows that it is economically viable and furthers national economic

development in manner consistent with Corps of Engineers economic procedures and Administration economic policies.

Major components of the Recommended Plan are discussed in the following paragraphs.

North Topeka Unit:

Station 165+00 to 189+00: Install an underseepage control berm 220 feet wide, seven feet thick at the levee toe, and sloping to three feet thick at the end of the berm.

Station 246+00 to 250+00: Install a series of six stainless steel pressure relief wells located along the thin blanket zone from station 246+00 to station 250+00. Adequate pressure control at this site requires removal of seep-water through below grade header piping that discharges into a cast-in-place concrete pump pit. This allows pumping to discharge the seep water to the river in a controlled manner.

Station 364+60: Proper in-place abandonment of the Fairchild Pump Station. The above-grade structure will be removed and properly disposed of while the below-grade structure and outlet lines will be filled with flowable fill or other suitable material and buried in-place.

South Topeka Unit:

Station 22+00 to 48+00: Install an underseepage control berm 100 feet wide, five feet thick at the levee toe, and sloping to three feet thick at the end of the berm.

Kansas Avenue Pump Station: Increase the strength factor of safety by installation of a wall stiffener on the interior foundation of the pump station.

Manholes: Installation of heel extensions to increase the uplift factor of safety of several manholes.

Floodwall: Construction of a new concrete wall on concrete foundation piles following the existing wall alignment and dimensions. Approximately 3,685 cubic yards of concrete will be needed to construct the new wall. A staggered construction sequence of existing wall demolition and new wall construction is recommended to ensure existing flood risk management benefits are maintained during implementation.

Waterworks Unit:

Stations 0+78 to 7+00 and 10+00 to 16+50: Install stability berms on the landside of the affected wall sections. Berms consist of compacted soil approximately two feet high extending from the wall five feet and then tapering at a one on three slope to the existing ground surface.

Oakland Unit:

64+00 to station 80+00: Install an underseepage control berm 240 feet wide, six and one-half feet thick at the levee toe, sloping to three feet thick at the end of the berm.

485+86 to 491+01: Install a stability berm two feet high extending from the wall five feet and then tapering at a one on three slope to the existing ground surface.

East Oakland Pump Station: Install a heel extension to increase the uplift factor of safety

Manhole at station 75+50: Install a heel extension to increase the uplift factor of safety

**Systems / Watershed Context.** The Topeka Study Area is a highly developed urban region of the Kansas River basin. Federal and local public works within the Kansas River basin provide for flood risk management, municipal and agricultural water supply, hydropower, recreation, and support for downstream recreation flows in the Missouri River.

**Environmental Operating Principles.** The Recommended Plan supports each of the seven USACE Environmental Operating Principles. The recommended plan will **strive to achieve environmental sustainability** by including inspection and monitoring throughout the project life. The recommended plan **considers environmental consequences** by avoiding construction in critical seasons and locations, and by mitigating for the small impacts that will result from construction. The recommended plan **seeks balance and synergy among human development activities and natural systems** by maximizing flood risk management benefits while avoiding and minimizing impacts to significant resources. By implementing the recommended plan, the Corps will **accept responsibility and accountability under the law** to ensure that the project complies with all applicable Federal Laws. The recommended plan **seeks ways and means to assess and mitigate cumulative impacts to the environment** by initially avoiding any impacts and mitigating for the small impacts that do occur.

Through consultation, coordination, and outreach with other Federal and State agencies, local government, and the public, the recommended plan will continue to **build and share an integrated scientific, economic, and social knowledge base**. Since the inception of the study, the Project Delivery Team (PDT) has **listened to, respected, and learned from the perspectives of individuals and groups interested in Corps activities** by maintaining coordination with local government representatives and interested members of the public.

**Agency Technical Review (ATR).** This project is beneath the threshold cost requiring external peer review, and is not controversial or singular enough to merit such. ATR was conducted by a qualified interdisciplinary team of Corps of Engineers personnel from the Louisville (LRL), St. Paul (MVP), and Seattle (NWS) Districts, with lead being assigned to Louisville District. Comments included requests for clarification of the formulation of plans and measures that were considered and screened out, recommendations for expanded description of the problem, requests for more detailed alternative plan descriptions, questions regarding economic data and analyses, and recommendations for improving discussions, displays, and drawing

plates/graphics. There were also suggestions for improving environmental benefits in the floodplain and through the mitigation measures, requests for more information and explanation regarding geotechnical underseepage computations, requests for more information regarding structural computations, and suggestions for better characterization of uplift issues. All substantive concerns of the ATR have been considered and resolved. ATR of the draft feasibility report was certified in October 2007. The HQUSACE Policy Review comments via the Policy Guidance Memorandum (PGM) were addressed, and responses incorporated into the report. The ATR of the final report with PGM responses incorporated was certified in November 2008.

