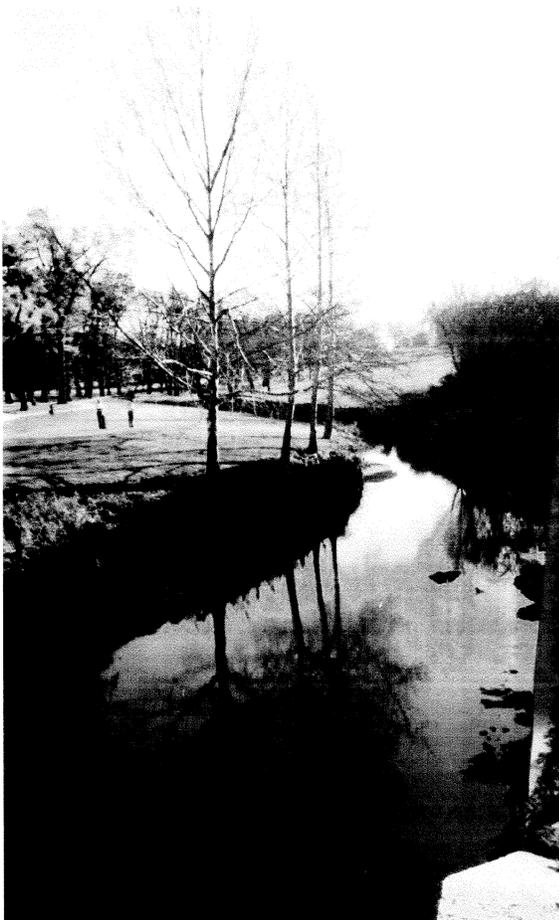


SECTION 905(b) ANALYSIS

RECONNAISSANCE STUDY

Brush Creek Basin Flood Damage Reduction and Ecosystem Restoration Kansas City, Missouri and Johnson County, Kansas

February 2005



**US Army Corps
of Engineers®
Kansas City District**

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BRUSH CREEK BASIN
Flood Damage Reduction and Ecosystem Restoration
Kansas City, Missouri and Johnson County, Kansas

SECTION 905(b) ANALYSIS
February 2005

1. STUDY AUTHORITY

The Brush Creek Basin Flood Damage Reduction and Ecosystem Restoration Study is authorized by a resolution (Docket 2698) of the Committee on Transportation and Infrastructure, U.S. House of Representatives, adopted July 24, 2002.

2. STUDY PURPOSE

This reconnaissance study evaluates the potential Federal interest in solutions to recurring flood damages, environmental degradation and related land and water resources needs and opportunities in the Brush Creek Basin in Kansas City, Missouri and Johnson County, Kansas. A positive determination of Federal interest in this study would be followed by development of a Project Management Plan (PMP) describing the scope of a feasibility study and a Feasibility Cost-Sharing Agreement (FCSA) binding the Federal and non-Federal partners to share the cost of a feasibility study.

3. LOCATION OF PROJECT/CONGRESSIONAL DISTRICT

The Brush Creek basin straddles the Kansas-Missouri State Line, with an overall drainage area of nearly 30 square miles. Slightly more than half of the drainage basin is located in the State of Missouri. The basin includes portions of Kansas City, Missouri and the cities of Fairway, Mission, Mission Hills, Mission Woods, Overland Park, Prairie Village, Roeland Park, Westwood, and Westwood Hills in northeast Johnson County, Kansas. The basin flows in a northeasterly direction towards the Blue River in Kansas City, Missouri. The basin is characterized by gently rolling topography and a well defined system of streams and valleys. In addition to the main channel of Brush Creek, the basin also includes tributaries such as Rock Creek in Johnson County, Kansas, and Town Fork Creek and the Brookside Area in Kansas City, Missouri.

The City of Kansas City, Missouri is located in the Fifth Congressional District of Missouri. Johnson County, Kansas is located in the Third Congressional District of Kansas.

4. PRIOR REPORTS AND EXISTING PROJECTS

4.1 PRIOR REPORTS

A number of Brush Creek Basin reports and studies of varying scope and detail have been prepared by the Corps of Engineers or other agencies, contractors, or local interests. They are listed chronologically as follows:

Brush Creek & Tributaries, U.S. Army Corps of Engineers, 1981.

This report presented various strategies for flood damage reduction including non-structural measures (evacuation, relocation, regulatory actions, and floodproofing), structural measures (bridge modifications, tunnels, underground diversions, channel modifications, levees or floodwalls, and detention structures), and combinations thereof. Bridge modification and tunnel modification were the two measures identified for future study in the Town Fork Creek Watershed. Both measures were found to have insufficient benefit/cost ratios.

Brush Creek & Tributaries, Missouri & Kansas, Feasibility Report on Flood Damage Reduction, Technical Support Appendices, U.S. Army Corps of Engineers, September 1981.

This problem identification appendix serves to supplement the Feasibility Report by providing detailed technical descriptions and data pertinent to the study of flooding and associated problems and needs in the Brush Creek Basin.

Brush Creek & Tributaries, Missouri & Kansas, Feasibility Report on Flood Damage Reduction, Technical Support Annex to Appendix C, U.S. Army Corps of Engineers, September 1981.

This report provides technical information concerning the calibration of the rainfall-runoff watershed model developed for the Brush Creek Basin.

Brush Creek Channel Modification, Authorized Project Report, Flood Protection Project, Kansas City, Missouri, U.S. Army Corps of Engineers, October 1988, Revised January 1989.

This project report presents the design, cost estimates, and supporting documentation for the Brush Creek Channel Modification Project between Roanoke Parkway and Forest Avenue in Kansas City, Missouri at a total cost of \$16.1 million. The authorized plan included lowering the channel bottom, modifying the channel side slopes, and replacing several bridges.

General Design Memorandum, Brush Creek Enhancement Channel Modifications, U.S. Army Corps of Engineers, May 1990.

The General Design Memorandum presents the results of engineering studies for the enhanced project (Park Plan) along Brush Creek through the Plaza. It served as the basis for preparation of plans and specifications for the Park Plan.

Technical Report HL-92-1, Hydraulic Model Investigation, Brush Creek, Kansas City, Missouri, U.S. Army Corps of Engineers, February 1992.

This report presents the results of a physical model study of Brush Creek through the Plaza area. The physical model was tested by reproducing prototype high-water marks obtained during the September 1977 flood.

Town Fork Creek Watershed Master Plan, Black & Veatch, 1997.

This master plan included the identification of areas with flood problems, analysis of the storm drainage system, and recommended improvements to mitigate flooding problems. The plan recommended \$40 million of improvements to the creek and \$35 million for the storm sewer system.

Structural Investigation of Bridges for Planning Assistance to States Project, Brush Creek Channel, Plaza to State Line Road, HNTB Corporation, October 1999.

This report presented the investigation and analysis of possible modifications to bridges in conjunction with a four-foot overexcavation of the Brush Creek channel for alleviating flooding problems and bridges considered in the report include the State Line Road, Ward Parkway, Rockwell Lane, Belleview Avenue, and Roanoke Parkway bridges.

Stormwater Management Advisory Committee Projects BC-07-31 and BC-07-33, Draft Report, Mission Hills, Kansas, The Larkin Group, February 2000.

This feasibility study was focused on addressing flooding and erosion problems along Brush Creek from the Indian Lane Bridge to State Line Road, and along Rock Creek from the northerly city limit of Mission Hills to the confluence with Brush Creek. The alternatives identified in study included channel deepening and widening, buyouts, floodproofing, floodwarning systems, and bio-engineered bank stabilization.

Technical Memorandum for Short-Term Flood Control Measures, Brush Creek, Plaza to State Line Road, Kansas City, Missouri, Dames & Moore, 2000.

This memorandum documents conceptual plans of short-term measures to alleviate flood and erosion problems in the Brush Creek floodplain from the State Line Road Bridge to the upstream end of the Federal flood control project.

Stage 1 Assessment Investigation of Flooding and Drainage Problems, Brush Creek, Plaza to State Line Road, Kansas City, Missouri, Final Report, URS Group Inc., August 2001.

This study investigated flooding and related stream bank erosion problems along Brush Creek from the Plaza to State Line Road. Both short-term and long-term flooding and erosion control measures were developed.

Brookside Watershed Area Storm and Sanitary Sewer Improvements Facility Plan, Kansas City, Missouri, Burns & McDonnell, December 2001.

The report presented the analysis and performance capabilities of the existing storm and sanitary sewer improvements, as well as recommendations for improvements to the existing facilities for the Brookside Watershed. Recommendations included the removal of private sewer interconnects, installation of backflow prevention devices, removal of public sewer interconnects, improved inlets, and repair and upgrade of existing local neighborhood collection systems.

Planning Assistance to States Study, Investigation of Flooding and Drainage Study, Brush Creek – West Plaza Reach to State Line Road, Stage II Assessment Alternatives for Hydraulic Analysis, U.S. Army Corps of Engineers, February 2002.

This study presents eighteen different alternatives for further evaluation and hydraulic modeling along Brush Creek from the west end of the plaza to State Line Road. The alternatives include channel deepening, channel widening, and sizing the bridge openings to pass the 500-year event.

Effects of Wastewater and Combined Sewer Overflows on Water Quality in the Blue River Basin, Kansas City, Missouri and Kansas, June 1998-October 2000, Donald H. Wilkison, Daniel J. Armstrong, and Dale W. Blevins, U.S. Geological Survey, 2002.

This report presents information to assess the effect of wastewater and combined sewer overflows on the stream water quality in the Blue River Basin, including Brush Creek. The study identifies wastewater inputs into Brush Creek as largely being the result of intermittent stormflow events that trigger the overflow of combined storm and sanitary sewers, and the subsequent discharge of untreated wastewater into Brush Creek.

Brookside Watershed Area Storm and Sanitary Sewer Improvements, Crestwood Area Facility Plan Update, Kansas City, Missouri, Burns & McDonnell, October 2002.

The report presented the analysis and performance capabilities of the existing storm and sanitary sewer improvements, as well as recommendations for improvements to the existing facilities for the Crestwood Area of the Brookside Watershed. Recommendations included the removal of private sewer interconnects, installation of backflow prevention devices, removal of public sewer interconnects, improved inlets, and repair and upgrade of existing local neighborhood collection systems.

Stage II Formulation and Evaluation of Flood Reduction Measures, Initial Alternatives Hydraulic Profiles & Summary Output, Brush Creek, Kansas City, Missouri, URS Group Inc., November 2002.

This memorandum presented the results of hydraulic modeling for five channel improvement alternatives and levee improvements along Brush Creek from State Line Road to the Plaza.

Westport Area Sewer Study, Volume I, U.S. Army Corps of Engineers, HDR Engineering, Inc., November 2002.

This study investigated the existing combined, sanitary, and storm sewers in the Westport area of Kansas City, Missouri to assess their overall condition and to provide overflow information for use in controlling the environmental impacts of combined and sanitary sewer overflows.

Town Fork Creek Flood Mitigation Plan, City of Kansas City, Missouri and Missouri State Emergency Management Agency, Shockey Consulting Services LLC and Burns & McDonnell, March 2003.

The purpose of the Town Fork Creek Flood Mitigation Plan was to develop coordinated strategies to reduce flooding thereby improving the quality of life in the watershed. The plan addressed those areas of the Town Fork Creek Basin below 63rd Street and was partially funded by a grant from the State Emergency Management Agency. Action steps identified in the plan included the formation of the Town Fork Creek Coordinating Committee; prevention of future flooding through zoning ordinances, stream setbacks, improved system maintenance, relocations and buyouts; preservation or restoration of natural stormwater management systems; and expanded flood warning system capabilities.

Kansas City Walkability Plan, City Planning & Development Department, Kansas City, Missouri, LSA Associates, March, 2003.

This plan presented a prioritized list of improvements in the Brush Creek corridor area including a complete creek-side trail network, improved street crossings, and coordination with major institutions along Brush Creek to promote and fund improved connections along the corridor.

Lake of the Enshriners, Section 1135 Preliminary Restoration Plan, Kansas City, Missouri, U.S. Army Corps of Engineers, March 2003.

This plan for the Lake of the Enshriners included the restoration of aquatic, aquatic fringe, and riparian habitat, and the development of native grasslands with wildflowers and woodland habitat. The plan also included outdoor education and low impact recreational opportunities.

Brush Creek Beautification Master Plan, Kansas City, Missouri, Bucher, Willis & Ratliff, May 2003.

The beautification master plan identified improvements along Brush Creek from the state line to the Blue River. The plan included ponds and waterfalls in the Ward Parkway median west of the Plaza, and water gardens, festival grounds, hotel and small business parks east of the Plaza. The channel upstream of the Plaza would be widened and

deepened. Lighted, curving creek-side walkways would be extended through the entire area.

Brookside Watershed Area Storm and Sanitary Sewer Improvements, Loose Park/Plaza South Area Facility Plan Update, Kansas City, Missouri, Burns & McDonnell, July 2003. The report presented the analysis and performance capabilities of the existing storm and sanitary sewer improvements, as well as recommendations for improvements to the existing facilities for the Loose Park/Plaza South Areas. Recommendations included the removal of private sewer interconnects, installation of backflow prevention devices, removal of public sewer interconnects, improved inlets, and repair and upgrade of existing local neighborhood collection systems.

Alternatives to Alleviate Flooding, Brush Creek, Kansas City, Missouri, U.S. Army Corps of Engineers, July 2003.

This report presented several alternatives to prevent flooding along Brush Creek from State Line Road to the west end of the Plaza. Alternatives included channelization, channel deepening, replacement or modification of bridges, a right bank levee, and detention basins. Hydraulic analysis and cost estimates were completed for several alternatives.

Brush Creek Corridor Economic Development Plan, Brush Creek Community Partners, Hammer, Siler, George Associates, Gould Evans Goodman Associates, October 2003. This plan identifies the exploration of the creation of a community improvement district or districts along the Brush Creek Corridor. The plan studied the corridor's potential for new retail, office, institutional, entertainment, and recreational development including hotels and restaurants.

4.2 EXISTING PROJECTS

The City of Mission, Kansas is studying improvements to address flooding problems along Rock Creek, a tributary to Brush Creek. One potential solution includes a \$15 million project to widen and deepen channel.

The City of Mission, Kansas is considering plans to encase Rock Creek between Woodson and Nall Avenue with large concrete conduits at a cost of over \$12 million. Additionally, Mission is considering redevelopment of the residential and commercial property between Woodson and Nall. Mission is working with Fairway, Mission Hills, and Kansas City, Missouri to develop acceptable solutions. Several funding options being explored include sales tax revenues, stormwater utility fees, and federal funding pursuits.

A new Prospect Avenue Bridge over Brush Creek is under construction and completion is expected in late 2004. The new bridge is nearly three times longer than the previous 80-foot span. The project includes channel improvements approximately 1000 feet on either

side of the bridge, similar to the flood control work through the Plaza. The work is being funded through a Federal Emergency Management Agency/State Emergency Management Agency grant and through the City of Kansas City's capital budget.

The City of Kansas City, Missouri is in the planning and design phase of replacing the Troost Avenue Bridge over Brush Creek, including streetscape design along Troost from 42nd Street to 52nd Street, with sidewalk and landscaping connections to the Brush Creek channel. Other planned bridge replacements include Belleview Avenue and Roanoke Parkway bridges.

The U.S. Army Corps of Engineers and Kansas City, Missouri are currently funding the construction of flood control improvements along Brush Creek near Woodland Avenue. The channel improvements, similar to those previously completed through the Plaza, begin upstream of Woodland Avenue and continue downstream towards the Bruce R. Watkins bridges.

5. PLANNING PROCESS

5.1 PLANNING BACKGROUND AND APPROACH

5.1.1 Six-Step Planning Process

The Principles and Guidelines published by the Water Resources Council prescribes a six-step planning process to be used in all Corps planning studies. The six steps are:

- 1) Identification of problems and opportunities;
- 2) Inventory existing conditions and forecast future conditions;
- 3) Formulate alternative plans;
- 4) Evaluate alternative plans;
- 5) Compare alternative plans;
- 6) Plan selection.