**EXPECTED PROJECT PERFORMANCE**

**Project Performance.** Project implementation would reduce the probability of a damaging flood in any one year to 0.3% (a 333-year event) for the overall levee system. Currently, it is as much as 5.7% (18-year) for Oakland, 2.4% (42-year) for North Topeka, and 0.4% (250-year) for South Topeka. In a 1%-chance (100-year) flood event, Oakland has a 97.1% chance of experiencing significant flood damage, North Topeka an 86.0% chance, and South Topeka a 15.8% chance. The long-term risk of a damaging flood in any of the Kansas River units over a 50-year period would be approximately 1 in 6; over 25 years, 1 in 11; over 10 years, 1 in 27.

**Project Costs.** Table 3 summarizes the selected plan costs.

**TABLE 3  
Cost Summary  
Topeka, Kansas, Feasibility Study  
(October 2008 Price Levels, \$1,000s)**

	<b>Water Works</b>	<b>South Topeka/ Oakland</b>	<b>North Topeka</b>	<b>Total</b>
Construction Item				
Lands & Damages	\$ 4	\$ 1,161	\$ 117	\$1,279
Elements				
Floodwalls and Levees	\$ 43	\$ 14,523	\$ 2,348	\$ 16,914
Subtotal	\$ 47	\$ 15,684	\$ 2,465	\$ 18,193
Preconstruction, Engineering, and Design (PED)	\$ 4	\$ 1,580	\$ 248	\$ 1,832
Construction Management	\$ 3	\$ 975	\$ 154	\$ 1,132
Total First Cost	\$ 51	\$ 18,239	\$ 2,867	\$ 21,157

**Equivalent Annual Costs and Benefits.** Table 4 summarizes the economic performance of the selected plan.

**TABLE 4**  
**Equivalent Annual Benefits and Costs**  
**Topeka, Kansas, Feasibility Study**  
**(October 2008 Price Level, 50-year Period of Analysis, 4.625 % Discount Rate, \$1,000s)**

	<b>Water Works</b>	<b>South Topeka/Oakland</b>	<b>North Topeka</b>	<b>Total</b>
<b>Investment Costs</b>				
Total Project Construction Costs	\$ 51	\$ 18,239	\$ 2,867	\$ 21,157
Interest During Construction	\$ 3	\$ 1,053	\$ 162	\$ 1,218
Total Investment Cost	\$ 54	\$ 19,292	\$ 3,029	\$ 22,375
<b>Average Annual Costs</b>				
Interest and Amortization of Initial Investment	\$ 3	\$ 996	\$ 156	\$ 1,155
OMRR&R	\$ 0	\$ 0	\$ 13	\$ 13
Total Average Annual Costs	\$ 3	\$ 996	\$ 169	\$ 1,168
<b>Average Annual Benefits</b>	\$ 6	\$ 4,014	\$ 11,408	\$ 15,428
<b>Net Annual Benefits</b>	\$ 3	\$ 3,018	\$ 11,239	\$ 14,260
<b>Benefit-Cost Ratio</b>	2.0	4.0	67.4	13.2
<b>Benefit-Cost Ratio (at 7%)</b>	1.4	2.8	48.4	9.2

**Cost Sharing.** The project cost allocation is 100 percent Flood Risk Management. In accordance with the cost sharing procedures prescribed in the Water Resources Development Act of 1986 (WRDA 86), as amended, the Federal government will be responsible for 65 percent of implementation costs and the non-Federal sponsors for the remaining 35 percent. The local sponsor share for the Waterworks, South Topeka, and Oakland Units will be the responsibility of the City of Topeka. The share for the North Topeka Unit will be the responsibility of the North Topeka Drainage District, however, it is anticipated that the City of Topeka will execute the Project Cooperation Agreement (PCA) and will have a separate sub-agreement with the North Topeka Drainage District.

Table 5 presents the total estimated project costs and cost sharing.

**TABLE 5**  
**Topeka, Kansas, Local Protection Project - Cost Sharing**  
**(October 2008 Price Level, \$1,000s)**

<b>Item</b>	<b>Federal Cost</b>	<b>Non-Federal Cost</b>	<b>Total</b>
Flood Damage Reduction (FDR)			
PED	\$ 1,191 (65)	\$ 641 (35)	\$ 1,832
LERRD	\$ 0	\$ 1,279	\$ 1,279
Flood Damage Reduction	\$ 11,730	\$ 6,316	\$ 18,046
Total Project	\$ 13,752 (65)	\$ 7,405 (35)	\$ 21,157

**Project Implementation.** The City of Topeka and the North Topeka Drainage District, the non-Federal sponsors, will provide 35 percent of the cost associated with construction of the Recommended Plan, including provision of all lands, easements, rights-of-way, and necessary

relocations (LERRD); and will pay 100 percent of the OMRR&R costs associated with the project.