The 905(b) report provides an initial appraisal involving all six steps, but most of the tasks pertaining to inventories, forecasts and plan analyses will occur later in the planning process (i.e., in the feasibility phase). The 905(b) analysis emphasizes identification of problems and opportunities as well as management measures that would serve as the building blocks of alternatives providing solutions.

5.1.2 National Objectives

In addition to the six-step planning process, the Principles and Guidelines also address national or Federal objectives. The Federal goal in water resources planning is to contribute to National Economic Development (NED) consistent with protecting the nation's environment. NED contributions increase the net value of the national output of

goods and services. This national perspective on economic outputs is in contrast to local or regional gains and losses that may not increase the net wealth of the nation as a whole. A second Federal objective is to contribute to National Ecosystem Restoration (NER) based on improvements in habitat quality and/or quantity. The intent of a 905(b) analysis is the identification of multipurpose objectives and alternatives that contribute to both NED and NER through a comprehensive focus on a complete watershed.

5.2 PROBLEMS AND OPPORTUNITIES

Flood hazards and damages as well as long-term watershed environmental degradation constitute the most serious concerns in the Brush Creek basin and are discussed below, along with opportunities to address those concerns.

5.2.1 Flood Hazards and Damage

The Brush Creek basin has been plagued with significant flood problems, including numerous casualties along the lower portion through the City of Kansas City, Missouri. The approximately 30 square mile basin is characterized by gently rolling topography with a well integrated network of streams and valleys. The watershed is completely urbanized and land use is predominantly single family residential, with some multiple-family housing. There are also several scattered commercial districts including the Country Club Plaza, a nationally-recognized retail district located along the north bank of lower Brush Creek. Other land uses include institutional areas, green spaces (golf courses, parks, and cemeteries), and an industrial area near the confluence of Brush Creek and the Blue River. At the headwaters of the basin in Overland Park, Kansas, the drainage is primarily conveyed through a storm sewer collection network. Further downstream through Prairie Village, Kansas; the collection network empties into an engineered open channel generally consisting of a concrete floor and gabion, rock, or concrete side walls. Through Mission Hills, Kansas and into portions of Kansas City, Missouri, the Brush Creek channel is more natural with a bed of cobbles, gravel, and some silt. The banks of the creek are vegetated in some places, and stabilized by either bioengineered or hard-armored approaches elsewhere. Approximately 2000 feet beyond the Kansas-Missouri State Line, Brush Creek consists of a paved concrete floor with some hard armoring along the banks. From approximately Roanoke Parkway to Troost Avenue in Kansas City, Missouri, Brush Creek has been reconstructed through a joint Corps and City approach to flood control and beautification project, including a deepened channel, two low dams forming shallow pools, and curving concrete walls and walkways. From Troost Avenue downstream to the confluence with the Blue River, several improvement projects are currently underway to continue the flood control and beautification efforts. This furthest downstream reach of Brush Creek also includes a naturally-landscaped lake which is planned to be further enhanced for aquatic, riparian, and terrestrial habitats.

Development within the Brush Creek watershed has increased impervious coverage and reduced hydrologic travel times, leading to increased runoff volumes, peak flow rates, and the potential for flash flooding. Although the Corps and City flood control efforts are effective in reducing flood potential through the Plaza reach, there are many areas along Brush Creek at considerable residual flood risk. This includes flooding potential along Brush Creek both upstream and downstream of the Plaza reach in both Kansas and Missouri.

Significant flooding problems also persist along tributaries such as Town Fork Creek and in the Brookside area of Kansas City, Missouri. These areas are served by a combined sewer overflow system and are subject to sanitary sewer backups and basement flooding. Major flooding issues also persist along Brush Creek and Rock Creek, which affects the cities of Mission, Fairway, Roeland Park, Mission Hills, and others in northeast Johnson County, Kansas.

5.2.2 Environmental Degradation

Brush Creek is a tributary to the Blue River, which is currently in various phases of Corps of Engineers study, design, and construction. Combined with the Missouri River approximately 10 miles downstream of the Brush Creek/Blue River confluence, these water features represent vital ecological resources to the greater metropolitan area of Kansas City. The Brush Creek basin offers opportunities for aquatic, riparian, and terrestrial resources within the region. Some small isolated areas of natural or restored habitat still exist in and along Brush Creek and its tributaries. Examples of such resources include the Lake of the Enshriners area near the mouth of Brush Creek, and the various remaining greenspace, parkland, and open areas along Brush Creek in both Kansas and Missouri, and along Rock Creek and Town Fork Creek. However, these habitat areas have been degraded over the years in terms of both in-channel habitat deterioration and loss of upland habitat areas in the watershed.

Development in the watershed has degraded the stream system both directly and indirectly. Direct impacts of development include floodplain filling, channel straightening, installation of storm sewer networks and combined sewer overflow systems, channel enclosures, concrete lining of stream channels, stormwater outfalls and discharges, lack of stream buffer zones, loss of riparian vegetation, and many roadway and utility crossings. Indirect impacts resulting from development in the basin include increased runoff volumes and peak discharge rates to streams as well as significantly reduced opportunities for infiltration, nutrient uptake, natural biological processes, and groundwater recharge.

The combination of direct and indirect impacts has increased peak flows, flood flow volumes, channel flow velocities, and the rate at which stream flows rise and fall after a storm. As a result, the increased flow in certain reaches of Brush Creek and its tributaries

has carved wider and deeper channels. This has caused widespread streambank erosion and channel instability in those portions of open channel that have not been stabilized.

Development impacts result in water quality impairments, use attainability and related public health concerns, sedimentation, reduced and degraded habitat areas (aquatic, riparian, and terrestrial), fragmentation of habitat and open space, and reduced recreational interests along the stream corridors. Further, such impacts limit redevelopment and community revitalization opportunities along the corridor.

5.2.3 Opportunities

The principal opportunity that would be addressed by a feasibility study of the Brush Creek basin is the identification of a multi-purpose plan addressing both ecosystem restoration and related flood damage reduction. The future of Brush Creek as a living stream with natural values is threatened by a number of impacts of continued floodplain encroachment, loss of shallow aquifer recharge, degraded water quality, continued sedimentation and build-up of pollutants, fragmentation of habitat areas, encroachment on aquatic habitat by channel modification, loss of riparian habitat and aesthetic values, and reduced recreational and redevelopment potential.

Although there are a variety of individual and localized flood mitigation and ecosystem restoration efforts being planned and considered throughout the Brush Creek basin, uncoordinated and fragmented flood damage reduction and ecosystem restoration efforts would not effectively capitalize on the opportunity for a holistic, comprehensive, and fully integrated approach. In addition to ecosystem restoration and flood damage reduction, other potential outcomes of a more comprehensive approach could include enhanced recreational, cultural, educational, and economic development opportunities. This comprehensive approach would create opportunities to enhance and transform the Brush Creek corridor into a vibrant and sustainable asset to the greater metropolitan Kansas City area.

5.3 EXISTING AND FUTURE CONDITIONS

Existing water-related resource conditions in the Brush Creek basin as of 2004 are discussed below, followed by a consideration of the future without-project conditions.

5.3.1 Existing Conditions

5.3.1.1 Flood Damages

Several major flooding events have occurred within the Brush Creek basin. Two of the most catastrophic flood events are briefly discussed below:

1977 – A devastating flood event occurred in September 1977. In a 24-hour period, approximately 12 inches of rain fell on Kansas City. The greatest flooding was experienced downstream of the Kansas-Missouri State Line, and each bridge downstream and including the State Line Bridge was overtopped. The flood event was estimated to be somewhere between a 200-year and 500-year recurrence interval. The flood killed twenty-five people and caused enormous amounts of property damage. The flood damage estimate was over \$66 million (1978 dollars), of which more than 80 percent was incurred by shops in the Country Club Plaza. Flooding also damaged businesses and residential areas in low-lying areas along the creek. The 1977 flood damaged the property of nearly 7,000 families.

1998 – In October 1998, the Kansas City area received as much as 7.7 inches of rainfall causing flooding of streets, businesses, and residences. Bridges were overtopped, including the Prospect Avenue bridge where three cars were swept away, resulting in seven casualties. Eleven persons were killed by this devastating flood event. Dozens of basements were filled with flood water and many homes sustained structural damage. The damage estimates were in the millions. At least two dozen successful rescues were documented. More than 100 apartment units were damaged near 46th Street and The Paseo intersection.

In addition to these catastrophic events, flooding and flood-related damages are recurring problems along Brush Creek throughout Kansas and Missouri. Many of the bridges and other public infrastructure in the vicinity of Brush Creek are routinely overtopped and subjected to flood damage. Long-established residential development areas along Brush Creek sustain repetitive flood damages to homes and personal property.

The State Line Road bridge does not have adequate hydraulic capacity and overtopping is expected during flood events greater than a 50-year flood. A physical model developed by the Corps indicates that overtopping could occur during a 10-year flood. There is also potential for overtopping at the Ward Parkway bridge for events greater than a 10-year flood. The Rockwell, Belleview, and Roanoke bridges all have overtopping frequencies of about a 50-year flood.

Both the Mission Road and Sheridan Road bridges over Rock Creek in the City of Fairway, Kansas are frequently overtopped. Residential developments along Rock Creek in the City of Fairway are subject to recurring flooding problems.

Recently updated floodplain mapping along Rock Creek now designates more than 100 businesses, representing about half of the downtown business district and the Mission Center Mall, as being within the 100-year floodplain. The value of commercial property within the revised floodplain delineation has been estimated at over \$35 million. The Mission downtown district was flooded in the 1950's and major flooding and flood-related damages occurred during the 1977 and 1998 events.

In the Town Fork Creek watershed, there are many structures located within areas that are subject to repetitive flooding. The 100-year floodplain for Town Fork Creek includes 115 residential and 12 non-residential structures. Many of these properties do not carry flood insurance. Critical facilities are also located along Town Fork Creek including Swope Parkway Health Center, Swope Park Ridge Geriatric Center, and Research Hospital. Major arterial streets in the watershed are frequently barricaded during flood events and include Cleveland Avenue and Swope Parkway. Collector and residential roadways are also subject to frequent closure.

In the Brookside area, flooding occurs due to dense development, inadequate capacity of both storm drainage and sanitary sewer facilities, improper interconnections between the stormwater and sanitary systems, and lack of designated stormwater overflow routes. During the 1998 flood event, residents reported as much as 9.5 feet of water in their homes and over \$750,000 in property damage.

In addition to these physical damages, other flood-related impacts from past events have included streambank erosion hazards, public infrastructure and utility damage, public health and safety issues, detours and delays, economic development limitations, and clean-up costs.

5.3.1.2 Environment

In addition to flooding problems, the Brush Creek Basin's ecosystem has been severely degraded. Over the years, the natural aquatic, riparian, and upland habitat conditions have been significantly altered through urban development. The expansion of residential, commercial, and some industrial developments, along with the supporting infrastructure, has contributed to the decline of the ecosystem's health throughout the basin. The channeling, straightening, and enclosure of streams within the watershed, and the reduction in riparian corridors have increased flooding potential and have degraded the natural environment. Land use practices within these developed areas have contributed to water quality problems as well. Degradation of aquatic ecosystem health and many of the flooding problems in the Brush Creek basin are the result of altered natural ecosystem functions in the basin.

Incidences of flooding in the basin have steadily risen over time while aquatic ecosystem health has declined. Basin-wide flooding problems and declining aquatic and riparian ecosystem health appear to be directly related. Merging efforts for both flood damage reduction and aquatic ecosystem restoration would likely diminish both problems.

The primary limiting factors to aquatic ecosystem health in the Brush Creek basin are physical barriers, floodplain connectivity, increased sedimentation conditions, degraded riparian conditions, and poor water quality. Flooding problems in the basin are directly interconnected with each of these limiting factors.

Physical Barriers – Physical barriers include stormwater and combined sewer overflow networks. Such infrastructure limits the available habitat and movement of aquatic species through the basin. The water sources necessary to support aquatic habitat are effectively separated from the natural environment and replaced by hydraulically-efficient, manmade conveyance systems. The natural biological processes that are environmentally beneficial for aquatic biota and water quality purposes are no longer effective. Also, roadway culverts and utility crossings dissect the riparian corridors throughout the basin.

Floodplain Connectivity – Floodplain connectivity refers to conditions affecting overall flows of a watercourse through its floodplain. Floodplains with open connectivity are connected directly to the stream channel at many locations, allowing wetlands and other off-channel features to temporarily store flood water and later discharge this storage back to the stream channel during lower flows. Streams with restricted floodplain connectivity are characterized by rapidly rising and falling flood levels with little connection to an overall floodplain. Brush Creek exhibits many of the characteristics of constrained floodplain connectivity. Flash flooding is common, with rapidly rising and falling flood levels. The majority of the naturally occurring floodplain areas adjacent to the stream channel have been filled in by development over the years.

Altered and degraded floodplain connectivity in the Brush Creek basin has contributed significantly to degraded aquatic ecosystems, increased flow velocities, greater streambank erosion, and channel incision. Enclosed storm sewer systems and channelization have limited the sustained development of off-channel habitats. Overall floodplain connectivity alterations in the Brush Creek basin have exacerbated flooding conditions and have degraded aquatic ecosystem health.

Sedimentation Conditions – In the headwaters of the Brush Creek basin, the majority of the natural watercourses have either been replaced with an enclosed storm sewer network or channelized. Coupled with increased impervious surface and peak flow rates due to development, the runoff conveyed by Brush Creek and its tributaries is erosive in those areas that are not adequately protected from scour. As sediment-laden runoff is conveyed downstream, deposition can occur in flatter, low-lying areas along the creek. As Brush Creek enters the Plaza reach, sediment is deposited in the areas behind the low dams constructed by the Corps and City of Kansas City, Missouri. These high levels of sediments, associated pollutants, and turbidity contribute to the degradation of aquatic habitat and the overall ecosystem within the basin. Sedimentation also causes the need for more frequent maintenance and can detract from the aesthetics of the area.

Riparian Conditions – Degraded riparian conditions exist in many locations throughout the Brush Creek basin. Areas with little or no natural vegetation

characterize the degraded riparian conditions. In many locations, development has occurred up to the edges of stream channels and in other areas, the stream channel has been replaced by a storm sewer network. The vegetation in these areas is often artificially landscaped with turf grasses and limited riparian habitat-supporting vegetation. Areas with little or no natural vegetation do not provide adequate shade and may result in increased water temperatures. Degraded riparian areas also do not adequately provide a buffer filter for stormwater runoff and other human-related activity. Streambank protection offered by naturally occurring vegetation is no longer present in many areas, leading to increased scour and erosion conditions. Available parkland, open space, and restored riparian areas are fragmented within the basin and do not fully function as a living riparian corridor.

Water Quality – High levels of fecal coliform bacteria, sediment-laden runoff and associated constituents, combined sewer overflows, and other loadings present in Brush Creek flows characterize the primary water quality problems. Brush Creek occasionally receives untreated wastewater from the overflow of combined sanitary and stormwater systems. Bacteria sources have been estimated by USGS and other studies as about 25% human and 75% other. Sediment and associated constituents behind the Brush Creek impoundments through the Plaza reach contribute to eutrophic and hypereutrophic conditions in these water bodies. Basin land use conditions and in-channel modifications impact habitat and limit aquatic life uses. Also, aesthetic and health concerns from the combined sewer overflows limit the development of recreational features along the Brush Creek corridor.

5.3.2 Future Without-Project Conditions

5.3.2.1 Flood Damages

Expected future conditions include continued flooding and associated damages throughout much of the basin. Local floodplain ordinances are in place to regulate future development/redevelopment within the 100-year floodplain. Local efforts are also underway to implement a variety of stormwater management programs, projects, and best management practices. However such ordinances, plans, and programs will not reduce flood damages below existing levels. Long-term consequences of flooding will also persist including the threat of loss of life, public health and safety, structure and contents damage, slowed economic growth and redevelopment potential, possible escalation of vacancies in the area, higher costs associated with repairing and preventing flood damage, and interrupted transportation access.