The NED Plan does not affect water surface profiles of the Kansas River or its tributaries and will not result in the creation of downstream induced flood damages. No new levees would be constructed and no existing levees would be raised. All project elements involve only modification of the existing levee system to meet expected design levels of performance rather than enhancement of performance to new levels.

Although floodplain users and occupants may desire total protection from flooding, it cannot be overemphasized that this is an unachievable goal. No flood risk management project can guarantee total elimination of flooding. A flood risk management project designed relative to a 1 percent-chance flood event (the event critical to FEMA levee certification) can be especially misleading. The reasoning is that an event of historical magnitude is not necessarily required to overwhelm the project and cause catastrophic damage, yet many floodplain tenants will feel that they have near-total protection against flooding. Therefore, it is important for floodplain users and occupants to be aware of the level of flood risk that remains even after project implementation.

The selected plan has substantial economic benefits and reduces study area equivalent annual damages in the existing condition by more than two-thirds. The probability and occurrence of flooding will be greatly diminished. There would remain a significant total of residual equivalent annual damages of approximately \$7.4 million. There still would be a 1 in 6 chance of exceedance over a 50-year period. The median annual exceedance probability of 0.003 indicates that there would be a 0.3 percent chance of a damaging flood event in any given year.

If the capacity of the Federal levee system is exceeded in a particular event, most of the areas inside the levees would be affected due to the flat floodplain topography in these areas. In general, if the amount of water that gets through or over the levees is sufficient to produce severe flood depths, damages in the study area could reach \$2 billion or more. Prohibitive depths of water would remain inside the levees for at least two weeks. Large-scale evacuations of urban neighborhoods would be necessary in advance, followed by relocation assistance. A number of highly-traveled highways and streets as well as railroad track would be closed and in some cases inundated. Water supply delivery to the entire city would be interrupted, perhaps for a few weeks.

Local leadership and emergency operations staff will need to design plans for these extreme flood events, which may be infrequent, but would hold the potential for catastrophe if they occurred. Effective emergency planning in advance is the best way to protect communities and minimize the damage from these rare flood events.

***NED Effects of NED Plan*** - The overall NED contribution to the national economy is \$14.3 million, which are the total net benefits of the project. The project would reduce the existing condition EAD of \$22.9 million by more than two-thirds to \$7.4 million in residual EAD. The chances of experiencing floods that could result in major inundation would be greatly reduced

(although not eliminated completely).

RED Effects of NED Plan - Existing local jobs, income and tax base, and future economic growth will benefit from a reduction of discouraging factors in the business climate such, as the potential of ruinous flood damage and income losses from shutdowns, while the potential for flood insurance requirements and stiffer building codes would be removed. The threat of large-scale job losses from relocations as well as reductions of the city's tax base would be sharply reduced.

Topeka's planned redevelopment of the riverfront in the center city could proceed absent the likelihood of increasing blight from frequent flood damage. Successful redevelopment would be expected to bring tourism and recreation revenues into the city and the study area.

***Other Social Effects of the NED Plan.*** Serious public safety concerns, particularly in Oakland, South Topeka, and North Topeka, would be minimized by a large reduction in flood risk. The chance of project exceedance (i.e., a damaging flood event) over a 25-year period, which currently is greater than 1 in 2 for Oakland and North Topeka, would improve to 1 in 11. Moreover, any floods that did occur in extreme circumstances likely would be overtopping rather than breaching events, which would imply a greater warning time.

Topeka residents in lower-income areas and minority neighborhoods would be disproportionately affected by ongoing flood risk. Thus, the same groups in South Topeka, Oakland and North Topeka also would benefit disproportionately from the project.

Local efforts to revitalize center city areas would avoid a substantial obstacle if flood risk is significantly reduced in the floodplain areas of North Topeka, Oakland and South Topeka. It bears repeating that much of the "center city" of Topeka is also floodplain terrain inside the Federal levees, and it would otherwise be subject to catastrophic flood damage in the future. Flood risk reduction would be a significant stabilizing influence for these neighborhoods.

The likelihood of periodic service interruptions at the Oakland and North Topeka sewage treatment plants, resulting in large releases of untreated sewage into the Kansas River, would be greatly reduced

**Operation, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R).** Future OMRR&R practices would remain the same as current operations for inspection and monitoring, levee mowing, vegetation control, outfall cleaning, maintenance of wells, etc. Additional cost will be added by the project with respect to maintenance of six new relief wells and temporary pumping of the well header during high flood events. The appropriate Operation and Maintenance manuals will be updated accordingly at the conclusion of the project design and construction period.