5.3.2.2 Environment

Various government organizations and regional agencies are individually identifying and conducting ecosystem restoration efforts in portions of the Brush Creek basin. However, current and past restoration efforts need augmentation and coordination on a larger scale so that basin-wide environmental benefits may be more fully realized in conjunction with a comprehensive basin-wide approach.

Future conditions include continued degradation of the overall ecosystem throughout the Brush Creek basin. Accumulation of pollutants in stream sediments in the impoundments through the Plaza reach and in the groundwater table will continue. Aquatic and riparian ecosystems will continue to be degraded without a comprehensive, basin-wide approach to restoration of habitat areas. Non-participation by the Corps in numerous restoration efforts would likely result in continued decline in the environmental resources throughout the basin.

In the context of this continued environmental degradation, it would also be difficult for the region to fully realize the recreational, cultural, and aesthetic potential of the Brush Creek corridor as a unique and valued natural amenity.

5.4 PLAN FORMULATION – MANAGEMENT MEASURES

An array of measures is available for the formulation of a multiple-purpose plan addressing both environmental restoration and related flood damage reduction within the Brush Creek basin. Each measure may also indirectly support water quality improvements, recreation, economic redevelopment, community revitalization, cultural and educational opportunities.

5.4.1 Ecosystem Restoration

No Action – The no action alternative will not meet the needs of providing overall restoration within the Brush Creek basin ecosystem.

Fish and Wildlife Habitat Areas – Habitat areas can be developed along the Brush Creek corridor. Aquatic, riparian, and upland habitats would be developed depending upon the location of available land within the watershed. Native vegetation and management strategies would be used to create a naturally-sustainable environment. Wetland and terrestrial habitat development could be included and may also function as mitigation opportunities for other local or regional projects.

Streambank Restoration – Existing streambanks that exhibit scour and erosion potential may be restored using bioengineering applications. By restoring streambanks, erosion, sediment transport, and sediment deposition would be controlled. Additionally, aquatic and riparian habitat could be created through the use of properly planned and arranged natural materials such as large woody debris or rock riffle pool complexes for in-channel structure and diversity.

Stream Corridor Restoration – In conjunction with many of the other alternatives listed, the restoration of a contiguous stream corridor along Brush Creek and its tributaries could provide many benefits. Linear, interconnected biotic communities and habitat areas (aquatic, riparian, and upland) could be developed along the creek, rather than the currently fragmented arrangement of open space and habitat areas. Recreational features and cultural linkages developed in coordination with stream corridor restoration unite communities.

Conveyance Modification – This alternative would involve modifications to the channel and overbank areas to reconnect the watercourses to their floodplains at specific locations. Sloping back revetments and creating hydraulic connections to excavated or low-lying floodplain areas and wetlands would allow for more frequent floodplain connectivity during flood events. Floodplains provide habitat for a variety of aquatic and riparian species. Re-vegetation of floodplain areas would improve sediment trapping and groundwater recharge functions. Wetlands can be restored or created in floodplain areas to further allow groundwater recharge.

Land Use Modification – This alternative would involve the facilitation of changes in land use practices detrimental to water quality and habitat. Easements or buyouts of industrial- or commercial-zoned properties with high aquatic, riparian, and upland habitat restoration potential would be pursued. Land swapping and other means of relocating existing or proposed land uses to less detrimental locations would be evaluated.

Sediment Transport – The transport and deposition of sediment throughout the Brush Creek watershed can be managed to minimize detrimental effects to the ecosystem. Potential solutions to address sediment deposition problems include the construction of sediment control structures, control basins, or sediment traps. Since sediment within Brush Creek is associated with various constituent loadings, the managed and controlled deposition of sediment can be beneficial in terms of facilitating removal and treatment, thereby improving water quality and habitat potential.

Combined Sewer Overflow (CSO) Disconnection – The removal of improper connections between the storm drainage network and the sanitary sewer system, along with the development of separate storm and sanitary piping systems would greatly reduce the discharge of untreated wastewater directly into the stream during high flow periods. During low flow periods, the CSO system sends both wastewater and stormwater to the treatment plant prior to discharge, thereby providing a benefit during such periods. The benefits of CSO disconnection would need to be evaluated over a wide array of scenarios to determine effectiveness in improving water quality over the long term.

Best Management Practices – Included in this alternative are the Best Management Practices (BMPs) associated with the U.S. Environmental Protection Agency's (EPA)

National Pollutant Discharge Elimination System (NPDES) Phase II. Following is a list of potential BMPs:

- Public Education and Outreach on Stormwater Impacts
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination
- Construction Site Stormwater Runoff Control
- Post-Construction Stormwater Management in New Development and Redevelopment
- Pollution Prevention and Good Housekeeping for Municipal Operations

5.4.2 Flood Damage Reduction

No Action – The no action alternative will not meet the needs of alleviating flooding the basin.

Channel Capacity Improvements – Modifications to the stream channel may be made to improve hydraulic conveyance properties, thereby lowering flood stages. Such modifications can also be made at bridges and culverts as necessary to remove hydraulic restrictions. Such improvements would need to be evaluated to determine potential detrimental effects on downstream areas.

Storm Sewer Improvements – Modifications to the existing storm sewer networks may be made to reduce the frequency of flooding in areas served by such systems. This approach can include additional surface inlets, parallel pipe systems, the installation of backflow prevention devices, replacement with adequately sized conveyance elements, removal of restrictive or collapsed segments, improved maintenance to achieve maximum performance, and the establishment of designated overflow routes that do not adversely affect existing properties or infrastructure.

Stream Channel Restoration – This alternative could include a variety of measures to restore portions of Brush Creek and its tributaries to naturalized stream channels. Areas currently served by storm sewer networks, combined sewer overflow systems, or paved channel systems could be restored by creating open channel conveyance areas similar to natural, predevelopment conditions. Bioengineering approaches may be used to appropriately stabilize the creek banks with native vegetation. Stream meanders and low-lying overbank areas could also be included.

Non-Structural Measures – Non-structural flood damage reduction alternatives include buyouts, relocations, flood warning systems and emergency response plans, floodproofing, elevation of existing structures, open space preservation, best management strategies, ordinance and policy revisions, and public involvement activities.

Stormwater Detention – This alternative would include the evaluation of upstream storage opportunities, open space, and overbank storage volumes that may be available for stormwater detention. Given the nature and extent of development throughout the basin, the availability of such areas is expected to be limited. To the extent practical, stormwater detention opportunities would also be considered in combination with other watershed-wide alternatives.

5.5 FORMULATION OF ALTERNATIVES AND PRELIMINARY EVALUATION

5.5.1 Brush Creek Watershed Summit

The Brush Creek Watershed Summit was held on October 20, 2004 and brought together approximately 60 attendees including local municipal and county representatives, local and regional organizations, city councilpersons, neighborhood associations, consultants, state and federal agencies, and political representatives. The Summit included background presentations, panel discussions on specific basin issues, watershed problems and opportunities, strategy development exercises, and discussion regarding the need for improved regional coordination. The following is a summary of each of these topics.

The background presentations included the following:

- Meeting Overview
- Review of 905(b) Process
- Corps of Engineers Authorities
- Key Activities within the Brush Creek Basin

The panel discussion topics on basin specific issues included the following:

- Ecosystem Restoration
- Water Quality and Combined Sewer Overflows
- Recreation
- Community Revitalization
- Economic Development

Watershed problems and opportunities discussion included the following:

- Habitat Restoration Compatible with Recreation
- Water Quality Improvements
- Multi-Objective Strategies
- Public Education on Ecosystem Restoration
- Replacement of Restrictive Bridges/Culverts
- BMPs to Mitigate Stormwater Impacts
- Adherence to Community and Regional Standards

The following is a summary of various basin-wide strategies:

- Holistic Watershed-Based Solutions
- Leveraging Multiple Funding Sources
- Water Quality Improvements (Non-Point Source)
- Bi-State and Regional Cooperation
- Involvement of Policy and Decision-Makers
- Innovative Solutions
- Proper Long-Term Planning
- Consensus-Based Decision Making
- Multi-Purpose Vision
- Habitat Restoration compatible with Recreation

A summary of regional coordination needs included the following:

- Bigger and Broader Group Involvement
- Dedicated Watershed/Water Resources Liaison at Mid America Regional Council (MARC)
- Continued Communication Across Jurisdictions

In addition to the strategies developed above, other valuable Summit outcomes were networking opportunities, relationship building, heightened awareness of Brush Creek watershed activities and resources, and a solid foundation for this reconnaissance effort.

5.5.2 Alternatives Formulation and Evaluation

The Brush Creek basin offers the opportunity to develop a comprehensive basin plan with complementary elements of ecosystem restoration and flood damage reduction. The following sections present some general and specific potential plan elements in each area of the Brush Creek basin. These individual elements would function collectively to form the overall basin plan.

A variety of alternatives will be considered during the feasibility phase. These will include a spectrum of actions from focusing entirely on flood damage reduction to focusing entirely on ecosystem restoration. The majority of the flood damage reduction alternatives preferred for further consideration are more non-structural approaches that restore natural channel and floodplain functions. It is unclear from the reconnaissance evaluation the extent of flood damage reduction obtained from individual actions such as those identified in this report. These actions may be more appropriately classified as ecosystem restoration with incidental flood damage reduction components.

It is highly unlikely that just one alternative will solve all the problems in the Brush Creek basin. One can expect to use the entire suite of alternatives previously identified. Several of the alternatives identified either under ecosystem restoration or under flood

damage reduction could serve both purposes in many ways. By pursuing a combination of such alternatives, it is likely that a collective set of solutions will represent the most cost-effective means of providing ecosystem restoration with ancillary flood relief.

Table 1 summarizes these potential measures which were identified during the Brush Creek Summit, through review of available documents and previous studies, and following field reconnaissance activities.

Basin Area Description	Flood Damage Reduction					Ecosystem Restoration							
	Channel Capacity	Storm Sewer Improvements	Stream Channel Restoration	Non-Structural	Stormwater Detention	Fish & Wildlife Habitat Areas	Streambank Restoration	Stream Corridor Restoration	Conveyance Modification	Land Use Modification	Sediment Transport	CSO Disconnection	Best Management Practices
Brush Creek – Plaza to Blue River	X		X	X		X	X	X	X	X	X	X	X
Brush Creek – Plaza reach				X		X		X			X		X
Brush Creek – State Line to Plaza	X		X	X		X	X	X	X	X	X		X
Brush Creek – 72 nd & Tomahawk to Plaza	X		X	X		X	X	X	X	X			X
Brush Creek – headwaters to 72 nd & Tomahawk	X	X	X	X	X	X		X		X			X
Brookside Area	X	X	X	X		X		X		X		X	X
Rock Creek	X	X	X	X	X	X		X		X			X
Town Fork Creek	X	X	X	X		X		X		X		X	X

5.5.1 Brush Creek – Plaza to Blue River

Extensive flood control and parks beautification is currently underway in this reach, including the new Prospect Avenue Bridge and channel construction, and similar design efforts in the vicinity of Troost Avenue. Ecosystem restoration efforts are also currently underway downstream of Swope Parkway through the Lake of the Enshriners. It is critical that these efforts continue to be adequately coordinated and funded as this reach represents the beginning point of the Brush Creek corridor. A full range of stream corridor benefits are available through this area including ecosystem restoration, flood damage reduction, as well as recreational linkages to educational, cultural, neighborhood, and economic revitalization interests.

An opportunity was identified by the City of Kansas City along Brush Creek in the vicinity of Bruce R. Watkins Expressway. In this area, some existing open space along Brush Creek is ripe for ecosystem restoration such as upland and riparian forest restoration and wetland development. Some flood damage reduction benefits could potentially be realized in this location. Approximately two to five acres of land and stream channel could be restored in this area. In addition, key desirable elements such as trail linkages and environment education could be incorporated into a project at this location.

On the south side of Brush Creek near its confluence with the Blue River lies an area of industrial land use. An opportunity exists to transform this area into a more environmentally-friendly land usage that is compatible with a stream corridor concept for Brush Creek. Other opportunities in this area include the implementation of site specific BMPs to minimize any detrimental effects of this industrial activity at the confluence.

5.5.2 Brush Creek – Through Plaza Reach

Significant Federal and local funds have been invested through the Plaza reach for flood damage reduction and park beautification purposes. Brush Creek's appeal as a community and regional amenity for recreation, gatherings and events, and economic activity is limited by water quality and aesthetic concerns. Sedimentation in the impoundments constructed through the Plaza results in unsightly and associated constituent loadings that present water quality problems as well.

There are opportunities to improve water quality and aesthetic conditions through this reach, and a watershed-wide approach will be most effective. Upstream controls, CSO separation, innovative BMPs, and public education/involvement all can be implemented to protect and enhance the public investment in this reach.

5.5.3 Brush Creek - State Line Road to Plaza

This reach of Brush Creek is characterized by a deteriorating concrete-lined channel bottom with stone and mortar side slopes and low-lying overbank areas. Portions of the creek are exhibiting severe active scour and erosion conditions. Hydraulically-deficient bridges are being planned for replacement.

Opportunity exists to follow through with necessary bridge augmentation or replacement to reduce the potential for flood damages. Stream channel restoration approaches can also be considered to transform the stream to a naturalized, bio-stabilized, meandering streamway with riparian habitat areas. Conveyance modification could be made to reconnect the stream channel to the low-lying floodplain overbank areas. A greenway trails system could connect the Plaza reach to the Missouri-Kansas state line.

5.5.4 Brush Creek – 72nd and Tomahawk Road to State Line Road

This reach of Brush Creek meanders through Indian Hills Golf Course, Mission Hills Golf Course, and adjoining residential neighborhoods. The channel bottom is generally rock, gravel, and rubble, and the side slopes are hard-armored in various locations. Several armored low water crossings and grade stabilization structures exist in this reach. Bio-engineered streambank stabilization has also been accomplished in portions of this reach.

Ecosystem restoration opportunities in this reach include the development of riparian habitat areas along the stream corridor. Further bio-engineering applications could also be pursued to limit erosion and sedimentation. Conveyance modifications could be made to reconnect the stream channel to some low-lying floodplain overbank areas.

5.5.5 Brush Creek – Headwaters to 72nd and Tomahawk Road

The most upstream headwaters of the Brush Creek basin are in northern Overland Park, Kansas. The residential neighborhoods in this area are served by a storm sewer network of inlets and pipe conduits. The open channel system begins at 79th and Lamar Avenue through Prairie Village until it is conveyed underneath a retail/commercial center near 72nd and Tomahawk Road. The open channel system generally consists of a concrete floor with gabion, rock, or concrete side slopes. This well-maintained open channel flows through residential back yards with limited overbank areas.

Opportunities appear somewhat limited through this reach given the dense residential development and infrastructure. There may be potential for stormwater detention or other system improvements through Porter Park, although detention storage volume would likely be minimal. The implementation of BMPs and continued maintenance of the stormwater system may be the most practical approaches in this area.

5.5.6 Rock Creek

Rock Creek begins in northern Overland Park, Kansas and flows northeasterly through the Cities of Mission and Fairway, Kansas until its confluence with Brush Creek in the Mission Hills Golf Course. The headwaters are conveyed by enclosed storm sewer networks that eventually empty into varied types of open channels. The main branch of Rock Creek begins as an open channel near 62nd and Lamar Avenue. Rock Creek meanders through residential and commercial areas, and behind the Mission Community Center. This portion of channel varies from a U-shaped concrete chute to gabions and concrete, to an unimproved channel with rocks, cobbles, and gravel.