**Key Social and Environmental Factors.** Construction of the NED plan requires excavations in several areas for modifications of existing structural features and the installation of relief wells and berms along portions of the levees. The construction of the South Topeka underseepage

berm will result in the permanent removal of approximately 7.5 acres of woodland habitat landward of the levee. Compensatory mitigation is proposed for this impact. Temporary impacts to wildlife will result from noise and traffic associated with the construction efforts.

Borrow excavation is needed within approximately 27.3 acres riverward of the South Topeka Unit and approximately 19.3 acres riverward of the Oakland Unit. Impacts within these agricultural borrow sites is considered temporary in nature and are expected to be less than significant. Standard construction site erosion and sediment control practices will be employed to prevent erosion and sediment deposition into adjacent waterways.

A detailed ecosystem mitigation plan is described in the Environmental Assessment. This plan has been coordinated with local and federal agencies including the U.S. Fish & Wildlife Service and the Kansas Department of Wildlife and Parks.

**Stakeholder Perspectives and Differences.** The sponsor's intent to participate in the feasibility study was originally stated in letters received in 1992 requesting the initiation of the study. The sponsors committed to the study financially by signing the Feasibility Cost Sharing Agreement (FCSA) in 1998. Several schedule and cost changes have been enacted during the study, each with the written approval of the local sponsor. The sponsors have shown every indication that they fully intend to progress into the design and construction phase of the project with the same support given to this Feasibility Study.

An updated letter of support and intent to cost share in the project was provided by the City of Topeka on December 11, 2008. The non-Federal sponsors strongly support the Recommended Plan. The project and local cost sharing requirements have been discussed with the sponsors during the study. They are legally constituted bodies under State statutes with taxing authority, and the Corps' assessment indicates that they have the necessary financial basis to cost share a project of this magnitude. The sponsors will continue to provide full cooperation and are prepared to meet the necessary financial obligation associated with the recommendations contained in the Feasibility Report.

Each of the sponsors continues to maintain the project in good condition as evidenced by recent annual inspection reports, and by the various evaluations undertaken in the feasibility study.

Extensive coordination with several State and Federal agencies took place during development and evaluation of the Recommended Plan and the Environmental Assessment. The following agencies were coordinated with and in some cases have provided comments or participated in the review of this project:

- Federal Emergency Management Agency
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- Natural Resources Conservation Service
- Kansas Department of Wildlife & Parks
- Kansas Department of Health and Environment

- Kansas State Historic Preservation Office

**Environmental Compliance.** The Topeka Feasibility Report consists of a main report, with a stand alone Environmental Assessment (EA), and appropriate appendices to both the main report and EA. There are no anticipated significant environmental, cultural or social impacts from construction of the Selected (NED) Plan. The project has responded to all resource agency and interested party comments, and compensatory mitigation for environmental losses are included in the plan. The mitigation plan has undergone an appropriate incremental analysis commensurate with the small impacted area. Construction of the South Topeka Levee underseepage control berm will result in removal of 7.5 acres of floodplain habitat in the form of shrubs and secondary trees. The report has justified compensation, consisting of the planting of 15 acres of floodplain habitat in the North Topeka Unit. Temporary impacts due to construction and hauling of waste materials have been satisfactorily addressed in the plan. The plan has received Section 106 Clearance from the Kansas State Historic Preservation Office (SHPO) on August 25, 2006. The final U.S. Fish & Wildlife Service Coordination Act Report was received on March 16, 2007, and the Selected Plan will result in no significant impacts on endangered species. It was determined that there are no features or activities that will necessitate a Clean Water Act Section 404(b)(1) or Section 401 permit. The Clean Water Act Section 402 NPDES permit will be obtained from the Kansas Department of Health and Environment (KDHE) during design phase.

**State and Agency Review.** To be completed by HQUSACE after completion of review.

**Certification of Agency Technical Review and Legal Review.** Final Agency Technical Review (ATR) was certified on November 26, 2008 with all review comments being satisfactorily addressed. Final Legal Certification was completed on December 22, 2008 by Kansas City District Council with the Feasibility Report and EA considered to be legally sufficient. The Cost Estimating Center of Expertise (CX) Review was completed by the Walla Walla District CX and certified on July 28, 2008. The Walla Walla CX review comments resulted in improvement in some of the computations, characterizations, descriptive elements and format of the total project cost estimate, but did not significantly affect the relative magnitude of the numbers nor the NED Plan recommendation.

**Policy Compliance Review.** The Policy Compliance Review conducted to date is documented in the Policy Guidance Memorandum dated 19 December 2008, which contains District responses to all comments. All responses have been incorporated into the final report, EA, and appendices as appropriate. The final policy review findings will be documented herein when completed by HQUSACE.