Near Roe Avenue and Shawnee Mission Parkway, Rock Creek is conveyed under the Mission Center Mall by a large underground conduit. The mall and much surrounding development have recently been determined to be within the 100-year floodplain of Rock

Creek. Downstream from Mission Center Mall, the creek meanders through a residential area in Fairway, Kansas until joining Brush Creek. This most downstream reach generally consists of a natural open channel with rock, gravel, and rubble bottom, with some areas of hard-armored side slopes.

The City of Mission is currently pursuing several funding sources in support of an aggressive community revitalization plan for Rock Creek. The plan includes downtown redevelopment and the transformation of Rock Creek into a linear streamway park with ecosystem restoration components. There may also be an opportunity for some detention to be developed. The City of Fairway, Kansas is considering a buyout program along flood-prone areas of Rock Creek, as well as the replacement of the Sheridan Avenue and Mission Road bridges.

A potential ecosystem restoration opportunity exists in the upper Rock Creek basin along about one mile of Rock Creek from Lamar Road to Mission Center Mall, and possibly further downstream through the mall area. This could include the removal of major structural elements such as concrete channel lining and daylighting of underground conveyance systems. This could be coupled with forested riparian and stream channel habitat restoration, and creation of wetlands to retain flood waters. Approximately one mile of riparian habitat could be restored and up to ten acres of wetlands could also be developed in this reach of Rock Creek.

Through the City of Fairway, a similar ecosystem restoration opportunity exists on lower Rock Creek. This would extend for approximately one mile starting downstream of Mission Center Mall to the confluence with Brush Creek. This opportunity would consist of the removal of various scattered streambank stabilization projects coupled with some stream channel and riparian habitat restoration. Up to one mile of channel and riparian forested habitat improvement benefits could be realized along Rock Creek in this reach. Providing continued support for a locally sponsored floodplain buyout program may be a related element of this opportunity. Some flood damage reduction benefits could be realized within the watershed through the full implementation of these various ecosystem restoration elements along Rock Creek.

There may be a potential Federal interest in participating in portions of these local and regional initiatives. In addition, a Rock Creek riparian corridor could be developed beginning at the confluence with Brush Creek and proceeding upstream through the City of Fairway towards Shawnee Mission Parkway. Eventually, the corridor could connect to the City of Mission's plans for streamway corridor development.

5.5.7 Brookside Area

The Brookside subwatershed of the Brush Creek basin is served by a storm sewer network with some combined sewer overflows. Opportunity exists to separate the stormwater and sanitary systems to improve water quality and reduce basement flooding.

Effective stream corridor restoration in this area would be difficult due to the extent of existing redevelopment.

5.5.8 Town Fork Creek

The Town Fork Greenway is located along the most downstream section of Town Fork Creek in the southeast corner of the Brush Creek watershed. In this area, the creek generally consists of a concrete-lined channel floor with rock and mortar side slopes. Low-lying overbank areas are generally wide and undeveloped with some remaining native vegetation. Some trails and recreational facilities are also present although they are likely in need of repair.

General opportunities exist to enhance and expand the Town Fork Greenway system upstream to Bruce R. Watkins Drive (U.S. Highway 71), and possibly further upstream towards 63rd Street. The hard-armored channel could be restored to a natural, vegetated, meandering streamway within a managed riparian corridor. Conveyance modifications could be made to reconnect the stream channel to low-lying floodplain overbank areas. Improved recreational trail networks could connect neighborhoods and provide linkages to the Brush Creek corridor.

Between Bruce R. Watkins and 63rd Street, up to two miles of riparian forest and about five to ten acres of wetland habitat could be developed or enhanced as part of a major riparian corridor improvement opportunity. Potential benefits of this watershed based approach could include innovative and permanent habitat restoration features, water quality improvements, and associated flood damage reduction benefits along Town Fork Creek. Within this section, the City of Kansas City identified a specific potential project near 57th & Bellefontaine. An existing tennis court within a city park may be removed, allowing for some riparian restoration and wetlands development along Town Fork Creek. Approximately 1,000 linear feet of riparian forest could be developed and about two to five acres of wetland habitat could be developed at this location.

Upstream of 63rd Street to Calvary cemetery, the creek meanders through a residential area where flooding and streambank erosion may be of concern. Buyouts, streambank stabilization, and riparian corridor restoration may be viable options in this area. Through the cemetery, active streambank erosion is evident.

The remainder of the basin is served by an enclosed storm sewer network and some combined sanitary sewers. Opportunities exist for separation of sanitary and stormwater systems, and for stream channel restoration (i.e. stream channel daylighting)

5.5.9 Brush Creek Corridor Development

A common, unifying theme throughout the Brush Creek watershed may be the development of a streamway corridor that extends from the mouth of Brush Creek

upstream into Johnson County, Kansas. The streamway corridor system could also extend into the various tributary watersheds including Town Fork Creek, Brookside, and Rock Creek. The streamway corridor would function as a natural, linear park system with stream buffer zones, riparian habitat areas, recreational and educational opportunities, and links to cultural amenities and neighborhoods. The streamway corridor would provide ancillary flood damage reduction benefits by limiting development in damageable areas along the corridor and providing floodwater detention. The corridor would be attractive to residential, commercial, and institutional developments bordering the corridor and may spur redevelopment and investment opportunities. This amenity would also assist in revitalizing and unifying the nearby communities and local residents.

6. FEDERAL INTEREST

The preliminary assessment of flood damage reduction and ecosystem restoration of the Brush Creek basin indicates that measures exist that are most likely economically justified, environmentally acceptable, supported by the local sponsor(s), and consistent with Corps policies, costs, and benefits. Ecosystem restoration is a high-priority budget output and a primary output of the alternatives to be considered. Flood damage reduction benefits can be derived through ecosystem restoration or independently. Further, the Corps has made significant contributions to addressing related challenges in Brush Creek and surrounding watersheds through past projects and through on-going investigations and planning activities. The development of a feasibility study would enable these previous and on-going activities to be maximized through a comprehensive, basin-wide approach serving the greater Kansas City metropolitan area. Therefore, there is a strong Federal interest in conducting the feasibility study.

7. PRELIMINARY FINANCIAL ANALYSIS

Local government officials repeatedly have expressed their intention to cost-share a Brush Creek Basin Feasibility Study, and development of a mutually acceptable sponsorship arrangement for a comprehensive watershed approach addressing multiple beneficial goals directed towards ecosystem restoration and flood damage reduction. Potential local sponsors include the City of Kansas City, Missouri, Johnson County, Kansas, and the several cities located in the northeast corner of Johnson County. It is anticipated that Kansas City, Missouri would be the official non-Federal sponsor and they will develop inter-local agreements with the other interested jurisdictions. In addition, the Mid-America Regional Council (MARC) may be interested in participation as a regional organization focused on watershed issues in the Kansas City region.

8. SUMMARY OF FEASIBILITY STUDY ASSUMPTIONS

- The Project Management Plan (PMP) and Feasibility Cost Sharing Agreement (FCSA) will be developed to identify the specific studies and issues for the

feasibility study. The approval of the PMP and initiation of the feasibility study will depend upon all parties coming to agreement on features to be studied, the cost-sharing allocation of study features, and the timing of schedule and funding. Upon approval of the plan by all parties, the FCSA will be signed.

- The proposed feasibility study will use as much existing information as possible to gain a clear understanding of flood problems and ecosystem restoration issues within the basin and the potential solutions already studied to determine the best means of proceeding.
- The local sponsor may desire to maximize opportunities for in-kind services in engineering or ecosystem restoration as their portion of the feasibility study cost.
- The document will be a combined Feasibility Report and EA or EIS.
- The document will incorporate local efforts targeted for ecosystem restoration and flood damage reduction as integral parts of the overall action plan within the Brush Creek basin.
- The feasibility report will be based upon existing information, revised or updated information provided by the local sponsor, and new studies. The Corps, local sponsor, or contract resources will perform new studies. The decision as to which entity will conduct the studies will be based upon who is the most logical and practical party to complete the task.
- Other feasibility assumptions will be outlined in the PMP.

9. RECOMMENDED FEASIBILITY PHASE STRATEGY

While a clear Federal interest exists in continuing the study in the Brush Creek basin, it is less clear which Federal study authority should be used in pursuing these projects. The basin is complicated, with a variety of on-going projects and planning efforts, a variety of problems affecting a number of somewhat non-contiguous areas, and insufficient information at present to affirmatively project a total cost for work in the Brush Creek basin. Consequently, we recommend initiation of study and characterization of existing conditions, as well as conduct of feasibility scoping under a Phase 1 Feasibility Study, to be followed by a decision point for assessing the direction of study and implementation for subsequent phases.

The PMP to be developed would reflect only the Phase 1 tasks. The initial phase of a Feasibility Study would provide a more detailed analysis of problems and opportunities within the basin. The outputs from the initial phase, including an estimate of how much work could be supported by available benefits in the basin, would allow for a better-informed decision regarding which authorities are most appropriate for pursuing the

remainder of the Feasibility Study tasks. Moreover, this approach is more sensitive to the possibility that a relatively inexpensive series of projects might emerge from a Feasibility Study, allowing the sponsor(s) the option of proceeding toward implementation via the more expeditious Continuing Authorities program.

10. FEASIBILITY PHASE MILESTONES

The feasibility study schedule is highly dependent upon the successful negotiation of the PMP with the local sponsor(s) and also availability of Federal and local funding. The schedule depicted in Table 2 for an initial phase is considered preliminary. As the PMP is developed, the schedule will be revised and refined.

Table 2 Initial Feasibility Phase Milestones	
Description	Target Dates
Complete Draft PMP and FCSA	July 2005
Execute FCSA	August 2005
Initiate Feasibility Study	September 2005
Complete Feasibility Study Phase I	July 2007

11. FEASIBILITY PHASE COST ESTIMATE

A preliminary estimate of Feasibility Study costs is presented in Table 3. The present estimate is largely based on similar studies completed previously and is consequently very general. The estimate will be substantially modified to reflect considerations specific to the project during formulation and negotiation on the PMP.

Table 3	
Preliminary Feasibility Study Cost Estimate	
Major Work Items	Study Cost
Surveys and Mapping	\$20,000
Hydrology and Hydraulic Studies	\$70,000
Geotechnical Studies	\$5,000
Public Involvement	\$20,000
Environmental Studies	\$100,000
Economic & Socioeconomic Studies	\$50,000
Project Management	\$70,000
Engineering and Design Analysis	\$50,000
HTRW Investigations	\$20,000
Cultural Resources Investigations	\$10,000
Cost Estimating	\$20,000
Plan Formulation and Evaluation	\$75,000
Real Estate Studies	\$20,000
Review Contingency	\$30,000
Total Project Costs	\$560,000
Total Federal Share	\$280,000
Total In-Kind Services	\$140,000
Cash Funds	\$140,000
Total Sponsor Share	\$280,000

12. POTENTIAL ISSUES AFFECTING INITIATION OF FEASIBILITY PHASE

Issues affecting feasibility phase initiation primarily will be related to mechanisms for finding the non-Federal share and financial arrangements to deliver non-Federal funds as needed. The Kansas City District is confident that the local sponsor(s) can and will successfully meet sponsorship requirements for a feasibility study.

13. PROJECT AREA MAP

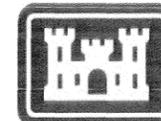
The project area map is enclosed.

14. RECOMMENDATIONS

I recommend that the Brush Creek Basin Flood Damage Reduction and Ecosystem Restoration Study proceed to the feasibility phase.



Michael A. Rossi
Colonel, Corps of Engineers
District Engineer



**US Army Corps
of Engineers**
Kansas City District

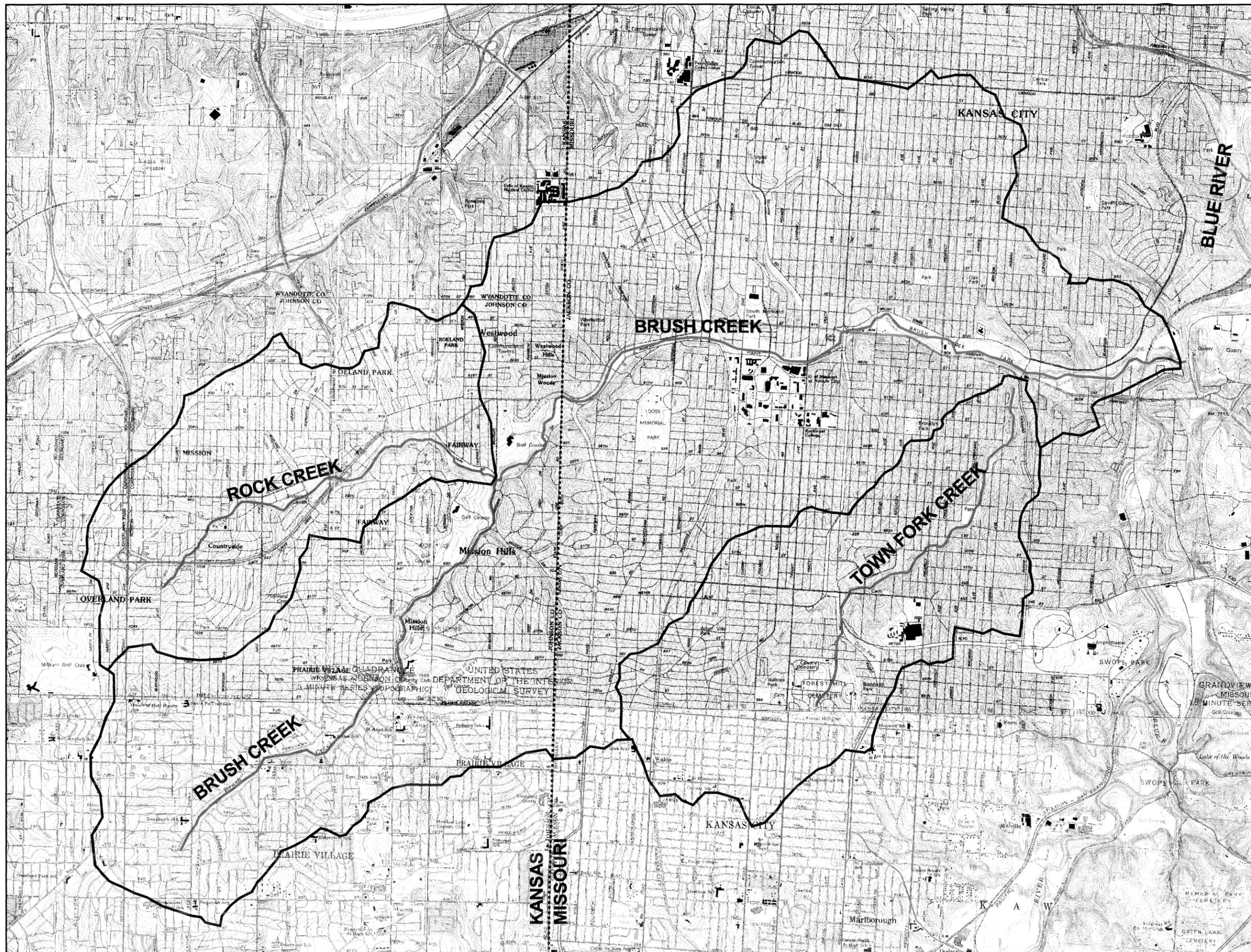
RECONNAISSANCE STUDY

**BRUSH CREEK BASIN
FLOOD DAMAGE REDUCTION
AND ECOSYSTEM RESTORATION**

-  Basin Boundary
-  Creek



400 0 400 Feet



CERTIFICATION OF INDEPENDENT TECHNICAL REVIEW
For
BRUSH CREEK BASIN, MISSOURI AND KANSAS

Multipurpose Flood Damage Reduction and Environmental Restoration Study
Section 905(b) Analysis

I certify that a Plan Formulation independent technical review for Section 905(b) Analysis of the Brush Creek Basin, Missouri and Kansas, has been completed in accordance with the Quality Control Plan. The comments and issues raised have been resolved and adequately addressed.

CERTIFIED BY:



DAVID L. COMBS
Chief, Planning Branch

2/23/05

Date